UNIVERSITY OF SOUTHAMPTON

FACULTY OF MEDICINE

Human Development and Health

Return to work after carpal tunnel release: What should we advise our patients?

by

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ABSTRACT

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WHAT SHOULD WE ADVISE OUR PATIENTS?

Lisa Newington

Carpal tunnel syndrome is a common condition associated with pain and altered sensation in the hand. Treatment includes carpal tunnel release surgery (CTR). Many individuals undergoing CTR work in paid roles, yet there is limited guidance for returning to work after their surgery. The aims of this thesis were: to identify and appraise the existing research and current clinical practice that is pertinent to return to work after CTR; and, to identify the outcomes and experiences of CTR patients who are workers.

Four studies were included: 1) a systematic review of reported return to work times after CTR; 2) a survey of the practice and return to work recommendation of UK hand surgeons and hand therapists; 3) a prospective multi-centre cohort study of patients undergoing CTR; and 4) a qualitative interview study of patients who had returned to work after CTR.

Across the 55 studies identified in the systematic review, the duration of work absence ranged from 4-168 days. Occupational information was poorly reported.

A variety of CTR pathways were reported by the 272 clinicians who completed the survey. There was wide variation in the recommended return to work times for specific job roles.

The cohort study recruited 167 participants from 16 sites. The median work absence was 21 days (range 1-99). Factors associated with return to work time included: sex, smoking status, belief that symptoms were caused by work, computer-use and expected duration of sick leave. Earlier return to work was not associated with poorer outcomes.

The return to work experiences of 14 interviewees were summarised in three themes. The first described a mismatch between expectation and experience: carpal tunnel release is not a 'minor' procedure. The second focused on the prescription of sick leave: need for a valid reason to be off work. The third centred on the practicalities of the return to work process: how to handle the return.

In conclusion, the duration of work absence after CTR varied widely, both in the literature and in practice. Expected duration of work absence was an important determinant of the time taken to return to work. Future collaboration with the UK hand surgery and primary care communities is needed to enable patients to have access to appropriate and consistent return to work advice. Caution is warranted because guidance that primarily focuses on providing timescales for return to work may preclude earlier return to work and function. Practical advice about everyday functioning and strategies to grade work-related hand use may be more beneficial for patients.

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Thesis outputs

Publications

Newington L, Harris EC, Walker-Bone K. Carpal tunnel syndrome and work. *Best Practice in Clinical Rheumatology* 2015; 29(3): 440-53.

Newington L, Stevens M, Warwick D, Adams J, Walker-Bone K. Sickness absence after carpal tunnel release: a systematic review of the literature. *Scandinavian Journal of Work, Environment and Health* 2018; 44(6):557-67.

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Publications (protocols)

Newington L, Stevens M, Ntani G, Adams J, Warwick D, Walker-Bone K. Systematic review of return to work timescales and strategies to enhance return to work after carpal tunnel release (protocol). *PROSPERO* 2016; CRD42016034158.

Publications (conference abstracts)

Newington L, Warwick D, Adams J, Ntani G, Walker-Bone K. Return to employment after carpal tunnel release surgery (REACTS): A survey of UK clinical practice. The 22nd FESSH Congress. Journal of Hand Surgery [European] 2017; 42(Suppl 1):S172-73.

Newington L, Warwick D, Adams J, Francis K, Ntani G, Walker-Bone K. Return to employment after carpal tunnel release: Do hand surgeons and hand therapists give patients the same advice? British Association of Hand Therapists Annual Conference (2017). *Hand Therapy* 2018; doi.org/10.1177/1758998317748800.

Newington L, Warwick D, Stevens M, Walker-Bone K, Adams J. A systematic review of return to work after carpal tunnel release. British Association of Hand Therapists Annual Conference (2018). *Hand Therapy* 2018; doi.org/10.1177/1758998319833544.

Newington L. Getting back to work after elective carpal tunnel release. British Society for Rheumatology Annual Conference (2019). *Rheumatology* 58(Suppl 3): doi.org/10.1093/rheumatology/kez109.109.

Presentations

Event/location	Date	Title	Format
9th Annual NIHR Trainee Meeting: Future Training for Future Health, Leeds, UK	24-26 Nov 2015	NIHR Doctoral Research Fellowship: the interview	Invited speaker
Carpal tunnel syndrome research network, University of East Anglia, UK	14-15 Apr 2016	Return to work after carpal tunnel release	Invited speaker
Association of Surgeons in Primary Care Annual Conference, Leamington Spa, UK	21 May 2016	Return to work after carpal tunnel release	Invited speaker
Research Design Service Fellowship Application Day, Southampton, UK	7 Jun 2016	Applying for an NIHR Doctoral Research Fellowship	Invited speaker and panel member
Arthritis Research UK – MRC Centre for Musculoskeletal Health and Work Stakeholder Meeting, MRC Lifecourse Epidemiology Unit, Southampton, UK	4 Jul 2016	Return to work after carpal tunnel release: research plan	Oral presentation
UK Research in Musculoskeletal Epidemiology Annual Showcase, Keele University, UK	7 Oct 2016	REACTS: Return to employment after carpal tunnel release surgery	Oral presentation

Event/location	Date	Title	Format
British Society for Surgery of the Hand/British Association of Hand Therapist Autumn Scientific Meeting Cardiff, UK	13-14 Oct 2016	Show me the money: getting your research funded	Invited speaker
Wessex Hand Club, Salisbury District Hospital, Salisbury, UK	4 Nov 2016	Getting started in research: the REACTS study	Oral presentation
Arthritis Research UK – MRC Centre for Musculoskeletal Health and Work 3rd Annual Scientific Meeting, MRC Lifecourse Epidemiology Unit, Southampton, UK	31 Jan 2017	Return to work after carpal tunnel release: plan for a programme of research	Oral presentation
Wessex Council for Allied Health Professionals in Research, Faculty of Health Sciences, University of Southampton, UK	22 Feb 2017	Meet the researcher: the REACTS study	Invited speaker
Association of Surgeons in Primary Care Annual Conference, Leamington Spa, UK	20 May 2017	Return to employment after CTR: findings from a survey of national practice	Invited speaker
Eurohand, 22nd FESSH (Federation of European Societies for Surgery of the Hand) Congress, Budapest, Hungary	21-24 Jun 2017	Return to employment after carpal tunnel release: a survey of UK clinical practice	Oral presentation
International Scientific Advisory Committee Meeting, MRC Lifecourse Epidemiology Unit, Southampton, UK	20 Sep 2017	REACTS: Return to employment after carpal tunnel release surgery	Poster presentation
British Association of Hand Therapists Annual Conference, Norwich, UK	10-11 Nov 2017	Return to employment after carpal tunnel release surgery: Do hand surgeons and hand therapists give patients the same advice?	Oral presentation
11th Annual NIHR Trainee Meeting: Future Training for Future Health, Leeds, UK	14-15 Nov 2017	When should you return to work after carpal tunnel release surgery?	Poster presentation (prize winner)
Arthritis Research UK – MRC Centre for Musculoskeletal Health and Work 4th Annual Scientific Meeting, MRC Lifecourse Epidemiology Unit, Southampton, UK	13 Feb 2018	Return to work after carpal tunnel release: findings from a systematic review and survey of practice	Oral presentation

Event/location	Date	Title	Format
Research Design Service Fellowship Application Day, Southampton, UK	12 Jun 2018	Applying for an NIHR Doctoral Research Fellowship: My experience & tips	Invited speaker and panel member
Arthritis Research UK – MRC Centre for Musculoskeletal Health and Work Funding Assessment, Southampton, UK	3 Oct 2018	When should you return to work after carpal tunnel release?	Poster presentation
British Society for Surgery of the Hand Autumn Scientific Meeting, London, UK	11-12 Oct 2018	When do patients return to different types of work after CTR: a systematic review	Poster presentation
British Association of Hand Therapists Annual Conference, Birmingham, UK	9-10 Nov 2018	Return to work after carpal tunnel release: a systematic review	Oral presentation
Musculoskeletal Health Research Colloquium, Health Sciences, University of Southampton, UK	5 Dec 2018	Return to work after carpal tunnel release: what should we advise our patients?	Invited speaker
Faculty seminar, MRC Lifecourse Epidemiology Unit, University of Southampton, UK	19 Feb 2019	Return to Employment After Carpal Tunnel Release Surgery	Invited speaker
NIHR Academy Roadshow with Southampton Academy for Research (SoAR), University of Southampton, UK	8 Mar 2019	Applying for an NIHR Doctoral Research Fellowship: My experience	Invited speaker and panel member
British Society for Surgery of the Hand, Spring Scientific Meeting, Swansea, UK	25 Apr 2019	Work and function after carpal tunnel release: a qualitative study	Oral presentation
British Society for Rheumatology Annual Conference, Birmingham, UK	1 May 2019	Getting back to work after elective carpal tunnel release	Invited speaker
14th IFSSH, 11th IFSHT Triennial Congress (International Federation of Societies for Surgery of the Hand), Berlin, Germany	19 Jun 2019	Return to employment after carpal tunnel release (REACTS): a prospective cohort study	Oral presentation
14th IFSSH, 11th IFSHT Triennial Congress (International Federation of Societies for Hand Therapy), Berlin, Germany	20 Jun 2019	Return to employment after carpal tunnel release (REACTS): the patient perspective	Oral presentation

Academic thesis: declaration of authorship

I, Lisa Newington, declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

RETURN TO WORK AFTER CARPAL TUNNEL RELEASE: WHAT SHOULD WE ADVISE OUR PATIENTS?

I confirm that:

1. This work was done wholly or mainly while in candidature for a research degree at this University;
2. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
3. Where I have consulted the published work of others, this is always clearly attributed;
4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
5. I have acknowledged all main sources of help;
6. Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
7. Parts of this work have been published: please see thesis outputs (page xix).

Signed:

Date: 25th October 2019

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Abbreviations

AAOS – American Academy of Orthopaedic Surgeons

ADLs – activities of daily living

AHP – allied health professional

ASPC – Association of Surgeons in Primary Care

BAHT – British Association of Hand Therapists

BCTQ – Boston Carpal Tunnel Questionnaire

BMI – body mass index (weight in kilograms divided by height in metres squared)

BOA – British Orthopaedic Association

BSSH – British Society for Surgery of the Hand

Cascot – computer assisted structured coding tool

CCG – Clinical Commissioning Group

CI – confidence interval

COREQ – Consolidated criteria for reporting qualitative research

CRN – Clinical Research Network (part of the NIHR infrastructure)

CRPS – complex regional pain syndrome

CTR – carpal tunnel release

CTS – carpal tunnel syndrome

CTS-6 – abbreviated version of the Boston Carpal Tunnel Questionnaire

DNA – deoxyribonucleic acid

FU1 – first follow-up in the REACTS cohort study (4 weeks after CTR)

FU2 – second (final) follow-up in the REACTS cohort study (12 weeks after CTR)

GP – general practitioner

HR – hazard ratio

HRA – Health Research Authority

hrs - hours

IQR – interquartile range

kg – kilograms

lbs – pounds

MHQ – Michigan Hand Questionnaire

N or n – number of participants/individuals

N/A – not applicable

NCS – nerve conduction studies

NHS – National Health Service

NICE – National Institute of Health and Care Excellence

NIHR – National Institute for Health Research

NPV – negative predictive value

NR – not reported

OHAG – occupational health advisory group

ONS – Office for National Statistics (United Kingdom)

OR – odds ratio

OT – occupational therapist

PAG – patient advisory group

PEM – Patient Evaluation Measure

POSAS – Patient and Observer Scar Assessment Scale

PPI – Patient and public involvement

PPV – positive predictive value

PRISMA – Preferred reporting items for systematic reviews and meta-analyses

PSAQ – Patient Scar Assessment Questionnaire

RCS – Royal College of Surgeons

RCT – randomised controlled trial

REACTS – return to employment after carpal tunnel release surgery (study name)

RSTN – Reconstructive Surgical Trials Network

RTW – return to work

SD – standard deviation

SOC – Standard Occupational Classification

STROBE – STrengthening Reporting of OBservational studies in Epidemiology

TCL – transverse carpal ligament

UK – United Kingdom

US – United States of America

WHO – World Health Organization

Chapter 1 Background and context

1.1 Introduction

The aim of this thesis was to investigate return to work after carpal tunnel release (CTR), a surgical procedure used for the treatment of carpal tunnel syndrome (CTS). Many patients undergoing CTR need to return to work after their surgery, but from personal experience as a hand therapist, the work-related advice that was available appeared to be quite limited and largely anecdotal in nature. Preliminary explorations of the literature found little evidence on which to base any return to work recommendations and this led to the development of this programme of research. Part 1 of this introductory chapter provides background information on the clinical features of CTS and its surgical management. Part 2 examines the existing literature concerning CTS and work.

1.2 Part 1: Carpal tunnel syndrome

Carpal tunnel syndrome (CTS) occurs when the median nerve becomes compressed as it passes through the carpal tunnel at the anterior wrist. Compression of the nerve causes an unpleasant altered sensation in the radial three and a half digits, and thenar muscle weakness. The first recorded description of CTS dates from 1854 in an account of two cases by James Paget [1, 2], with subsequent work by Marie and Foix in 1913 suggesting the proposed aetiology [3]. In the current literature, CTS is frequently described as the most common peripheral nerve entrapment disorder [4-10].

1.2.1 Anatomy

The carpal tunnel is formed by the concave shape of the carpal bones at its base, bordered radially by the trapezium and on the ulnar aspect by the hamate and pisiform. The transverse carpal ligament (TCL) joins these radial and ulnar boarders, forming the roof of the tunnel. The median nerve (cervical roots C5-T1) is the most superficial structure inside the carpal tunnel, with the four flexor digitorum superficialis tendons, the

flexor pollicis longus tendon and the four flexor digitorum profundus tendons located more deeply (Figure 1.1).

Compression of the median nerve within the carpal tunnel affects the distal branches to the median-innervated digital nerves and the recurrent branch of the median nerve. The latter branch innervates the thenar muscles. The palmar cutaneous branch of the median nerve, which provides sensation to the palm, remains superficial to the TCL and is unaffected in CTS.

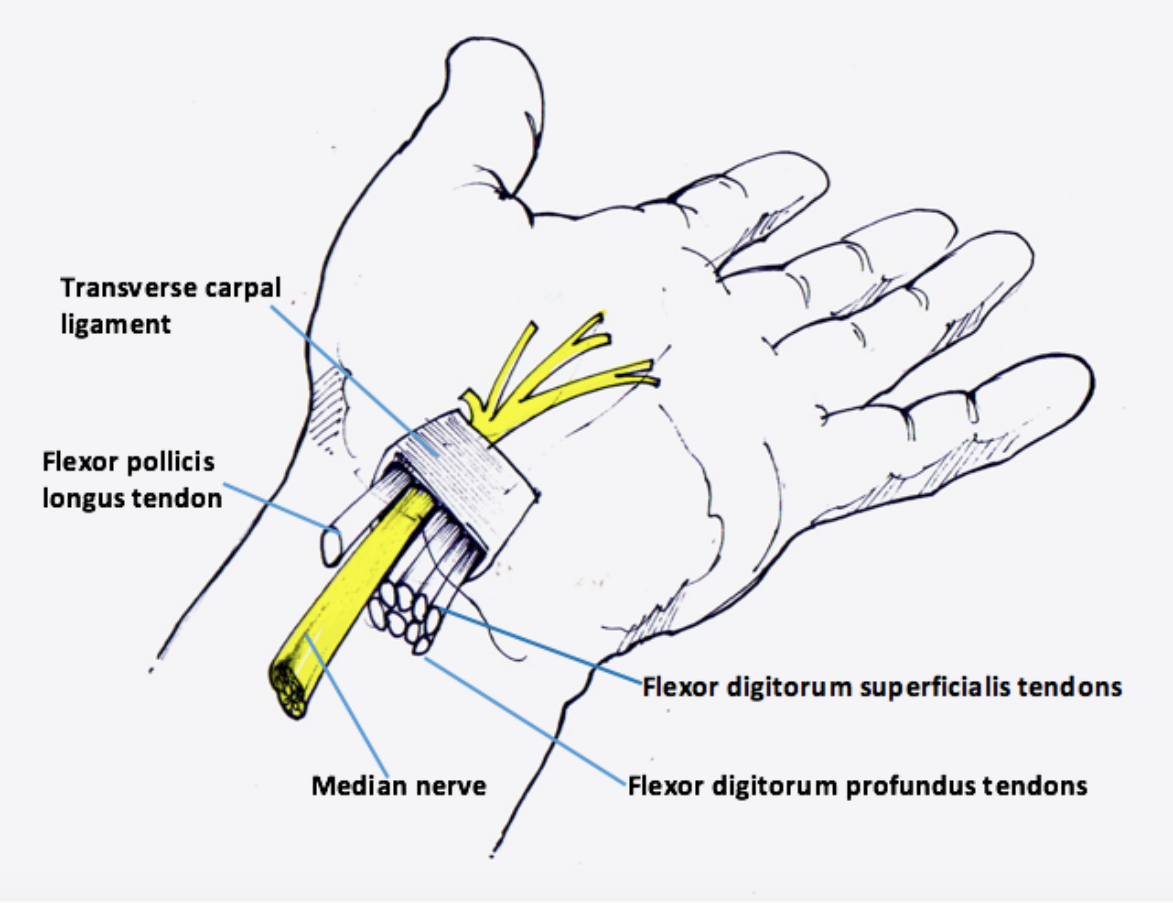


Figure 1.1 Carpal tunnel anatomy

1.2.2 Aetiology

CTS is thought to occur from compression of the epineural blood supply causing localised ischaemia and conduction deficits of the median nerve [9, 11, 12]. In theory, increased pressure inside the carpal tunnel could be caused by any factor that increases the volume of the structures within the tunnel, or reduces its overall dimensions [7]. In practice, the

cause of the median nerve compression is often undetermined, and the clinical presentation is frequently labelled as idiopathic CTS [9].

1.2.3 Symptoms and burden of disease

CTS sensory symptoms typically involve altered sensation (paraesthesia, numbness and pain) in the thumb, index and middle fingers and the radial half of the ring finger. This is consistent with compression affecting the median-innervated digital nerves. These sensory changes are often worst at night [7]. Motor symptoms include thenar muscle weakness and atrophy.

The nature and impact of CTS symptoms have been explored in a series of qualitative interviews, which found that both sensory and motor symptoms were associated with marked functional difficulties [13]. In many cases, participants reported having to modify both their work and their routine daily activities as a result of their CTS. In addition to localised symptoms, CTS sensory and functional deficits have also been found to negatively correlate with sleep quality [14] and to positively correlate with depression [15].

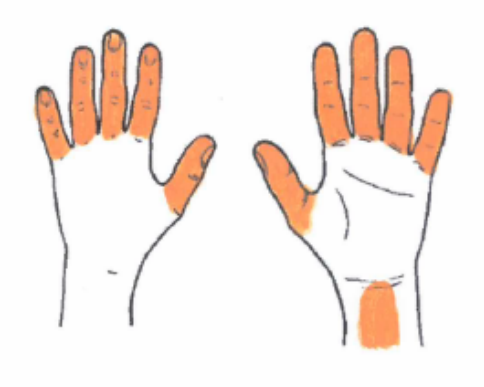
1.2.4 Case definition and diagnosis

There is no standardised case definition for CTS [16, 17] and a diagnosis can be made through three approaches. The first relies on a patient-reported history and pattern of symptoms that are consistent with median nerve compression at the carpal tunnel; the second adds observation and clinical examination; and the third uses neurophysiological testing or other investigations [16, 18].

1.2.4.1 History and pattern of symptoms

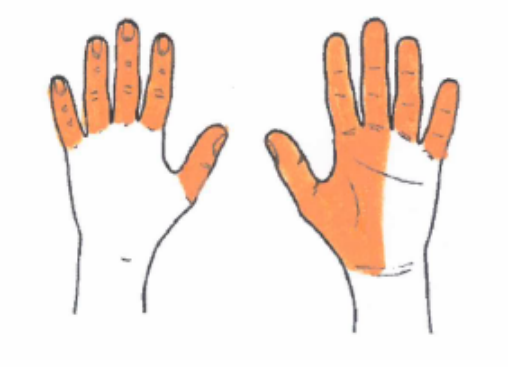
The common sensory symptoms of CTS were discussed in Section 1.2.3. Clinicians may use hand diagrams to record the distribution and nature of their patients' symptoms, or these details may be collected verbally as part of the initial history taking. Hand diagrams are useful for the self-reporting of symptoms in epidemiological research as they allow information to be collected without clinical examination. Katz and Stirrat first reported

the use of hand diagrams for CTS and defined diagnostic criteria for classic, probable or unlikely CTS [19]. The criteria have since been updated to improve inter-rater reliability (Figure 1.2) and have been estimated to have 33-40% sensitivity and 76-81% specificity for a diagnosis of CTS (using the hand diagram scores of classic or probable) when compared with nerve conduction studies [20]. Given the low sensitivity, false negatives (failing to identify individuals with CTS) are very likely using this diagnostic method alone.



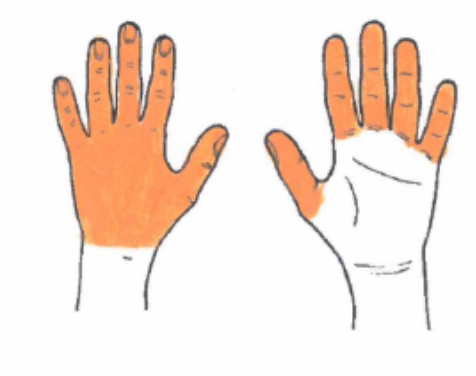
Classic

Paraesthesia, numbness or pain in at least two of the thumb, index or middle fingers. Excluded if symptoms on the palm and dorsum of hand. Little finger symptoms, wrist pain or radiation proximal to the wrist allowed. For index and middle fingers, must include shading of more than 50% of the volar middle phalanx and/or some of the distal phalanx. For the thumb, must include volar shading over the distal phalanx.



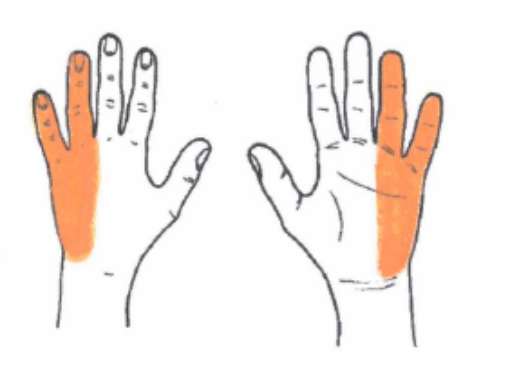
Probable

Same shading as classic, but allowed to extend into the palm volarly, unless confined to the ulnar side of the palm.



Possible

Tingling, numbness or pain in at least one of the thumb, index or middle fingers. May include the dorsum of the hand.



Unlikely

No shading of the volar thumb, index or middle fingers.

Figure 1.2 Hand diagrams for carpal tunnel syndrome

Originally developed by Katz & Stirrat [19], later modified by Calfee et al [20]. Shading represents the patient-reported area of sensory alteration. Scores of classic or probable are used to indicate carpal tunnel syndrome [20].

1.2.4.2 Clinical examination

Two provocative tests are routinely reported in the diagnosis of CTS: Tinel's Sign and Phalen's Test. Tinel's Sign involves percussion of the median nerve as it passes through the carpal tunnel [21]. Phalen's Test involves positioning the patient with elbows flexed and the wrists in maximal active flexion for 60 seconds [22]. For both tests, a positive response is defined as the onset of paraesthesia in the hand/digits in a median nerve distribution that replicates the patient's usual symptoms. Various sensitivity and specificity findings have been reported in the literature. A meta-analysis of the existing data estimated 68% sensitivity and 73% specificity for Phalen's Test (3,218 cases, 1,637 controls), and 50% sensitivity and 77% specificity for Tinel's Sign (2,640 cases, 1,614 controls) [23]. Eligibility criteria for the meta-analysis required studies to have a defined CTS case definition, however it was unclear which diagnostic criteria were then used as the basis for the sensitivity and specificity calculations [23]. As with the use of hand diagrams, the low reported sensitivities mean that false negative diagnoses may be common with these tests. Data provided in the meta-analysis discussed above was used to estimate the negative predictive values (NPVs) of both tests, that is the probability that following a negative test the individual will truly not have CTS. For Phalen's test the estimated NPV was 54% and for Tinel's test, 48%. Positive predictive values (the probability that an individual will truly have CTS following a positive test result) were calculated as 83% and 78%, respectively.

1.2.4.3 Nerve conduction studies

Nerve conduction studies (NCS) are used to assess nerve motor and sensory function. Compression of the median nerve within the carpal tunnel leads to reduced conduction velocities and smaller conduction amplitudes distally in both sensory and motor branches of the nerve. Typically, sensory abnormalities can be detected by NCS at an earlier stage of CTS than motor abnormalities [24]. Various neurophysiological tests can be used for the diagnosis of CTS and Bland established a standardised classification scale for the interpretation of NCS findings into one of seven grades of CTS severity ranging from 'no CTS' to 'extremely severe CTS' [24].

NCS may be viewed as more objective than the other CTS diagnostic methods discussed above, however it is important that NCS are performed in a temperature controlled

environment. Hand temperature should be >33°C; at lower temperatures, the velocity of nerve conduction is reduced and the amplitude of the action potential may increase [25]. Furthermore, accurate limb positioning and measurement is important to allow the best correlation between the length of the nerve and the surface measurement, and the appropriate level of nerve stimulation is required to avoid stimulating neighbouring nerves or erroneously detecting a conduction block [25].

NCS findings are often used as the 'gold standard' when assessing the accuracy of other diagnostic tests for CTS, however a wide range of cut-off values for a positive diagnosis of CTS are reported [26]. An interesting study by Bachmann et al. assessed the impact of using either NCS or a clinical diagnosis of CTS (reported symptoms and clinical tests) as the 'gold standard' reference point [17]. Seventy-four patients were included and there were 14 cases of disagreement between the two diagnostic methods (kappa 0.67, 95% CI 0.48, 0.85). In all but one of these cases, CTS was diagnosed by NCS, but not by assessment of the patient's signs and symptoms. It is unclear whether these 13 patients went on to develop clinically diagnosed CTS (i.e. the NCS findings provided an early warning diagnosis before symptoms developed), or whether the NCS findings were a false positive.

1.2.4.4 Diagnostic guidelines

The American Academy of Orthopaedic Surgeons (AAOS) and the British Orthopaedic Association (BOA) have both recently updated their guidelines on the diagnosis and management of CTS. To facilitate comparison, their key diagnostic recommendations are summarised in Table 1.1. There are interesting differences in the format of the two documents: the AAOS provides a rating of strong, moderate, or limited evidence to support each of the possible diagnostic techniques, leaving the clinician to make a decision based on their summary of the available evidence; while the BOA gives more specific practice recommendations. The AAOS also use the term 'risk factors' to indicate a combination of clinical features of CTS, such as worsening symptoms at night, and true risk factors (characteristics which increase the likelihood of developing the condition), such as being female.

The implication for research is that without standardised diagnostic criteria, CTS study populations are selected according to a range of criteria and may therefore represent sub-populations of individuals with different CTS characteristics. This needs to be considered when comparing the findings from different study populations and was also a consideration for the subsequent stages of this thesis.

Table 1.1 Diagnostic criteria for carpal tunnel syndrome

	American Academy of Orthopaedic Surgeons	**British Orthopaedic Association**
History	- Individual risk factors should not be used alone to make a diagnosis of CTS because each has poor specificity or sensitivity - Individual risk factors may include: female sex, bilateral symptoms, history of diabetes mellitus, worsening of symptoms at night, duration of symptoms, patient localisation of symptoms, hand dominance, older age and high BMI	The patient reports: - Intermittent paraesthesia in the correct distribution in mild CTS, progressing to persistent paraesthesia in severe CTS - Nocturnal symptoms (or pain/ paraesthesia exacerbated at night)
Examination	- Individual tests should not be used alone to make a diagnosis of CTS because each has poor specificity or sensitivity - Tests include: Phalen's Test, Tinel's Sign, Flick Sign, Upper Limb Nerve Tension Testing - Thenar muscle atrophy has high specificity for CTS, but poor sensitivity	On examination, the patient demonstrates: - Sensory impairment in the correct distribution - Subjective weakness in the thumb/ loss of coordination in mild CTS - Objective, but mild thenar muscle weakness in moderate CTS - Thenar muscle wasting in severe CTS - Vibration sense may be reduced in moderate CTS
Investigation	- Diagnostic questionnaires and/or electrodiagnostic studies could be used to aid the diagnosis of CTS - Ultrasound should not be routinely used for CTS diagnosis	Nerve conduction studies are typically not indicated. They should only be used in one or more of the following: - Equivocal findings from the history and clinical examination - Persistent or recurrent CTS - Unclear diagnosis suggesting peripheral neuropathy Blood tests are only needed if the history and examination suggest a specific secondary cause, e.g. hypothyroidism, rheumatoid arthritis

Adapted from the American Academy of Orthopaedic Surgeons: Management of Carpal Tunnel Syndrome, Evidence-Based Clinical Practice Guideline [16] and the British Orthopaedic Association Commissioning Guide: Treatment of Carpal Tunnel Syndrome [18].

1.2.5 Incidence and prevalence

CTS incidence and prevalence have been estimated in several different populations, with widely varying findings (Table 1.2). The highest identified prevalence appears to be 17,300 per 100,000 women (17.3%), as assessed by self-reported symptoms of recurring pain, numbness and/or paraesthesia in the median nerve distribution, across a stratified sample of the Swedish population [6]. The lowest reported prevalence was 472 per 100,000 for women and 245 per 100,000 for men in a review of CTS medical codes from a large UK clinical practice database [27]. The approximately 45-fold difference between these two estimates highlights the difficulty that arises in the comparison of data using different CTS case definitions, but may also represent possible cultural differences in symptom reporting (or documenting), or reflect different distributions of known risk factors for CTS.

Table 1.2 Occurrence of carpal tunnel syndrome

Author and country	Case definition of carpal tunnel syndrome	Study population	Sample size	Incidence per 100,000/year		Prevalence per 100,000	
				Female	*Male*	*Female*	*Male*
RECRUITED FROM GENERAL POPULATIONS							
Atroshi et al. 1999 [6] Sweden	Self-reported symptoms	General population (stratified sample)	2,466	NR		17,300 [a]	10,400 [a]
	Clinical examination	Sub-sample with self-reported symptoms	287	NR		4,600 [a]	2,000 [a]
	Nerve conduction studies		262	NR		5,200 [a]	4,300 [a]
	Clinical examination and nerve conduction studies		262	NR		3,000 [a]	2,100 [a]
Bharucha et al. 1991 [28] India	Self-reported symptoms and clinical examination	Farsi community	14,000 (approx.)	NR		557	
Dale et al. 2013 [29] USA	Katz hand diagrams or clinical examination	Fulltime workers	4,321 (8,833 person years)	9,300 [c]		10,000 [a]	5,800 [a]
	Nerve conduction studies	Sub-sample with symptoms		4,000 [c]			
De Krom et al. 1992 [30] Netherlands	Self-reported symptoms and nerve conduction studies	General population (stratified sample)	504	NR		3,400 [a]	600 [a]
RECRUITED FROM REFERRED POPULATIONS OR FROM DATABASES OF MEDICAL RECORDS							
Bland & Rudolfer 2003 [31] UK	Nerve conduction studies (after referral for suspected CTS)	Patients referred for nerve conduction studies	11,233	139	67	NR	
Burton et al. 2018 [27] UK	Carpal tunnel syndrome medical code in records in 2013	Clinical practice research datalink	3,473,094 person years	360 [b]	191 [b]	472 [b]	245 [b]
Latinovic et al. 2006 [32] UK	Carpal tunnel syndrome medical code in records	General practice research database	1,830,000 person years	193 [d]	88 [d]	2,016 [d]	784 [d]
Mondelli et al. 2002 [33] Italy	Clinical assessment and nerve conduction studies	Referred for median nerve conduction studies	119, 620 (Sienna Health District)	506 [e]	139 [e]	NR	
Tadjerbashi et al. 2019 [34] Sweden	Carpal tunnel syndrome medical code in records from 2001-2009	National patient registry	Swedish population	232 [e]	104 [e]	NR	

[a.] Reported as a percentage. [b.] Reported as the number per 10,000 person-years. [c.] Reported as the number per 100 person-years. [d.] Age standardised to European standard population. [e.] Reported as the number per 100,000 person-years. NR not reported.

1.2.6 Risk factors

Multiple risk factors have been identified for CTS, although in many cases the causal mechanisms are undetermined and the association with CTS is inconclusive. DNA registries are currently being used explore the potential genetic determinants of susceptibility to CTS and a recent genome-wide association study using UK Biobank data identified 16 significant susceptibility loci, with biologically plausible genes involved in growth and connective tissue structure [35]. If and how these genes contribute to an increased likelihood of developing CTS remains to be determined.

Widely accepted demographic and clinical risk factors include: being female [28, 31-33, 36-38]; older age (although this association does not appear to be straightforward and bimodal distributions of peak incidence have been reported) [31, 32, 39]; obesity [37, 40-43]; systemic inflammatory conditions, such as rheumatoid arthritis [9, 44], hypothyroidism [9, 45] and diabetes mellitus [9, 44, 46]. Other clinical risk factors may include localised injury or osteoarthritis [37]. For those risk factors that are potentially modifiable, such as obesity, it is not clear whether management of the underlying condition may resolve CTS symptoms. One small study of a weight-loss intervention resulted in a significant reduction in body mass index with treatment, but no change in CTS severity as assessed by NCS [47]. A number of occupational risk factors have also been identified and these will be specifically discussed in Section 1.3.1.

1.2.7 Outcome measures for carpal tunnel syndrome

Several assessment tools can be used to quantify the severity of CTS for an individual patient. In a clinical setting, this measurement will enable the clinician to determine whether the patient's burden of CTS has changed over time, and/or whether a particular intervention has been beneficial. In a research setting, assessments of research participants' outcomes allow measures of the average outcome and the level of variation to be calculated across the study population.

The AAOS guidelines on the management of CTS do not specifically discuss the collection of patient outcome data [16]. The BOA guidelines, however, suggest two patient-reported measures that can be used for the collection of CTS audit data [18]; the Patient Evaluation

Measure (PEM) [48] and the Boston Carpal Tunnel Questionnaire (BCTQ) [49]. The BCTQ includes questions that relate to common CTS symptoms and functional problems. Patients are asked to score both the severity and frequency of their symptoms and the level of difficulty they have when performing functional activities that require pinch grip [49]. The PEM uses a similar format, but the questions are not specific to CTS and an additional patient satisfaction component is also included [48]. Both of these outcome measures rely on patient self-report, however patient populations were not involved in their design and no qualitative assessment has been performed to assess whether the included questions are meaningful to patients, or if they represent the key outcomes that are important to patients, rather than clinicians. 'Validity' assessments have been conducted on a small number of individuals where the questionnaire findings were compared to objective measures including two-point discrimination and grip strength [49, 50]; however these objective measures had not been specifically validated for outcome assessment in CTS patients.

A systematic review by Jerosch-Herold et al. found that the most frequently assessed outcomes in RCTs of CTS surgery were self-reported symptom resolution, grip or pinch strength and return to work [51]. Other outcomes included sensation, range of movement, nerve conduction, carpal tunnel pressure and post-operative complications. The non-standardisation and range of outcomes collected in CTS research have made it difficult to compare data from separate studies [52]. Development of a core outcome set for hand and wrist conditions is underway through the International Consortium for Health Outcome Measurement and its adoption will hopefully facilitate comparison and pooling of data from future CTS studies [53].

1.2.8 Carpal tunnel syndrome treatment

Non-operative interventions are widely used as the first line of treatment for CTS, with surgery recommended for more severe cases or where non-operative management has failed to improve symptoms. The BOA guidelines recommend that patients should be referred for a surgical assessment if they experience persistent symptoms and disability that does not respond to up to six weeks of evidence-based treatments [18]. The AAOS

guidelines report that there is strong evidence of greater benefit to the patient 6 and 12 months after surgery than with non-operative interventions [16].

The decision of whether to opt for non-operative treatment or surgery may depend on a number of factors, including patient and surgeon preference, resource usage and local protocol [54, 55]. The AAOS and the BOA recommendations for CTS treatment are summarised in Table 1.3. Although the guidelines are structured in different ways, the general recommendations are similar and encompass findings from published systematic reviews [56-59].

Within the UK, the treatment pathway for CTS is not consistent. A recent survey of the 211 Clinical Commissioning Groups (CCGs) found that across the 175 CCGs who responded, there was marked variation in their policies [55]. CCGs are "clinically-led statutory NHS bodies and are responsible for the planning and commissioning of healthcare services in their local area" [60]. This includes local treatment policies relating to CTS. Nineteen percent of respondents to the survey stipulated that it was mandatory for their patients to have at least one corticosteroid injection before referral for surgery; 2% required at least two injections; and 6% did not mention the need for corticosteroid injections. The required duration of non-operative treatment (splinting and/or injection) before referral for surgery was permitted also varied. The impact of this treatment variation on outcomes for patients with CTS is not clear and further research is needed to guide equitable healthcare delivery at the national level. Interestingly, previous AAOS guidelines advised that patients should first be offered non-operative treatment, with surgery provided only if this proved ineffective; however the most recent guidelines include surgery as a first-line treatment option [16, 54]. Whether this improves patient outcomes is also unclear.

Table 1.3 Treatment recommendations for carpal tunnel syndrome

	American Academy of Orthopaedic Surgeons	British Orthopaedic Association
Non-operative management	- Strong evidence supports use of immobilisation (splint, brace or orthosis) - Strong evidence supports use of methylprednisolone injection - Strong evidence supports not using magnet therapy - Moderate evidence supports use of oral steroids - Moderate evidence supports not using other oral medication (e.g. diurectics, gabapentin, non-steroidal anti-inflammatories) - Limited evidence supports use of therapeutic ultrasound - Limited evidence supports use of laser therapy	- Trial of non-operative management recommended for mild CTS including wrist splints (wrist in neutral) at night and/or a single steroid injection with local anaesthetic - No more than two modalities of conservative treatment should be used to avoid inappropriately delaying surgery - Refer for surgery if persistent symptoms and disability not responding within 6-12 weeks - No convincing evidence to support the use of non-conventional treatments e.g. laser therapy and acupuncture
Surgery	- Strong evidence that surgical release should relieve symptoms and improve function - Strong evidence that surgical treatment should have greater treatment benefit at 6 and 12 months compared to non-operative treatments - Limited evidence that endoscopic treatment may have better short-term benefits compared to open release - Limited evidence supports use of local anaesthesia, rather than regional block - Limited evidence supports not using prophylactic antibiotics before surgery	- Surgical release can be either open or endoscopic - Open surgery is recommended for elderly patients and those with multiple comorbidities - Endoscopic surgery may result in better short-term outcomes and patient satisfaction - Surgery should be performed in a sterile operating/minor procedures room as a day case by a competent surgeon - Surgery should be under local or regional anaesthetic - Urgent surgery is indicated where there is clinical evidence of recent denervation with persistent altered sensation or a sudden progression in symptoms
Post-operative input	- Strong evidence supports no benefit of routine post-operative immobilisation - Moderate evidence supports no additional benefit of routine supervised therapy over home programmes	- Patients will ordinarily require a single follow-up appointment, there may be a clinical need for further appointments, which may be virtual - A small minority of patients will need hand therapy - Need to identify and manage problems early, specifically CRPS, scar sensitivity and/or nerve damage

Adapted from the AAOS Management of Carpal Tunnel Syndrome, Evidence-Based Clinical Practice Guideline [16] and the BOA Commissioning Guide: Treatment of Carpal Tunnel Syndrome [18].

1.2.8.1 Non-operative interventions

Non-operative interventions for CTS include splinting, median nerve gliding exercises, activity modification and corticosteroid injections. There is limited evidence that wearing a splint at night improves CTS symptoms in the short-term, compared to no treatment, although the optimum splint design, wearing regime and its effectiveness compared to other non-operative interventions remain to be determined [56]. Heterogeneity in the existing studies limits their comparison and prohibits a precise definition of the duration of 'short-term'. Furthermore, the possible role of placebo in CTS splinting has not been assessed. Corticosteroid injection was associated with greater improvement in CTS symptoms when compared with a placebo as assessed in a meta-analysis and more recent RCT [59, 61]. Both splinting and corticosteroid injection are recommended as treatment options for CTS in the UK and US [16, 18]. The evidence for other non-operative treatment modalities is currently insufficient [57, 58, 62].

A recent systematic review by Burton et al. explored the clinical course of non-operatively managed CTS and found that 57-66% of patients went on to have surgery after an initial period of non-operative treatment [63]. The authors also found that longer symptom duration, a positive Phalen's Test and thenar wasting were all associated with poorer outcomes after non-operative treatment. Poor outcomes were defined differently in the included studies and encompassed the persistence or worsening of symptoms, worsening of NCS findings, progression to surgery, and work absence due to CTS after 18 months of treatment. Differences in this definition hindered comparison of studies. In addition, all of the included studies were assessed at moderate-high risk of bias, largely due to issues with attrition, statistical reporting and confounding.

1.2.9 Types of surgical procedure

Carpal tunnel release (CTR) surgery involves transecting the transverse carpal ligament (TCL) to relieve the pressure on the median nerve. The surgery can be either open or endoscopic, and is typically performed as a day case with local or regional anaesthesia [16, 18]. CTR is a common elective procedure. More than 52,000 surgical cases were recorded in the English NHS in 2012 [64] and it has been predicted that this figure will rise to 90,630 (95% CI 77,363-104,020) by 2025 [65]. CTR is commonly reported to have a high

success rate, with successful outcomes reported for 70-90% of patients, albeit using different measures of 'success' [66-68].

1.2.9.1 Open carpal tunnel release

Two common surgical incisions can be used for open CTR. The traditional longitudinal incision starts at the intersection of the line running from the base of the thumb at the first web space to the hook of hamate (Kaplan's cardinal line) and a line running from the radial border of the ring finger to the wrist. The incision extends 4-5cm proximally crossing the distal wrist crease [69]. The mini incision starts in the same position, but extends for only 2-3cm and remains distal to the wrist crease [69]. The approximate size and positions of these incision sites are shown in Figure 1.3.

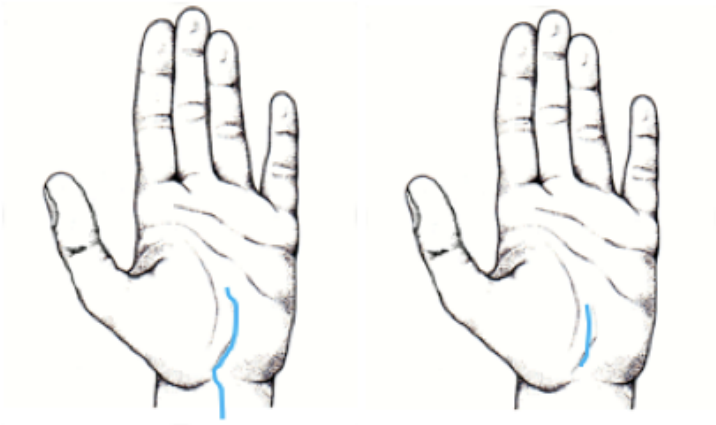
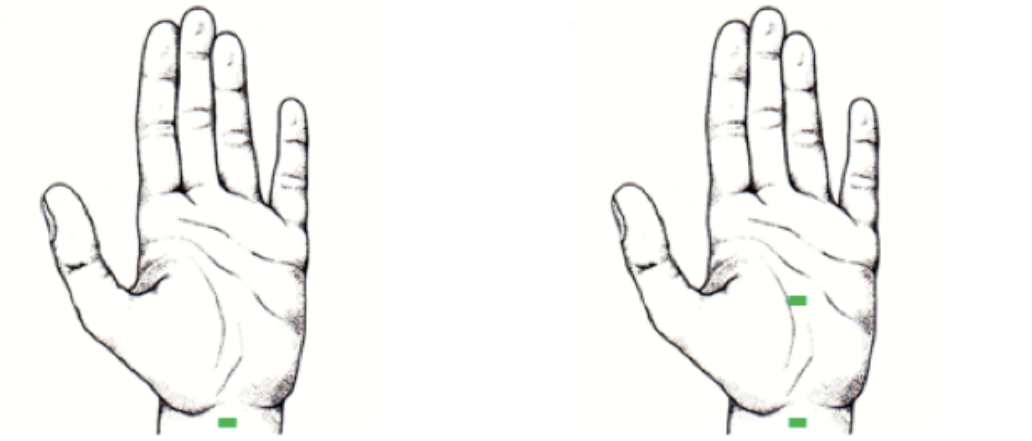


Figure 1.3 Surgical incisions for open carpal tunnel release

Hand images from the London Hand and Wrist Unit hand assessment form. Used with permission.

1.2.9.2 Endoscopic carpal tunnel release

Endoscopic CTR can be performed through a single portal in the wrist, as described by Agee in 1992 [70], or via two portals in the wrist and palm, as described by Chow in 1989 [71]. The typical incision sites are shown in Figure 1.4.



Single portal incision **Two portal proximal and distal incisions**

Figure 1.4 Surgical incisions for endoscopic carpal tunnel release

Hand images from the London Hand and Wrist Unit hand assessment form. Used with permission.

1.2.9.3 Comparison of surgical procedures

A 2012 survey of members of the American Association for Hand Surgery found that 33% of the 123 respondents reported using a traditional longitudinal incision, 45% used a mini incision and 20% used endoscopic techniques [72]. The same population was previously surveyed in 1987 (n=467), when the majority of surgeons reported using a traditional incision (66%) and fewer were using the mini incision (32%) [73]. Endoscopic CTR was not performed at this time. This trend for increasing adoption of minimally invasive surgical techniques has also been seen with other procedures, such as appendicectomy [74]. The general aims of minimally invasive techniques are to reduce post-operative complications, such as infection and pain, accelerate recovery times, and improve aesthetics.

Several systematic reviews and meta-analyses have compared the outcomes of endoscopic and open CTR in an attempt to determine which procedure provides superior results and found that endoscopic CTR was associated with a faster recovery [75-84]. The

BOA and AAOS guidelines both recommend the use of either open or endoscopic CTR procedures (Table 1.3), with the suggestion that endoscopic surgery may lead to faster return to function [16, 18]. However, concerns persist about possibility of median nerve damage or incomplete release of the TCL due to a reduced visual field with endoscopic surgery [77]. Endoscopic CTR is also a more expensive procedure than open CTR. One study from the USA reviewed health insurance and private payer costs for the two procedure types and found that the total costs (facility, surgeon and therapy fees) were US $851 higher for endoscopic surgery (mean annual reimbursement per patient) [85]. To establish the cost-utility of both modes of surgery, factors such as: the healthcare system; surgical training; surgical equipment; duration of surgery; post-operative input; recovery time for the patient; and time off work all need to be taken into account.

1.2.9.4 Post-operative management

A comprehensive systematic review of the effectiveness and safety of rehabilitation interventions after CTR found 22 relevant RCTs with a total of 1,521 participants [86]. The primary review outcome was change in self-reported functional ability assessed at least three months after surgery. As with the reviews of non-operative CTS treatment, there was marked heterogeneity in the interventions and outcome measures used in the included studies, and meta-analyses were not possible. The review found that there were no significant differences in outcome when a desensitisation programme was compared to no treatment; when a multi-modal rehabilitation programme was compared to normal activities/exercise; or when early mobilisation was compared to immobilisation in a splint until suture removal. The specific content of the desensitisation programme was not outlined in the review and the original paper is inaccessible as an unpublished masters thesis, however desensitisation programmes typically include scar massage and graded exposure to different textures [87]. The multi-modal rehabilitation programme consisted of active and passive range of movement exercises, scar massage, nerve gliding exercises, pinch strengthening and sensory discrimination training [88]. It was not possible to assess other patient outcomes, such as time to return to work, because these data had not been routinely collected.

The BOA suggest that patients will typically require one follow-up appointment after their CTR surgery, with few needing specific hand therapy rehabilitation (Table 1.3). Reasons

for hand therapy referral include scar sensitivity, nerve damage or the development of complex regional pain syndrome (CRPS) [18]. There is little information regarding the actual post-operative treatment pathway within the UK and this will be explored further in the survey of clinical practice described in Chapter 4. Further research is required to determine which patients benefit from particular post-operative rehabilitation interventions, and to measure functional and work-related outcomes in addition to self-reported symptoms. This latter point contributed to the development of the prospective cohort study reported in Chapter 5.

1.2.10 Carpal tunnel syndrome summary

CTS is a common musculoskeletal condition, although estimates of the incidence and prevalence vary due to the use of different case definitions. CTS diagnosis can incorporate self-reported symptoms, clinical assessment and NCS, with the latter not recommended in the UK for the diagnosis of routine cases. Non-operative treatments include wrist splinting and corticosteroid injection. For severe cases of CTS, or when there is no improvement in symptoms with non-operative interventions, CTR is recommended.

Comparison of studies investigating both the occurrence of CTS and the effectiveness of different treatment strategies is currently hindered by the absence of a standardised case definition or a core outcome set.

1.3 Part 2: Carpal tunnel syndrome and work

1.3.1 Occupational activity as a risk factor for carpal tunnel syndrome

The role of work factors in CTS development is controversial and studies of possible occupational risk factors are often limited by the potential for recall bias due to retrospective study designs. For example, individuals with CTS symptoms may be more likely to recall their exposure to particular occupational activities, such as using vibrating tools or typing, than those without symptoms. This would tend to bias findings towards an increased risk for the exposure. Conversely, the inconsistences in the case definition for CTS that were discussed in Section 1.2.4, make it difficult to rule out diagnostic

misclassification, which would tend to underestimate the risk of the exposure. These limitations need to be considered when examining the literature.

A systematic review of CTS and its relation to occupation concluded that the risk of developing CTS more than doubled with regular and prolonged use of hand-held vibratory tools or with highly repetitive wrist flexion/extension, especially with a forceful grip [89]. This review was used as the basis for UK criteria for Industrial Injuries Disablement Benefit, which states that a CTS patient is eligible for reimbursement in the following circumstances:

1. The use, at the time the symptoms first develop, of hand-held powered tools whose internal parts vibrate so as to transmit the vibration to the hand, but excluding those tools which are solely powered by hand; or
2. Repeated flexion and extension of the wrist for at least 20 hours per week for a period or periods amounting in aggregate to at least 12 months in the 24 months prior to the onset of symptoms [90].

However, in practice, Industrial Injuries Disablement Benefit is very rarely provided for a diagnosis of CTS and often only in conjunction with another occupation-related diagnosis. This is due to the difficulty in determining whether an individual's symptoms were specifically caused by their work, given the common occurrence of CTS in the general population [91].

It is often presumed that computer use is associated with an increased risk of CTS, however several high-quality studies have shown no statistically significant association [92, 93]. A Swedish population-based health survey (n=2,465) found the prevalence of CTS was actually lowest in those with the highest frequency of keyboard use [92]. The case definition of CTS was based on self-reported symptoms, with nerve conduction tests for those reporting recurrent sensory changes in the median nerve distribution. The clandestine nature of the survey (it was marketed as a general health survey, although a key aim was to assess the association between CTS and computer use) is rare within CTS research. This strategy addresses the possible influence of the individual's beliefs on self-reported data because it is conceivable that respondents who believe that computer work causes CTS, and were computer users, might be more likely to report symptoms.

The content of CTS-related information in the media has been explored by Anthony et al., who investigated the contribution of the popular press in creating a stigma surrounding repetitive hand use as the cause of common upper limb disorders [94]. The authors identified 124 articles published from 2003-2006 in five major US newspapers discussing upper limb conditions; 85 of these concerned CTS. When independently coded by two reviewers, 52% of CTS articles were found to stigmatise activities involving repetitive hand use and 28% appeared to blame CTS patients for performing these activities. The majority of the stigmatising language was attributed to journalists (95%), although it was also found in quotes from patients and healthcare professionals. Interestingly, less than a quarter of articles mentioned more objective information such as the symptoms, treatment options, or other risk factors for the upper limb disorders being discussed. These findings highlight that the printed media may be a driver for misinformation concerning CTS; websites and social media are likely to be other sources.

Being diagnosed with work-related CTS, and/or the belief that the symptoms were caused by work could have a negative impact on the return to work process after CTR. This was therefore considered in the development of the subsequent chapters of this thesis.

1.3.2 Work psychosocial factors as a risk factor for carpal tunnel syndrome

In addition to the physical attributes of work, psychosocial factors may also play a role in the development of CTS. As discussed above, studies of potential psychosocial risk factors are often limited by issues with recall bias. A large study of 3,515 workers across six US sites over nine years took steps to minimise this by recruiting individuals prospectively (before development of any symptoms) and by using NCS as well as self-report to confirm the CTS diagnosis. The authors found that in addition to sex, age and BMI; high job strain increased the risk of CTS (HR 1.86, 95% CI 1.11, 3.14), while social support from supervisors and colleagues was protective (HR 0.54, 95% CI 0.31, 0.95) [95].

There were similar findings in a large cross-sectional study of French workers (n=3,710), in which high psychological demand was associated with CTS in women (OR 1.90, 95% CI 1.17, 3.09), and low skilled work was associated with CTS in men (OR 1.77, 95% CI 1.01, 3.11) [96]. CTS was diagnosed by self-reported symptoms and clinical examination. It is unclear whether psychological job demands, such as high job strain, have the potential to

lead to physiological changes that increase the risk of CTS, or whether these negative psychological factors alter the interpretation and reporting of CTS symptoms, making an individual more likely to present with these symptoms.

1.3.3 Job change, reduced work productivity and sick leave associated with carpal tunnel syndrome

1.3.3.1 Job change

The sensory and motor symptoms associated with CTS can impede hand functioning [97]. This may lead to an individual requiring work activity modification and/or a change to their job role. The Maine Carpal Tunnel Study recruited 315 patients with CTS, who completed questionnaires at baseline and then 6, 18 and 30 months later. At baseline, 10% of participants reported that they had changed jobs because of their CTS within the previous six months; another 13% had changed jobs between baseline and six months, and over the whole follow-up period 31% changed jobs because of their CTS [98]. A further 14% stopped work completely because of CTS. The most important reasons given for the decision to change jobs or stop working were: work-related hand and wrist pain (54%) and the lack of opportunity to switch to lighter duties or to an alternative work role (33%). Rates of job change/medical retirement in other comparable non-CTS populations were not reported by the authors and therefore the extent to which CTS contributed to the patients' decisions to change jobs or leave the work force are unknown; however, the potential impacts of CTS on work and employment should not be overlooked.

1.3.3.2 Reduced productivity

In addition to job change or leaving the work force, CTS may also be associated with reduced work productivity. Evanoff *et al.* conducted a retrospective case-control study of 234 construction workers with CTS and 249 controls matched for age, trade and insurance eligibility [99]. Compared to controls, the CTS group were more likely to report decreased work productivity and/or quality (OR 2.37, 95% CI 1.52, 3.68) and decreased performance of physical work demands (OR 1.59, 95% CI 1.13, 2.24). Interestingly, there were no significant differences in monthly work hours between CTS patients and controls,

suggesting that despite their self-reported issues with work performance, the CTS patients were not taking notable periods of sick leave. This may reflect a healthy worker effect. If only those who were working were able to enrol in the study, those who were currently on sick leave because of CTS would necessarily be excluded. Alternatively, these findings may represent presenteeism; the situation where people with health issues that would usually prompt work absence, still present for work [100]. Specific data on presenteeism related to CTS are lacking, but this concept should be considered when examining the impacts of the condition on work and work functioning, along with the potential driving forces for presenteeism and absenteeism at employer, employee and societal levels.

1.3.3.3 Sick leave

Atroshi et al. specifically explored sick leave in relation to a new diagnosis of CTS in individuals living in the Skåne region of Sweden [101]. The authors found that in comparison to age-, sex- and district of residence-matched controls, those newly diagnosed with CTS had significantly more sick leave for each 30-day period from 12 months before their diagnosis to 24 months after. The mean number of sick days before diagnosis was initially around 1.5 days higher in the CTS group until approximately one month before diagnosis when this increased to 6.5 days, decreasing again in the following months. A similar pattern was seen with surgery, where sick leave increased sharply approximately one month before surgery and then decreased again around three months post-CTR. This research was possible because Sweden has a national database which requires information on all sickness absence lasting longer than 14 days to be registered with the Swedish Social Insurance Agency [101]. There is no such system in the UK, and it has not been possible for researchers to collect extensive data on CTS-related sick leave at regional or national levels.

1.3.4 Work absence after carpal tunnel release

Surgical treatment of CTS will usually require a period of reduced hand use and work absence to enable the incision site to heal. Data about the proportion of individuals undergoing CTR in the UK who need to return to work are not currently available, but a

recent UK-based cohort study of CTS patients found that approximately half of their 626 participants were in paid employment on enrolment [68].

1.3.4.1 Guidance on the duration of work absence after carpal tunnel release

The amount of post-operative sick leave needed is likely to depend on the nature of the work and the physical loads and upper limb stresses involved. The UK Royal College of Surgeons list their recommended return to work times after CTR for several broad job categories, with heavier manual roles requiring the longest periods of leave (Table 1.4) [102]. It is unclear how the RCS developed these recommendations, including how the occupational groups and timescales were chosen, or whether CTR patients and occupational health professionals were involved. Furthermore, it is not known if this advice is consistently given to patients, or if surgeons routinely provide alternative information based on their own experience of treating CTR patients.

No evidence-based guidance or recommendations from other relevant professional bodies were found. The search included, but was not limited to: national and international clinical associations for surgery/hand surgery, hand therapy, orthopaedics and general practice; and the National Institute for Health and Care Excellence.

Table 1.4 Recommended return to work times after carpal tunnel release

Type of work	Time off work (weeks)
Supervisory/managerial	1-2
Light manual (clerical/secretarial)	2-4
Medium manual (cleaner/nurse/check-out operative)	4-6
Heavy manual	6-10
Custodial/rescue services	6-10

Adapted from the Royal College of Surgeons document: Get well soon – helping you make a speedy recover after carpal tunnel release [102].

1.3.5 Existing research exploring return to work after carpal tunnel release

A scoping review was conducted to establish the extent of existing literature concerning return to work after CTR [103]. The identified studies included a combination of randomised controlled trials, cohort studies, case-series and systematic reviews, however time to return to work after CTR was rarely included as a primary outcome. The duration of post-operative work absence reported by the studies included in this review ranged from a few days to several months, however occupational information, such as the type of work or job contract, was poorly reported, which restricted comparison between studies.

To date, seven published systematic reviews comparing outcomes after open and endoscopic CTR have included time to return to work or activities of daily living (ADLs) in their meta-analyses. The review findings are summarised in Table 1.5. There was marked overlap in the studies included, however all reviews included at least two studies which were unique to their analysis. The nearly universal consensus was that endoscopic CTR was associated with earlier return to work times than open surgery.

Table 1.5 Meta-analyses of time to return to work or function after open and endoscopic carpal tunnel release

Author	Year	Included studies	Procedure associated with earlier return to work/function	Mean difference (days)	95% confidence intervals
Thoma et al. [82]	2004	3 RCTs	No difference	NR	NR
Scholten et al. [75]	2007	6 RCTs	Endoscopic CTR	-6.08	-9.13, -3.03
Kohanzadeh et al. [78]	2012	22 RCTs and obs. studies	Endoscopic CTR	-6.48	NR [a]
Chen et al. [76]	2014	4 RCTs	Endoscopic CTR	-8.21	-9.79, -6.63
Vasiliadis et al. [84]	2014	4 RCTs	Endoscopic CTR	-8.10	-14.28, -1.92
Sayegh & Strauch [80]	2015	11 RCTs	Endoscopic CTR	-8.73	-12.82, -4.65
Vasiliadis et al. [83]	2015	13 RCTs / quasi RCTs	Endoscopic CTR	-9.56	-12.51, -6.60

[a.] $p<0.001$

RCTs randomised controlled trials, obs observational, CTR carpal tunnel release, NR not reported.

An additional meta-analysis compared return to work after traditional open CTR versus minimally invasive open surgery. Santi et al. included three RCTs whose findings had been reported in the previous reviews, and one additional study [79]. Their analysis favoured minimally invasive surgery for earlier return to work (mean difference -7.22 days, 95% CI -10.01, -4.43).

These eight existing systematic reviews were broadly compliant with the PRISMA guidelines [104], and provide valuable information about the role of surgical procedure on the time taken to return to function after surgery. However, there was no consideration of the type of work to which the study participants were returning; whether altered work arrangements, such as amended duties or modified working hours, were required; or when the participants had been advised to return to work. Furthermore, the terms 'return to work' and 'return to ADLs' were used interchangeably as an outcome, while in practice, these are not the same thing. There may be a number of reasons why someone returns to work before being able to complete their usual ADLs, or vice versa, such as financial need, the nature of their work, or whether the dominant or non-dominant hand is affected.

Receipt of worker' compensation has been found to influence return to work after CTR. A 2018 meta-analysis of 25 RCTs and observational studies found that only 77% of patients receiving workers' compensation were able to return to their pre-surgery occupation, compared with 93% of those without compensation [105]. Among those who returned to their previous occupation, the period of post-operative work absence was 4.9 weeks longer in the workers' compensation group. This difference is much greater than any reported in the reviews of CTR surgical procedures discussed above, and suggests that contextual factors are likely to play an important role in return to work outcomes, regardless of the type of surgical procedure.

Prognostic factors for return to work after CTR have also been systematically reviewed [106]. Peters et al. found that poorer work-related outcomes (defined as any outcome pertaining to work, work disability or functioning at work) were associated with: older age; lower household income; greater upper limb functional limitations; more than two musculoskeletal pain sites; lower recovery expectations; poorer mental health status; higher job strain; higher job demands with high job control; poorer co-worker

relationships; poorer pre-operative work functioning; less supportive workplace policies; pre-operative work absence due to CTS, or for any cause; workers' compensation; lawyer involvement and longer post-diagnosis wait for surgery [106]. However, caution must be taken with the interpretation of these findings because few of the included studies investigated the same prognostic factors and many were assessed at high risk of bias. Despite these limitations, this review provides a comprehensive summary of the existing evidence and was used to inform the development of subsequent stages of this thesis.

Possible consequences of returning to work too soon after CTR include wound dehiscence and/or infection, and delayed healing. Possible consequences of delayed return to work include progression to long-term sick leave and the negative impacts that are associated with this. The optimum timescale and method of return to work (e.g. to full duties, or a graded return) will depend on individual, clinical and workplace factors. Qualitative research with patients who had recently undergone knee arthroplasty found that the process of returning to work after surgery was influenced by three key themes: delays in surgical intervention, limited and often inconsistent advice from healthcare professionals regarding return to work, and the absence of rehabilitation to optimise recovery and facilitate return to work [107]. Chapter 6 of this thesis explores whether similar factors were influential for a CTR patient population.

1.3.6 Certification for work absence after carpal tunnel release

In the UK, any period of work absence greater than seven calendar days requires certification from an appropriate healthcare professional in the form of a fit note [108], a copy of which is provided in Appendix A. This period includes both working and non-working days. Those issuing fit notes are advised to consider the work that their patient could do before advising that they are not fit for any work, and to give information about the functional effects of their patient's condition on their fitness for work in general [108]. The process of return to work after a period of ill health or elective surgery is not standardised and may be governed by policy at the level of individual employers.

To date, there is no literature on the effect of the fit note on return to work outcomes for patients with CTS or following CTR, however one prospective cohort study of 50 patients found that the surgeon's advice was the strongest predictor of return to work time after

CTR (OR 30.5, 95% CI 3.2, 288) [109]. The role of advice has also been assessed in a prospective cohort study including 318 employed patients undergoing CTR in a single hospital in the UK [110]. All patients were followed up in a nurse-led clinic, where they were advised to start using their hand immediately and to return to activities of daily living and work as soon as they felt able. Not all of the participants were employed, but of the 191 working in manual roles, 91% had returned to work by two weeks and 98% by four weeks. For non-manual workers (n=81), 99% were working by two weeks and 100% by four weeks. While these findings may not be transferable to other populations (the authors acknowledged that a large proportion of their patients were self-employed), they do suggest that allowing the patient to take greater responsibility for return to work decision-making may facilitate earlier return to work times.

1.3.7 Return to different types of work after carpal tunnel release

The type of work that the individual needs to return to has been suggested as an important factor in determining the duration of work absence after CTR, with longer durations of work absence observed for manual compared to non-manual roles [111]. The RCS guidance discussed in Section 1.3.4.1 also centres around the need for different amounts of post-operative sick leave depending upon the nature of the individual's job. Although not specifically stated, the presumed reasoning is that it will take longer to recover the required range of movement, grip strength and weight-bearing tolerance to be able to comfortably manage heavy work duties. Hence the recommendation to return to light work more quickly than to heavy manual roles. Other considerations include the potential risk of surgical site infection or dehiscence.

The UK Department for Work and Pensions advises that it is the responsibility of the treating clinician to discuss work activities and potential modifications when providing a fit note [108], however within research studies, different job roles need to be classified to enable comparison. The Standard Occupational Classification (SOC), created by the UK Office of National Statistics, determines a job code based on individual job titles [112]. There are nine major occupational categories, each of which has several subgroups. This is also used to define the categories of manual and non-manual roles. This system has recently been used to classify work in a large UK-based cohort study exploring health and

employment in those aged over 50 years [113]. There are flaws with this system in that a person's job title may not accurately reflect the level of physical functioning involved, however it has the benefit of objectively determining job categorisation and was explicitly designed for this role. Similar categorisation systems are used elsewhere, for example, Finland [114], USA [115], Australia and New Zealand [116].

In addition to the type of work, the nature of the job contract may also be important. It is conceivable that those who do not receive any sick pay may wish to return to work more rapidly than those with paid leave in order to prevent financial hardship. The meta-analysis by Dunn et al. (discussed in Section 1.3.5) found that workers' compensation was associated with longer work absence after CTR when compared to those without compensation [105]. None of the included studies were conducted in the UK and the role of the UK healthcare, statutory and occupational sick pay systems on return to work after CTR have not yet been explored. In addition, factors such as the transiency of the work contract also need to be taken into account. Being self-employed rather than employed has been associated with earlier return to work after CTR [117, 118], but potential differences between those with temporary and permanent contracts have not been explored.

1.4 Summary

For CTR patients who work in paid employment, the duration of work absence after CTR reported in the literature appears to vary widely and, outside a broad categorisation of manual and non-manual work, the impact of job type on return to work time is unclear. There is currently no evidence-based guidance to inform patients or clinicians when it might be safe to return to different types of work, or other functional activities, after CTR. Furthermore, it is not known whether early return to heavy work activities is detrimental to clinical outcomes.

From personal experience, the advice given to patients regarding return to work and function after CTR surgery varies. Often this is without clinicians having a good understanding of what the patient's job entails and without discussing the potential for work modifications to facilitate the return. There may be financial implications for the

patient and/or their employer with any delay to return to work, especially for those who are self-employed or have a zero hours contract.

To date the limited research exploring work outcomes after CTR has focused on return to work as a measure to assess the efficacy of different surgical interventions, with little attention given to the role of other clinical or occupational factors, including the type of work the individual is returning to or their usual work schedule.

Chapter 2 Summary of thesis aims, objectives and methods

2.1 Thesis outline

The introductory literature review that informed Chapter 1 led to the development of a series of research questions regarding return to work after carpal tunnel release (CTR). These questions sit under two broad aims:

1. To identify and appraise the existing research and current clinical practice that is pertinent to return to work after CTR, and

2. To identify the outcomes and experiences of CTR patients who are workers.

The research questions and methods used to address these aims are summarised in the following sections. Each component of the research programme is presented as a separate thesis chapter, including specific methods, results and discussion sections. The final chapter combines the findings from each of the previous chapters to suggest the potential clinical implications of this thesis and areas for future research.

2.1.1 Research questions

1. What is currently known about when patients return to work after CTR?
2. How do occupational factors impact upon these return to work times?
3. What advice do UK healthcare professionals give their patients about returning to work after CTR?
4. When and how do UK CTR patients return to work after their surgery?
5. What factors are associated with return to work time in this population?
6. Is earlier return to work after CTR associated with poorer outcomes?

2.1.2 Aim 1: Review of existing research and clinical practice

To identify and appraise the existing research and current clinical practice that is pertinent to return to work after carpal tunnel release.

2.1.2.1 Systematic review (Chapter 3)

Objectives: To provide a comprehensive systematic review of the existing literature, specifically to identify: when patients return to work after CTR and whether this varies based on occupational factors.

Research questions addressed: 1) What is currently known about when patients return to work after CTR, and 2) how do occupational factors impact upon these return to work times?

Methods: A search strategy was developed to identify reported return to work timescales after CTR. Both the published and grey literature were systematically searched. Assessment of study eligibility, risk of bias assessment and data extraction were completed independently by two reviewers. The review protocol was published prior to starting the systematic review to ensure transparency.

Analyses: Narrative data syntheses were performed for the included articles. Duration of work absence was summarised as the median and range for each occupational and study characteristic. Heterogeneity in the research methods and data collected prevented formal meta-analysis.

Self-assessment of review quality: The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines were used to direct the conduct of the review and the PRISMA checklist was used as a guide to ensure the quality of the review reporting [104].

2.1.2.2 Survey of UK clinical practice (Chapter 4)

Objectives: To characterise the recommendations that hand surgeons and hand therapists offer for patients returning to work after CTR and to identify the factors they consider most influential for return to work.

Research question addressed: 3) What advice do UK healthcare professionals give their patients about returning to work after CTR?

Participants: Members of UK clinical professional bodies who perform CTR surgery, or treat CTR patients, were invited to take part in the survey. These included the British Society for Surgery of the Hand, Association of Surgeons in Primary Care and British Association of Hand Therapists. Clinicians were eligible if they had treated at least one CTR patient in the previous 12 months.

Methods: Questionnaires were developed in collaboration with practising clinicians and occupational health professionals, and were piloted for face and content validity. The questions were tailored to each professional group. The survey was distributed electronically to members of the professional bodies and was handed out in paper form at the 2016 British Society for Surgery of the Hand and British Association of Hand Therapists Autumn Scientific meeting.

Analyses: Data were primarily analysed descriptively. Differences in recommended return to work times between clinical groups were assessed using Wilcoxon rank-sum test. Reported advice was analysed qualitatively using thematic analysis.

Self-assessment of research quality: The survey design, conduct and reporting were directed and reviewed using the published guide by Burns and Kho to ensure quality [119].

2.1.3 Aim 2: Investigation of work outcomes after carpal tunnel release

To prospectively identify the outcomes and experiences of CTR patients who are workers.

2.1.3.1 Prospective cohort study of workers undergoing CTR (Chapter 5)

Objectives: To identify when and how patients return to work after CTR for a range of occupations, and to identify the key factors associated with return to work time.

Research questions addressed: 4) When and how do UK CTR patients return to work after their surgery; 5) what factors are associated with return to work time in this population; and 6) is earlier return to work after CTR associated with poorer outcomes?

Participants: Patients referred for CTR at one of 16 sites in England and Wales. Sites included primary care, NHS secondary care and private practice. Eligibility criteria were: aged ≥18 years, working in paid employment for ≥20 hour per week, no previous CTR to either hand and able to understand spoken and written English.

Methods: Questionnaires were completed at baseline (before surgery), and at 4 and 12 weeks after CTR. Information was collected on demographic, clinical, occupational and psychological factors. An additional diary card was used to collect weekly clinical information for the first four weeks after surgery (or until return to work, if this was longer than four weeks). Operative information was extracted from the medical records.
Analyses: Questionnaire data were summarised descriptively. Factors associated with the duration of work absence were analysed using a Cox proportional hazards model and factors associated with poor outcomes were analysed using logistic regression. The differences in return to work time for those with and without the predefined poor outcomes were assessed using Wilcoxon rank-sum test. Free text comments were analysed qualitatively using thematic analysis.
Self-assessment of research quality: Study design and reporting was directed by the STROBE statement (STrengthening the Reporting of OBservational studies in Epidemiology) [120].

2.1.3.2 Qualitative interview study of patients' experiences of returning to work (Chapter 6)

Objectives: To explore patient experiences of returning to work after CTR and to identify the key factors that were important in determining how and when they returned to work.
Research questions addressed: 4) When and how do UK CTR patients return to work after their surgery; 5) what factors are associated with return to work time in this population?
Participants: Individuals who had completed the prospective cohort study were invited to participate using a purposive sampling frame that included: age, sex, occupation and duration of work-absence after CTR.
Methods: Semi-structured individual interviews with questions focused on hand/wrist symptoms, return to work decision-making and the individual's experience of returning to work. Interviews were audio recorded and transcribed verbatim.
Analyses: Transcripts were analysed using the Framework Method to identify the key themes underpinning the participants experiences.
Self-assessment of research quality: Study design was guided by the Mays and Pope criteria for assessing quality and qualitative research [121] and reporting was directed by the COREQ criteria (COnsolidated criteria for REporting Qualitative research) [122].

2.2 Patient and public involvement

2.2.1 Patient advisory group

Individuals who had previously undergone CTR were invited to contribute to the development of this programme of research. During the initial application for funding, the proposed studies were discussed informally with four individuals recruited from the lead researcher's clinical practice and that of her colleagues. The benefits of meaningful involvement of patients and/or the public in all stages of research development, conduct and dissemination have been widely acknowledged [123, 124]. Patient involvement ensured that the content of the research was considered of value by patients and their ideas and suggestions regarding the format of the research were incorporated to enable a user-friendly design.

Each of these patient advisors participated in a telephone conversation in which their experience of CTR was discussed. This included the process of resuming everyday function and work. Patient advisors were asked to think about the positives and negatives of their experience, things that they would have done differently with the benefit of hindsight, and any suggestions for improvement to the CTR pathway. The preliminary research ideas were discussed and the patient advisors were asked for their opinions.

The patient advisers reported that they recalled receiving a lack of information before their surgery, which made it difficult to plan their time off work, as well as other activities, such as travel during the post-operative period. They believed that establishing return to work guidance was important, but that any guidance needed to be flexible enough to allow patients to make their own decisions. Overall, they could not foresee any problems with an observational study of return to work after CTR and thought that patients would be happy to share their experiences in a questionnaire-based format.

A formal patient advisory group was established after PhD fellowship funding was awarded by the NIHR. This comprised the four informal advisors (BM, RC, RR, AD), plus two additional members (RP and KQ). The latter were invited to join the group after they made contact with the lead researcher about the REACTS study, but were not eligible to

participate. Due to the geographical spread of the patient advisors, and other commitments on their time, all preferred to contribute to the group via phone and email, rather than meeting together in one location. Patient advisors were reimbursed for their time in accordance with the INVOLVE guidelines [125]. The patient advisors were involved in all stages of the design, development, analysis and reporting of this research; specific examples are shown in Table 2.1. All advisors were kept up to date with the progress of the research through twice yearly newsletters, an example of which is shown in Appendix B.

Table 2.1. Summary of patient advisory group involvement in this programme of research

Patient advisory group involvement	
Systematic review	- Discussion and development of research questions - Preparation of poster presentation for NIHR conference (2017) - Preparation of e-poster presentation for BSSH conference (2018)
Clinical practice survey	- Discussion and development of research questions - Preparation of poster presentation for NIHR conference (2017) - Preparation of oral presentation for BAHT conference (2017)
Cohort study	- Discussion and development of research questions and format - Discussion of study inclusion/exclusion criteria - Preparation of oral presentation for ASPC conference (2016) - Development of patient information sheets and consent forms - Development of all patient questionnaires - Future involvement planned for the dissemination of the study findings
Qualitative interview study	- Discussion and development of research question - Development of interview schedule - Practice interviews to pilot the interview schedule and format - Evaluation of themes identified during qualitative analysis - Suggested visual representation of themes

NIHR National institute of Healthcare Research; BSSH British Society for Surgery of the Hand; BAHT British Association of Hand Therapists; ASPC Association of Surgeons in Primary care.

2.2.2 Occupational health advisory group

A group of occupational health advisors was also established to support this research through feedback and guidance. Before this thesis, the lead researcher had limited experience of the role of occupational health services in supporting workers undergoing elective surgical procedures. Occupational health advisors were recruited to ensure that the research programme was relevant and evidence-based in this element of healthcare. Three practising occupational physicians were involved and all discussed the proposed research with the lead researcher and provided feedback on the draft protocol. These

individuals were: Dr Ira Madan at Guy's and St Thomas' NHS Foundation Trust, London; Dr Angela Skidmore at University Hospital Southampton NHS Foundation Trust; and Dr Kaveh Asanati at Imperial College, London. As the research progressed, the occupational health advisors also provided feedback on the draft clinician and patient questionnaires. This feedback was incorporated into the final versions. Later, the advisors provided assistance with disseminating the findings among their clinical specialty.

2.3 Summary

This chapter outlined the aims and research questions used to direct this thesis. A mixed methods strategy including both quantitative and qualitative research was chosen to best address the individual research questions. The inclusion of qualitative methods ensured that there was an opportunity for the experiences and views of individuals to be explored in depth. The quantitative components enabled the collection of standardised information from a large number of clinicians and CTR patients with the goal of being broadly representative of the larger population. Patient advisors were involved throughout to offer a patient perspective on the design and content of the studies. This helped to ensure that the research was meaningful to patients, not just clinicians, and that participation in the studies described in Chapter 5 and Chapter 6 was not overly burdensome. The involvement of occupational health advisors added additional expertise on an area of the UK health service where the lead author had little former knowledge.

Full details of the four studies included in this programme of research are provided separately in Chapters 3-6.

Chapter 3 Work absence after carpal tunnel release: a systematic review

3.1 Publication

This systematic review was accepted for publication in the Scandinavian Journal of Work, Environment and Health in 2018 [126]. The published content is provided in Appendix C. The following chapter provides a detailed description of the systematic review, including additional material that was not submitted for publication. Assistance was provided by Martin Stevens (PhD student, University of Southampton), who worked with the lead researcher to carry out eligibility screening and data extraction; and Karen Walker-Bone (PhD supervisor, University of Southampton), who worked with the lead researcher to conduct risk of bias assessments for the included studies.

3.2 Introduction and objectives

The literature search conducted to inform the first chapter of this thesis found minimal information regarding timescales for return to work after CTR. While several systematic reviews have been published that include time to return to work or ADLs as part of their analyses, the distinction between work and other functional activities was unclear [75, 76, 78-80, 82-84]. Furthermore, none of the existing reviews specifically explored the duration of work absence after CTR in relation to the patients' occupation. The first aim of this thesis was therefore to systematically identify and appraise the existing research regarding return to work after carpal tunnel release. This prompted the development of the first two research questions: what is currently known about when patients return to work after CTR, and how do occupational factors impact upon these return to work times?

The objective of this systematic review was therefore to systematically identify reported post-operative return to work timescales for patients undergoing CTR, including occupation and pattern of work data where available.

3.3 Methods

The Centre for Reviews and Dissemination guidelines for systematic reviews in healthcare [127] were used to direct the review process and the PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) guidelines were used to ensure appropriate reporting [128]. The completed PRISMA checklist is provided in Appendix D.

3.3.1 Search strategy

The review protocol was pre-registered with PROSPERO, the international prospective register of systematic reviews [129]. Full eligibility criteria are shown in Table 3.1. Eligible studies were those reporting post-operative return to work time after CTR, using any surgical technique, in a working population. The earlier scoping review found that there were few relevant RCTs that included time to return to work as an outcome measure [103] and therefore cohort studies and case-control studies were included in this systematic review. Case studies and case series were excluded due to their inherent high risk of bias [127], although the difficultly in clearly distinguishing between cohort studies with one study group (eligible) and case series (ineligible) was acknowledged [130]. After discussion with the supervisory team, the following operational definitions were adopted based on the nature of recruitment and the presence/absence of an a priori research protocol. An additional review was also performed by the primary supervisor (KWB) for all cases where the reason for exclusion was 'case series', and for included cohort studies with a single study group. Any disagreements were resolved through discussion.

1. Case series: a sequentially recruited group of patients, treated in a single site, or by a single clinician without a pre-specified research protocol or follow-up period.
2. Cohort studies: participants recruited from more than one clinic using a pre-specified research protocol and a pre-defined follow-up period.

Table 3.1 Review eligibility criteria

Review inclusion criteria	Review exclusion criteria
1. Patients treated with carpal tunnel release surgery using any surgical technique 2. Working population (including those on sick leave pre-operatively) 3. Post-operative return to work times documented, either as a measure of time or the proportion of participants who had returned by specified time points	1. Surgical intervention other than carpal tunnel release 2. Traumatic injuries requiring carpal tunnel release 3. Population not employed at the time of surgery (retired, unemployed, children) 4. Review articles, case series, case studies

In total, nine electronic databases, six trials registries, five grey literature sources and four key journals were searched by the lead researcher between February and March 2016. There were no restrictions for publication date or country. The databases and other search locations are shown in Table 3.2.

Table 3.2 Literature search locations

Electronic databases	MEDLINE, EMBASE, Web of Science, Scopus, AMED, CINHAL, PEDro, PsychINFO, PubMed
Trials registries	Cochrane Central Register of Controlled trials, ClinicalTrials.gov, EU Clinical Trials Register, Alltrials.net, WHO International Clinical Trials Registry, NIHR UK Clinical Trials Gateway
Grey literature sources	E-Theses Online Service, OpenThesis, ProQuest, OpenGrey, OpenDOAR
Key journals	Journal of Hand Surgery (European and American volumes), Occupational Medicine, Journal of Occupational Rehabilitation

In addition, the reference lists from the previous scoping review [103] and other identified relevant systematic reviews [75, 76, 78-80, 82-84, 106] were hand checked to capture any additional eligible studies. An example search strategy for Medline is provided in Appendix E; similar searches were conducted in the other databases.

Title and abstract screening was performed independently by two reviewers (LN and MS) using the Covidence web platform (www.covidence.org); any disagreements were discussed and taken to an additional independent reviewer (KWB) if agreement was not reached. All reviewers agreed the final decision. Full text was retrieved for those articles

selected from this initial screen, and in cases where no abstract had been found. Full text screening was performed according to the review inclusion and exclusion criteria (Table 3.1), following the same process as above. For the included studies, data extraction was performed independently by LN and MS using pre-piloted data extraction forms (Appendix F). Where clarification or additional information were required, LN contacted the relevant author by email.

3.3.2 Risk of bias assessment

Study risk of bias was assessed independently by LN and KWB using the Cochrane Collaboration's tool for assessing risk of bias in randomised trials [131] and a modified version of the Cochrane assessment tool for risk of bias in non-randomised trials [132, 133]. The items assessed are summarised in Table 3.3.

Using the Cochrane terminology, the two authors reviewed each item for RCTs as being at 'low', 'high' or 'unclear' risk of bias; for observational studies, each item was rated as 'low', 'moderate', 'serious' or 'critical' risk of bias. When there was insufficient information to make a firm judgment about the risk of bias for an individual item, the rating 'no information' was used. Summary scores for observational studies were derived from the lowest score (highest risk of bias) for any single item [132, 133]. For RCTs, the absence of participant blinding was excluded from the summary score because of the difficulties with blinding patients in surgical trials and in reporting their own return to work. None of the studies had attempted to blind participants for these features. Studies were rated at low risk of bias if rated 'low' for all remaining domains; high risk of bias if rated 'high' for two additional domains; and 'unclear' for other scoring patterns. Following a pilot of the risk of bias assessment process, the papers were reviewed independently by LN and KWB and any differences in rating were resolved and agreed by discussion. The template risk of bias assessment forms are shown in Appendix G.

Table 3.3 Items assessed in the risk of bias assessments by type of study

Randomised controlled trials	Case control studies	Cohort studies
- Random sequence generation - Allocation concealment - Participant and personnel blinding - Outcome blinding - Completeness of outcome data for return to work - Selection of the reported result - Other sources of bias, particularly post-operative rehabilitation and complications	- Possible confounding - Selection of participants - Measurement of interventions - Completeness of outcome data for return to work - Selection of the reported result - Other sources of bias, particularly post-operative rehabilitation and complications	- Possible confounding - Selection of participants - Measurement of interventions - Departures from the intended interventions - Completeness of outcome data for return to work - Selection of the reported result - Other sources of bias, particularly post-operative rehabilitation and complications

Taken from the Cochrane Collaboration's tool for assessing risk of bias in randomised [131] and non-randomised trials [132, 133].

3.3.3 Data synthesis

It was anticipated that return to work data would be reported in one of two ways: 1) the average time period from CTR to return to work; or 2) the proportion of individuals who had returned to work by specified time points.

For the first scenario, data for time to return to work were expected to be skewed, with a few individuals (outliers) taking much longer to return and thereby contributing to an increased range and mean. In this situation, the median is a more appropriate representation of the central tendency of the data, and the interquartile range (IQR) a more appropriate measure of the data spread. Optimal reporting of the duration of work absence was therefore considered as the median and IQR. Summary data were calculated using the median return to work times reported for each study or study intervention group. A separate summary of mean return to work times was calculated where the median had not been reported by the authors. It was not possible to take into account the spread of the data in each study because this information was rarely reported. For each summary calculation, the number of studies and observations (study arms) that provided these data were documented. Due to inconsistent reporting of the number of workers in the included studies, summary data could not be weighted for sample size.

For the second scenario, review data were summarised as the proportion of participants who had returned to work by the specific time points documented in each study. No summary calculation was performed due to variation in these time points.

For both scenarios, it was assumed that the included studies would report return to work times using a mixture of days, weeks and months. To enable direct comparison, all time points were reported as days within this review. The basis of the conversion was that one week was equal to seven days and one month equal to 30 days. In the absence of explicit information, an assumption was made that the reported return to work times included all seven days of a calendar week, regardless of the participants' usual working pattern.

3.4 Results

3.4.1 Study characteristics

The literature search was conducted up to 12 March 2016 and identified a total of 9,668 records, of which 5,639 were duplicates. After abstract and title screening, 301 full-text articles were retrieved for further assessment and 56 eligible study reports were identified; 18 RCTs [70, 88, 134-149] and 38 observational studies [101, 109, 111, 117, 118, 150-182].

Twenty-four authors were contacted for additional information [101, 183-205]. The requested information predominantly included: access to primary data where return to work information was only given as the difference between study groups, or was only reported in the abstract; clarification of whether studies reporting 'return to work or normal functioning' had specific data for return to work; or whether any additional papers had been published for the identified conference abstracts. Nine authors replied [101, 183, 186, 187, 189, 190, 192, 198, 203], however only one, Isam Atroshi, provided clarification which enabled the paper to be included. In their study, the duration of post-operative work absence was reported in table form under the heading 'new sickness absence period' [101]. In addition, contact was made with the lead author of the existing systematic review exploring prognostic factors for return to work after CTR [106]. Susan

Peters kindly provided their list of identified studies and this was cross checked against those identified by the current search.

The PRISMA flow diagram [104] for the study selection process is presented in Figure 3.1. Two of the included reports described findings from the same participants [111, 151], however they provided different return to work analyses and have been included separately. Where participant numbers and demographics are summarised in this review, the individuals involved in these two reports have only been counted once. For this reason, the total number of included studies was 55, with 56 reports. Excluded studies and the reason for exclusion are listed in Appendix H.

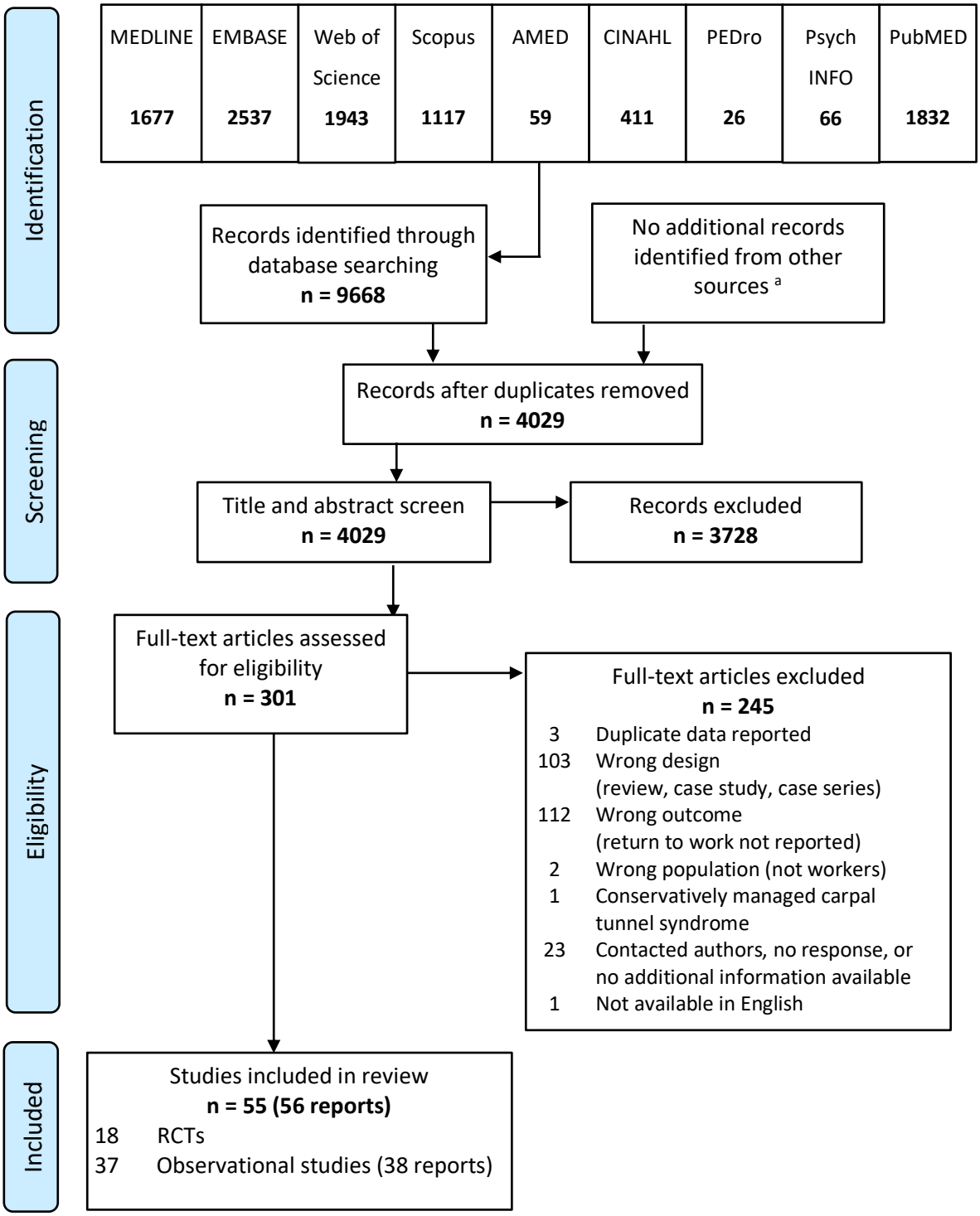


Figure 3.1 Systematic review flow diagram

Adapted from the PRISMA statement on preferred reported items for systematic reviews [104].
[a.] Other sources comprised: 1. Trials registries (Cochrane Central Register of Controlled trials, ClinicalTrials.gov, EU Clinical Trials Register, Alltrials.net, WHO International Clinical Trials Registry, NIHR UK Clinical Trials Gateway); 2. Grey literature databases (E-Theses Online Service, OpenThesis, ProQuest, OpenGrey, OpenDOAR; 3. Key journals (Journal of Hand Surgery [European and American volumes], Occupational Medicine, Journal of Occupational Rehabilitation); 4. References from the identified existing systematic reviews [75, 76, 78-80, 82-84, 106].

Sixteen countries were represented in the included studies, of which two were collaborations involving patients in the USA and Sweden [135, 153]. Twenty-seven studies were conducted in the USA [70, 111, 138, 141, 148, 150, 151, 154-157, 159, 162, 164-166, 170-172, 174-181] and one in Canada [173]. The remaining studies were conducted in Europe and the UK [88, 101, 117, 118, 134, 136, 137, 139, 140, 142-146, 149, 152, 160, 161, 167-169, 182], Asia [147, 158, 163] and Israel [109]. The date of publication ranged from 1992 [70, 156, 165] to 2016 [158], with 33 (60%) of the included studies published in 2000 or later.

3.4.1.1 Participants

The 55 included studies comprised 14,335 CTR patients (1,551 from RCTs, 7,328 from cohort studies and 5,456 from a single case control study). Seven studies did not document mean/median age, or any measure of age distribution for their CTR participants [101, 109, 138, 156, 159, 165, 182]. Of the 17 RCTs and 31 observational studies that did report age data, the mean age of the CTR participants ranged from 44-60 years in RCTs, and 37-66 years in cohort studies. Sex distribution was reported by 16 RCTs and 32 observational studies and the male/female ratio was 1:2.4 across both RCTs and cohort studies, compared with 1:3 for the case-control study. Seven studies did not report the sex of their participants [70, 138, 155, 156, 159, 165, 173].

Study inclusion and exclusion criteria varied widely between studies. Importantly, there were no consistently reported methods of CTS diagnosis. Six studies included only individuals with unilateral CTS [144, 149, 158, 167, 178, 179]; seven studies included only individuals with bilateral CTS [134, 139, 160, 162, 163, 176, 180]; 29 studies (30 reports) included individuals undergoing either unilateral or bilateral CTR [70, 111, 118, 135, 137, 140-142, 145, 147, 148, 150-152, 155, 157, 159, 161, 164-166, 168-170, 172-175, 177, 182]; and 14 studies did not report any information on whether one or both hands were involved [88, 101, 109, 117, 136, 138, 143, 146, 152-154, 156, 171, 181].

Return to work timescales were reported by all included studies, however, six RCTs [88, 134, 137, 138, 141, 147] and seven cohort studies [164, 168-170, 176, 177, 180] did not specify the number of individuals included in their return to work analyses. Across the studies which did report the number of workers, return to work time was reported for a

total of 807 workers in RCTs, 6,410 workers in cohort studies and 1,529 in a single case control study. With a pragmatic assumption that, where unreported, all participants provided return to work data, these totals would increase to 1,263 workers from RCTs and 8,600 from observational studies. Unfortunately, very few studies reported demographic information specific to the included workers.

3.4.1.2 Risk of bias

The outcome of the risk of bias assessments are summarised in Figure 3.2 to Figure 3.4. Overall only four studies were rated at low risk of bias: one RCT [149], one case control study [101] and two cohort studies [152, 181]. In contrast, six RCTs were rated at high risk of bias [70, 134, 140, 141, 147, 148] and 19 cohort studies were rated at critical [156, 171] or serious [154, 159-161, 163-166, 168-170, 172, 174, 176-178, 180] risk of bias.

Randomised controlled trials	Sequence generation	Allocation concealment	Participant blinding	Outcome blinding – RTW	Outcome data – time to RTW	Selective reporting	Other	Summary rating
Agee 1992		?			?	?	?	
Atroshi 2006								
Bhattacharya 2004								
Brown 1993								?
Bruser 1999		?			?	?	?	?
Cellocco 2009					?	?		?
Cook 1995	?	?			?	?	?	?
Ferdinand 2002							?	?
Finsen 1999	?				?	?		
Foulkes 1994							?	
Jacobsen 1996	?	?		?		?		?
Jugovac 2002						?	?	?
Larsen 2013						?		?
Provinciali 2000					?		?	?
Saw 2003						?		?
Sennwald 1995					?	?	?	?
Tian 2007	?	?			?	?		
Trumble 2002		?			?			

Low risk of bias ? Unclear risk of bias High risk of bias

Figure 3.2 Risk of bias assessment for the included randomised trials

Participant blinding was excluded from the summary score due to the difficulty of blinding participants in surgical trials. Studies were rated at low risk of bias if rated 'low' for all remaining domains; high risk of bias if rated 'high' for two additional domains; and 'unclear' for other scoring patterns.
RTW return to work.

Case control study	Confounding	Participant selection	Measurement of intervention	Missing data	Measurement of RTW outcomes	Selective reporting	Overall bias
Atroshi 2015							

Low risk of bias Moderate risk of bias Serious risk of bias

Figure 3.3 Risk of bias assessment for the included case control study

RTW return to work.

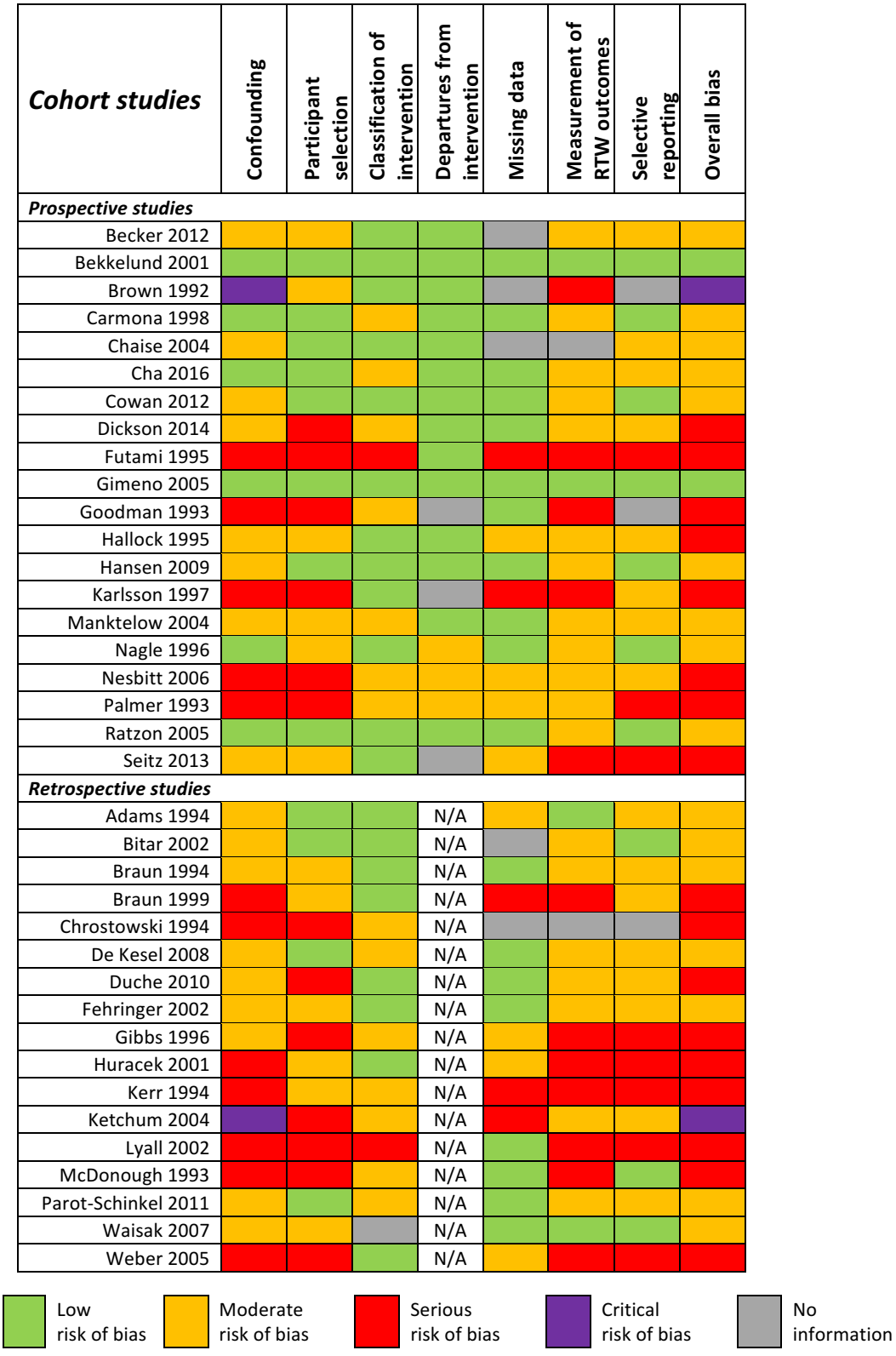


Figure 3.4 Risk of bias assessment for the included cohort studies

Cohort studies were rated at low risk of bias if the study scored 'low' for all domains; moderate if they scored at least 'moderate' for all domains; serious if they scored serious in one or more domain; and critical if they scored critical in one or more domain.
RTW return to work, N/A not applicable.

In the included RCTs, the use of a random sequence to determine a participant's treatment group, and the subsequent concealment of this allocation from the study investigators, were generally well reported. As expected, participant blinding was not reported in any study; unfortunately, only one study adequately described outcome assessor blinding and the collection of return to work data from a national database [149].

Few studies of any design stated their outcome measures and planned analysis a priori; similarly, few outlined their method of calculating post-operative return to work time, or the time points of assessment. Furthermore, the handling of data from those who had not returned to work before the end of the study period (right censored data) was not adequately addressed. Potential confounders were discussed in the majority of observational studies, although not always adequately. Common concerns raised during the risk of bias assessment centred on the case-mix, including the use of obviously different populations for each treatment group [171], and not reporting any occupational information for study participants [154, 156, 159, 168, 169, 180]. Eight of the included studies (three RCTs and five observational reports) did not document explicit study inclusion or exclusion criteria [109, 134, 136, 137, 151, 168, 175, 180].

The assessment of time to return to work after CTR in relation to study risk of bias is discussed in Section 3.4.1.2.

3.4.1.3 Measurement of return to work timescales

The primary outcome of this review (duration of work absence after CTR) was reported by all studies, however there was no common method of defining or collecting these data. The reported return to work measures fell into four broad, non-hierarchical, categories based on the source of the information as reported by 35 studies (36 reports): 1) regional/national databases; 2) patient-reported questionnaires or telephone interviews; 3) clinical assessment by healthcare professionals; and 4) extraction from the medical records.

It was often difficult to determine which individuals provided return to work information and how the information was derived, for example via self-reported questionnaires or

face-to-face discussion. If return to work data were obtained from the clinic or medical records, the details of who collected and extracted this information was not provided. The diversity of these return to work measures and time points of assessment are summarised in Table 3.4 to Table 3.7.

The reliance on retrospective patient recall, in some cases several years after their CTR surgery and return to work, was a limitation of many studies, as shown in Table 3.5, and the accuracy of the reported return to work times is difficult to assess. Data collection methods based on recall may have led to either inflated or deflated time points, but there is no reason to expect that the recall of this information would be systematically biased in one direction.

Twenty studies, 11 RCTs [70, 134, 136, 139, 140, 142-144, 146-148] and nine observational studies [117, 154, 156, 158, 160, 163, 165, 169, 175], reported post-operative return to work times without defining their return to work measure, or explaining how their return to work information was collected.

Table 3.4 Summary of return to work information collected from regional or national databases

	Description of return to work measure	**Data collection method**
Atroshi *et al.* 2006 [149]	Number of days from surgery to patient's return to work. Defined for the analysis as the number of days from surgery until partial or total return to work	Retrieved from the national social insurance office
Atroshi *et al.* 2015 [101]	Net full-time sickness was calculated for those exceeding 14 days. Only sickness absence exceeding 14 days was registered with the social insurance agency. Sickness could be granted for a full working day (8 hours) or 0.75, 0.5, 0.25 of a day	Retrieved from the national social insurance office
Wasiak & Pransky 2007 [179]	Number of compensated days off work separated for before and after surgery	Retrieved from workers' compensation claims

Table 3.5 Summary of return to work information collected from participant questionnaires or telephone interviews

	Description of return to work measure	Data collection method	Data collection time point [a]
Cellocco *et al.* 2009 [137]	Time to return to work	Self-reported by phone	30 days
Foulkes *et al.* 1994 [141]	Time lost from work	Telephone survey	3 years
Becker *et al.* 2012 [151]; Cowan *et al.* 2012 [111]	Patients asked to report any change of work role after surgery, how long they waited before returning to modified duty work, and how long they waited before returning to their normal duties	Questionnaire	6 months
Bekkelund *et al.* 2001 [152]	Duration of workers' compensation for carpal tunnel release	Questionnaire	NR
Carmona *et al.* 1998 [157]	Time elapsed until the subject reported return to work after surgery	Telephone interview	NR
De Kesel *et al.* 2008 [118]	Duration of work incapacity period after surgery	Questionnaire	NR
Gibbs *et al.* 1996 [164]	Time to return to work	Questionnaire	NR
Hansen *et al.* 2009 [167]	Time off work dichotomised to ≤21 days or >21 days	Questionnaire	3 months
Ketchum 2004 [171]	Return to work	Telephone interview or clinic assessment	NR
Manktelow *et al.* 2004 [173]	Return to work, with or without modifications	Questionnaire and extracted from medical notes	4 years
Nesbitt *et al.* 2006 [176]	Number of weeks off work post-operatively	Questionnaire	6 months
Palmer *et al.* 1993 [177]	Date of return to any gainful employment	Questionnaire	2, 4 and 6 weeks; plus 3 and 6 months
Parot-Schinkel *et al.* 2011 [182]	From, and including, the day of surgery to the end of sick leave when the patient returned to any work with or without restriction	Questionnaire	Up to 2 years
Ratzon *et al.* 2006 [109]	Return to work	Questionnaire and telephone interview	Every 2 weeks for 3 months

[a.] Time since carpal tunnel release surgery. NR Not reported.

Table 3.6 Summary of return to work information collected during clinical assessment

	Description of return to work measure	Data collection method and timing [a]
Cook *et al.* 1995 [138]	Return to light duties and return to full duties. The decision to return to work was reached jointly by patient and physician	Assessed in clinic [b]
Provinciali *et al.* 2000 [88]	Delay in return to work was assessed by calculating the number of days from the date of operation until patients returned to their daily activities in full	Assessed at 12 days, 1 and 3 months after surgery
Saw *et al.* 2003 [145]	Calculated from the date of surgery and the date of return to work reported by the patient	Assessed at 1, 3, 6 and 12 weeks
Adams *et al.* 1994 [150]	Classified as: returned to same job, returned to a different job, did not return to any job. Also dichotomised into time loss ≤90 days (normal recovery) and time loss > 90 days (abnormal or delayed recovery)	Time loss certified by an attending physician [b]
Brown *et al.* 1993 [135]	Return to normal work duties without marked restriction	Assessed at 21, 42 and 84 days
Chrostowski *et al.* 1994 [159]	Time to return to work and any complications	Assessed at 14 and 42 days
Duche & Trabelsi 2010 [161]	Duration of sick leave	Assessed 4-6 weeks after surgery, further reviews for those still on sick leave
Fehringer *et al.* 2002 [162]	Return to light or regular duty was directed by the surgeon. Light duty was defined as no lifting greater than 3-5lbs, no repetitive use of the extremity and the ability to use splints as required	As directed by surgeon [b]
Gimeno *et al.* 2005 [181]	Classified in three ways: returned to work and functioning successfully, returned to work with limitations, or not returned to work for health reasons	Assessed at 2 and 6 months
Hallock & Lutz 1995 [166]	Time between surgery and return to work	Assessed in clinic [b]
Seitz & Lall 2013 [178]	Return to at least light duties	Hand therapy assessment at 1, 3, 6 and 12 weeks; plus 6 and 12 months

[a.] Time since carpal tunnel release surgery.

[b.] The time point(s) for the assessment of return to work information was not reported.

Table 3.7 Summary of return to work information collected from the medical records

	Description of return to work measure	Data collection method [a]
Bitar *et al.* 2002 [153]	Number of days off work after surgery	Medical records and/or insurance company claims
Braun & Jackson 1994 [155]	Time from operation to return to work, or return to less strenuous occupation. Excluded patients with other medical conditions or injuries that precluded return to work	Medical records
Huracek *et al.* 2001 [168]	Return to previous work activities	Medical records
Kerr *et al.* 1994 [170]	Length of time before return to work	Medical records
Lyall *et al.* 2002[172]	Return to: one handed, two handed or full duty. Full duty status was given when the physician considered the patient to be medically able to return to the normal duties of his/her job	Medical records after each clinic visit
McDonough & Gruenloh 1993 [174]	Lost time from work	Medical records
Weber & Boyer 2005 [180]	Time off work	Medical records and patient telephoned

[a.] The time point(s) for the entry of return to work information in the medical records was not reported for any of the included studies.

3.4.1.4 Bilateral or unilateral surgery

Six of the included studies recruited only participants who were undergoing unilateral CTR [144, 149, 158, 167, 178, 179]. For these studies, the period of post-operative work absence could be considered from the date of surgery to the time of return to full or modified work duties.

For patients requiring bilateral surgery for CTS, there were two treatment options; simultaneous surgery, when both hands were operated on during the same surgical episode, and staged surgery, when each hand was operated on at a separate time point. The method of calculating return to work times for participants undergoing staged bilateral CTR was more variable, and could incorporate the work absence for both hands, mean work absence overall, or work absence for either the first or second operation. Thirty-six studies included patients with bilateral CTS, although one excluded bilateral participants from their return to work analysis [70]. Twelve studies (13 reports) did not

document whether the bilateral surgery was staged or simultaneous, or how the return to work timescale was calculated for participants undergoing bilateral release [111, 137, 141, 147, 151, 155, 157, 159, 161, 172-174, 182].

Of the remaining 22 studies, three RCTs assessed only simultaneous surgery and each participant was counted as one case for the return to work analysis [135, 139, 140]. Four observational studies compared the outcomes following simultaneous or staged CTR using the total duration of work absence for both hands combined in the staged groups [162, 168, 176, 180]. A further four studies included both simultaneous and staged CTR patients in the same study group. Of these, Nagle et al. [175] and Palmer et al. [177] both reported return to work time as the period of work absence from the second surgery for participants undergoing staged releases; Kerr et al. stated that "the length of time from the second surgery to the patient's return to work was also designated as the return to work time for the first surgery" [170] (p 267); and Futami et al. did not specify how return to work time was calculated for the simultaneous and staged release participants [163].

Eleven studies only used staged surgery for their bilateral patients, eight of these reported return to work timescales for each hand, but did not specify the time period between surgeries [118, 142, 148, 150, 164-166, 169]. The remaining three studies reported return to work timescales for each hand and the intervening time period between surgical procedures: Bhattacharya et al. [134] and Dickinson et al. [160] allowed a minimum of six weeks between surgeries; while Saw et al. allowed a minimum of seven months [145]. None of these studies explained how the data were reported for participants who had not returned to work by the time of the second surgery.

Fourteen studies (five RCTs [88, 136, 138, 143, 146] and nine observational studies [101, 109, 117, 152-154, 156, 171, 181]) did not report whether the included participants were undergoing unilateral or bilateral surgery. Because of the widespread lack of information about the inclusion and management of bilateral CTR patients, the summary data reported in the subsequent sections includes only simultaneous bilateral CTR, unless otherwise stated.

3.4.2 Return to work timescales

The first objective of this systematic review was to identify post-operative return to work timescales for patients undergoing CTR. The characteristics of the included studies and their reported return to work times are outlined in Table 3.8 to Table 3.11. Overall, there was wide variation in the reported durations of post-operative work absence (Figure 3.5). Average work absence ranged from a mean of 4 days for participants undergoing open CTR in a retrospective cohort study with a serious risk of bias [164], to a mean of 168 days (24 weeks) for participants with lawyer representation undergoing open CTR in a prospective cohort study, also with a serious risk of bias [154]. Neither of these studies reported standard deviations or provided any estimate of the range around the mean times.

The longest return to work times were found in studies that did not document the type of CTR procedure performed and reported the mean time point [150, 154, 155]. The median and IQR were chosen as the ideal method of data reporting for this review, but the majority of studies summarised their data as the mean (Figure 3.5). Where the mean was used, it was often unclear how return to work time was calculated for participants who had not returned to work by the end of the study period. This raises the possible issue of right-censoring and the associated underestimation of the mean time point.

Only two studies reported median and IQR [101, 149], with a further five reporting median and range [134, 148, 152, 162, 169]. Two studies provided individual participant data, which allowed these summary measures to be calculated [139, 142]. All reported measures of central tendency (mean and median) and the distribution of the data (standard deviation, range and inter-quartile range) are included in the supporting tables and figures. Median return to work time is reported in the text, with the mean used only where the median was not available.

Figure 3.5 Return to work times in days after carpal tunnel release

Surgical interventions are separated into endoscopic (triangle) and open CTR (circle). Where both were performed this is indicated with a diamond. Where the CTR procedure type was not reported, this is marked with a cross. Median (green) and mean (orange) return to work times are reported in days. Symbol size represents the number of study participants. Outcome of the risk of bias assessment is shown by the shaded blue bars.

Table 3.8 Randomised controlled trials reporting return to work times after carpal tunnel release

Study	Compensation or insurance type	Work type	Number of workers	CTR procedure and study group	Time to return to work (days)				Risk of bias
					Median	Mean	Range	SD	
Agee 1992	Workers' compensation	NR	10	Open	78	-	-	-	High
USA [70]	No workers' compensation		20		45.5	-	-	-	
	Combined		30		46.5	-	-	-	
	Workers' compensation		11	Endoscopic	71	-	-	-	
	No workers' compensation		38		16.5	-	-	-	
	Combined		49		25	-	-	-	
Atroshi 2006	State insurance	NR	6	Open (on sick leave before CTR)	37	76	14-174 [a]	74	Low
Sweden [149]			59	Open (not on sick leave before CTR)	28	33	23-44 [a]	19	
			10	Endoscopic (on sick leave before CTR)	51	84	25-200 [a]	62	
			53	Endoscopic (not on sick leave before CTR)	28	28	17-39 [a]	16	
		Blue collar work	95	Open and endoscopic	36	44	-	36	
		While collar work	27	Open and endoscopic	21	19	-	14	
Bhattacharya 2004	NR	NR	26 [b]	Bilateral open (2.5cm incision)	14	-	<7-42	-	High
UK [134]			26 [b]	Bilateral KnifeLight [d]	14	-	<7-42	-	
Brown 1993	Mixed	NR	40	Open (3.5-4.5cm incision)	28	-	-	-	Unclear
USA & Sweden [135]			41	Endoscopic (two portals)	14	-	-	-	
Bruser 1999	NR	NR	38	Open (2.5cm incision)	21	18	-	-	Unclear
Germany [136]			42	Open (4.5cm incision)	18	19	-	-	
Cellocco 2009	NR	NR	103 [b]	Open	-	25	23-29	-	Unclear
Italy [137]			82 [b]	KnifeLight [d]	-	17	15-18	-	
Cook 1995	Mixed	Light duties	25 [b]	Open (splint)	-	24	-	-	Unclear
USA [138]		Full duties	25 [b]		-	27	-	-	
		Light duties	25 [b]	Open (no splint)	-	15	-	-	
		Full duties	25 [b]		-	17	-	-	
Ferdinand 2002	NR	NR	14	Bilateral open and endoscopic	26.5	31	11-70	17	Unclear
UK [139]									
Finsen 1999	State insurance	NR	19	Open (splint)	42	-	-	-	High
Norway [140]			28	Open (no splint)	42	-	-	-	
Foulkes 1994	NR	NR	8 [b]	Open (standard procedure)	53	-	1-180	-	High
USA [141]			15 [b]	Open with epineurotomy	59	-	14-120	-	
Jacobsen 1996	No workers' compensation	NR	16 [c]	Open	19	19	0-42	10	Unclear
Sweden [142]			16 [c]	Endoscopic (two portals)	19.5	17	0-31	9	

Study	Compensation or insurance type	Work type	Number of workers	CTR procedure and study group	Time to return to work (days)				Risk of bias
					Median	Mean	Range	SD	
Jugovac 2002	NR	NR	36	Open (2.5cm incision)	-	15	5-45	-	Unclear
Croatia [143]			36	Open (long incision)	-	30	10-60	-	
Larsen 2013	State insurance	NR	23	Open (3cm incision)	16	-	-	-	Unclear
Denmark [144]			17	Open (7cm incision)	20	-	-	-	
			16	Endoscopic (one portal)	7	-	-	-	
Provinciali 2000	No workers' compensation	NR	50 [b]	Open (therapy-led rehabilitation)	-	32	-	11	Unclear
Italy [88]			50 [b]	Open (home exercise programme)	-	43	-	13	
Saw 2003	NR	NR	42	Open	-	26	-	14	Unclear
UK [145]			43	Endoscopic (one portal)	-	18	-	11	
Sennwald 1995	NR	NR	22 [b]	Open	-	42	-	-	Unclear
Switzerland [146]			25 [b]	Endoscopic (one portal)	-	24	-	-	
Tian 2007	NR	NR	30 [b]	Open	-	28	-	-	High
China [147]			32 [b]	Endoscopic (one portal)	-	12	-	-	
Trumble 2002	Mixed	NR	49	Open	38	-	14-84	-	High
USA [148]			53	Endoscopic (one portal)	18	-	3-56	-	

[a.] Interquartile range. [b.] Number of workers not explicitly stated. [c.] Reported as number of hands, rather than number of individuals.
[d.] KnifeLight is a minimally invasive open carpal tunnel release surgical tool with illumination.
NR not reported, CTR carpal tunnel release, RTW return to work, SD standard deviation.

Table 3.9 Case control study reporting return to work times after carpal tunnel release

Study	Compensation or insurance type	Work type	Number of workers	CTR procedure and study group	Time to return to work (days)				Risk of bias
					Median	Mean	Range	SD	
Atroshi 2015	State insurance	NR	1121	CTR procedure not reported (female)	35	44	27-45 [a]	44	Low
Sweden [101]			408	CTR procedure not reported (male)	41	52	28-50 [a]	65	

[a.] Interquartile range. NR not reported, CTR carpal tunnel release, RTW return to work, SD standard deviation.

Table 3.10 Prospective cohort studies reporting return to work times after carpal tunnel release

Study	Compensation or insurance type	Work type	No. of workers	CTR procedure and study group	Time to return to work (days)				Risk of bias
					Median	Mean	Range	SD	
Becker 2012 & Cowan 2012 USA [111, 151]	No workers' compensation	All work types (modified duties)	66	Open (short incision)	-	12	0-90	16	Moderate
		All work types (normal duties)			-	19	0-90	22	
		Desk-based (modified duties)	34		-	7	0-49	11	
		Desk-based (normal duties)			-	10	0-90	17	
		Non-desk-based (modified duties)	32		-	18	0-90	20	
		Non-desk-based (normal duties)			-	30	3-90	23	
		Part-time (modified duties)	13		-	15	0-56	18	
		Part-time (normal duties)			-	34	0-90	33	
		Full-time (modified duties)	52		-	10	0-49	11	
		Full-time (normal duties)			-	14	0-60	14	
Bekkelund 2001 Norway [152]	Workers' compensation	NR	106	Open (all participants)	42	-	<7-365	-	Low
			71	Open (female)	49	-	<7-365	-	
			35	Open (male)	42	-	<7-84	-	
Brown 1992 USA [156]	NR	NR	149 [a]	Endoscopic (one portal)	-	16	-	-	Critical
			152 [a]	Endoscopic (two portals)	-	15	-	-	
Carmona 1998 USA [157]	Mixed	NR	59	CTR procedure not reported	35	-	-	-	Moderate
Chaise 2004 France [117]	Mixed	Non-manual work (self-employed)	18	Biportal CTR without an endoscope	-	11	-	-	Moderate
		Non-manual work (private sector)	23		-	21	-	-	
		Non-manual work (civil servant)	28		-	49	-	-	
		Manual work (self-employed)	69		-	29	-	-	
		Manual work (private sector)	67		-	42	-	-	
		Manual work (civil servant)	28		-	63	-	-	
	State insurance	Self-employed	75		-	17	-	-	
		Private sector employee	70		-	31	-	-	
		Civil servant or comparable	46		-	56	-	-	
	Workers' compensation	Self-employed	12		-	34	-	-	
		Private sector employee	20		-	46	-	-	
		Civil servant	10		-	72	-	-	
Cha 2016 Korea [158]	No workers' compensation	NR	52	Open CTR with delay	-	9	-	1	Moderate
			100	Immediate open CTR	-	15	-	2	

Study	Compensation or insurance type	Work type	No. of workers	CTR procedure and study group	Time to return to work (days)				Risk of bias
					Median	Mean	Range	SD	
Dickson 2014 UK [160]	NR	All work types	23	Bilateral open (simultaneous procedures)	-	20	-	-	Serious
		Non-manual work	16		-	18	-	-	
		Manual work	7		-	24	-	-	
		All work types	14	Bilateral open (staged procedures)	-	33	-	-	
		Non-manual work	9		-	29	-	-	
		Manual work	5		-	42	-	-	
Futami 1995 Japan [163]	NR	NR	3	Open	-	49	-	-	Serious
			3	Endoscopic (one portal)	-	42	-	-	
Goodman 1993 USA [165]	NR	NR	44	CTR procedure not reported (RTW policy)	-	6	-	-	Serious
			23	CTR procedure not reported (standard care)	-	29	-	-	
Hallock 1995 USA [166]	Mixed	NR	39 [b]	Open	-	46	-	37	Serious
			25 [b]	Endoscopic (two portals)	-	40	-	19	
	Workers' compensation	NR	25 [b]	Open	-	60	-	38	
			20 [b]	Endoscopic (two portals)	-	46	-	15	
Hansen 2009 Denmark [167]	State insurance	NR	75	Endoscopic (one portal)	-	20	-	14	Moderate
Karlsson 1997 Sweden [169]	NR	NR	50 [a]	Open	32	-	7-84	-	Serious
			24 [a]	Open with TCL lengthening	42	-	21-154	-	
Manktelow 2004 Canada [173]	Workers' compensation	NR	772	Endoscopic	-	92	-	-	Moderate
Nagle 1996 USA [175]	Workers' compensation	All work types	92	Endoscopic	-	57	0-256	-	Moderate
		Sedentary work	13		-	35	1-151	-	
		Light work	10		-	41	15-79	-	
		Light-repetitive work	21		-	51	9-152	-	
		Medium manual work	21		-	59	4-144	-	
		Heavy manual work	14		-	101	0-256	-	
	No workers' compensation	All work types	199		-	22	0-153	-	
		Sedentary work	56		-	17	0-153	-	
		Light work	62		-	25	1-143	-	
		Light-repetitive work	21		-	21	2-67	-	
		Medium manual work	25		-	27	1-74	-	
		Heavy manual work	13		-	22	1-75	-	

Study	Compensation or insurance type	Work type	No. of workers	CTR procedure and study group	Time to return to work (days)				Risk of bias
					Median	Mean	Range	SD	
Nesbitt 2006 USA [176]	No workers' compensation	NR	12 [a]	Bilateral endoscopic (simultaneous)	-	18	-	-	Serious
	Mixed	NR	31 [a]	Bilateral endoscopic (staged 1-3 weeks)	-	60	-	-	
			28 [a]	Bilateral endoscopic (staged >3 weeks)	-	42	-	-	
Palmer 1993 USA [177]	Combined	NR	41 [a]	Open	-	44	4-142	38	Serious
	Workers' compensation		26 [a]		-	51	10-142	33	
	No workers' compensation		15 [a]		-	27	4-138	38	
	Combined	NR	70 [a]	Endoscopic (one portal)	-	21	1-66	13	
	Workers' compensation		39 [a]		-	30	8-66	11	
	No workers' compensation		11 [a]		-	11	1-21	6	
	Mixed	NR	62 [a]	Endoscopic (two portals)	-	28	1-77	17	
	Workers' compensation		36 [a]		-	35	12-79	15	
	No workers' compensation		26 [a]		-	20	1-77	16	
Seitz 2013 USA [178]	Workers' compensation	NR	18	Open (3-3.5cm incision)	-	36	-	-	Serious
	No workers' compensation		25		-	16	-	-	
	Workers' compensation	NR	16	Open with TCL lengthening	-	24	-	-	
	No workers' compensation		24		-	9	-	-	

[a.] Number of workers not explicitly stated. [b.] Reported as number of hands, rather than number of individuals.

NR not reported, CTR carpal tunnel release, RTW return to work, SD standard deviation, TCL transverse carpal ligament.

Table 3.11 Retrospective cohort studies reporting return to work times after carpal tunnel release

Study	Compensation or insurance type	Work type	No. of Workers	CTR procedure and study group	Time to return to work (days)				Risk of bias
					Median	Mean	Range	SD	
Adams 1994 USA [150]	Workers' compensation	NR	191	CTR procedure not reported	-	113	-	-	Moderate
Bitar 2002 USA & Sweden [153]	Workers' compensation	NR	34	Open (USA)	-	72	-	42	Moderate
	No workers' compensation	NR	47 [a]	Open (USA)	-	57	-	37	
			42 [a]	Open (Sweden)	-	36	-	23	
Braun 1994 USA [155]	Workers' compensation	NR	49	CTR procedure not reported (normal NCS)	-	160	-	-	Moderate
			74	CTR procedure not reported (abnormal NCS)	-	148	-	-	
			25	CTR procedure not reported (no NCS)	-	126	-	-	
Braun 1999 USA [154]	NR	NR	63 [a]	CTR procedure not reported (lawyer involved)	-	168	-	-	Serious
			162 [a]	CTR procedure not reported (no lawyer)	-	140	-	-	
Chrostowski 1994 USA [159]	No workers' compensation	NR	19 [a]	Open	-	40	28-42	-	Serious
			16 [a]	Endoscopic (one portal)	-	12	0-14	-	
De Kesel 2008 Belgium [118]	State insurance	Employed	92 [b]	Open and endoscopic (one portal)	-	36	-	24	Moderate
		Self-employed	15 [b]		-	23	-	24	
		Non-manual work	35 [b]		-	27	-	20	
		Light manual work	49 [b]		-	36	-	20	
		Heavy manual work	22 [b]		-	42	-	34	
Duche 2010 France [161]	NR	NR	178	Open (2-3cm incision)	-	35	7-42	-	Serious
			136	Open with Canaletto™ implant	-	21	<7-56	-	
Fehringer 2002 USA [162]	Workers' compensation	NR	28	Bilateral endoscopic (simultaneous surgery)	114	115	35-263	-	Moderate
	No workers' compensation	NR	20		15	36	7-137	-	
	Mixed	Light duties	48		13	18	7-107	-	
		Normal duties			63	82	7-263	-	
	Workers' compensation	NR	32	Bilateral endoscopic (staged surgery)	109	126	17-408	-	
	No workers' compensation	NR	16		78	80	19-224	-	
	Mixed	Light duties	48		22	34	10-163	-	
		Normal duties			92	113	17-408	-	
Gibbs 1996 USA [164]	Mixed	NR	26 [b]	Open	-	4	1->1003	-	Serious
			10 [b]	Endoscopic	-	14	1-91	-	
Huracek 2001 Switzerland [168]	NR	NR	59 [a]	Bilateral open (simultaneous surgery)	-	39	-	-	Serious
			66 [a]	Open (staged surgery if bilateral n=9)	-	48	-	-	

Study	Compensation or insurance type	Work type	No. of Workers	CTR procedure and study group	Time to return to work (days)				Risk of bias
					Median	Mean	Range	SD	
Kerr 1994	Workers' compensation	NR	41	Open	-	50	-	-	Serious
USA [170]	Private insurance		31		-	38	-	-	
	Workers' compensation		41	Endoscopic (two portals)	-	47	-	-	
	Private insurance		31		-	22	-	-	
Ketchum 2004	Mixed	NR	7	Open (3cm incision)	-	75	-	11	Critical
USA [171]			57	Open (with flexor tenosynovectomy)	-	84	-	29	
Lyall 2002	Workers' compensation	Full duties	58	Open immediate or delayed surgery	-	64	11-356	-	Serious
USA [172]		One-handed activities			-	23	4-83	-	
		Two-handed activities			-	50	11-160	-	
McDonough 1993	Mixed	NR	28	Open	-	50	11-103	-	Serious
USA [174]	Workers' compensation		14		-	56	31-103	-	
	Mixed		27	Endoscopic	-	29	4-67	-	
	Workers' compensation		10		-	32	4-67	-	
Parot-Schinkel 2011	Mixed	NR	851	Open	60	-	-	-	Moderate
France [182]									
Wasiak 2007	Workers' compensation	NR	1410	Open	34	85	-	174	Moderate
USA [179]			287	Endoscopic	27	62	-	131	
Weber 2005	Mixed	NR	92 [a]	Bilateral open (simultaneous surgery)	23	-	-	-	Serious
USA [180]			16 [a]	Bilateral open (staged surgery)	42	-	-	-	

[a.] Number of workers not explicitly stated. [b.] Reported as number of hands, rather than number of individuals.

NR not reported, CTR carpal tunnel release, RTW return to work, SD standard deviation, NCS nerve conduction studies.

3.4.2.1 Return to work times and study characteristics

Formal meta-analysis was not possible due to heterogeneity in study methods, populations and interventions. However, to facilitate comparison, the return to work timescales reported in the individual studies were summarised to give the median return to work time (and range) for different study characteristics (Table 3.12).

The overall median duration of post-operative work absence was similar for studies that reported their data as the median or mean return to work time (28 days versus 30 days, respectively). Return to work times were consistently shorter in RCTs when compared with observational studies for both median and mean data. Where the type of CTR procedure was reported, as expected, earlier return to work was found with endoscopic rather than open CTR; however, longer periods of work absence were reported in studies not documenting the CTR technique.

Study location also appeared to be an important determinant of return to work time, with studies from Scandinavia and North American reporting longer return to work times than those conducted elsewhere in Europe. Interestingly, studies with larger sample sizes (>100 participants per study arm) reported longer return to work times than studies with 30-100 workers, which were in turn longer than those reported by studies with fewer than 30 participants.

There was no observed pattern of return to work times generally increasing or decreasing over time (Figure 3.6). The two studies led by Braun (published in 1994 and 1999) [154, 155], and the study by Adams et al. in 1994, reported notably longer return to work times than other studies. The method of CTR was not documented in these reports.

Table 3.12 Summary of return to work times for different study characteristics

Subgroup	Studies	Subgroups [a]	Return to work time reported as median (days)		Studies	Subgroups [a]	Return to work time reported as mean (days)	
			Median	Range			Median	Range
All studies	*19*	*35*	*28*	*7-60*	*41*	*81*	*30*	*4-168*
Study								
Randomised controlled trials	11	24	26	7-59	11	23	25	12-84
Observational study	8	11	35	21.5-60	30	58	36	4-168
CTR procedure								
Open CTR	15	21	34	14-60	29	44	29.5	4-85
Endoscopic CTR	9	10	18.75	7-51	21	28	22	12-92
Procedure not reported	3	4	35	26.5-41	6	10	119.5	31-168
Sample size								
<30 workers	7	14	23.25	7-59	17	28	29	4-126
30-100 workers	9	15	28	14-46.5	24	40	31	6-168
>100 workers	4	6	38	27-60	9	13	44	15-140
Location								
Scandinavia	8	18	30	7-51	5	10	34.5	17-84
Europe (excluding Scandinavia)	4	6	19.5	14-60	12	21	26	15-57
North America	8	13	28	13-59	22	44	37	4-168
Other	-	-	-	-	3	6	21.5	9-49
Risk of bias								
Low (all studies)	3	7	37	28-51	2	6	48	28-84
Moderate (observational studies)	4	5	34	13-60	12	21	57	9-160
Unclear (randomised controlled trials)	5	10	19.25	7-28	9	17	24	15-43
High/serious/critical (all studies)	7	13	38	14-59	18	37	29	4-168

[a.] Number of study arms/subgroups.

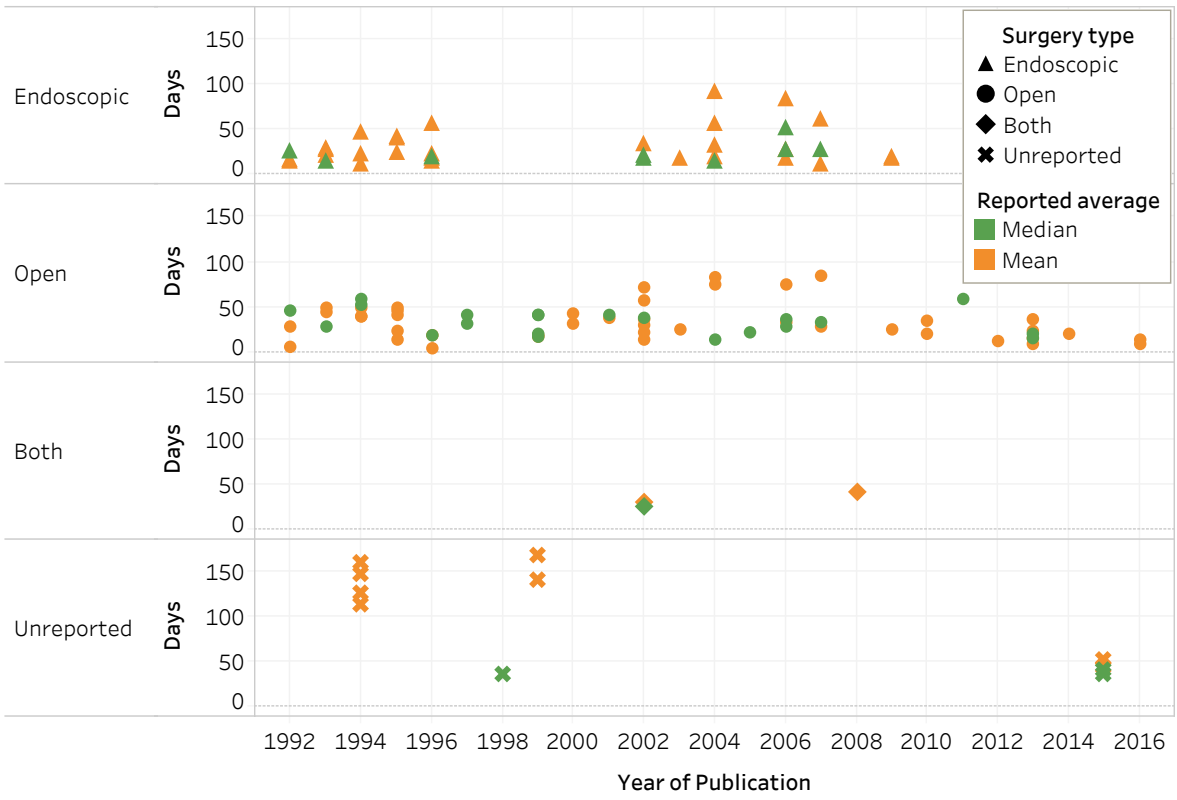


Figure 3.6 Return to work times after carpal tunnel release by year of publication

Data shown separately for endoscopic surgery (triangle), open surgery (circle), both procedures combined (diamond), and where the type of surgery was unreported (cross). Median return to work time is indicated in green, mean in orange.

3.4.2.2 Return to work times and risk of bias

There was no observed pattern of the duration of work absence either increasing or decreasing along the hierarchy of risk of bias categories (Figure 3.7). Interestingly, the 11 RCTs rated at unclear risk of bias generally reported faster return to work times and showed less variation than the studies in other risk of bias categories (Table 3.12).

Across the four studies assessed at low risk of bias, the shortest period of post-operative sick leave was reported by Atroshi et al., with a median return to work time of 28 days following both open (n=59) and endoscopic (n=53) surgery in patients without pre-operative sick leave [149]. For those who had been on sick leave pre-operatively, the median post-operative return to work time increased to 37 days for open CTR (n=6) and 51 days for endoscopic CTR (n=10; Table 3.8).

The subsequent paper by Atroshi et al. recorded median return to work times of 35 days for women (n=1,121) and 41 days for men (n=408), although the type of CTR was not specified (Table 3.9) [101]. It is important to note that the method of reporting return to work time used by Atroshi et al. in this later study was restricted to information logged with the social insurance office, which only included those who returned to work after 14 days. This left-censoring is likely to have inflated the reported timescales and may have also occurred in other studies, particularly where return to work data was collected from national or regional databases, but it was not reported elsewhere.

Bekkelund et al. reported the longest period of post-operative work absence of the studies assessed at low risk of bias; a median of 49 days for women (n=71) and 42 days for men (n=35) following open CTR (Table 3.10) [152].

The remaining paper rated at low risk of bias reported return to work as the percentage of participants who had returned by certain post-operative time points. Gimeno et al. found that by two months (60 days) after surgery 41% of participants were working successfully, 28% were working with limitations and 31% were not working (n=128) [181]. By six months (180 days) this had improved to 58% working successfully, 26% working with limitations and 16% not working (n=122; Figure 3.8). Whether the participant was working successfully or with limitations was self-rated by the participants and involved a combination of questions about physical, psychological and social demands. The type of CTR was not specified.

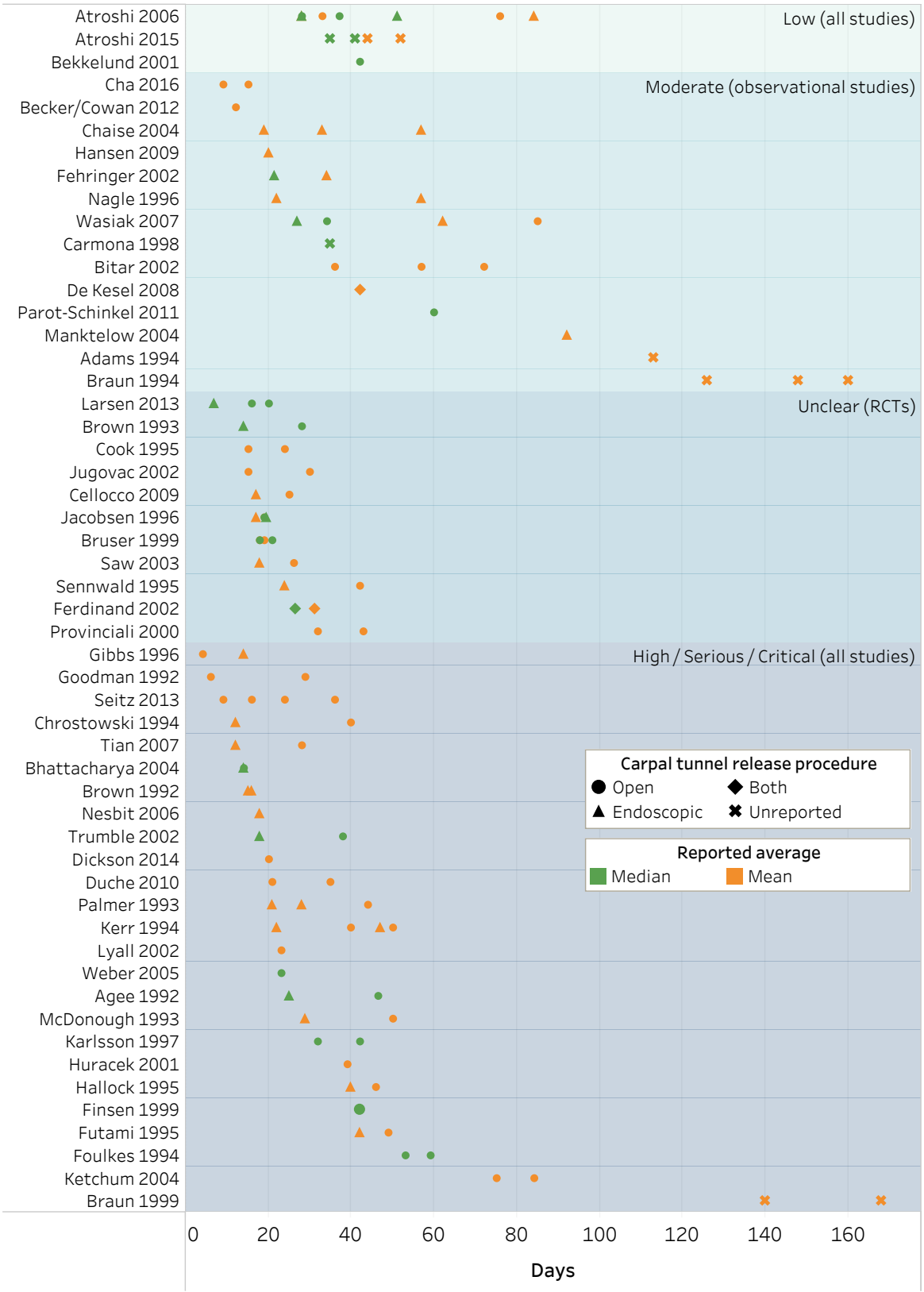


Figure 3.7 Return to work times after carpal tunnel release by study risk of bias

The studies are grouped according to the risk of bias assessments and ordered from lowest to highest risk. Surgical interventions are separated into endoscopic (triangle), open (circle), both (diamond) and unreported (cross). Summary information is reported as the median (green) and mean (orange).

3.4.2.3 Return to work rates

Seven studies reported the percentage of participants who had returned to work by specified time points [109, 150, 156, 157, 167, 177, 181]. Across these seven studies, the time points when approximately 75% of study participants had returned to work ranged from 21 days (three weeks) to 90 days (three months). For approximately 95% of participants to be back at work, the range was 42 days (six weeks) to 365 days (one year).

It appeared that more participants returned to work within a month of surgery with endoscopic CTR compared to open CTR, however variation in the assessment time points chosen by each study make this comparison difficult. Furthermore, none of the studies randomly allocated patients to receive either endoscopic or open CTR, and therefore potential bias in the choice of treatment cannot be excluded. The slowest return to work rates were seen in the studies not specifying the CTR technique used. Cumulative return to work rates are shown in Figure 3.8.

3.4.2.4 Return to work by sex

Only two studies reported their return to work outcomes by sex, both with a low risk of bias. Atroshi et al. found the median return to work time for female CTR patients was 35 days (n=1,121), while this was 41 days for males (n=408; Table 3.8) [101]. Bekkelund et al. reported the opposite trend, with female CTR patients returning in a median of 49 days (n=71) and male patients in a median of 42 days (n=35; Table 3.10) [152]. One hypothesis could be that occupational role had a greater influence on return to work time than sex; however occupational information was not reported in these two studies and this hypothesis cannot be further explored.

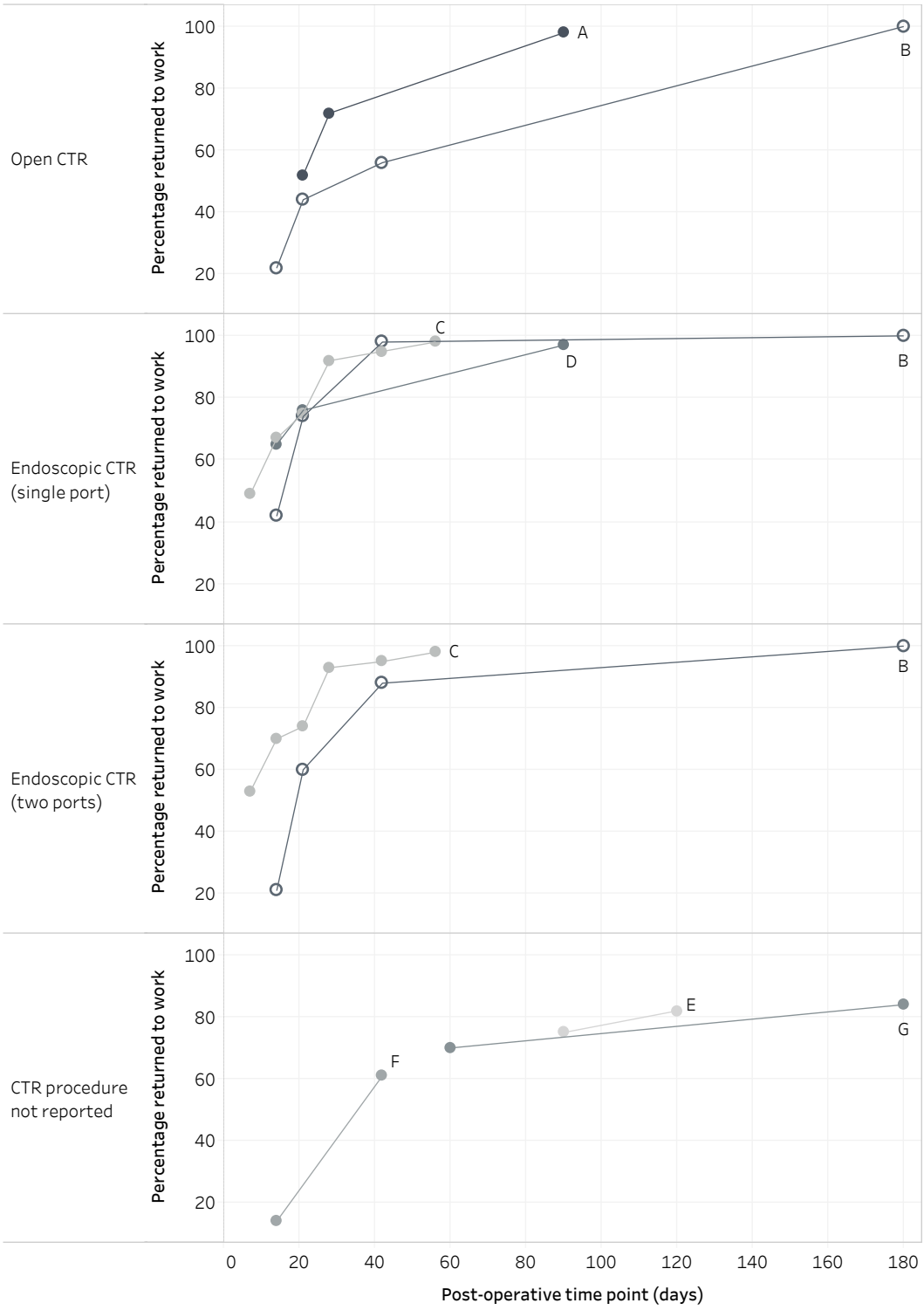


Figure 3.8 Cumulative proportion of carpal tunnel release patients who had returned to work by the time points reported in each study

A. Ratzon et al. [109], B. Palmer et al. [177], C. Brown et al. [156], D. Hansen et al. [167], E. Adams et al. [150], F. Carmona et al. [157], G. Gimeno et al. [181].

3.4.3 Occupational characteristics and return to work times

The secondary objective of this systematic review was to explore how occupational factors impact upon return to work times after CTR. Only 23 of the 56 included studies reported any work-related information and this was primarily the workers' compensation status of participants. The reported work characteristics could be broadly defined in five categories: full and modified duties; full and part-time work; type of occupation; type of job contract and the influence of workers' compensation or other insurance. The following sections describe the findings for each of these categories and a summary is provided in Table 3.13.

3.4.3.1 Return to modified or full duties

Four studies (five reports) specified whether their measure of work absence included participants who had returned to full or modified duties [111, 138, 151, 162, 172]. For the purposes of this review, return to light duties, one-handed activity and light two-handed activity were all classified as 'modified duties', and return to normal or full duties were classified as 'full duties'. As might be expected, return to modified duties occurred sooner than return to full duties; however, the reported timescales were wide-ranging and there was substantial overlap in the timing of return to each of these categories (Table 3.13).

Of the three studies assessing open CTR, Becker et al. reported the earliest return to work times: a mean of 12 days for modified duties; and 19 days for full duties (n=66; Table 3.10) [151]. Cook et al. reported similar mean times for participants randomised not to receive a post-operative splint (15 days for light duties and 17 days for full duties), whereas longer durations of work absence were reported for those who were splinted (24 days for light duties and 27 days for full duties; Table 3.8) [138]. Lyall et al. reported the longest mean return to work times: 23 days for return to one-handed duty; 50 days for return to two-handed duty; and 64 days for return to full duties (n=58; Table 3.11) [172].

Only one study reported return to light and full duties after endoscopic CTR. Fehringer et al. compared bilateral simultaneous endoscopic CTR with staged surgery and found that the median time to return to light duties was 13 days for simultaneous CTR (n=48) and

21.5 days for staged surgery (n=48) [162]. Return to full duties took 63 days and 91.5 days respectively (Table 3.11).

3.4.3.2 Return to full or part-time work

Cowan et al. were the only authors to report return to work times for different working schedules [111], and also reported this data in relation to return to modified and full duties using the same participants as Becker et al., as described above [151]. The duration of work absence was longer for part-time workers compared to their full-time counterparts. Full-time workers (n=52) took a mean of 10 days to return to modified duties and 14 days to return to full duties. For part-time workers (n=13), this was 15 days and 34 days respectively (Table 3.10).

3.4.3.3 Return to different occupations

Only six of the 55 included studies reported return to work times separately for different occupational classifications. Five studies were rated at low [149] or moderate risk of bias [111, 117, 118, 175], and one was rated at serious risk of bias [160]. The ways in which occupations were classified were not consistent across studies; consequently, work types were collated into two groups to facilitate comparison. Desk-based, sedentary, white-collar or light work was classified as 'non-manual'; and light-repetitive, medium, heavy or blue-collar work was classified as 'manual'. A subgroup of 'heavy manual' work was also created where it was described as such by the included studies. As might be expected, return to non-manual work occurred earlier than return to manual work, which occurred earlier than return to heavy manual work, but again, the reported timescales were wide-ranging and there was overlap between the categories. The following section outlines the duration of work absence in relation to the occupational classification used in the included studies (using their terminology) and the type of CTR. Summary data is shown in Table 3.13 using the occupational categories defined above.

Cowan et al. was the only study to report return to work times following open CTR [111]. Desk-based workers (n=34) returned to full duties in a mean of 10 days, while non desk-based workers (n=32) took a mean 30 days (Table 3.10).

Atroshi et al. [149]. and De Kesel et al. [118] both reported return to work times following either open or endoscopic CTR. Atroshi et al. found that blue collar workers took a median of 36 days to return to work (n=95), while white collar workers took 21 days (n=27; Table 3.8). De Kesel et al. categorised occupation into three categories and found that non-manual workers returned to work in a mean of 27 days (n=35), light manual workers in 36 days (n=49), and heavy manual workers in 49 days (n=22; Table 3.11).

Two studies reported return to work times for different occupational groups after endoscopic CTR. Of these, Chaise et al. also categorised participants by type of employment contract [117] and Nagle et al. compared those with and without workers' compensation (Table 3.10) [175]. Chaise et al. found that return to non-manual occupations occurred earlier than return to manual occupations across three types of contract: self-employed (n=87), private sector (n=90) and local government (n=28). Mean return to work times for non-manual occupations were 11, 21 and 29 days respectively, while for manual occupations, these durations approximately doubled (29, 42 and 63 days; Table 3.10).

Nagle et al. used the US Department of Labor categories to define sedentary, light, light-repetitive, medium and heavy work, and found that the mean reported return to work times generally increased along this gradient (Table 3.10) [175]. For participants without workers' compensation, those with sedentary work (n=56) had the shortest duration of work absence (mean 17 days), while those in medium work (n=25) had the longest (27 days). Among participants with workers' compensation, those with sedentary work (n=92) were also the earliest to return (mean 35 days), while those in heavy manual work (n=14) had the longest duration of work absence (101 days).

Dickson et al. compared non-manual and manual workers undergoing staged and simultaneous open CTR [160]. For non-manual roles (n=25), those undergoing simultaneous surgery returned in a mean of 18 days, compared to 29 days for staged surgery. For manual workers (n=12), these times were 24 days and 42 days, respectively (Table 3.10).

In addition to the five studies discussed above, one RCT, which compared open and endoscopic CTR for participants with bilateral CTS, provided individual participant data,

including job title [139]. Without knowing the participant's return to work time, LN and MS independently coded the job titles (n=14). The definition of 'manual' and 'non-manual' was framed as discussed at the beginning of the current section, with non-manual primarily representing desk-based activities. Only four participants were considered non-manual workers (managers, social worker and receptionist). The remaining participants were viewed as manual workers, with jobs including aircraft engineer, cleaners and cooks. For non-manual workers, the median return to work time was 20.5 days (range 14-56) compared with 28 days (range 11-70) for manual workers (Table 3.8). The Standard Occupational Classification system for the UK (SOC) advises against making a classification of manual or non-manual work from job title alone [112], and therefore this classification was not included in the summary data shown in Table 3.13.

3.4.3.4 Type of work contract

Only two studies reported return to work times separately for those who were employed and self-employed; both found that self-employed workers had shorter durations of work absence. As discussed in Section 3.4.3.3, Chaise et al. found that self-employed workers returned to non-manual roles a mean of 10 days earlier than those employed in the private sector and 18 days earlier than those employed in local government. For manual roles, these differences were 13 and 34 days respectively (Table 3.10). De Kesel at al. found that self-employed workers (n=15) returned to any type of work a mean of 13 days earlier than those who were employed (n=92; Table 3.11).

3.4.3.5 Workers' compensation and other insurance

Eight studies specifically compared return to work timescales for those with and without workers' compensation, and in all studies, those without compensation returned to work sooner [70, 117, 153, 162, 170, 175, 177, 178]. An additional 20 studies (21 reports) provided data about the workers' compensation or insurance status of their participants allowing their findings to be included in the summary data reported in Table 3.13. Six studies reported that all participants received workers' compensation [150, 152, 155, 172, 173, 179]; five studies (six reports) reported that none of their participants received workers' compensation [88, 111, 142, 151, 158, 159]; three studies reported return to

work times for a sub-section of their sample who were/were not receiving workers' compensation [166, 174, 176]; and six studies reported that their participants all received state insurance [101, 118, 140, 144, 149, 167]. Overall, those without workers' compensation returned to work more quickly than those with state insurance, who in turn returned more quickly than those receiving workers' compensation (Table 3.13).

Table 3.13 Summary of return to work times for different occupational characteristics

Subgroup	Studies	Subgroups [a]	Return to work time reported as median (days)		Studies	Subgroups [a]	Return to work time reported as mean (days)	
			Median	Range			Median	Range
Work duties								
Modified duties	1	1	13	-	4	6	20.5	12-50
Full duties	1	1	63	-	4	5	27	17-82
Work type								
Non-manual	1	1	21	-	6	11	21	7-49
Manual	1	1	36	-	6	14	39	18-101
Heavy manual	-	-	-	-	3	4	46.5	22-101
Employer								
Employed	-	-	-	-	2	3	36	33-57
Self-employed	-	-	-	-	2	2	21	19-23
Working pattern								
Part-time	-	-	-	-	1	2	24.5	15-34
Full-time	-	-	-	-	1	2	12	10-14
Workers' compensation status								
Workers' compensation	4	6	56.5	27-114	16	29	56	23-160
No workers' compensation	3	5	19	15-45.5	12	20	18.5	3-57
Other health insurance [b]	4	11	35	7-51	7	14	35	17-84

[a.] Number of study arms/subgroups. [b.] Any reported health insurance including national and personal schemes.

3.4.4 Post-operative management and advice

While the identification of post-operative management strategies and reported recommendations for return to function were not stated aims of the review, this information was extracted because of its potential influence on when and how the study participants returned to work. Three RCTs [70, 143, 147] and 13 observational studies [101, 150, 152, 155, 157-159, 164, 173, 175, 179, 181, 182] made no mention of either factor. Among the remaining studies, both the reported post-operative management and return to work advice were highly variable. A summary of the various post-operative management strategies and specific functional and work recommendations are shown in Table 3.14 to Table 3.16.

3.4.4.1 Suture removal

Suture removal was frequently reported, with 14 studies including this information [88, 134, 135, 139, 140, 142, 148, 149, 156, 160, 162, 166, 176, 178]. The mean time for removal of sutures was 11.3 days after surgery (range 7-14 days; Table 3.14 to Table 3.16).

3.4.4.2 Rehabilitation

Post-operative rehabilitation was discussed in eight studies. Five of these stated that participants did not routinely receive post-operative therapy (hand therapy, occupational therapy or physiotherapy) [140, 148, 153, 160, 162], of which three explained when a participant might need to be referred for therapy input. Trumble et al. [148] and Bitar et al. [153] both referred individuals with signs of complex regional pain syndrome. Fehringer et al. [162] referred those who had not made sufficient progress with their home exercise programme, although the method of assessing whether or not the patient's progress was sufficient was not discussed.

The content of the therapy intervention was only reported by one of these five studies, where it was described as "modalities, desensitization, soft-tissue mobilization and strengthening" [162] p318.

The remaining three studies specified that all study participants received post-operative therapy input [88, 172, 177]. Provinciali et al. assessed the use of a multimodal rehabilitation programme versus a home exercise programme. The home programme consisted of progressive exercises to increase strength and endurance, while the multi-modal programme involved ten 1-hour sessions of physiotherapy over a 14 day period after removal of sutures. This therapy intervention was well described and included stretching of the palmar fascia, strengthening of abductor pollics brevis and opponens pollicis, scar massage, median nerve gliding, pinch strengthening and sensory re-education [88]. The hand therapy interventions reported by Palmer et al. and Lyall et al. followed similar themes: differential tendon gliding, thumb and wrist range of movement, strengthening and scar management [172, 177]. In addition, Lyall et al. also included progressive work simulation activities increasing from 20 minutes at 21 days to 40 minutes at 28 days and finally 60 minutes at 35 days [172]; however the content of these work simulation activities was not described.

Post-operative instructions to move the wrist and fingers and use the hand for function were commonly reported, however it was not clear who had provided this self-management information or in what format (e.g. verbally, as a written handout, or by electronic methods). Furthermore, it was not clear whether the instructions included a specific home exercise programme, or were related to movement more generally. It might be expected that therapy-led rehabilitation would be more individualised to the patient when compared to general self-management advice, but it was not possible to assess this from the data reported in the included studies.

3.4.4.3 Return to function

Only six studies (seven reports) discussed when participants were advised to return to functional activities, but the advice was again inconsistent. Brown et al. and Bhattacharya et al. advised return to activities of daily living and normal activities only after removal of sutures [134, 135]. Among the remaining five studies, there was a three-fold difference in the suggested time points for resuming heavier activities. Palmer et al. recommended return to activities of daily living as soon as possible, but to avoid heavy pushing or pulling for 14 days [177]. Cellocco et al. advised that heavy activities be avoided for 21 days [137]; similarly, Weber and Boyer advised return to unrestricted activities after 21 days

[180]. Becker et al. and Cowan et al. were slightly more cautious with their advice, recommending that heavy lifting and forceful gripping were only introduced after 30 days [111, 151]; Finsen et al. were more cautious still, and recommended no heavy lifting for 42 days [140].

3.4.4.4 Return to work decision-making

Thirteen studies (14 reports) specifically mentioned either the process in place to authorise post-operative sick leave, or specific advice concerning return to work. Four studies recommended returning to work as soon as possible [111, 142, 151, 177]; of these, Jacobsen and Rahme also stated that the need for extended sick leave after an initial 14-day period was discussed on a case by case basis with the surgeon [142]. Larson et al. recommended returning to work when able, and indicated that somewhere in the region of 2-42 days was probably a sufficient period of post-operative leave [144]. Brown et al. advised using the hand for work as tolerated, but only after the sutures had been removed [135], and Saw et al. advised to return to work once the discomfort had improved sufficiently to allow safe practice [145]. The remaining seven studies described the individual(s) who were responsible for return to work decision-making. In Ratzon et al., Braun et al. and Goodman, the surgeon made the decision [109, 154, 165]; in Hansen et al., it was the participant's GP [167]; in Lyall et al., it was a joint decision between the surgeon and therapist [172]; and in Cook et al. and Finsen et al., it was a joint decision between doctor and patient [138, 140].

Table 3.14 Post-operative management and advice in studies reporting specific work-related recommendations

Study details	Suture removal	Post-operative management	Functional advice / exercise advice	Specific work advice
Becker *et al.* 2012 [151]; Cowan *et al.* 2012 [111]	NR	NR	Return to normal activities as soon as possible; no heavy lifting and forceful gripping for 30 days	Return to work as soon as possible
Braun *et al.* 1999 [154]	NR	NR	NR	Physician decided return to work date
Brown *et al.* 1993 [135]	8-14 days	Splinted in 30˚ wrist extension until suture removal	Use hand for ADLs as tolerated after suture removal	Use hand for work as tolerated after suture removal
Cook *et al.* 1995 [138]	NR	Volar plaster for 14 days	Full finger movement	Decision of when to return to work made by patient and physician
Finsen *et al.* 1999 [140]	14 days	No routine therapy	Move wrist and fingers as able; no heavy lifting for 42 days	Decision of when to return to work made by patient and physician
Goodman 1993 [165]	NR	Compressive dressing for 1 day	Immediate finger and wrist movement	Study assessed an aggressive return to work policy
Hansen *et al.* 2009 [167]	NR	NR	NR	Duration of sick leave determined by GP
Jacobsen *et al.* 1996 [142]	14 days	NR	Use hands from day 1 after surgery	Return to work as soon as possible. Additional leave discussed with surgeon if not returned by day 14
Larsen *et al.* 2013 [144]	NR	Soft dressing with no splint	NR	Advised 2-42 days leave probably sufficient. To return whenever feels able
Lyall *et al.* 2002 [172]	NR	Wrist (+/- fingers) splinted for 21 days	Therapy input from day 5	Doctor and therapist aim for return from 42-56 days
Palmer *et al.* 1993 [177]		Bulky dressing for 14 days	Therapy input for wrist and digit movement, scar management and strengthening	Return as soon as symptoms allow, avoiding heavy pushing or pulling for 14 days
Ratzon *et al.* 2005 [109]	NR	NR	NR	Surgeon advised when to return to work
Saw *et al.* 2003 [145]	NR	Dressing with no splint	Use hand as comfort allows	Return to work when discomfort improved sufficiently to allow safe practice

NR not reported, ADLs activities of daily living.

Table 3.15 Post-operative management and advice in studies reporting functional, but not work-related, recommendations

Study details	Suture removal	Post-operative management	Functional advice / exercise advice
Atroshi *et al.* 2006 [149]	10 days	Bulky dressing for 10 days	Immediate finger ROM; use hand for ADLs as tolerated
Bhattacharya *et al.* 2004 [134]	10 days	Protective dressing for 10 days	Keep fingers moving; return to normal activities after suture removal
Bitar *et al.* 2002 [153]		Volar plaster slab for 14 days. No therapy unless CRPS	Light activity for 14 days
Cellocco *et al.* 2009 [137]	NR	No splint provided	Encouraged to use hand normally. Advised to avoid heavy activities for 21 days
Chaise *et al.* 2004 [117]	NR	Wrist immobilised in 20˚ extension for 21 days	Actively move fingers and use hands as able
De Kesel *et al.* 2008 [118]	NR	Compressive bandage for 6 days	Immediate wrist and finger movement
Duche & Trabelsi 2010 [161]	NR	Written information given on normal post-operative progress	Use hand as soon as possible. No particular restrictions
Futami 1995 [163]	NR	Inpatient for a mean of 6.5 days post-operatively	Immediate finger and wrist movement
Hallock & Lutz 1995 [166]	14 days	NR	Range of movement commenced on day 2
Huracek *et al.* 2001 [168]	NR	No splint	Instruction in function provided
Ketchum *et al.* 2004 [171]	NR	Compression dressing and drain 5-7 days	Movement, nerve gliding and progressive strengthening started at day 5-7
McDonough & Gruenloh 1993 [174]	NR	Immediate movement vs. volar plaster 14-21 days	Immediate movement vs. mobilise wrist after removal of plaster
Seitz & Lall 2013 [178]	7-10 days	Soft compression dressing removed day 4. Warm water soaks and scar massage 7-10 days	Light functional use from day 4; strengthening from day 21
Trumble *et al.* 2002 [148]	14 days	Bulky dressing for 14 days. No therapy unless CRPS	Written hand exercises provided at 14 days
Weber & Boyer 2005 [180]	NR	Soft splint for 7 days, then over the counter splint with gradual wean	Standard protocol for movement, strength and function; unrestricted activities by day 21

NR not reported, ADLs activities of daily living, CRPS complex regional pain syndrome.

Table 3.16 Post-operative management in studies not reporting functional or work-related advice

Study details	Suture removal	Post-operative management
Brown *et al.* 1992 [156]	10 days	Splint in 30˚ wrist extension for 10 days
Bruser *et al.* 1999 [136]	NR	Dorsal short-arm splint for 7 days
Dickson *et al.* 2014 [160]	8-10 days	Bulky dressing for 8-10 days. No routine therapy
Fehringer *et al.* 2002 [162]	7-10 days	Daily home exercise programme from day 1. Removal of bulky dressing at day 2. Splint for function for 14 days. Therapy if slow recovery
Ferdinand *et al.* 2002 [139]	14 days	Bandaged for 17 days
Foulkes *et al.* 1994 [141]	NR	Wrist splint for 7 days
Karlsson *et al.* 1997 [169]	NR	Wrist immobilised in splint for 14-21 days
Kerr *et al.* 1994 [170]	NR	Thumb spica for 7 days
Nesbitt *et al.* 2006 [176]	7-10 days	Bulky dressing for 2-3 days
Provinciali *et al.* 2000 [88]	12 days	Compared multi-modal therapy-led rehabilitation with home exercise programme
Sennwald *et al.*1995 [146]	NR	Volar plaster splint for 10 days

NR not reported.

3.6 Discussion

This review adds to the existing literature by systematically identifying studies reporting return to work timescales following CTR and collating the findings according to different occupational, clinical and demographic characteristics. Previous reviews did not make a clear distinction between return to work and return to ADLs, or explore return to work times for different work roles.

Mean return to work times ranged from four days to more than five months, and overall there was a wide spread of timescales both within and between studies. Return to modified duties occurred sooner than return to full duties; return to non-manual occupations were quicker than return to heavier manual roles; and workers' compensation or other insurance was associated with longer periods of work absence. However, it was surprising how few studies adequately reported work-related information, such as occupation, working pattern (full-time or part-time), employment

status (employed or self-employed), availability of paid sick leave and return to work advice. For studies comparing different surgical interventions, these work-related variables may be important confounders. In line with the findings from previous meta-analyses, endoscopic surgery appeared to be linked with shorter periods of post-operative work absence than open CTR [79, 80, 83]. This emphasises the need for studies of CTR to clearly document the surgical procedure(s) used.

It is a strength of the current review that it included studies with differing methodologies and patient populations, which allowed identification of all the available return to work times and associated occupational information reported for CTR. The findings add to the existing research by showing that the surgical procedure is likely to be just one of a host of factors influencing when a patient returns to work after CTR. Other strengths of this review include the use of two independent reviewers for eligibility screening, data extraction and risk of bias assessment, and adherence to the pre-published review protocol. In addition, several strategies were used to optimise the identification of eligible papers, including grey literature and key journal searches, and contacting authors for additional information.

Wide variation was seen in both the study designs and reported outcomes of the 55 studies (56 reports) included in this review. There were observed differences in the research methodologies, the populations studied, the CTR procedures and the post-operative regimes. The method of measuring and reporting the period of work absence was also highly variable and few studies were deemed at low risk of bias. Risk of bias was assessed at both the study and outcome levels via the different components of the Cochrane risk of bias tools [131-133]. These tools were primarily designed to assess the risk of bias in studies assessing the effectiveness of different interventions, but not all of the included studies took this format. Piloting of the risk of bias assessment process, and the discussion and resolution of any disagreement, ensured that all studies were assessed according to their study design. While details of the measurement of return to work were often inadequately reported, there was no reason to expect that studies were systematically over or underestimating return to work times.

3.6.1 Study location

There were deliberately no restrictions imposed on study location, although this potentially created issues associated with the comparison of findings from different cultural and healthcare backgrounds. However, the majority of included studies were conducted in the USA; these results showed a wide spread across the range of reported timescales, including both the shortest and longest periods of work absence. The reported return to work timescales from studies conducted in Europe also fell across a wide range. Intriguingly, the three studies conducted in Asia all reported return to work times towards the shorter end of the spectrum. Previous research comparing work absences attributed to musculoskeletal conditions in 18 countries found that, even within the same occupational category, there was more than 10-fold variation. The authors also found that the lowest prevalence of prolonged sick leave in multiple occupational groups was in Asia (Japan) [206].

Only one study included in this review specifically compared return to work times across two different geographical settings. Bitar et al. retrospectively assessed post-operative absence in 81 female workers from USA (34 with workers' compensation, 47 without) and 42 female workers from Sweden [153]. Both groups from the USA took longer to return to work than the Swedish cohort. The availability of compensation or other paid sick leave is an important factor that may be associated with geography, however the influences of additional cultural and contextual factors on post-operative return to work timescales also need to be considered. A recommendation for future research is for authors to briefly describe the relevant national and local systems of healthcare and sickness absence management that relate to their study participants. This would facilitate the categorisation and comparison of studies that were conducted in similar settings.

For the four studies based in the UK, median return to work times ranged from 14-26.5 days [134, 139] and mean times ranged from 18-33 days [145, 160]. All four studies involved different patient populations (for example: bilateral, unilateral or mixed CTS populations) and assessed different surgical techniques (endoscopic, KnifeLight and open CTR). Furthermore, occupational information was only mentioned in one of these studies [160]. Therefore, this systematic review has limited capacity to describe UK clinical practice.

Of the studies that assessed the effect of workers' compensation on the duration of work absence, all showed that participants receiving workers' compensation took longer to return to work than their counterparts. This reflects the findings from a previous meta-analysis [105], and those from a recent review of prognostic factors for return to work after CTR [106]. The negative influence of workers' compensation on patient work outcomes has also been seen with other surgical procedures [207]. How this phenomenon interconnects with factors such as patient expectations and the provision of pre- and post-operative information needs to be considered.

3.6.2 Study design

Unlike previous systematic reviews including return to work outcomes after CTR [79, 80, 83], this review was not restricted to RCTs. Only one RCT documented occupational information about its participants [149] and therefore the inclusion of observational studies allowed return to work timescales to be collated across several occupational settings. Reported median/mean return to work times were faster for RCTs compared with observational studies. It is possible that the included RCTs had more restrictive inclusion criteria, leading to a more homogeneous participant population, but this is difficult to assess because full eligibility criteria were rarely reported. In addition, the RCT trial protocols may have included guidance on when patients should be advised to return to work; but if so, this information was not published.

The majority of the included studies reported mean return to work time. However, time to return to work was not normally distributed, as seen in the three studies which reported both mean and median timescales [149, 162, 179]. The most notable difference was observed in the study by Wasiak & Pransky, where the median duration of work absence following open CTR was 34 days compared to a mean of 85 days. The findings from this systematic review suggest that the use of median and IQR is the most appropriate method of summarising this type of return to work data.

A previous analysis of return to work reporting among RCTs that compared endoscopic and open CTR concluded that while clinically pertinent, this outcome was inadequately measured and reported [208]. The review was published in 2005, but this still appears to be the case. It was not possible to assess how much of the variation in the reported

return to work times were the result of real differences, or simply differences in the definition of return to work. For example, the time to return to light duties or full duties may be very different for any given individual, but the level of work that the participant was returning to was not adequately reported in the majority of studies. Furthermore, the time to first return to work may not be the most appropriate measure of return to work outcomes as it does not capture any subsequent episodes of related work absence.

3.6.3 Classification of occupational factors

Agreement is also needed on the optimal methods of reporting work-related factors. Occupation and work duties, employment type and the availability of sick pay were not routinely reported in the included studies. Recommendations for return to work following CTR and other surgical procedures commonly advocate different time points depending on the occupation of the patient; however, with only limited occupational information reported in research studies, there is still very little evidence from which to assess the potential influences of these work-related factors.

Only six studies in the current review discussed the occupations to which the participants were returning. Given that the type of work may be a confounder in studies comparing two treatments for CTR, it is surprising that occupation was given such little attention. Interestingly, most of the reported timescales for desk-based [111], non-manual [117, 118], white-collar [149] or sedentary workers [175] were greater than the 7-14 days recommended by the UK Royal College of Surgeons (RCS; Table 1.4) [102]. Conversely, most of the return to work times for heavy manual [118, 175] or blue collar workers [149] were less than the 42-70 days (6-10 weeks) recommended by the RCS. As discussed in Section 1.3.4.1, the origin of the timescales suggested by the RCS is unknown, but was most likely obtained from consensus opinion. Evidence from the current systematic review suggests that in practice, return to work times after CTR may not match this framework.

None of the included studies described the assessment of return to work in the context of the participants' routine working pattern or schedule. Is it assumed that the return to work times were based on a calendar week of seven days, rather than the days that each participant would usually be in work, however this may not have been the case in all

studies. Greater transparency is required in all aspects of the reporting and measurement of work absence.

3.6.4 Return to work advice and decision-making

It was not a key aim of the current review to systematically search for return to work recommendations, however this information was captured due to the possible influence on the return to work process. The advice ranged from encouraging patients to return to work as soon as possible, to ensuring that the patient returned no sooner than a specific time point advised by their surgeon/GP. Ratzon et al. found that in their cohort of predominantly female manual or clerical workers in Israel, the surgeon's recommendations were the strongest predictor of delayed return to work [109]. In other clinical areas, a qualitative study of return to work after cholecystectomy found that clinicians rated the advice received as a key factor in determining when their patients returned to work. Conversely, patients reported that their physical limitations were more important [209]. Regardless of whether the return to work advice is, or is not, a key feature of the duration of sickness absence after CTR, there is a need to think about the potential negative effects of giving conflicting recommendations. Inconsistencies in the advice provided about returning to work had a detrimental effect on patient experience and were associated with delays in successful return to work in a qualitative study of patients following total knee replacement [107].

3.6.5 Limitations

The current review has several limitations. The scope was deliberately kept broad to reflect the patient population and surgical procedures seen in clinical practice, however this allowed variability across the included studies and meant that weighted data pooling was not appropriate. In addition, in order to present the data consistently, all timescales were reported in days. In some cases, this involved a conversion from weeks to days and therefore may not be a true representation of the timescales collected in the original dataset.

Study selection criteria were based on the Centre for Reviews and Dissemination recommendations regarding the hierarchy of evidence [127] and therefore case studies

and case series were excluded due to their inherent high risk of bias. In practice, it was difficult to clearly distinguish between case series and cohort studies with a single cohort. Operational definitions were created in discussion with the supervisory team and were used to direct the review. An additional 61 case series reporting return to work times after CTR were identified (Appendix H) and it is acknowledged that the review findings may have differed with their inclusion. It is also possible that other studies recorded and reported the duration of work absence after CTR, but did not include this information in their abstract. These papers would have been excluded at the title and abstract screening stage.

Despite these limitations, this review adds to the existing CTR literature by demonstrating the wide range of return to work times across a large number of multinational primary studies. Previous reviews have been limited to the smaller number of published RCTs. Furthermore, the findings of this review support the call for greater clarity in the reporting of work-related outcomes. 'Return to work time' needs to be measured consistently and ideally include a description of influential factors, such as occupation, return to work advice, return to modified or full duties and therapy rehabilitation.

3.7 Summary

The objective of this review was to identify when patients returned to work after CTR and whether this varied based on occupational factors. Post-operative work absence was hugely variable across the 55 included studies, ranging from a few days to several months. Few studies reported relevant occupational information, but where reported, participants were able to return to lighter work roles and duties more quickly than to heavier work activities. Other work-related characteristics, such as working schedule and employment type, may be important, but were rarely assessed. Workers' compensation was linked to longer durations of work absence.

The findings from this review informed subsequent sections of this thesis in a number of ways. Inconsistencies between the identified studies highlighted several methodological issues that would need to be addressed in the prospective cohort study (Chapter 5), including the definition and assessment of return to work; assessment and reporting of

work-related upper limb activity and other components of occupation; and the categorisation and examination of return to work advice. Reviewing the literature systematically also confirmed that the existing evidence alone was insufficient to advise patients when it might be appropriate to return to their work after CTR.

Chapter 4 Return to work after carpal tunnel release: a survey of UK hand surgeons and hand therapists

4.1 Publication

This survey has been published in the Journal of Hand Surgery (European volume) [210]. The published content is provided in Appendix I. The following chapter provides a more comprehensive report, including information on the development of the survey questionnaires and additional analyses that were not incorporated into the publication. Support was provided by Kristin Francis (Manager, London Hand and Wrist Unit), who assisted the lead author with thematic analysis of the open text responses reported in this chapter.

4.2 Introduction and study objectives

In light of the wide variation in the duration of work absence after CTR that was identified in the systematic review, the current survey was developed specifically to gain insight into the self-reported practice of UK hand surgeons and therapists, including their recommendations for return to work after CTR. The survey was not designed to provide a definitive summary of clinical practice, rather to explore the range of views among members of this specialist group of clinicians.

There were three key objectives:

1. To identify and classify the advice given to patients returning to work after CTR surgery,
2. To discover which factors these healthcare practitioners consider most important for return to work after CTR, and
3. To explore and examine variation between clinicians both in their practice and return to work recommendations.

4.3 Methods

The questionnaire content was developed with the following structure: respondent demographics, elective CTR procedures, and CTR and work. Separate versions were created for the surgeons and therapists to reflect their differing roles in the patient pathway, however the return to work questions were identical to enable direct comparison. During the questionnaire development phase, feedback was gathered from four clinical colleagues who specialised in hand surgery, hand therapy or occupational health. These individuals provided suggestions for the question wording and content, formatting and clarity of instructions. The final questionnaires were piloted for face and content validity with three practising clinicians and further refined based on their feedback. The majority of questions were multiple choice, although open text boxes were used for the clinicians to enter their return to work recommendations without prompts and to provide additional information. Ethics approval was granted by the University of Southampton Faculty of Medicine Ethics Committee (20993). Copies of the questionnaires, including the participant information sheet, are located in Appendix J.

4.3.1 Questionnaire content and development

4.3.1.1 Respondent demographics

The UK hand surgery and hand therapy communities are small, with approximately 600 members of their respective professional bodies, and therefore care was taken to ensure that the demographic information collected could not lead to identification. For this reason, data were limited to clinical grade, clinical specialty, and the broad geographic region in which the respondent's practice was based. A resulting limitation from the need to preserve anonymity is that it was not possible to compare responses from clinicians working in the same healthcare trusts. This could have highlighted whether reported practice differed at a local level.

4.3.1.2 Elective carpal tunnel release procedures

To ensure that respondents were currently involved in the care of CTR patients, surgeons were asked approximately how many CTR procedures they had performed in the last 12

months, and therapists were asked whether they had assessed, treated or advised any patients undergoing elective CTR, again in the last 12 months. If the answer was none or no, respectively, the respondent was directed to the end of the questionnaire. Similarly, clinicians who had not recently treated CTR patients who were in employment (employed or self-employed) were excluded in order to encourage personalised and reflective responses, rather than hypothetical answers. At all stages, respondents were asked to answer in terms of their own clinical practice.

Surgeons were asked to indicate the type of CTR procedures and incisions used. There are no standardised terms for different CTR incisions, and variation in the assumption of what constitutes a 'mini' incision has been identified as a limitation in previous surveys [211]. For this reason, images were included in our questionnaire to define the incisions referred to in the survey. Details of the usual CTR procedure type (endoscopic or open) and the incision size were requested because previous studies have associated shorter CTR incision length with earlier return to work [143]. Similarly, several meta-analyses, and the systematic review reported in Chapter 3, all reported that endoscopic CTR was associated with faster return to work than open surgery [75, 76, 78, 80, 83, 84]. This question enabled an exploration of any relationship between the recommended duration of work absence and the favoured CTR procedure.

The use of median nerve conduction studies (NCS) in the pre-operative diagnosis of CTS was also assessed. CTS severity can be graded using the Bland criteria for NCS [24] and in recent years there is evidence that US surgeons are increasingly using NCS data in their management of CTS patients [211, 212]. In the UK, NCS are not recommended for patients presenting with unequivocal signs and symptoms of CTS [18], although it is not clear what occurs in practice.

Post-operative follow-up was found to be highly variable in the systematic review (Section 3.4.4) and therefore surgeons were asked for information on their usual follow-up plan, including both the individual providing the follow-up care and the usual timescale for these appointments. Therapists were asked about the referral pathway for CTR patients and which treatments they commonly provided.

For patients with bilateral CTS, the option of simultaneous or staged surgery was explored. Surgeon respondents were questioned on the factors that might lead them to suggest simultaneous CTR, with several work-related factors listed as possible options for selection.

4.3.1.3 Carpal tunnel release and work

Both clinical groups were asked the earliest time point, in days, that a patient could return to three different roles: desk-based duties (e.g. keyboard, mouse, writing, telephone); repetitive light manual duties (e.g. driving, delivery, stacking); and heavy manual duties (e.g. construction). The wording and activities for these three work roles were based on the occupational descriptions identified in the systematic review (Section 3.4.3.3) and were developed in collaboration with practising hand surgeons, hand therapists and occupational health clinicians. Although this question did not allow for consideration of the specific factors for each individual patient, it was included to give a general picture of the earliest time point that the respondents believed appropriate for patients to return to the three different occupational roles. This was followed with an open question asking: what do you recommend for patients returning to work after CTR? The existing UK Royal College of Surgeons' guidelines were not mentioned to avoid inadvertently prompting respondents to search online for these recommendations while completing the survey.

For the remaining two questions, respondents were presented with a list of 22 factors that could contribute to variation in return to work after CTR. The list of items was informed by the existing literature and through discussion with practising clinicians. All 22 factors and their key reasons for inclusion are listed in Table 4.1.

Respondents were first asked whether or not they took each factor into consideration when framing their advice about return to work. Rather than asking the respondents to select only those factors they thought applicable, a yes/no response was requested for each factor. The aim was to encourage respondents to read and consider each factor in turn and to minimise potential bias in the selection of factors positioned towards the top (primacy effect) or bottom (recency effect) of the list [213]. In addition, the question was worded neutrally, with no indication of whether each factor was, or was not found to be

influential for return to work in the literature. Space was provided for respondents to list any additional factors they felt were important. The next question asked respondents to select three factors from the same list that they considered to be the most influential for patients returning to work after CTR.

Surgeons were also asked about the provision of fit notes and who else in their team might be involved in providing return to work advice for their patients. In the UK, fit notes were introduced as a replacement to the more traditional sick note following the Working for a Healthier Tomorrow report [214]. The aim of this initiative was to change perceptions of fitness for work and to challenge the belief that it is inappropriate to be at work unless 100% fit. However, a survey of fit note use by hospital doctors found that more than half of respondents did not recall any specific training in providing appropriate fit note content [215]. This question was included in order to explore who was involved in the provision of fit notes for CTR patients and whether they recommended returning to work before being 100% fit.

Table 4.1 Factors influencing return to work after carpal tunnel release

Questionnaire item	Reason for inclusion
Age	Older age has been linked to poorer work-related outcomes after CTR [106, 182].
Sex	Better work outcomes were reported for men in some studies [152, 182], and women in others [101].
Side of surgery	Hand dominance and side of surgery are poorly reported. Surgery to the non-dominant hand has been linked to quicker and more complete resolution of symptoms [216].
Obesity	Obese patients (body mass index ≥30kg/m^2) were found to have a significantly lower probability of return to work after CTR [182].
Musculoskeletal disorders	Pain at more than two musculoskeletal sites was linked to poorer work outcomes after CTR [106].
Educational level	Lower educational attainment was linked to increased work absence six months after CTR [217]. Fewer years of education also formed part of a multivariable model describing increased absenteeism after CTR [188].
Type of work	Longer return to work times after CTR were found for heavy manual workers compared to those in non-manual occupations [111, 117, 118, 149, 175]. Exposure to hand-intense work was also part of a multivariable model describing poorer symptomatic and work outcomes after CTR [217, 218]. Higher psychological job demands and lower job control were both associated with work absence six months after CTR [217].
Employer support	More supportive organisational policies and practices have been associated with shorter work absence six months after CTR [217].
Friends / family support	Co-worker support was associated with shorter work absence six months after CTR [217]. The patient advisory group raised the importance of family support.
Pre-operative symptoms	Being unable to work pre-operatively because of CTR symptoms was found to be a strong predictive factor for post-operative work absence of >21 days [167].
Pre-operative function	Greater upper limb functional disability has been identified as a prognostic factor for poorer work-related outcomes after CTR [106].
Pre-operative neurophysiology	Improved median nerve distal motor latency from pre-operative to three months post-CTR was correlated with improved function over the same period [167].
Post-operative presentation	Post-operative scar pain was not associated with the period of work absence after open and endoscopic CTR [149].
Patient expectations	Expectation of a shorter period of work absence after CTR has been associated with an increased likelihood of earlier return to work [106, 151].
Co-existing flexor tenosynovitis	Patients undergoing CTR with tenosynovectomy were found to have longer periods of post-operative sick leave than those undergoing CTR alone [171].
History of scarring	Excessive scar formation can lead to restricted movement, and both hypertrophic and keloid scarring are thought to have genetic components [219].
Patient psychological health	Diagnosed depression was associated with work absence two months after CTR [220]; similarly, poorer mental health status was predictive of work absence six months after CTR [218].
Bilateral versus unilateral surgery	Simultaneous bilateral CTR has been linked to shorter overall work absence than staged surgery [160, 162, 168, 176, 180] and bilateral CTR surgery has been found to predict greater post-operative sick leave compared to unilateral surgery [188].

Surgical technique	Endoscopic CTR was associated with earlier return to work than open CTR [75, 76, 78, 80, 83, 84]. Similarly, mini incision CTR has been linked to faster return to work than traditional open surgery [79].
Availability of post-operative rehabilitation	There is limited evidence for the benefit of post-operative rehabilitation after CTR. Current recommendations advise that the provision of rehabilitation should be based on clinical expertise and patient preference [86].
Need to drive	Patients have identified returning to driving as an important milestone after orthopaedic surgery [221].
Financial considerations for the patient	Workers' compensation has been associated with delayed return to work after CTR [105]. Restrictions on driving have also been linked to financial hardship after orthopaedic surgery [221].

4.3.2 Survey distribution and populations sampled

CTR procedures are performed by surgeons from various clinical specialities, including hand surgery, general orthopaedics and plastic surgery. In addition, general practitioners (GPs) across the UK have the opportunity to complete additional training and perform CTR as part of primary care based minor surgery. In order to capture these different individuals, members of the British Society for Surgery of the Hand (BSSH), the Association of Surgeons in Primary Care (ASPC) and the Reconstructive Surgical Trials Network (RSTN) were invited to complete the electronic survey.

The RSTN is a collaboration of surgeons and allied health professional (AHPs) interested in hand surgery and plastic surgery research, and is supported by the Royal College of Surgeons and BSSH. Preliminary discussion with specialist registrars in plastic and orthopaedic surgery identified that clinicians at this level regularly perform CTR procedures while working in hand units, but few are members of the BSSH. The RSTN was included to try to capture these individuals.

The therapist survey was emailed to members of the British Association of Hand Therapists (BAHT) and was also included in the email to the RSTN. All electronic invitations were sent by the administrative team for each professional body and a reminder email was sent 10-14 days later. The launch of the survey was timed to coincide with the 2016 BSSH/BAHT combined Autumn Scientific Meeting in Cardiff, where paper versions of both surveys were distributed by the lead researcher.

The sample was chosen to capture UK surgeons who regularly perform CTR and UK therapists who regularly treat CTR patients. One limitation is that there may be clinicians treating these patients, who are not members of the professional bodies surveyed. However, it was not practical to send the questionnaire to all UK surgeons, regardless of clinical specialty, or to all UK occupational and physiotherapists, in an attempt to access these individuals. As mentioned in the introduction to this chapter, the survey was not designed to provide a definitive summary of clinical practice, rather to explore whether there were a range of views regarding return to work after CTR among clinicians who were specialised in treating this patient population.

4.3.3 Analysis

As the purpose of this survey was exploratory, the primary analyses were descriptive. The median was used as the key summary statistic for return to work times because, as discussed in Section 3.3.3, return to work times tend not to be normally distributed, and therefore clinicians who recommend longer periods of work absence would inflate the mean. Wilcoxon rank-sum test was used to test for differences in the median recommended return to work time between groups of clinicians. Wilcoxon rank-sum converts the range of values to ranks across both samples and compares the sum of these ranks, meaning that a normal distribution is not required [222]. Pearson's chi-squared test was used to assess for differences in the proportion of clinicians selecting each of the 22 factors in relation to the content of their return to work advice (categorical data). One assumption of Pearson's chi-squared is that the sample is sufficiently large to avoid high rates of type II errors, and for this reason, Fishers' exact test was used in cases when there were fewer than five respondents from either group for a given factor [223]. In the absence of existing data and because there was no primary outcome, a power calculation was not performed. Stata (version 14.3, StataCorp) was used for all descriptive statistics and tests for difference. Statistical significance was taken at the $p<0.05$ level. The potential for type 2 errors due to an insufficient sample size (failing to identify significant differences between groups, when in reality there is one) is acknowledged.

Reponses to the open question asking clinicians for their return to work recommendations were analysed qualitatively by two researchers (LN and KF). The initial

themes were derived independently from the respondents' text and modified and combined through discussion to create the final themes and sub-themes, which were agreed between the two researchers [224]. Themes were generated from the data without the use of a pre-existing coding framework in order to capture the key elements of the responses in relation to the overall aim of classifying return to work advice. An initial descriptive analysis (grouping and organising similar codes) was followed by a subsequent interpretive analysis in an attempt to theorise the broader meanings of the responses [224]. NVivo (version 11) was used for these analyses.

The quality of the survey development, content and reporting was assessed using the peer review recommendations by Burns and Kho [119]. The completed assessment is provided in Appendix K.

4.4 Results

4.4.1 Response rates

An estimated 1,959 clinicians received an invitation to complete the survey, of which, 310 completed it, yielding a response rate of 15.8% across both survey formats. Among surgeons, the response rate was 13.5% (173/1,277), compared with 20.1% for therapists (137/682).

4.4.1.1 Paper survey

There were 437 registered attendees at the BSSH/BAHT joint conference, 428 of whom were eligible to complete the survey. Exclusions were medical students (n=6) and honorary or senior BSSH members (n=3). Of the remaining 428 attendees, 174 were consultant surgeons, 85 were surgical trainees, 128 were hand therapists and 41 were other non-members of either BSSH or BAHT. A total of 80 surgeons and 61 therapists completed the paper version of the survey, yielding response rates of 26.7% and 47.7% respectively (Figure 4.1).

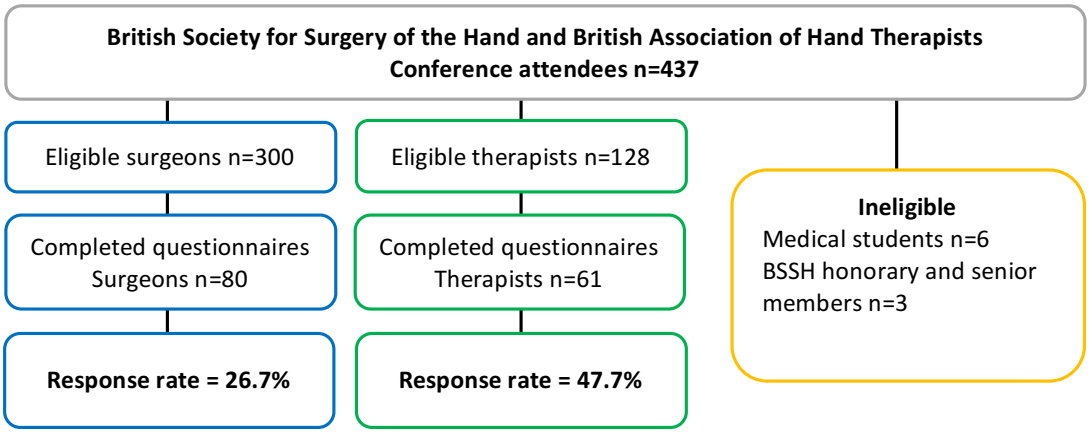


Figure 4.1 Response rates for the paper-based version of the clinician survey

BSSH British Society for Surgery of the Hand.

4.4.1.2 Electronic survey

The electronic version of the survey was emailed to a total of 1,531 potentially eligible surgeons and therapists; excluding 10 cases where the email was returned as undeliverable and excluding the 80 surgeons and 61 therapists who had already completed the paper version of the survey (it was assumed that no one would complete more than one version of the survey). It was also assumed that those who had completed the paper questionnaire were all BSSH, ASPC or BAHT members, which may not have been the case. However, many BSSH and BAHT members were also registered with the RSTN and would have received duplicate survey invitations from the different organisations, thereby overestimating the number of unique individuals and underestimating the response rate. A total of 93 surgeons and 76 therapists completed the electronic survey; yielding response rates of 9.5% and 13.7% respectively (Figure 4.2).

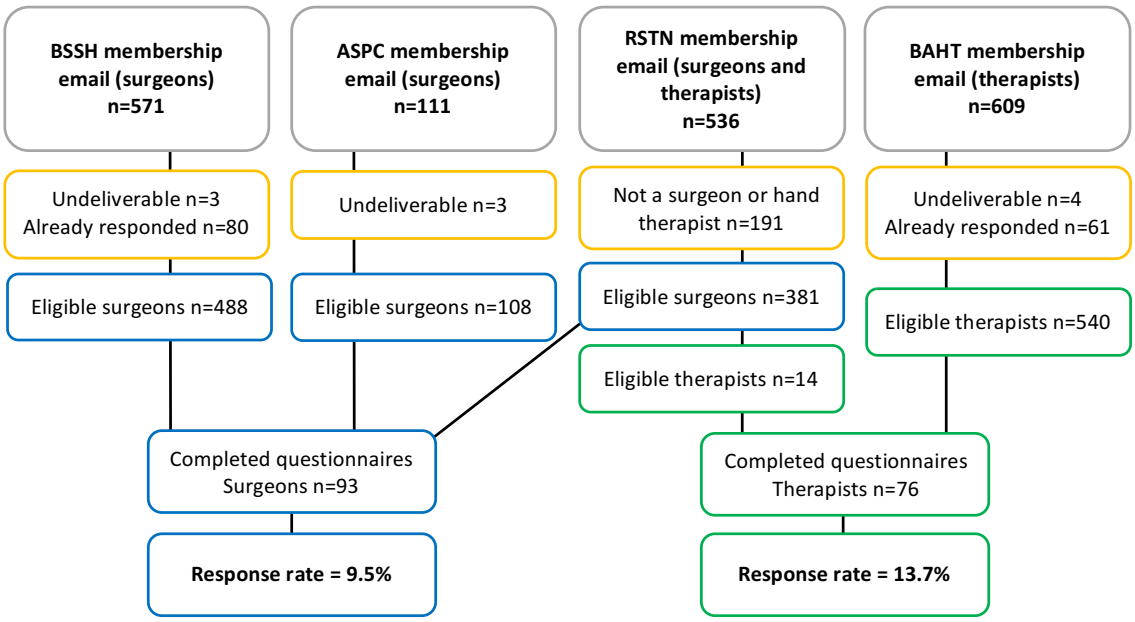


Figure 4.2 Response rates for the electronic version of the clinician survey

BSSH British Society for Surgery of the hand, ASPC Association of Surgeons in Primary Care, RSTN Reconstructive Surgical Trials Network, BAHT British Association of Hand Therapists.

4.4.2 Participants

A total of 154 surgeons and 118 therapists were included in the analyses. Nineteen surgeons and 19 therapists were excluded after completing the survey for the reasons shown in Table 4.2.

Table 4.2 Reasons for exclusion from the clinician survey

Surgeons	N
Not performed any CTR procedures in the last 12 months	7
Did not provide data on number of CTRs performed	5
Not operated on any CTR patients who were working in paid employment in last 12 months	6
Did not practise in the UK	1
Total excluded	**19**

Therapists	N
Not treated any CTR patients in the last 12 months	6
Did not provide data on number of CTR patients treated	2
Did not treat any CTR patients who were working in paid employment in the last 12 months	8
Did not practise in the UK	3
Total excluded	**19**

N number of clinicians, CTR carpal tunnel release.

Demographic details for the included respondents are shown in Table 4.3. Eighty-seven percent of clinicians were based in England and overall, 98% of surgeons and 89% of therapists worked in an NHS setting. Sixty-eight percent of surgeons and 28% of therapists worked in private practice at least some of the time. The majority of surgeons were consultant grade (84%); only 5% were GPs. Fifty-three percent of surgeons listed hand surgery as one of their clinical specialities. The majority of therapists were occupational therapists by background (60%). This reflects the composition of BAHT membership in 2016-17, where 64% were occupational therapists and 36% were physiotherapists (personal correspondence with Eve Dunn at bahthandtherapy@gmail.com 14/07/2017). All therapy respondents were the equivalent of an NHS band 6 or above (senior therapist), and 11% of occupational therapists and 17% of physiotherapists worked at the highest clinical grades (NHS band 8a or above, equivalent to clinical specialist and team lead roles). Ninety-five percent of therapists listed hand therapy as one of their clinical specialities, followed by orthopaedics (44%) and plastics (29%).

Table 4.3 Respondent demographics

	Surgeons N=154 (%)		**Therapists** N=118 (%)		
UK region	England	135 (88)	England	101 (86)	
	Wales	8 (5)	Wales	6 (5)	
	Scotland	4 (3)	Scotland	4 (3)	
	Northern Ireland	2 (1)	Northern Ireland	6 (5)	
	Ireland	2 (1)	Ireland	1 (1)	
	Missing	3 (2)	Missing	0	
Clinical grade				**Occupational Therapists** N=71	**Physiotherapists** N=46
	Consultant	130 (84)	Band 5	0	0
	General Practitioner	8 (5)	Band 6	21 (30)	8 (17)
	Junior doctor	9 (6)	Band 7	35 (49)	16 (35)
	Other	4 (3)	Band 8a	10 (14)	19 (41)
	Missing	3 (2)	Band ≥ 8b	3 (4)	1 (2)
			Other	1 (1)	0
			Missing	1 (1)	2 (4)
Clinical speciality [a]	Primary care	8 (5)	Hand therapy	112 (95)	
	Orthopaedics	80 (52)	Upper limb	32 (27)	
	Plastics	35 (23)	Rheumatology	26 (22)	
	Hand surgery	82 (53)	Plastics	34 (29)	
	Other	4 (3)	Orthopaedics	52 (44)	
	Missing	1 (1)	Paediatrics	16 (14)	
			Neurology	2 (2)	
			Musculoskeletal	33 (28)	
			Other	5 (4)	
			Missing	0	
Healthcare setting [a]	NHS tertiary care	82 (53)	NHS	105 (89)	
	NHS secondary care	61 (40)	Private (employed)	21 (18)	
	NHS primary care	16 (10)	Private (self-employed)	12 (10)	
	Private practice	104 (68)	Academia	2 (2)	
	Other	2 (1)	Other	0	
	Missing	1(1)	Missing	3 (3)	

[a.] Responses for clinical specialty and healthcare setting were not mutually exclusive, therefore percentages do not sum to 100%.

Demographic details for the 38 individuals who were excluded from the analyses were broadly similar to those included. However, the excluded surgeons were more likely to be GPs (42% versus 5%), and less likely to be hand surgery specialists (16% versus 53%). The excluded therapists were more likely to be band 5 level (16% versus 0%) and less likely to report orthopaedics (26% versus 44%), rheumatology (11% versus 22%) or paediatrics (5 versus 14%) as areas of speciality.

4.4.3 Carpal tunnel release patient pathway

4.4.3.1 Pre-operative

Surgeons were asked to estimate the use of non-operative treatments prior to CTR surgery. Overall, only three surgeons stated that none of their patients had received a steroid injection, two reported than none of their patients had used a splint, and 24% stated that there had been no pre-operative hand therapy. The most common responses were that: up to a third of patients received a corticosteroid injection (49% of surgeons); between one and two thirds were provided with a splint (34% of surgeons); and up to a third received therapy input (40% of surgeons). Nerve conduction studies were used pre-operatively by at least 80% of surgeons, and of these, 8% of surgeons (12 individuals) reported using nerve conduction studies for all their CTR patients (Figure 4.3).

The large majority of therapists (86%) reported treating at least one CTS patient before surgery in the previous 12 months (Table 4.4).

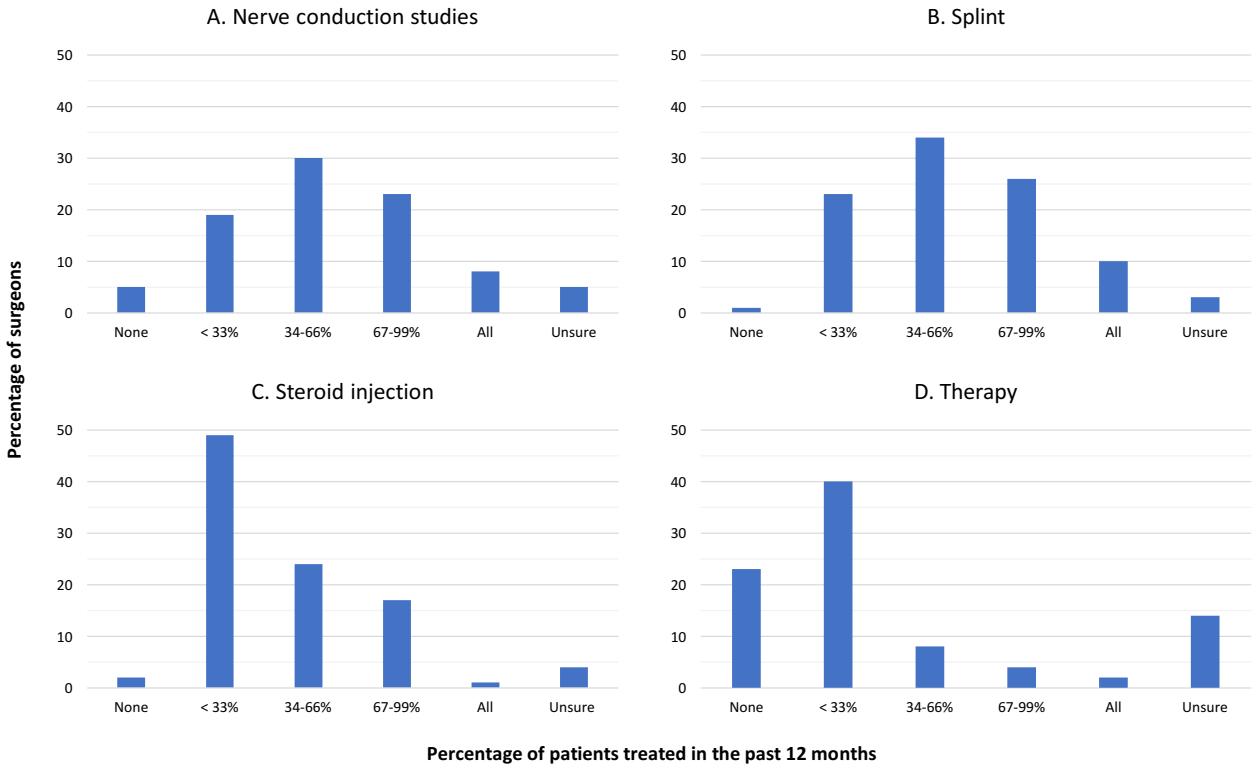


Figure 4.3 Surgeon-reported use of pre-operative interventions

4.4.3.2 Surgery

Surgeons were asked to estimate the number of CTR patients they had operated on over the previous 12 months. As expected, CTR was a commonly performed procedure for this group of clinicians. Forty-five percent of respondents carried out more than 70 procedures, with a further 32% carrying out between 31-70. Full details are shown in Table 4.4.

Table 4.4 Estimated number of carpal tunnel release patients treated in the past 12 months

Number of CTR patients treated	**Surgeons** N=154 (%)	**Therapists** N=118 (%)	
		Pre-operatively	**Post-operatively**
1 – 10	9 (6)	54 (46)	39 (33)
11 – 30	26 (17)	22 (19)	44 (37)
31 – 70	49 (32)	15 (13)	25 (21)
71 – 100	32 (21)	3 (3)	4 (3)
> 100	38 (25)	6 (5)	3 (3)
Missing	0	18 (15)	3 (3)

CTR carpal tunnel release.

The prevalence of three different surgical techniques for CTR are listed in Table 4.5. In the preceding year, 50% of surgeons reported using a mini open procedure for all CTR patients, with an additional 27% using this technique at least some of the time. Eighteen percent of surgeons used the traditional open procedure for all patients, with an additional 24% reporting that they used this extended incision in some instances. Only five of the surgeons surveyed used endoscopic procedures, of which one used this technique with all of their patients. Surgeons who provided additional comments in response to this question described the use of the mini incision for primary CTRs, reserving the traditional incision for revisions or when tenosynovectomy was required.

All respondents answered at least one part of this question, giving the estimated prevalence for the surgical techniques they used, however many (>33%) did not select the 'none' category for the techniques not used. For this reason, where no response had been given for a particular surgical technique, but had been provided for others, it was assumed that the respondent did not use that technique.

Table 4.5 Surgeon-reported prevalence of performing different carpal tunnel release procedures in the previous 12 months

Proportion of patients	**Surgeons** N=154		
	Traditional incision (%)	**Mini incision** (%)	**Endoscopic** (%)
0%	89 (58)	35 (23)	149 (97)
1 – 33%	33 (21)	3 (2)	2 (1)
34 – 66%	3 (2)	3 (2)	1 (1)
67 – 99%	1 (1)	36 (23)	1 (1)
100%	28 (18)	77 (50)	1 (1)

When asked about bilateral CTS patients, three surgeons stated that they always recommend bilateral simultaneous surgery, 58 stated that they never recommend simultaneous surgery, and 93 recommended simultaneous CTR in some instances. The latter group was asked to choose the key factors that might lead them to suggest simultaneous surgery; the majority selected patient request (89%) and the need to minimise work absence (76%). Less frequently selected were: self-employed patients (51%); severe symptoms (32%); use of general anaesthetic (13%); and self-funding patients (12%). Additional comments included the use of simultaneous surgery only for patients with a good level of support available at home, or for those who usually depend on others for self-care.

4.4.3.3 Post-operative

Within the NHS, 57% of surgeons reported personally reviewing their CTR patients post-operatively. This increased to 79% of surgeons in private practice. Post-operative therapy input was not standard, with only 20% of surgeons in the NHS and 14% of surgeons in private practice routinely referring for therapy. A quarter of NHS surgeons reportedly referred patients to dressing clinics and just over one-third referred to primary care. In private practice, this fell to 10% and 22%, respectively. Few surgeons in either setting reported using telephone follow-up or involved occupational health professionals.

Wide variation was reported in the time to follow-up post-operatively. Surgeon follow-up ranged from 3-120 days in the NHS and 1-90 days in private practice, with follow-up appointments tending to occur more quickly after surgery in private practice (Table 4.6).

Primary care follow-up ranged from 2-90 days in the NHS and 2-117 days for those operating in private practice. Where therapists were involved, NHS therapy input ranged from 2-90 days in the NHS, compared with 2-42 days for private practice. Dressing clinic follow-up took place at a median of 13 days in the NHS and 14 days in private practice (Table 4.6).

The surgeons who provided additional comments regarding the format and timescale of follow-up discussed two other features of their healthcare settings. The first was the use of extended scope therapy clinics for the routine follow-up of post-operative CTR patients. The term extended scope is used to define specialist allied health professional roles that require additional training outside the traditional scope of practice. Within the context of CTR, this refers to clinics that were led by clinical specialist hand therapists and run independently from the surgical team. The second feature mentioned in the comments was the existence of a different follow-up pathways for patients undergoing staged bilateral surgery.

Table 4.6 Individuals involved in the post-operative treatment of carpal tunnel release patients in the NHS and private practice

Individual involved in post-operative CTR patient care	NHS			Private Practice		
	Surgeons N=149 (%) [a]	Follow-up time point in days		Surgeons N=104 (%) [a]	Follow-up time point in days	
		Mean (SD)	Median (IQR)		Mean (SD)	Median (IQR)
Operating surgeon in person	85 (57)	38 (24.6)	42 (14-42)	82 (79)	24 (17.0)	14 (12-42)
Operating surgeon by phone	1 (1)	42	42	5 (5)	16 (16.6)	10 (4-21)
Member of surgical team	43 (29)	34 (21.9)	42 (14-42)	2 (2)	28 (19.8)	28 (14-42)
Dressing clinic	38 (26)	13 (9.6)	12 (7-14)	10 (10)	13 (3.1)	14 (12-14)
Primary care	54 (36)	13 (11.2)	12 (10-14)	23 (22)	15 (22.4)	11 (10-14)
Therapist	30 (20)	19 (17.8)	14 (12-14)	15 (14)	15 (13.6)	10 (5-21)
Occupational health	1 (1)	7	7	0	-	-
No planned follow up	9 (6)	-	-	2 (2)		
Other	3 (2)	-	-	5 (5)	-	-

[a.] Responses were not mutually exclusive and therefore the percentages do not sum to 100%.
SD standard deviation, IQR interquartile range.

A fifth of surgeons reported referring patients for post-operative therapy, although a third of therapists reported that therapy was provided as part of the standard pathway. The majority of therapists reported that patients were referred on an individual basis for

specific therapy input (79%). Three therapists specified that CTR patients were seen post-operatively in extended scope therapy-led clinics.

Scar management was the most common therapy treatment and was provided by nearly all therapists (95%). Eighty-eight percent of therapists also provided sensory re-education and/or desensitisation. Fewer therapists provided splints or removed sutures (39% and 42%, respectively). Nine therapists listed other treatment modalities including: ultrasound, range of movement exercises, oedema management and median nerve gliding. The therapist-reported reasons for referral and content of the treatment provided are shown in Table 4.7.

Table 4.7 Reported reasons for therapy referral after carpal tunnel release and the treatment provided

Reason for post-operative referral	**Therapists** N=118 (%) [a]	**Treatment provided**	**Therapists** N=118 (%) [a]
Routine pathway	39 (33)	Scar management	113 (96)
Individual basis	93 (79)	Sensory re-education	104 (88)
Only seen pre-operatively	1 (1)	Advice	95 (81)
		Functional rehabilitation	82 (69)
		Strengthening	78 (66)
		Pain management	76 (64)
		Removal of sutures	49 (42)
		Splint provision	46 (39)
		Other	9 (8)

[a.] Responses were not mutually exclusive and therefore the percentages do not sum to 100%.

4.4.4 Recommended return to work times for different occupations

Respondents were asked to report the earliest time point after CTR surgery that they thought someone could return to desk-based, repetitive light manual and heavy manual roles. The median times were 7, 15 and 30 days, respectively (Table 4.8). There was, however, wide variation reported by both surgeons and therapists, and the recommended return to work times range from: 0-42 days for desk-based duties; 1-56 days for light manual duties; and 1-90 days for heavy manual duties.

There were no significant differences between the median times recommended by therapists and surgeons for return to light manual and heavy manual roles and the interquartile ranges were identical for both clinical groups (14-28 days for light manual

and 21-42 days for heavy manual). In contrast, the surgeons recommended a median of 7 days for return to desk based duties, while the therapists recommended a median of 10 days (p=0.02).

Table 4.8 Clinician-recommended return to work times

Type of work	Clinician group	Number of clinicians	Recommended return to work time (days)					P-value [a]
			Mean	SD	Median	IQR	Range	
Desk-based	Surgeons	145	8.6	7.0	7	2-14	0-42	**0.02**
	Therapists	104	10.2	6.4	10	6-14	0-30	
	All	*249*	*9.3*	*6.8*	*7*	*3-14*		
Repetitive light manual	Surgeons	144	19.1	10.0	14	14-28	1-56	0.58
	Therapists	104	20.0	10.3	16	14-28	2-45	
	All	*248*	*19.5*	*10.1*	*15*	*14-28*		
Heavy manual	Surgeons	145	32.8	16.8	30	21-42	1-90	0.96
	Therapists	104	33.0	15.8	30	21-42	5-90	
	All	*249*	*32.9*	*16.3*	*30*	*21-42*		

[a] Wilcoxon rank-sum was used to test for difference in the median recommended return to work time by surgeons and therapists. Significant differences at the 5% level are highlighted in bold.
SD standard deviation, IQR interquartile range.

For all occupational categories, the median recommended return to work times were earlier for those surgeons who reported always using a mini open incision (n=77) compared to those who reported always using the traditional open incision (n=28; Table 4.9). These differences were not significant, but this subgroup analysis is likely to be underpowered. This analysis was not performed for endoscopic surgery due to the small number of surgeons who reported always using endoscopic surgery (n=1).

Table 4.9 Recommended return to work times by surgeons using only one type of carpal tunnel release procedure

Type of work	Type of CTR procedure	N [a]	Recommended time (days)					P-value [b]
			Mean	SD	Median	IQR	Range	
Desk-based	Traditional open	28	11.3	9.3	14	2.5-15	1-42	0.16
	Mini open	72	8.3	6.3	7	3-14	0-28	
Repetitive light manual	Traditional open	28	22.1	13.0	21	14-28	1-56	0.11
	Mini open	71	17.8	8.8	14	14-21	1-42	
Heavy manual	Traditional open	28	36.4	22.8	35	21-42	1-90	0.30
	Mini open	72	30.4	14.4	28	21-42	4-90	

[a.] Number of surgeons who reported only using one type of surgical procedure. [b.] Wilcoxon rank-sum was used to test for a difference in the median recommended return to work time. Significant differences at the 5% level are highlighted in bold.
CTR carpal tunnel release, SD standard deviation, IQR interquartile range.

For all three occupational categories, the clinicians who had treated more than 70 CTR patients in the previous year (approximately 2-3 CTR patients per week) recommended earlier return to work than those who had treated fewer patients. This was observed for both therapists and surgeons. As shown in Table 4.10, this trend reached statistical significance for the recommended times to return to repetitive light manual duties in both clinical groups, and for return to heavy manual duties as advised by therapists.

Table 4.10 Recommended return to work times by number of carpal tunnel release patients treated in the previous 12 months

Type of work	Clinician group	CTR patients treated	N [a]	Recommended time (days)					P-value [b]
				Mean	SD	Median	IQR	Range	
Desk-based	Surgeons	≤70 patients	79	9.9	7.9	7	3-14	0-42	0.06
		>70 patients	66	7.1	5.3	6.75	2-14	1-21	
	Therapists	≤70 patients	91	10.5	6.5	10	6-14	0-30	0.37
		>70 patients	13	8.4	5.3	8	5-14	0-17	
Repetitive light manual	Surgeons	≤70 patients	78	20.7	10.0	21	14-28	1-56	**0.01**
		>70 patients	66	17.1	9.7	14	14-21	1-52.5	
	Therapists	≤70 patients	91	20.8	10.4	18	14-28	2-45	**0.03**
		>70 patients	13	14.4	7.3	14	10-15	4-28	
Heavy manual	Surgeons	≤70 patients	79	33.9	16.2	36	21-42	1-90	0.24
		>70 patients	66	31.5	17.5	29	21-42	4-90	
	Therapists	≤70 patients	91	34.3	15.9	31.5	21-42	10-90	**0.02**
		>70 patients	13	23.7	11.1	21	16-28	5-42	

[a.] Number of clinicians. [b.] Wilcoxon rank-sum was used to test for difference in the median recommend return to work time between clinicians who treated >70 carpal tunnel release patients and those who treated ≤70 patients. For therapists, this included pre- and/or post-operative patients. Significant differences at the 5% level are highlighted in bold.
SD standard deviation, IQR interquartile range.

4.4.5 Return to work advice

4.4.5.1 Advice time points and formats

Seventy-seven percent of surgeons reported that they gave advice to at least two thirds of their patients pre-operatively; 71% to at least two thirds of their patients at the time of surgery and 51% to at least two thirds of their patients post-operatively. Overall, 50 surgeons (32%) reportedly advised all of their CTR patients about return to work at all three time points. In comparison, 56% of therapists reported giving return to work advice to at least two thirds of their patients either pre- or post-operatively (Table 4.11). Therapists were also asked about the format of the advice given. Verbal advice was the most common method used both pre- and post-operatively (Table 4.12). Other formats

included providing a letter for the patient to give to their employer and providing access to a web-based forum.

Ten percent of surgeons reported personally issuing a fit note for all CTR patients, while 17% did not provide fit notes for any of their CTR patients (Table 4.11). Surgeons were also asked whether, in the last 12 months, they had ever advised a patient to return to work after CTR when they were not 100% fit; 65% replied yes.

Table 4.11 Provision and timing of return to work advice

Proportion of patients provided with work advice	**Surgeons** N=154				**Therapists** N=118 (%)
	Pre-operatively (%)	**At time of surgery** (%)	**Post-operatively** (%)	**Fit note issued** (%)	
0%	0	2 (1)	9 (6)	26 (17)	0
1 – 33%	1(1)	8 (5)	14 (9)	29 (19)	17 (14)
34 – 66%	18 (12)	10 (6)	7 (5)	32 (21)	31 (26)
67 – 99%	36 (23)	25 (16)	19 (12)	30 (19)	24 (20)
100%	83 (54)	86 (55)	61 (39)	15 (10)	43 (36)
Unsure [a]	5 (3)	3 (2)	13 (8)	12 (8)	0
Missing [b]	12 (8)	21 (14)	32 (21)	10 (6)	3 (3)

[a.] No surgeons answered 'unsure' for all four questions.
[b.] Of the missing responses for surgeons, nine individuals did not answer any of these questions.

Table 4.12 Format and timing of return to work advice (therapists)

Advice format	**Therapists** N=118 (%) [a]	
	Pre-operatively	**Post-operatively**
Spoken	49 (42)	101 (86)
Paper information sheet	18 (15)	24 (20)
Electronic information sheet	4 (3)	3 (3)
Website	4 (4)	2 (2)
Other	0	3 (3)

[a.] Responses were not mutually exclusive and therefore the percentages do not sum to 100%.

4.4.5.2 Return to work recommendations

In total, 128 surgeons (83%) and 94 therapists (80%) responded to the open-ended question: what do you recommend for patients returning to work after carpal tunnel release. Thematic analysis of the content found that the reported advice focused around five main themes: work characteristics, return to driving, general post-operative management, return to work strategies and conflicting advice.

4.4.5.2.1 Work characteristics

Most clinicians suggested activities that the CTR patients should avoid in the early post-operative period. The types of activity mentioned were often similar and included heavy lifting/gripping and weight-bearing, however the timescale over which the activity should be avoided varied. For example: *"Wait 2/52 before loading the palm to ensure wound is ok"* (Surgeon #220), compared to: *"Avoid pushing against palm (pushing up from chair, etc.) for 6 weeks"* (Surgeon #262). Many respondents wrote that earlier return to work was possible for patients who have control over their work tasks and/or are able to return to modified duties. Five respondents commented that self-employed patients tended to return to work as soon as possible, regardless of their occupation or the advice given, as summarised by Surgeon #51: *"Most heavy manual workers/farmers need 21 days, but ignore me [and] go back to work as soon as they can. Self-employed people do what they want independent of any advice."*

4.4.5.2.2 Return to driving

Many respondents referred to recommended times for return to driving, giving advice which ranged from recommending that patients could return to driving the day after surgery, to suggesting that patients should not drive until six weeks post-operatively. Other responses seemed to focus on safety aspects, as summarised by Therapist #36: *"If involves driving, patient must be able to make a decision 'are they safe and in control of the car,' for insurance reasons"*. Respondents recognised that for many patients, return to driving might be the limiting factor for return to work.

4.4.5.2.3 General post-operative management

Many clinicians framed their reported advice around the need for dry/clean/light activities until the surgical incision site was healed. However, there seemed to be a dichotomy with some clinicians stating that they advised returning to work with sutures in situ, and other clinicians recommending that their patients should wait until the sutures were removed and the wound healed before returning to work. A number of clinicians mentioned the usefulness of scar massage and desensitisation but these comments did not seem to be specific to any work activity or timescale, rather that it was beneficial for all. Few individuals gave advice about upper limb exercises and these were

predominantly therapists who linked exercise with general ergonomic advice. Specific work reconditioning was not mentioned in any responses.

4.4.5.2.4 Return to work strategies

Surgeons and therapists generally reported giving one of three types of return to work advice after CTR:

1) Recommending that all patients return to work as soon as possible, for example: *"Encouraging pts [patients] to return to work as early as possible, as pain allows. There is no structure that must be protected"* (Therapist #32).
2) Advising patients to return when they felt able to do their work duties, for example, "*They should return when able to do duties either modified or normally"* (Therapist #26).
3) Specifically prescribing a particular time point for return to different work duties, for example, *"3 weeks - light duties or clerical. 6 weeks - heavy or normal work."* (Surgeon #41). As with the data presented in Table 4.8, the duration of these recommended time points also varied.

4.4.5.2.5 Conflicting advice

Several respondents identified a problem with different healthcare professionals providing different advice, and this was felt to be detrimental to patient outcomes. The potential for conflicting information to be given by surgeons, therapists and GPs was highlighted, for example*: "I am never very clear what to advise, as the patient may get different advice from the surgeon"* (Therapist #105); *"The HTs [hand therapists] will decide when they can go to work"* (Surgeon #271); and "*Never give patients more than 3/52 off work…but what their GPs do I do not know!"* (Surgeon #13).

4.4.6 Key factors for return to work

Both groups of clinicians were asked about the factors they consider when framing their return to work advice for individual CTR patients. From the list of 22 potential factors, the most commonly selected response was 'type of work', which was chosen by 95% of surgeons and 100% of therapists. The least commonly selected factor was 'obesity', which was chosen by 2% of surgeons and 10% of therapists.

The three factors most commonly reported as influential by the surgeons were: type of work (81%); employer support (33%); and financial considerations for the patient (32%). This compared with: type of work (77%); post-operative clinical presentation (58%); and hand dominance and side of surgery for the therapists (34%). Significant differences were found in the proportion of surgeons and therapists selecting five of the 22 factors. Employer support, need to drive and financial considerations for the patient were selected by significantly more surgeons than therapists. Hand dominance in relation to side of surgery and post-operative clinical presentation were selected by significantly more therapists than surgeons. Sex was the only factor not selected by any surgeons or therapists (Table 4.13).

Table 4.13 Factors considered when framing return to work advice after carpal tunnel release

	Factors considered in framing return to work advice				Factors selected as one of the three most influential				
	Surgeons N=143 (%)	**Rank**	**Therapists** N=102 (%)	**Rank**	**Surgeons** N=149 (%)	**Rank**	**Therapists** N=113 (%)	**Rank**	**P-value** [a]
Age	38 (27)	14	60 (59)	15	4 (3)	13	2 (2)	16	0.70
Sex	14 (10)	20	20 (20)	21	0	22	0	22	-
Hand dominance and side of surgery	62 (43)	9	88 (86)	5	24 (16)	7	38 (34)	3	**0.001**
Obesity	3 (2)	22	10 (10)	22	2 (1)	18	0	22	0.51
Co-existing musculoskeletal disorders	61 (43)	10	83 (81)	8	7 (5)	10	7 (6)	10	0.59
Education level	26 (18)	15	55 (54)	17	2 (1)	18	1 (1)	19	1.00
Type of Work	136 (95)	1	102 (100)	1	120 (81)	1	87 (77)	1	0.49
Employer support	100 (70)	2	91 (89)	3	49 (33)	2	22 (19)	4	**0.02**
Friends/Family support	61 (43)	10	58 (57)	16	5 (3)	11	0	22	0.07
Pre-operative symptoms	21 (15)	17	70 (69)	14	3 (2)	15	7 (6)	10	0.12
Pre-operative functional status	45 (31)	13	83 (81)	8	3 (2)	15	5 (4)	11	0.30
Pre-operative neurophysiology/imaging	5 (4)	21	38 (37)	19	0	22	1 (1)	19	0.43
Post-operative clinical presentation	77 (54)	7	98 (96)	2	29 (19)	6	65 (58)	2	**<0.001**
Patient expectations	93 (65)	4	91 (89)	3	34 (23)	5	16 (14)	6	0.08
Coexisting flexor tenosynovitis	51 (36)	12	83 (81)	8	4 (3)	13	4 (4)	13	0.73
History of hypertrophic/keloid scarring	24 (17)	16	64 (63)	13	1 (1)	20	2 (2)	16	0.58
Patient psychological health	66 (46)	8	85 (83)	6	16 (11)	8	10 (9)	7	0.61
Bilateral vs unilateral surgery	89 (62)	5	85 (83)	6	12 (8)	9	7 (6)	10	0.57
Surgical technique	19 (13)	18	31 (30)	20	2 (1)	18	2 (2)	16	1.00
Availability of post-operative rehabilitation	17 (12)	19	39 (38)	18	1 (1)	20	1 (1)	19	1.00
Need to drive	98 (69)	3	82 (80)	11	42 (28)	4	4 (4)	13	**<0.001**
Financial considerations for the patient	83 (58)	6	78 (76)	12	48 (32)	3	18 (16)	5	**0.001**
Other	6 (4)	-	8 (8)	-	3 (2)	-	1 (1)	-	0.64

[a.] Pearson's chi-squared used to test for difference the surgeons' and therapists' selection of their three most influential factors. Fisher's exact test was used for cases with fewer than five observations. Significant differences at the 5% level are highlighted in bold.

4.5 Discussion

This survey investigated the self-reported practice of UK hand surgeons and hand therapists, focusing on the return to work advice provided to their CTR patients, and the factors they considered most influential in the return to work process. Although CTR is a common elective procedure, this information had not been previously reported for clinicians in the UK, or elsewhere. The survey findings provide important contextual detail for the subsequent stages of this thesis, and for other studies exploring return to work after elective hand surgery. This survey was not designed to provide consensus opinion, rather to examine whether there was variation in practice among a selected group of specialist clinicians.

4.5.1 Return to work times

Clinician-recommended return to work times after CTR were requested for three broad job categories: desk-based duties; repetitive light manual duties; and heavy manual duties. Although none of the respondents mentioned the RCS guidelines, the median recommended return to work times for the first two occupational categories were similar to the earliest time points suggested by the RCS (7 days for supervisory roles and 14 days for light manual roles) [102]. However, the median clinician-recommended time for return to heavy manual work was 12 days earlier than advised by the RCS (42 days) [102], implying that this guidance might be viewed as over-cautious by many clinicians. In the UK, even earlier return to manual work has been reported in an uncontrolled study of a nurse-led service. In this case series, 17% of the 191 manual workers returned to work within a day of surgery; 71% returned by 7 days and 91% within 14 days [110]. However, comparisons between the findings of the current survey, the previous research, and the RCS guidelines are limited by differences in the format of the occupational categorisation.

The recommended return to work times reported in the current survey were also earlier than those identified in the systematic review (Table 3.13). The median recommended time to return to desk-based work was two weeks earlier than had been identified in the systematic review (7 days versus 21 days). For heavy manual work, this difference was 16.5 days (30 days versus 46.5 days). Again, these differences may be the result of

different occupational classifications, but could also represent a difference between recommended and actual return to work times. This will be explored in more detail as part of the cohort study reported in Chapter 5.

Considerable variation in return to work recommendations was observed among the 272 respondents, despite the use of similar surgical procedures. For desk-based work, the range of recommended return to work times spanned 6 weeks, this was even greater for repetitive light manual duties (8 weeks) and heavy manual duties (3 months). This suggests that patients across the UK receive widely different, and possibly even conflicting, advice about when they should aim to return to work after CTR. The survey format did not allow assessment of whether treatment and advice was better standardised locally and this will be explored in more detail in Chapter 5 and Chapter 6.

Reported provision of fit notes also varied in the current survey and it is possible that those surgeons who recommended return to some (or all) types of work within seven days of CTR may issue fewer fit notes as patients are able to self-certify sickness absence of this duration. However, surgeons may also be reliant on their patients' GPs to provide this certification. It was not possible to further explore these theories with the data collected.

Interestingly, there were differences between the recommended time to return to desk-based duties reported by surgeons and therapists. Surgeons advised 7 days, while therapists advised 10. Suture removal usually takes place 10-14 days after CTR, and therefore it is possible that the surveyed surgeons advise their patients to return to work with sutures in situ, while the surveyed therapists wait until sutures are removed. To date, there is no evidence suggesting whether or not there is any risk to the wound, or other longer-term patient outcomes, from carrying out desk-based duties before the surgical incision site is healed.

For all three work categories, clinicians who treated larger numbers of CTR patients recommended earlier return to work times than those who saw these patients less frequently, although there was wide variation even within this population. The lack of evidence-based guidance for return to work after CTR may mean that clinicians are reliant on their own experience, rather than any available evidence, when advising their

patients. It is possible that clinicians with greater experience of treating CTR patients may have found that earlier return to work was not detrimental to recovery in their CTR patient population. Clinical reasoning processes have been explored in a series of qualitative interviews with expert and novice occupational therapists [225]. The authors suggest that there was a continuum from a very structured approach to a more intuitive process with experience. A similar process may occur with the provision of return to work advice.

4.5.2 Content of return to work advice

Reported return to work recommendations were described in five main themes: work characteristics, return to driving, general post-operative management, return to work strategies and conflicting advice.

As with the recommended return to work timescales, advice regarding when to return to other work-related activities, such as driving, heavy lifting and weight-bearing spanned a wide range of time points. It appeared that there was agreement among clinicians on the types of activities that might be problematic after CTR, but not when it might be safe to resume these activities. Many respondents identified that patients may be receiving conflicting advice from different healthcare professionals, but this was only identified as a potential issue between, rather than within, professional groups. None of the respondents reported an awareness of variation within their own speciality. Conflicting health advice has been identified as a growing, yet poorly understood problem [226].

Many clinicians included general post-operative management in the content of their return to work advice. It is possible that these clinicians considered their advice about wound care as work-related advice, or that this topic was something they felt more comfortable with than making suggestions based on the patient's work. Very few clinicians mentioned specifically tailoring their advice to their patient's work. In addition, none of the respondents mentioned the existing RCS guidance [102]. It is not clear whether they were unaware of this document, or if they chose to give alternative advice.

4.5.3 Factors considered when framing return to work advice

All therapists and 95% of surgeons reported taking the patient's 'type of work' into consideration when providing return to work advice. This may reflect practice, however, it is also possible that the high frequency of the responses was influenced by the survey topic, which explicitly concerned CTR and work.

The second most commonly selected factor by surgeons was 'employer support', followed by the 'need to drive'. This contrasted with therapists, where greater numbers chose 'post-operative clinical presentation', followed by 'patient expectations' and 'employer support'. The factors that were chosen fall into two themes: a focus on the practicalities of getting to work and the level of support that is available when the patient gets there; and a focus on the clinical aspects of the patient's recovery and their individual expectations for returning to work. One possible explanation for the difference between therapists and surgeons is that the two clinical groups may see different patient populations. Routine hand therapy after CTR is not recommended by the current British guidelines [18] and only 20% of surgeons reported routinely referring their patients for post-operative therapy, while up to 79% of surgeons routinely saw these patients for follow-up themselves. In this situation, therapists are likely to be referred only those patients with specific functional difficulties or issues with pain/scarring, which require particular clinical assessments, whereas surgeons are more likely to see patients with a whole range of clinical outcomes.

4.5.3.1 Employer support

The importance of employer support was also identified by Katz et al., who found that workers in low support organisations had greater odds of sickness absence 12 months after CTR surgery (OR 2.94, 95% CI 1.2-7.3) [217]. Their model for increased sickness absence at 12 months also included older age (OR per decade 1.80, 95% CI 1.07-3.01) and poorer pre-operative physical functioning measured by the physical dimension of the SF-12 (OR 2.02, 95% CI 1.21-3.39). Both of these factors were included in the list presented to survey respondents, but were not selected in high frequencies.

4.5.3.2 Driving

There are currently no evidence-based guidelines suggesting when it is safe for a patient to return to driving after CTR, and there is some confusion over whose responsibility it is to determine whether an individual is safe. The UK Driver and Vehicle Licensing Agency (DVLA) does not offer guidance specifically for hand surgery, but it does state that: "Licence holders wishing to drive after surgery should establish with their own doctors when it is safe to do so." [227](p109). A survey completed by 89 plastic or orthopaedic surgeons, practising in the UK and Ireland, found that 53% believed that it was the patient's responsibility to determine when they were safe to drive after hand surgery; 40% felt that it was up to their insurance company; and only 7% believed that it was the surgeon's responsibility [228]. The same survey respondents were asked when they would advise their patients to return to driving after CTR and the responses are shown in Table 4.14. Although there are issues with this survey question, notably that the answer options are not mutually exclusive, it does illustrate that there are also differing views of what advice to give patients among other populations of clinicians.

Table 4.14 Recommended time to resume driving after carpal tunnel release surgery

How soon after carpal tunnel release surgery is it safe to drive?	Percentage of surgeons [a]
Immediately	0
When comfortable	8
When able to do an emergency stop	12
As soon as in full control of the car	28
24-48 hours	0
1-2 weeks	18
2-4 weeks	19
4-6 weeks	3
>6 weeks	0
When splints or dressing are removed	8
Do not advise or not applicable	5

Taken from Murphy et al. [228]. [a.] N=89 plastic or orthopaedic surgeons.

Patients' reports of return to driving after CTR have also been explored, and the findings differed from those reported above. In a group of 139 patients who underwent minimally invasive hand surgery (half of which was CTR), 50% reported driving immediately after surgery and all felt safe doing so [229]. The other 50% chose not to drive immediately, and waited for a range of <1 to 14 days before resuming. For many patients, their ability to return to work is determined by being able to drive there. It is not clear whether

driving soon after CTR is detrimental to wound healing and patient recovery, or whether outcomes differ depending on the side of surgery, or use of manual or automatic vehicles.

4.5.3.3 Clinical presentation

When framing their return to work advice, 96% of therapists reported that they took the patient's clinical presentation into account. However, several studies have found that patients' post-operative presentations did not play a significant role in return to work times. An RCT by Atroshi et al., comparing endoscopic and open CTR, found that levels of pain in the scar and proximal palm were not associated with the time taken to return to work [149]; Hansen et al. found that self-reported hand function did not predict whether patients returned to work ≤21 days or after [167]; and Ratzon et al. found that neither patient-reported symptoms, nor objective assessments of function were associated with return to work time [109]. Unfortunately, the format of the current survey did not allow assessment of the rationale behind the therapists' response, however, it may be helpful for the hand therapy community to consider whether or not such importance should be attached to the clinical presentation when advising CTR patients about return to work.

4.5.3.4 Patient expectations

Therapy respondents reported that patient expectations were an important determinant of the advice they provided. The relationship between expected and actual improvement in CTS symptoms has been assessed by Becker et al., who found that patients' expected and actual improvement after endoscopic CTR was very similar [151]. How clinicians assess patient expectations, address any unrealistic expectations, and how they incorporate patient expectations into their return to work advice requires further exploration. Expectations in relation to the duration of post-operative work absence was specifically included in the cohort study discussed in Chapter 5.

4.5.4 Variation in the carpal tunnel release pathway

4.5.4.1 Non-operative treatments

The reported provision of pre-operative CTS treatments (corticosteroid injections, splinting and therapy) varied, as did the use of pre-operative nerve conduction studies. This mixed pattern of pre-operative input is consistent with the recent audit of 214 Clinical Commissioning Groups (CCGs) in England, discussed in Section 1.2.8 [55]. Regional differences in the incidence of CTR surgery and the proportion of CTS-diagnosed patients being treated operatively have also been reported in Sweden [34]. It is possible that the lack of consistent guidance for CTS management contributed to the variation reported in our survey; however, the optimal pre-operative treatment pathway remains unclear and agreement is required to ensure that patients are offered equitable and effective treatment.

4.5.4.2 Type of incision

The majority of surgeons reported that they used a mini open incision. Endoscopic procedures were not common and were only used by five surgeons (one working solely in private practice and two working solely in the NHS). Endoscopic surgery is more common in the US [72], but the expense of the equipment and the longer surgical training period compared to open CTR, means that endoscopic CTR is unlikely to be cost effective for the UK NHS setting [85].

A previous systematic review found that the use of a mini incision was associated with earlier return to work after CTR when compared with the traditional incision [79]. In the current survey, surgeons who only used a mini incision tended to recommend earlier return to work times than those who always used the longer traditional incision, but this difference was not statistically significant. However, this analysis was likely to be underpowered because few surgeons reported only using one incision type.

4.5.4.3 Post-operative management

Reported post-operative follow-up pathways were also variable, with patients in both NHS and private settings being treated by a variety of healthcare professionals including

surgeons, dressing clinic nurses, GPs, primary care nurses and therapists. Interestingly only one NHS surgeon reported regular occupational health involvement, although some patients may access occupational health through their employer. As several different healthcare professionals may be involved in the post-operative care of CTR patients, this raises questions about the consistency of return to work advice provided. It is not known whether patients receive the same advice from each clinician, and if not, whose advice do they choose to follow? The median time points for dressing clinic, primary care and therapy follow-up were all within two weeks of surgery, and therefore these clinicians may be best placed to provide timely post-operative work advice, rather than those in the surgical team, where the median follow-up time was 42 days (6 weeks) in the NHS and 28 days (4 weeks) in private practice.

4.5.5 Limitations

4.5.5.1 Self-reported data

A key limitation of our study was the use of self-reported data, which as highlighted above, may not be a true reflection of clinical practice. Several steps were taken in an attempt to promote accurate reporting. Firstly, respondents who had not treated any CTR patients in the previous 12 months or had not treated any CTR patients who were workers at the time of surgery were excluded. Secondly, an open text box (without prompts) was used for the respondents to describe their return to work recommendations. To avoid influencing respondents, this question was positioned before the list of 22 factors that might be associated with return to work outcomes. Thirdly, yes/no tick boxes were used for the list of factors to avoid potential bias of respondents selecting the options closer to the top or bottom of the list. Responses were assessed for yay-saying or nay-saying (individuals answering consistently yes, or no, for all options) [230]. This applied to only four individuals and is therefore unlikely to have affected the overall findings. Finally, the participant information sheet clearly stated that the survey questions had no right or wrong answers; however, respondents may still have answered in a way that they felt reflected best practice, rather than their usual practice. While possible social desirability bias needs to be considered, this survey creates a starting point

for further research exploring return to work after CTR and was not designed to be a definitive record of practice.

4.5.5.2 Response rates and response bias

Response rates for the current survey were not out of line with other efforts to reach this same group of clinicians. The paper-based version of the survey performed better than the electronic version, and overall a greater proportion of therapists responded than doctors. Recent electronic surveys of UK hand therapists have typically yielded low response rates, with a 2016 survey investigating conservative management of closed zone I extensor tendon injuries yielding only 5.7% [231]. Among doctors, response rates have been found to vary with speciality, with fewer surgeons completing electronic surveys than medics [232]. A recent electronic survey of intra-operative sharps injuries in American Society for Surgery of the Hand members yielded a 14.5% response rate [233]. Despite the reasonable response rate (in comparison to the existing research), the small sample size in the current survey means that the potential for type 2 errors should not be ignored. It is possible that additional differences between groups would be identified with a larger sample.

The use of both paper-based and electronic formats was an attempt to access a broader range of individuals, not just those who were willing and able to attend a professional conference. Unfortunately, it was not possible to assess for potential response bias in the current survey because there is no register of surgeons performing CTR or therapists treating CTR patients that could be compared to the survey sample. A common element of response bias is that individuals who are particularly interested in the survey topic are more likely to complete the questionnaire [234]. This may have occurred, and it is important to note that the survey title clearly outlined its topic. It is acknowledged that the findings from this exploratory survey will not represent the range, or perhaps even the most common practice within the UK. While this is a clear limitation of the study, the wide variation in clinical practice and return to work recommendations identified in this reasonably homogenous and self-selected group of clinicians hints at even greater variation in the broader population.

Two differences between those who completed the survey in the paper-based and electronic formats were anticipated and observed. Firstly, a higher prevalence of clinicians based in Wales completed the paper-based version; this was expected because the questionnaires were distributed at the BSSH/BAHT Scientific Meeting held in Cardiff. Secondly, more GPs completed the questionnaire electronically; this was expected because primary care surgeons were specifically targeted by an electronic mail out. In other ways, the demographics of those completing the survey in the two formats were similar.

Respondents were not asked to indicate how they received the invitation to complete the survey. All paper-based questionnaires were given out at the combined BSSH/BAHT Scientific Meeting, however, four recruitment sources were used to send the electronic questionnaire. The email to RSTN members was sent last and very few additional responses were gained after its delivery. It is possible that these individuals were not routinely performing CTR and therefore did not complete the survey. The RSTN was added after discussion with junior doctors working in hand surgery who suggested that additional recruitment methods would be needed because many plastics and orthopaedic trainees in hand surgery were not members of BSSH. However, only nine junior doctors completed the current survey, and all but one of these individuals completed the paper-based version. In terms of clinical practice, junior doctors will tend to be guided by the practice of their consultant, and therefore the inclusion of additional junior doctors may not alter the findings of this survey. However, alternative strategies are clearly required to capture this clinical group.

While the current survey will not have reached all individuals in the UK who routinely perform CTR. All UK specialist bodies for surgeons and hand therapists routinely involved in the management of CTR were identified and included in the sampling frame.

4.6 Summary

This survey had three objectives: 1) to identify and classify the advice given to patients returning to work after CTR surgery; 2) to discover which factors these healthcare practitioners consider most important for return to work after CTR, and 3) to explore and

examine variation between clinicians in their practice and return to work recommendations. The self-reported practice of the 272 respondents found that despite the majority of surgeons commonly using the same CTR technique (mini incision), there were wide-ranging CTR patient pathways and varied return to work recommendations. This is consistent with the broad range of return to work times identified in the systematic review reported in Chapter 3.

A key theme of self-reported return to work recommendations was general post-operative wound management. It may be that clinicians felt more confident advising on this topic. Responders also reported advice about return to different functional activities, such as driving, but the recommended timescales for resuming these activities also varied. There was awareness of the possibility of patients receiving conflicting advice.

The factors that were considered important for return to work were classified in two themes and differed between the groups of clinicians. For surgeons, the focus was on the practicalities of getting to work and the level of support that is available when the patient gets there. For therapists, the focus was the clinical aspects of the patients' recovery and their individual expectations for returning to work. This difference may be explained by a difference in the CTR patient populations seen by therapists and surgeons. It is likely that many factors contribute to a patient's decision of when to return to work after a CTR, but recommendations from their surgeon or other healthcare professionals may play an important role.

There is currently no consensus, and very little evidence, on the optimal advice and return to work timescales for patients after CTR and best practice has yet to be determined. The existing RCS guidance, which is not evidence-based, appears to be unknown or disregarded by a number of the specialist clinicians included in the current survey. If there are no detrimental effects of earlier return to work for the three broad job types outlined in this survey, the recommendation would be for clinicians to move towards advising earlier return to work time frames.

Chapter 5 Return to employment after carpal tunnel release surgery (REACTS): a prospective cohort study

5.1 Introduction and study objectives

The next stage of this thesis expands the topics raised by the systematic review of reported return to work times after CTR (Chapter 3) and the survey exploring clinicians' return to work recommendations (Chapter 4). These previous studies identified variation in the duration of work absence after CTR and highlighted a number of factors that could contribute to this variation. Existing research has explored determinants of return to work outcomes in other settings, [106], but the findings have not been consistent and, to date, UK populations have not been explored. The survey reported in the previous chapter found that UK surgeons and hand therapists recommended a wide range of return to work time points for the same occupational activities, but it is unclear whether this reported advice reflects the recommendations that patients actually receive, or recall. Clinicians with more experience of treating CTR patients tended to recommend earlier return to work. It may be that those who advised longer periods of work absence were concerned that early return to work would be detrimental to clinical outcomes, but there is insufficient evidence to confirm or refute this concern.

The specific objectives for the next two chapters of this thesis were to:

1. Identify when and how UK patients return to work after CTR for a range of occupations,
2. Investigate the key factors associated with return to work time in this population,
3. Examine whether earlier return to work is associated with poorer outcomes, and
4. Explore the return to work advice that patients receive.

5.2 Methods

5.2.1 Study design

To best meet the thesis objectives, a prospective observational cohort study was developed with a nested qualitative interview study. The study was named Return to Employment After Carpal Tunnel release Surgery (REACTS).

A prospective approach was chosen to minimise the impact of recall bias. Individuals were identified at the point of being referred for CTR, with the study designed to collect patient self-reported information throughout their CTR pathway. As there is no centralised database for work absence reporting in the UK, this was the only feasible method of collecting relevant work and return to work data. The qualitative component of the study was included to gain greater understanding of the experience of returning to work after CTR. The current chapter solely discusses the cohort study component, the interview study is reported separately in Chapter 6.

The STROBE statement checklist was used to guide the reporting of the REACTS prospective cohort study [120] and the completed appraisal checklist is provided in Appendix L. Additional support was provided by Georgia Ntani (medical statistician, MRC Lifecourse Epidemiology Unit), who assisted the lead author in planning the data analyses.

5.2.2 Inclusion and exclusion criteria

Study inclusion criteria were deliberately kept broad in an attempt to recruit a sample of participants who were representative of the general CTR patient population. Potentially eligible patients were asked to self-select whether they met the study inclusion and exclusion criteria, using the wording shown in Table 5.1. The reasoning behind each criterion is discussed below. Details about the type of surgical procedure were collected from the operative records by one of the local study team at each of the study sites. A diagnosis of CTS was assumed by the patient being referred for CTR.

Table 5.1 REACTS study inclusion and exclusion criteria

Self-selected by potential participants	Assessed by recruiting clinician
- Aged over 18 and referred for carpal tunnel release surgery - Routinely work in paid employment for at least 20 hours per week - Plan to return to work after carpal tunnel release surgery - Have not previously had carpal tunnel release surgery on either hand - Have not previously had a serious injury to the same wrist/hand	- No planned surgical procedures for conditions other than carpal tunnel syndrome

5.2.2.1 Aged over 18 and referred for carpal tunnel release surgery

Only adult patients (≥18 years) were eligible to participate because CTS and CTR are extremely rare at younger ages. The reported peak incidence of CTS varies in the literature, but studies agree that the onset of CTS usually occurs after the age of 30 years, with the majority of patients becoming symptomatic between the ages of 40-70 years [31, 32, 39]. It was therefore not expected that any individuals under the age of 18 would fulfil the other study eligibility criteria. There was no upper age limit and recruitment was not limited to a particular surgical technique for CTR.

5.2.2.2 Routinely work in paid employment for at least 20 hours per week

Those working in a voluntary (unpaid) capacity were not eligible to take part because it was expected that the factors contributing to return to work times and processes for unpaid roles would differ compared with paid employment. Participants were asked about their employment type as part of the baseline study questionnaire. The UK does not have an accepted definition of the number of working hours per week that constitute full and part-time working hours [235]. Therefore, a cut-off of 20 hours per week was chosen to include individuals working full time, or more than 50% of a hypothetical 40 hour working week. It was hypothesised that the factors contributing to return to work might be different for those individuals working fewer hours. A similar cut-off point has been used by others in CTR research [220]. Those with zero hours contracts (in which the number of hours worked per week may vary) were eligible to participate if their usual duration of paid work exceeded 20 hours.

5.2.2.3 Plan to return to work after carpal tunnel release surgery

Those not planning to return to work after surgery (for example, due to planned retirement) were excluded because this situation was not relevant to the study research question.

5.2.2.4 Have not previously had carpal tunnel release surgery on either hand

To avoid study participants being familiar with the healing timescales or return to work processes after CTR, only individuals with no previous experience of CTR were eligible to participate. Those undergoing bilateral simultaneous CTR were eligible to take part, as were those undergoing sequential CTR, but only for the first side. Patients with a previous serious injury to the same wrist/hand were excluded. This was to exclude participants with marked functional deficits in the operated hand, where it might be difficult to ascertain the specific effects of CTR surgery on their symptoms and function. The definition of 'serious' was self-defined by the participant, with the assumption that those with residual deficits would be most likely to label their previous injury as 'serious'.

5.2.2.5 Only listed for carpal tunnel release

An additional criterion assessed by the recruiting clinical teams was that the patient should be listed for CTR without any additional surgical procedures for other existing acute or chronic upper limb conditions. This might include, but was not limited to: A1 pulley release for trigger finger, surgery or collagenase injection for Dupuytren's disease, or surgical procedures for rheumatoid or osteo- arthritis. It was expected that surgical treatment for a concomitant condition could involve different post-operative management, which may have other impacts on the patient's return to work.

5.2.3 Questionnaire development and content

The following section contains information about the development of the study questionnaires, including their content, piloting and the initial processing of each variable before the subsequent analyses. As discussed in Section 2.2, draft versions of the questionnaires were shared with the patient and occupational health advisory groups, who reviewed each iteration and provided comments and suggestions. In addition, drafts

of the baseline questionnaire were piloted with three patients referred for management of chronic hand/wrist injuries, but not necessarily CTS, in the hand therapy clinic at Chelsea and Westminster NHS Foundation Trust. These patients' suggestions were incorporated into the subsequent drafts. All members of the patient advisory group approved the final questionnaire content and format, including the presentation and readability.

The questions were chosen to capture information on variables that might be expected to influence return to work after CTR. This was based on the published research identified as in the systematic review (Chapter 3) and introductory section (Chapter 1) of this thesis, and the survey of hand surgeons and hand therapists (Chapter 4). The content of each questionnaire section and the reasons for inclusion are discussed below. Where categorical responses were used, an 'other, please specify' option was given to avoid restricting participants unnecessarily. 'Other' responses were reviewed by the lead researcher and either coded into the existing categories or added as new categories, where appropriate. This process was reviewed by GN and any disagreements resolved by discussion. The full versions of the baseline and first follow-up questionnaires are included in Appendix M and Appendix N; the final follow-up questionnaire (3 months after CTR) did not contain any new questions and has therefore not been included in the appendices.

5.2.3.1 Baseline questionnaire (before surgery)

5.2.3.1.1 Demographic factors

General demographic information was requested including date of birth, sex and hand dominance. Other studies have found that older age was associated with poorer work outcomes after CTR [106, 182], while no clear sex effect has been shown [101, 152]. Hand dominance in relation to side of surgery is rarely reported in CTR studies, however, surgery to the non-dominant hand has been linked to quicker and more complete resolution of CTS symptoms [216] and 34% of hand therapists who responded to the survey in Chapter 4 selected hand dominance as one of the top three factors influencing return to work.

After discussion with the patient advisory group, it was decided not to include questions about ethnicity. Group members were concerned that participants may not be comfortable providing this information, and no evidence was found to suggest that ethnicity may be important in return to work after CTR.

5.2.3.1.2 Carpal tunnel release planning

Information was collected on the expected date of CTR, side of surgery, availability of occupational health services and the patient's expectations about time off work post-surgery. Expected duration of work absence has been identified as a determinant of return to work time in previous CTR studies [106, 111]. Participants were asked if they had been given any information about their operation, and/or any information about returning to work afterwards. If yes, they were asked who had provided information and an open text box was provided for them to describe the content. Surgeon's advice has been reported as a key determinant of time to return to work after CTR [109], as have recommendations from nurse-led CTR clinics to return to normal activities, including work, as soon as possible [110]. It is not known whether other healthcare professionals, or other information sources, such as the internet, are also consulted for work-related advice.

5.2.3.1.3 Occupational factors

Participants were asked to list their main occupation and the industry in which they work (examples were provided to facilitate the response). This information was processed using the UK Office for National Statistics Standard Occupational Classification [112] and Computer Assisted Structured Coding tool (Cascot) [236] to generate manual and non-manual categories. Cases where the coding match was confirmed as less than 64% were reviewed by the lead researcher and coded by hand [236]. This was checked by the department data manager (VC) and any queries resolved through discussion.

Participants were asked to categorise their employment type as: employed (permanent contract), employed (temporary/renewable contract), zero hours contract and self-employed. The systematic review (Chapter 3) found earlier return to work times for self-employed individuals compared to those who were employed; but this was only investigated in two studies [117, 118]. The additional sub-categories for employment type listed above and a separate question about sick-pay entitlement were included to allow

the impact of work contract type to be explored [237]. Participants were also asked how many hours they usually worked each week and over how many days; this information was collected for the participant's main job and any other routine paid work. The total number of work hours per week was calculated by combining the hours for main and additional jobs.

Occupational activities that load the upper limb and potential work stressors were asked as a series of yes/no questions following the format of a recent multi-centre RCT exploring management of non-specific distal arm pain [238]. These questions originated in the Job Content Questionnaire, designed to assess psychological and physical aspects of work [239]. Activities included: computer use, tasks involving repeated wrist/finger movement, holding vibrating tools, lifting more than 5 or 10kgs, pushing/pulling a heavy weight, working with the neck flexed or rotated, and driving. The systematic review (Chapter 3) found that manual workers took longer to return to work than non-manual workers and these questions were used to determine the self-reported level of upper limb manual activity involved in each participant's job.

Potential psychosocial work stressors were also assessed. These included piecemeal work, activity targets and bonuses, and tight deadlines. As the first three items all concerned payment for results, these were combined for the analyses. Participants were also asked whether they found their main job demanding on their hands/wrist and whether their boss/colleagues were supportive. Both questions were scored on a 0-10 scale as reported previously in a study of sick leave duration after endoscopic CTR [167]. These were dichotomised as supportive (7-10) and neutral/unsupportive (0-6). A question about general job satisfaction was also included later in this section of the questionnaire, with the Likert response options: very satisfied, satisfied/fairly satisfied, dissatisfied and very dissatisfied [167, 240]. The last two options were condensed to give three categories for the analyses.

To assess self-reported work function, participants were asked to complete the work performance section of the Michigan Hand Questionnaire (MHQ) [241]. This patient reported outcome measure is frequently used in upper limb clinical practice and research and has been validated for use with CTS and CTR populations [242]. Permission was granted for the MHQ to be used in the study and the license agreement is included in

Appendix O. The questionnaire asked participants to recall how much difficulty they had with general work tasks over the past four weeks in relation to problems with their hands/wrists, for example: needing to shorten their working day, taking longer to complete tasks or needing to take breaks. Using the standard scoring, each question was completed on a Likert scale of: always, often, sometimes, rarely and never, and combined to give a score from 0-100, with 100 representing no problems with work functioning [243]. Participants were also asked whether they had taken any periods of sickness absence from work over the previous four weeks, both related to the hand/wrist problem, or for any other problem.

5.2.3.1.4 General health

Seven general health questions were included to capture information on comorbidities, physical and mental health and somatisation. Self-reported health was assessed using the first SF-36 question: In general, would you say your health is – excellent, very good, good, fair, poor [244]. This was taken from the original SF-36 version, which is free from licence charges and was dichotomised as excellent/very good/good and fair/poor for the analyses.

Participants were asked their height and weight to enable the calculation of BMI (body mass index; weight in kilograms/height in metres squared). This was categorised using standard WHO classification: underweight (BMI <18.5), normal weight (BMI 18.5-24.9), overweight (BMI 25.0-29.9) and obese (BMI ≥30.0) [245]. Smoking status was categorised as those who have never smoked regularly, those who have smoked in the past and those who regularly smoke, with the latter two categories combined for the analyses. Previous studies have found that obesity (BMI ≥30) was linked to poorer work outcomes [182] and smoking was linked to poorer clinical outcomes after CTR [246].

A list of common health problems and their impact on general activities was assessed using the Self-Administered Comorbidity Questionnaire [247]. Participants were asked first to select whether they have any of the 14 medical conditions and if so whether this limited their activities. All medical conditions were worded in an accessible format, as evaluated by the patient advisory group. Responses were analysed as the number of comorbidities and the number of disabling comorbidities using the scale: 0, 1, ≥2. Mental health was assessed using the mental health and vitality questions from the licence-free

version of the SF-36 [244]. One modification was made to change the wording of the question 'Did you feel full of pep?' to 'Did you feel full of get-up-and-go?' for the UK rather than US setting. The questions were used to calculate the summary score from 0-100 (where 100 represents no disability).

Somatisation was assessed using a subset of five questions from the Four-Dimensional Symptom Questionnaire [248] as previously reported in UK cohort studies of health and employment [113] and upper limb pain in primary care [249]. The number of symptoms that were rated by the participant as at least moderately distressing were used to create the analysis categories of: 0, 1, ≥2 symptoms.

5.2.3.1.5 Hand and wrist symptoms and function

Katz & Stirrat hand diagrams were included for the participants to indicate where on their hand(s) they experience pain and/or tingling and numbness [19]. This self-administered tool can be used clinically as part of the CTS diagnosis process using the scoring system modified by Calfee et al. [20]. The question format is shown in Figure 5.1 and also included a question on symptom duration categorised as less than 3 months, 3-6 months, 6-12 months and more than a year. This was dichotomised to ≤1 year and >1 year for analysis.

All participants were expected to have clinically diagnosed CTS as they were undergoing CTR, but participants were asked to answer for both hands, so that symptoms in the non-operated hand were also assessed. This was used to define bilateral or unilateral symptoms. Responses were scored by the lead researcher using the criteria in Table 5.2 [20]. The first ten participants were separately assessed by LN and KWB, after this any uncertainties were discussed and a random sample of 24 questionnaires (~10% of the sample) were also assessed by KWB to ensure consistency. Hand diagram scores were dichotomised according to a stringent definition of CTS (classic and probable) and unlikely CTS (possible and unlikely).

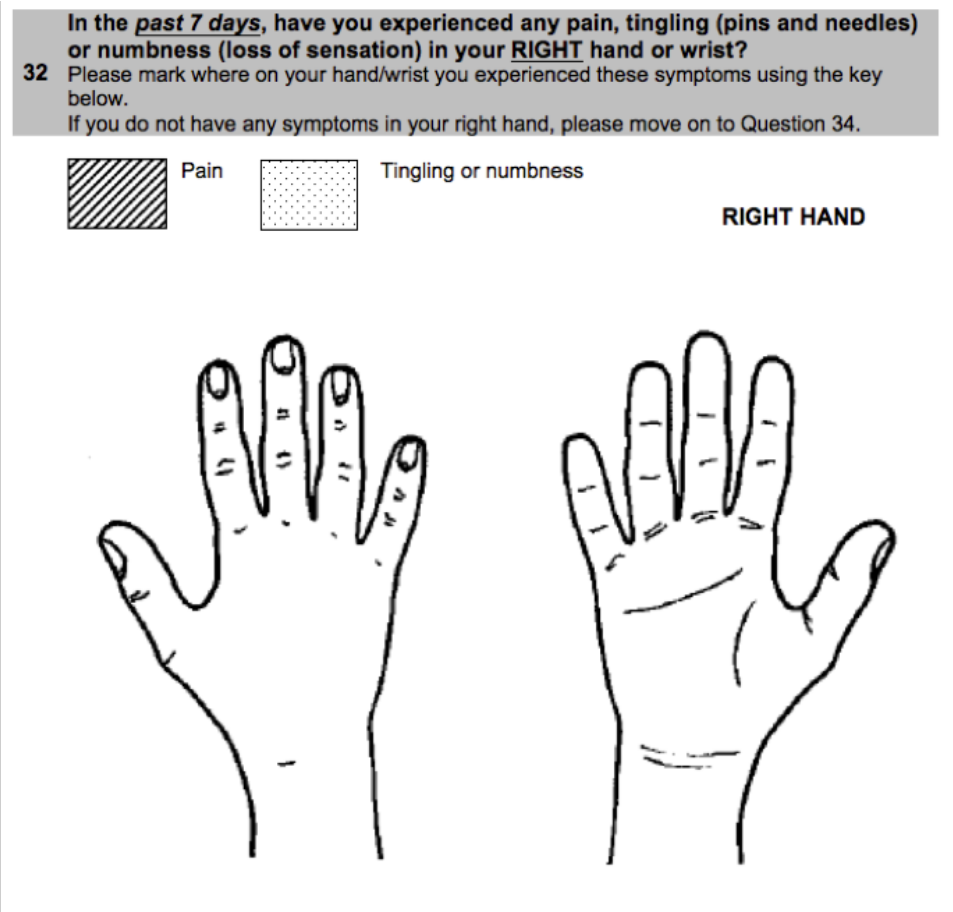


Figure 5.1 Hand diagram used in the baseline (pre-operative) questionnaire

Table 5.2 Scoring system used for the hand diagrams

Katz Score	Area of shading
Classic 1	Tingling, numbness or pain in at least two of digits 1, 2, 3. Excluded if symptoms on the palm and dorsum of hand. Little finger symptoms, wrist pain, or radiation proximal to the wrist allowed. For index and middle finger, must include shading of more than half the volar surface over the middle phalanx and/or some of the distal phalanx. For thumb, must include volar shading over the distal phalanx
Probable 2	Same shading as classic, but allowed to extend into palm volarly, unless confined to the ulnar side of palm
Possible 3	Tingling, numbness, burning or pain in at least one of thumb, index and middle finger. May include dorsum of hand
Unlikely 4	No shading of volar thumb, index and middle fingers

Taken from Calfee et al [20].

The CTS-6 questionnaire was included to assess the severity of CTS symptoms [250]. This tool is a shorter version of the Boston Carpal Tunnel Questionnaire [49] and has been assessed for use pre- and post CTR surgery. The six questions explore the severity of pain and numbness, whether this occurs during the daytime or at night, and whether this wakes the individual. Participants were asked to complete these questions separately for each hand using a 5-point Likert scale. Using the standard scoring criteria, responses for each item were combined to give a mean score ranging from 1-5, with 5 representing the highest severity of symptoms. If one response was missing (per hand) this was imputed using the mean score of the remaining responses [250].

Hand function was assessed using the MHQ sub-sections on unilateral hand function (asked for each hand), satisfaction with hand function (asked for each hand), and ability to perform unilateral and bilateral activities of daily living (ADLs) [241]. The MHQ summary question relating to the level of satisfaction with the appearance of each hand was also included. All questions were scored on the 5-point Likert scales provided and used the standard wording and scoring to enable comparison with other study populations. Possible scores for each sub-section range from 1-100, with 100 representing no problems or the highest level of satisfaction. Missing data were imputed according to the MHQ guidelines, which allow the scale to be calculated if more than 50% of the questions for each sub-section have been completed [243].

5.2.3.1.6 Health beliefs

The remaining questions related to health beliefs. Beliefs about the cause of symptoms and likely prognosis have been identified as key themes in health-seeking behaviour for CTS [251] and upper limb pain [249], and blaming oneself for the hand problem has been associated with long durations of sick leave after endoscopic CTR [167]. The participant's expectations for being able to use the affected hand normally within 3 months of surgery, fear of long-term hand problems, blaming oneself for the hand problem and the perceived level of support available from friends and family were assessed. Responses were rated on a 0-10 scale as reported by Hansen et al. [167]. All responses were converted to a unidirectional scale with 10 being the best outcome, and were dichotomised using the process described in Section 5.2.3.1.3; neutral/negative response 0-6 and positive response 7-10.

Participants were also asked to agree/disagree (via a 5-point Likert scale) with a series of seven questions about the believed cause of their symptoms. Using previously reported methods, the responses were dichotomised to those who agreed (agree/strongly agree) and those who did not agree (neither agree nor disagree/disagree/disagree strongly) with each statement [249]. The first two questions were combined to generate six items: 1) I think I was born with a weakness in this part of my body/problems like this run in my family; 2) my problem was caused by work; 3) my problem probably wasn't caused by work, but work made it worse; 4) I have a lot of stress in my life and that has made my problem a lot worse; 5) a lack of exercise probably contributed to my problem; 6) as you get older, parts of the body wear out and problems like mine are likely [249].

Finally, the abbreviated Pain Catastrophizing Scale was included, which provides insight about the participant's pain beliefs [252]. Responses were dichotomised to those who reported catastrophising pain thoughts and feelings to at least a moderate degree in response to all questions, and those who did not.

5.2.3.2 Follow-up questionnaires (after surgery)

The two follow-up questionnaires were developed with similar sections and content to the baseline, but without repetition of the questions on: general health, health beliefs, somatisation, or hand diagrams. The work section was replaced with questions relating to return to work and any change in job since baseline, and additional questions were added relating to the CTR surgery and scar. Open text questions were included at the end of each section to enable participants to add any additional comments or information that they felt relevant. Follow-up questionnaires were sent out at 4 and 12 weeks after surgery.

5.2.3.2.1 CTR surgery details and scar symptoms

Participants were asked about the duration of their hospital stay, the type of anaesthetic used, the timing of post-operative healthcare appointments, any incidence of post-operative infection and its management. Details were also collected about any future CTR planned for the other hand.

For the scar assessment, two existing patient reported questionnaires were piloted with the patient advisory group: the Patient and Observer Scar Assessment Scale (POSAS), patient scale [253]; and the Patient Scar Assessment Questionnaire (PSAQ), scar symptoms subscale [254]. The unanimous decision by the group members was that the PSAQ subscale more accurately represented the types of symptoms that they had experienced after their own surgery and was easier to complete, and therefore this measure was adopted. For the analyses, the PSAQ summary question relating to the overall extent of the scar symptoms was dichotomised to fairly/very troublesome/unbearable and a little/not at all troublesome.

Perceived surgical success was assessed at both follow-up time points using a Global Rating of Change score. Participants were asked: how do you rate your symptoms in your operated hand(s) now, compared to before your surgery? As with previous CTS research, the 5-point scale was dichotomised using the most stringent definition of successful (cured, much better) and poor (slightly better, unchanged, worse) outcomes [68].

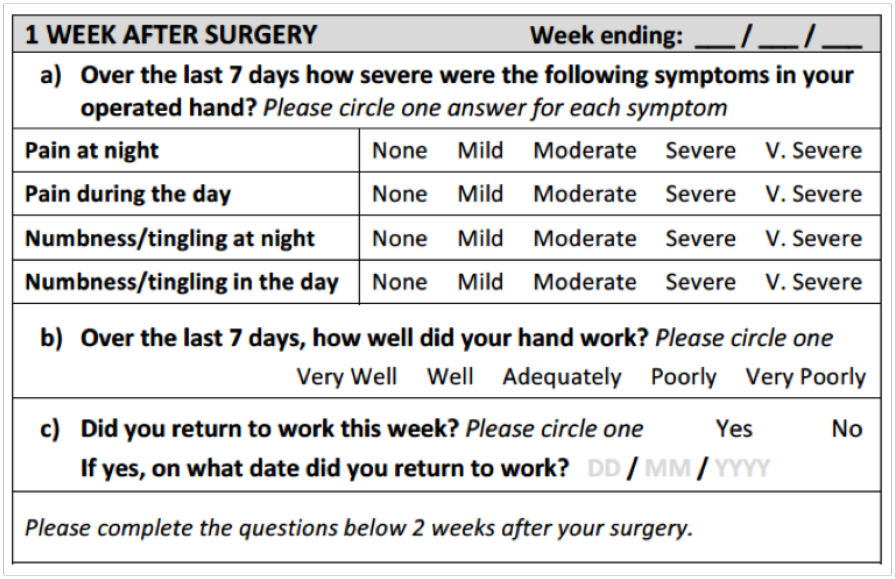
5.2.3.2.2 Return to work

Participants were asked whether they had returned to work, and if so the date of first return. Information was also collected about the duration of any amendments to work duties or hours in the post-operative period and any CTR-related sick-leave taken after their first return. As discussed in the systematic review (Chapter 3), previous studies of return to work after CTR reported little or no information about the return to work process (Section 3.4.1.3). These questions were included to enable an exploration of the potential relationship between return to work time and subsequent sick-leave, in addition to any subsequent change in job. Information was also collected about any new advice received regarding return to work at each follow-up.

5.2.3.3 Diary card

Participants were asked to complete a weekly diary card for the first four weeks after CTR, or until return to work if this was longer than four weeks. The maximum diary card duration was 10 weeks. The diary card included three questions that related to: CTS symptom (taken from the CTS-6 [250]), hand function (taken from the MHQ [241]) and whether or not they had returned to work that week. An excerpt from the diary card is

shown in Figure 5.2. This brief diary was included to capture the pattern of symptoms in the immediate post-operative period, and to identify any change in symptoms coinciding with return to work during this timeframe. The collection of weekly information was also chosen to limit recall bias.



1 WEEK AFTER SURGERY	Week ending: ___ / ___ / ___				
a) **Over the last 7 days how severe were the following symptoms in your operated hand?** *Please circle one answer for each symptom*					
Pain at night	None	Mild	Moderate	Severe	V. Severe
Pain during the day	None	Mild	Moderate	Severe	V. Severe
Numbness/tingling at night	None	Mild	Moderate	Severe	V. Severe
Numbness/tingling in the day	None	Mild	Moderate	Severe	V. Severe
b) **Over the last 7 days, how well did your hand work?** *Please circle one*	Very Well	Well	Adequately	Poorly	Very Poorly
c) **Did you return to work this week?** *Please circle one*	Yes	No			
If yes, on what date did you return to work? DD / MM / YYYY					
Please complete the questions below 2 weeks after your surgery.					

Figure 5.2 REACTS study diary card

5.2.4 Sample size calculation

During the study development phase an estimated sample size calculation was performed using the available published data and with support from a statistician (GN). The sample size calculation was based on the research question: is earlier return to work associated with poorer outcomes? To date, no studies have explored whether earlier return to work across a range of occupations is associated with poorer outcomes after CTR, but post-operative success is generally reported as 70-90% [66-68], albeit when assessed at varying time points and without a clear definition of 'success' [51]. With such limited evidence available, the preliminary sample size calculation was estimated using a series of scenarios to determine an appropriate number of participants required to provide sufficient statistical power. With the resources and time available, it was considered it feasible to recruit around 350 participants and with an estimated drop-out rate of ~20% this would leave an estimated 276 participants.

Taking the reported 'success' rates discussed above, it was assumed that among the first half of participants (those who returned to work before the overall median time point), approximately 10% would report a poor outcome (Global Rating of Change score of slight improvement, unchanged or worse), equating to 90% success. For the second half of participants (those who took longer than the median time point to return), it was assumed that ~30% would report this poor outcome, equating to 70% 'success'. This assumption was based on the notion that the presence of persistent symptoms and/or poorer functional ability might delay return to work.

It was further assumed that those who reported a poor outcome on the Global Rating of Change score at 12 weeks would also be more likely to have reported a poor outcome at the median time point than those who did not report this poor outcome at 12 weeks. Finally, it was assumed that the overall prevalence of a poor outcome at 12 weeks would be 20% (equating to 80% 'success'). With these assumptions, a sample size of 276 would give 80% power to detect a relative risk of 1.78 with an alpha error of 0.05. That is the relative risk of a poor outcome at 12 weeks associated with earlier return to work (before the median time point) compared to those who return to work after the median time point; as demonstrated in Table 5.3.

Additionally, the REACTS study was designed to allow the assessment of return to work across a range of time points, rather than before/after the median time point which would tend to increase power. Furthermore, poor outcomes at 12 weeks were defined using: 1) Global Rating of Change score (surgical outcome); 2) scar symptoms assessed by the PSAQ summary question; 3) self-reported post-operative antibiotic use; and 4) additional sick leave related to the operated hand after first returning to work. The use of additional measures would tend to increase the prevalence of a poor outcome, also increasing power.

Table 5.3 Power calculation estimation

Status at median time of return to work		Number of patients	Proportion with a poor outcome at 12 weeks [a]
Symptoms present	**Returned to work**		
No	No	97	P
No	Yes	124	P*R
Yes	No	41	5*P
Yes	Yes	14	5*P*R
Total		**276**	**0.2**

[a.] The value 5 relates to the assumption that at 12 weeks post-surgery, the prevalence of symptoms would be five times greater in those who had symptoms at the median time point. R relative risk of symptoms, P proportion of participants.

5.2.5 Study sites

A preliminary scoping exercise was conducted during the study planning stages to estimate the number of potentially eligible participants at five possible recruitment sites, all known to the supervisory team. Sites were asked to report the number of patients aged between 18-65 who underwent a CTR procedure. Data were collected from a previous 12-month period, typically the 2014 calendar year. Although these criteria did not completely match the REACTS study inclusion criteria, this information was routinely collected and therefore easily obtained. The findings were as follows: Queen Alexandra Hospital, Portsmouth – 227; Salisbury District Hospital – 58; Basingstoke and North Hampshire Hospital and Royal Hampshire County Hospital, Winchester – 311; Southampton NHS Treatment Centre – 130.

Given the desired study sample of ~275 (350 to allow for loss to follow-up), and an expected study duration of 18 months, this would require ~20 participants to be enrolled each month across all sites. On this basis, 10 sites were therefore considered sufficient to reach this recruitment target (two participants per month, per site), with six additional sites identified in case supplementary recruitment was required.

Sites involved in the preliminary scoping exercise were contacted initially and invited to participate; additional sites were recruited by word of mouth and following presentations about this programme of work at national conferences. Due to the different local procedures involved in setting up study sites, the start dates varied for each site; however, the recruitment end date was 01/09/2018 throughout. Sites were chosen to

represent the range of healthcare settings in which CTR surgery is performed in the UK and were categorised as NHS secondary care, extended scope primary care units and private specialist hand surgery facilities. It was also attempted to recruit a geographical spread of sites to ensure that different CCGs and hospital trusts were represented as well as different employers. The lead researcher provided training and support for study set-up at all sites.

5.2.6 Study flow and time points

Participants were identified pre-operatively, by either their hand surgeon or a local research nurse, when attending a normal healthcare appointment. Potential participants were provided with a REACTS study pack containing: the study invitation letter, participant information sheet, baseline questionnaire incorporating the study consent form, and a pre-paid envelope. At two sites (Southampton General Hospital and Lymington Hospital), study invitation packs were also posted to CTR patients with their appointment letter. After reading the participant information sheet and eligibility criteria, participants were invited to self-consent by completing the consent form and questionnaire, which they were asked to return using the pre-paid envelope. All returned consent forms were checked for completeness and ambiguities were clarified by phone or email before the participant was enrolled.

Enrolled participants were sent a diary card to complete for the first 4-10 weeks after CTR. Follow-up questionnaires were sent at 4 and 12 weeks after surgery. These time points were chosen on the basis of the RCS return to work recommendations (Section 1.3.4.1) [102] and supported by the results from the survey of hand surgeons and therapists (Section 4.4.4). Very few clinicians reported advising longer than four weeks off work for patients working in desk-based or light manual roles, and that the median recommended time point for return to heavy manual work was 30 days. It was therefore anticipated that at least half of the REACTS study participants would have returned to work within four weeks of their surgery. The longest return to work time suggested in the survey and in the RCS guidelines was 12 weeks (for heavy manual work), which suggested that it was reasonable to assume that almost all study participants would have returned

to work before receiving the final study questionnaire. The flow of the study for each participant is shown in Figure 5.3.

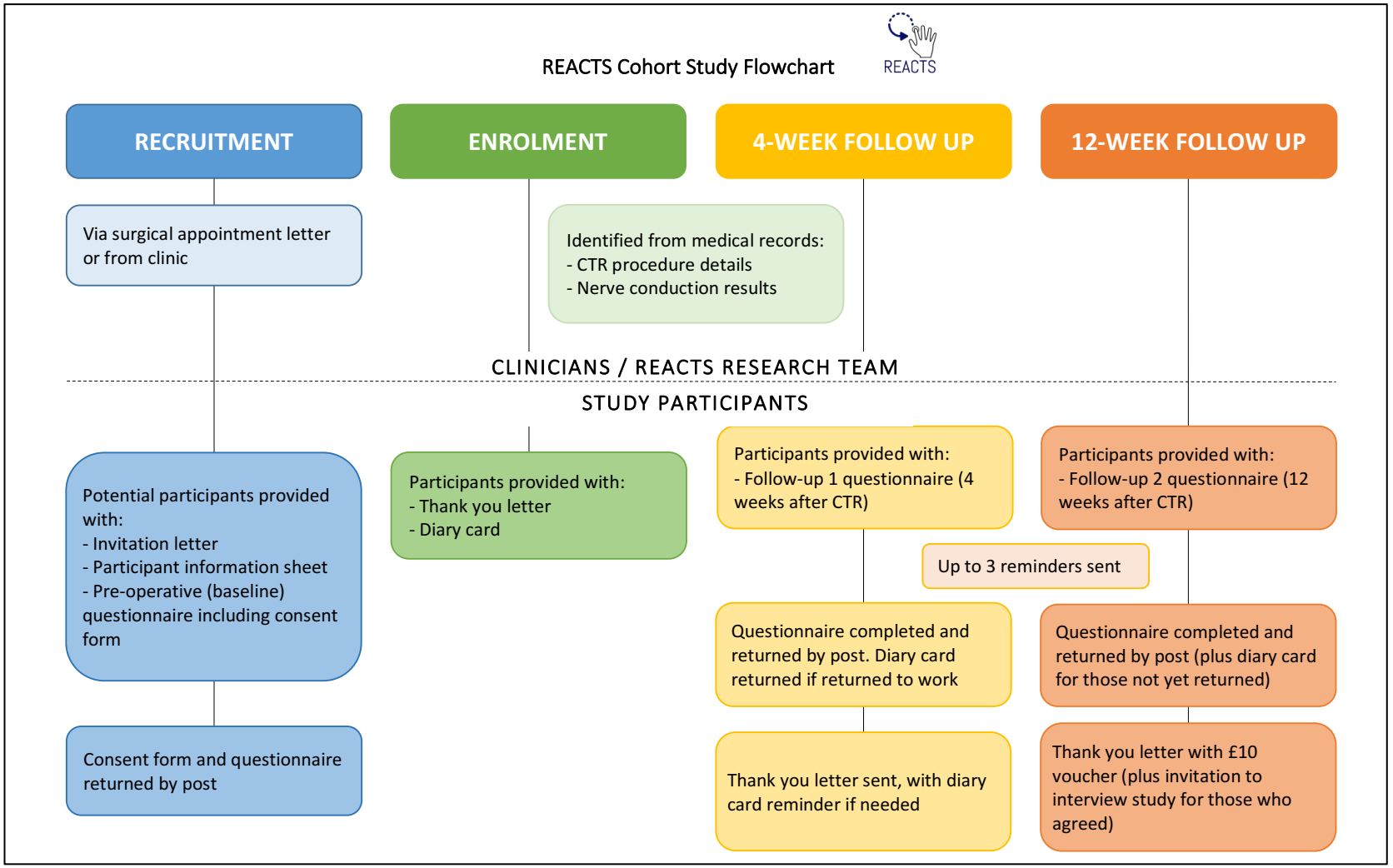


Figure 5.3 REACTS study flowchart

5.2.7 Analysis

Data entry was completed in duplicate by data processors at the MRC Lifecourse Epidemiology Unit and any discrepancies were checked against the original questionnaire by the lead researcher. Data analysis was performed using Stata version 15 (StataCorp LLC) and statistical support was provided by Georgia Ntani. All time points were reported in days. Where the participants had the option to respond in days, weeks or months, the following conversion was used: one week equals 7 days and one month equals 30.4368 days (to take into account the varying length of calendar months). Other time points were calculated using the dates provided by the participants.

5.2.7.1 Assessment of selection bias

In order to assess for potential selection bias, comparisons were made between those who dropped out of the study before providing any follow-up (post-operative data) and the final study sample. The following demographic, clinical and occupational variables were assessed: age, sex, BMI, smoking status, study site, self-reported general health, number of comorbidities, number of disabling comorbidities, SF-36 mental health score, CTS-6 score (combined for both hands because the side of CTR was not confirmed for those who dropped out), MHQ bilateral activities of daily living score, job contract type, expected duration of leave after CTR, availability of sick-pay, MHQ work function score, level of job demand on the hands/wrists and job satisfaction. Categorical variables were assessed using Chi-squared test, continuous variables were assessed using t-test if they demonstrated a normal distribution and Wilcoxon rank-sum test if the distribution was skewed. Normal distribution was assessed by comparing mean and medians values and through a visual assessment of the data plotted as a histogram [255].

5.2.7.2 Factors associated with return to work time

Cox proportional hazards model was used to explore the factors associated with return to work time. All baseline and surgical variables were analysed individually in an age- and sex-adjusted model and those which were significant at $p<0.05$ were included as covariates in the final multivariable model. The multivariable analysis was also adjusted for age and sex.

5.2.7.3 Poorer outcomes and return to work time

The assessment of whether earlier return to work was associated with poorer outcomes was made using four variables. Two were reported at 12 weeks after surgery: Global Rating of Change score and PSAQ scar symptoms summary question. A poor outcome on the Global Rating of Change score was defined using the cut point discussed in Section 5.2.3.2.1, where symptoms were reported as worse, unchanged or slightly improved [68]. A poor outcome for the PSAQ question was defined as scar symptoms that were at least fairly troublesome (Section 5.2.3.2.1). Differences in return to work times between those with poor outcomes and the rest of the cohort were compared using Wilcoxon rank-sum test.

In addition, the prescription of antibiotics after return to work and any additional sick leave after first return to work were also regarded as poor outcomes. Antibiotic use was taken as an indicator of post-operative wound infection, although the prevalence of wound infection was expected to be very low based on personal experience and published reports [256]. Similarly, it was expected that few people would report additional sick leave after returning to work. These variables were therefore summarised descriptively.

Poor outcomes were also summarised by combining the data from all four variables to define a measure of any poor outcome. Return to work times for those with/without any poor outcomes were compared using Wilcoxon rank-sum test. The prevalence of any poor outcome in those who returned to work before/after each of the median time points recommended by the clinicians surveyed in Section 4.4.4 was also assessed using Chi^2. These time points were 7 days, 15 days and 30 days.

Finally, predictors of any poor outcome were assessed using logistic regression. This analysis was performed to explore whether there was any overlap in the factors associated with the duration of work absence and those associated with a poor outcome. Variables were selected using the same process described for the Cox proportional hazards model in Section 5.2.7.2.

5.2.7.4 Return to work advice

The content of the open text comments regarding return to work were analysed using a thematic analysis that adopted the same coding structure developed in Section 4.3.3. This was carried out by the lead author and reviewed by the supervisory team. All baseline responses were included in this analysis.

5.2.8 Ethics approval

The REACTS study was approved by the NHS Research Ethics Committee (IRAS project ID 209840; REC reference 16/WA/0390) and the University of Southampton Faculty of Medicine Ethics Committee (ERGO reference 25757). In addition, the study was CRN (Clinical Research Network) portfolio adopted (CPMS reference 32370), which meant that recruiting NHS sites were provided with study support costs through the NIHR infrastructure. Local Research Governance approval was obtained from each participating site prior to recruitment.

5.3 Results

5.3.1 Study sample

A total of 217 individuals completed the baseline pre-operative questionnaire and 167 provided follow-up data (77%). Of these, 147 participants completed all study components (68%), 160 completed baseline and first follow-up and 151 completed baseline and final follow-up (Figure 5.4). Unless otherwise stated, the sample size denominator is 167 for the reporting of the results. Participants were recruited from 16 study sites; 51% from NHS secondary care, 36% from NHS primary care and 13% from private facilities (Table 5.4). The number of recruitment packs remaining at each site was recorded at the end of the recruitment period to enable an approximate recruitment response to be calculated. Approximately a quarter of individuals who were provided with a REACTS study pack returned the baseline questionnaire.

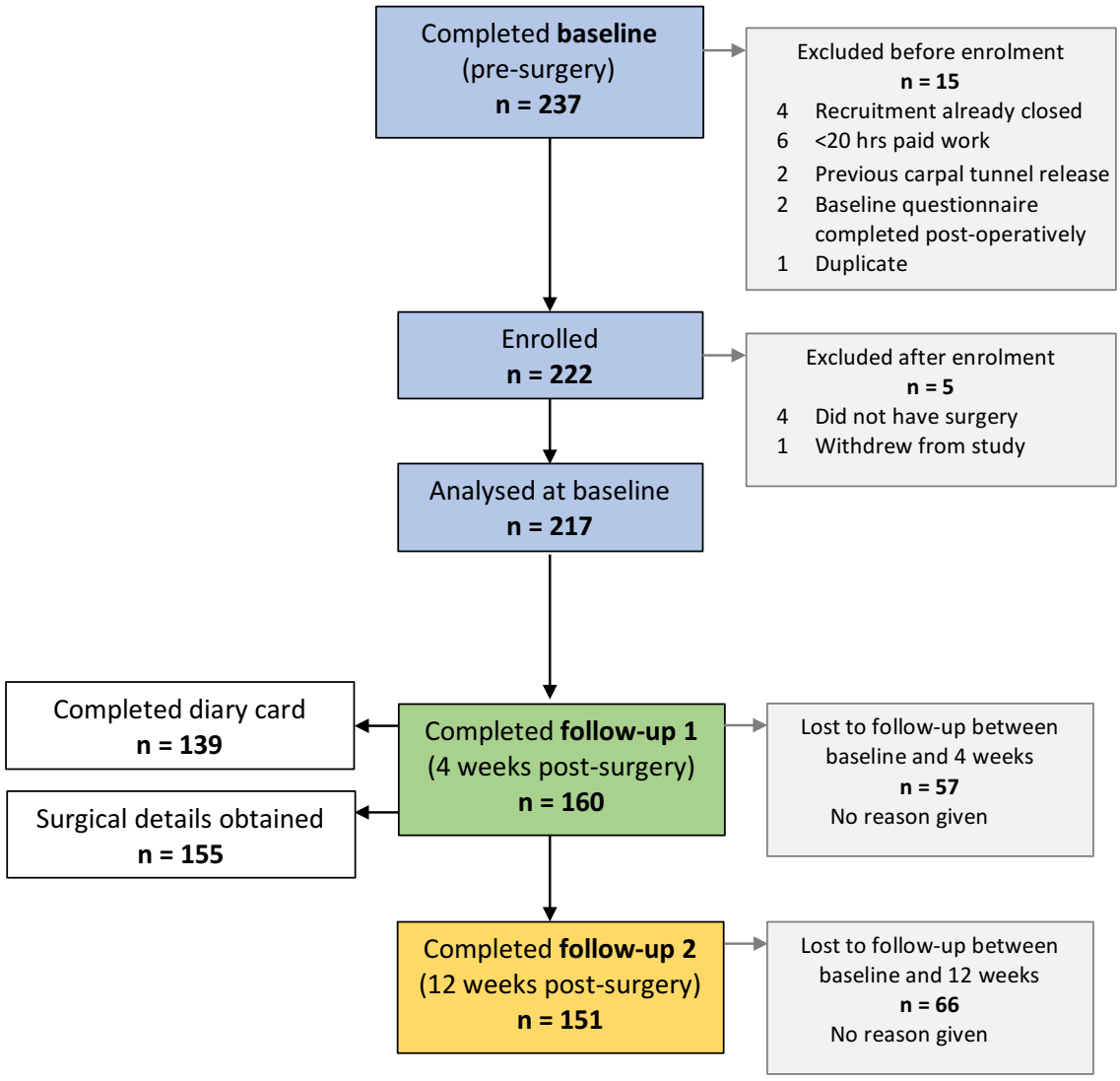


Figure 5.4 REACTS study participant flow

A total of 167 individuals provided baseline and either follow-up 1 or follow-up 2 data, therefore, unless otherwise stated, 167 was used as the denominator throughout the analyses.

Comparisons of those who dropped out before follow-up and those who remained in the study highlighted several significant differences. Those who dropped out were more likely to be younger (mean age 45.2 years compared with 52.5 years in the study sample), current smokers (32% compared to 10% of the study sample); recruited from secondary care (62% compared to 48% of the study sample); have poorer SF36 mental health scores (mean 59.5 compared with 64.9 in the study sample); have poorer MHQ bilateral function scores (mean 53.4 compared with 60.2 in the study sample); and report shorter durations of available sick pay (28% reported less than one week while 15% reported 1-6 months; this compared to 15% and 40%, respectively, in the study sample).

There were no significant differences between the two groups in sex, BMI, general health status, CTS-6 score, MHQ activities of daily living score, type of job contract, expected duration of work absence after CTR, MHQ work function score, level of work demand on the hands/wrist or job satisfaction. Baseline demographics for the study sample are shown in Table 5.4 and Table 5.5.

Table 5.4 Study recruitment sites and numbers enrolled and remaining in the REACTS study

Healthcare type [a]	Study site	Study open	Number enrolled at baseline	Number followed-up
Primary care	Kent and Canterbury Hospital, Canterbury [b]	Mar-17	22	20
	Salisbury Medical Practice	Apr-17	17	13
	Tollgate Practice, Colchester [c]	May-17	26	21
	St Luke's Surgery, Walsall	Aug-17	13	10
Secondary care	Royal Gloucester Hospital, Gloucester	Apr-17	12	11
	Broomfield Hospital, Chelmsford	Apr-17	4	3
	Southampton General Hospital, Southampton	Apr-17	12	9
	Lymington New Forest Hospital, Lymington	Apr-17	15	10
	Queen Alexandra Hospital, Portsmouth	May-17	28	16
	Southampton NHS Treatment Centre, Southampton [c]	May-17	14	12
	Chelsea and Westminster Hospital, London	Aug-17	1	1
	Basingstoke and North Hampshire Hospital, Basingstoke	Jan-18	14	9
	Royal Hampshire County Hospital, Winchester	Jan-18	5	3
	Royal Berkshire Hospital, Reading	Apr-18	4	4
	University Hospital of Wales, Cardiff	Apr-18	2	2
Private facilities	Wessex Nuffield Hospital and Sarum Road Hospital, Winchester [d]	Jun-17	28	23
		Total	**217**	**167**

[a.] Healthcare sites represent: NHS secondary care, NHS extended scope primary care and private specialist hand surgery facilities.
[b.] Secondary care recruitment site where all carpal tunnel releases are performed in primary care by primary care surgeons.
[c.] NHS services provided by a private company.
[d.] Two separate private facilities where participants were recruited (and surgery performed) by the same surgeon.

Table 5.5 Baseline demographics, general health and health beliefs

Demographics and general health characteristics	
Mean age in years (SD)	52.5 (9.19)
Age category (years)	**n (%)**
25-35	9 (5)
36-45	21 (13)
46-55	61 (37)
56-65	65 (39)
>65	11 (7)
Sex	**n (%)**
Female	101 (60)
Male	66 (40)
BMI (kg/m^2)	**n (%)**
Underweight (<18.5)	0
Normal (18.5-24.9)	40 (24)
Overweight (25-29.9)	51 (31)
Obese (≥30)	62 (37)
Smoking status	**n (%)**
Never smoked	95 (57)
Current or ex-smoker	70 (42)
General health status	**n (%)**
Excellent/very good/good	145 (87)
Fair/poor	21 (13)
Mean SF-36 mental health score (SD)	64.8
(Max score 100, higher = better health)	(17.68)
Number of comorbidities	**n (%)**
None	45 (27)
1	55 (33)
≥2	67 (40)
Number of disabling comorbidities	**n (%)**
None	115 (69)
1	32 (19)
≥2	20 (12)
Hand dominance	**n (%)**
Right	147 (88)
Left	16 (10)
Ambidextrous	4 (2)

Health beliefs n (%)	
Believes that they will be able to use hand normally in 3 months	
Yes	148 (89)
No	17 (10)
Afraid of long-term hand problems	
Yes	77 (46)
No	87 (52)
Blames self for hand problem	
Yes	21 (13)
No	144 (86)
Pain catastrophisation to at least a moderate degree	
Yes	51 (31)
No	114 (68)
Problems like this run in my family/born with a weakness	
Yes	48 (29)
No	117 (70)
Stress makes my hand problem worse	
Yes	18 (11)
No	147 (88)
A lack of exercise contributed to my problem	
Yes	13 (8)
No	152 (91)
As you get older the body starts to wear out problems like mine are likely to occur	
Yes	95 (57)
No	69 (41)
Number of somatising symptoms	
None	82 (49)
1	47 (28)
≥2	37 (22)
My family/friends are supportive of my hand problem	
Yes	137 (82)
No	28 (17)

5.3.2 Occupational characteristics

The majority of participants were employed in a single job with a permanent contract (73%). The most common working pattern was 5 days per week (63%) and the median number of working hours was 37.5 hours (IQR 30-42). Using the SOC and Cascot coding [112, 236], approximately one third of participants were classified as manual workers. Levels of job satisfaction were high, with only 11% of participants reporting that they were dissatisfied or very dissatisfied with their job as a whole.

A quarter of participants reported that they had not received any advice about work in relation to their CTR surgery. Thirteen percent of participants were not expecting to take any time off work after their CTR. Among those who did expect to take sick leave, the median expected duration of this leave was 14 days (IQR 13-28). Baseline occupational characteristics are summarised in Table 5.6.

Table 5.6 Baseline occupational characteristics

Work pattern and employment type	
Median working hours per week (IQR)	37.5 (30-42)
Median working days per week (IQR)	5 (4-5)
Have more than one job	**N (%)**
Yes	10 (6)
No	156 (93)
Type of work contract	**N (%)**
Employed (permanent contract)	132 (79)
Self-employed	29 (17)
Temporary/zero hours contract	5 (3)
Access to occupational health	**N (%)**
Yes	71 (43)
No	79 (47)
Unsure	16 (10)
Available sick pay	**N (%)**
≤1 month	39 (23)
>1 month	80 (48)
Unsure	38 (23)
Sick leave taken in last month	**N (%)**
For hand and wrist problem:	
Yes	16 (10)
No	135 (81)
For another reason:	
Yes	19 (11)
No	129 (77)
Expect to be off work after CTR	**N (%)**
Yes	143 (86)
No	21 (13)
Expected duration of leave – median days (IQR)	14 (13-28)
Received work advice before CTR	**N (%)**
Yes	121 (72)
No	43 (26)
Work Beliefs	
My problem was caused by work	**N (%)**
Yes	72 (43)
No	93 (56)
My problem wasn't caused by work, but work made it worse	**N (%)**
Yes	80 (48)
No	84 (50)
My employer/colleagues are supportive of my hand problem	**N (%)**
Yes	92 (55)
No	41 (25)
Not applicable – work alone	31 (19)

Work characteristics	
Median MHQ work score (IQR) Max score 100, higher = better work functioning)	65 (50-85)
Occupational classification	**N (%)**
Manual	64 (38)
Non-manual	103 (62)
Payment driven by targets	**N (%)**
Yes	29 (17)
No	129 (77)
Work to tight deadlines	**N (%)**
Yes	99 (59)
No	66 (40)
Computer use at work	**N (%)**
≤1 hour	65 (39)
>1 hour ≤4 hours	28 (17)
>4 hours	70 (42)
Work with power tools	**N (%)**
Yes	34 (20)
No	127 (76)
Work with hands above shoulder height >1 hr	**N (%)**
Yes	29 (17)
No	131 (78)
Lift/carry >5kg in one hand	**N (%)**
Yes	80 (48)
No	81 (49)
Lift/carry >10kg	**N (%)**
Yes	68 (41)
No	94 (56)
Push/pull a heavy weight	**N (%)**
Yes	76 (46)
No	88 (53)
Work with neck flexed >2hrs	**N (%)**
Yes	62 (37)
No	102 (61)
Work with neck rotated >2hrs	**N (%)**
Yes	42 (25)
No	119 (71)
Driving for work >1hr	**N (%)**
Yes	62 (37)
No	100 (60)
Job demanding on hands/ wrists	**N (%)**
Yes	138 (83)
No	29 (17)
Job satisfaction	**N (%)**
Very satisfied	66 (40)
Satisfied/fairly satisfied	81 (49)
Dissatisfied/very dissatisfied	18 (11)

5.3.3 Questionnaire time points

Seventy-two participants (43%) were recruited pre-operatively on the day of their CTR. For the remaining 95 participants, the median time between recruitment and CTR was 14 days (IQR 5-44, range 1-199). The first follow-up questionnaire (FU1) was completed a median of 32 days after CTR (IQR 29-39 days) and the final questionnaire (FU2) was completed a median of 91 days after CTR (IQR 86-103 days).

5.3.4 Carpal tunnel release procedure

Surgical record forms were returned by the recruiting sites for 93% of study participants (n=155). The 11 missing forms were distributed over five sites in both NHS secondary and primary care.

Approximately half of participants with a completed surgical record forms had NCS performed before their CTR. All participants underwent open CTR. Two participants had a documented extended incision, the remainder had a mini incision. One participant was operated on under general anaesthetic, the rest under local anaesthetic. Two participants underwent simultaneous bilateral CTR, the remainder underwent unilateral surgery. Data for the dominant hand was used for those who underwent bilateral surgery. There was only one record of an unexpected finding during surgery, which was a vascular abnormality. Two additional procedures were documented, both median nerve neurolyses. The majority of participants (64%) reported that they expected to undergo a CTR for their other hand in the future and 31% of these individuals expected their next CTR within six months. CTR characteristics are shown in Table 5.7.

Table 5.7 Carpal tunnel release characteristics

Carpal tunnel release characteristics [a] N (%)	
Katz hand diagram score for side of surgery	
Classic/probable	110 (66)
Possible/unlikely	54 (32)
Duration of carpal tunnel syndrome symptoms	
≤1 year	39 (23)
>1 year	127 (76)
Bilateral symptoms	
Unilateral symptoms	41 (25)
Bilateral symptoms	124 (74)
Pre-operative nerve conduction testing	
Yes	80 (51)
No	74 (47)
Clinic site	
Primary care	64 (38)
Secondary care	80 (48)
Private	23 (14)
Surgeon type/grade	
Consultant	62 (37)
Registrar	32 (19)
GP	61 (37)
Carpal tunnel release to dominant hand	
Yes	113 (68)
No	54 (32)
Suture material	
Non-absorbable	122 (78)
Absorbable	24 (15)

[a.] Data from baseline (pre-operative) questionnaire and surgical record form.

5.3.5 Follow-up care

Post-operative care was provided by a range of healthcare professionals. The most common services were a review with the surgeon/member of the surgical team, or an appointment with the GP or practice nurse. Table 5.8 shows the range of healthcare services used. Two individuals who underwent CTR at NHS sites accessed follow-up in the private sector. The remainder of those who accessed private healthcare services for follow-up had been operated on at a private hospital site.

Table 5.8 Healthcare services used after carpal tunnel release

	Between surgery and follow-up 1 (%) N=160		**Between follow-up 1 and follow-up 2 (%)** N=151	
	NHS	**Private**	**NHS**	**Private**
Surgeon / surgical team	43 (27)	11 (7)	43 (28)	10 (7)
GP / practice nurse	80 (50)	3 (2)	21 (14)	1 (1)
Hospital nurse	21 (13)	1 (1)	4 (3)	2 (2)
Pharmacist	13 (8)	0	4 (3)	0
Therapist [a]	3 (2)	1 (1)	8 (5)	2 (1)
ED [b] / minor injuries	1 (1)	0	0	0
Occupational health practitioner	0	1 (1)	2 (1)	1 (1)
Chiropractor / osteopath	0	0	1 (1)	0

[a.] Occupational therapist, physiotherapist or hand therapist.
[b.] Emergency department.

5.3.6 Clinical outcomes

The large majority of participants reported that their surgery had been successful. At FU1, 79% of participants reported that they were much better or cured on the Global Ranging of Change score, at FU2 this was 78%. Scores for CTS symptoms (CTS-6), hand function (MHQ) and bilateral and unilateral ADL performance (MHQ) all improved after surgery (Figure 5.5 and Figure 5.6) and the proportion of individuals who were satisfied with the appearance of their hand improved from 69% at baseline to 72% at FU1 and 80% at FU2.

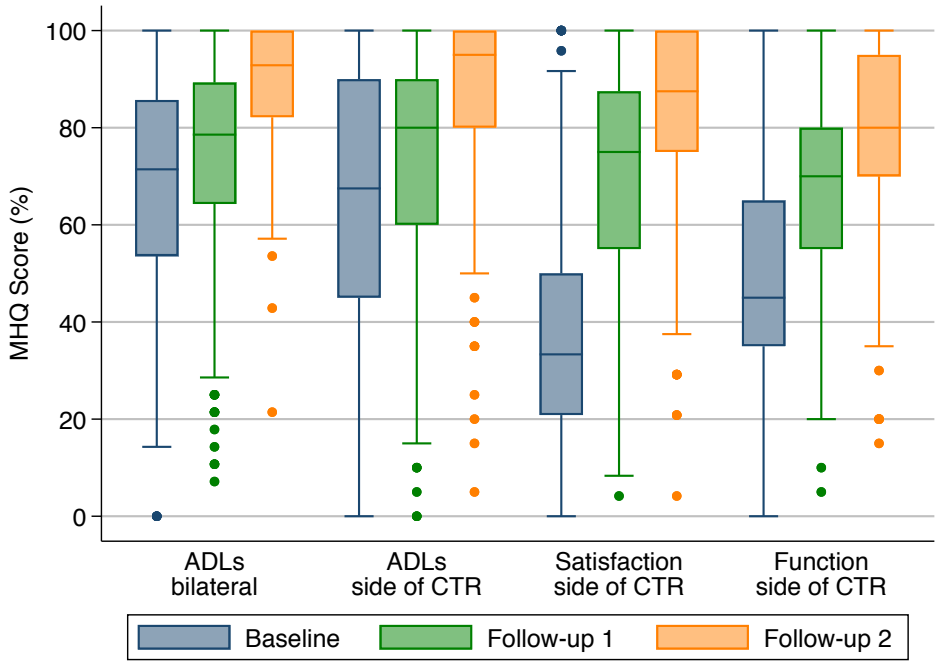


Figure 5.5 Michigan Hand Questionnaire scores at baseline and follow-up (median, interquartile range and range)

Score range from 0-100, with 100 representing the best score.
ADLs activities of daily living, CTR carpal tunnel release.

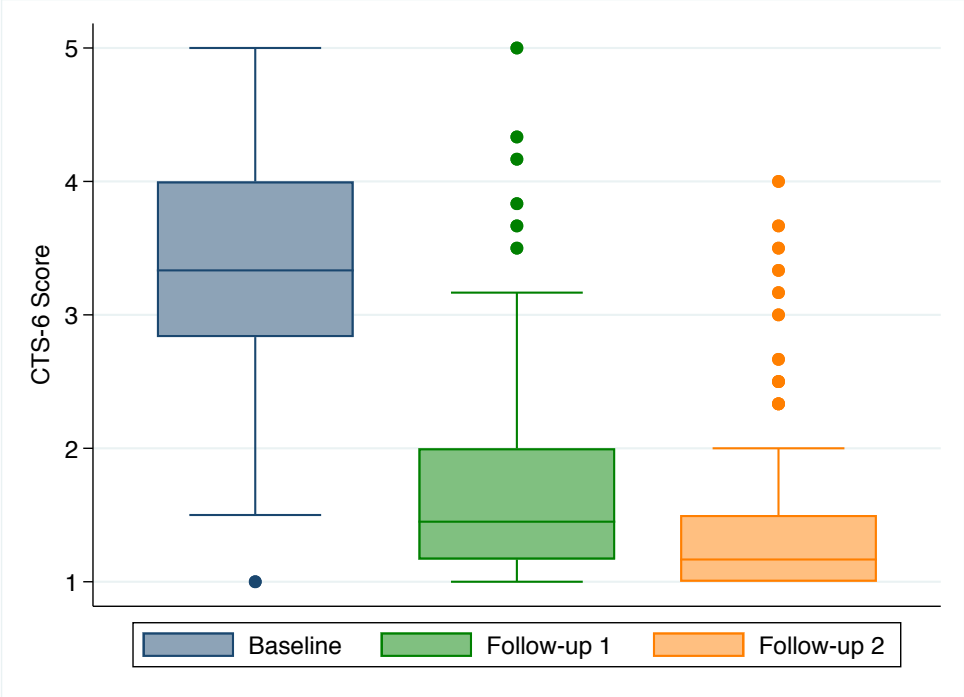


Figure 5.6 CTS-6 scores at baseline and follow-up (median, interquartile range and range)

Score range from 1-5, with 1 representing the best score.

5.3.7 Clinical complications

Eight individuals reported that they were prescribed antibiotics for a post-operative infection (excluding any prescribed on the day of surgery). These individuals had been recruited across six different sites. No participants reported being admitted to hospital or requiring additional surgery after their CTR.

5.3.8 Return to work times

Seven participants had not returned to work by the end of the study period; one reported that they had been made redundant and six reported that they were planning to return to work. Of these, four individuals (two manual workers, two non-manual workers) did not complete the final follow-up questionnaire, but their expected return to work times (provided at four weeks after CTR) ranged from 42-71 days after surgery. Two participants had not returned to work by the final follow-up point. Both worked in manual roles and their expected return to work times were 91 and 101 days after surgery. These individuals were right censored to their latest follow-up time point for the Kaplan Meier curve and were not included in the analysis of factors associated with return to work time.

The duration of work absence for all study participants is shown in Figure 5.7. Across the whole cohort, the median return to work time was 21 days (IQR 12-35, range 1-99). Eighteen percent of the cohort had returned to work by 7 days; 33% by 14 days; 50% by 21 days; 62% by 28 days and 83% by 42 days.

Manual workers took longer to return to work than non-manual workers (Figure 5.8). The median duration of work absence for non-manual workers was 18 days (IQR 8-31) and this increased to 27 days (IQR 15-42) for those working in manual roles. Self-employed workers returned to work more quickly than those who were employed. For self-employed workers, the median duration of work absence was 13 days (IQR 6-19) compared with 23 days (IQR 14-41) for employed workers (Figure 5.8).

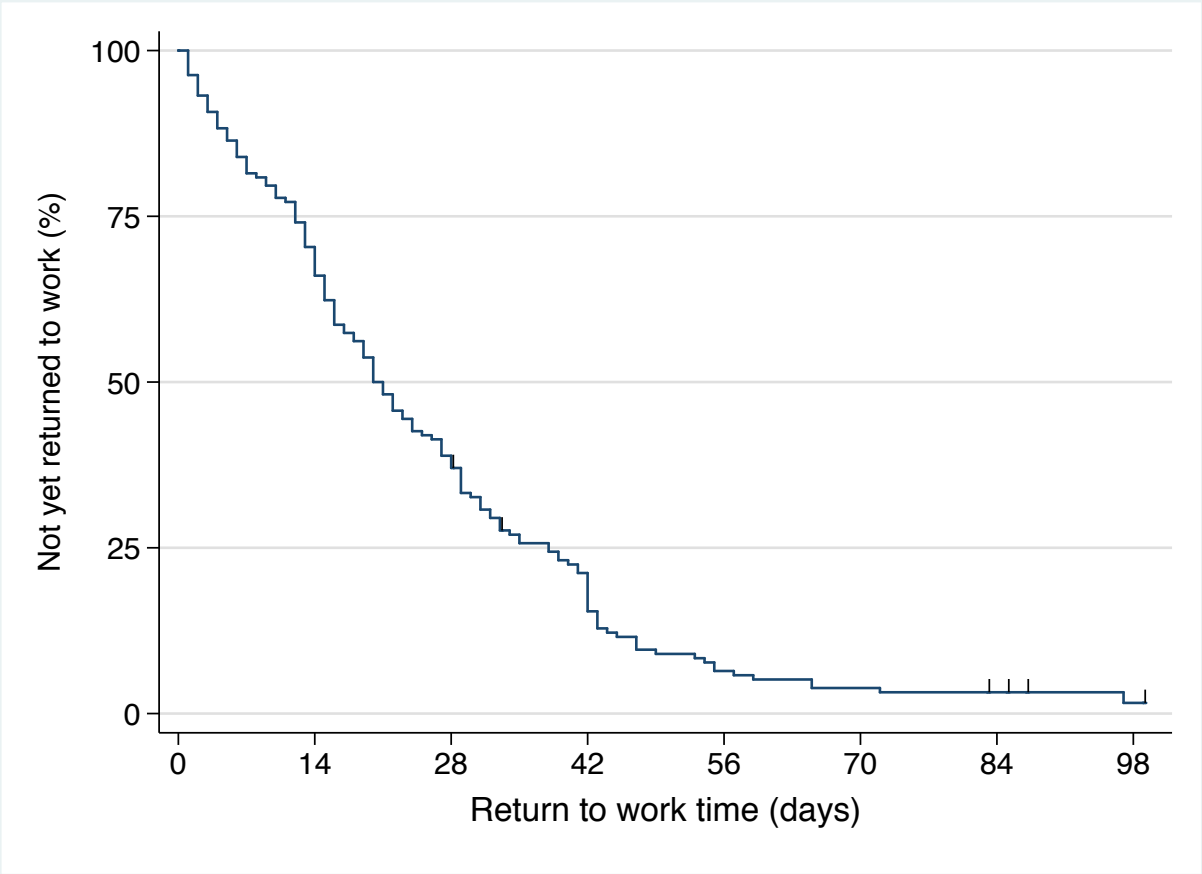
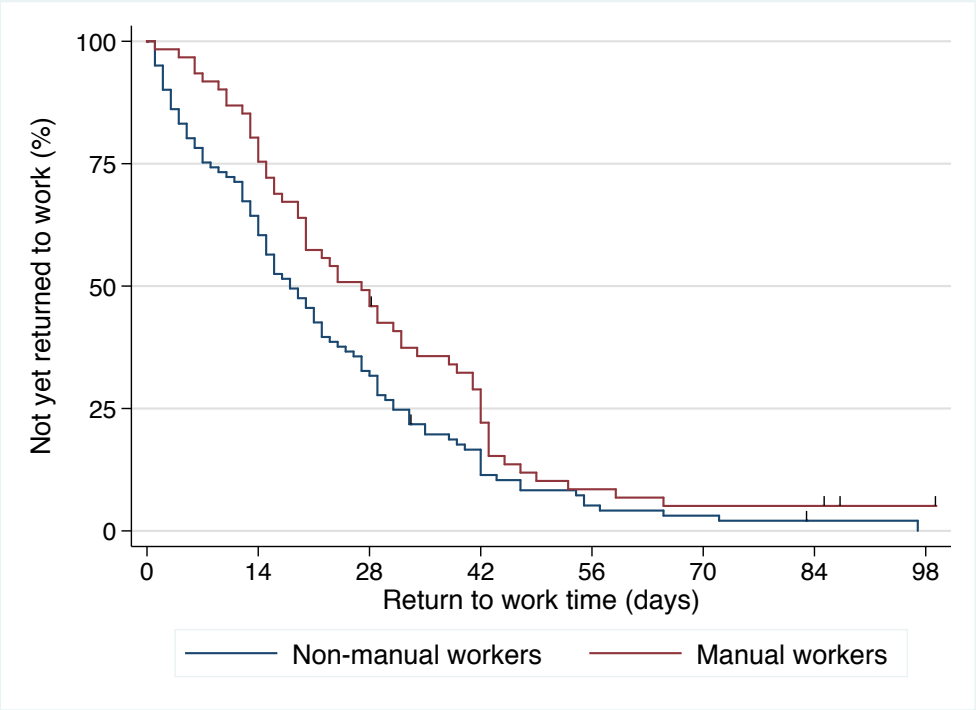
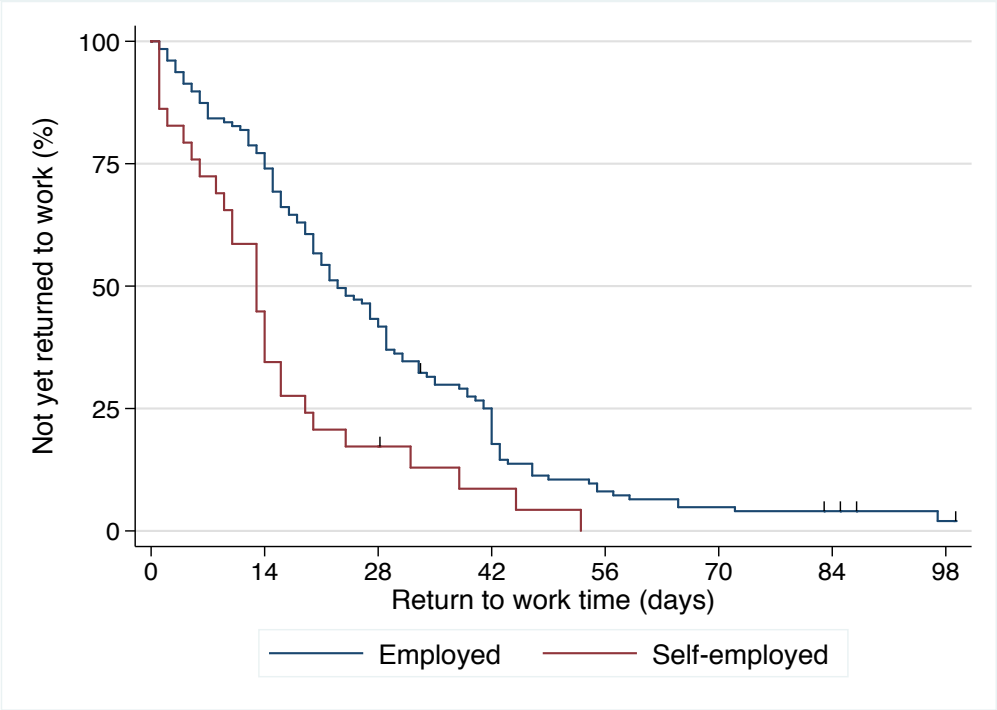


Figure 5.7 Kaplan Meier curve showing duration of work absence after carpal tunnel release

Vertical tick marks indicate participants who had not reported return to work. Data for these individuals were right censored to the date of their latest study questionnaire.



A. Manual and non-manual workers



B. Employed and self-employed workers

Figure 5.8 Kaplan Meier curves showing duration of work absence after carpal tunnel release for different occupational categories

Vertical tick marks indicate participants who had not reported return to work. Data for these individuals were right censored to the date of their latest study questionnaire.

5.3.9 Return to work day

The most common day for return to work was Monday (39%), with the proportion decreasing sequentially from Monday to Friday. Fewest participants returned to work at the weekend (Figure 5.9).

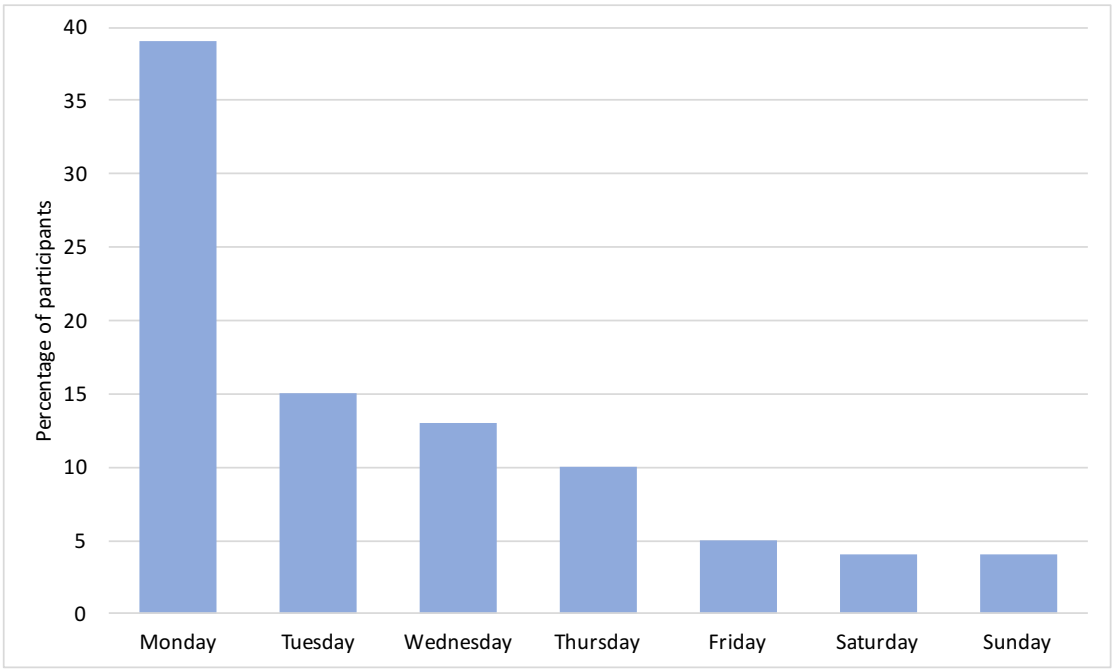


Figure 5.9 Day of first return to work after carpal tunnel release

5.3.10 Amended duties and reduced hours

Ninety-seven participants (58%) reported that they initially returned to a modified working pattern (reduced hours and/or amended duties). Twenty-six participants (16%) reported initially returning to reduced hours, and of these, 14 (56%) had resumed full hours by two weeks, seven (27%) by five weeks and five individuals had not returned to full hours by the end of the study period. The median duration of work absence for those who returned to reduced hours was longer than for those who returned straight to their normal working hours (median 27 days, IQR 14-38, n=25; compared to 19.5 days, IQR 11.5-32.5, n=124).

More than half of the cohort reported initially returning to amended duties (n=94, 56%), including 23 of the 26 who returned to reduced hours. Of these, 12 (13%) had returned to full duties within a week; another 27 (41%) by two weeks and another 20 (21%) by seven

weeks. Thirty individuals (32%) reported that they had not returned to full duties by the end of the study period and data were missing for the remaining five participants. The duration of work absence was similar for those who did/did not return to amended duties (median 20 days, IQR 11-35, n=92; versus 20.5 days, IQR 12-33, n=58).

The prevalence of amended work duties and shorter work hours were explored for different occupational characteristics (Table 5.9). A greater proportion of manual workers reported that they returned to amended duties compared to those in non-manual roles (63% versus 52%). More self-employed individuals reported returning to amended duties than those who were employed (69% versus 53%). For other occupational characteristics, the proportion of individuals who reported modified working patterns were broadly similar.

Table 5.9 Prevalence of return to modified working patterns for different occupational characteristics

	Shorter hours N (%)	**Amended duties N (%)**
Whole cohort	26 (16)	94 (56)
Work type		
Manual (N=64)	9 (14)	40 (63)
Non-manual (N=103)	17 (17)	54 (52)
Contract type		
Employed (N=132)	17 (13)	70 (53)
Self-employed (N=29)	9 (31)	20 (69)
> 1 hour computer use at work		
No (N=65)	12 (19)	37 (58)
Yes (N=98)	14 (14)	55 (56)
Lift ≥10 kg or push/pull heavy weight at work or use a power tool		
No (N=72)	13 (18)	35 (49)
Yes (N=92)	13 (14)	57 (62)

5.3.11 Factors associated with return to work time: age- and sex-adjusted analyses

The relationship between the duration of work absence and the baseline demographic, clinical and occupational factors was assessed using a Cox proportional hazards model. In these analyses, a hazard ratio of >1 represents an increased likelihood of earlier return to work. Seventeen factors were significant in the age- and sex-adjusted analyses. The significant findings in these analyses are presented in Table 5.10 and summarised below. Non-significant findings are shown in Appendix P.

5.3.11.1 Clinical variables

Participants operated on at a private clinic were more likely to return to work earlier than those operated on in NHS secondary care, while those whose surgery was performed by a registrar were more likely to return to work later than those who were operated on by a consultant.

Baseline CTS-6 scores were assessed as tertiles. Participants in the middle and lowest tertiles (poorer CTS-6 scores) were more likely to take longer to return to work than those in the upper tertile (better CTS-6 scores).

5.3.11.2 Demographic variables

Participants aged over 65 years were more likely to return to work earlier than those in the reference category of 46-55 years. Smoking was associated with slower return to work.

5.3.11.3 Occupational variables

Compared to their respective reference categories, those who were: manual workers; whose job involved lifting or carrying >10kg; whose job involved pushing or pulling a heavy weight; who reported that their job was demanding on their hands/wrists; and had access to >1 month of sick pay, were all more likely to take longer to return to work. Conversely, those who were self-employed, had a work role where payment was driven by targets, did not have access to occupational health or carried out ≥1 hour of computer use per day, were all more likely to return to work faster.

5.3.11.4 Beliefs and expectations

Participants who were afraid of having long term hand problems, or believed that their problem was caused by work were more likely to return to work later than those who did not hold these beliefs. Those who expected to take more than a week off work were more likely to do so.

5.3.12 Factors associated with return to work time: multivariable analysis

All significant factors from the age and sex-adjusted analyses were included as covariates in the multivariable model. The results of this analysis are also shown in Table 5.10.

Four factors were associated with longer durations of work absence: being a current or ex-smoker; believing that CTS was caused by work; being female; and expecting to take more than a week off work. There was a gradient effect within the expected duration of sick leave reported at baseline (Figure 5.10). Despite this relationship, participants generally took longer to return to work than they had expected. The mean difference between the actual duration of leave and the expected time was 8 days (SD 15.6).

One age category (36-45 years) was associated with longer work absence than the reference category (46-55), however this category only contained 21 individuals and there was no gradient of HRs either increasing or decreasing across all age categories.

Having a work role that involved >1 hour of computer use was the only factor associated with earlier return to work in the multivariable model. No clinical factors were linked to return to work time.

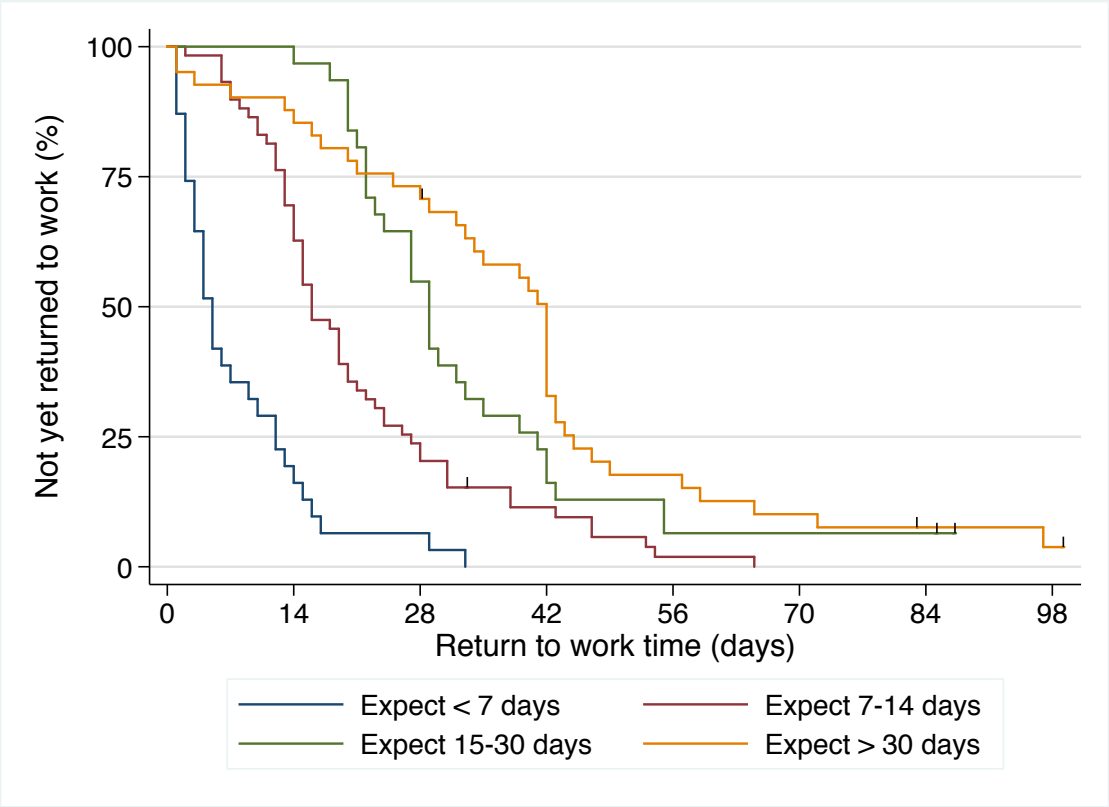


Figure 5.10 Kaplan Meier curve showing time to return to work after carpal tunnel in comparison with expected duration of work absence

Vertical tick marks indicate participants who had not reported return to work. Data for these individuals were right censored to the date of their latest study questionnaire.

Table 5.10 Cox proportional hazards analyses of factors associated with the duration of work absence

Demographic, general health and health belief variables	N	Return to work time (days)		Age- and sex-adjusted analyses [a]			Multivariable model [b]		
		Median	IQR	Hazard ratio [c]	95% CI	P value	Hazard ratio [c]	95% CI	P value
Age									
25-35	9	20	14-27	1.27	0.60, 2.69	0.54	2.44	0.93, 6.44	0.71
36-45	21	22	13-41	0.78	0.46, 1.34	0.37	**0.48**	**0.24, 0.96**	**0.04**
46-55	60	19.5	8-33	1	-	-	1	-	-
56-65	61	25	15-42	0.85	0.59, 1.22	0.37	1.01	0.66, 1.54	0.97
>65	11	12	6-14	2.38	1.20, 4.70	0.01	2.10	0.91, 4.82	0.08
Sex									
Female	98	22.5	14-40	0.86	0.61, 1.22	0.41	**0.43**	**0.25, 0.71**	**0.001**
Male	64	18.5	8-30	1	-	-	1	-	-
Smoking status									
Current/ex-smoker	67	28	14-42	0.62	0.45, 0.87	0.01	**0.56**	**0.36, 0.85**	**0.007**
Never smoked	93	17	10-32	1	-	-	1	-	-
Afraid of long term hand problems									
Yes	75	22	13-43	0.64	0.46, 0.90	0.01	0.73	0.49, 1.09	0.12
No	84	19.5	11-30	1	-	-	1	-	-

Table continues…

Clinical variables	N	Return to work time (days)		Age- and sex-adjusted analyses [a]			Multivariable model [b]		
		Median	IQR	Hazard ratio [c]	95% CI	P value	Hazard ratio [c]	95% CI	P value
CTS- 6									
Tertile 1 (good)	53	16	10-27	1	-	-	1	-	-
Tertile 2 (intermediate)	57	25	15-42	0.6	0.41, 0.89	0.01	0.88	0.55, 1.41	0.59
Tertile 3 (poor)	45	23	13-40	0.7	0.46, 1.06	0.1	1.26	0.76, 2.09	0.36
Clinic site									
Primary care	63	20	13-33	1.21	0.85, 1.72	0.28			
Secondary care	77	22	12-42	1	-	-			
Private facilities	22	17.5	7-28	1.71	1.03, 2.85	0.04			
Grade of surgeon									
Consultant	60	18.5	10-34	1	-				
Registrar	30	23	18-43	0.62	0.39, 0.99	0.05			
GP	60	19.5	13-32.5	0.97	0.67, 1.40	0.86			
Clinic site and surgeon [d]									
Primary care – GP							1.22	0.75, 2.00	0.43
Secondary care – consultant							1	-	-
Secondary care – registrar							0.83	0.44, 1.55	0.55
Private facilities – consultant							1.43	0.76, 2.68	0.27

Table continues…

Occupational variables	N	Return to work time (days)		Age- and sex-adjusted analyses [a]			Multivariable model [b]		
		Median	IQR	Hazard ratio [c]	95% CI	P value	Hazard ratio [c]	95% CI	P value
Job classification [e]									
Manual	61	27	15-42	0.58	0.41, 0.82	<0.001	0.91	0.50, 1.66	0.77
Non-manual	101	18	8-31	1	-	-	1	-	-
Work contract									
Employed	127	23	14-41	1	-	-	1	-	-
Self-employed	29	13	6-19	1.96	1.25, 3.07	<0.001	1.36	0.70, 2.64	0.37
Other	5	12	3-31	2.08	0.82, 5.29	0.12	0.71	0.18, 2.76	0.62
Weekly working hours									
20-37.5	81	24	15-38	1	-	-	-	-	-
>37.5	81	17	6-31	1.12	0.76, 1.64	0.56	-	-	-
Payment driven by targets									
Yes	28	27.5	15.5-46	0.58	0.38, 0.90	0.02	1.18	0.69, 2.01	0.54
No	125	20	12-33	1	-	-	1	-	-
Job demanding on hands/wrists									
Yes	133	21	13-39	0.61	0.40, 0.92	0.02	1.08	0.65, 1.78	0.76
No	29	18	6-28	1	-	-	1	-	-
Computer use at work									
≤1 hour	61	29	19-43	1	-	-	1	-	-
>1 hour	96	16	7-29	2.9	1.98, 4.24	<0.001	**2.19**	**1.19, 4.03**	**0.01**
Lift/carry >10kg									
Yes	65	25	13-41	0.57	0.39, 0.85	0.01	0.62	0.36, 1.07	0.09
No	92	19	10.5-33	1	-	-	1	-	-

Table continues…

Occupational variables (continued)	N	Return to work time (days)		Age- and sex-adjusted analyses [a]			Multivariable model [b]		
		Median	IQR	Hazard ratio [c]	95% CI	P value	Hazard ratio [c]	95% CI	P value
Push/pull heavy weight									
Yes	72	27.5	15.5-42	0.51	0.36, 0.73	<0.001	1.08	0.65, 1.81	0.76
No	87	16	9-31	1	-	-	1	-	-
Occupational health access									
Yes	71	27	16-43	1	-	-	1	-	-
No / unsure	91	16	9-29	1.85	1.33, 2.58	<0.001	1.60	0.95, 2.68	0.08
Availability of sick pay									
≤ 1 month	38	17.5	12-32	1	-	-	1	-	-
> 1 month	78	27.5	16-42	0.59	0.39, 0.89	0.01	0.65	0.38, 1.09	0.10
Unsure	36	16.5	10-29	1.07	0.67, 1.71	0.79	1.24	0.69, 2.20	0.47
Expected duration of work absence after CTR									
< 7 days	31	5	2-12	1	-	-	1	-	-
7-14 days	59	16	13-27	0.27	0.17, 0.43	<0.001	**0.34**	**0.19, 0.61**	**<0.001**
15-30 days	31	29	22-41	0.13	0.07, 0.22	<0.001	**0.28**	**0.14, 0.56**	**<0.001**
> 30 days	41	41	25-44	0.09	0.05, 0.16	<0.001	**0.13**	**0.06, 0.26**	**<0.001**
Believe problem caused by work									
Yes	69	26	12-42	0.57	0.41, 0.81	0.002	**0.63**	**0.42, 0.94**	**0.02**
No	91	19	12-33	1	-	-	1	-	-

[a.] Reported for each individual variable adjusted for age and sex only.

[b.] Mutually adjusted for age, sex and all variables that were significant at p<0.05 (for any category) in the previous column.

[c.] Hazard ratio >1 relates to earlier return to work.

[d.] Primary care site and GP surgeon categories were identical and it was therefore necessary to combine surgeon grade and clinical site for the multivariable model.

[e.] Categorised according to the Standard Occupational Classification using the Computer Assisted Standardised Coding Tool [112, 236].

N number of participants, IQR interquartile range, CI confidence interval. Significant findings in the multivariable model are highlighted in bold.

5.3.12.1 Post-hoc power calculation for the assessment of factors associated with return to work time

Considering the results presented in Section 5.3.8, a post-hoc power calculation was conducted based on the recorded prevalence for three potential explanatory variables: computer use at work for >1 hour (57%); lifting/carrying ≥10kg (38%); and the belief that the CTS symptoms were caused by work (41%). Considering the prevalence of these variables in the sample, and the corresponding hazard ratios estimated (2.15, 0.54, 0.70; Table 5.10), it was found that between 55-255 participants would be needed for such hazard ratios to be detectable. This was assuming 80% power and an alpha error of 0.05.

5.3.13 Assessment of poor outcomes in relation to earlier return to work

5.3.13.1 Antibiotics after first return to work

Of those prescribed post-operative antibiotics, three individuals had already returned to work when their antibiotics were prescribed. The remaining five individuals either returned to work after taking their course of antibiotics (n=3) or had not returned to work by the end of the study period (n=2). Of those who required antibiotics after return to work, two participants were in the earliest quartile for return to work times across the whole cohort, returning to work in one and seven days, and two required additional sick leave after first return (Table 5.11).

5.3.13.2 Sick leave after first return to work

Twelve individuals reported that they required additional hand-related sick leave after they first returned to work, five worked in manual roles and seven in non-manual roles. Of these, 10 individuals provided the duration of this additional work absence, which ranged from 0.5-6 days (median 1.8 days). None of these individuals were in the earliest quartile of return to work times across the whole cohort (Table 5.11).

Table 5.11 Characteristics of participants reporting additional sick leave or post-operative antibiotics after first return to work

Sex	Job title	Occupational classification	Contract type [a]	Time to first return to work (days)	Post-operative antibiotics	Related sick leave after return to work (days)	Global Rating of Change Score 12 weeks after surgery
Female	Service manager	Non-manual	Employed	17	Yes	0.5	Much better
Female	Sales advisor	Non-manual	Employed	7	Yes	#	NR
Male	Mechanic	Manual	Self-employed	1	Yes	0	Worse [b]
Male	Property maintenance	Manual	Self-employed	24	No	3	Completely cured [b]
Female	Renal dialysis assistant	Non-manual	Employed	20	No	6	Much better
Female	Gardener	Manual	Self-employed	45	No	1.5	Much better
Male	Fork-lift truck engineer	Manual	Employed	20	No	1	Completely cured
Male	Maintenance	Manual	Self-employed	9	No	4	Much better
Female	Charity advice worker	Non-manual	Employed	27	No	1	Much better
Female	Education manager	Non-manual	Employed	55	No	2	Slightly better
Female	Domestic cleaner	Manual	Self-employed	19	No	4	Much better
Female	Human resources director	Non-manual	Employed	29	No	#	Completely cured
Female	Social worker	Non-manual	Self-employed	4	No	1	Much better

[a.] All employed individuals had a permanent contract. [b.] Data provided at four weeks only

Additional sick leave taken after first return to work, but duration not reported. NR not reported

5.3.13.3 Global Rating of Change score at 12 weeks

Using the Global Rating of Change score, 19 participants (11%) reported that their CTS symptoms were slightly better (n=12), had not changed (n=2) or were worse (n=5). The median return to work time for this subgroup was 25 days (IQR 16-42, n=18). Those whose symptoms were reported as much better or completely cured (78%) returned to work more quickly, although this difference was not statistically significant (median 20 days, IQR 12-34.5, n=128, Wilcoxon rank-sum test, p=0.16).

5.3.13.4 Scar problems at 12 weeks

Seventeen individuals (10%) reported that their scar was fairly troublesome (n=15) or very troublesome (n=2) on the PSAQ summary question. None of the participants reported that their scar was 'unbearable'. The median return to work time for this subgroup was 39 days (IQR 16-55, n=17). Those whose scar was a little or not at all troublesome (79%) returned to work notably faster; median 20 days (IQR 12-33, n=128). This difference was statistically significant (Wilcoxon rank-sum test, p=0.02).

Six individuals reported poor outcomes for both the Global Rating of Change score and the PSAQ summary scar question. None of these participants were included in the previous descriptions of those requiring additional sick leave after first return to work, nor reported being prescribed antibiotics. Two worked in manual roles, four worked in non-manual roles. One individual was self-employed and the remainder were employed with a permanent contract. For these individuals, the median return to work time was 40.5 days, range 10-83 days.

5.3.13.5 Any poor outcomes

The prevalence and overlap between each of the four poor outcomes described in Section 5.3.13.1 to Section 5.3.13.4 are shown in Table 5.12. Participants were categorised into those with any poor outcome (n=41) and those who reported no poor outcomes for any of the four variables (n=118). The median return to work time for those with no poor outcomes was earlier than for those with any poor outcome; 19 days (IQR 11-33, n=115) compared with 25.5 days (IQR 14.5-42, n=40). This difference was not statistically significant (Wilcoxon rank-sum test p=0.06).

Table 5.12 Prevalence of poor outcomes after carpal tunnel release

Measure of poor outcome	N (% of cohort)			
Global rating of change (GROC) [a]	0	1	6	19 (11)
Scar (PSAQ) [b]	0	2	17 (10)	
Extra sick leave [c]	2	12 (6)		
Antibiotics [d]	3 (2)			
	Antibiotics	**Extra sick leave**	**Scar (PSAQ)**	**GROC**

The black cells show the total number of individuals with a poor outcome for each measure. The numbers in the white cells correspond to individuals reporting more than one poor outcome. These categories are not mutually exclusive.

[a.] Global Rating of Change score of slightly improved, no change, worse.

[b.] Patient Scar Assessment Questionnaire summary scar score of fairly troublesome, very troublesome, unbearable.

[c.] Additional sick leave related to the operated hand after first return to work.

[d.] Antibiotic prescription for a wound infection after returning to work.

The relationship between baseline variables, reported return to work time, and the prevalence of any poor outcome was explored using logistic regression (Table 5.13). Only three factors were found to be significantly associated with a poor outcome in the multivariable model: Katz hand diagram classification of possible or unlikely CTS (in comparison to classic or probable CTS); not having received information about return to work pre-operatively; and reporting a lack of social support. Age and sex-adjusted analyses for the Global Rating of Change and PSAQ scar scores are provided in Appendix Q.

Table 5.13 Logistic regression analyses comparing baseline variables and any poor outcome

	Poor outcome N (%)		Age- and sex- adjusted analyses [a]			Multivariable model [b]		
	Yes	No	OR	95% CI	P value	OR	95% CI	P value
CTR to dominant hand								
Yes	22 (20)	84 (74)	1	-	-	1	-	-
No	19 (35)	34 (63)	2.41	1.12, 5.17	0.02	4.39	1.01, 19.13	0.05
Clinic site								
Primary care	11 (17)	51 (80)	0.40	0.17, 0.92	0.03	0.22	0.05, 1.05	0.06
Secondary care	27 (34)	48 (60)	1	-	-	-	-	-
Private clinic	3 (13)	19 (83)	0.27	0.72, 1.02	0.05	0.29	0.04, 2.31	0.24
General health								
Excellent/very good/good	32 (22)	108 (74)	1	-	-	1	-	-
Fair/poor	9 (43)	9 (43)	3.95	1.32, 11.81	0.01	0.46	0.45, 4.77	0.52
Somatising symptoms								
None	14 (17)	64 (78)	1	-	-	1	-	-
1	10 (21)	34 (72)	1.40	0.55, 3.55	0.48	1.11	0.20, 6.09	0.90
2+	17 (46)	19 (51)	4.67	1.86. 11.68	0.001	5.45	0.97, 30.62	0.05
SF-36 MH								
Tertile 1 (poor)	18 (34)	32 (60)	5.28	1.69, 16.50	0.004	3.28	0.48, 22.51	0.23
Tertile 2 (intermediate)	18 (30)	40 (67)	4.18	1.38, 12.62	0.01	2.48	0.42, 14.80	0.32
Tertile 3 (good)	5 (9)	45 (85)	1	-	-		-	-
Afraid of long term problems								
Yes	24 (31)	46 (60)	2.47	1.16, 5.23	0.02	2.15	0.28, 7,81	0.27
No	16 (18)	70 (80)	1	-	-	-	-	-
Pain catastrophisation								
To at least a moderate degree	17 (33)	28 (56)	2.79	1.21, 6.42	0.02	1.48	0.28, 7.81	0.64
No	23 (20)	89 (78)	1	-	-	-	-	-
Problem made worse by stress								
Yes	8 (44)	7 (39)	3.70	1.22, 11.20	0.02	7.74	0.78, 76.69	0.08
No	32 (21)	110 (75)	1	-	-	-	-	-
MHQ function side of CTR								
Tertile 1 (poor)	27 (39)	41 (59)	3.61	1.43, 0.09	0.01	1.92	0.25, 14.72	0.53
Tertile 2 (intermediate)	5 (12)	33 (77)	0.83	0.24, 2.80	0.76	0.21	0.02, 2.23	0.19
Tertile 3 (good)	8 (15)	43 (83)	1	-	-	-	-	-
MHQ ADLs bilateral								
Tertile 1 (poor)	20 (36)	35 (63)	4.39	1.52, 12.67	0.01	0.56	0.04, 8.86	0.68
Tertile 2 (intermediate)	14 (24)	40 (68)	2.47	0.85, 7.15	0.10	1.02	0.07, 15.24	0.99
Tertile 3 (good)	6 (12)	43 (84)	1	-	-	-	-	-
MHQ ADLs side of CTR								
Tertile 1 (poor)	26 (46)	29 (52)	6.62	2.33, 18.75	<0.001	5.27	0.37, 74.87	0.22
Tertile 2 (intermediate)	9 (16)	45 (80)	1.24	0.40, 3.85	0.71	1.76	0.17, 18.74	0.64
Tertile 3 (good)	6 (11)	43 (80)	1	-	-	-	-	-
MHQ satisfaction								
Tertile 1 (poor)	27 (36)	47 (62)	3.49	1.34, 9.09	0.01	1.12	0.11, 11.21	0.93
Tertile 2 (intermediate)	7 (18)	26 (68)	1.62	0.50, 5.25	0.43	1.44	0.16, 13.23	0.75
Tertile 3 (good)	7 (13)	45 (85)	1	-	-	-	-	-

	Poor outcome N (%)		Age- and sex- adjusted analyses [a]			Multivariable model [b]		
	Yes	No	OR	95% CI	P value	OR	95% CI	P value
Katz hand diagram classification								
Classic/probable	21 (19)	85 (77)	1	-	-	-	-	-
Possible/unlikely	20 (37)	31 (57)	2.83	1.31, 6.12	0.01	**8.91**	**1.94, 40.98**	**0.01**
Job contract								
Employed (permanent)	27 (21)	99 (75)	1	-	-	-	-	-
Self-employed	11 (38)	16 (55)	2.85	1.10, 7.39	0.03	2.45	0.49, 12.40	0.28
MHQ work function								
Tertile 1 (poor)	23 (38)	33 (54)	4.52	1.60, 12.73	0.004	2.28	0.28, 18.33	0.44
Tertile 2 (intermediate)	12 (19)	48 (77)	1.56	0.53, 4.60	0.42	1.03	0.13, 6.67	0.98
Tertile 3 (good)	6 (14)	37 (84)	1	-	-	-	-	-
Received pre-operative information about return to work								
Yes	24 (20)	93 (77)	1	-	-	-	-	-
No	15 (35)	24 (56)	2.42	1.07, 5.44	0.03	**7.34**	**1.38, 38.96**	**0.02**
Job demanding on hands/wrists								
Yes	38 (28)	92 (67)	3.68	1.04, 13.08	0.04	3.80	0.41, 35.42	0.24
No	3 (10)	26 (90)	1	-	-	-	-	-
Lack of social support								
Yes	12 (43)	14 (50)	2.77	1.14, 6.74	0.03	**9.05**	**1.64, 50.01**	**0.01**
No	28 (20)	103 (75)	1	-	-	-	-	-

[a.] Individual variables adjusted for age and sex. Only those which were significant at p<0.05 are listed.
[b.] Mutually adjusted for age, sex and all variables included in the table.
OR odds ratio, CI confidence interval. Significant findings in the multivariable model are highlighted in bold.
Any poor outcome was defined as reporting at least one of the following:
Global Rating of Change score of slightly improved, no change, worse; Patient Scar Assessment Questionnaire summary scar score of fairly troublesome, very troublesome, unbearable; additional sick leave related to the operated hand after first return to work and antibiotic prescription for a wound infection after returning to work.

5.3.13.6 Return to work before 7 days, by 14 days and before 30 days

There were no statistically significant differences in the prevalence of any of the poor outcomes described above when comparing those who returned to work in less than 7 days (n=26) with those who returned at 7 days or later (n=136, Chi^2 p>0.05). This was also the case for those who returned at 14 days or earlier (n=55) versus those who returned after 14 days (n=107). However, a significantly larger proportion of those returning after 30 days (n=53) reported problems with their scar compared with those who returned before 30 days (n=109, Chi^2 p=0.004). There was no significant difference for any other measures of poor outcome between these groups.

5.3.14 Return to work advice

At baseline, 73% of participants reported that they had received advice about returning to work after their CTR. Of these, the majority indicated that this information came from the surgeon/surgical team (84%) hospital nurse (17%) or from their GP or primary care nurse (23%). These responses were not mutually exclusive. When asked about the content of their advice as an open text question, 116 participants responded (69%). Participants generally adopted a bullet point-type format for their comments to list one or two pieces of information. These comments were analysed using thematic analysis, which led to the identification of four main themes: general post-operative information; when to return to work; how to return to work; and return to driving (Figure 5.11). Each of the themes will be discussed below, supported by representative quotes from the REACTS participants. Relevant demographic and occupational details (sex, job title, type of work contract, and duration of work absence in days) are listed for the participants quoted.

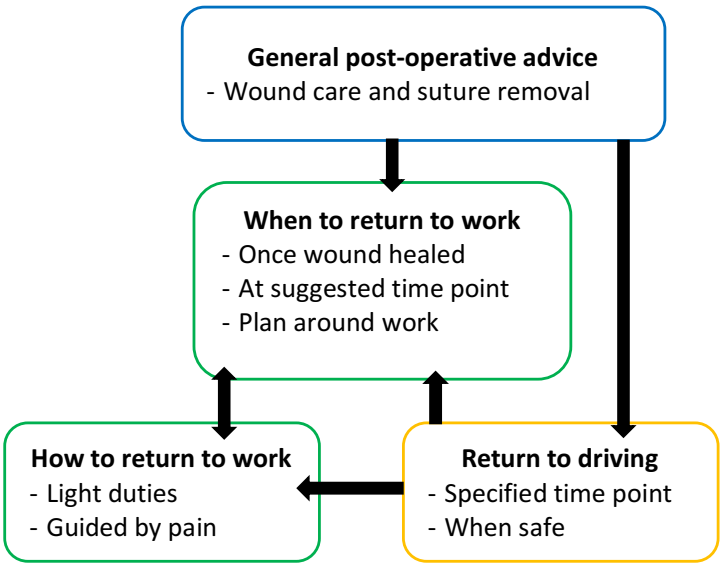


Figure 5.11 Themes identified in the reported return to work advice

5.3.14.1 General post-operative information

Many participants provided comments concerning general post-operative management, including: wound care recommendations; information about removal of sutures: and suggestions to elevate and exercise the hand after surgery. While this does not directly

relate to return to work, return to general functioning may be viewed as a precursor to return to work activities. Many participants reported specific recommendations, such as advice to exercise:

"To exercise arm and hand to keep swelling to a minimum and to prevent stiffness."

#63 – Accountant, employed, female, RTW (return to work) 7 days.

Or general advice to use the hand normally:

"Pain relief should be instant. To be aware of the area where the scar will be after stitches are removed, the more it is used the better."

#70 – Master decorator, employed, male, RTW 10 days.

Other reported more restrictive advice, such as limiting use of the hand for a specified period of time:

"No getting the wound wet for 2 weeks. Not to do much at all for 2 weeks… To keep dressing clean – high risk of infection. To return if adverse swelling or pain."

#16 – Optician, employed, female, RTW 45 days.

A number of participants did not specify the actual content of the advice they received, instead stating the general type of information provided, such as:

"Basic info about operation time, likelihood of success and basic recovery times prior to carrying out various activities from driving to manual handling."

#58 – Construction director, employed, male, RTW 3 days.

In addition, many participants recalled advice to avoid certain activities after their surgery, such as heavy lifting or weight-bearing through the hand. Occasionally, this was specifically applied to the participant's work role, but more often the advice was recalled in terms of general hand function. There was variation in the recommended time period to avoid heavy lifting, and demonstrated below:

"Not to lift any heavy objects or drive for around 2 weeks."

#122 – Healthcare assistant, employed, female, RTW 33 days.

"To not lift heavy items for 4-6 weeks."

#121 – Conveyancer, employed, female, RTW 15 days.

5.3.14.2 When to return to work

Many participants outlined reported advice about when to return to work. This was either described as a particular time point, or in terms of wound healing. However, one participant specifically recalled that they had not been given any advice about returning to work, only the type of general post-operative information outlined above:

"I have not been given advice about whether to return to work in a particular time frame. I have been told verbally what the operation entails and what they will do and how my symptoms will/should change but not straight away."

#193 – Teacher, employed, female, RTW 4 days.

5.3.14.2.1 Return once wound is healed

Wound healing was frequently reported as an important factor in determining when it was appropriate to return to work. This was usually described in terms of the 'removal of stitches' or 'once healed'. No participants described instructions about how they might tell whether the wound was healed and it is possible that removal of sutures presented a tangible surrogate for an assessment of wound healing. Examples included:

"Because of infection not to return until fully healed."

#173 – Plumber, employed, male, RTW 42 days.

"I had a helpful information leaflet & was told once my stitches are out I can drive & return to work."

#94 – Admin assistant, employed, female, RTW 14 days.

5.3.14.3 Recommended period of work absence

When a recommended return to work time point had been reported, this was often linked to different types of work which were frequently described in terms of broad categories, such as desk-based or heavy manual work, for example:

"*I would need time off work. The period of work depends on the type of work I do, but most people need up to 2 weeks. Heavy work may need 4-6 weeks."*

#23 Farmer, self-employed, male, RTW 6 days.

Other participants specifically reported an advised return to work time point in relation to their own work duties, for example:

"Both of the above [surgeon/ surgical team and hospital nurse] stated I would need 'a month' or 'at least 4 weeks' off after operation due to my work as a gardener and using my right-hand quite heavily, from 1st day back at work."

#104 – Gardener, self-employed, female, RTW 45 days.

"*Because of my job in the elderly sector – personal care and pushing wheelchairs – probably 4 weeks possibly 6 weeks.*"

#43 – Care assistant, employed, female, RTW 39 days.

A few participants reported a combination of the two types of advice described above. These individuals listed timescales for broad job roles, but with recommendations to tailor their return to work based on their own work duties, for example:

"If I were a typist, 2 weeks is the norm. It's about what I can do & need to be able to do."

#90 – Bank cashier, employed, female, RTW 35 days.

The recommended period of work absence was also described in terms of the duration of the sickness certification that would be provided. None of the participants used the term fit-note, instead this was either described as a 'sick note', being 'off sick' or being 'signed off'. A number mentioned that they had been advised that their surgical team would provide the initial fit/sick note, usually for a period of two weeks, at which point they would need to visit their GP in order to extend it:

"I received a sick note from the hospital for 2 weeks, then I have to have my stitches out by my nurse at my doctors, where I will ask them for a further sick note depending how my hand has healed."

#54 – Sales assistant, employed, female, RTW 29 days.

For other participants, there was the expectation that their surgical team would provide their sickness certification for the duration of their time off work, although this was less commonly reported:

"Was advised by surgeon that he will sign me off from work for a period of 6 weeks because I work in a retail environment requiring lifting heavy crates & using a scanning device."

#163 – Retail assistant, employed, female, RTW 42 days.

One participant reported that they had been advised by their nurse that it was inappropriate for them to return to work before the end of the time period documented on their fit note.

"Don't go back too early due to insurance being invalid as sick note provided."

#222 – Property maintenance, self-employed, male, RTW 24 days.

5.3.14.3.1 Planning around the surgery date around work

A small number of participants noted that they had some ability to plan their CTR date to fit around their work requirements. This included planning to make use of public holidays and statutory work closures over Christmas or the summer, such as the participant below:

"Advised by surgeon that I'd need 4-6 weeks. We discussed timing the surgery just before Christmas to take advantage of the holidays, as I am a lecturer. Work have agreed that I can work from home and use iPad dictation technology to assist."

#107 – University lecturer, employed, female, RTW 33 days.

Others noted that they planned to use annual leave to extend their time off work during the recovery period:

"2-3 weeks. So will take 2 weeks sick leave & one annual leave tacked on."

#41 – Consultant anaesthetist, employed, male, RTW time not provided.

A number of individuals acknowledged that they would find it difficult to take the recommended period of time off work. This was primarily those who were self-employed, although the potential reasons for needing to return earlier than advised were not discussed:

"I was advised to have maximum time off, but due to being self-employed, it is not practical. I can return to work with restricted duties."

#60 – Builder, self-employed, male, RTW not reported.

Interestingly, one participant noted a discrepancy between the duration of work absence recommended by their surgeon and their employer, with the employer suggesting an earlier return:

"Work advised to return to work immediately on light duties, surgeon advised 3-6 weeks off dependent on recovery & heaviness of work."

#124 – Machine operator, employed, female, RTW 42 days.

5.3.14.4 How to return to work

Several participants highlighted that the return to work advice they received focused solely on the suggested timescale for returning to work, possibly hinting at a desire for other information regarding the return to work process:

"Only time off work and for how long."

#66 – Housekeeper, employed, female, RTW 65 days.

Others reported information regarding making a graded return to work and functional activities. This included suggestions to initially return part-time or to only carry out lighter duties. However, there was no discussion of what 'light-duties' might constitute for the individual in relation to their job role. In some instances, this advice came from the surgical team, but other individuals were also mentioned, including friends and family with previous experience of CTR, for example:

"Surgeon gave me an information pack which says 2-3 weeks off, light duties upon return, depending on recovery. Friend & colleague told me he had 3 weeks off & did light duties for 1 week upon returning to work."

#42 – Distribution operative, employed, female, RTW not reported.

Alternative advice included reported recommendations to return to work straight away, but to only use the non-operated hand:

"I can return to work straight away but won't have use of my hand for a couple of weeks."

#105 – Manager motorcycle dealership, employed, male, RTW 1 day.

Or to be guided by pain:

"To listen to body, take it slowly, pain will limit work."

#79 – Gardener, self-employed, male, RTW not reported.

5.3.14.4.1 Driving

Driving and/or commuting was a frequently mentioned topic. There were a range of reported recommendations, but the most commonly reported was to resume driving between 10-14 days after surgery. In all cases, this was reported as being prohibited from driving prior to the specified time point, for example:

"Cannot drive for 2 weeks."

#156 – Human resources director, employed, female, RTW 29 days.

A minority recalled being advised not to resume driving for longer periods of time, ranging from 3-6 weeks. For these participants, the advice about when to return to work and when to return to driving appeared to follow the same time points, for example:

"To take a minimum of 6 weeks off work following surgery. To keep hand dry. Do not drive for 6 weeks. To see surgeon for follow up appointment 6 weeks after surgery."

#150 – Motor vehicle technician, employed, male, RTW 43 days.

"4 weeks before able to drive, could go back to work after 4 weeks as long as no heavy lifting (I am a teacher & often lift boxes of 16 textbooks!)."

#120 – Science teacher employed, female, RTW 40 days.

A small number of participants recalled being advised to return to driving after a week:

"No driving or using hand for first 2 days then no driving for a week, use hand as much as possible."

#169 – Enterprise architect, self-employed, female, RTW 1 day.

While others recalled being advised to return to driving when they felt safe to do so:

"Driving as soon as I feel safe; take someone with me to practice."

#103 – Psychologist, employed, female, RTW 6 days.

5.4 Discussion

The REACTS prospective cohort study explored return to work after CTR in a UK population. The focus was to describe the return to work process and investigate the factors associated with the length of work absence after CTR. Further aims were to establish whether earlier return to work was associated with poor outcomes among this cohort, and to explore the content of the return to work advice that participants received.

Among the 167 participants who provided follow-up data, the median return to work time was 21 days (IQR 12-35, range 1-99) and at least half of participants reported that they needed to amend their work duties when they first returned. Both demographic and occupational factors were associated with the duration of work absence, as were health beliefs and expectations. Importantly, earlier return to work did not appear to be associated with poor outcomes.

5.4.1 Study participants

Study participants were recruited from 16 different settings, including NHS secondary and primary care, and private practice. These settings were chosen to represent the range of healthcare facilities in which CTR is performed in the UK. As the patient CTR pathway is not consistent across the country [55], the study sites were deliberately spread across a broad geographic area (nine counties) to capture this. This range of locations also enabled the recruitment of individuals working in different occupations because the dominant industries and employers vary geographically.

The mean age of participants was 52.5 years; 9 years younger than a recently published UK multi-centre CTS cohort [68]. Many REACTS study sites anecdotally reported that retirement was a frequent reason for ineligibility and therefore this difference is likely to be the result of the eligibility criterion that required individuals to be working in paid employment for at least 20 hours per week. The younger age of REACTS study participants may better represent the working population than previous studies which also included retirees, home-makers and the unemployed. As expected, more women were recruited than men, which reflects the sex distribution for CTS (Section 1.2.6).

At 12 weeks, successful surgical outcomes were reported by 78% of REACTS participants, as defined by a Global Rating of Change score of much better or cured. This proportion was identical to that found in the recent study by Jerosch-Herold et al., referred to above [68]. This finding is also consistent with the 70-90% success rate which is widely quoted in the literature [66-68].

5.4.2 When did participants return to work after carpal tunnel release?

The median duration of work absence after CTR was 21 days (IQR 12-35). This was seven days earlier than the median time point estimated for all studies included in the systematic review (Chapter 3), but was similar to the times summarised for the four European studies [134, 136, 139, 182] (Table 3.12). Consistency between the findings from the REACTS study and existing studies that collected data in a similar way, and took place in comparable healthcare and occupational environments, suggests that three weeks (21 days) is a reasonable reflection of the median duration of work absence after CTR for all types of work combined, within these settings.

In terms of tissue healing, a time point of 21 days after surgery corresponds to the proliferation and/or remodelling phases [257]. One previous study of wound healing after CTR (n=53) found that by two weeks of surgery, 66% of patients had achieved wound healing with mild bruising (Southampton grade 1) and by six weeks 98% had achieved complete healing (Southampton grade 0) [258]. No data were reported between these time points. The nature of the REACTS study prohibited evaluation of the timing and quality of wound healing for participants and therefore the relationship between wound healing and return to work time could not be specifically explored.

5.4.2.1 Return to work times for different occupational activities

The results from the REACTS study showed that manual workers took longer to return to work than non-manual workers. This was also found in the systematic review (Table 3.13); however, the type of work that the participants were returning to was not consistently classified, and few of the studies documented how their categories of manual and non-manual workers were defined [111, 117, 118, 149, 160, 175]. The use of a standardised coding system for manual/non-manual work [236] is a strength of the

REACTS study, as is the inclusion and categorisation of other occupational factors, such as employed/self-employed.

Manual/non-manual categories maybe of limited use to clinicians and patients due to the non-standardised definitions used in practice. For this reason, nine work-related upper limb activities were included in the REACTS baseline questionnaire. In the age and sex-adjusted model, lifting or carrying >10kg and pushing or pulling a heavy weight were both associated with slower return to work as compared with those not reporting these exposures. Computer use of more than an hour was associated with earlier return to work compared to those who did not use a computer, or did so for shorter periods, in both the age- and sex-adjusted analysis and multivariable model. However, none of the categories of occupational activity were mutually exclusive, with many participants reporting work roles that involved a mixture of different types of upper limb activities.

Return to work times after CTR in relation to specific occupational upper limb activities have not been previously reported, and therefore these findings may help direct clinicians to ask about specific upper limb functioning when giving advice to their patients about returning to work after CTR.

5.4.2.2 Return to work times for the self-employed

A number of responders to the clinician survey in Chapter 4 expressed concern that self-employed workers returned to work too soon after CTR, and often against advice (Section 4.4.5.2.1). The results from the REACTS study found that self-employed workers were more likely to return to work earlier than those who were employed, although the type of job contract was not significantly associated with the duration of work absence in the final model.

Only two studies identified in the systematic review (Chapter 3) reported the type of job contract, but both found that those who were self-employed returned to work more quickly [117, 118]. Studies of return to work after other surgical procedures also had similar findings [259]. There are several plausible reasons for why self-employed workers may return to work more quickly, including financial necessity and/or the desire not to disrupt the service provided to their clients. In addition, return to work may be more

flexible for self-employed workers if they have greater control over demands, working hours and physical activities, which could facilitate earlier return to work.

Being self-employed was associated with higher odds of a poor outcome in the age- and sex-adjusted analysis (OR 2.85, 95% CI 1.10, 7.39), while earlier return to work was not. This suggests that clinicians' concerns about poor post-operative outcomes for self-employed patients may be warranted. However, the issue does not appear to be as clear cut as self-employed patients returning to work too soon. It is possible that self-employed individuals return to a higher intensity of upper limb use, or that other, as yet unidentified, factors in self-employment influence post-operative outcomes.

5.4.2.3 Return to work for part-time and full-time workers

Part-time work generally encompasses anything less than the normal full-time hours for the place of work. In order to define part time work for the REACTS study, participants were dichotomised to those working more than the median of 37.5 hours per week and those working between 20-37.5 hours (20 hours per week was the minimum requirement for study eligibility). Those working >37.5 hours per week appeared to return to work more quickly than those working fewer hours, but there was wide variation in both groups and this difference was not significant in the age- and sex-adjusted analysis.

Usual working hours reported by the REACTS study participants were compared with UK data from the Office of National Statistics for the year the study commenced (2017) and the proportions were very similar, suggesting that the REACTS sample was broadly representative of the general population for this characteristic [260].

Previous research has identified significantly faster return to work for full-time (compared with part-time) workers after CTR, although the definition of full and part-time work was not provided [111]. As discussed above, this pattern was not found in the REACTS study.

5.4.3 Which factors were associated with the duration of work absence?

To date, the few studies that explored determinants of work absence after CTR were limited to single centre studies with small sample sizes [109, 111, 261]. The findings from

the current study expand this existing literature. In the multivariable Cox proportional hazards model, five baseline variables were significantly associated with the duration of work absence after CTR. This included a combination of demographic and occupational characteristics, and also health beliefs and patient expectations. Potential implications of these findings are discussed in the following sections.

5.4.3.1 Demographic factors

In the current study, women were more likely to take longer to return to work than men. Previous studies exploring time to return to work after CTR have found contradictory effects of sex [101, 152]. Associations between sex and other measures of health, such as pain [262], have been reported, and it therefore appears appropriate to continue to include sex as a covariate in analyses of outcomes after CTR, despite these conflicting findings. However, there is currently insufficient evidence to support any difference in return to work strategies based on this finding.

Smokers and ex-smokers were more likely to return to work later than non-smokers. Smoking has been shown to have detrimental effects on wound healing after hand surgery through a number of postulated mechanisms, including reduced perfusion and impaired collagen synthesis [263]. Interestingly, smoking was not associated with an increased incidence of poor outcomes after CTR in the REACTS study, but those with a history of smoking did expect to take longer to return to work than those who had never smoked. It is possible that those with a history of smoking were advised to return to work later than non-smokers based on concerns about delayed wound healing, or that smoking was associated with other characteristics that impacted upon return to work times (e.g. type of work).

5.4.3.2 Occupational factors

Of the nine occupational upper limb activities that were included in this study (Section 5.2.3.1.3), only computer use was found to be significantly associated with return to work time in the multivariable model. Those reporting more than an hour of computer-based work per day were twice as likely to return to work earlier than those who did not use a computer, or did so for shorter periods (Table 5.10). The manual/non-manual coding that

was discussed in Section 5.4.2.1, was not statistically significantly associated with return to work time in the multivariable model, perhaps due to inconsistencies between job title and occupational upper limb activity and/or overlap with other baseline variables. Earlier return to work after CTR for desk-based workers has been reported previously [111], and was supported by the recommendations of clinicians surveyed in Chapter 4 (Table 4.8). It is possible that clinician recommendations contributed to the increased likelihood of earlier return to work among computer users, especially because 'desk-based work' is a relatively easy concept for both clinicians and patients to describe when discussing return to work. It may be that recruiting clinicians were routinely recommending earlier return to work for their patients with desk-based roles compared to other types of work.

5.4.3.3 Beliefs and expectations

Those who believed that their hand/wrist problem was caused by work were nearly 40% more likely to take longer to return to work compared to those who did not (Table 5.10). Beliefs about the cause of symptoms were also found to be important in a study of work outcomes among patients with knee osteoarthritis. Hoorntje et al. found that the belief that work had been the cause of the patient's symptoms was a major determinant of leaving the labour force after knee arthroplasty [264].

In the case of CTS, it is possible that work may have contributed to the development of symptoms. As discussed in Section 1.3.1, regular and prolonged use of vibrating hand-held tools has been found to increase the risk of developing CTS [89]. However, among the REACTS participants who reported that their CTS symptoms were caused by work, only a third reported using power tools that made their hand or arm vibrate. The potential influence of causal beliefs on work outcomes is an important consideration, and may also be a component of the systematic review finding that workers' compensation was associated with longer durations of work absence after CTR (Table 3.13). In many jurisdictions, workers' compensation is only provided for cases where the condition was attributed as work-related, but how this is determined is unclear.

Within the REACTS study, those who expected to return to work more quickly did so. Compared to those who expected to return within a week, there was a sequential increase in the likelihood of longer durations of work absence for those expecting to return between 7-14 days, 15-30 days and >30 days (Table 5.10). The magnitude of these

effects was large, most notably for those in the latter category, who were ten times more likely to return to work later than those who expected to take less than a week off. Studies of return to work following work absence for other musculoskeletal and mental health conditions have also identified the importance of patient expectations, which were a prominent determinant of return to work time or other return to work outcomes [265-267]. Additionally, positive patient expectations regarding the benefit of physiotherapy treatment were found to be associated with better clinical outcomes [268], while expectations are also thought to play an important role in the placebo effect [269].

Cowan et al. specifically explored the determinants of return to work after CTR in a US-based cohort (n=66). They similarly found that expected/desired duration of work absence was a significant determinant of time to return to work [111]. As with the REACTS study, their final model included desk-based work and expected/desired duration of work absence. It is important to recognise the potential overlap between desk-based work (computer use >1 hour) and expected return to work time. As discussed in Section 5.4.2.1, the survey reported in Chapter 4 found that clinicians recommend earlier return to desk-based work compared to other work categories. When this was explored for the REACTS data, 70% of participants in the earliest tertile for expected duration of work absence (those who expected to return the soonest) reported >1 hour of computer use. This compared with 48% of the middle tertile and 32% for the latest tertile. It is possible that the expected return to work time was largely driven by the advice received, and perhaps the advice provided was broadly related to desk-based versus other types of work. The role of expectations on outcomes, including return to work, after hand and wrist surgery requires further exploration, particularly as it is likely that these could be influenced by consistent advice and recommendations.

Seventy-two percent of REACTS participants reported having received information about return to work when they completed the pre-operative questionnaire. Most stated that the advice was predominantly provided by their surgical team (84%) or their GP (23%) (Section 5.3.14), suggesting that these participants tended to rely on health information from treating clinicians, rather than independently seeking advice from electronic resources. This has implications for any future recommendations for changes to the

content of return to work advice, as relevant clinicians will need to be fully engaged in delivering the suggested information.

5.4.3.4 Clinical factors

None of the clinical variables, such as the severity or duration of CTS, the clinic site, or the grade and speciality of surgeon were significantly associated with return to work time at the multivariable level. However, in the age- and sex-adjusted analyses, those treated in private facilities returned to work more quickly than those treated in NHS secondary care and those operated on by a registrar took longer to return to work than those whose surgery was performed by a consultant. Participants recruited from private facilities were predominantly non-manual workers (>85%) which may explain why these treatment sites were associated with earlier return to work. A more mixed pattern of manual/non-manual categories was identified for other clinic sites.

The difference between registrar and consultant surgeons may be explained by registrars being more cautious when advising their patients about return to work, perhaps for fear of poorer clinical outcomes if occupational activities were resumed too soon. This hypothesis is consistent with the results of the survey of clinicians in Chapter 4, which found that those with more experience of treating CTR patients tended to advise earlier return to work (Table 4.10). Importantly, neither surgeon grade, nor hospital site, were associated with the measures of poor outcome in the REACTS study.

5.4.4 Return to work advice

Open text comments provided by REACTS participants highlighted that their return to work advice frequently included a recommended return to work time point and this was often dichotomised as desk-based or manual activity (Section 5.3.14). A finding that mirrored the open text responses provided by clinicians (Section 4.4.5). Other commonly reported components of the advice were wound care and timescales for return to driving. Wound care advice was largely consistent, but recommendations for when to return to driving varied, as was also found in the clinician survey (Section 4.4.5.2.2).

Approximately a quarter of participants did not recall receiving any advice about returning to work before their CTR. This may be an underrepresentation of the wider situation because recruiting clinicians in the current study may have been prompted to discuss work with their patients given the topic of this research. Advanced information about the likely functional impacts of the surgery and suggestions about when and how to return to work after CTR could help individuals plan this process with their employers and/or clients. Half of those who reported that they did not receive any advice about returning to work after CTR were categorised as having at least one poor outcome, a much higher proportion than those who reported that they did receive advice. Further exploration of patient expectations for return to work and the advice provided by their clinicians are discussed as part of the qualitative study reported in Chapter 6.

5.4.5 Was earlier return to work associated with poorer outcomes?

Existing advice about return to work after CTR from the Royal College of Surgeons (RCS) provides a recovery tracker, which states that you are not fit to return to work until at least 15 days after surgery [102]. In the REACTS cohort, a third of participants returned to work on or before 14 days, 73% of whom were classified as non-manual workers. There was no increased incidence of poor outcomes among those who returned to work before/after this time point (nor those who returned before/after seven days), suggesting that the RCS guidance is overly cautious. It is also noteworthy that the RCS recovery tracker contradicts information provided on the previous page of the RCS guidance, which advises return to supervisory or managerial work from one week.

Neither earlier return to work, nor being self-employed were significantly associated with poor outcomes in the multivariable analysis, although for one or two individuals, it is possible that a very early return to manual work may have had detrimental effects. For example, the self-employed mechanic who returned to work one day after CTR, developed a post-operative wound infection that required antibiotics and rated his post-operative symptoms at four weeks as worse than before surgery (Table 5.11). In reality, there may be an early cut-off point before which it is harmful to return to heavy or dirty activities, but within the current study it was not possible to explore this further due to

the small number of poor outcomes reported and the varied return to work times for those performing heavy manual activities.

5.4.5.1 Factors associated with poor outcome after carpal tunnel release

Three factors were significantly associated with increased odds of poor outcomes: reported absence of pre-operative return to work information; reported lack of social support; and a Katz hand diagram score of possible/unlikely CTS. It is important to note that the prevalence of poor outcomes was, as expected, low (~25%) and therefore these analyses lack precision, as seen by the wide confidence intervals. Furthermore, the analysis of predictors of a poor outcome was not a key component of the study design, and was performed to explore whether there was overlap between the factors associated with the duration of work absence. No overlap was found. However, none of the factors associated with a poor outcome in the current study had been previously reported and the findings add to the debate on the predictors of surgical outcomes after CTR [68, 261].

Those who reported a Katz hand diagram score of possible/unlikely CTS had greater odds of a poor outcome when compared with those reporting a classic/probable distribution of CTS symptoms. One possible reason for poor outcomes in these individuals could be that they did not have true CTS and as a result their symptoms did not improve with surgery. However, of the 20 individuals who reported a poor outcome and a Katz score of possible/unlikely, a lack of symptomatic improvement was found in only nine individuals, with the remaining 11 reporting a combination of issues with their scar, additional sick leave and post-operative infection.

Those who reported an absence of pre-operative information about return to work had greater odds of a poor outcome when compared with those who recalled receiving this information. This is an interesting finding, particularly as there were later opportunities for work-related information to be provided, including on the day of surgery or during post-operative follow-up. Furthermore, the 15 individuals who reported both a poor outcome and the absence of return to work advice at baseline were distributed across 11 of the 16 recruiting sites, so this does not appear to be linked to one particular CTR pathway. It is possible that some advice was provided to these individuals, but not in a format that was easily remembered or accessible, or that these participants did not

specifically ask about work and were therefore not provided with any information. It is unclear why this might specifically be associated with poorer outcomes in this study, however it could relate to health literacy and information accessibility in all aspects of the CTR experience.

Those who reported a lack of social support had greater odds of a poor outcome when compared with those who reported sufficient support from their friends and family. No other studies of CTR outcomes that included this factor were identified, and there have been conflicting findings for the role of social support on outcomes following other types of surgery. Higher perceived levels of social support were associated with better long term outcomes following cardiac surgery, but this was not found among patients undergoing elective lower limb or lumbar spine surgery [270]. For patients with upper limb trauma, higher social support was found to correlate with improved patient reported functional outcomes in a mixed cohort of surgically and non-operatively managed patients [271]. The mechanism whereby social support might improve outcomes is likely to be multi-factorial. Perceived social support may be an indicator of other features, such as coping strategies, self-efficacy, or the nature of social networks, or may reflect a general optimism that would also influence self-reported treatment outcomes [272]. Findings from the REACTS study suggest that more research is needed to better understand the role of social support in post-operative outcomes after CTR and other elective upper limb surgery.

5.4.6 How did participants return to work?

5.4.6.1 Day of return to work

Duration of work absence was based on calendar days between the date of CTR and the date of first return to work, rather than days of work missed. This format was chosen for ease of patient-reporting, and to avoid any confusion regarding the counting of work and non-work days. Using date-based data also had the benefit of identifying the day of first return. The majority of participants returned to work on a Monday (39%) with sequentially fewer returns throughout the week. There has been little attention to the day of return to work in the literature. Workers and employers may choose Monday

because for many, this is the start of the usual working week, however it could be argued that returning later in the week might be a better strategy as this could allow a weekend break from occupational hand-use. Discussion with the occupational advisory group found that these clinicians often do advise their patients to return mid-week, and specifically for this reason. There is currently no evidence to suggest that either strategy would be better for CTR patients.

5.4.6.2 Return to amended duties or reduced hours

A large proportion of the REACTS cohort (56%) reported returning to amended work duties, and this was more common among manual workers and those who were self-employed. Return to work times were similar for those who did/did not return to amended duties. This differed from the four studies in the systematic review which reported earlier to return to modified duties [138, 151, 162, 172]. Across these studies, all conducted in the US, it took approximately a week longer to return to full duties after first return to modified duties (Section 3.4.3.1); however all participants initially returned to modified duties. Only two studies provided a definition for modified duties, they were: one-handed activities [172]; and no lifting greater than 3-5lbs with the ability to wear splints, if needed [162]. In both cases, this was specifically prescribed by the treating surgeon.

Within the REACTS study, amended duties were defined as needing to alter or avoid any usual work activities as a direct result of the CTR. This did not need to be prescribed or formally documented, rather it was an assessment of the individual's self-reported work ability when they first returned. For those who initially returned to amended duties, there appeared to be two dominant time frames for resuming full duties; between 1-2 weeks (41%) and more than 7 weeks (32%). It is possible that the latter category represents a more formalised graded return to work, with the former representing those who were able to build up to full duties without a formal return to work schedule. However, it is not possible to explore this with the available data.

None of the existing studies reported return to reduced hours as a method of grading the return to work after CTR, but this was a component of the return to work process for 16% of the REACTS cohort. For employed individuals, it is expected that line manager approval

would be required for any reduction in hours, and it is possible that this was a strategy to facilitate return to work for those individuals who were struggling post-operatively or had a prolonged period of work absence. The finding that the median duration of work absence was longer for those who returned to reduced hours (compared to the rest of the cohort) adds support to this theory.

5.4.7 Strengths

The REACTS study used a prospective design. This allowed the questionnaires to be designed around the research questions, rather than based on the content of pre-existing data sets. The inclusion of the potential determinants of return to work time that had been identified in the earlier chapters of this thesis permitted an in-depth exploration of occupational factors, which had not previously been examined together in a single study of return to work after CTR. In addition, the data analyses were pre-defined, which enabled transparency, particularly with the processing of a large number of variables. The use of a multi-centre design ensured that the characteristics of any one surgeon or clinic site did not influence the findings and enhanced their generalisability. Finally, recording whether the CTR was for the dominant or non-dominant hand allowed the role of hand dominance and return to work time to be explored, although no effect was noted.

5.4.8 Limitations

5.4.8.1 Selection and attrition bias

Patients who chose to participate in this questionnaire-based study may not be fully representative of the wider CTR population. Non-participation may have occurred for a number of reasons, such as not being aware of the study, the burden of participation, or negative perceptions of healthcare research [273]. Recruiters were encouraged to ask all their CTR patients to self-assess whether they were eligible for the study, and if so whether they would be interested in taking part. To keep the recruitment process as simple as possible for the recruiting clinicians, the reasons for declined participation were not formally recorded. Anecdotally, recruiters reported that working fewer than 20 hours per week in paid employment, due to retirement or unemployment, was a common

reason for ineligibility. A recent cohort study of CTR patients found that less than half of their study population were workers [68], which supports these anecdotal reports. In addition, one site was concerned that potential participants were put-off by the task of completing the baseline questionnaire. In this instance, local research nurse support was provided, which did boost recruitment.

Steps were taken to minimise loss to follow-up after recruitment. This included the incentive of a £10 shopping voucher on completion of the study and up to three reminders were used for each follow-up questionnaire using a combination of post, email and text. Acceptable response rates have been suggested to have a lower limit of 60-80% [274]. The current study achieved 77%, well within this limit. Comparison of those lost to follow-up after completion of the baseline questionnaire and those who remained in the study did identify some important differences. Participants who continued with the study were older, less likely to be a current smoker, had better mental health and functional scores (SF-36 and MHQ function) and greater access to occupational sick pay. Other studies have also found that smoking status (being a smoker) was associated with refusal to participate in clinical trials [275].

5.4.8.2 Self-reported data

The reliance on self-reported data is a limitation. To minimise recall bias, the maximum period of recall for the questionnaires was four weeks. To increase the accuracy of the reported return to work date, this information was collected twice: once contemporaneously as part of the diary card and again as part of the follow-up questionnaire. Reported side of surgery and date of CTR were also cross-checked with the operation record. There were very few discrepancies in these data and when a discrepancy did occur, clarification was sought from both the participant and clinic site which resolved the issue.

The patient advisory group was involved in the development of the questionnaires and other study material to ensure that these were user-friendly, and as an attempt to increase completion and reduce errors. Strategies included using two versions of FU2, one for those who had already returned to work at FU1 and one for those who had not. This avoided the need for multiple instructions to skip sections that were not relevant,

which it was hoped would reduce the risk of responders missing relevant questions or completing irrelevant questions in error.

In addition, self-reported measures for CTS symptoms and hand function that are commonly used within healthcare settings were chosen for the study [243, 250]. The lead researcher had experience of using these measures to guide and assess the treatment of patients with hand and upper limb conditions, and had found them to be acceptable and meaningful to both patients and clinicians.

5.4.8.3 Diagnosis of carpal tunnel syndrome

A clinical diagnosis of CTS was not made as part of the study, rather all participants were presumed to have CTS as diagnosed by their treating clinician when referring the patient for CTR. Using the pre-operative hand diagrams, 66% of participants reported symptoms that were defined as classic or probable CTS and another 31% were defined as possible CTS [19, 20]. Three individuals (all recruited from different sites) reported symptoms that were defined as unlikely to be CTS. One of these individuals reported good outcomes for all measures at 12 weeks, however two had poor outcomes on the CTS-6 and one also had poor outcomes on the Global Rating of Change and MHQ function scores. It is possible that these two individuals did not have CTS. Many studies of CTR include positive NCS findings in their eligibility criteria, however this was not possible in the current study because NCS are only recommended in cases of clinical ambiguity in the UK and therefore do not form part of routine clinical practice [18].

5.4.8.4 Bilateral symptoms

Participants were asked at baseline whether or not they were expecting to have CTR for one or both hands and CTS symptom data was collected for both hands. The large majority of the cohort had bilateral symptoms (74%). Two participants had simultaneous bilateral surgery (data for their dominant hand was used for the analyses) and 64% expected to have future CTR surgery for the other hand. It is possible that participants could have had surgery to their second hand during the REACTS follow-up period. When the REACTS study was set-up, surgery to the second hand was not anticipated during the 12 week follow-up period based on the waiting list times for elective hand surgery and discussion with the local clinicians. When the possibility of further surgery was re-asked

at FU1, 16 individuals (10%) responded that they were expecting CTR for their second hand within two months. All but two of these individuals had already returned to work when they completed FU1 and therefore their reported duration of work absence will not have been influenced by any additional CTR surgery. However, it is possible that the remaining two individuals, both of whom reported periods of work absence that were longer than the median, had undergone CTR to the other hand during this period. However, the small number of individuals involved means that this is unlikely to affect the overall study findings.

5.4.8.5 Assessment of pain

Pain was assessed at all time points as part of a self-reported measure of CTS symptoms (CTS-6) [250]. In addition, the follow-up questionnaires contained an assessment of scar-related symptoms including pain [254]. It is however a limitation that the study did not include a specific pain scale, such as the visual analogue scale [276], which would have enabled a comparison of CTS pain and post-surgical pain using the same scale and facilitated comparison with other study populations.

5.4.8.6 Occupational information

A standardised occupational classification system based on functional upper limb tasks was not identified when searching the literature for this thesis, nor in discussion with established researchers in this field. Existing upper limb functional status measures focus on identifying functional problems, rather than categorising occupation [277]. REACTS participants were therefore defined as working in manual or non-manual roles based on their job title and industry using the Office for National Statistics SOC [112] and Cascot coding system [236]. This is a standardised and transparent coding tool, but there could still be discrepancies if the individual's job title did not accurately reflect their job role. As discussed in Section 5.2.3.1.3, to counter this, participants were also asked about upper limb functional activities in their job as part of the baseline questionnaire. Each activity was included in the analysis of factors influencing return to work time and were assessed independently of the classification of manual or non-manual work.

5.4.8.7 Confounding

Steps were taken to identify possible confounders of the duration of work absence after CTR. This included the literature reviews in Chapters 1 and 3 and by directly asking clinicians as part of the survey reported in Chapter 4. The identified variables were incorporated into the participant questionnaires developed for the current study. However, as with all observational studies, the potential impact of confounding needs to be considered. This may be particularly important for the finding that expected duration of work absence was strongly associated with the actual duration. Many factors could have both shaped this expectation and independently influenced return to work time, such as the information the individual received from healthcare professionals and other sources, which may itself have been guided by the nature of their work. In addition, individuals may have held strong personal beliefs regarding when it might be appropriate for them to resume their work duties. It is not possible to assess these complex relationships within the current data, but the potential influence of additional confounding factors needs to be considered when interpreting the study findings.

5.4.8.8 Power

Recruitment was slower and lower than anticipated based on preliminary estimations from the sites. Strategies to maximise recruitment included: adding additional sites; increasing the duration of the recruitment period; involving local research nurses; and providing updates which compared recruitment rates between sites in an attempt to generate competition. However, a number of analyses lacked power due to small numbers of participants within subgroups. This raises the possibility of type II errors and with a larger sample size, additional variables may have been found to be significantly associated with return to work time, or poor outcomes. However, the REACTS study was notably larger than previous prospective research that explored determinants of the time to return to work after CTR [109, 111, 261] and the post-hoc power calculation identified that the sample was acceptable for the analysis of factors associated with the duration of work absence.

5.5 Summary

The REACTS prospective cohort study identified when and how patients recruited from 16 different UK sites returned work after CTR. Return to work times were also identified for the range of occupational characteristics that had been identified in the systematic review (Chapter 3) and introductory chapter (Chapter 1). Exploration of the factors associated with the duration of work absence found that those who used a computer at work for more than an hour per day were more than twice as likely to return to work earlier than those who did not use a computer, or who did so for shorter periods. No other occupational factors were identified as significant.

Two demographic factors also appeared to be associated with the duration of work absence after CTR: both women and smokers were more likely to take longer to return than their respective reference categories. In addition, those who believed that their CTS symptoms were caused by their work were more likely to take longer to return, while those who expected to return to work earlier were significantly more likely to do so. Importantly, earlier return to work was not associated poorer outcomes.

Thematic analysis of the return to work advice that participants recalled receiving found that the general content of this advice was very similar, however the timescales recommended for resuming specific activities, such as driving, varied widely. The next chapter of this thesis will continue the exploration of return to work advice through an in-depth inquiry of patients' individual experiences.

Chapter 6 Return to work after carpal tunnel release: a qualitative interview study

6.1 Publication

This interview study has been published in BMC Musculoskeletal Disorders [278]. The approved publication is provided in Appendix R. The following chapter provides a detailed description of the study, including the design of the interview schedule and the analysis process. Additional support was provided by Charlotte Brooks (occupational therapist, University Hospital Southampton NHS Foundation Trust and healthcare researcher, University of Southampton), who assisted the lead author with the Framework analysis.

6.2 Introduction and study objectives

Traditionally, quantitative and qualitative healthcare research have been viewed as separate disciplines. Quantitative research arose from a positivist paradigm with the focus on searching for 'truth' and 'facts' via the assessment of measurable elements; a contrast to qualitative research, which has its focus on the 'subjective' exploration of opinions and motivations [279]. While these two disciplines arise from different ontological (the nature of being) and epistemological (the nature of knowledge) perspectives, the complexity of researching health and healthcare increasingly requires combined or 'mixed methods' approaches [280]. Furthermore, these two disciplines are interlinked in current clinical training and practice, as illustrated by the biopsychosocial model of health [281, 282]. This model explores the interplay between biological, psychological and social factors to help determine why an individual patient might experience a health problem.

From a research perspective, the biopsychosocial model emphasises a focus on the interdependent, rather than separate, nature of these three elements. The qualitative aspect of this thesis was designed to enable the perspectives of individual participants to be explored in detail and for the findings to be presented alongside the quantitative

analyses from the REACTS cohort study. The COREQ checklist (COnsolidated criteria for REporting Qualitative research) was used to guide the development and reporting of this chapter and the completed checklist is provided in Appendix S.

6.2.1 Study objectives

This interview study was developed to gain a greater understanding of patients' experience of returning to work after CTR. The objective was to explore the views of a purposive sample of patients in depth, in order to identify common themes that described the key elements of their experiences and any recurring barriers and facilitators for returning to work.

6.2.2 The researcher's perspective

An important element of qualitative research is that the researcher is aware of their contribution to data generation through their interaction with the research participants and of their contribution to data analysis through the interpretation of the data content. Awareness of this involvement is a key component of establishing the validity/ truthfulness of the qualitative study, regardless of the quality criteria adopted [122, 283]. As part of this reflexive approach, a summary of the lead researcher's background and the steps taken to highlight any preconceptions that might have influenced the data collection and/or the analyses is provided in Appendix T.

6.3 Methods

6.3.1 Study design

Semi-structured one-to-one interviews were used to explore individual experiences and to gain feedback and reflection on the process of return to work. Individual interviews allowed a detailed investigation of the personal perspectives and context for each interviewee, while the semi-structured format enabled similar questions to be asked to all interviewees. Focus groups were considered, but the geographically wide recruitment

area meant that this would have involved extensive travel for participants, potentially limiting recruitment, especially as all participants also had work commitments.

Steps were taken to build rapport with the interviewees both before and during the interview. This included the content of email and/or telephone correspondence when arranging the interview timing, and the initial introductory section of the interview. These steps were considered important to enable the participant to feel safe and willing to talk freely about their experiences [284, 285].

6.3.1.1 Development of the interview schedule

The interview schedule was informed by the literature reviews completed for Chapter 1 and Chapter 3 of this thesis. The aim was to target the gaps in the existing literature while also providing additional details to complement the cohort study (Chapter 5). Feedback on the content and wording was obtained from the REACTS patient advisory group, practising clinicians (two hand therapists and one hand surgeon) and the supervisory team, in an iterative process involving three reviewed versions. The final interview schedule was designed to guide the interviewees to reflect upon their expectations and experiences of the CTR process, their post-operative hand function and returning to work. Open ended questions were used throughout to allow the interviewee to have flexibility in the context of the conversation. Interviewees were also asked to discuss, hypothetically, the advice they would give to others in a similar situation, with the benefit of their experience. This question was added to guide interviewees to think about the elements of their experience that might be most helpful to others, and to perhaps provide context for any clinical guidance developed. All attempts were made to phrase the interview questions simply and adopting language that had previously been used by the interviewee. The final draft of the interview schedule was piloted with a member of the patient advisory group prior to commencing the study interviews. At this stage, minor amendments were made to the wording of several questions and extra probes were added.

The question topics and the justification for inclusion are shown in Table 6.1 and the full interview schedule is included Appendix U. In addition to the structured questions, there were lists of prompts for the interviewer to probe in situations where those topics had

not already been raised by the interviewee [284]. The interview schedule provided a structure for the interview, however after the initial question, the interviewer used the guide flexibly and altered the order of questions according to the interviewee's responses.

Table 6.1 Interview questions and summary of the rationale for inclusion

Interview question	Rationale for inclusion
1. How does you work involve you using your arms and hands day-to-day?	- Explore work-related hand-use - Identify changes in work role as a result of CTS or CTR - Identify any reported links between work and CTS development
2. Please tell me about how your hands and wrists felt before you had surgery?	- Provide a background to the perceived level of CTS symptoms - Explore any difference between pre- and post-operative symptoms
3. How do your hands feel now?	- Identify any residual (or new) symptoms - If so, explore whether they attribute these symptoms to any particular factors
4. How did you decide to have the carpal tunnel release surgery?	- Explore decision-making and expectations surrounding CTR surgery
5. What sort of information were you given about your surgery and going back to work afterwards?	- Explore different sources of information accessed - Explore the focus of this information
6. What medical treatment did you receive after your surgery?	- Explore the different stages of the post-operative care pathway and the participants views of this process - Identify which healthcare practitioners are/could be involved in providing return to work advice
7. How did you decide when to return to work?	- Explore the reasoning behind return to work decision-making - Identify influential factors in return to work decision-making
8. Tell me about your return to work and how it went?	- Explore the positive and negative experiences of the individual's return to work
9. Do you think you were 100% fit to do your job when you returned to work?	- Explore graded return to work and provision/need for additional assistance
10. While off work how did you manage with your home or family commitments?	- Understand the functional impacts during the immediate post-operative period - Explore any links between function at home and return to work timing
11. With the benefit of your experience, what advice would you give about returning to work to a friend who needed a carpal tunnel release?	- Focus interviewees on identifying the elements of returning to work that were most important to them
12. Is there anything that you would like to add about returning to work after your surgery that we haven't discussed?	- Avoid closing the conversation with interviewer-led questions - Allow participants to add any other reflections, comments or suggestions

CTS carpal tunnel syndrome, CTR carpal tunnel release.

6.3.1.2 Participants and recruitment

A purposive (or criterion-based) sample of participants was recruited from the REACTS cohort study. Eligible individuals were those who had completed questionnaires at all three time points (pre-operatively, and at 4 and 12 weeks after CTR). The sampling frame took into account age, sex, type of work and work contract, study site and duration of post-operative work absence. These characteristics were chosen on the basis of the systematic review (Chapter 3) and survey of clinicians (Chapter 4), which suggested that these factors may be important for return to work outcomes, and to ensure demographic spread. The use of purposive sampling to direct the targeted recruitment of individuals with the desired characteristics is recommended to ensure a detailed exploration of the key research questions across a variety of experiences [286].

The operationalisation of the sampling frame involved several steps. Initially, interview invitations and the study participant information sheet were sent to all consenting participants on completion of the REACTS cohort study (Appendix V). The invitation included a reply slip and pre-paid envelope, in addition to the phone number and email address for the lead researcher. Participants were able to choose how they wished to respond. A log was kept of participant characteristics for enrolled interviewees according to the sampling frame, and this was then used to target the subsequent invitations to participants with the demographic or occupational characteristics that were absent from the sample. The focus of this recruitment strategy was to ensure that diverse patient experiences were included in the study in order to maximise understanding of returning to work after CTR.

Interviews were offered face to face, either at a private office space within the University of Southampton, at the participant's home, or via telephone. All interviews were conducted by the lead researcher and were audio recorded. The audio files were transcribed verbatim by the UK Transcription Company (under a Data Sharing Agreement that was approved by the NHS, HRA and University of Southampton). Transcripts were not returned to participants for comment or correction, but were reviewed against the audio recording by the lead researcher (and amended, if appropriate). Interviewees were provided with a £10 High Street Voucher as a token of thanks.

Recruitment commenced once the first REACTS study participant had completed all stages of the cohort study and continued until the lead researcher and supervisory team were confident that data saturation was achieved. The definition of data saturation was two-fold to encompass both sampling and analytical saturation [287]. The first phase of saturation occurred when the interviewer began hearing the same comments repeated multiple times by different interviewees [288], and this was confirmed by the second phase of saturation when no new codes were identified during the initial data analysis [289]. The flow of the study is illustrated in Figure 6.1.

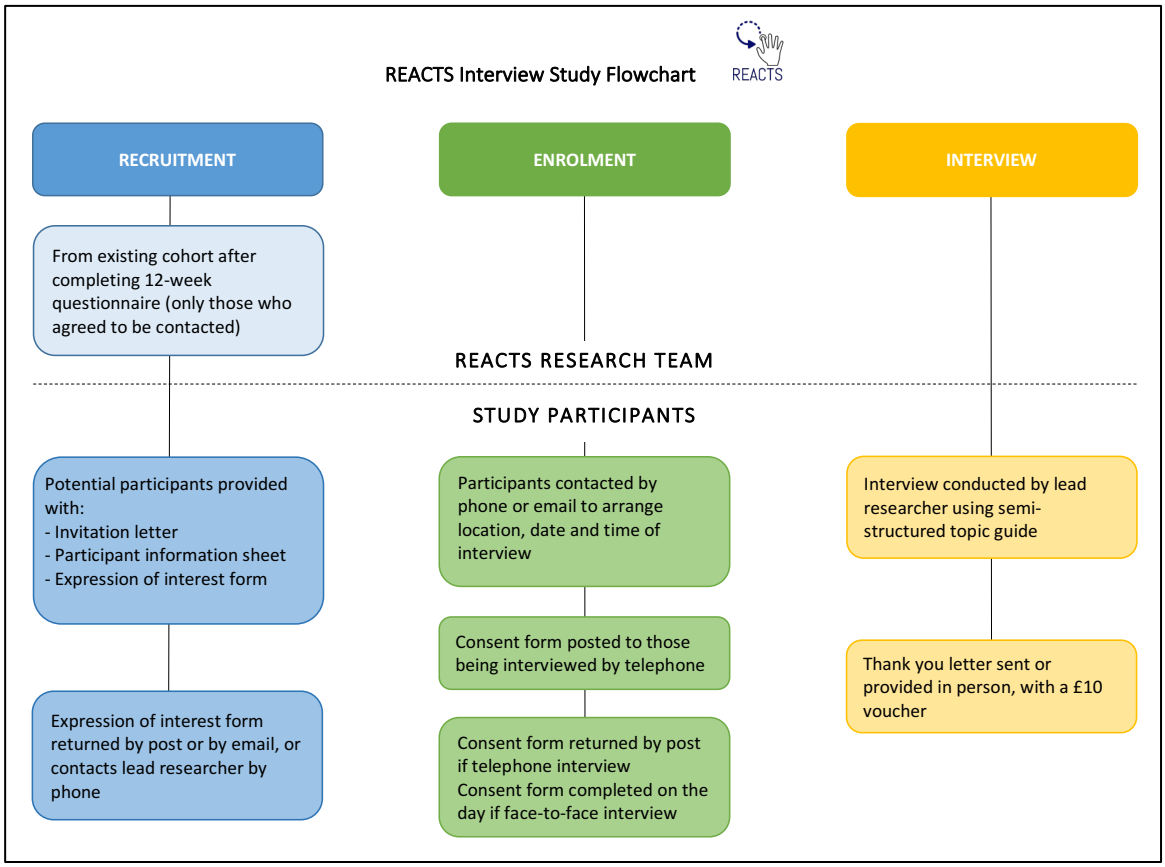


Figure 6.1 Flowchart of the qualitative interview study

6.3.1.3 Analysis

Data were managed and analysed using the Framework Method [290]. This is a multistage process that involves: familiarity with the interview; coding; developing and applying an analytical framework; charting data into a framework matrix; and interpreting the data [291]. The Framework Method was chosen due to its systematic and clearly defined approach [290], which complements the quantitative components of this thesis.

The process adopted in the current study is outlined below, adapted from the Framework Method structure and terminology described by Gale et al. [291].

6.3.1.3.1 Familiarisation

The first stage of framework analysis involved familiarisation with the data. In addition to the audio recording and verbatim transcription, the interviewer made brief notes during the interviews to highlight the participants' emphases and to note any immediate analytical thoughts. After each interview, this was incorporated into an interview log, which included descriptive, reflective and analytical comments, an example of which is shown in Appendix W. Familiarity with the content of the interview was achieved by listening and re-listening to the audio recording in addition to reading and re-reading the transcript and reviewing the interview log. This allowed any important contextual issues to be noted on the transcript. Initial analytical thoughts and impressions were noted on the right margin of the transcripts during this stage. The interview log was also used as a tool for critical reflection on the interview process and to focus improvements in interview technique.

6.3.1.3.2 Initial coding

After familiarisation, each sentence of the interviews was given a code (or codes). This was a label that described what had been interpreted as the important content of the sentence. There were no formally pre-identified codes, and codes were developed inductively in response to the transcripts. However, the study was conducted in the context of the whole thesis and the topics raised in earlier chapters of this thesis were included where mentioned by interviewees. The lead researcher (LN), and members of the supervisory team (CB, KWB and JA) independently completed the familiarisation and initial coding for the first interview. LN and CB repeated this process for an additional interview. This enabled the coding framework to be developed collaboratively. Codes referred to values, beliefs and emotions in addition to a descriptive summary of the content. An example of the initial coding and familiarisation comments are shown in the excerpt below (Table 6.2). The first two stages of analysis (familiarisation and initial coding) were performed following each interview and preliminary analytical ideas were continually noted, developed and re-developed.

Table 6.2 Example of the initial interview coding and analytical comments

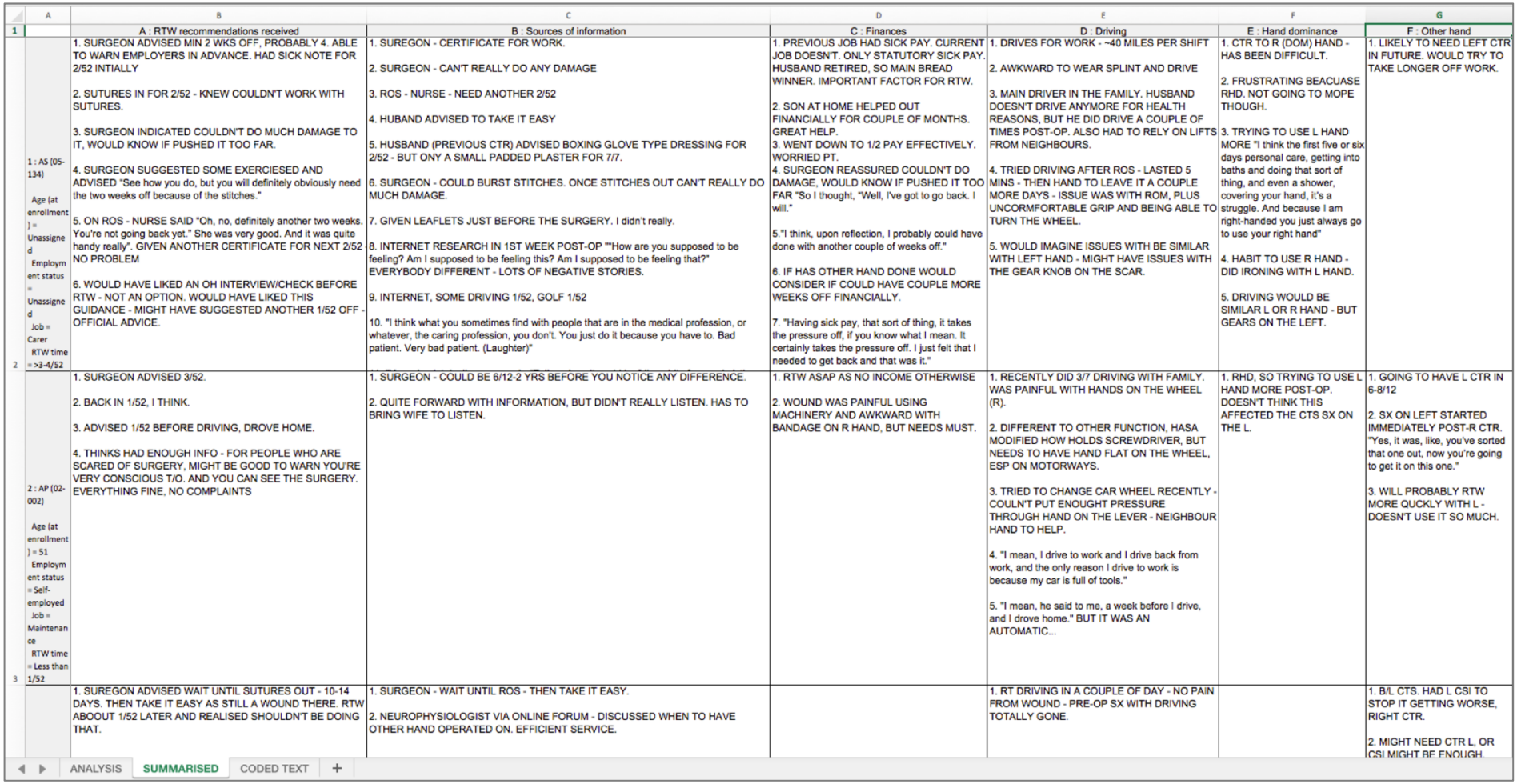
Coding	Interviewee text (participant #106)	Comments
Symptom severity *Non-operative interventions* *Post-operative function (immediate period)* *Frustration with lack of function*	Well, yes. I mean, before I had the operation, they were both quite bad although the right one was always worse. So I was wearing a splint for both wrists. Then, when I came home and had the other one bandaged up, got a couple of days into it and it was driving me mad not being able to move either of them so I gave up with the splint on the left one and it's - touch wood, I've not used it again yet.	*Difficulty managing with left splint after right CTR – situation led to splint wean for left. Was the splint necessary if okay without it? Any advice about post-operative function? Additional issues with bilateral symptoms?*

6.3.1.3.3 Developing and applying the analytical framework

Once coding had been completed for the first five interviews, the research team met to discuss the identified codes and to formalise the content of the working analytical framework. This involved the use of common language to label the codes and discussion of initial ideas of ways that the codes could be clustered and interlinked. However, coding was an iterative process with new codes being added to this framework and earlier interviews re-coded, if appropriate, once new codes were identified. After all interview transcripts had been coded, the analytical framework was then formally applied. The transcripts were uploaded on to NVivo (Version 11, QSR International Ltd) and the coding framework was applied to each transcript.

6.3.1.3.4 Charting data to form the framework matrix

The matrices function in NVivo was used to create a spreadsheet of the interviewees' text, which allowed the data to be viewed by code and by interviewee. The coded text was then summarised (or 'charted') by the lead researcher to illustrate the key points for each passage of text. This summarisation stage is a key part of the Framework Method and is required to make the matrices manageable for the interpretive analyses across all interviewees [291]. An example of the charting process is shown in Figure 6.2. Using NVivo, these summaries remained linked to the original text for reference and the grouping of the codes within each matrix spreadsheet could be easily switched to allow interrogation of different aspects of the data across all interviewees. The charted frameworks were reviewed and discussed by the supervisory team.



	A	B	C	D	E	F	G
1		A : RTW recommendations received	B : Sources of information	C : Finances	D : Driving	E : Hand dominance	F : Other hand
2	1 : AS (05-134) Age (at enrollment) = Unassigned Employment status = Unassigned Job = Carer RTW time = >3-4/52	1. SURGEON ADVISED MIN 2 WKS OFF, PROBABLY 4. ABLE TO WARN EMPLOYERS IN ADVANCE. HAD SICK NOTE FOR 2/52 INTIALLY 2. SUTURES IN FOR 2/52 - KNEW COULDN'T WORK WITH SUTURES. 3. SURGEON INDICATED COULDN'T DO MUCH DAMAGE TO IT, WOULD KNOW IF PUSHED IT TOO FAR. 4. SURGEON SUGGESTED SOME EXERCIESED AND ADVISED "See how you do, but you will definitely obviously need the two weeks off because of the stitches." 5. ON ROS - NURSE SAID "Oh, no, definitely another two weeks. You're not going back yet." She was very good. And it was quite handy really". GIVEN ANOTHER CERTIFICATE FOR NEXT 2/52 NO PROBLEM 6. WOULD HAVE LIKED AN OH INTERVIEW/CHECK BEFORE RTW - NOT AN OPTION. WOULD HAVE LIKED THIS GUIDANCE - MIGHT HAVE SUGGESTED ANOTHER 1/52 OFF - OFFICIAL ADVICE.	1. SUREGON - CERTIFICATE FOR WORK. 2. SURGEON - CAN'T REALLY DO ANY DAMAGE 3. ROS - NURSE - NEED ANOTHER 2/52 4. HUBAND ADVISED TO TAKE IT EASY 5. HUSBAND (PREVIOUS CTR) ADVISED BOXING GLOVE TYPE DRESSING FOR 2/52 - BUT ONY A SMALL PADDED PLASTER FOR 7/7. 6. SURGEON - COULD BURST STITCHES. ONCE STITCHES OUT CAN'T REALLY DO MUCH DAMAGE. 7. GIVEN LEAFLETS JUST BEFORE THE SURGERY. I didn't really. 8. INTERNET RESEARCH IN 1ST WEEK POST-OP ""How are you supposed to be feeling? Am I supposed to be feeling this? Am I supposed to be feeling that?" EVERYBODY DIFFERENT - LOTS OF NEGATIVE STORIES. 9. INTERNET, SOME DRIVING 1/52, GOLF 1/52 10. "I think what you sometimes find with people that are in the medical profession, or whatever, the caring profession, you don't. You just do it because you have to. Bad patient. Very bad patient. (Laughter)"	1. PREVIOUS JOB HAD SICK PAY. CURRENT JOB DOESN'T. ONLY STATUTORY SICK PAY. HUSBAND RETIRED, SO MAIN BREAD WINNER. IMPORTANT FACTOR FOR RTW. 2. SON AT HOME HELPED OUT FINANCIALLY FOR COUPLE OF MONTHS. GREAT HELP. 3. WENT DOWN TO 1/2 PAY EFFECTIVELY. WORRIED PT. 4. SURGEON REASSURED COULDN'T DO DAMAGE, WOULD KNOW IF PUSHED IT TOO FAR "So I thought, "Well, I've got to go back. I will." 5."I think, upon reflection, I probably could have done with another couple of weeks off." 6. IF HAS OTHER HAND DONE WOULD CONSIDER IF COULD HAVE COUPLE MORE WEEKS OFF FINANCIALLY. 7. "Having sick pay, that sort of thing, it takes the pressure off, if you know what I mean. It certainly takes the pressure off. I just felt that I needed to get back and that was it."	1. DRIVES FOR WORK - ~40 MILES PER SHIFT 2. AWKWARD TO WEAR SPLINT AND DRIVE 3. MAIN DRIVER IN THE FAMILY. HUSBAND DOESN'T DRIVE ANYMORE FOR HEALTH REASONS, BUT HE DID DRIVE A COUPLE OF TIMES POST-OP. ALSO HAD TO RELY ON LIFTS FROM NEIGHBOURS. 4. TRIED DRIVING AFTER ROS - LASTED 5 MINS - THEN HAND TO LEAVE IT A COUPLE MORE DAYS - ISSUE WAS WITH ROM, PLUS UNCORMFORTABLE GRIP AND BEING ABLE TO TURN THE WHEEL. 5. WOULD IMAGINE ISSUES WITH BE SIMILAR WITH LEFT HAND - MIGHT HAVE ISSUES WITH THE GEAR KNOB ON THE SCAR.	1. CTR TO R (DOM) HAND - HAS BEEN DIFFICULT. 2. FRUSTRATING BEACUASE RHD. NOT GOING TO MOPE THOUGH. 3. TRYING TO USE L HAND MORE "I think the first five or six days personal care, getting into baths and doing that sort of thing, and even a shower, covering your hand, it's a struggle. And because I am right-handed you just always go to use your right hand" 4. HABIT TO USE R HAND - DID IRONING WITH L HAND. 5. DRIVING WOULD BE SIMILAR L OR R HAND - BUT GEARS ON THE LEFT.	1. LIKELY TO NEED LEFT CTR IN FUTURE. WOULD TRY TO TAKE LONGER OFF WORK.
3	2 : AP (02-002) Age (at enrollment) = 51 Employment status = Self-employed Job = Maintenance RTW time = Less than 1/52	1. SURGEON ADVISED 3/52. 2. BACK IN 1/52, I THINK. 3. ADVISED 1/52 BEFORE DRIVING, DROVE HOME. 4. THINKS HAD ENOUGH INFO - FOR PEOPLE WHO ARE SCARED OF SURGERY, MIGHT BE GOOD TO WARN YOU'RE VERY CONSCIOUS T/O. AND YOU CAN SEE THE SURGERY. EVERYTHING FINE, NO COMPLAINTS	1. SURGEON - COULD BE 6/12-2 YRS BEFORE YOU NOTICE ANY DIFFERENCE. 2. QUITE FORWARD WITH INFORMATION, BUT DIDN'T REALLY LISTEN. HAS TO BRING WIFE TO LISTEN.	1. RTW ASAP AS NO INCOME OTHERWISE 2. WOUND WAS PAINFUL USING MACHINERY AND AWKWARD WITH BANDAGE ON R HAND, BUT NEEDS MUST.	1. RECENTLY DID 3/7 DRIVING WITH FAMILY. WAS PAINFUL WITH HANDS ON THE WHEEL (R). 2. DIFFERENT TO OTHER FUNCTION, HASA MODIFIED HOW HOLDS SCREWDRIVER, BUT NEEDS TO HAVE HAND FLAT ON THE WHEEL, ESP ON MOTORWAYS. 3. TRIED TO CHANGE CAR WHEEL RECENTLY - COULN'T PUT ENOUGHT PRESSURE THROUGH HAND ON THE LEVER - NEIGHBOUR HAND TO HELP. 4. "I mean, I drive to work and I drive back from work, and the only reason I drive to work is because my car is full of tools." 5. "I mean, he said to me, a week before I drive, and I drove home." BUT IT WAS AN AUTOMATIC...	1. RHD, SO TRYING TO USE L HAND MORE POST-OP. DOESN'T THINK THIS AFFECTED THE CTS SX ON THE L.	1. GOING TO HAVE L CTR IN 6-8/12 2. SX ON LEFT STARTED IMMEDIATELY POST-R CTR. "Yes, it was, like, you've sorted that one out, now you're going to get it on this one." 3. WILL PROBABLY RTW MORE QUCKLY WITH L - DOESN'T USE IT SO MUCH.
		1. SUREGON ADVISED WAIT UNTIL SUTURES OUT - 10-14 DAYS. THEN TAKE IT EASY AS STILL A WOUND THERE. RTW ABOOUT 1/52 LATER AND REALISED SHOULDN'T BE DOING THAT.	1. SURGEON - WAIT UNTIL ROS - THEN TAKE IT EASY. 2. NEUROPHYSIOLOGIST VIA ONLINE FORUM - DISCUSSED WHEN TO HAVE OTHER HAND OPERATED ON. EFFICIENT SERVICE.		1. RT DRIVING IN A COUPLE OF DAY - NO PAIN FROM WOUND - PRE-OP SX WITH DRIVING TOTALLY GONE.		1. B/L CTS. HAD L CSI TO STOP IT GETTING WORSE, RIGHT CTR. 2. MIGHT NEED CTR L, OR CSI MIGHT BE ENOUGH

ANALYSIS | SUMMARISED | CODED TEXT | +

Figure 6.2 Excerpt of a charted framework matrix

6.3.1.3.5 Interpreting the data

Ideas about possible themes were noted throughout the analysis process and discussed with members of the supervisory team. The charted framework matrices were reviewed and organised to illustrate the key themes discussed by interviewees and to identify situations in which there were obvious differences. As the emerging themes were explored in detail, sub-themes were created to illustrate these differences. An example of this interpretation phase is shown in Figure 6.3. All themes and sub-themes were re-assessed against the full text transcripts to ensure that they were supported by, and representative of, the original data. The themes were reviewed and approved by all members of the research team and divergent views within the themes were discussed.

Figure 6.3 Example of the data interpretation process

6.3.1.4 Ethics approval

Combined ethics applications were made for the REACTS cohort study and this nested qualitative interview study. All approvals are listed in Section 5.2.8. At the time of recruitment to the cohort, participants were asked whether or not they wished to be contacted about the interview study. Separate consent was then obtained after recruitment to the interview study.

6.3.1.5 Assessment of quality in the current study

The Mays and Pope recommendations were used as quality criteria in the development of the current study [121]. An assessment of these criteria is shown in Appendix X. In addition to pursuing quality during the research process, the COREQ checklist was used as a tool to ensure that key criteria relating to qualitative research rigour were adopted when reporting the study (as also mentioned in Section 6.2) [122]. This included: reflection on the personal characteristics of the interviewer and their relationship with the study participants (Appendix T); defining the theoretical framework behind the study (Section 6.2); providing transparency regarding participant selection and data collection (Section 6.3.1.2); and providing transparency and clarity in data analysis and reporting (Sections 6.3.1.3 and 6.4). The completed COREQ checklist is provided in Appendix S.

6.4 Results

6.4.1 Participants

Fifteen individuals agreed to be interviewed from a total of 31 invitations. An initial 10 interviews were conducted, with an additional four interviews completed to a point where data saturation was reached. Contact was lost with one individual after consent was obtained, but before the interview was scheduled. Variation was achieved for all demographic characteristics included in the sampling frame (Table 6.3). Eight study sites were represented by the interview participants: Broomfield Hospital (one participant); Kent and Canterbury Hospital (three participants); Lymington New Forest Hospital (two participants); Queen Alexandra Hospital, Portsmouth (two participants); Southampton NHS Treatment Centre (one participant); Salisbury Medical Practice (two participants);

Tollgate Practice (one participant); and Wessex Nuffield Hospital (two participants). This gave a representation of NHS primary and secondary care services and private healthcare settings. As a number of the participants' jobs are quite specific, the recruiting sites are not listed for each participant in order to preserve anonymity. The interviews took place between August 2017 and June 2018.

The majority of interviewees were female (11/14) and the median age was 51 years. Most were employed, although self-employed workers and those on zero hours contracts were represented in similar proportions to the whole study cohort (Table 6.3). Interviewees worked in a range of different industries with varied occupational roles. Participant demographics are illustrated in Table 6.4. To maximise anonymity, pseudonyms were chosen based on commonly occurring names in the UK, and therefore do not represent the diversity of names that were present.

All interviews were conducted via the telephone, with the exception of one, which was conducted face to face at the MRC Lifecourse Epidemiology Unit at Southampton General Hospital. The mean interview duration was 27 minutes, and the range was 16-48 minutes. The median time between CTR and interview was 127 days (range 94-160).

Table 6.3 Demographic information for interviewees and the REACTS cohort (according to the characteristics included in the sampling frame)

	N	Median age (years) [range]	Number of females (%)	Type of work contract (%)			Median post-operative work absence (days)	
				Employed	Self-employed	Zero hours or temporary contract	Expected [range]	Actual [range]
Interviewees	14	51 [27-68]	11 (78.6)	10 (71.4)	3 (21.4)	1	21 [7-42]	21.5 [2-87]
Invited, but not interviewed	17	49 [37-70]	11 (64.7)	15 (88.2)	2 (11.8)	0	21 [2-42]	29 [1-99]
Whole REACTS cohort	217	52 [26-77]	132 (60.8)	167 (76.9)	41 (19.0)	4	14 [1-63]	20 [1-99]

N number of participants, REACTS return to employment after carpal tunnel release surgery.

Table 6.4 Demographic and occupational information for the interviewees

Pseudonym	Sex	Age [a] (years)	Type of work contract [b]	Job title	Available sick pay	Dominant hand	Side of CTR	Post-operative work absence (days)	
								Expected	Actual
Jill	Female	57	Employed	Sales assistant	Unsure	Right	Right	14	21
Debbie	Female	55	Employed	Nurse	>6 months	Right	Right	21	21
Alan	Male	51	Self-employed	Maintenance	<1 week	Right	Right	7	7
Sarah	Female	61	Self-employed	Horse livery owner	>6 months	Right	Right	NR	0
Peter	Male	51	Employed	Mechanic	<1 week	Right	Left	21	16
Emma	Female	55	Employed	Optician	1-6 months	Both	Left	42	42
George	Male	68	Self-employed	Gardener	<1 week	Left	Right	21	14
Helen	Female	53	Employed	Nurse	>6 months	Right	Right	21	8
Fiona	Female	27	Employed	Animal technician	1-6 months	Right	Right	21	21
Donna	Female	35	Employed	Police officer	1-6 months	Right	Left	14	42
Charlotte	Female	42	Employed	Postal worker	1-6 months	Right	Right	21	98
Vicky	Female	48	Employed	Secretary	1-6 months	Right	Right	7	4
Amanda	Female	42	Employed	Administrator	>6 months	Right	Right	14	6
Alison	Female	49	Zero hours contract	Carer	<1 week	Right	Right	17.5	28

[a.] Age at enrolment. [b.] All participants listed as employed reported having a permanent work contract. CTR carpal tunnel release, NR not reported.

6.4.2 Key themes identified from the interviews

Three main themes were identified from the interview texts. The first theme did not focus specifically on work, but rather a lack of preparedness for functional difficulties experienced in the immediate post-operative period: *it's not a 'minor' procedure*. The second theme explored the desire for *validation for time off* work, while the third encompassed the participants' reflections on *handling the return.* The three themes are explored below using illustrative quotes from the interviewees, labelled with pseudonyms to preserve anonymity. A summary of the themes is illustrated in Figure 6.4. The content of the participants' interview responses did not lead to the identification of universal barriers and/or facilitators for the return to work process, instead, provided insight to the context of return to work decision-making.

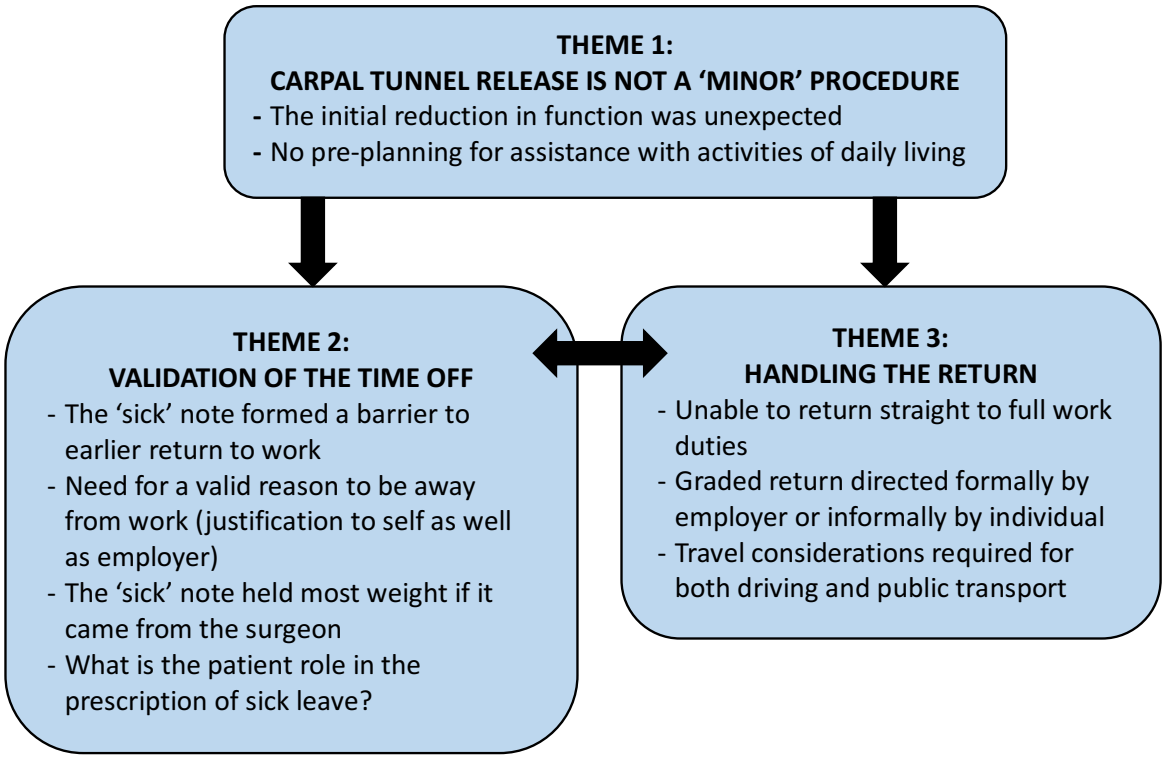


Figure 6.4 Key themes in the return to work after carpal tunnel release

6.4.2.1 Theme 1: Carpal tunnel release is not a 'minor' procedure

It appeared that the level of functional disability experienced by the interviewees in the immediate post-operative period was often unexpected. All interviewees recalled

difficulty with function and many reported that they had required assistance from their partners or children with personal and domestic activities of daily living. Showering and cooking were widely discussed as problematic, as were dressing and tying shoelaces. The quote from Fiona, below, gives an example of these issues:

> *"I suppose actually just mentally preparing myself, because obviously, I'd never had any surgery done on a hand or a foot, or anything like that before. Obviously, you don't realise beforehand how frustrating it's going to be to not be able to use it, if that makes sense? I even struggled with going for a shower, trying to wash your hair and things like that. I had to get my partner, bless him, to wash my hair. It's just mentally preparing yourself- To not be able to do as much as you would normally, but I suppose that's the same for any surgery. I suppose I just didn't prepare myself for what I could and couldn't do."*
>
> Fiona, animal technician (employed)

In particular, the wording used by participants focused on their own lack of mental and physical preparation. This was seen as something that they, personally, should have thought about and organised in advance of their surgery; something that they would do differently if there was a 'next time'; or would warn a friend who required CTR in the future. One participant, who lived alone, reflected that she would have planned for a friend to be available to help her had she been aware of the extent of her functional limitations in advance. None of the interviewees reported that they had made any prior plans for how to manage their daily activities in the initial post-operative period.

There seemed to be a pre-operative expectation that CTR would be a small procedure, but this did not appear to fit with the participants' experiences of their recovery. This mismatch between participants' expectations and experience could have been viewed negatively, however, while participants did raise this as a suggestion for improvement in future, most looked back on their immediate post-operative period with humour, recalling the unusual methods and strategies they had used to cope with having one hand out of action. The humour was identified as the laughter which punctuated many of the interviews, the choice of language and descriptions of humorous scenarios. Humour appeared to be a coping mechanism for the challenging and unexpected nature of the

situation in which they found themselves. Debbie's quote below illustrates several of these concepts, including a need for greater preparation, the mismatch between expectation and experience, the level of functional disability experienced and the use of humour:

> *"You don't realise how much you depend on your hands until you can't use them. I managed to adapt with having a shower and sticking my hand out behind the curtain. (Laughter). But washing hair and drying hair was an absolute nightmare. It didn't happen properly. (Laughter). Cooking, yes, was a nightmare. I found I couldn't lift a saucepan properly with my left hand. It wasn't as strong as my dominant hand. And even cutting up your dinner, you really don't realise. You do find ways to adapt in the end, but you just don't realise how you rely on your dominant hand all the time. It was a good fortnight to be able to even grip a knife to cut anything properly. I just couldn't grip it. It was too painful across the palm of the hand where the cut was, to grip the knife… But I think I would have prepared for it a bit more. Yes. Or even roped a friend in more to come and do things for me."*
>
> Debbie, nurse (employed)

Participants reported that they did recall receiving some information peri-operatively, but reported that this focused on wound management and avoidance of infection, or scar management, rather than movement or function. For example, Jill recalled the following information:

> "*When I was at the hospital they said make an appointment for 10 days to have them [the sutures] out. They told you about washing, about when to take the bandage off. I think I had, I think they may've given me one spare dressing."*
>
> Jill, sales assistant (employed)

Furthermore, the method of information delivery was often seen as impersonal, such as receiving a leaflet as part of a pack. This did not appear to give opportunity for any dialogue to take place between patient and clinician, or for the information to be personalised to the individual's needs. It appeared that the information received was standardised and limited to details that would be applicable to all CTR patients.

Participants felt that they were left to interpret general guidance for their own situation, but suggested that their clinicians could take a more proactive role in flagging up daily activities that might be difficult and suggesting ways to tackle this, as discussed by Emma:

> *"I was just told to keep it dry. No washing up. I was just told what I couldn't do, rather than anything that might help me do day-to-day tasks… I think the exercises could have been given in a different way. I was just given a sheet of paper. It was in my pack, it wasn't even pointed out to me. I found it in my pack. The trouble is in hospital, they give you lots of information, but it's in a pack. Whereas, if somebody has physically gone through the exercises with me, that would have been a good thing."*
>
> Emma, optician (employed).

All interviewees recalled struggling to be independent with basic ADLs in the immediate post-operative period. For many, this difficulty was unexpected and they recalled a lack of information about what they should and shouldn't be doing with their operated hand. Any thoughts or individual decisions about return to work were therefore made in the context of this period of reduced function.

6.4.2.2 Theme 2: Validation of the time taken off work

The second theme divided into three distinct subthemes, all concerning the nature and/or the process of obtaining validation for taking time away from work.

6.4.2.2.1 The sick note as a barrier for earlier return to work

Sickness certification was discussed by all employed participants. This was viewed as the formal process that allowed authorised work absence, and the method of communicating with their employer about when their clinician had 'permitted' return to work. Interestingly, none of these participants had returned to work before their specified time point, even when they were made aware that earlier return to work was possible. The language used by participants centred on the traditional sick note, rather than its replacement, the fit note, which has been in place since 2010. It appeared that participants held the recommended time frame for work absence recorded on this document as a definite minimum period of absence. In effect, the fit/sick note could be

perceived as a barrier, with participants only eligible to return to work after this prescribed time period. Importantly, this was the case for participants both with and without occupational sick pay. Interviewees appeared to trust their clinician that this was the correct thing to do in order to optimise their recovery. Having a certified period of work absence also appeared to legitimise the leave, not only to the employer, but to the patients themselves, as Fiona outlines:

> *"He did sign me off for three weeks. He said, 'Because of my work', but obviously, after the two weeks, I went to see him and I had the stitches out… Yes. He said then, 'You can return to work but on lighter duties'. He said he's done the sick note for three weeks, so it was up to me really… I was thinking about going back to work after two weeks, but that's just because you get a bit bored at home when you've got nothing to do. I'm glad I took the three weeks, because if I went back after two weeks, I would have done more than what I should have done… If your surgeon signs you off for a certain amount of time, I would take that, all of that time, to recover properly, yes."*
>
> Fiona, animal technician (employed)

Therefore, prescribed time points potentially limited earlier return to activities, including work. A number of interviewees recalled that they were *"not going to go against the surgeon's recommendation"* (Emma, optician). However, where a recommended timescale had not been given, one participant reported resuming driving soon after surgery to no ill effect, as illustrated by Sarah below. The interviewees illustrated the powerful impact that their clinician's advice had on their return to work times and decision-making. It appeared that where specific time points were given, interviewees were reluctant to resume the activity (work or other function) before the recommended time point. However, where advice was not specifically given, a number of participants used their own judgement and reported earlier return to function. This is illustrated by Sarah and Amanda's experiences of return to driving, both of whom were right handed and had CTR to their dominant hand. Sarah did not recall any particular advice regarding driving and returned within a few days:

> *"I probably had- I had it done over the weekend, and within a couple of days I was back driving, because I had absolutely nil pain from the wound. The pain that I used to get when driving was totally gone."*
>
> Sarah, stable owner (self-employed)

In contrast, Amanda was advised not to drive for two weeks and felt that this fitted with her level of post-operative functional ability:

> *Like, getting in the car, I didn't drive for over two weeks... I didn't feel happy to because my wrist felt, I don't know, just not quite strong enough. I was worried. It's alright if the roads aren't busy and you could just go along, but if I had to react to something quickly, I didn't feel comfortable with that. Yes. I was told, advised for two weeks not to and then to see how I felt after that."*
>
> Amanda, administrator (employed)

The above example of the timing and experience of return to driving highlights how different interviewees were receiving differing advice regarding when it was 'safe' to resume particular activities. This perhaps fed into the individual's actions in terms of following the advice received, or not, and perhaps how they felt about any pain or discomfort they experienced on initially resuming the activity.

There was a difference between employed and self-employed interviewees in their reported response to the return to work recommendations that they received. Unlike the employed participants, who returned to work after the timescale documented on the fit/sick note, those who were self-employed all reported returning to work earlier than had been verbally recommended. As might be expected, the reasons for this were primarily financial. All self-employed interviewees worked in roles with elements of heavy manual activity and reported return to work within 1-3 weeks of their surgery. None of these participants reported significant negative effects of earlier return to work, but on reflection, the majority felt that they had returned too soon. It is possible that the awareness that they had returned to work earlier than advised contributed to this reflection, as discussed by Alan below:

"I went back to work as soon as I possibly could, you know, because no one's going to pay me if I don't earn money…. Probably a little bit too early, I did jump the gun a little bit, but now I'm okay, so it's all good."

Alan, maintenance worker (self-employed)

6.4.2.2.2 It held more weight coming from the surgeon

The legitimisation of their period of work absence was discussed by several interviewees and formed an important part of their return to work process. Participants appeared grateful when they received a sick/fit note from their surgical team. Some felt this 'held more weight' than a sick/fit note from their GP while others had been concerned that they would not be able to get an appointment with their GP to provide certification for their sick leave. It is possible that employed interviewees were concerned about being viewed as malingerers by their employers or colleagues and felt that they needed strong justification for being off work. Overwhelmingly, the surgeon was viewed as the best person to provide this justification, as illustrated by Emma's quote which discusses a difference in her perception of certification if provided by the surgeon or GP:

"[The fit/sick note] was given to me straight away, so I didn't have to ask for it. That was one of the most helpful things. Having the six-week note from the surgeon, rather than having to go to my GP. It held more weight, coming from the surgeon."

Emma, optician (employed)

After the initial post-operative period, a number of interviewees who worked in manual roles reported that they would have found a return to work interview or assessment beneficial at the end of their period of prescribed sick-leave. These individuals did not feel quite ready to return to work at this point, but seemed to feel unable to extend their period of leave. The key reason for this appeared to be that they felt a need for an external individual to guide and reassure them that additional work absence was justified. In these interviews, they did not look to their surgeon to provide this information, rather someone from within their workplace, as described by Alison below. It appeared that these individuals were looking for someone with knowledge of their particular work role and pressures to be able to appropriately direct their return to work process and to endorse their belief that more time off was required:

"I think, on reflection, had I had an interview before returning to work, or had I had some sort of occupational health check, I think that would have guided me. Had they have said to me at that check then, 'Well, [Alison], let's give it another week', I would have said, 'Alright then'. Because I was being told officially, if you like. I've always been a little bit like that. I'm not the sort of person that will go off sick… You sort of get on with it, but then you realise that perhaps you should have given yourself another couple of weeks, I think. So that was it. There was no return to work interview or anything, which possibly in my previous employment I may well have had."

Alison, carer (zero hours contract)

6.4.2.2.3 The patient role in the prescription of sick leave

Recommended times to return to work or other functional activities, such as driving, were primarily viewed as prescribed time points, specified by the surgeon for the patient to follow. Only one individual reported initiating a dialogue around the duration of their sick leave. Vicky reported negotiating a shorter period off work when their fit/sick note was being written. This was on the day of surgery, suggesting that the participant may have decided when she would be able to return to work, in advance of any experience of her post-operative symptoms or functional ability:

"I mean, to be fair, he tried to sign me off for four weeks, and I said, 'How about one?' He said, 'Well, let's just say on light duties', and gave me a sick note, do you see what I mean?... I said to him- because he laughed and he went, 'Well, that's what I would do', So I said to him, 'We're both singing on the same hymn sheet, then'. I know some people would have been more than happy to go, 'Yes, great, I have a month off'. But like he said to me, 'If you like your job, what's the point?' Do you see what I mean?"

Vicky, secretary (employed)

While the large majority of participants highlighted the importance of following their clinician's recommendations, one interviewee held an opposing view on the role of advice. For this individual, a 68-year-old self-employed gardener, advice from any 'expert'

was not something to simply follow, but rather one consideration in a personal decision-making process:

> *"Well, you've just got to play it by ear really. When it was all strapped up it was a bit awkward. I was advised not to work, but of course I did. I mean sod that. I mean it's rather like accountants or anything else, you take the advice on board that they give you and adapt it to your own use."*
>
> George, gardener (self-employed)

6.4.2.3 Theme 3: Handling the return

Two commonly reported sub-themes occurred as participants discussed handling their return to work process. The first was the need for a graded increased in hand function, while the second centred on travelling to work.

6.4.2.3.1 Making a graded return to work

After their initial period of sick leave, most participants described features of a graded return to work. The degree of modification varied. For some individuals, this meant taking longer to carry out their work activities, asking co-workers to assist with heavier tasks, or wearing a protective wrist splint. For other interviewees, there was a formalised structure involving the employer and/or occupational health clinicians. None of the participants saw return to work as part of their post-operative rehabilitation, rather the emphasis was on resuming work roles without causing pain or damage to the healing hand.

The outcome of a workplace risk assessment was discussed by one interviewee. Fiona was very happy with her return to work and the processes in place to guide this, however, the language she used also ties in to the sub-theme described above, with the interviewee as a passive recipient following the work recommendations outlined by her employer, rather than playing an active part in the return to work decision-making:

> *"I had to do a risk assessment with the health and safety officer, my supervisor there. I wasn't allowed to do any cleaning for at least three to four weeks, I think it was… Yes, because of the heaviness, because of the actual manual work involved, they didn't want me to go back to that. Even when I did the feeding, they said, 'Oh,*

you can try feeding', because sometimes, you're still lifting heavy things. I wasn't allowed to lift panels. I could only lift feed buckets that I felt I was comfortable to."

Fiona, animal technical (employed)

The return to work process described by other interviewees was more informal and self-directed, but still had elements of gradually resuming normal activities, as Peter, who worked as a mechanic, discusses below:

"*I was planning just to go back and go on the computer and do the invoices and things, but that didn't work out, so I just did light stuff that I could do with my right hand. If there was anything that I needed to move or lift then someone else moved or lifted it for me*."

Peter, mechanic (employed)

Some interviewees reported hand/wrist pain associated with return to work. They linked the pain to specific work tasks, such as using hand-held machinery, opening jars and pushing down on a stapler. For many this served as a reminder to use the hand less forcefully or to modify the activity. Other interviewees reported that lack of dexterity and/or strength were their main problems on return to work. This meant that there were certain activities they felt physically unable to do when they first returned. Interviewees described breaking down their work role into activities that they could and couldn't do, as Debbie recalled:

"I mean, I was there in body and useful to do some things, but I couldn't do the full job for a start. I couldn't grip, to be quite honest. I couldn't do the like taking out stitches and things like that at work. I couldn't grip the scissors properly."

Debbie, nurse (employed)

Interviewees who had control of, or were involved in, the organisation of their work tasks upon their return appeared to be content with their return to work process. This contrasted with a small group of individuals who felt unsupported by their employers and struggled with the expectation that they should return to full active work duties as reflected by Emma:

> *"I'm not 100% fit, I would say. If I had lots of people come in to adjust their glasses, I would be in pain by the evening… I think, even now, I would prefer it to be arranged better for me, so there were not so many people at once. Still, with consideration".*
>
> Emma, optician (employed)

Regardless of the job role or duration of work absence, all participants reported a need to modify their work activities to some extent when they first returned. Only one participant reported receiving advice about how to return to work from their surgical team. Charlotte reported being advised to *"go back on light duties; answering the phone and typing"* (Charlotte, postal worker). In contrast, the majority of interviewees specifically highlighted an absence of tailored return to work advice from their surgeon. Interviewees recalled that the principal advice from their surgeons was how long to take off work. For some, this led them to feel that they had returned to work too soon. This was particularly the case for interviewees with manual roles (i.e. those who potentially required greater work modifications) and those without a formal work-based return to work process (i.e. those without other 'official' sources of targeted return to work advice). This experience is illustrated by Emma and Jill below. Emma found that she had to initiate the discussion about work and found the guidance unclear:

> *"When the surgeon found out what I did, and that I used my hands a lot, he recommended the full six weeks off work. He said, 'Normally I would recommend four weeks off work, but because of what you do, I would recommend the full six weeks off work'. Just that really, a bit of a chat about the length of time to be off work. I didn't have any advice on what to do when I went back…. None of them talked about work, unless I asked. I said to my surgeon, 'What should I be doing?'. He said, 'Just treat it as normal now. Just use your hand as normal, but take it slowly'. I thought, 'What does that mean?'."*
>
> Emma, optician (employed)

Jill reflected that perhaps she would have received more information about return to work if she had asked additional questions, or if the surgeon knew more about her job:

> *"Yes, I didn't get too much actually from [the surgeon], maybe it was me not asking the right questions but sometimes you just don't think or you don't know always what to ask. Not in advance, on the day they gave me the little printed leaflet about carpal tunnel surgery… Yes, I mean in the little leaflet they gave you it's a rough sort of ballpark from the myriad of jobs that are out there, you know, most people would go back doing this, most people drive within this amount of time. They didn't ask me what I did and specifically tailor anything to that, no."*
>
> Jill, sales assistant (employed)

The need for more information about return to work and function was important for many interviewees, who commented that their advice to future CTR patients would be to ask the clinicians lots of questions. As summarised by Alison:

> *"I would say to any of my colleagues, particularly as I'm the mummy of the group, 'If you want to ask questions, just ask as many questions as you can. Be comfortable with that'."*
>
> Alison, carer (zero hours contract)

This was especially suggested during the pre-operative appointments. Interviewees advised gathering appropriate information to share with their employers in advance of the surgery and to discuss how to return to work in addition to the suggested duration of time off. This ties in with the idea of the interviewees seeking legitimisation in order to justify taking a period of time off work and then making a graded return to their usual work function, as Emma observed below:

> *"I suppose, having something to take back to my employer, would have been useful. Some sort of note from the surgeon saying, as a result of the type of operation, type of procedure I had had, what they should allow me to do. To not put me under pressure, and that kind of thing. Basically, it was me having to tell them and them believing me. Whereas if I had had something formal and official to show them, to say, 'Look, this is what I've got to be allowed to do now, because it's part of my recuperation. If you don't support this, then it could slow down the whole process or cause damage in the future'."*

Emma, optician (employed)

6.4.2.3.2 Travelling to work

The need to drive was a limiting factor for return to work for a large group of interviewees. Many reported that a lack of public transport made it extremely difficult to get to work if they were not able to drive, as illustrated by Debbie:

> *"I don't have a bus to get because of the shift time, so I have to drive."*
>
> Debbie, nurse (employed)

However, Charlotte, who was reliant on public transport to travel to work, also found this difficult in the early post-operative stages:

> *"[It was] a little bit of a struggle when I get- I use the public transport because- I mean you've got only one hand and then when you want to get on and get off, it's quite difficult."*
>
> Charlotte, postal worker (employed).

Two recommendations were commonly recalled relating to return to driving. The first, that they had been advised to return after removal of sutures, and the second, to return from two weeks after surgery. In practice, these are similar time points, as sutures are usually removed at 10-14 days. As with the return to work time points discussed above, most interviewees reporting strictly adhering to the advice they were given: *"Obviously I couldn't drive until I had the stitches out"* (Vicky, secretary). In comparison, several interviewees reported driving at earlier time points, as shown in the quote below and also discussed in Section 6.4.2.2.1:

> *"I mean, he said to me, a week before I drive, and I drove home. But I had an automatic at the time, so it didn't bother me."*
>
> Alan, maintenance worker (self-employed)

As with the provision of other post-operative or work-related information, a few interviewees did not recall being given any information about driving. Again, it appeared that they were looking for validation from their surgeon before they felt safe, authorised

or confident to resume this activity. Fiona recalled phoning the surgery team to find our whether she was permitted to start driving:

> *"[What] was unclear was whether you're allowed to drive or not, that was the only thing that wasn't made 100% clear to me. Obviously, when I had the stitches in and stuff, you can't really do too much, but after I had the stitches taken out, I wasn't sure whether I was- I assumed I was allowed to drive, but there wasn't much information… Yes, it was a couple of days after the stitches. I did phone the surgery just to be sure, because I wasn't sure in terms of after surgery."*
>
> Fiona, animal technician (employed)

A number of other interviewees also raised the different requirements for driving depending on the side of surgery or the type of car. One interviewee, who had CTR to both hands within the REACTS study period, highlighted the main perceived differences:

> *"But the left was worse than the right, because of course I've got a manual car, so the gear change was particularly- I wouldn't say difficult. I wouldn't say I would have gone on a long journey, I wouldn't like to have done an emergency stop. Yes, so gear changing was probably challenging, I think the word is (laughter). I had to use two hands to pull the handbrake on when I had the left done, but the right, because - you don't use your right, you only use it on the steering wheel."*
>
> Vicky, secretary (employed)

6.5 Discussion

The aim of this study was to gather in-depth interview data from a sample of REACTS study participants to explore the patient experience of carpal tunnel release and returning to work. Three key themes were identified from the interviews: the perception that CTR is *not a 'minor' procedure*; the desire for both internal and external *validation of the time off* work; and reflections on *handling the return* to work. These findings illustrate important messages that add to the previous components of this thesis and provide context for the development of any specific return to work recommendations.

Unexpectedly, explicit barriers or facilitators for return to work were not identified, instead the picture appeared more complex and many aspects of the three key themes were interpreted as both a barrier and a facilitator for return to work. For example, interviewees appeared to be seeking specific information from the surgeon regarding when they should return to work and how to make a graded return (potential facilitators), yet when a period of work absence was documented on a fit note, no interviewees returned to work before that time point (a barrier to earlier or self-directed return to work). A similar scenario was observed for return to driving. These findings suggest that there is need to be mindful of both the potential positives and negatives of any change in return to work strategy after CTR.

The majority of interviewees appeared to be looking for specific authorisation regarding timings and strategies for returning to their work duties. Currently, there is no evidence-based guidance that provides this information, and the survey of clinicians reported in Chapter 4 identified that a wide range of recommendations are suggested by clinicians. Interviewees appeared to be looking for authoritative guidelines, but at present these do not exist.

6.5.1 Information provision

Provision of appropriate information was seen as something that could enhance the post-operative experience, but had been lacking for the majority of participants. Interviewees recalled underestimating the immediate functional impacts of CTR, but the reason for this mismatch between expectation and experience was not clear. Some interviewees reported that they felt that they had been given insufficient information about this aspect of their recovery, while others suggested that there was a general perception of CTR as a ‘minor’ procedure, which may have shaped expectations at a more sub-conscious level.

In healthcare nomenclature, CTR often is termed a ‘minor procedure’ as demonstrated by the National Institute for Health and Clinical Excellence surgery grades [292]. Perhaps this terminology is misleading because ‘minor’ can be interpreted in many other senses. The reported reduced ability to grip and/or weight-bear through the hand after CTR, coupled with the described recommendations to keep the wound dry until removal of sutures, had an important impact for the majority of interviewees. The level of complexity of the

procedure did not seem to equate to the level of impact felt by the patients and this contributed to a reported lack of preparedness in the immediate post-operative period. This situation could be improved by clinicians communicating the likely post-operative impacts of the surgery.

Taking this further, clinicians could give CTR patients suitable information about how to manage their ADLs in the immediate post-operative period, and suggest strategies to assist with short-term reduced hand function. Reflection on potential reasons for why this does not appear to happen currently, raised three hypotheses. The first being that clinicians may not be aware of (or may have forgotten) the extent of the likely functional limitations after CTR; perhaps because they too have become accustomed to thinking about the 'minor' element of this minor procedure. The second scenario is that clinicians may feel that they do not have time to discuss the subject of function when listing the patient for surgery in a busy clinic. The third scenario is that the clinician may believe that discussing ADLs is not part of their remit. This may especially be the case for surgeons, as these aspects of patient care might not have historically formed part of their training.

It is possible that the unexpected functional (dis)ability reported by interviewees in the immediate post-operative period could negatively influence when an individual perceives that they are fit to return to work. Expectations and information provision have been explored for other health conditions, including in a recent participant co-designed study of an 'enhanced recovery after surgery' programme for elective colorectal surgery [293]. Gillis et al. identified that access to relevant information (including the care pathway, the procedure and managing at home post-operatively) was central to positive patient experiences in their participant group. Communication skills were not explicitly discussed, although the overall message from patient participants was: "If you tell us why, help us understand what we need to do, we will be happy to do all we can" [293] P7. The findings from the current interview study suggest that this perspective is likely to extend to other surgical scenarios, including CTR.

The concept of information provision was also raised in the third theme (handling the return) with many interviewees highlighting that they would have liked more advice about how to return to their work, including information that they could share with their employers. 'Return to work' can be conceptualised as both an outcome (i.e. whether the

patient has returned to work or not) and a process (i.e. the transition from not being at work to resuming work in as full a capacity as possible). It appeared that the interview participants were ideally looking for their return to work to be handled as the latter.

Surprisingly, the described process of return to work sits most closely with the biomedical model: interviewees recalled being advised (or wanting advice) from their surgeon about things they should/should not do as a result of their surgery [294, 295]. This model has been criticised in the return to work literature for neglecting contextual factors, such as socio-economics, the work environment and the individual's personal and psychological status [294, 296]. However, it appeared that these interviewees were looking for tailored advice from their surgeon based on medical recommendations in relation to their job role; in addition to sufficient (authoritative) information for them to share with their employer in order to apply these recommendations to the physical, environmental and psychological aspects of their job. It seemed that employed interviewees saw themselves as messengers to deliver medical recommendations between their surgeon/GP and employer, a finding that has also been reported in a qualitative study of employees returning after workplace injury [297].

It is not clear whether this is the optimal model of care for CTR patients (or indeed any patients), and future research might explore whether using the additional comments section of the fit note could be a way of providing the targeted information that the interviewees appeared to be seeking [214]. Perhaps the surgeons involved in the current study were wary of providing return to work advice in case conflicting information was given elsewhere, for example by the GP. Or perhaps they did not feel qualified to provide this advice, especially when the upper limb demands of job roles are not yet fully understood [298].

Nonetheless, interviewees appeared to be looking to the surgeon as the authority to provide this information. The generation of evidence-based guidance regarding the return to work process after CTR is an aim of this thesis, and it appears that from the patients' perspective, the person they seek information from and trust to deliver this advice is their surgeon. This creates a responsibility for the surgeon to communicate the available evidence in a way that empowers patients to be confident to make their own assessment of their fitness to return to different work and functional activities. In the

current study, self-employed interviewees appeared to be more confident in this respect, but it is not clear whether this was due to an inherent increase in self-efficacy associated with being self-employed; a difference in information received (none recalled being given a fit/sick note with a prescribed period of work absence); or the way return to work advice was communicated; or a combination of factors.

As discussed previously, the analysis of open text responses from the clinicians surveyed in Chapter 4 identified that some surgeons and therapists did report treating self-employed workers differently when providing return to work advice, along with an expectation that self-employed workers make their own decision, irrespective of the recommendations provided (Section 4.4.5.2.1). Aligned with this, it would be interesting to explore whether self-employed individuals take longer periods of post-operative work absence if they are given written guidance (i.e. a fit note), rather than verbal information?

6.5.2 Authorised work absence

The interviewees placed a strong emphasis on the need for formally authorised work absence *(validation of time off)*. This might be expected given that formal authorisation is often required by employers and for statutory sick pay, but for many interviewees this validation was also to justify to themselves that there was a real need to take time off work. A qualitative interview study of 263 male car mechanics found a strong will to attend work, despite illness [299]. This was shaped by the habit of attending work as part of a daily routine and the importance of not letting colleagues and customers down. The focus on authorised work absence by interviewees in the current study, could perhaps be interpreted as a response to similar internal drivers.

It was interesting that the current 'fit note' system for authorising work absence was never referred to as such, rather as its previous incarnation, the 'sick note', or as simply a 'certificate' or 'being signed off'. Furthermore, the fit note appeared to have been used in the manner of a sick note to indicate a period of 'prescribed' work absence, rather than to indicate the requirements under which the patient may be fit for return. A similar finding was reported in a systematic review of fit note use in the UK, which found that only a small minority of patients treated in primary care received the recommendation

that they 'may be fit' for work with structured advice and/or comments on the functional effects of their condition [300].

In the current study, interviewees appeared deterred from returning to work before the period of time documented on their fit/sick note due to the assumption that this would be going against clinical advice. This suggests the potential power that appropriate evidence-based return to work advice could have if delivered and documented by the surgeon. As discussed above, receiving authorised time off work appeared to be beneficial to the interviewees' experience, but for some, adherence to this prescribed time period became a barrier to earlier return to work.

The current NHS fit note guidance for patients that is available on the 'common health questions' NHS website is potentially ambiguous [301]. It states that: "You should go back to work as soon as you feel able to and, with your employer's agreement. This may be before your fit note runs out." However, two paragraphs later it states: "You should not go back to work before the end date on your fit note if your doctor has advised that you should stay off work for the full period covered by the fit note". In practice, it may not be clear to the patient which of these statements best applies to them. It is conceivable that the fit note could be better used to provide clarity for patients after CTR and that clinicians could better empower their patients to manage their post-operative rehabilitation and return to work without a focus on rigid timelines.

6.5.3 The return to work process

All interviewees discussed a need to modify their work activities on initial return to work. This ranged from a formalised graded return programme to more informal situations, such as asking co-workers for help with certain tasks. Only one interviewee recalled receiving information from their surgeon with suggestions for how to return to work. In addition to the recommended timescale for returning to work, interviewees reflected that practical suggestions for how to build up activities would have been helpful. Not knowing what they could/should be doing with their hand may have created a barrier to resuming work activities.

A recent prospective cohort study examined the effect of CTR on typing speed in 27 participants who usually used a computer [302]. Zumsteg et al. found that mean typing speed reduced significantly from 49.7 words per minute preoperatively to 45.2 at one week after CTR. This had nearly recovered to the preoperative level by the second week, but it was not until the third week after surgery that typing speeds reached and surpassed the preoperative measure. In the same cohort, a similar pattern was seen with the functional subsection of the Boston Carpal Tunnel Questionnaire [49], which also continued to improve by the 12-week follow-up. This suggests that function, including typing speed, improves after CTR and eventually exceeds pre-surgery levels. However, the improvement occurs gradually and only after an initial deterioration. A description of this gradual improvement in functional ability could be incorporated into advice regarding graded return to work activities.

Graded return to work advice is usually limited to long term conditions and long term sick leave [303] and little attention has been given to return to work after elective upper limb surgery. A qualitative interview study of return to work after total knee replacement also reported that patients felt that they had received limited advice regarding when and how to return to work [107]. Participants recalled that this delayed their return to work as they were not sure which activities they could and should be doing [107]. It appears that the desire for tailored return to work advice is not limited to the CTR population. Perhaps the provision of appropriate information to guide a graded return may facilitate the return to work process.

6.5.4 Divergent views

As illustrated in Section 6.4.2.2.3, one interviewee reported a different perspective on their return to work and the advice received. This was a self-employed gardener (George), aged 68, who returned to work earlier than advised, and whose approach to advice (from any professional) was to adapt it as he felt best applied to him. A study of return to work in 1,585 patients who underwent elective percutaneous coronary intervention found that self-reported health (as assessed by the SF-12) at 4 weeks after the intervention, was a stronger predictor of the patient being at work 4, 12 and 52 weeks after surgery than any clinical measure [304]. In the current study, it appeared that George felt well enough in

himself and fit to return to work (perhaps linking this to his self-reported health), so he returned, even though this was contrary to advice. This highlights the potential impact of personality on the level of engagement with health information and suggests the importance of the patient's self-perceived health in their return to work decision-making. The fact that George was still working in a physical role aged 68 suggests a level of confidence in his own abilities and good overall physical fitness. Individuals who return to work earlier than advised should not be perceived as making a bad decision; they may feel physically ready to resume their activity and therefore from their perspective they are ready to return to work.

6.5.5 Limitations

This interview study was designed and conducted in accordance with the qualitative research recommendations outlined by May and Pope [121] and the reporting was guided by the COREQ checklist [122]. All attempts were made to ensure that the research process was transparent and that key quality criteria were met, however there are still a number of limitations. Participants were recruited prospectively from the existing REACTS cohort, sampling for age, sex, type of work and work contract, study site and duration of post-operative work absence. Very few REACTS participants were unable to return to work during the 12-week study period (n=2; Section 5.3.8). No interviewees were unable to return to work because of their CTR and therefore this experience was not explored as part of the current study.

It was not possible to invite participants from all 16 REACTS study sites to take part in this nested interview study because six of these sites were added at a later stage. Therefore, participants were only recruited from eight of the 11 available sites and it is possible that the patient experience at other sites may have differed from those included. In addition, the proportion of male interviewees was lower than the proportion invited, and lower than across the cohort as a whole. This had the potential to over-represent the experiences of women. To address this, any marked differences between the responses of male and female interviewees were explored in the early stages of the analyses and sex-effects were not notable.

REACTS study participants were invited to participate in the interview study only after completion of the final cohort study questionnaire. This effectively excluded those who dropped out of the cohort study. While this is a limitation in that non-responders may have reported different experiences to responders, it was necessary to allow the purposive sampling strategy. Interviewees had been treated in a range of different healthcare settings (primary care, secondary care and private healthcare) and had encountered different CTR patient pathways. Both the lead researcher and supervisory team are confident that the interviewees illustrated a broad range of experiences and that interviewing was continued until data saturation was met. These findings are therefore likely to show some transferability to other CTR populations within the UK.

Another aspect of recruiting interviewees from the main REACTS study is that they may have been more focused on the process and experience of return to work than other CTR patients. These individuals had already completed three questionnaires on similar topics, and had been provided with information in the form of participant information sheets. It is possible that this affected their behaviour in relation to returning to work, and/or influenced their interview responses. However, the participant information sheets and questionnaires did not include any reference to existing return to work guidance or provide any work or health recommendations. In addition, steps were taken to facilitate the interviewees to talk freely and openly about their experiences, including efforts to build rapport and a conversational style of interviewing, rather than a rigid order of questions [284]. It was not possible for interviewees to check and provide feedback on the analyses because ethics approval had not been obtained to re-contact interviewees, however the analyses were discussed in detail with two members of the patient advisory group who confirmed that their experiences were mirrored in the interpretation. These individuals also gave suggestions on the order and content of the presented findings.

By recruiting interviewees from the REACTS study, their surgical team had also been involved in this programme of research. These clinicians may have therefore given greater consideration to providing work-related advice due to their interest in the study topic and through their involvement. However, even if these clinical teams discussed work-related issues with their CTR patients in more detail than at other locations, the interviewees' responses highlighted that even greater focus is required.

The role of the interviewer in the generation of the interview data also needs to be considered. The interviewer was a practising physiotherapist, specialised in hand therapy, and a relatively inexperienced qualitative researcher. None of the participants were known to the interviewer in a clinical capacity and, while the interviewer's job title was listed on the supporting participant information sheets, it was not introduced by the interviewer during the discussion. However, it is possible that interviewees may have given different responses if interviewed by a non-clinical researcher. The interviewer and study team were aware of this potential influence and it was discussed during the data analysis stages. In addition, support and qualitative research training was provided by an experienced qualitative researcher (CB), who was someone without experience of CTS, CTR, hand therapy or hand surgery. This ensured that the analysis was not solely conducted through a hand therapist's lens or by individuals exposed to the current literature in this field.

6.6 Summary

This qualitative study has raised several important areas for discussion regarding return to work after CTR. It was interesting that interviewees did not recall tangible barriers or facilitators of their return to work, rather their experiences were more process-driven with a general desire for more information to better inform their return to work. Interviewees appeared to be looking to their surgeon to provide specific advice.

Employed interviewees all reported a similar view of their fit note: namely that it was a sick note and it was essential to authorise their prescribed period of time away from work. Only one interviewee recalled any information about how to grade their return to work, but there was a general consensus that advice about grading/modifying their work activities would have supported their return. Intriguingly, the fit/sick note appeared to act as a barrier to early return to work, as interviewees were reluctant to return before this prescribed period. Self-employed workers appeared to approach their return to work advice more flexibly, and returned to work when they felt able, rather than at the time period that had been recommended.

Return to work decisions were made in the context of unexpected difficulties with ADLs in the immediate post-operative period. Interviewees appeared to reflect on these functional problems with humour, but identified that it would have been beneficial to have known about these issues in advance to enable them to plan for the post-operative period.

The key themes identified from this interview study suggest that patient experiences after CTR may be enhanced by clinicians: 1) communicating the likely short-term functional impacts of the CTR procedure and strategies to assist with this; 2) initiating dialogue with patients to discuss their work, including examples of how the individual might grade their return (which could be documented on a fit note); and, 3) providing sufficient, tailored information to empower patients to be confident in their own decision-making regarding return to work and function.

Chapter 7 Conclusions, clinical implications and future research

7.1 Summary of the findings

This thesis was developed in response to uncertainty regarding what to advise patients about returning to work after CTR. A research strategy comprising four related studies was created to explore the subject, with each study addressing different aspects of the thesis objectives, and focusing on a different research question or questions. The questions were not necessarily explored sequentially and the findings presented in this summary include material reported throughout the thesis. The six original research questions outlined in Chapter 2 are summarised below, along with a summary of the relevant findings from this thesis.

7.1.1 What is currently known about when patients return to work after CTR?

In searching for and appraising the existing literature, it was apparent that duration of work absence was often used as a secondary outcome in research exploring the effectiveness of different CTR interventions. This resulted in the identification of a large number of studies (n=55) that were eligible for inclusion in the systematic review (Chapter 3). Despite return to work time being commonly reported, details regarding the definition of return to work, and how and when this measurement was made were often lacking.

There was a surprising range in the average (most commonly presented as the mean) duration of work absence that was reported by the studies included in the systematic review (range 4-168 days). Variation persisted when studies were categorised according to different methodological characteristics, such as type of study, risk of bias assessment, sample size, location and type of CTR. The least variation occurred between the summary data reported in RCTs. It may be that the RCT study protocols detailed specific return to work recommendations, although none were reported, or that RCT participants were more homogeneous for key characteristics as compared with those recruited to

observational studies. However, insufficient information was provided to explore this further.

Studies assessing the effectiveness of different interventions often reported a significant difference in return to work times between groups. This suggests that return to work times are modifiable, yet none of the included studies explored the possible role of the clinician/researcher in influencing these return to work times through the information provided to their study participants.

7.1.2 How did occupational factors impact upon these return to work times?

The most commonly reported occupational factor in the systematic review was workers' compensation status (Section 3.4.3). As has been shown in other settings [105], receipt of workers' compensation was associated with longer periods of work absence. A common prerequisite for workers' compensation is that the compensated condition was caused by the recipient's work [305]. Interestingly, the prospective cohort study (Chapter 5) found that those who believed that their CTS symptoms were caused by work were more likely to take longer to return to work after CTR than those who did not.

Other occupational factors were only reported by up to six of the studies included in the systematic review, but appeared to play a role in when participants returned to work. The review found that non-manual workers returned before manual workers; self-employed workers returned before those who were employed; full-time workers returned before those who were part-time; and return to modified duties occurred before return to full duties. However, as with 'time to return to work', these occupational characteristics were not consistently defined and it was not possible to ascertain which factors were the most important in relation to the reported duration of work absence, or whether these factors were significantly associated with the duration of work absence when other demographic and clinical factors were also considered.

7.1.3 What advice did UK healthcare professionals give their patients about returning to work after CTR?

The survey of hand surgeons and hand therapists described in Chapter 4 found that this group of clinicians recommended a wide range of return to work times for three specified occupational roles. At the most extreme, the range of recommended times to return to heavy manual duties (e.g. construction) spanned 90 days (three months). The smallest range was found for recommended times to return to desk-based roles, which spanned 30 days (one month). This suggests that even among a group of specialist and self-selected clinicians, there were very differing views on when it might be safe for CTR patients to resume specific work activities.

Thematic analysis of the clinicians' free text responses identified that the general content of the advice they reportedly gave their patients was similar, yet when time points were specified for return to particular activities, as with recommended return to work times, these were inconsistent. Clinicians were aware that patients may be receiving different advice, and may therefore be amenable to changing their practice should more standardised and evidence-based advice become available.

Similar advice content was reported by participants in the prospective cohort study (Chapter 5). This may indicate that the clinicians were reasonably accurate with their self-report, however the same coding frame and researchers were involved in both analyses, which would have aided the identification of similarities. However, using the same coding frame would also have facilitated the identification of differences between the two data sets, yet very few were identified, supporting the suggestion of accurate reporting by the clinicians.

Key themes in the reported content of return to work advice are shown in Table 7.1. Importantly, receipt of conflicting advice was not a theme of patient reports. This suggests that local advice may be more similar than the varied responses that were identified nationally in the clinician survey.

Table 7.1 Themes identified from the return to work advice as reported by patients and clinicians

Clinician reported		Patient reported
General post-operative management	↔	General post-operative advice
Return to driving	↔	Return to driving
Return to work strategies	↔	How to return to work
Work characteristics	↔	When to return to work
Conflicting advice		

The order of the themes is non-hierarchical and the arrows indicate themes with similar content. Clinician reported themes were identified in Chapter 4, patient reported theme were identified in Chapter 5.

When interviewees were asked about their experience of returning to work (Chapter 6), they identified a key area where they felt that information was missing. Interviewees reported that the focus had been on *when* to return to work, rather than *how*, and they were often unsure about how to adapt their usual work activities in order to grade their return. While this topic was addressed in the themes that arose from the REACTS cohort participants and the surveyed clinicians ('how to return to work' and 'return to work strategies', respectively [Table 7.1]), the content of these themes was very general, such as the recommendations to be guided by pain or simply to grade the return to normal work duties. The deeper exploration of these themes in the qualitative interviews found that patients appeared to be looking for more specific and practical advice about how to actually apply these recommendations to their work role and environment.

7.1.4 When and how did UK CTR patients return to work after their surgery?

The median time to return to work across all participants in the prospective cohort study was 21 days (IQR 12-35 days; Section 5.3.8). The duration of work absence was shorter for non-manual workers (median 18 days, IQR 8-31) when compared to manual workers (median 27 days, IQR 15-42) and for self-employed workers (median 13 days, IQR 6-19) when compared with those who were employed (median 23 days, IQR 14-41). Return to work times were similar for those who returned to modified or full duties (20 days and 20.5 days, respectively).

The majority of participants returned to work on a Monday (39%), with increasingly fewer individuals returning on other days of the week. More than half of participants reported initially returning to amended duties before resuming their normal work role. This fits with both the reported advice and clinician recommendations discussed above. Fewer participants (16%) reported returning to reduced hours when they first returned to work.

The transitions from amended to full duties or reduced hours to full hours spanned more than eight weeks, although in both cases, the majority of participants took less than two weeks to return to their normal work role and pattern after first return.

7.1.5 What factors were associated with return to work time in this population?

Each of the factors that had been identified as a potential determinant of the duration of work absence after CTR (Section 1.3.4 and Section 4.4.6) were included in the prospective cohort study. Possible associations between these factors and the duration of work absence were explored using a Cox proportional hazards model (Section 5.3.12) and only one occupational characteristic was significant: those who reported using a computer for more than an hour per day as part of their work role were more likely to return to work earlier than those who did not (HR 2.19, 95% CI 1.19, 4.03).

Two demographic factors were significant: smokers (and ex-smokers) were more likely to return to work later than those who had never smoked (HR 0.56, 95% CI 0.36, 0.85); and women were more likely to return to work later than men (HR 0.43, 95% CI 0.25, 0.71).

Finally, two factors related to health beliefs and expectations were also significant: those who believed that their hand and wrist problem was caused by their work were more likely to return to work later than those who did not (HR 0.63, 95% CI 0.42, 0.94); and those who expected to take longer to return to work were more likely to do so. Compared to those expecting to take less than a week of leave, those who expected to take 7-14 days were approximately 65% more likely to return later (HR 0.34, 95% CI 0.19, 0.61); those who expected to take 15-30 days were approximately 70% more likely to return later (HR 0.28, 95% CI 0.14, 0.56); and those who expected to take more than 30 days were nearly 90% more likely to return later (HR 0.13, 95% CI 0.06, 0.26).

7.1.6 Was earlier return to work after CTR associated with poorer outcomes?

As anticipated, poor outcomes were rare (Section 5.3.13). Three participants reported being prescribed antibiotics for a wound infection after returning to work and 12 reported taking additional CTR-related sick leave after first returning to work. At 12 weeks after CTR, 19 participants reported that their CTS symptoms were only slightly better, had not changed or were worse after their surgery; and 17 reported that their scar was fairly or very troublesome. There were no differences in the prevalence of each of these poor outcomes among those who returned before/after 7 days; before/after 14 days; and before/after 30 days, with the exception of a fairly or very troublesome scar, which was more common among those who took longer than 30 days to return to work. Although this study does not allow the assessment of causality, it is plausible that issues with the scar were a factor in delaying return to work for these individuals.

Using a composite measure which included all four of the poor outcomes described above, 41 individuals were defined as having any poor outcome. There were no significant differences in the duration of work absence for those with and without any poor outcome when assessed using Wilcoxon rank-sum test. Therefore, data from the cohort study suggests that earlier return to work is not associated with poorer clinical outcomes, or linked to the need for additional post-operative sick leave.

7.2 Strengths and limitations

It is a strength of this whole programme of research that it employed a combination of research methods to explore the topic of return to work after CTR. The findings from earlier stages of the thesis were used to inform the subsequent chapters and the findings from all chapters contributed to the final thesis conclusions. Specific strengths and limitations of the individual studies included in this thesis were discussed within each chapter; the following sections provide a summary.

7.2.1 Limitations

The key limitations of each study are summarised below:

1) The systematic review was limited by the poor reporting of occupational information in the existing literature. This meant that while a large number of studies were eligible for inclusion in the review, a formal meta-analysis of return to work times for different types of work was not possible. Despite this, an attempt was made to summarise the data descriptively to enable comparison between studies and to identify factors that might be important determinants of the duration of work absence after CTR.

2) The survey of clinicians did not seek to identify a representative sample and therefore the findings are not generalisable to a wider population. However, the wide variation in return to work recommendations that was identified among this self-selected group of specialist clinicians may indicate even greater disparity among the broader population. The patient reported data collected in Chapter 5 and Chapter 6 also suggested that return to work advice was not consistent between clinicians.

3) The prospective cohort study was limited by power, especially because recruitment was lower than desired. Additional factors may have been significantly associated with the duration of work absence or a poor outcome after surgery, but were not detected in the current study. However, the REACTS study was larger than previous studies that addressed a similar research question, and had the added strength of collecting data prospectively and across multiple clinical settings.

4) The qualitative interview study recruited participants who had been involved in the REACTS cohort study. Although a purposive sampling frame was used to recruit interviewees with different occupational and demographic characteristics, the resulting sample only included individuals who were willing to take part in both the cohort and interview studies and therefore other patient experiences may have been missed. In particular, those who decided not to return to work after their CTR, or those who had lower levels of literacy, or did not speak sufficient English to be able to participate in a questionnaire-based study.

7.2.2 Strengths

Involvement of the patient advisory group throughout this programme of research ensured that the research questions were meaningful to patients, that participation in the

cohort and interview studies was not overly burdensome, and that the qualitative analyses were not conducted solely through an academic or clinical-academic lens.

Pre-specified protocols and analysis plans were used for all studies, which provided transparency. Furthermore, the thematic analyses of the free text data from the clinician and REACTS study questionnaires were performed by two researchers, and the framework analysis of the qualitative interview study was assisted and appraised by an experienced qualitative researcher. This research plan allowed the lead researcher to lead all aspects of the research, but reduced the risk of bias or errors being introduced, which may have occurred if all analyses were conducted by only one individual.

It is also a strength of this programme of research that three of the included studies have already been published in relevant peer reviewed journals. In addition, the findings from all four studies have been presented at national and international conferences including hand surgery, hand therapy, primary care and occupational medicine specialties. This has enabled feedback and dialogue with interested researchers and clinicians, and facilitated future collaborations.

7.3 Clinical implications: what should we advise our patients?

This programme of research has highlighted that there is wide variation in both return to work advice and the duration of work absence after CTR in a UK population. While there were differences in the time to return to work among individuals with different occupational characteristics (for example, different types of work and job contracts), these occupational factors did not sufficiently explain the differences in return to work times. However, the expected duration of work absence was identified as a significant factor. Participants were not asked to discuss the reasoning behind their expected duration of work absence, but they were asked about the sources of any return to work information that they had received. The surgeon/surgical team and GP were the most commonly reported source of this information. Interestingly, those who reported that they had not received any information about returning to work before their surgery had greater odds of a poor outcome, but not slower return to work.

These findings indicate that the pre-operative return to work advice provided by clinicians may play an important role in shaping patients' expectations of when it is safe and appropriate for them to return to work. These expectations may then inform patients' return to work decision-making and guide conversations with their employers/clients.

A summary of possible return to work advice based on the findings from this thesis is provided in Table 7.2. The table also outlines areas that remain unknown. Due to the exploratory nature of the research, it is not possible to create firm return to work recommendations, however, it is hoped that the next update of policy documents, such as the BAO and AAOS guidelines will include successful return to work as an important outcome of CTR. These policies could also incorporate the descriptive findings reported in Chapter 5, such as the recorded timing of return to work. In particular, the finding that in this UK setting, >50% of participants had returned to work within three weeks of CTR and >75% of patients had returned within five weeks. These findings do not provide evidence to recommend when patients should be advised to return to work, but in the absence of other data, they may form a helpful reference for clinicians to compare with their own practice.

Table 7.2 Return to work advice based on the findings in this thesis

What we could tell our patients	What we still do not know
Half of patients return to work within 3 weeks of CTR, and >75% return to work within 5 weeks	Whether patients should be advised to return to work at different time points depending on the nature of their work
Those with manual jobs tend to take longer to return to work than those in non-manual jobs	How to consistently categorise different types of work
Earlier return to work does not appear to be associated with poorer surgical outcomes	Whether there is a time point before which return to some types of work could be detrimental
Your hand will need to be kept dry as the wound heals. Think about this in advance of your surgery and perhaps pre-prepare food, or make sure someone is available to help, should you need it	Whether providing information designed to improve patient experiences in the immediate post-operative period affects return to work decision-making and timescales
It is common to experience difficulty with some tasks when you first return to work. If possible, start with lighter tasks and build up your activities as able	How to define light duties across a range of occupations
	If providing specific return to work advice affects when patients return to work

7.3.1 When to return to work

Variation in the recommended return to work times provided by clinicians could be reduced by increasing awareness of the existing guidance, such as that provided by the Royal College of Surgeons (Section 1.3.4.1). However, this existing guidance may be too conservative, especially for manual roles. Clinicians surveyed in Chapter 4 recommended earlier return to heavy manual work than the RCS (IQR 3-6 weeks versus RCS recommendation of 6-10 weeks). Furthermore, participants in the cohort study (Chapter 5) whose work involved heavy lifting or pushing or pulling heavy weights (indicators of a heavy manual job) also tended to return to work earlier than the RCS recommended 6-10 weeks (IQR 2-7 weeks).

This thesis was based on observational and qualitative studies and therefore it is not possible to recommend optimal return to work times from the findings presented, however this programme of research has drawn attention to wide variation in practice and the need for future research in this area. At present, the recommendation would be for clinicians to be mindful of the potential influence of their advice, and that long periods of work absence after CTR (more than the identified upper quartile cut point of 5 weeks; Section 5.3.8) are unlikely to be required for the majority of patients. In addition, return to work within the first week of surgery (i.e. before the removal of sutures) was not associated with worse outcomes, such as: increased prevalence of wound infection; additional sick leave; scar problems; or decreased satisfaction with the outcomes of surgery.

7.3.2 How to return to work

Interviewees reported that the return to work advice they received tended to focus on when to return to work, rather than how. This meant that they often struggled with identifying how to grade their return. Advice to return to light duties or to make a graded return was not easily interpreted. It would therefore be beneficial for clinicians to incorporate practical advice, for example suggesting how to grade or modify work activities, or to give examples of what ‘light duties’ might entail. This information could be included on the fit note to assist communication with the patient’s employer. The current programme of research did not explore the format of the return to work information

provision, and this requires additional investigation to ensure that all CTR patients are able to access any return to work recommendations in a format that is appropriate for their needs.

7.3.3 Other advice

As discussed in Section 7.1.5, the expected duration of work absence was found to be associated with actual return to work times in the cohort study. The role of expectations was also highlighted in the qualitative interviews. Interviewees identified a mismatch between the expectation that CTR would be a 'minor' procedure and the reality of their immediate post-operative experience. It would therefore be helpful for clinicians to provide information in advance to highlight that the operated hand will need to be kept clean and dry until the incision site is healed, and that this will restrict hand use. This advice could also include suggestions of how to prepare for the most commonly reported difficulties in the immediate post-operative period: showering/washing and preparing food.

Participants in both the cohort and interview study groups recalled receiving advice about wound management and infection prevention. As it appeared that this information was being consistently provided, it could perhaps act as an anchor for clinicians to provide work and functional recommendations at the same time.

7.4 Future collaborations

In light of the findings from this thesis and the existing research, discussions are underway to update the existing RCS guidance for return to work after CTR. This would involve a Delphi study in collaboration with the British Society for Surgery of the Hand, the Royal College of Surgeons and the Association of Surgeons in Primary Care. While this collaboration would not improve the quality of the evidence regarding return to work after CTR, the focus would be on reducing variation in return to work recommendations for the same job activities, and in promoting the finding that earlier return to work was not associated with poorer outcomes. This consensus process would also include

discussion of when to advise return to driving, which was also identified as an area of inconsistent advice in the current programme of research.

In addition, a collaboration has been formed with an occupational health physician in Israel, who is interested in exploring the determinants of return to work times after CTR within the Israeli healthcare system. Findings from the REACTS study have been used to inform study development and sample size calculations.

7.5 Suggestions for future research

This thesis raises several important questions regarding return to work advice, which are likely to apply more broadly than CTR. Firstly, the classification of different types of work is inconsistent, which makes comparison between studies difficult and limits the translation of research findings into practice. The traditional classification of manual/non-manual work based on job title, which is commonly used for epidemiological research in the UK [112, 236], may not accurately reflect the physical demands of an individual's job. In the current study, a series of upper limb activities was also included to capture specific details [239], but there is no standardised method of categorising these responses into different patterns of job-based functioning. While there are a number of measures that specifically assess work-related upper limb functioning in research [277], none are specific to the hand and wrist, and the large number of questions restricts their use with patients in routine clinical practice or as part of a research questionnaire which also needs to address other aims. If different work-related recommendations are to be provided for patients returning to different job roles, there is currently no way for clinicians to assess how to best stratify this advice.

Within the hand surgery and hand therapy community, there is a need to further explore the existing literature to identify whether there is an effective method of capturing patient-reported occupational (and recreational) upper limb use and, if so, how this can then be used to direct appropriate rehabilitation and work-related advice, and to assess the outcomes of this advice. This would also facilitate appropriate descriptions of return to light duties and graded activities, as discussed in Section 7.1.3. If there is no existing valid tool, then its creation and investigation is warranted.

Secondly, the role of patient expectations as a determinant of clinical outcomes requires further investigation. It has been suggested that expectations play an important role in the placebo effect [306], and the current programme of research found that those who expected to return to work more quickly did so. Additional research is required to explore whether expectations can be systematically manipulated within a research setting to learn more about potential causality. This could include an RCT of targeted information designed to inform expectations around returning to work and function after surgery.

Finally, as discussed in Section 5.4.5, the provision of any healthcare advice requires it to be delivered in a format that is accessible and user-friendly for those who receive it. Any change to the existing guidance for return to work after CTR would benefit from being developed in collaboration with patient advisors and should undergo accessibility testing with different patient groups.

Appendices A to X

Appendix A Fit note

Statement of Fitness for Work
For social security or Statutory Sick Pay

Patient's name: Mr, Mrs, Miss, Ms

I assessed your case on: 1 / /

and, because of the following condition(s): 2

I advise you that:
3 ☐ you are not fit for work.
4 ☐ you may be fit for work taking account of the following advice:

If available, and with your employer's agreement, you may benefit from:
☐ a phased return to work ☐ amended duties
☐ altered hours ☐ workplace adaptations
5

Comments, including functional effects of your condition(s):
6

This will be the case for 7

or from 8 / / to / /

9 I will/will not need to assess your fitness for work again at the end of this period.
(Please delete as applicable)

Doctor's signature

Date of statement / /

Doctor's address

Med 3 04/10

Appendix B Patient advisory group newsletter example

Issue 2
January 2017

Return to employment after carpal tunnel release surgery (REACTS)

REACTS

Thank you again for your help with my research. I really appreciate the time given by all of our patient advisors and I really couldn't have got this project running without your support. I am now one year into my PhD (I can't believe how quickly the time has gone), and wanted take this opportunity to update you on the progress of the REACTS programme.

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1. When do patients return to work after carpal tunnel surgery?

The bulk of the literature review is now complete. We found 56 published research papers reporting when patients returned to work after various different types of carpal tunnel release surgery. Because the age, medical background, occupation, type of carpal tunnel surgery, and rehab varied across the different papers, it was not possible to pool the results to establish an 'average' return to work time.

Surprisingly only four papers included patients having surgery in the UK. Across these patients the average time off work after surgery was approximately 27 days. How does that compare with your experience? I will be writing up our findings from the whole review in the early part of 2017 and hope to publish this in a relevant medical journal. I will include a summary of this as part of the next newsletter.

2. What information do UK hand surgeons and hand therapists give to carpal tunnel surgery patients?

I launched our national survey at the British Society for Surgery of the Hand and British Society of Hand Therapists conference in Cardiff 2016. The online version of the survey ran from October to December. In total, 173 hand surgeons and 137 hand therapists completed the questionnaire. I have started analysing the responses and this preliminary work has discovered that:

- Most surgeons use a short open incision as opposed to the traditional long incision or endoscopic techniques
- For patients with symptoms in both hands, opinion varied on whether to recommend that both hands be operated on at time same time, or in two separate operations
- Most surgeons did not routinely request nerve conductions tests when making a decision about whether carpal tunnel release was needed
- Follow-up after surgery varied in both the timescale and the healthcare professionals involved
- The recommended return to work timescales for desk-based, light manual and heavy work were wide-ranging

3. Observational study of patients undergoing carpal tunnel release surgery

Arthritis Research UK | MRC Medical Research Council | centre for musculoskeletal health & work

In December were were granted approval from the NHS ethics committee to run our study. Patients will be recruited before their carpal tunnel release surgery and will be asked to complete a questionnaire about their symptoms and the work that they do. These individuals will be contacted again 4 and 12 weeks after their surgery to complete follow-up questionnaires about their progress and their experience of returning to work. A number of the REACTS patient advisors helped me develop these questionnaires, so many thanks to you for giving up your time and making really useful suggestions for improvement.

We are aiming to recruit 350 study participants and now have 10 sites signed up to be involved: Southampton General Hospital, Southampton NHS Treatment Centre, Lymington New Forest Hospital, Portsmouth Queen Alexandra Hospital, Salisbury Medical Practice, Royal Gloucestershire Hospital, Kent and Canterbury Hospital, Colchester Tollgate Clinic, Broomfield Hospital and St Luke's Clinic Walsall.

I hope to start recruiting participants for this study in early March 2017.

Thank you again for all your support

We couldn't have done it without you!

Very best wishes and Happy New Year from the REACTS research team

The next six months…

We would be really grateful for your continued involvement in the study. Part of the observational study will involve interviewing 10-30 of the study participants about their experience of returning to work after their surgery and the advice they were given. I am keen to have your input into the interview questions, and perhaps practice the interview on one or two of you, if anyone is keen?!

I will continue to keep you updated on the progress of the REACTS research.

Thanks again and a very happy new year.

Appendix C Systematic review publication

Review

Scand J Work Environ Health. 2018;44(6):557–567 doi:10.5271/sjweh.3762

Sickness absence after carpal tunnel release: a systematic review of the literature

by Lisa Newington, MSc,[1,2] Martin Stevens, LLB,[1] David Warwick, MD,[3] Jo Adams, PhD,[4,5] Karen Walker-Bone, PhD [1]

Newington L, Stevens M, Warwick D, Adams J, Walker-Bone K. Sickness absence after carpal tunnel release: a systematic review of the literature. *Scand J Work Environ Health*. 2018:44(6):557–567. doi:10.5271/sjweh.3762

Objectives The aim of this systematic review was to provide an overview of time to return to work (RTW) after carpal tunnel release (CTR), including return to different occupations and working patterns.

Methods A systematic search from inception to 2016 was conducted using nine electronic databases, trial registries and grey literature repositories. Randomized controlled trials and observational studies reporting RTW times after CTR were included. Study risk of bias was assessed using Cochrane risk of bias assessment tools. Time to RTW was summarized using median and range.

Results A total of 56 relevant studies were identified: 18 randomized controlled trials and 38 observational studies. Only 4 studies were rated as having a low risk of bias. Reported RTW times ranged from 4–168 days. Few studies reported occupational information. Among 6 studies, median time to return to non-manual work was 21 days (range 7–41), compared with 39 days for manual work (range 18–101). Median time to return to modified or full duties was 23 days (ranges 12–50 and 17–64, respectively), as reported by 3 studies. There was no common method of defining, collecting or reporting RTW data.

Conclusions This review highlights wide variation in reported RTW times after CTR. Whilst occupational factors may play a role, these were poorly reported, and there is currently limited evidence to inform individual patients of their expected duration of work absence after CTR. A standardized definition of RTW is needed, as well as an agreed method of collecting and reporting related data.

Key terms carpal tunnel syndrome; CTS; elective hand surgery; return to work; return-to-work; RTW; sick leave.

Carpal tunnel syndrome (CTS) is a common peripheral nerve entrapment disorder (1) and recommended treatment includes carpal tunnel release surgery (CTR) (2, 3). CTR has become a common elective operation, with more than 77 000 CTR procedures expected to be performed annually in the English National Health Service (NHS) alone by 2020 (4). Despite CTR being such a frequently performed procedure, there is currently no evidence-based guidance to inform patients and clinicians about when it is safe to return to work, or other activities, after their surgery. Extended work absence after CTR may have financial consequences for both the worker and employer, whereas returning to work too soon after surgery could be associated with reduced work performance, increased workplace risk due to altered grip and dexterity, or clinical complications.

Whilst there have been previous systematic reviews which included return-to-work (RTW) time after CTR as a measure of the effectiveness of different CTR interventions (5–9), these reviews have not explored the variation caused by occupational factors, such as the type of work, work pattern or whether participants were employed or self-employed. Moreover, RTW may be defined in a number of ways and can include: return

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to (i) full duties, (ii) amended duties, or (iii) modified working hours. To our knowledge, none of the existing reviews has considered this diversity. We therefore undertook a systematic review of the literature to address the following question: when do patients return to work after CTR, and how do occupational factors influence this timing?

Methods

The review protocol was pre-registered with PROSPERO (registration number: CRD42016034158) (10) and carried out according to the PRISMA guidelines (11).

Selection criteria

Eligible studies were those reporting post-operative RTW time after CTR, using any surgical technique, in a working population. Randomized controlled trials (RCT), cohort studies and case–control studies were eligible for inclusion (table 1).

Table 1. Review eligibility criteria. [CTR=carpal tunnel release.]

Inclusion criteria	Exclusion criteria
1. Patients treated with CTR surgery using any surgical technique	1. Surgical intervention other than CTR
2. Working population (including those on sick leave pre-operatively)	2. Traumatic injuries requiring CTR
3. Post-operative return to work times documented	3. Population not employed at the time of surgery (retired, unemployed, children)
	4. Review articles, case series, case studies

Search strategy

The first author searched 24 electronic sources between February and March 2016. These comprised electronic databases, trials registries, grey literature sources and the electronic records of four relevant journals (figure 1). There were no restrictions for country of origin or date of publication, but due to time and resource limitations, studies were restricted to those available in the English language. The example search strategy for Medline is provided in appendix A (www.sjweh.fi/show_abstract.php?abstract_id=3762).

Eligibility assessment

Two reviewers independently performed title and abstract screening using the Covidence web platform (www.covidence.org). Any disagreements were discussed and taken to an additional independent reviewer if agreement was not reached. All reviewers agreed the final decision. Full text was retrieved for those articles selected from this initial screen and in cases where no abstract had been found. Full text screening was performed according to the review inclusion and exclusion criteria (table 1), following the same process as above.

Data extraction

For the included studies, two reviewers independently performed data extraction using pre-piloted data extraction forms (appendix B, (www.sjweh.fi/show_abstract.php?abstract_id=3762). Data extraction included year of publication, country of research, study population, study design, CTR surgical technique, information about workers' compensation (or other insurance) status, post-operative management and measurement of RTW time. Where clarification or additional information were required, the first author contacted the relevant author by email.

Methodological assessment

Two reviewers independently assessed study risk of bias using the Cochrane Collaboration's tool for assessing risk of bias in randomized trials and a modified version of the tool for non-randomized trials (12, 13). The items included in the risk of bias assessment are shown in appendix C (www.sjweh.fi/show_abstract.php?abstract_id=3762). For each item, RCT were rated as low, unclear or high risk of bias and observational studies were rated as low, moderate, serious or critical risk of bias. When there was insufficient information to make a firm judgment about the risk of bias for an individual item, the rating "no information" was used. Summary scores for observational studies were derived from the lowest score (highest risk of bias) for any single item (13). For RCT, the absence of patient blinding was excluded from the summary score because of the difficulties with blinding patients in surgical trials. Studies were rated at low risk of bias if rated low for all remaining domains; high risk of bias if rated high for two additional domains; and unclear for other scoring patterns. Following a pilot, the papers were reviewed independently and any differences in scoring were resolved and agreed by discussion.

Data synthesis

RTW data were reported in two ways: (i) the average time period from CTR to RTW; or (ii) the proportion of individuals who had returned by specified time points. The duration until RTW was reported using a mixture of days, weeks and months. To enable direct comparison within the review, all durations have been reported in days. The basis of the conversion was that one week

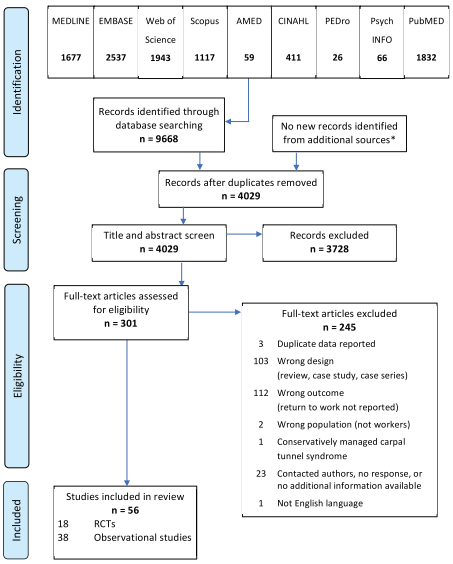

Figure 1. Systematic review flow diagram. Additional sources comprised: (1) trial registries (Cochrane Central Register of Controlled Trials; ClinicalTrials.gov; EU Clinical Trials Register; Alltrials.net; WHO International Clinical Trials Registry; NIHR UK Clinical Trials Gateway); (2) grey literature databases (e-theses Online Service; OpenThesis; ProQuest; OpenGrey; OpenDOAR); and (3) key journals (J Hand Surg - European; J Hand Surg - US; Occup Med; J Occup Rehab).

was equal to 7 days and one month equaled 30 days. In the absence of explicit information, an assumption was made that the reported RTW times included all 7 days of a calendar week, regardless of the participants' usual working pattern. Heterogeneity in both study methods and populations limited the review to a narrative analysis with summary descriptive statistics. Duration before RTW was summarized using the median and range. For each summary calculation, the number of studies and observations (study arms) that provided these data were documented. Due to inconsistent reporting of the number of workers in the included studies, summary data was not weighted for sample size.

Results

Study characteristics

Results for each stage of the literature search and reasons for exclusion are shown in figure 1. A total of 4029 individual records were identified, of which 56 met the review inclusion criteria; 18 RCT and 38 observational studies. Twenty-four authors were contacted for additional information, with only one providing clarification that enabled the study to be included (14). We found that two papers reported on the same study participants (15, 16), but as different RTW analyses were undertaken, both have been included in this review. Participant numbers and demographics were only counted once for these reports. The included research took place in 16 countries, primarily in North America and Europe, with three studies in Asia and one in Israel. Publication dates ranged from 1992–2016.

Participants

The 56 included studies comprised 14 335 CTR patients (1551 from RCT, 7328 from cohort studies and 5456 from a single case control study). Of these, 7 studies did not report the age of participants (14, 17–22) and 7 did not report the sex (18–21, 23–25). The mean age of CTR participants in the RCT ranged between 44–60 years, compared with 37–66 years in the cohort studies. The male/female ratio of participants was 1:2.4 for RCT and cohort studies and 1:3 for the case–control study. Study characteristics and reported duration until RTW are shown in appendix D (www.sjweh.fi/show_abstract.php?abstract_id=3762).

We found that study inclusion and exclusion criteria varied widely between studies. For example, there were no consistently reported methods of CTS diagnosis. Furthermore, 6 studies included only unilateral CTS (26–31), 7 included only bilateral CTS (32–38); 29 included individuals undergoing either unilateral or bilateral CTR (16, 20–25, 39–60), and 14 did not report whether participants had unilateral or bilateral CTS or CTR (14, 17–19, 48, 61–69).

Duration until RTW was reported by all included studies, however 6 RCT (18, 32, 40, 42, 45, 63) and 7 cohort studies (37, 38, 52, 54–56, 60) did not specify the number of individuals included in their RTW analyses. With the pragmatic assumption that, where unreported, all participants provided RTW data, this yielded a total of 1263 workers from RCT, 7071 from cohort studies and 1529 from 1 case–control study.

Methodological assessment

The risk of bias assessments are summarized in appendix C. Overall, only 4 studies were rated at low risk of bias: 1 RCT (27), 2 cohort studies (48, 69) and 1 case–control study (14). This compared with 27 studies rated at moderate or unclear risk of bias and 25 studies rated at high, serious or critical risk of bias. Common concerns centered on the assessment and reporting of RTW data, issues with the selection of participants for

observational studies, and the lack of assessor blinding for RTW data in RCT.

Measurement of return to work timescales

There was no common method of defining or collecting RTW data. Only 36 studies (64%) reported any information on how the period of post-operative work absence was calculated. Of these, three non-hierarchical categories were identified based on the method of RTW data collection: (i) regional/national databases (14, 27, 31); (ii) patient reported questionnaires or telephone interviews (15–17, 22, 25, 29, 37, 40, 42, 48–50, 52, 60, 68); and (iii) medical records. For the latter, RTW information was either recorded during clinical assessment (18, 20, 30, 35, 39, 44, 47, 51, 53, 63, 69) or was extracted retrospectively from the records (24, 38, 54, 56–58, 65).

Return to work timescales

Figure 2 shows the average time to RTW for the included studies. Only 19 studies summarized RTW time as a median. Median RTW time in these studies ranged from 7–60 days with an overall median of 28 days. Mean RTW times were reported in 41 studies, ranging from 4–168 days, with the overall median of 30 days (table 2). Of the 56 included studies, only 8 reported median RTW time and range or interquartile range (14, 27, 32, 35, 42, 46, 48, 55), while 24 studies provided a single point estimate with no measure of the spread of the data. Table 2 summarizes the reported duration to RTW according to different study characteristics: study type, CTR procedure, sample size, RTW data collection method, study location and risk of bias score. Details from the individual studies, including characteristics and reported RTW times are provided in appendix D.

Duration of work absence did not appear to increase or decrease consistently according to the hierarchy of risk of bias categories. Interestingly, the 11 RCT rated at unclear risk of bias generally reported faster RTW times and showed less variability than the studies in other risk of bias categories (table 2). RTW times varied when classified according to the method of data collection; median RTW times obtained from medical records tended to be earlier than those reported in databases or collected by interviews or questionnaires. In contrast, mean RTW times reported by interview/questionnaire were earlier than those recorded by the other methods (table 2). We found no apparent relationship between reported RTW time and year of publication.

Return to work rates

The percentage of participants who had returned to work by different post-operative time points was reported in 7 cohort studies; however, there was minimal overlap in the timing of data collection for each study (17, 19, 29, 47, 49, 60, 69). The reported time points for at least 50% of study participants to return to work ranged from 7–42 days (figure 3). Only one study recorded 100% RTW and this had occurred by 180 days (6 months) (60).

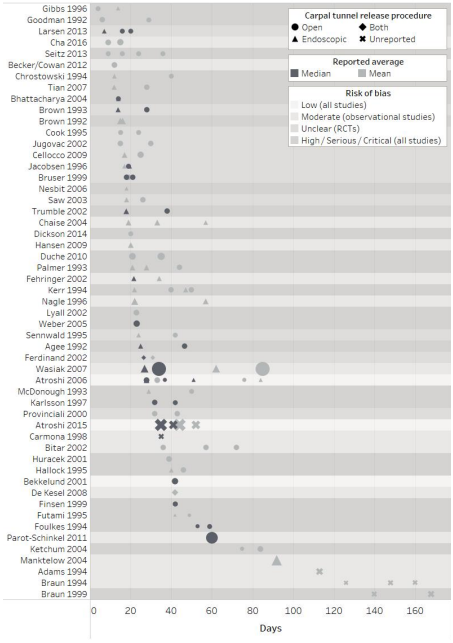

Figure 2. Reported return to work times following carpal tunnel release according to surgical procedure, point estimate (median/mean) and study risk of bias. Symbol size represents the number of study participants per study arm (range 3–1410).

Occupational information

Table 3 shows the summary RTW times for studies reporting occupational information. Of the 56 studies, 6 reported RTW times for different job types (16, 27, 34, 50, 59, 67), and 4 distinguished between return to modified duties and return to full duties (15, 18, 35, 57). Neither the method of classifying occupation nor the description of what constituted modified or full duties, were consistent across studies. For the purposes of this review, we classified desk-based, sedentary, white-collar or light work as "non-manual"; and light-repetitive, medium, heavy or blue-collar work as "manual". We also defined a subgroup of "heavy manual" workers which consisted of heavy manual and blue-collar work. Return

Table 2. Summary of reported return to work times according to methodological characteristics. [CTR=carpal tunnel release

Subgroup	Studies	Observations [a]	Return to work time reported as median (days)		Studies	Observations [a]	Return to work time reported as mean (days)	
			Median	Range			Median	Range
All studies	19	35	28	7–60	41	81	30	4–168
Study								
Randomized controlled trials	11	24	26	7–59	11	23	25	12–84
Observational study	8	11	35	21.5–60	30	58	36	4–168
CTR procedure								
Open CTR	15	21	34	14–60	29	44	29.5	4–85
Endoscopic CTR	9	10	18.75	7–51	21	28	22	12–92
Procedure not reported	3	4	35	26.5–41	6	10	119.5	31–168
Sample size (number of workers)								
<30	7	14	23.25	7–59	17	28	29	4–126
30–100	9	15	28	14–46.5	24	40	31	6–168
>100	4	6	38	27–60	9	13	44	15–140
Source of return to work data								
Regional or national databases	3	8	34.5	27–51	3	8	57	28–85
Questionnaires or interviews	4	5	53	35–60	9	14	23	4–92
Medical records	3	4	22.25	14–28	15	32	36	6–160
Not reported	7	14	23	14–46.5	14	27	22	6–168
Location								
Scandinavia	8	18	30	7–51	5	10	34.5	17–84
Europe (excluding Scandinavia)	4	6	19.5	14–60	12	21	26	15–57
North America	8	13	28	13–59	22	44	37	4–168
Other	·	·	·	··	3	6	21.5	9–49
Risk of bias								
Low (all studies)	3	7	37	28–51	2	6	48	28–84
Moderate (observational studies)	4	5	34	13–60	12	21	57	9–160
Unclear (randomised controlled trials)	5	10	19.25	7–28	9	17	24	15–43
High/serious/critical (all studies)	7	13	38	14–59	18	37	29	4–168

[a] Number of study arms. For each summary calculation, the number of studies and observations (study arms) are reported. Summary data was not weighted for sample size.

to light duties, one-handed activity, and light two-handed activity were classified as "modified duties"; return to normal or full duties were classified as "full duties".

Only Gimeno et al (69) reported return to work rates for different levels of work functioning. They reported that by two months after surgery, 41% of study participants reported working normally, while 28% had work limitations. By six months, this had improved to 58% and 26%, respectively. At both time points, the remainder of participants had yet to return to work. Only one study reported RTW time separately for full- and part-time work (16) and two studies reported RTW times separately for self-employed and employed participants (50, 67).

Participants receiving workers' compensation took longer to return to work in all studies reporting and comparing insurance types (23, 30, 35, 56, 59, 60, 65, 67). Where other insurance types were stated, such as national insurance schemes or private insurance, mean RTW times tended to be shorter than among those receiving workers' compensation (67, 56).

Earlier RTW was found in: non-manual workers; those able to return to modified duties; full-time workers; individuals who were self-employed; and those not receiving workers' compensation.

Return to work advice

Few studies reported that patients received any standardized RTW advice. Four studies recommended returning to work as soon as possible (15, 16, 43, 60); others advised patients to return when able (26, 44) or after suture removal (39). Three studies reported that the surgeon was responsible for suggesting a RTW time (17, 21, 66); one study reported that this was the role of the general practitioner (29); one study reported a combined decision between the surgeon and therapist (57); and two studies reported a combined decision between surgeon and patient (18, 41).

Discussion

This review systematically identified 56 studies reporting RTW timescales following CTR and compared their findings according to different occupational, clinical and study characteristics. Overall, our review points to substantial heterogeneity in the duration of work absence after CTR. Mean RTW times ranged from 4–168 days in 41 studies; median RTW times ranged from 14–60 days in 17 studies. Earlier RTW was reported following endoscopic CTR and in populations without workers'

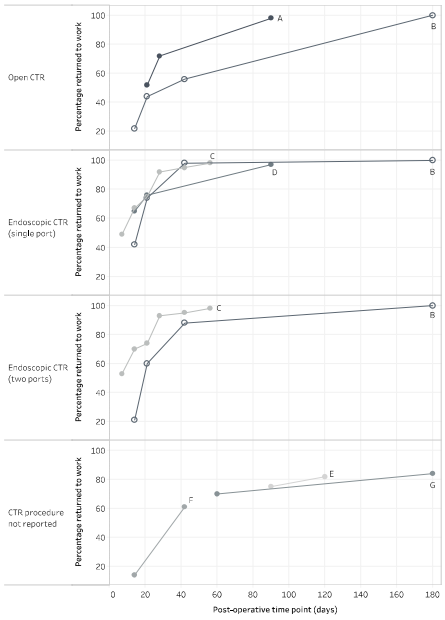

Figure 3. Cumulative proportion of carpal tunnel release patients who had returned to work by the reported time points. [CTR=carpal tunnel release; A=Ratzon et al (17); B=Palmer et al (60); C=Brown et al (19); D=Hansen et al (29); E=Adams et al (47); F=Carmona et al (49); G=Gimeno et al (69).]

compensation, findings that are consistent with those of previous systematic reviews (5–9, 70). We also found that return to modified duties occurred sooner than return to full duties and return to non-manual occupations were generally faster than return to manual roles. Where studies categorized the type of work, heavy manual work was associated with the longest period of work absence. This finding is supported by a recent review of the prognostic factors for RTW after CTR, which found that exposure to bending/twisting the hands at work, repetitive activities, heavy lifting and blue-collar work were all associated with delayed RTW (71).

Given that these findings might be expected, it was surprising how few studies adequately reported work-related information, such as occupation, working pattern (full-time or part-time), employment status (employed or self-employed) and availability of paid sick-leave. Only 36 studies gave a definition of RTW or described their method of collecting RTW data. Where this was defined, 50% used the participants' medical records as their data source. Our observed lack of reporting of work-related information in the included studies may therefore be explained, in part, by an absence of routine collection, or recording, of work-related information in clinical practice.

Two studies reported RTW data for employed and self-employed individuals, and both found that those who were self-employed returned to work sooner than salaried workers (50, 67). A further two studies deliberately excluded self-employed individuals from their RTW analyses (24, 44), the assumption being that the RTW process would be notably different for these individuals. However, a recent systematic review of RTW after hip and knee arthroplasty found no difference in RTW times for employed and self-employed workers, although only 2 of the 19 included studies reported relevant data (72). The role of the type of work contract (permanent, fixed term, zero hours or self-employed) on RTW after elective surgery remains unclear and requires further examination in CTR populations, taking into account issues such as job security and sick-leave entitlement.

We only found one study that specifically compared individuals in full-time work with those working part-time (16). The authors reported shorter periods of post-operative sick-leave among full-time workers, however, it is unclear whether all calendar days, or just those where the participant would usually be working, were included in this estimation.

Interestingly, we found that studies with large sample sizes (>100 workers per study arm) tended to report longer RTW times than medium-sized (30–100 workers) or small studies (<30 workers). One explanation for this finding is the left-censoring of data in at least one of the large studies. Atroshi et al (14) explicitly stated that their RTW data were obtained from a national database that registered work absences >14 days. Therefore, any individuals who returned to work within 14 days of their CTR would be omitted from this study. If every CTR patient had been included, the median time to RTW would be shorter. We could not ascertain whether a similar convention was adopted in the large study by Wasiak & Pransky (31), who also obtained RTW information from regional/national databases. Importantly, when the results were further examined, there was no clear association between RTW times and the method of obtaining RTW data. Moreover, we found no clear relationship between reported RTW times and risk of bias scoring.

Advice provided by healthcare professionals, particularly the surgeon, may be an important determinant of RTW time. Ratzon et al (17) found that surgeon's advice was a strong predictor of RTW times among their cohort. However, we were unable to explore the role of advice in the current review because so few studies specified what advice had been given and by whom.

The eligibility criteria for our review were deliberately broad to reflect the patients and CTR procedures

Table 3. Summary return to work (RTW) times according to reported occupational characteristics.

Subgroup	Studies	Observations [a]	RTW time reported as median (days)		Studies	Observations [a]	RTW time reported as mean (days)	
			Median	Range			Median	Range
Work duties								
Modified duties	1	1	13	..	4	6	20.5	12–50
Full duties	1	1	63	..	4	5	27	17–82
Work type								
Non-manual	1	1	21	..	6	11	21	7–49
Manual	1	1	36	..	6	14	39	18–101
Heavy manual	1	1	36	..	3	4	46.5	22–101
Employer								
Employed	.	.	.	..	2	3	36	33–57
Self-employed	.	.	.	..	2	2	21	19–23
Working pattern								
Part-time	.	.	.	..	1	2	24.5	15–34
Full-time	.	.	.	..	1	2	12	10–14
Workers' compensation status								
Workers' compensation	4	6	56.5	27–114	16	29	56	23–160
No workers' compensation	3	5	19	15–45.5	12	20	18.5	3–57
Other health insurance [b]	4	11	35	7-51	7	14	35	17–84

[a] Number of study arms/subgroups. For each summary calculation, the number of studies and observations (study arms) are reported. Summary data was not weighted for sample size.

[b] Any reported health insurance including national and personal schemes.

seen in clinical practice. All studies purported to measure RTW duration after CTR, but key information, such as the definition of RTW, the method of assessment and the number of workers contributing data were frequently unreported. As a result, we provided descriptive summaries of the reported RTW times as the median and range. It is a limitation of the current review that we were unable to pool data for a formal meta-analysis with a sample size weighting.

In order to present the data consistently, all RTW durations were reported in days. In some cases, this involved a conversion from weeks or months to days, which may not truly reflect the timescales collected in the original dataset. It is also possible that some authors calculated RTW duration based on a 5-day working week, although this was not specified.

Time to RTW would not be expected to show a normal distribution because the presence of a few individuals who take much longer to RTW will cause a positive skew to the data. For this reason, summarizing RTW duration as the mean has the potential to inflate the point estimate, as seen in four of the five studies that reported both mean and median (14, 27, 31, 35). At the most extreme, the study by Wasiak & Pransky (31) reported a mean RTW time after open CTR of 85 days as compared with a median of 34 days (31). This bias has obvious implications when interpreting the findings of our review and for patients wishing to know the usual period of time it takes for someone to return to an occupation that is similar to their own. To generate more useful clinical information, future research should report RTW times as the median and range to better enable comparison between studies. Only eight of the studies in our review reported their data in this way and therefore consideration needs to be given to the probable positive skew of the studies which reported only mean RTW time, and the associated consequences of this on the summary data presented in this review.

Despite the weaknesses identified in many of the included studies, our review adds to the existing CTR literature by demonstrating a wide range of RTW times across a large number of international studies using different methodological approaches. Previous reviews have been restricted to either the smaller number of published RCT that were designed to assess the clinical effectiveness of different interventions (5–9); or to studies of prognostic factors for RTW without an assessment of the duration of work absence (71).

Inconsistencies in the definition and measurement of time to RTW in CTR settings have been previously discussed (73). The authors called for standardized assessment of RTW, measured in days, and including information on type of work, insurance status and rehabilitation. The results of the current review show that this information is still not consistently reported and clear standards for the measurement and reporting of work-related outcomes in clinical studies need to be defined. In particular, we would argue for a clear statement of the number of workers in the study sample; provision of summary data on the spread of RTW times, rather than just a point estimate; documentation of the number of workers who had not returned to work by the end of the study period; capturing any subsequent, related periods of sick leave; and making a clear distinction between return to paid work and return to other activities. There is also a need to establish a definition for the assessment of return to modified and full work duties and a standardized categorization of occupational roles. In the current

review, only six studies provided information on RTW times for different types of occupation, but the classifications varied so widely that it was only feasible to group into discrete "manual" and "non-manual" categories for purposes of the review summary. As a result, the studies provide only limited information for clinicians to draw upon in advising individual patients of how long it might take to return to specific work roles.

We purposefully included research conducted in any country and acknowledge the potential issues associated with the comparison of findings from different cultural, social, welfare and healthcare backgrounds. In fact, the majority of included studies were conducted in the USA and the results were spread across the range of reported RTW durations, including both the shortest and longest periods of work absence. Scandinavian studies reported longer RTW times than those conducted in other parts of Europe. This finding might also be partly explained by the left-censoring of RTW data captured from national databases, as discussed above. One study included in this review specifically compared RTW times across two different geographical settings. Bitar et al (65) retrospectively assessed post-operative work absence among 81 female workers from USA (34 with workers' compensation, 47 without) and 42 female workers from Sweden. Both groups from the USA took longer to return to work than the Swedish cohort. The availability of compensation or other paid sick leave is an important determinant of duration to RTW, however the influences of additional cultural and contextual factors on post-operative RTW timescales warrant further exploration.

The key factors underpinning the wide variation in reported RTW times remain unclear, largely due to the heterogeneity of the available studies and incomplete reporting. The findings of our review support the call for greater clarity in the reporting of work-related outcomes in relevant studies. RTW time needs to be measured consistently and include a description of influential factors, such as: type of occupation and employment status, RTW advice and return to modified or full duties. However, despite the limitations of the available studies, our findings suggest that occupational factors play an important role in RTW after CTR. The identified literature suggests longer periods of work absence among those who: were employed (rather than self-employed), worked part-time (rather than full-time), worked in heavy manual occupations, or were required to return to full (rather than amended) duties. Further research is required to determine whether earlier RTW is appropriate for these groups, and if so, to determine the safest recommended timescales.

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Conflicts of interest

The authors declare no conflict of interest.

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Appendix D PRISMA checklist

	#	Checklist item	Section
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Chapter 3
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	Appendix C
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	Section
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	Section 3.2
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	Section 3.3.1
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	Section 3.3.1 & Table 3.1
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	Section 3.3.1 & Table 3.2
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Appendix E
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	Section 3.3.1
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	Section 3.3.1 & Appendix F
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	Appendix F
Individual study risk of bias	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	Section 3.3.2, Table 3.3 & Appendix G
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	Section 3.3.3
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	Section 3.3.3

	#	Checklist item	Section
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	Section 3.3.2 & 3.4.1.2
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	N/A
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	Section 3.4.1, Figure 3.1 & Appendix H
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Section 3.4.1
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Figure 3.2, Figure 3.3 & Figure 3.4
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Table 3.8 – Table 3.11
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	Table 3.12 & Table 3.13
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	Section 3.4.2.2 & Figure 3.7
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	N/A
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	Section 3.5
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	Section 3.6.5
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	Section 3.7
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	Acknowledgements & Appendix C

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 2009; 6(7): e1000097. doi:10.1371/journal.pmed1000097.

Appendix E Sample search strategy (Medline)

Population:
carpal tunnel syndrome/
carpal tunnel.mp.
median neuropathy/
median neuropath*.mp.
median nerve entrap*.mp.
median nerve compress*.mp.
median nerve imping*.mp.

AND

general surgery/ or orthopaedics/ or surgery, plastic/
surg*.mp.
release.mp.
decompression, surgical/
decompression.mp.
epineurotomy.mp.
operat*
postoperat*.mp.
post operat*.mp.

Intervention/Comparator:
No particular search terms will be defined to ensure that no interventions/comparators are missed

AND

Outcomes:
return to work/
return to work.mp.
sick leave/
sick*.mp.
absenteeism/
absen*.mp.
time off work.mp.
work/
work*.mp.
convalescence/
convales*
employ*.mp
occupations/
occupation*

time factors/
time.mp.
function*.mp.
treatment outcomes/
outcome*

Appendix F Systematic review data extraction forms

F.1 Randomised controlled trials

STUDY IDENTIFICATION				
Reviewer	Study number	Year	Primary author	Journal

STUDY DETAILS		**Location in text**
Study design		
Location (country)		
Source of participants & method of recruitment		
N assessed for eligibility		
Total N randomised		
PARTICIPANT CHARACTERISTICS		**Location in text**
Method of CTS diagnosis (mark all that apply)	☐ Phalen's test ☐ Tinel's test ☐ History of symptoms ☐ Nerve conduction studies ☐ Other (please state)	
Key inclusion criteria		
Key exclusion criteria		
Bilateral/unilateral CTS	☐ Bilateral CTS patients only ☐ Unilateral CTS patients only ☐ Mixture ☐ Unclear ☐ Other (please state)	
INTERVENTION(S) & COMPARATOR(S)		**Location in text**
Group 1	**N**	
Description of CTR technique	☐ Open traditional incision ☐ Open mini-incision ☐ Endoscopic (☐ one port / ☐ two port) ☐ Other (please state) ☐ General anaesthetic ☐ Regional block / local anaesthetic ☐ Other (please state)	
Description of intervention if separate from CTR technique		
Post-op management	☐ Bulky dressings (when removed?) ☐ Splint or cast (when removed?) ☐ Removal of sutures (when?) ☐ Rehab Please select ☐ Unclear ☐ Other (please state)	

Advice about RTW / function	☐ Advice about function (what and who by) ☐ Advice about return to work (what and who by) ☐ Not mentioned / unclear	
Age (mean, SD)		
Male/female	Male = Female = ☐ Not specified	
Pre-op CTS severity	☐ Boston/Levine/Levine-Katz/carpal tunnel questionnaire General score: Symptom severity score (SSS): Functional status score (FSS): ☐ Not reported	
Number of workers in grp 3		
Insurance status of workers	☐ Workers' compensation – number: ☐ Insurance – number: ☐ Sick pay – number: ☐ No funding – number: ☐ Other funding for sick leave	
Occupational classification & numbers		
Group 2		**N** / **Location in text**
Description of CTR technique	☐ Open traditional incision ☐ Open mini-incision ☐ Endoscopic (☐ one port / ☐ two port) ☐ Other (please state ☐ General anaesthetic ☐ Regional block / local anaesthetic ☐ Other (please state)	
Description of intervention if separate from CTR technique		
Post-op management	☐ Bulky dressings (when removed?) ☐ Splint or cast (when removed?) ☐ Removal of sutures (when?) ☐ Rehab Please select ☐ Unclear ☐ Other (please state)	
Advice about RTW / function	☐ Advice about function (what and who by) ☐ Advice about return to work (what and who by) ☐ Not mentioned / unclear	
Age (mean, SD)		
Male/female	Male = Female = ☐ Not specified	
Pre-op CTS severity	☐ Boston/Levine/Levine-Katz/carpal tunnel questionnaire General score: Symptom severity score (SSS): Functional status score (FSS): ☐ Not reported	
Number of workers in grp 3		

Insurance status of workers	☐ Workers' compensation – number: ☐ Insurance – number: ☐ Sick pay – number: ☐ No funding – number: ☐ Other funding for sick leave (please state)	
Occupational classification & numbers		

Group 3 (if applicable)		**N**	**Location in text**
Description of CTR technique	☐ Open traditional incision ☐ Open mini-incision ☐ Endoscopic (☐ one port / ☐ two port) ☐ Other (please state) ☐ General anaesthetic ☐ Regional block / local anaesthetic ☐ Other (please state)		
Description of intervention if separate from CTR technique			
Post-op management	☐ Bulky dressings (when removed?) ☐ Splint or cast (when removed?) ☐ Removal of sutures (when?) ☐ Rehab Please select ☐ Unclear ☐ Other (please state)		
Advice about RTW / function	☐ Advice about function (what and who by) ☐ Advice about return to work (what and who by) ☐ Not mentioned / unclear		
Age (mean, SD)			
Male/female	Male = Female = ☐ Not specified		
Pre-op CTS severity	☐ Boston/Levine/Levine-Katz/carpal tunnel questionnaire General score: Symptom severity score (SSS): Functional status score (FSS): ☐ Not reported		
Number of workers in grp 3			
Insurance status of workers	☐ Workers' compensation – number: ☐ Insurance – number: ☐ Sick pay – number: ☐ No funding – number: ☐ Other funding for sick leave (please state)		
Occupational classification & numbers			

OUTCOMES	**Location in text**
Mark all outcomes recorded for this study: ☐ Return to work timescale ☐ Return to work schedule/process ☐ Number of drop outs/losses to follow-up ☐ Complications ☐ Patient-reported measures of CTS symptoms ☐ Patient-reported measures of hand/wrist function	

☐ Return to ADL timescale/quality ☐ Quality of life measure (eg SF36/SF12) ☐ Strength (eg grip/pinch) ☐ Sensation (eg Semmes-Weinstein monofilaments /2-point discrimination) ☐ Neurophysiology (eg nerve conduction/EMG) ☐ Cost Study primary outcome(s):	

Primary review outcome: Return to work time point		**Location in text**
Term used in text (eg sick leave, time to RTW etc)		
Definition of measure (eg time from surgery to return to full duties etc)		
Method of data collection (eg patient self-report etc)		
Time point(s) at which outcome is reported		
Plan for RTW measure for bilateral cases	☐ Bilateral – simultaneous surgery counted as one case ☐ Bilateral – staged CTR: RTW reported for each hand ☐ Bilateral – staged CTR: RTW reported for one hand ☐ Bilateral patients excluded ☐ Unclear ☐ Other (please state)	
Hand dominance, side of surgery and RTW (please select all that apply)	☐ Hand dominance discussed ☐ Hand dominance in relation to side of surgery ☐ Hand dominance in relation to surgery & RTW ☐ Unclear ☐ Other (please state)	

RESULTS: return to work time point

Grp 1 N workers	Grp 1 Mean/ median	Grp 1 SD/IQR	Grp 2 N workers	Grp 2 Mean/ median	Grp 2 SD/IQR	Time point	Type of effect estimate	Low CI	Up CI	p-value	Location in text and nature of measure
Other outcomes for RTW and/or details on the RTW process Group 1 Group 2											
Grp 1 N workers	Grp 1 Mean/ median	Grp 1 SD/IQR	Grp 3 N workers	Grp 3 Mean/ median	Grp 3 SD/IQR	Time point	Type of effect estimate	Low CI	Up CI	p-value	Location in text and nature of measure
Other outcomes for RTW and/or details on the RTW process Group 3											
Grp 2 N workers	Grp 2 Mean/ median	Grp 2 SD/IQR	Grp 3 N workers	Grp 3 Mean/ median	Grp 3 SD/IQR	Time point	Type of effect estimate	Low CI	Up CI	p-value	Location in text and nature of measure

F.2 Observational studies

STUDY IDENTIFICATION				
Reviewer	Study number	Year	Primary author	Journal

STUDY DETAILS		Location in text
Study design		
Location (country)		
Source of participants & method of recruitment		
N assessed for eligibility		
Total N included		
PARTICIPANT CHARACTERISTICS		**Location in text**
Method of CTS diagnosis (mark all that apply)	☐ Phalen's test ☐ Tinel's test ☐ History of symptoms ☐ Nerve conduction studies ☐ Other (please state)	
Key inclusion criteria		
Key exclusion criteria		
Bilateral/unilateral CTS	☐ Bilateral CTS patients only ☐ Unilateral CTS patients only ☐ Mixture ☐ Unclear ☐ Other (please state)	
INTERVENTION(S) & COMPARATOR(S)		**Location in text**
Group 1	**N**	
Description of CTR technique	☐ Open traditional incision ☐ Open mini-incision ☐ Endoscopic (☐ one port / ☐ two port) ☐ Other (please state) ☐ General anaesthetic ☐ Regional block / local anaesthetic ☐ Other (please state)	
Description of intervention if separate from CTR technique		
Post-op management	☐ Bulky dressings (when removed?) ☐ Splint or cast (when removed?) ☐ Removal of sutures (when?) ☐ Rehab Please select ☐ Unclear ☐ Other (please state)	
Advice about RTW / function	☐ Advice about function (what and who by) ☐ Advice about return to work (what and who by) ☐ Not mentioned / unclear	
Age (mean, SD)		

Male/female	Male = Female = ☐ Not specified	
Pre-op CTS severity	☐ Boston/Levine/Levine-Katz/carpal tunnel questionnaire General score: Symptom severity score (SSS): Functional status score (FSS): ☐ Not reported	
Number of workers in grp 1		
Insurance status of workers	☐ Workers' compensation – number: ☐ Insurance – number: ☐ Sick pay – number: ☐ No funding – number: ☐ Other funding for sick leave	
Occupational classification & numbers		

Group 2		**N**	**Location in text**
Description of CTR technique	☐ Open traditional incision ☐ Open mini-incision ☐ Endoscopic (☐ one port / ☐ two port) ☐ Other (please state ☐ General anaesthetic ☐ Regional block / local anaesthetic ☐ Other (please state)		
Description of intervention if separate from CTR technique			
Post-op management	☐ Bulky dressings (when removed?) ☐ Splint or cast (when removed?) ☐ Removal of sutures (when?) ☐ Rehab Please select ☐ Unclear ☐ Other (please state)		
Advice about RTW / function	☐ Advice about function (what and who by) ☐ Advice about return to work (what and who by) ☐ Not mentioned / unclear		
Age (mean, SD)			
Male/female	Male = Female = ☐ Not specified		
Pre-op CTS severity	☐ Boston/Levine/Levine-Katz/carpal tunnel questionnaire General score: Symptom severity score (SSS): Functional status score (FSS): ☐ Not reported		
Number of workers in grp 2			
Insurance status of workers	☐ Workers' compensation – number: ☐ Insurance – number: ☐ Sick pay – number: ☐ No funding – number: ☐ Other funding for sick leave (please state)		
Occupational classification & numbers			

Group 3 (if applicable)		N	Location in text
Description of CTR technique	☐ Open traditional incision ☐ Open mini-incision ☐ Endoscopic (☐ one port / ☐ two port) ☐ Other (please state) ☐ General anaesthetic ☐ Regional block / local anaesthetic ☐ Other (please state)		
Description of intervention if separate from CTR technique			
Post-op management	☐ Bulky dressings (when removed?) ☐ Splint or cast (when removed?) ☐ Removal of sutures (when?) ☐ Rehab Please select ☐ Unclear ☐ Other (please state)		
Advice about RTW / function	☐ Advice about function (what and who by) ☐ Advice about return to work (what and who by) ☐ Not mentioned / unclear		
Age (mean, SD)			
Male/female	Male = Female = ☐ Not specified		
Pre-op CTS severity	☐ Boston/Levine/Levine-Katz/carpal tunnel questionnaire General score: Symptom severity score (SSS): Functional status score (FSS): ☐ Not reported		
Number of workers in grp 3			
Insurance status of workers	☐ Workers' compensation – number: ☐ Insurance – number: ☐ Sick pay – number: ☐ No funding – number: ☐ Other funding for sick leave (please state)		
Occupational classification & numbers			
OUTCOMES			**Location in text**
Mark all outcomes recorded for this study: ☐ Return to work timescale ☐ Return to work schedule/process ☐ Number of drop outs/losses to follow-up ☐ Complications ☐ Patient-reported measures of CTS symptoms ☐ Patient-reported measures of hand/wrist function ☐ Return to ADL timescale/quality ☐ Quality of life measure (eg SF36/SF12) ☐ Strength (eg grip/pinch) ☐ Sensation (eg Semmes-Weinstein monofilaments /2-point discrimination) ☐ Neurophysiology (eg nerve conduction/EMG) ☐ Cost Study primary outcome(s):			
Primary review outcome: Return to work time point			**Location**

		in text
Term used in text (eg sick leave, time to RTW etc)		
Definition of measure (eg time from surgery to return to full duties etc)		
Method of data collection (eg patient self-report etc)		
Time point(s) at which outcome is reported		
Plan for RTW measure for bilateral cases	☐ Bilateral – simultaneous surgery counted as one case ☐ Bilateral – staged CTR: RTW reported for each hand ☐ Bilateral – staged CTR: RTW reported for one hand ☐ Bilateral patients excluded ☐ Unclear ☐ Other (please state)	
Hand dominance, side of surgery and RTW (please select all that apply)	☐ Hand dominance discussed ☐ Hand dominance in relation to side of surgery ☐ Hand dominance in relation to surgery & RTW ☐ Unclear ☐ Other (please state)	

RESULTS: return to work time point

Grp 1 N workers	Grp 1 Mean/ median	Grp 1 SD/IQR	Grp 2 N workers	Grp 2 Mean/ median	Grp 2 SD/IQR	Time point	Type of effect estimate	Low CI	Up CI	p-value	Location in text and nature of measure
Other outcomes for RTW and/or details on the RTW process Group 1 Group 2											
Grp 1 N workers	Grp 1 Mean/ median	Grp 1 SD/IQR	Grp 3 N workers	Grp 3 Mean/ median	Grp 3 SD/IQR	Time point	Type of effect estimate	Low CI	Up CI	p-value	Location in text and nature of measure
Other outcomes for RTW and/or details on the RTW process Group 3											
Grp 2 N workers	Grp 2 Mean/ median	Grp 2 SD/IQR	Grp 3 N workers	Grp 3 Mean/ median	Grp 3 SD/IQR	Time point	Type of effect estimate	Low CI	Up CI	p-value	Location in text and nature of measure

Appendix G Risk of bias assessment forms

G.1 Randomised controlled trials

Study number	**Primary author and year of publication**		
Title			
Study aims			
CRITERIA	**DESCRIPTION**	**RoB H/L/U**	**JUDGEMENT**
Sequence generation			
Allocation concealment			
Blinding of participants / personnel			
Blinding of outcome assessors	RETURN TO WORK		
Incomplete outcome data	RETURN TO WORK		
Selective outcome reporting			
Other sources of bias	POST-OPERATIVE ADVICE COMPLICATIONS		

G.2 Observational studies

Study number	**Reviewer**	**Primary author and year of publication**	**Study type**
Title			
Study aims			

CRITERIA	**DETAILS**	**DESCRIPTION & JUDGEMENT (inc direction of bias if identified)**	**RISK OF BIAS**
Confounding	- *Is confounding of the effect of intervention likely?* - *Do the authors use an appropriate analysis method to adjust for key confounders?* - *Were adjusted confounders measured validly and reliably?* - *Do the authors avoid controlling for post-intervention variables?*		**Low** **Moderate** **Serious** **Critical** **No info**
Selection of participants	- *CASE CONTROL: Were the controls sampled from the population that gave rise to the cases, or using another method that avoids selection bias?* - *If present, were adjustment techniques used to correct for presence of selection bias?*		**Low** **Moderate** **Serious** **Critical** **No info**

Measurement of interventions	- *Is intervention status well defined?* - *Was information on intervention status recorded at the time of intervention?* - *Was information on intervention status unaffected by knowledge of the outcome?*		**Low** **Moderate** **Serious** **Critical** **No info** **N/A**
Departures from the intended interventions	- *Were critical co-interventions balanced across groups?* - *Were numbers of switches to other interventions low?* - *Was implementation failure low?*		**Low** **Moderate** **Serious** **Critical** **No info** **N/A**
Missing data	- *Was outcome status reasonably complete?* - *Were data on intervention status reasonably complete? And for other variables in the analysis?* - *Are the % of participants and reasons for missing data similar across groups?* - *Are appropriate statistical methods used to account for missing data?*	RETURN TO WORK	**Low** **Moderate** **Serious** **Critical** **No info**
Measurement of outcomes	- *CASE CONTROL: Was the definition of case status and control status based on objective criteria? And applied without knowledge of the intervention received?* - *Could the outcome measure have been influenced by the knowledge of the intervention received?* - *Were outcome assessors blinded?*	RETURN TO WORK | ADVICE | COMPLICATIONS	**Low** **Moderate** **Serious** **Critical** **No info**
Selection of the reported result	- *Are the reported analyses likely to be selected on the basis of the results (multiple outcome measures, multiple analyses, different subgroups)?*	RETURN TO WORK	**Low** **Moderate** **Serious** **Critical** **No info**
Overall bias	***Low*** *Study comparable to well-performed RCT (overall if low for all domains)*		**Low**
	Moderate *Study good for a non-randomised study (overall if low/moderate for all domains)*		**Moderate**
	Serious *Some important problems* *(overall if serious in ≥1 domain, with no critical)*		**Serious**
	Critical *Too problematic to provide useful info* *(overall if critical in ≥1 domain)*		**Critical**
	No info *Too little info to make judgement of bias* *(overall if not clear indication of serious/critical)*		**No info**

Appendix H Studies excluded from the systematic review and reason for exclusion

1. Abasolo, L; Carmona, L; Hernandez-Garcia, C; Lajas, C; Loza, E; Blanco, M; Candelas, G; Fernandez-Gutierrez, B; Jover, JA. Musculoskeletal work disability for clinicians: Time course and effectiveness of specialized intervention program by diagnosis. *Arthritis Care & Research* 2007 57(2):335-42. **Reason for exclusion:** Carpal tunnel syndrome not surgically managed

2. Abdullah, AF; Wolber, PH; Ditto, EW. Sequelae of carpal tunnel surgery: rationale for the design of a surgical approach. *Neurosurgery* 1995; 37(5):931-5. **Reason for exclusion:** Return to work timescales not documented

3. Abrams, R. Endoscopic versus open carpal tunnel release. *Journal of Hand Surgery [Am]* 2009; 34(3):535-39. **Reason for exclusion:** Case study

4. Acharya, AD; Auchincloss, JM. Return to functional hand use and work following open carpal tunnel surgery. *Journal of Hand Surgery [Am]* 2005; 30(6):607-10. **Reason for exclusion:** Case series

5. Adams, BD. Endoscopic carpal tunnel release. *Journal of the American Academy of Orthopedic Surgery* 1994; 2(3):179-84. **Reason for exclusion:** Review article

6. Adulkasem, W; Hirunyachot P; Prathumsuwan, C. Locally made instruments for endoscopic carpal tunnel release. *Journal of Orthopaedic Surgery* 2000; 8(1):9-13. **Reason for exclusion:** Case series

7. Afshar, A; Yekta, Z. Surgical improvement of the hands in sequential bilateral carpal tunnel surgery. *Journal of Plastics Reconstructive & Aesthetics Surgery* 2010; 63(2):E193-4. **Reason for exclusion:** Return to work timescales not documented

8. Agee, JM; McCarroll, HR; North, ER. Endoscopic carpal tunnel release using the single proximal incision technique. *Hand Clinics* 1994; 10(4):647-59. **Reason for exclusion:** Review article

9. Ahmed, GS. Chronic carpal tunnel syndrome: Results of carpal tunnel release. *Journal of the Liaquat University of Medical and Health Sciences* 2007; 6(1):21-24. **Reason for exclusion:** Return to work timescales not documented

10. Akhtar, S; Sinha, S; Bradley, MJ; Burke, FD; Wilgis, SEF; Dubin, NH. Study to assess differences in outcome following open carpal tunnel decompressions performed by surgeons of differing grade. *Annal of the Royal College of Surgeons of England* 2007; 89(8):785-88. **Reason for exclusion:** Return to work timescales not documented

11. Al-Awadi, Y; Al-Sheikh, T; Dawood, OM; Alexandrov, J. Review study for 243 patients with carpal tunnel syndrome who underwent open release. *Pan Arab Journal of Neurosurgery* 2007; 11(2):69-72. **Reason for exclusion:** Return to work timescales not documented

12. Alper, BS. Evidence-based medicine. Surgery or steroid injection for carpal tunnel syndrome? *Clinical Advisor* 2005; 8(11):161. **Reason for exclusion:** Review article

13. Al-Qattan, MM; Bowen, V; Manktelow RT. Factors associated with poor outcome following primary carpal tunnel release in non-diabetic patients. *Journal of Hand Surgery [Br]* 1994; 19(5): 622-5. **Reason for exclusion:** Return to work timescales not documented.

14. Amadio, PC; Silverstein, MD; Ilstrup, DM; Schleck, CD; Jensen, LM. Outcome assessment for carpal tunnel surgery: the relative responsiveness of generic, arthritis-specific, disease-specific, and physical examination measures. *Journal of Hand Surgery [Am]* 1996; 21(3):338-46. **Reason for exclusion:** Return to work timescales not documented

15. Amick, BC; Habeck, RV; Ossmann, J; Fossel, AH; Keller, R; Katz JN. Predictors of successful work role functioning after carpal tunnel release surgery. *Journal of Occupational & Environmental Medicine* 2004; 46(5):490-500. **Reason for exclusion:** Return to work timescales not documented

16. Amirfeyz, R; Pentlow, A; Foote, J; Leslie I. Assessing the clinical significance of change scores following carpal tunnel surgery. *International Orthopaedics* 2009; 33(1):181-85. **Reason for exclusion:** Return to work timescales not documented

17. Andreu, JL; Ly-Pen, D. A randomized controlled trial of surgery vs seriod injection for carpal tunnel syndrome. *Neurology* 2006; 66(6):955. **Reason for exclusion:** Comment in response to an article; no new relevant information

18. Appleby, MA; Neville-Smith, M; Parrott, MW. Functional outcomes post carpal tunnel release: A modified replication of a previous study. *Journal of Hand Therapy* 2009; 22(3):240-48. **Reason for exclusion:** Return to work timescales not documented

19. Asamoto, S; Boker, DK; Jodicke, A. Surgical treatment of carpal tunnel syndrome. *Japanese Journal of Neurosurgery* 2004; 13(1):27-31. **Reason for exclusion:** Return to work timescales not documented

20. Aslani, HR; Alizadeh, K; Eajazi, A; Karimi, A; Karimi, MH; Zaferani, Z; Hosseini Khameneh, SM. Comparison of carpal tunnel release with three different techniques. *Clinical Neurology & Neurosurgery* 2012; 114(7):965-68. **Reason for exclusion:** Authors contacted for additional information. Return to work timescales reported in combination with return to daily activities; authors unable to access separate data specifically for return to work timescales

21. Astifidis, RP; Koczan, BJ; Dubin, NH; Burke, FD; Wilgis, EFS. Patient satisfaction with carpal tunnel surgery: Self administered questionnaire versus physical testing. *Hand Therapy* 2009; 14(2):39-45. **Reason for exclusion:** Return to work timescales not documented

22. Atabey, C; Kahraman, S; Kafadar, A; Akbörü, M. Endoscopic carpal tunnel release using the biportal technique. *Military Medicine* 2006; 171(2):150-52. **Reason for exclusion:** Case series

23. Atherton, WG; Faraj, AA; Riddick, AC; Davis, TR. Follow-up after carpal tunnel decompression – general practitioner surgery or hand clinic? A Randomized prospective study. *Journal of Hand Surgery [Br]* 1999; 24(3):296-7. **Reason for exclusion:** Return to work timescales not documented

24. Atroshi, I; Gummesson, C; McCabe, SJ; Ornstein, E. The SF-6D healthy utility index in carpal tunnel syndrome. *Journal of Hand Surgery [Eur]* 2007; 32(2):198-202. **Reason for exclusion:** Return to work timescales not documented

25. Atroshi, I; Hofer, M; Larsson, GU; Ornstein, E; Johnsson, R; Ranstam, J. Open compared with 20portal endoscopic carpal tunnel release: A 5-year follow-up of a randomized controlled trial. *Journal of Hand Surgery [Am]* 2009; 34(2):266-72. **Reason for exclusion:** Return to work timescales not documented

26. Atroshi, I; Hofer, M; Larsson, GU; Ranstam, J. Extended follow-up of a randomized clinical trial of open vs endoscopic release surgery for carpal tunnel syndrome. *Journal of the American Medical Association* 2015; 314;(13):1399-401. **Reason for exclusion:** Return to work timescales not documented

27. Atroshi, I; Johnsson, R; Nouhan, R; Crain, G, McCabe, SJ. Endoscopic carpal tunnel release: prospective assessment of 225 consecutive cases. *Journal of Hand Surgery [Br]* 1997; 22(1):42-7. **Reason for exclusion:** Case series

28. Atroshi, I; Johnsson, R; Ornstein, E. Patient satisfaction and return to work after endoscopic carpal tunnel surgery. *Journal of Hand Surgery [Am]* 1998; 23(1):58-65. **Reason for exclusion:** Case series

29. Avci, S; Sayli, U. Carpal tunnel release using a short palmar incision and a new knife. *Journal of Hand Surgery [Br]* 2000; 25(4):357-60. **Reason for exclusion:** Case series

30. Avila-Ramirez, J; Avila-Cervantes, R; Reyes-Rodriguez, V; Dominguez-Herz, R. Open carpal tunnel release, retrospective analysis from 101 patients. *Journal of Neurosurgery* 2012; 117(2):A439-40. **Reason for exclusion:** Return to work timescales not documented

31. Badger, SA; O'Donnell, ME; Sherigar, JM; Connolly, P; Spence, RAJ. Open carpal tunnel release – still a safe and effective operation. *Ulster Medical Journal* 2008; 77(1):22-24. **Reason for exclusion:** Return to work timescales not documented

32. Bande, S; De Smet, L; Fabry, G. The results of carpal tunnel release: open versus endoscopic technique. *Journal of Hand Surgery [Br]* 1994; 19(1):14-17. **Reason for exclusion:** Author contacted for additional information; no response. Return to work timescales combined with return to leisure activities

33. Barnowski, TL; Blessinger, SC; Britton, KJ; Flanagan, KE; Mieling, PA; Ptacek, MN; Moyers, PA. The relationship of compliance and grip strength return post-carpal tunnel release surgery. *Work* 1998: 10(2):181-91. **Reason for exclusion:** Case series

34. Barton, NJ. Re: Carpal tunnel syndrome and work, Dias et al. *Journal of Hand Surgery [Br & Eur]* 2005; 30(1):99. **Reason for exclusion:** Comment in response to an article with no new relevant information

35. Bekkelund, SI; Pierre-Jerome, C; Ingebrigtsen, T. Clinical outcome and disability in carpal tunnel syndrome. *Neurology* 1999; 52(6):A217-18. **Reason for exclusion:** Authors contacted for additional information; unable to extract return to work timescales from the reported data

36. Bessette, L; Daltroy, LH; Lew, RA; Liang, MH; Fossel, AH; Katz, JN. Association between patients expectations of carpal tunnel surgery and patients satisfaction, and change in symptoms and function severity at 6 months follow-up. *Arthritis & Rheumatism* 1995; 38(9):1370. **Reason for exclusion:** Return to work timescales not documented

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Appendix I Publication from the survey of clinicians

Full Length Article

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Return to work recommendations after carpal tunnel release: a survey of UK hand surgeons and hand therapists

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Abstract

There is a limited evidence base from which to derive recommendations for safe and effective return to different types of occupation after carpal tunnel release surgery. The current practice of members of the British Society for Surgery of the Hand and the British Association of Hand Therapists was investigated with a questionnaire. In total, 173 surgeons and 137 therapists responded from an estimated sample of 1959. Median recommended return-to-work times were 7 days for desk-based duties, 15 days for repetitive light manual duties and 30 days for heavy manual duties. However, the responses were wide-ranging: 0–30 days for desk-based; 1–56 days for repetitive light manual; and 1–90 days for heavy manual. Variation in the recommended timescales for return to work and other functional activities after carpal tunnel release suggests that patients are receiving different and possibly even conflicting advice.

Level of evidence: V

Keywords

Carpal tunnel syndrome, carpal tunnel release, return to work, advice

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Introduction

To date, there is a limited evidence base from which to advise patients when they should aim to return to work (RTW), or other activities, after carpal tunnel release (CTR). The Royal College of Surgeons' patient guide 'Helping you make a speedy recovery after carpal tunnel release' suggests timescales for return to different occupations: supervisory and managerial roles (7–14 days); light manual roles (14–28 days); heavy manual, rescue or custodial roles (42–70 days) (Royal College of Surgeons, 2014). However, it is not clear how these timescales were derived, or whether clinicians in the UK refer to this guidance when providing advice for patients.

There is evidence that RTW times vary widely, with mean post-operative work absence ranging from a few days to several months (Newington et al., 2015). The reasons for this variation appear to be complex and include both individual and work-related factors (Peters et al., 2016). The role of surgeon-recommended RTW times after CTR has been explored in one small study (Ratzon et al., 2006). It was found that patients did not always follow their surgeon's advice (6% returned 1 week earlier than recommended and 28% returned at least 1 week later); however, surgeons' recommendations were a strong predictor of delayed RTW, defined as >21 days (Odds ratio: 30.5; 95% CI 3.2 to 288).

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The purpose of this study was to investigate the RTW recommendations of practising clinicians for patients undergoing CTR.

Methods

This survey of practice was conducted among members of the British Society for Surgery of the Hand (BSSH), the Association of Surgeons in Primary Care, the Reconstructive Surgical Trials Network and the British Association of Hand Therapists (BAHT). Questionnaires were circulated electronically in November–December 2016. A reminder email was sent 10–14 days later. In addition, printed versions of the questionnaire were distributed at the 2016 BSSH/BAHT Autumn Scientific Meeting by LN and DW. Questionnaire content was developed in collaboration with clinicians specializing in hand surgery, hand therapy and occupational health, and was piloted with five practising hand surgeons and therapists. The final anonymous questionnaire asked respondents to answer in terms of their own clinical practice in the previous 12 months (Appendix S1, available online). Approval was granted by the University of Southampton Faculty of Medicine Ethics Committee (20993) with the collaborative agreement of the clinical associations involved.

Statistical methods

Primary statistical analyses were descriptive. Data for recommended RTW times were not normally distributed and therefore the Wilcoxon rank-sum test was used to explore differences between the hand surgery and therapy groups. Statistical significance was set at the $p > 0.05$ level. Responses to the open-ended question were categorized independently and agreed by two researchers (LN and KF).

Results

One hundred and seventy-three surgeons and 137 therapists completed the questionnaire. The estimated number of clinicians who were invited to participate was 1277 surgeons and 682 therapists, yielding response rates of 13.5% and 20.1%, respectively. Thirty-eight clinicians were excluded from the final analysis because they had either not treated any CTR patients who were workers in the previous 12 months or did not practise in the UK. Most of the surgical respondents (84%) were at consultant level; only eight surgeons were based in primary care. The majority of therapists were at senior and clinical specialist grades (68%) and were divided into occupational therapists (60%) and physiotherapists (40%). Sixty-eight per cent of surgeons and 28% of therapists worked in private practice at least some of the time. The predominant CTR method was the mini open incision (77% of surgeons).

Return to work times

Respondents were asked to report the earliest time after CTR that they advised their patients to return to three different types of work: desk-based duties (e.g. keyboard, mouse, writing, telephone); repetitive light manual duties (e.g. driving, delivery, stacking); and heavy manual duties (e.g. construction). Recommended RTW times are shown in Table 1. For each of these work types, clinicians who reported treating more than 70 CTR patients in the previous 12 months (one to two patients per week) recommended earlier RTW times than those treating fewer patients.

Return to work recommendations

One hundred and twenty-six surgeons (82%) and 94 therapists (80%) responded to an open question: *what do you recommend for patients returning to work after carpal tunnel release*? Wound healing was discussed by 39 surgeons (31%) and 31 therapists (33%), with advice to limit function to clean and/or dry activities until healed. Forty-three surgeons (34%) and 51 therapists (54%) advised avoiding activities that might aggravate the surgical site, such as heavy gripping or weight-bearing through the hand. The recommended duration over which these activities should be avoided ranged from 2–6 weeks. A smaller number of responders, 38 surgeons (30%) and 12 therapists (13%), gave advice about commuting to work. The suggested timescales for resuming driving ranged from the day of surgery to 6 weeks post-operatively. Fifty-three surgeons (42%) and 29 therapists (31%) reported that their advice was dependent on the patient's individual circumstances, although only seven surgeons and six therapists reported involving the patients' employers in the RTW decision-making.

Discussion

In this UK-based survey of 272 respondents, we found variation in the reported CTR patient pathways and RTW recommendations, despite the use of similar surgical procedures. Among respondents, the median recommended times for return to desk-based duties (7 days) and light manual duties (15 days) reflect the earliest time points suggested in the Royal College of Surgeons' patient guidance document (Royal College of Surgeons, 2014).

Table 1. Recommended RTW times.

		Recommended time (days)			
	n	Median	IQR	Range	*p*-value
Desk-based duties					
Surgeons	145	7	2–14	0–42	**0.02**
Therapists	104	10	6–14	0–30	
All	249	7	3–14		
Repetitive light manual duties					
Surgeons	144	14	14–28	1–56	0.58
Therapists	104	16	14–28	2–45	
All	248	15	14–28		
Heavy manual duties					
Surgeons	145	30	21–42	1–90	0.96
Therapists	104	30	21–42	5–90	
All	249	30	21–42		

IQR: interquartile range.
Significant *p*-value shown in bold.

However, the median recommended time for return to heavy manual duties suggested by our respondents was 30 days, some 12 days earlier than the Royal College of Surgeons' guideline. This may suggest that the guideline, the evidence for which is unknown, is over-cautious for this particular occupational group and that, in practice, few patients need these extra days. Even earlier return to manual work has been reported in an uncontrolled study of a nurse-led carpal tunnel service (Mallick et al., 2009). In this case series, 17% of the 191 manual workers returned to work within 1 day of surgery; 71% returned by 7 days and 91% within 2 weeks.

The only statistically significant difference between surgeons and therapists was found in the median recommended time to return to desk-based duties (surgeons, 7 days; therapists, 10 days). Suture removal usually takes place 10–14 days after CTR and it is possible that surgeons generally advise their patients to return to desk-based work with sutures in situ, whereas therapists wait until sutures are removed. However, there is currently no evidence suggesting whether or not there is a risk to the incision site from carrying out desk-based duties before the wound is fully healed.

For all three work categories, clinicians treating larger numbers of CTR patients (>70 per year) reported advising earlier RTW. We chose a cut-off point of >70 patients to enable a comparison of those treating one or two CTR patients every week with those treating CTR patients less frequently. It is possible that clinicians with greater experience of treating CTR patients may be confident that earlier RTW is not detrimental to recovery. However, we found wide variation in reported timescales, even among those treating higher numbers of patients. This implies that patients are receiving different, and possibly conflicting, advice about when to RTW, even from clinicians experienced in treating CTR patients.

A key limitation of our study is the potential for non-response bias. However, although the response rate was low (14–20%), the variation identified among this group of engaged clinicians (members of professional societies and/or conference attendees) may suggest even greater heterogeneity among the wider population of surgeons and therapists. We acknowledge that the use of self-reported data may not be a true reflection of clinical practice and several steps were taken in an attempt to promote accurate reporting. The sampling frame was designed to capture clinicians regularly treating CTR patients, and these individuals were asked to think about their own practice, rather than answer hypothetically.

Overall, the content of clinician-reported RTW advice for CTR patients was similar, however the timescales for return to functional activities, such as driving, and for return to different occupational duties were wide-ranging. This suggests that patients are being given different advice about when it is safe for them to return to similar work roles. Furthermore, individual patients may be receiving conflicting RTW recommendations from different clinicians. Currently, there is limited evidence to better inform RTW advice and we are now conducting a multicentre prospective study to establish whether earlier RTW after CTR is safe and effective, or whether longer periods of post-operative work absence are required for optimal surgical outcomes.

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Ethical approval Full ethical approval was granted by the University of Southampton Faculty of Medicine Ethics Committee (20993) with the collaborative agreement of the clinical associations involved.

Supplementary material Supplementary material is available at: journals.sagepub.com/doi/suppl/10.1177/1753193418786375.

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Appendix J Clinician surveys

J.1 Surgeon questionnaire

Medicine

centre for musculoskeletal health & work

REACTS

UNIVERSITY OF Southampton

Return to Employment After Carpal Tunnel Release Surgery (REACTS):

A Survey of UK Clinical Practice

The answers given are anonymous. Individual replies will only be seen by the study team.

SERIAL NO: | | | | | | |

REACTS

Participant Information Sheet

REACTS: Return to employment after carpal tunnel release surgery – a survey of UK clinical practice

What is the research about?
We would like to invite you to take part in a survey exploring return to work after carpal tunnel release. This study is part of an NIHR-funded programme of research investigating return to work after carpal tunnel release surgery. The aim of this survey is to describe current UK clinical practice and it involves questions about your usual management of carpal tunnel release patients.

Why have you been chosen?
You have been invited to participate as a surgeon who may treat this patient population. If you do not routinely perform carpal tunnel release surgery, we would still like you to respond to section one.

What will participation involve?
This is a one-off survey with a maximum of 17 questions. Completion of the questionnaire is expected to take approximately five minutes, although some questions may not be relevant to your practice. There are no right or wrong answers to this survey and no trick questions.

Participation is voluntary, and you are under no obligation to take part. You are free to withdraw at any point prior to returning the questionnaire.

Anonymity and confidentiality
The survey is anonymous; we do not ask for any identifying information. In accordance with the UK Data Protection Act (1998), all data will be kept confidential, used only for research purposes and shared only with the research team. Data will be stored electronically on a password protected, encrypted computer and hard copies of the survey will be stored in a locked filing cabinet.

Study findings
The survey findings will be shared with UK professional bodies, including: British Society for Surgery of the Hand, Association of Surgeons in Primary Care, Reconstructive Surgical Trials Network and British Association of Hand Therapists. If you would like to be directly notified of the study findings, please contact Lisa Newington using the details below.

Funding and approval
This study has been approved by the University of Southampton Ethics Committee (ERGO 20993) and is funded by the National Institute for Health Research (DRF-2015-08-056).

Contact details
If you have any questions about this survey, please do not hesitate to contact the lead researcher:
Lisa Newington | ln@mrc.soton.ac.uk | 023 8077 7624.

In the unlikely event of a concern or complaint, please contact the Research Governance Office: rgoinfo@soton.ac.uk | 023 8059 5058.

The research supervisors are Professor David Warwick, Professor Jo Adams and Professor Karen Walker-Bone at the University of Southampton.

Section 1 Background Information

1. Please indicate your clinical grade
(Please tick one box)

a) Consultant ☐ b) General practitioner ☐ c) Associate specialist / staff grade ☐

d) Specialist registrar ☐ e) Other *(please specify)* ☐ .....

.....

2. Please indicate your clinical specialty
(Please select all that apply)

a) Primary care ☐ b) Orthopaedics ☐ c) Plastics ☐

d) Hand surgery ☐ e) Other *(please specify)* ☐ .....

.....

3. Please indicate where you predominantly work
(Please tick one box)

a) England ☐ b) Wales ☐ c) Scotland ☐

d) Northern Ireland ☐ e) Ireland ☐ f) Other *(please specify)* ☐

.....

4. Approximately how many elective carpal tunnel release procedures did you perform in the last 12 months?
(Please tick one box)

a) None ☐ b) 1-10 ☐ c) 11-30 ☐

d) 31-70 ☐ e) 71-100 ☐ f) >100 ☐

If you answered a) None to the above question, thank you for completing the questionnaire; please turn to the last page.

Section 2 Elective Carpal Tunnel Release Procedures

5. Of all the elective carpal tunnel releases you performed in the past 12 months, approximately what proportion were carried out in each of the following settings?
(Please tick one box for each setting)

	None	1-33%	34-66%	67-99%	All
a) NHS tertiary care (specialist hand/upper limb unit)	☐	☐	☐	☐	☐
b) NHS secondary care	☐	☐	☐	☐	☐
c) NHS primary care	☐	☐	☐	☐	☐
d) Private practice	☐	☐	☐	☐	☐
e) Other	☐	☐	☐	☐	☐

If other, please specify .....

6. Thinking about all the elective carpal tunnel releases you performed in the last 12 months, which surgical procedures did you use?
(Please tick the approximate proportion of patients treated with each method)


A. Traditional open incision


B. Mini open incision

	None	1-33%	34-66%	67-99%	All
a) Traditional open incision *(see figure A)*	☐	☐	☐	☐	☐
b) Mini open incision *(see figure B)*	☐	☐	☐	☐	☐
c) Endoscopic	☐	☐	☐	☐	☐
d) Other	☐	☐	☐	☐	☐

If other, please specify .....

Section 2 Elective Carpal Tunnel Release Procedures

7. Of these patients, approximately what proportion had the following pre-operative nerve conduction study results for their affected hand(s)?
(Please tick one box for each nerve conduction study scenario)

	None	1-33%	34-66%	67-99%	All	Unsure
a) Did not have nerve conduction studies	☐	☐	☐	☐	☐	☐
b) Abnormal nerve conduction studies	☐	☐	☐	☐	☐	☐
c) Normal nerve conduction studies	☐	☐	☐	☐	☐	☐

8. Thinking about all the carpal tunnel releases you performed in the last 12 months, approximately what proportion of patients had the following non-operative treatments before their surgery?
(Please tick one box for each treatment)

	None	1-33%	34-66%	67-99%	All	Unsure
a) Steroid injection(s)	☐	☐	☐	☐	☐	☐
b) Provision of a splint	☐	☐	☐	☐	☐	☐
c) Hand therapy / physiotherapy / occupational therapy	☐	☐	☐	☐	☐	☐

9a. What is your usual follow-up plan for uncomplicated elective carpal tunnel release patients *treated in the NHS*?
(Please tick and record the approximate timescales for all that apply)

			Days
a)	Reviewed by you personally	☐	
b)	Telephone follow-up by you personally	☐	
c)	Reviewed by another member of the surgical team	☐	
d)	Followed up in a dressings clinic	☐	
e)	Followed up in primary care	☐	
f)	Followed up by therapist	☐	
g)	Followed up by occupational health professional	☐	
h)	No planned follow-up	☐	
i)	Other *(please specify)*	☐	

Section 2 Elective Carpal Tunnel Release Procedures

9b. What is your usual follow-up plan for uncomplicated elective carpal tunnel release patients *treated privately*?
(Please record approximate timescales for all that apply)

			Days
a)	Reviewed by you personally	☐	☐
b)	Telephone follow-up by you personally	☐	☐
c)	Reviewed by another member of the surgical team	☐	☐
d)	Followed up in a dressings clinic	☐	☐
e)	Followed up in primary care	☐	☐
f)	Followed up by therapist	☐	☐
g)	Followed up by occupational health professional	☐	☐
h)	No planned follow-up	☐	
i)	Other *(please specify)*	☐	☐

.....

10a. How do you manage patients who present with bilateral carpal tunnel syndrome and require carpal tunnel releases?
(Please tick one box)

a) I always recommend bilateral simultaneous carpal tunnel release (go to Q11) ☐
b) I never recommend bilateral simultaneous carpal tunnel release (go to Q11) ☐
c) I recommend bilateral simultaneous carpal tunnel release in some instances ☐

10b. If you recommend bilateral carpal tunnel release in some instances (answer C above), which factors might lead you to suggesting bilateral simultaneous surgery?
(Please tick all that apply)

a) Patient request ☐ b) Use of general anaesthetic ☐ c) Severe symptoms ☐
d) Self-employed ☐ e) Self-funding ☐ f) Need to minimise work absence ☐

g) Other *(please specify)* .....

11. In the past 12 months have you performed any elective carpal tunnel releases for patients who were employed or self-employed at the time of surgery?

a) Yes ☐ b) No ☐

If you answered b) No to the above question, thank you for completing the questionnaire; please turn to the last page.

Section 3 Carpal Tunnel Release and Work

12. Thinking about your patients in the last 12 months who were employed or self-employed at the time of their carpal tunnel release:

12a. What proportion were issued with a fit note by you personally? *(Please tick one box)*

None	1-33%	34-66%	67-99%	All	Unsure
☐	☐	☐	☐	☐	☐

12b. What proportion were given advice on returning to work (by you or any member of your team) at each of the following time points?
(Please tick one box per time point)

	None	1-33%	34-66%	67-99%	All	Unsure
a) Pre-operatively	☐	☐	☐	☐	☐	☐
b) At the time of surgery	☐	☐	☐	☐	☐	☐
c) Post-operatively	☐	☐	☐	☐	☐	☐

12c. If patients were given advice about return to work, who provided this advice?
(Please tick all that apply)

a) You personally ☐
b) Another member of the surgical team ☐
c) Hospital nurse ☐
d) GP or primary care nurse ☐
e) Specialist hand therapist ☐
f) Other physiotherapist / occupational therapist ☐
g) Occupational health professional ☐
h) No advice given ☐
i) Other *(please specify)* ☐

13. For the following roles, what do you consider the earliest time point that someone could return to work following carpal tunnel release?
(Please give an approximate number of days for each work type)

		Days
a)	Desk-based duties (e.g. keyboard, mouse, writing, telephone)	☐
b)	Repetitive light manual duties (e.g. driving, delivery, stacking)	☐
c)	Heavy manual duties (e.g. construction)	☐

14. In the past 12 months have you ever advised a patient to return to work following carpal tunnel release even if they were unable to perform all their usual occupational tasks?

a) Yes ☐ b) No ☐

Section 3 Carpal Tunnel Release and Work

15. **What do you recommend for patients returning to work after carpal tunnel release?**
(Please think about the timescales for returning to different activities, including anything you specifically advise your patients to avoid)

Section 3 Carpal Tunnel Release and Work

16. **When framing your advice about return to work after carpal tunnel release for individual patients, do you tailor your advice in any way according to the following factors?**
(Please tick one box for each factor)

	Yes	No
Age	☐	☐
Gender	☐	☐
Hand dominance and side of surgery	☐	☐
Obesity	☐	☐
Co-existing musculoskeletal disorders	☐	☐
Educational level	☐	☐
Type of work	☐	☐
Employer support	☐	☐
Friends / family support	☐	☐
Pre-operative symptoms	☐	☐
Pre-operative functional status	☐	☐
Pre-operative neurophysiology / imaging	☐	☐
Post-operative clinical presentation	☐	☐
Patient expectations	☐	☐
Coexisting flexor tenosynovitis	☐	☐
History of hypertrophic / keloid scarring	☐	☐
Patient psychological health	☐	☐
Bilateral vs unilateral surgery	☐	☐
Surgical technique	☐	☐
Availability of post-operative rehabilitation	☐	☐
Need to drive	☐	☐
Financial considerations for the patient	☐	☐
Other *(please specify)*	☐	☐

Section 3 Carpal Tunnel Release and Work

17. **Of these factors, please select the *three* you consider most influential for return to work after carpal tunnel release.**
(Please write 1 for the most important, 2 for the second and 3 for the third. You do not need to rank the whole list)

Age ☐
Gender ☐
Hand dominance and side of surgery ☐
Obesity ☐
Co-existing musculoskeletal disorders ☐
Educational level ☐
Type of work ☐
Employer support ☐
Friends/Family support ☐
Pre-operative symptoms ☐
Pre-operative functional status ☐
Pre-operative neurophysiology/imaging ☐
Post-operative clinical presentation ☐
Patient expectations ☐
Coexisting flexor tenosynovitis ☐
History of hypertrophic / keloid scarring ☐
Patient psychological health ☐
Bilateral vs unilateral surgery ☐
Surgical technique ☐
Availability of post-operative rehabilitation ☐
Need to drive ☐
Financial considerations for the patient ☐
Other *(please specify)* ☐

J.2 Therapist questionnaire (only those sections which differ from surgeon questionnaire)

Medicine

centre for musculoskeletal health & work

REACTS

UNIVERSITY OF Southampton

Return to Employment After Carpal Tunnel Release Surgery (REACTS):

A Survey of UK Hand Therapy Practice

The answers given are anonymous. Individual replies will only be seen by the study team.

Section 1 Background Information

1. What is your professional background?
(Please tick one box)

a) Physiotherapist ☐ b) Occupational therapist ☐ c) Other (*please specify)* ☐

2. In which clinical area(s) do you routinely work?
(Please select all that apply)

a) Hand therapy ☐ b) Upper limb ☐ c) Rheumatology ☐

d) Plastics ☐ e) Orthopaedics ☐ f) Paediatrics ☐

g) Neurology ☐ h) Musculoskeletal ☐ i) Other *(please specify)* ☐

3. What is your clinical grade?
(Please tick one box. If you are not employed in the NHS, please select the grade that most closely matches your role)

a) Band 5 ☐ b) Band 6 ☐ c) Band 7 ☐

d) Band 8a ☐ e) Band 8b and above ☐ f) Not currently working in clinical practice ☐

g) Other *(please specify)* ☐ .....

4. In which part of the UK do you predominantly work?
(Please tick one box)

a) England ☐ b) Wales ☐ c) Scotland ☐

d) Northern Ireland ☐ e) Ireland ☐ f) Other *(please specify)* ☐

Section 1 Background Information

5. In which healthcare setting are you based?
(Please tick all that apply)

a) NHS ☐
b) Private practice – employed by a private healthcare provider ☐
c) Private practice – self-employed ☐
d) Academic ☐
e) Other *(please specify)* ☐ .....

.....

6. In the past 12 months, have you assessed / treated / advised any patients undergoing elective carpal tunnel release?

a) Yes ☐ b) No ☐

If you answered b) No to the above question, thank you for completing the questionnaire; please turn to the last page.

Section 2 Elective Carpal Tunnel Release Procedures

7. Approximately how many elective carpal tunnel release patients did you assess / treat / advise in the past 12 months at each of the following time points?
(Please tick one box per time point)

	1-10	11-30	31-70	71-100	>100
a) Pre-operatively	☐	☐	☐	☐	☐
b) Post-operatively	☐	☐	☐	☐	☐

8. Thinking about the patients you saw *following carpal tunnel release* in the last 12 months:

8a. Why were they referred for therapy?
(Please select all that apply)

a) Routine post-operative protocol / pathway ☐
b) On an individual basis for specific therapy management ☐
c) N/A – only saw patients pre-operatively ☐
d) Other *(please specify)* ☐ .....

.....

8b. What treatment(s) did you provide?
(Please select all that apply)

a) Removal of sutures / wound management ☐
b) Scar management ☐
c) Provision of splints ☐
d) Sensory re-education / desensitisation ☐
e) Strengthening ☐
f) Pain management ☐
g) Functional rehabilitation ☐
h) Advice ☐
i) Other *(please specify)* ☐

.....

.....

.....

9. In the past 12 months, have you treated any patients who were employed or self-employed at the time of their carpal tunnel release?

a) Yes ☐ b) No ☐

If you answered b) No to the above question, thank you for completing the questionnaire; please turn to the last page.

Section 3 Carpal Tunnel Release and Work

10. Thinking about your patients in the past 12 months who were employed or self-employed at the time of their carpal tunnel release: approximately what proportion did you personally give advice to about returning to work?
(Please tick one box)

None	1-33%	34-66%	67-99%	All
☐	☐	☐	☐	☐

If you answered None to the above question, thank you for completing the questionnaire; please turn to the last page.

11. When do you provide return to work information for patients undergoing carpal tunnel release, and in what format?
(Please select all that apply for each time point)

	Pre-operatively	Post-operatively
a) Spoken	☐	☐
b) Paper-based information sheet	☐	☐
c) Electronic information sheet	☐	☐
d) Website	☐	☐
e) Other *(please specify)*	☐	☐

12. For the following roles, what do you consider the earliest time point that someone could return to work following carpal tunnel release?
(Please give an approximate number of days for each work type)

		Days
a)	Desk-based duties (e.g. keyboard, mouse, writing, telephone)	☐
b)	Repetitive light manual duties (e.g. driving, delivery, stacking)	☐
c)	Heavy manual duties (e.g. construction)	☐

Appendix K Survey appraisal checklist

Appraisal guide	Response	Section
Was a clear research question posed?	There were three linked research questions: (i) to identify and classify the advice given to patients returning to work after CTR; (ii) to discover which factors healthcare practitioners consider most important for return to work after CTR (iii) to explore and examine variation between clinicians in their practice and return to work recommendations	Section 4.2
Was the target population defined and was the sample representative of the population?	Target population: UK surgeons who routinely perform CTR procedures and UK hand therapists who routinely treat CTR patients. Sample population: members of specialist clinical groups who perform hand surgery or hand therapy and report treating CTR patients in the previous 12 months. The reasoning behind the choice of the sample population was discussed. The sample population was not designed to represent all UK clinicians who might perform CTR, rather those who have a specialist interest in hand and wrist conditions. It might be expected that this group of clinicians are more homogenous in their practice and therefore any observed differences could represent broader diversity in the wider population of surgeons and therapists.	Section 4.3.2
Was a systematic approach used to develop the questionnaire?	Question content was directed by literature searches and by discussion with relevant clinicians. The reasoning behind the inclusion of each question was discussed. The format and order of questions was discussed.	Section 4.3.1 & Table 4.1
Was the questionnaire tested?	Individual questions were not pre-tested, but the entire questionnaire was pilot tested with individuals from the target population.	Section 4.3
Were the questionnaires administered in a manner that limited both response and non-response bias?	Attempts to limit response bias included reassurance there were no right or wrong responses. Attempts to limit non-response bias included using paper and electronic formats for the survey, with reminder emails for the latter.	Section 4.3.2 & Section 4.5.5
Was the response rate reported?	Response rates were reported for both the electronic and paper version of the survey. Reminders were sent for the electronic version in an attempt to enhance the response rate. It was not possible to fully assess non-response bias; this was acknowledged as a limitation of the survey. Response rates were higher than comparative surveys among similar populations	Section 4.3.2 & Section 4.5.5
Were the results clearly and transparently reported?	The analysis plan was developed and reported, and the handling of missing data is discussed. The full questionnaire is provided for reference. The conclusions were framed in light of the reported findings.	Section 4.3.3, Section 4.4 & Appendix J

From: Burns KA, Kho ME. How to assess a survey report: a guide for readers and peer reviewers. CMAJ 2015; 187(6): E198-205. doi:10.1503 /cmaj.140545.

Appendix L STROBE checklist (cohort study)

Item	Recommendation	Location
Title and abstract		
Title	Indicate study design	Chapter 5
Introduction		
Background	Explain scientific background and rationale	Section 5.1
Objectives	State objectives and any pre-specified hypotheses	Section 5.1
Methods		
Study design	Present key elements of the study design early	Section 5.2.1
Setting	Describe the setting, locations and relevant dates	Section 5.2 & Table 5.4
Participants	Give eligibility criteria, sources and methods of selection of participants, and methods of follow-up	Section 5.2.2 & Figure 5.3
Variables	Clearly define all outcomes, exposures, predictors, potential confounders and effect modifiers	Section 5.2.3
Data sources	Give sources of data and methods of assessment	Section 5.2.3
Bias	Describe and effects to address potential sources of bias	Section 5.2.3 & Section 5.2.7
Study size	Explain how the study size was determined	Section 5.2.4
Quantitative variables	Described how quantitative variables were handled in the analyses	Section 5.2.3
Statistical methods	Described all statistical methods	Section 5.2.7
	Explain how missing data were addressed	Section 5.3.1
	Explain how lost to follow-up was addressed	Section 5.3.1
Results		
Participants	Reported the number of individuals at each stage of the study	Figure 5.4
	Give reasons for non-participation	Figure 5.4
Descriptive data	Give characteristics of study participants	Table 5.5 to Table 5.7
	Indicate number of participants for each variables of interest	As above
	Summarise follow-up time	Section 5.3.3
Outcome data	Report number of outcome events over time	Section 5.3.6 to Section 5.3.7
Main results	Give adjusted and unadjusted estimates and measures of precision. Make clear which confounders were adjusted for	Table 5.10
Other analyses	Reported any subgroup analyses	Section 5.3.13

Discussion		
Key results	Summarise key results with reference to study objectives	Section 5.4
Limitations	Discuss limitations including the direction and magnitude of any potential bias	Section 5.4.8
Interpretation	Give a caution overall interpretation considering the objectives, limitations, results from other studies	
Generalisability	Discuss the external validity of the results	Section 5.4.2 & Section 5.4.7
Other information		
Funding	Give sources of funding and the role of the funders	Acknowledgements

From: Vandenbroucke JP, von Elm E, Altman DG et al. Strengthening the reporting of observational studies in epidemiology (STROBE): explanation and elaboration. *Epidemiology* 2007; 18(6): 805-35.

Appendix M REACTS baseline questionnaire

University Hospital Southampton NHS
NHS Foundation Trust

REACTS

Arthritis Research UK | centre for musculoskeletal health & work
MRC

UNIVERSITY OF Southampton

Site | | | |

Please fill in today's date | | | | | | |
d d m m y y

Before Your Carpal Tunnel Release Surgery

Return to Employment After Carpal Tunnel Release Surgery (REACTS)

ln@mrc.soton.ac.uk | 023 8077 7624
Arthritis Research UK – MRC Centre for Musculoskeletal Health and Work
MRC Lifecourse Epidemiology Unit, University of Southampton
Southampton General Hosptial (MP 95), SO16 6YD

IRAS reference: 209840

University Hospital Southampton NHS Foundation Trust | REACTS | Arthritis Research UK MRC centre for musculoskeletal health & work | University of Southampton

CONSENT FORM (IRAS reference: 209840)

You should complete this form after you have read the Participant Information Sheet.

REACTS: Return to employment after carpal tunnel release surgery

Thank you for considering taking part in this research. If you have any questions arising from the Participant Information Sheet, please ask the research team before you decide whether to take part.

Please initial the boxes if you agree with each statement

1. I have read the Participant Information Sheet (version 2.0; 06.12.16) and have had the opportunity to ask questions about the study. ☐

2. I meet the criteria for being involved in this study: ☐
   - Aged over 18 and referred for carpal tunnel release surgery
   - Routinely work in paid employment for at least 20 hours per week
   - Plan to return to work after carpal tunnel release surgery
   - Have not previously had carpal tunnel release surgery on either hand
   - Have not previously had a serious injury to the same wrist/hand that will have the carpal tunnel release operation

3. I agree to take part in this research and agree for my data to be used for the purposes explained in the Participant Information Sheet (version 2.0; 06.12.16). I understand that this information will be handled in accordance with the terms of the UK Data Protection Act 1998. ☐
   a. I agree for the REACTS research team to access pre-operative test results concerning my hand and wrist symptoms. No other information will be accessed. ☐
   b. I agree for the REACTS research team to access my carpal tunnel release surgical record. No other information will be accessed. ☐

4. I understand that if I decide at any time during the research that I no longer wish to take part, I can notify the researchers and withdraw from the study immediately, without giving a reason. If I do, I understand that I can ask for any contribution I have already made to be removed from the study, up to the time when I have completed the final questionnaire. ☐

Signature _____ Date _____ / _____ / _____

Name _____ Phone _____
(please print) *(only to be used if we lose touch)*

Postal address _____

_____

Email address _____
(please print)

ADDITIONAL QUESTIONS

Please circle one response for each question

I prefer to receive the next two questionnaires by	**Post**	**Email**	**Don't mind**
I prefer to receive correspondence about the study by	**Post**	**Email**	**Don't mind**
I would like to be notified of the findings from this research	**Yes**	**No**	
I am happy to be contacted about the next stage of the research, which will involve a one-off discussion with the lead researcher	**Yes**	**No**	
I am happy to be contacted about other studies related to this research	**Yes**	**No**	

When the research team receives your completed questionnaire and consent form, we will sign it below and return a copy to you for your records.

Researcher signature _____ Date ____ / ____ / ____

Researcher name _____

University of Southampton research supervisors:
Professor Karen Walker-Bone | Professor Jo Adams | Professor David Warwick

SECTION A: BACKGROUND

1 What is your date of birth?

d	d	m	m	y	y

2 Are you:

Male ☐ Female ☐ Other ☐

3 Are you:

Right handed ☐ Left handed ☐ Both ☐

4 Do you routinely carry out paid work for 20 hours or longer in a given week?

Yes ☐ No ☐

If no, *thank you for your interest in our study, however, we are only looking for individuals who carry out paid work for at least 20 hours per week. You* ***do not*** *need to complete the rest of the questionnaire, but please return it using the pre-paid envelope provided.*

5 When do you expect to have your carpal tunnel surgery?
Please enter the exact date if known, or provide the approximate month and year if unsure.

d	d	m	m	y	y

6 Which hand will be operated on?
If both hands please answer Question 6.1; if one hand, please move on to Question 7.

Right ☐ Left ☐ Both ☐

6.1 If both hands, which side will be operated on first?

Right ☐ Left ☐ Both sides operated on the same day ☐ Unsure ☐

7 Do you have access to an occupational health service through your place of work?

Yes ☐ No ☐ Unsure ☐

8 Do you expect to take any time off work following your surgery?
If yes, please answer Question 8.1; if no, please move on to Question 9.

Yes ☐ No ☐ Unsure ☐

8.1 If you do expect to take time off work, how long do you expect to take?
Please complete using days, weeks or months; whichever applies.

Days ☐ Weeks ☐ Months ☐

SECTION A: BACKGROUND

9 Have you been given any information about your operation?
If yes, please answer Question 9.1; if no, please move on to Question 10.

Yes ☐ No ☐

9.1 If yes, who provided this information? Please tick all that apply.

a)	Your surgeon or a member of the surgical team	☐	f)	Occupational health nurse or doctor	☐
b)	Hospital nurse	☐	g)	Employer	☐
c)	GP or practice nurse	☐	h)	Friend or family member	☐
d)	Hand therapist	☐	i)	Internet	☐
e)	Physiotherapist or occupational therapist	☐	j)	Other *(please specify)*	☐

.....

10 Have you been given any information about returning to work after your surgery?
If yes, please answer the rest of Question 10; if no, please move on to Question 11.

Yes ☐ No ☐

10.1 If yes, who provided this information? Please tick all that apply.

a)	Your surgeon or a member of the surgical team	☐	f)	Occupational health nurse or doctor	☐
b)	Hospital nurse	☐	g)	Employer	☐
c)	GP or practice nurse	☐	h)	Friend or family member	☐
d)	Hand therapist	☐	i)	Internet	☐
e)	Physiotherapist or occupational therapist	☐	j)	Other *(please specify)*	☐

.....

10.2 What advice were you given?
If this advice came from more than one source, please indicate who advised what.

.....

.....

.....

.....

.....

.....

.....

SECTION B: WORK

12 What is your MAIN occupation at the moment (e.g. secretary, teacher, builder etc.)?

.....

13 And in what industry do you work (e.g. farming, shipyard, car factory, shoe shop, hospital, insurance office etc)?

.....

14 Which of the following best describes your present work situation for your MAIN occupation? Please tick one box.

a) Employed (permanent contract) ☐
b) Employed (temporary/renewable contract) ☐
c) Zero hours contract ☐
d) Self-employed ☐
e) Other *(please specify)* ☐ .....

15 On average, how many *hours* per week do you normally work in your main occupation?

☐☐☐ hours

16 On average, how many *days* per week do you normally work in your main occupation?

☐ days

17 Do you have any other paid work?
If yes, please answer Question 17.1; if no, please move on to Question 18.

Yes ☐ No ☐

17.1 If yes, on average, how many hours a week do you work in other paid jobs? ☐☐ hours

18 Does an average day at work in your MAIN job normally involve any of the following? Please tick one box for each question.

		Yes	No
a)	Piecework in which you are paid according to the number of articles or tasks you or your team make or finish in the day?	☐	☐
b)	A target number of articles or tasks that you or your team are expected to make or finish in the day?	☐	☐
c)	Payment of a bonus if you make or finish more than an agreed number of articles/tasks in the day?	☐	☐
d)	Working to tight deadlines	☐	☐
e)	Use of a computer keyboard or mouse for longer than 1 hour in total?	☐	☐

SECTION B: WORK

		Yes	No
f)	Use of a computer keyboard or mouse for longer than 4 hours in total?	☐	☐
g)	Other tasks involving repeated movements of the wrist or fingers for longer than 4 hours in total? *(Please indicate which tasks)*	☐	☐

	----------		
h)	Working with a powered tool that makes your hand(s) or arm(s) vibrate (e.g. chain saw, pneumatic drill)?	☐	☐
i)	Working with your hand(s) above shoulder height for longer than 1 hour in total?	☐	☐
j)	Lifting or carrying weights of 5 kg (11 lbs) or more in one hand (e.g. a tool bag or heavy briefcase)?	☐	☐
k)	Lifting or carrying a weight of 10 kg (22 lbs) or more?	☐	☐
l)	Tasks involving pushing or pulling a heavy weight?	☐	☐
m)	Working for longer than two hours in total with your neck bent forward?	☐	☐
n)	Working for longer than half an hour in total with your neck twisted e.g. when looking to one side?	☐	☐
o)	Driving for more than an hour?	☐	☐

19 Do you find your MAIN job demanding on your hands/wrists?
Please circle one number, where 0 represents not at all, and 10 represents very much.

0 1 2 3 4 5 6 7 8 9 10

Not at all — Very much

20 Does your MAIN employer (or boss/colleagues if self-employed) know about your hand/wrist problem?
If yes, please answer Question 20.1; if no, or not applicable, please move on to Question 21.

Yes ☐ No ☐ N/A self-employed and work alone ☐

20.1 Is your MAIN employer (or boss/colleagues if self-employed) supportive of your hand/wrist problem?
Please circle one number, where 0 represents not at all, and 10 represents very much

0 1 2 3 4 5 6 7 8 9 10

Not at all — Very much

SECTION B: WORK

21 The following questions refer to how you did in your MAIN job during the *past 4 weeks*.
Please tick one box for each question.

	How much of the time during the past 4 weeks …	**Always**	**Often**	**Sometimes**	**Rarely**	**Never**
a)	Were you unable to do your work because of problems with your hand(s) / wrist(s)?	☐	☐	☐	☐	☐
b)	Did you have to shorten your work day because of problems with your hand(s) / wrists(s)	☐	☐	☐	☐	☐
c)	Did you have to take breaks at work because of problems with your hand(s) / wrists(s)?	☐	☐	☐	☐	☐
d)	Did you get less done because of problems with your hand(s) / wrist(s)?	☐	☐	☐	☐	☐
e)	Did you take longer to do the tasks in your work because of problems with your hand(s) / wrists(s)?	☐	☐	☐	☐	☐

22 During the *past 4 weeks*, how much time have you missed from your MAIN job for the following reasons?
Please write 0 if you have not missed any time from work during this period. You can answer in days or hours, whichever applies.

a) Time missed because of the problem with your hand(s)/wrist(s) ☐☐ Days ***or*** ☐☐ Hours

b) Time missed because of any other problem ☐☐ Days ***or*** ☐☐ Hours

23 If you fell ill and were off work, how long could you get your normal full pay (excluding bonuses)?
Please tick the option that best represents your MAIN job.

a) Less than one week ☐
b) 1 – 4 weeks ☐
c) 1 – 6 months ☐
d) More than 6 months ☐
e) Not sure ☐

24 How satisfied are you with your MAIN job as a whole, taking everything into consideration? This includes your salary, career possibilities, management, colleagues etc. Please tick one box.

a) Very satisfied ☐
b) Satisfied/fairly satisfied ☐
c) Dissatisfied ☐
d) Very dissatisfied ☐

SECTION C: GENERAL HEALTH

25 In general, would you say your health is:

a) Excellent ☐
b) Very good ☐
c) Good ☐
d) Fair ☐
e) Poor ☐

26 What is your height? Please answer in either feet and inches or centimetres.

☐ feet ☐☐ inches ***or*** ☐☐☐ cms

27 What is your weight? Please answer in either stones and pounds or kilograms.

☐☐ stones ☐☐ lbs ***or*** ☐☐ kgs

28 Do you, or have you ever, smoked regularly? Please tick one box.

a) I have never smoked regularly ☐
b) I have smoked in the past, but do not currently smoke regularly ☐
c) I regularly smoke ☐

29 The following is a list of common health problems. Please indicate if you currently have, or don't have, the problem listed in part 1. If you have the problem, please answer the corresponding question in part 2.
Please answer all questions in part 1.

	HEALTH PROBLEM	PART 1 Do you have the problem? NO	PART 1 YES *(if yes move to part 2)* →	PART 2 Does it limit your activities? NO	PART 2 YES
a)	Heart disease	☐	☐	☐	☐
b)	High blood pressure	☐	☐	☐	☐
c)	Lung disease	☐	☐	☐	☐
d)	Diabetes	☐	☐	☐	☐
e)	Ulcer or stomach disease	☐	☐	☐	☐
f)	Kidney disease	☐	☐	☐	☐
g)	Liver disease	☐	☐	☐	☐
h)	Thyroid disease	☐	☐	☐	☐
i)	Anaemia or other blood disease	☐	☐	☐	☐
j)	Cancer	☐	☐	☐	☐

SECTION C: GENERAL HEALTH

	HEALTH PROBLEM continued…	Do you have the problem? NO	Do you have the problem? YES (if yes move to part 2) →	Does it limit your activities? NO	Does it limit your activities? YES
k)	Depression	☐	☐	☐	☐
l)	Osteoarthritis	☐	☐	☐	☐
m)	Back pain	☐	☐	☐	☐
n)	Rheumatoid arthritis	☐	☐	☐	☐

	29.1 Please list any other medical problems that have not been mentioned.	Does it limit your activities? NO	YES
o)	.....	☐	☐
p)	.....	☐	☐
q)	.....	☐	☐

30 **The following questions are about how you feel and how things have been with you during the *past 4 weeks*.** For each question, please give the answer that comes closest to the way you have been feeling. Please tick one box for each row.

	How much of the time during the past 4 weeks …	All of the time	Most of the time	A good bit of the time	Some of the time	A little bit of the time	None of the time
a)	Did you feel full of 'get-up-and-go'?	☐	☐	☐	☐	☐	☐
b)	Have you been a very nervous person?	☐	☐	☐	☐	☐	☐
c)	Have you felt so down in the dumps that nothing could cheer you up?	☐	☐	☐	☐	☐	☐
d)	Have you felt calm and peaceful?	☐	☐	☐	☐	☐	☐
e)	Did you have a lot of energy?	☐	☐	☐	☐	☐	☐
f)	Have you felt downhearted and blue?	☐	☐	☐	☐	☐	☐
g)	Did you feel worn out?	☐	☐	☐	☐	☐	☐
h)	Have you been a happy person?	☐	☐	☐	☐	☐	☐
i)	Did you feel tired?	☐	☐	☐	☐	☐	☐

SECTION C: GENERAL HEALTH

31 **Below is a list of problems that people sometimes have. Please read each one carefully and tick the box that best describes how much that problem has distressed or bothered you during the *past 7 days*, including today?**
Please tick one box for each row.

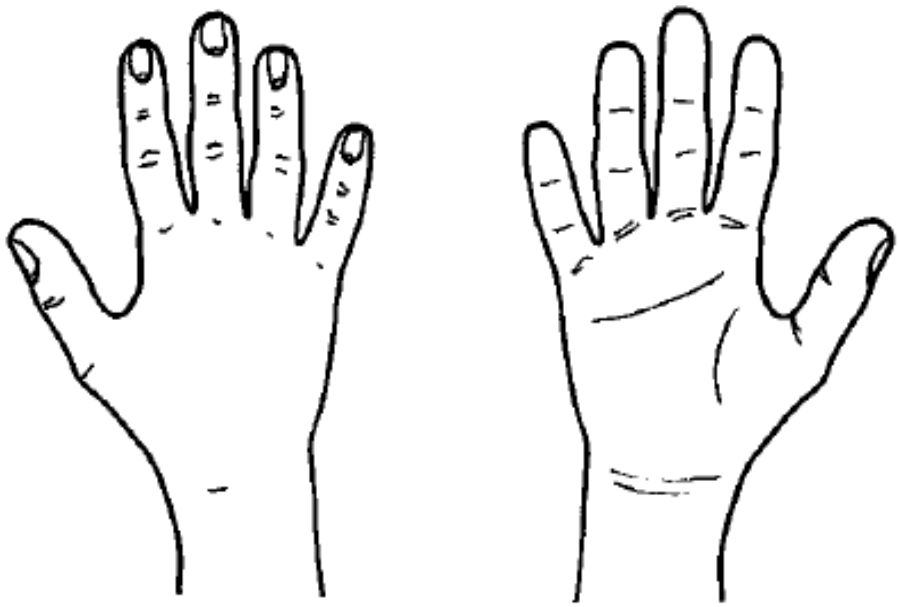
		Not at all	A little bit	Moderately	Quite a bit	Extremely
a)	Faintness or dizziness	☐	☐	☐	☐	☐
b)	Pains in the heart or chest	☐	☐	☐	☐	☐
c)	Nausea or upset stomach	☐	☐	☐	☐	☐
d)	Trouble getting your breath	☐	☐	☐	☐	☐
e)	Hot or cold spells	☐	☐	☐	☐	☐

SECTION D: HAND AND WRIST FUNCTION

32 In the *past 7 days*, have you experienced any pain, tingling (pins and needles) or numbness (loss of sensation) in your RIGHT hand or wrist?
Please mark where on your hand/wrist you experienced these symptoms using the key below.
If you do not have any symptoms in your right hand, please move on to Question 34.

Pain ☐ Tingling or numbness

RIGHT HAND



33 How long ago did the first of these symptoms begin? Please tick one box.

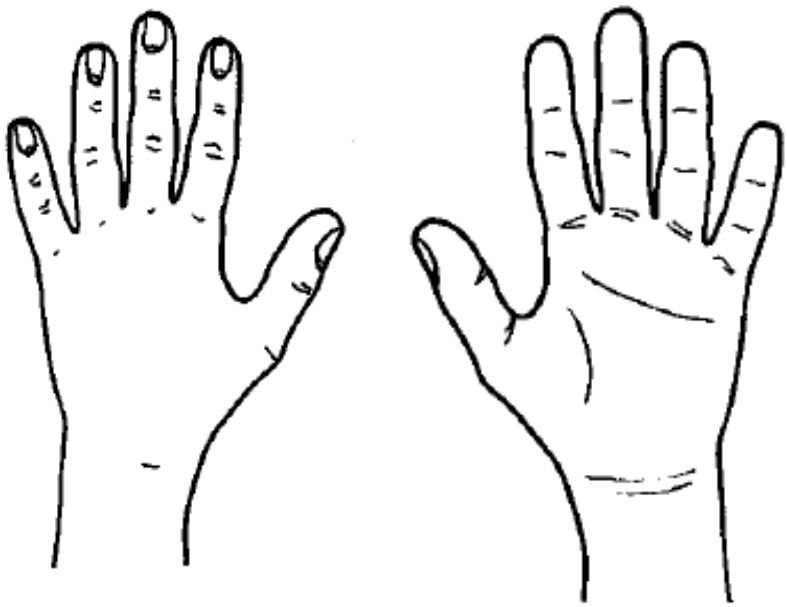
a) Less than 3 months ☐
b) 3 – 6 months ☐
c) 6 – 12 months ☐
d) More than a year ☐

SECTION D: HAND AND WRIST FUNCTION

34 **In the *past 7 days*, have you experienced any pain, tingling (pins and needles) or numbness (loss of sensation) in your LEFT hand or wrist?**
Please mark where on your hand/wrist you experienced these symptoms using the key below.
If you do not have any symptoms in your right hand, please move on to Question 36.

Pain ☐ Tingling or numbness

LEFT HAND



35 How long ago did the first of these symptoms begin? Please tick one box.

a) Less than 3 months ☐
b) 3 – 6 months ☐
c) 6 – 12 months ☐
d) More than a year ☐

SECTION D: HAND AND WRIST FUNCTION

36 **The following questions refer to your symptoms over the *last 7 days*.**
Please answer for each hand, even if you only have problems with one side.
Please tick one box for each row.

36.1 How severe were the following symptoms in your RIGHT hand?	None	Mild	Moderate	Severe	Very severe
a) Pain at night	☐	☐	☐	☐	☐
b) Pain during the daytime	☐	☐	☐	☐	☐
c) Numbness or tingling at night	☐	☐	☐	☐	☐
d) Numbness or tingling during the daytime	☐	☐	☐	☐	☐
How often did the following symptoms in your RIGHT hand wake you up at night?	**Never**	**Once**	**2 or 3 times**	**4 or 5 times**	**More than 5 times**
e) Pain	☐	☐	☐	☐	☐
f) Numbness or tingling	☐	☐	☐	☐	☐

36.2 How severe were the following symptoms in your LEFT hand?	None	Mild	Moderate	Severe	Very severe
a) Pain at night	☐	☐	☐	☐	☐
b) Pain during the daytime	☐	☐	☐	☐	☐
c) Numbness or tingling at night	☐	☐	☐	☐	☐
d) Numbness or tingling during the daytime	☐	☐	☐	☐	☐
How often did the following symptoms in your LEFT hand wake you up at night?	**Never**	**Once**	**2 or 3 times**	**4 or 5 times**	**More than 5 times**
e) Pain	☐	☐	☐	☐	☐
f) Numbness or tingling	☐	☐	☐	☐	☐

37 **This question refers to the appearance (look) of your hand during the *past 7 days*.** Please tick one box for each hand.

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
a) I am satisfied with the appearance (look) of my **RIGHT** hand	☐	☐	☐	☐	☐
b) I am satisfied with the appearance (look) of my **LEFT** hand	☐	☐	☐	☐	☐

SECTION D: HAND AND WRIST FUNCTION

38 Please answer the following questions on a scale of 0-10, where 0 represents not at all, and 10 represents very much. Please circle one number for each question.

38.1 Do you think that you will be able to use your hand normally 3 months after the operation?

0 1 2 3 4 5 6 7 8 9 10

38.2 Are you afraid of having long-term problems with your hand?

0 1 2 3 4 5 6 7 8 9 10

38.3 Do you blame yourself for your hand problem?

0 1 2 3 4 5 6 7 8 9 10

38.4 Are your family and friends supportive of your hand problem?

0 1 2 3 4 5 6 7 8 9 10

39 The following statements describe people's beliefs about their health problems. Please indicate whether you agree or disagree with them in relation to the problems you have with your hand(s) or wrist(s).
Please tick the box which most closely reflects how you feel for each statement.

		Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly Disagree
a)	Problems like this run in my family	☐	☐	☐	☐	☐
b)	I think I was born with a weakness or underlying problem in this part of my body	☐	☐	☐	☐	☐
c)	My problem was caused by work	☐	☐	☐	☐	☐
d)	Work probably didn't cause my problem, but it made it worse	☐	☐	☐	☐	☐
e)	I have a lot of stress in my life and that has made my problem a lot worse	☐	☐	☐	☐	☐
f)	I think a lack of exercise probably contributed to my problem	☐	☐	☐	☐	☐
g)	As you get older, parts of the body start to wear out and problems like mine are likely to occur	☐	☐	☐	☐	☐

SECTION D: HAND AND WRIST FUNCTION

40 We are interested in the types of thoughts and feelings that you have when you are in pain. The following statements describe different thoughts and feelings that may be associated with pain. Please indicate the degree to which you have these thoughts and feelings when you are experiencing pain.
Please tick one box for each statement.

		Not at all	To a slight degree	To a moderate degree	To a great degree	All of the time
a)	I keep thinking about how badly I want the pain to stop	☐	☐	☐	☐	☐
b)	It's terrible and I think it's never going to get any better	☐	☐	☐	☐	☐
c)	I become afraid that the pain may get worse	☐	☐	☐	☐	☐
d)	I anxiously want the pain to go away	☐	☐	☐	☐	☐

The following questions refer to the function of your hands/wrists during the ***past 7 days***. Please answer all questions for the right and left sides, even if you do not experience any problems. Please tick one box for each question.

41 RIGHT SIDE	Very well	Well	Adequately	Poorly	Very poorly
a) Overall, how well did your ***right*** hand work?	☐	☐	☐	☐	☐
b) How well did your ***right*** fingers move?	☐	☐	☐	☐	☐
c) How well did your ***right*** wrist move?	☐	☐	☐	☐	☐
	Very good	**Good**	**Fair**	**Poor**	**Very poor**
d) How was the strength in your ***right*** hand?	☐	☐	☐	☐	☐
e) How was the sensation (feeling) in your ***right*** hand?	☐	☐	☐	☐	☐

42 LEFT SIDE	Very well	Well	Adequately	Poorly	Very poorly
a) Overall, how well did your ***left*** hand work?	☐	☐	☐	☐	☐
b) How well did your ***left*** fingers move?	☐	☐	☐	☐	☐
c) How well did your ***left*** wrist move?	☐	☐	☐	☐	☐
	Very good	**Good**	**Fair**	**Poor**	**Very poor**
d) How was the strength in your ***left*** hand?	☐	☐	☐	☐	☐
e) How was the sensation (feeling) in your ***left*** hand?	☐	☐	☐	☐	☐

SECTION D: HAND AND WRIST FUNCTION

The following questions refer to the ability of your hands to do certain tasks during the ***past 7 days***. If you do not do a certain task, please estimate the difficulty you would have in performing it. Please tick one box for every activity.

43 How difficult was it for you to perform the following activities using your RIGHT HAND?

		Not at all difficult	A little difficult	Somewhat difficult	Moderately difficult	Very difficult
a)	Turn a door knob	☐	☐	☐	☐	☐
b)	Pick up a coin	☐	☐	☐	☐	☐
c)	Hold a glass of water	☐	☐	☐	☐	☐
d)	Turn a key in a lock	☐	☐	☐	☐	☐
e)	Hold a frying pan	☐	☐	☐	☐	☐

44 How difficult was it for you to perform the following activities using your LEFT HAND?

		Not at all difficult	A little difficult	Somewhat difficult	Moderately difficult	Very difficult
a)	Turn a door knob	☐	☐	☐	☐	☐
b)	Pick up a coin	☐	☐	☐	☐	☐
c)	Hold a glass of water	☐	☐	☐	☐	☐
d)	Turn a key in a lock	☐	☐	☐	☐	☐
e)	Hold a frying pan	☐	☐	☐	☐	☐

45 How difficult was it for you to perform the following activities using BOTH HANDS?

		Not at all difficult	A little difficult	Somewhat difficult	Moderately difficult	Very difficult
a)	Open a jar	☐	☐	☐	☐	☐
b)	Button a shirt/blouse	☐	☐	☐	☐	☐
c)	Eat with a knife/fork	☐	☐	☐	☐	☐
d)	Carry a grocery bag	☐	☐	☐	☐	☐
e)	Wash dishes	☐	☐	☐	☐	☐
f)	Wash your hair	☐	☐	☐	☐	☐
g)	Tie shoelaces/knots	☐	☐	☐	☐	☐

SECTION D: HAND AND WRIST FUNCTION

The following questions refer to your satisfaction with your hands/wrists during the ***past 7 days***. Please tick one box for each question

46 How satisfied were you with your RIGHT hand/wrist during the *past 7 days*?

	RIGHT HAND	Very satisfied	Somewhat satisfied	Neither satisfied or dissatisfied	Somewhat dissatisfied	Very dissatisfied
a)	Overall function of your hand	☐	☐	☐	☐	☐
b)	Movement of the fingers	☐	☐	☐	☐	☐
c)	Movement of your wrist	☐	☐	☐	☐	☐
d)	Strength of your hand	☐	☐	☐	☐	☐
e)	Pain level of your hand	☐	☐	☐	☐	☐
f)	Sensation (feeling) of your hand	☐	☐	☐	☐	☐

47 How satisfied were you with your LEFT hand/wrist during the *past 7 days*?

	LEFT HAND	Very satisfied	Somewhat satisfied	Neither satisfied or dissatisfied	Somewhat dissatisfied	Very dissatisfied
a)	Overall function of your hand	☐	☐	☐	☐	☐
b)	Movement of the fingers	☐	☐	☐	☐	☐
c)	Movement of your wrist	☐	☐	☐	☐	☐
d)	Strength of your hand	☐	☐	☐	☐	☐
e)	Pain level of your hand	☐	☐	☐	☐	☐
f)	Sensation (feeling) of your hand	☐	☐	☐	☐	☐

Thank you for completing this questionnaire!
Please return it to the REACTS team
using the pre-paid envelope.

REACTS

If you have any questions, or would like any additional information, please contact Lisa Newington on:
ln@mrc.soton.ac.uk | 023 8077 7624 | 07866 997732

Appendix N REACTS follow-up questionnaire

University Hospital Southampton NHS
NHS Foundation Trust

REACTS

Arthritis Research UK | MRC | centre for musculoskeletal health & work

UNIVERSITY OF Southampton

REACTS ID: | | | | | |

One Month After Your Carpal Tunnel Release Surgery

REACTS

Return to Employment After Carpal Tunnel Release Surgery (REACTS)

ln@mrc.soton.ac.uk | 023 8077 7624
Arthritis Research UK – MRC Centre for Musculoskeletal Health and Work
MRC Lifecourse Epidemiology Unit, University of Southampton
Southampton General Hosptial (MP 95), SO16 6YD

IRAS reference: 209840

SECTION A: ABOUT YOUR OPERATION

Please fill in today's date | | | | | | | | | (d d m m y y y y)

1 What was the date of your carpal tunnel release surgery? | | | | | | | | | (d d m m y y y y)

2 Which side was operated on? Please tick one box.

Right ☐ Left ☐ Both ☐

3 What type of anaesthetic did you have? Please tick one box.

a) General anaesthetic (you were sent to sleep) ☐

b) Local or regional anaesthetic (your arm was made numb, but you were still awake) ☐

c) Other *(please specify)* ☐

---

d) Unsure ☐

4 How long did you need to stay in the hospital/clinic after your operation?
Please tick one box (and specify the number of nights, if applicable).

a) I went home the same day ☐

b) I needed to stay overnight (one night only) ☐

c) I needed to stay for more than one night ☐

(Please specify for how long) ☐☐ nights

SECTION A: ABOUT YOUR OPERATION

5 Have you used any of the following services specifically for your operated hand(s) since your surgery?
Please give the number of visits for each service, and the date(s) attended, if known.

		I used this service in the NHS		I used this service privately	
		Number of visits	Dates attended, if known	Number of visits	Dates attended, if known
a)	Your surgeon, or one of the surgical team				
b)	GP or practice nurse				
c)	Hospital nurse				
d)	Pharmacist				
e)	Hand therapist				
f)	Other physiotherapist or occupational therapist				
g)	Chiropractor or osteopath				
h)	Occupational health nurse or doctor				
i)	Accident and emergency (A&E) or minor injuries unit				
j)	Other (*please specify)*				

SECTION A: ABOUT YOUR OPERATION

6 Have you taken any antibiotics for an infection in your surgical wound?
Please do not include any antibiotics you were prescribed at the time of your operation.

Yes ☐ No ☐

If yes, what date did you start taking the antibiotics? ☐☐☐☐☐☐☐☐ (d d m m y y y y)

7 Have you been admitted to hospital because of a problem with your operated hand(s)? If yes, please answer the rest of Question 7; if no, please move on to Question 8.

Yes ☐ No ☐

7.1 If yes, when were you first admitted? ☐☐☐☐☐☐☐☐ (d d m m y y y y)

7.2 How many nights did you stay in hospital?
Please answer 0 if you didn't stay overnight. ☐☐ nights

7.3 Did you require another operation? Yes ☐ No ☐

8 Have you been advised that you may need a carpal tunnel release for your other hand in the future?
If yes, please answer Question 8.1; if no, please move on to Question 9.

Yes ☐ No ☐

8.1 If yes, when are you expecting to have this surgery? Please tick one box.

a) In less than 2 months ☐
b) In 2-5 months ☐
c) In 6-11 months ☐
d) In more than a year ☐
e) Unsure ☐

9 If you would like to give us any other information about your operation, or the healthcare services you have used, please do so here:

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SECTION B: WORK

10 Compared to before your surgery, which of the following best describes your current work situation? Please tick one box.

a) Returned to the same job, work duties and hours – **please go to Question 14** ☐

b) Returned to the same job, with altered duties or hours – **please go to Question 14** ☐

c) Started a new job – **please go to Question 11** ☐

d) Not yet returned to work, but plan to return in the future – **please go to Question 12** ☐

e) Do not plan to return to work – **please go to Question 13** ☐

11 Thinking about your new job:

11.1 What is your main occupation now (e.g. secretary, teacher, builder etc.)?

.....

11.2 In what industry do you work (e.g. farming, shipyard, car factory, shoe shop, hospital, insurance office etc.)?

.....

11.3 Did you change jobs because of your hand/wrist problem? Please tick one box.

a) Yes, my hand/wrist problem was the main reason for my job change ☐

b) Yes, my hand/wrist problem was one of several reasons for my job change ☐

c) No, my job change was nothing to do with my hand/wrist problem ☐

d) Other, please specify ☐

.....

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Please go to Question 14

SECTION B: WORK

12 **If you have not yet returned to work, when do you think you might be able to return?** Please give an estimated date if you are unsure.

d	d	m	m	y	y	y	y

12.1 **Have you discussed when to return to work with anyone?** If yes, please answer the rest of Question 12; if no, please move on to Question 21.

Yes ☐ No ☐

12.2 If yes, who have you discussed this with? Please tick all that apply.

a) Your surgeon or a member of the surgical team ☐
b) Hospital nurse ☐
c) GP or practice nurse ☐
d) Hand therapist ☐
e) Physiotherapist or occupational therapist ☐
f) Occupational health nurse or doctor ☐
g) Employer or manager (or colleagues if self-employed ☐
h) Friend or family member ☐
i) Other *(please specify)* ☐

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12.3 **Since your operation, have you been given any specific advice about when and how to return to work?** This could include any activities to avoid or timescales to follow. Please list any advice here, including who gave you this advice:

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Please go to Question 21

SECTION B: WORK

13 **If you do not plan to return to work, what is the main reason for this decision?**
Please tick one box.

a) Retirement ☐

b) Redundancy ☐

c) Position/work no longer available ☐

d) Unable to do your work because of your problem with your hand(s)/wrist(s) ☐

e) Unable to do your work because of any other problem ☐

f) Other *(please specify)* ☐

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13.1 **Have you been advised not to return to work by anyone?**
If yes, please answer Question 13.2; if no, please move on to Question 21.

Yes ☐ No ☐

13.2 If yes, who by? Please tick all that apply.

a) Your surgeon or a member of the surgical team ☐

b) Hospital nurse ☐

c) GP or practice nurse ☐

d) Hand therapist ☐

e) Physiotherapist or occupational therapist ☐

f) Occupational health nurse or doctor ☐

g) Employer or manager (or colleagues if self-employed) ☐

h) Friend or family member ☐

i) Other *(please specify)* ☐

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Please go to Question 21

SECTION B: WORK

14 When did you first return to work after your carpal tunnel release surgery?

d	d	m	m	y	y	y	y

15 How much work-time did you miss between the date of your surgery and the date you first returned to work?
Please include all work-time missed, even if this had been pre-arranged with your employer, or was taken as annual leave. You can answer in hours, days or weeks, whichever applies.

☐☐☐ hours ☐☐ days ☐☐ weeks

15.1 Was any of this time paid?
Please tick one box (and provide the amount of time, if applicable).

a) Yes, all of my time away from work was paid ☐

b) Yes, some of my time away from work was paid ☐
(please specify how much time was paid, you can use hours, days or weeks, whichever applies)

☐☐☐ hours ☐☐ days ☐☐ weeks

c) No, none of my time off was paid ☐

d) Not sure ☐

16 Since your surgery, have you discussed when to return to work with anyone?
If yes, please answer the rest of Question 16; if no, please move on to Question 17.

Yes ☐ No ☐

16.1 If yes, who did you discuss this with? Please tick all that apply.

a) Your surgeon or a member of the surgical team ☐
b) Hospital nurse ☐
c) GP or practice nurse ☐
d) Hand therapist ☐
e) Physiotherapist or occupational therapist ☐
f) Occupational health nurse or doctor ☐
g) Employer or manager (or colleagues if self-employed ☐
h) Friend or family member ☐
i) Other *(please specify)* ☐

.....

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SECTION B: WORK

16.2 **Please list any advice you have been given (since your surgery) about when and how to return to work?**
This could include any activities to avoid or timescales to follow. If this advice came from more than one place, please indicate who advised what.

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17 **Since returning to work after your operation, have you needed to take any time off work because of a problem with your operated hand(s)/wrist(s)?**
If yes, please answer Question 17.1; if no, please move on to Question 18.

Yes ☐ No ☐

17.1 **If yes, how much time did you take off work?**
Please answer in days or hours, whichever applies.

☐☐☐ hours ☐☐ days ☐☐ weeks

18 **When you first returned to work after your surgery, did you work shorter hours than would be normal for your job as a direct result of your operation?**
If yes, please answer the rest of Question 18; if no, please move on to Question 19.

Yes ☐ No ☐

18.1 **Have you since gone back to working full hours?**
If yes, please answer Question 18.2; if no, please move on to Question 19.

Yes ☐ No ☐

18.2 **If yes, when did you return to full working hours?**
If you do not know the exact date, approximately how many weeks did you work reduced hours?

☐☐☐☐☐☐☐☐
d d m m y y y y

a) Less than a week ☐

b) 1 – 2 weeks ☐

c) More than 2 weeks, but less than 3 weeks ☐

d) 3 weeks or longer ☐

SECTION B: WORK

19 **When you first returned to work after your surgery, did you need to alter or avoid any of your usual work duties as a direct result of your operation?**
If yes, please answer the rest of Question 19; if no, please move on to Question 20.

Yes ☐ No ☐

19.1 **Have you since gone back to full duties?**
If yes, please answer Question 19.2; if no, please move on to Question 20.

Yes ☐ No ☐

19.2 **If yes, when did you return to full working duties?**
If you do not know the exact date, approximately how many weeks did you have altered work duties?

d	d	m	m	y	y	y	y

a) Less than a week ☐

b) 1 – 2 weeks ☐

c) More than 2 weeks, but less than 3 weeks ☐

d) 3 weeks or longer ☐

20 **If you would like to give us any additional information about returning to work, please do so here:**

SECTION C: HAND AND WRIST SYMPTOMS

21 **The following questions refer to your symptoms over the *last 7 days*.**
Please answer for each hand. Please tick one box for each row.

21.1 **How severe were the following symptoms in your RIGHT hand?**	**None**	**Mild**	**Moderate**	**Severe**	**Very severe**
a) Pain at night	☐	☐	☐	☐	☐
b) Pain during the daytime	☐	☐	☐	☐	☐
c) Numbness or tingling at night	☐	☐	☐	☐	☐
d) Numbness or tingling during the daytime	☐	☐	☐	☐	☐

How often did the following symptoms in your RIGHT hand wake you up at night?	**Never**	**Once**	**2 or 3 times**	**4 or 5 times**	**More than 5 times**
e) Pain	☐	☐	☐	☐	☐
f) Numbness or tingling	☐	☐	☐	☐	☐

21.2 **How severe were the following symptoms in your LEFT hand?**	**None**	**Mild**	**Moderate**	**Severe**	**Very severe**
a) Pain at night	☐	☐	☐	☐	☐
b) Pain during the daytime	☐	☐	☐	☐	☐
c) Numbness or tingling at night	☐	☐	☐	☐	☐
d) Numbness or tingling during the daytime	☐	☐	☐	☐	☐

How often did the following symptoms in your LEFT hand wake you up at night?	**Never**	**Once**	**2 or 3 times**	**4 or 5 times**	**More than 5 times**
e) Pain	☐	☐	☐	☐	☐
f) Numbness or tingling	☐	☐	☐	☐	☐

22 **This question refers to the appearance (look) of your hands during the *past 7 days*.** Please tick one box for each hand.

	Strongly agree	**Agree**	**Neither agree nor disagree**	**Disagree**	**Strongly disagree**
a) I am satisfied with the appearance (look) of my **RIGHT** hand	☐	☐	☐	☐	☐
b) I am satisfied with the appearance (look) of my **LEFT** hand	☐	☐	☐	☐	☐

SECTION C: HAND AND WRIST SYMPTOMS

23 **How do you rate your symptoms in your operated hand(s) now, compared to before your surgery?** Please tick one box.

a) Completely cured ☐ c) Unchanged ☐ e) Worse ☐

b) Much better ☐ d) Slightly better ☐

24 The following questions ask specifically about your scar. Please think about your scar over the ***past 7 days***.

24.1 **Has your scar been itchy?**
If yes, please continue; if no, please move on to Question 24.2

Yes ☐ No ☐

Yes, it was itchy:	Sometimes	☐	Often	☐	Always	☐
And when it was itchy, it was:	Slightly itchy	☐	Fairly itchy	☐	Very itchy	☐

24.2 **Has your scar caused you pain?**
If yes, please continue; if no, please move on to Question 24.3

Yes ☐ No ☐

Yes, it was painful:	Sometimes	☐	Often	☐	Always	☐
And when it hurt, it was:	Slightly painful	☐	Fairly painful	☐	Very painful	☐

24.3 **Has your scar been uncomfortable?**
If yes, please continue; if no, please move on to Question 24.4

Yes ☐ No ☐

Yes, it was uncomfortable:	Sometimes	☐	Often	☐	Always	☐
And when it was uncomfortable, it was:	Slightly uncomfortable	☐	Fairly uncomfortable	☐	Very uncomfortable	☐

SECTION C: HAND AND WRIST SYMPTOMS

24.4 Has your scar felt numb?
If yes, please continue; if no, please move on to Question 24.5

Yes ☐ No ☐

Yes, it was numb:	Sometimes	☐	Often	☐	Always	☐
And when it felt numb, it was:	Slightly numb	☐	Fairly numb	☐	Very numb	☐

24.5 Have you had odd sensations in your scar e.g. tightening, pulling or pins and needles? If yes, please continue; if no, please move on to Question 24.6

Yes ☐ No ☐

Yes, I have had odd sensations:	Sometimes	☐	Often	☐	Always	☐

24.6 Has your scar caught on things e.g. clothing?
If yes, please continue; if no, please move on to Question 24.7

Yes ☐ No ☐

Yes, it has caught on things:	Sometimes	☐	Often	☐	Always	☐

24.7 Overall, how troublesome are the symptoms from your scar?
Please tick one box.

Not at all troublesome	A little troublesome	Fairly troublesome	Very troublesome	Unbearable
☐	☐	☐	☐	☐

SECTION D: HAND AND WRIST FUNCTION

The following questions refer to the function of your hands/wrists during the ***past 7 days***. Please answer all questions for the right and left sides, even if you do not experience any problems. Please tick one box for each question.

25 RIGHT SIDE	**Very well**	**Well**	**Adequately**	**Poorly**	**Very poorly**
a) Overall, how well did your ***right*** hand work?	☐	☐	☐	☐	☐
b) How well did your ***right*** fingers move?	☐	☐	☐	☐	☐
c) How well did your ***right*** wrist move?	☐	☐	☐	☐	☐
	Very good	**Good**	**Fair**	**Poor**	**Very poor**
d) How was the strength in your ***right*** hand?	☐	☐	☐	☐	☐
e) How was the sensation (feeling) in your ***right*** hand?	☐	☐	☐	☐	☐

26 LEFT SIDE	**Very well**	**Well**	**Adequately**	**Poorly**	**Very poorly**
a) Overall, how well did your ***left*** hand work?	☐	☐	☐	☐	☐
b) How well did your ***left*** fingers move?	☐	☐	☐	☐	☐
c) How well did your ***left*** wrist move?	☐	☐	☐	☐	☐
	Very good	**Good**	**Fair**	**Poor**	**Very poor**
d) How was the strength in your ***left*** hand?	☐	☐	☐	☐	☐
e) How was the sensation (feeling) in your ***left*** hand?	☐	☐	☐	☐	☐

The following questions refer to the ability of your hands to do certain tasks during the ***past 7 days***. If you do not do a certain task, please estimate the difficulty you would have in performing it. Please tick one box for every activity.

27 How difficult was it for you to perform the following activities using your RIGHT HAND?	**Not at all difficult**	**A little difficult**	**Somewhat difficult**	**Moderately difficult**	**Very difficult**
a) Turn a door knob	☐	☐	☐	☐	☐
b) Pick up a coin	☐	☐	☐	☐	☐
c) Hold a glass of water	☐	☐	☐	☐	☐
d) Turn a key in a lock	☐	☐	☐	☐	☐
e) Hold a frying pan	☐	☐	☐	☐	☐

SECTION D: HAND AND WRIST FUNCTION

28 How difficult was it for you to perform the following activities using your LEFT HAND?

		Not at all difficult	A little difficult	Somewhat difficult	Moderately difficult	Very difficult
a)	Turn a door knob	☐	☐	☐	☐	☐
b)	Pick up a coin	☐	☐	☐	☐	☐
c)	Hold a glass of water	☐	☐	☐	☐	☐
d)	Turn a key in a lock	☐	☐	☐	☐	☐
e)	Hold a frying pan	☐	☐	☐	☐	☐

29 How difficult was it for you to perform the following activities using BOTH HANDS?

		Not at all difficult	A little difficult	Somewhat difficult	Moderately difficult	Very difficult
a)	Open a jar	☐	☐	☐	☐	☐
b)	Button a shirt/blouse	☐	☐	☐	☐	☐
c)	Eat with a knife/fork	☐	☐	☐	☐	☐
d)	Carry a grocery bag	☐	☐	☐	☐	☐
e)	Wash dishes	☐	☐	☐	☐	☐
f)	Wash your hair	☐	☐	☐	☐	☐
g)	Tie shoelaces/knots	☐	☐	☐	☐	☐

The following questions refer to your satisfaction with your hands/wrists during the ***past 7 days***. Please tick one box for each question.

30 How satisfied were you with your RIGHT hand/wrist during the *past 7 days*?

	RIGHT HAND	Very satisfied	Somewhat satisfied	Neither satisfied or dissatisfied	Somewhat dissatisfied	Very dissatisfied
a)	Overall function of your hand	☐	☐	☐	☐	☐
b)	Movement of the fingers	☐	☐	☐	☐	☐
c)	Movement of your wrist	☐	☐	☐	☐	☐
d)	Strength of your hand	☐	☐	☐	☐	☐
e)	Pain level of your hand	☐	☐	☐	☐	☐
f)	Sensation (feeling) of your hand	☐	☐	☐	☐	☐

SECTION D: HAND AND WRIST FUNCTION

31 How satisfied were you with your LEFT hand/wrist during the *past 7 days*?

	LEFT HAND	Very satisfied	Somewhat satisfied	Neither satisfied or dissatisfied	Somewhat dissatisfied	Very dissatisfied
a)	Overall function of your hand	☐	☐	☐	☐	☐
b)	Movement of the fingers	☐	☐	☐	☐	☐
c)	Movement of your wrist	☐	☐	☐	☐	☐
d)	Strength of your hand	☐	☐	☐	☐	☐
e)	Pain level of your hand	☐	☐	☐	☐	☐
f)	Sensation (feeling) of your hand	☐	☐	☐	☐	☐

32 If you would like to give us any additional information about your hand and wrist function, please do so here:

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Thank you for completing this questionnaire!
Please return it to the REACTS team
using the pre-paid envelope.

REACTS

If you have any questions or would like any additional information, please contact Lisa Newington on:
ln@mrc.soton.ac.uk | 023 8077 7624 | 07866 997732

Appendix O Michigan Hand Questionnaire licence agreement

License Agreement #7125-umich

This license agreement is ***completed***.

Pricing Information

Unit Price
$0.00

Quantity
1

Net Price
$0.00

Sales Tax
$0.00

Shipping
$0.00 None Selected

Total Price
$0.00

Licensee Information

First Name
Lisa

Last Name
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University of Southampton

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SO16 6YD

Country
GB

Digital Downloads

This agreement includes 1 digital file, each available to the licensee for download.

- **Michigan Hand Questionnaire** - ZIP - 239 KB

  No expiration date or download limit set.

Appendix P Non-significant age- and sex-adjusted Cox proportional hazards analyses

P.1 Demographic, general health and health beliefs variables

	N	Return to work time (days)		Age- and sex-adjusted analyses		
		Median	IQR	Hazard ratio [a]	95% CI	P value
BMI						
Normal	39	18	10-34	1	-	-
Overweight	50	20.5	12-32	0.85	0.54, 1.33	0.48
Obese	60	20.5	12-39.5	0.80	0.53, 1.22	0.30
General health status						
Excellent-good	141	20	12-34	1	-	-
Fair-poor	20	25	9-42.5	0.85	0.51, 1.42	0.54
Number of comorbidities						
None	44	18.5	6-33	1	-	-
One	53	27	14-42	0.81	0.53-1.23	0.32
Two or more	65	20	10-31	0.99	0.65, 1.50	0.95
Number of disabling comorbidities						
None	111	20	9-35	1	-	-
One	31	23	13-39	0.78	0.51-1.19	0.25
Two or more	20	21	13.5-34.5	0.87	0.52, 1.45	0.58
Number of somatising symptoms						
None	77	20	11-35	1	-	-
One	47	24	13-34	1	0.69, 1.46	0.99
Two or more	37	20	13-39	0.79	0.52, 1.20	0.27
SF-36 mental health score						
Tertile 1 (poor)	52	24	11-38.5	0.87	(0.58,1.31)	0.51
Tertile 2 (intermediate)	58	17.5	10-39	1	(0.67,1.51)	0.98
Tertile 2 (good)	51	16	7-33	1	-	-
Believe will be able to use hand normally in 3 months						
Yes	144	21	12-35	1	-	-
No	16	20	14-40	1	0.58, 1.72	0.99
Blames self for their hand problem						
No	140	20	12-39.5	1	-	-
Yes	20	23.5	14.5-29	1.2	0.72, 1.99	0.48
Problems like this run in the family/born with a weakness						
No	112	20	12-38.5	1	-	-
Yes	48	25.5	13-32.5	0.79	0.55, 1.12	0.18

	N	Return to work time (days)		Age- and sex-adjusted analyses		
		Median	IQR	Hazard ratio [a]	95% CI	P value
Stress makes the hand problem worse						
No	143	20	12-35	1	-	-
Yes	17	29	14-40	0.70	0.42, 1.17	0.17
Lack of exercise contributed to the problem						
No	148	21	13-38	1	-	-
Yes	12	15	10.5-25	1.29	0.69, 2.43	0.43
Problems like this likely as you get older						
No	64	19	10-25	1	-	-
Yes	95	24	15-38	1.25	0.88, 1.76	0.22
Pain catastrophisation to at least a moderate degree						
No	111	19	10-35			
Yes	49	24	15-38	0.91	0.62, 1.33	0.61

[a.] Hazard ratio >1 relates to earlier return to work.

P.2 Clinical variables

	N	Return to work time (days)		Age- and sex-adjusted analyses		
		Median	IQR	Hazard ratio [a]	95% CI	P value
CTR to dominant hand						
Yes	108	19.5	12-33	1	-	-
No	54	27	13-42	0.73	0.52, 1.03	0.08
Katz hand diagram score for side of CTR						
Classic/probable	107	23	14-40	1	-	-
Possible/unlikely	52	15	7.5-30.5	1.19	0.84, 1.69	0.33
Duration of symptoms						
≤ 1 year	39	19	10-35	1	-	-
More than 1 year	127	21	13-36.5	0.86	0.58, 1.25	0.42
Pre-operative nerve conduction testing						
No	72	21	14-39.5	1	-	-
Yes	77	20	11-33	1.13	0.81, 1.58	0.47
Suture material						
Non-absorbable	117	20	12-38	1	-	-
Absorbable	24	20.5	13-31	1.07	(0.66,1.72)	0.78
MHQ function (side of CTR)						
Poor (tertile 1)	68	23.5	13-42	0.81	(0.55,1.19)	0.29
Intermediate (tertile 2)	41	20	14-33	0.9	(0.58,1.40)	0.65
Good (tertile 3)	51	20	7-29	1	-	-
MHQ bilateral activities of daily living						
Poor (tertile 1)	53	18	10-31	1.09	0.72, 1.64	0.69
Intermediate (tertile 2)	58	26	15-42	0.71	0.48, 1.06	0.09
Good (tertile 3)	50	20.5	9-31	1	-	-
MHQ activities of daily living (side of CTR)						
Poor (tertile 1)	55	20	12-42	0.89	(0.59,1.34)	0.57
Intermediate (tertile 2)	53	21	14-35	0.99	(0.66,1.48)	0.96
Good (tertile 3)	53	21	10-32	1	-	-
MHQ satisfaction with function (side of CTR)						
Poor (tertile 1)	74	24.5	12-42	0.84	(0.58,1.23)	0.38
Intermediate (tertile 2)	37	20	15-29	1.07	(0.68,1.70)	0.77
Good (tertile 3)	51	20	7-31	1	-	-
MHQ satisfaction with appearance (side of CTR)						
Satisfied	113	21	11-34	1	-	-
Dissatisfied	48	19	13-38	0.92	0.65, 1.31	0.65

[a.] Hazard ratio >1 relates to earlier return to work.

P.3 Occupational variables

	N	Return to work time (days)		Age- and sex-adjusted analyses		
		Median	IQR	Hazard ratio [a]	95% CI	P value
More than one job						
No	151	20	12-34	1	-	-
Yes	10	34	24-43	0.59	0.30, 1.16	0.13
Total weekly work hours						
≤37.5	81	24	15-38	1	-	-
>37.5	81	17	6-31	1.12	0.76, 1.64	0.58
Total weekly work days						
< 5 days	44	24	16-34.5	1.08	0.75, 1.56	0.69
5 days	101	20	11-41	1	-	-
> 5 days	17	13	7-20	1.67	0.96, 2.93	0.07
Sick leave for CTS in past month						
No	132	20.5	12-34.5	1	-	-
Yes	16	15	9.5-29	1.08	0.61, 1.91	0.79
Sick leave for other reason in past month						
No	126	19.5	10-33	REF	REF	REF
Yes	19	31	21-42	0.71	(0.42,1.18)	0.18
MHQ work						
Poor (tertile 1)	74	24.5	12-42	0.84	(0.58,1.23)	0.38
Intermediate (tertile 2)	37	20	15-29	1.07	(0.68,1.70)	0.77
Good (tertile 3)	51	20	7-31	1	-	-
Return to work advice and baseline						
Yes	120	20.5	12-34.5	1	-	-
No	40	22	13.5-39.5	1	0.69, 1.44	1
Job satisfaction						
Satisfied	142	20	10-33	1	-	-
Dissatisfied	18	32.5	21-43	0.66	0.40, 1.10	0.11
Problem wasn't caused by work, buy work made it worse						
No	82	21	12-35	1	-	-
Yes	77	20	13-33	0.9	0.65, 1.26	0.55
Employer/colleagues are supportive of hand problem						
Yes	89	19	12-29	1	-	-
No	39	29	19-42	0.68	(0.46,1.02)	0.06
N/A	31	16	10-41	0.84	(0.54,1.29)	0.42
Work to tight deadlines						
No	65	23	14-39	1	-	-
Yes	95	19	10-35	1.2	0.86, 1.67	0.29
Work with power tools						
No	123	20	12-35	1	-	-
Yes	33	20	14-38	0.76	0.48, 1.22	0.25

	N	Return to work time (days)		Age- and sex-adjusted analyses		
		Median	IQR	Hazard ratio [a]	95% CI	P value
Work with hands above shoulder height >1hr						
No	126	20.5	12-35	1	-	-
Yes	29	20	13-38	0.84	0.55, 1.3)	0.44
Work with neck flexed >2 hrs						
No	98	21	13-35	1	-	-
Yes	61	20	9-35	1.16	0.83, 1.62	0.39
Driving for work >1kr						
No	98	22	14-39	1	-	-
Yes	59	16	6-32	1.22	(0.84,1.77)	0.30

[a.] Hazard ratio >1 relates to earlier return to work.

Appendix Q Predictors of poor outcomes after carpal tunnel release

Q.1 Poor outcome on Global Rating of Change Score

A poor outcome was defined as a score of worse, no change, or slightly better on the Global Rating of Change Score assessed at 12 weeks after CTR.

Logistic regression (adjusted for age and sex only)					
	Poor outcome N (%)		Odds ratio	95% confidence intervals	P value
	Yes	No			
Pain catastrophisation					
No	9 (8)	97 (85)	1	-	-
Yes	9 (18)	33 (65)	3.54	1.15, 10.85	**0.03**
SF36 mental health					
Tertile 1 (poor)	10 (19)	37 (70)	14.55	1.65, 128.00	**0.02**
Tertile 2 (intermediate)	8 (13)	48 (80)	7.29	0.84, 62.92	**0.07**
Tertile 3 (good)	1 (2)	45 (85)	1	-	-
Somatising symptoms					
None	6 (7)	68 (83)	1	-	-
One	4 (9)	37 (78)	1.33	0.34, 5.11	0.68
≥ 2	9 (24)	26 (70)	5.10	1.54, 16.85	**0.01**
General health					
Excellent/v. good/good	14 (10)	120 (83)	1	-	-
Fair/poor	5 (24)	10 (48)	4.14	1.08, 15.85	**0.04**
MHQ ADLs side of carpal tunnel release					
Tertile 1 (poor)	13 (23)	39 (70)	7.40	1.49, 36.79	**0.01**
Tertile 2 (intermediate)	4 (7)	48 (86)	1.42	0.24, 8.40	0.70
Tertile 3 (good)	2 (4)	43 (80)	1	-	-
MHQ work					
Tertile 1 (poor)	11 (18)	41 (67)	5.52	1.11, 27.36	**0.04**
Tertile 2 (intermediate)	6 (10)	52 (84)	2.21	0.42, 11.76	0.35
Tertile 3 (good)	2 (5)	38 (86)	1	-	-

Significant findings are highlighted in bold.
MHQ Michigan Hand Questionnaire, ADLs activities of daily living.

Q.2 Poor outcome on Patient Scar Assessment Questionnaire

A poor outcome was defined as a scar that was reported as unbearable, very troublesome or fairly troublesome at 12 weeks after CTR.

Logistic regression (adjusted for age and sex only)					
	Poor outcome N (%)		Odds ratio	95% confidence interval	P value
	Yes	No			
Stress makes hand problem worse					
Yes	5 (28)	8 (44)	6.12	1.62, 23.13	**0.01**
No	12 (8)	122 (83)	1	-	-
Afraid of long-term hand problems					
Yes	12 (16)	54 (70)	3.77	1.21, 11.70	**0.02**
No	5 (6)	75 (86)	1	-	-
Number of somatising symptoms					
None	4 (5)	69 (84)	1	-	-
1	2 (4)	39 (83)	0.91	0.15, 5.41	0.91
≥2	11 (30)	24 (65)	10.20	2.68, 38.83	**0.001**
Expected duration of work absence					
Tertile 1 (short)	4 (5)	65 (81)	1	-	-
Tertile 2 (medium)	3 (14)	18 (86)	2.71	0.52, 14.02	0.23
Tertile 3 (long)	9 (19)	34 (72)	4.74	1.27, 17.72	**0.02**

Significant findings are highlighted in bold.

Appendix R Qualitative interview study publication

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RESEARCH ARTICLE Open Access

Return to work after carpal tunnel release surgery: a qualitative interview study

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Abstract

Background: Carpal tunnel syndrome is a common nerve compression disorder which affects hand sensation and function. Carpal tunnel release surgery (CTR) is frequently performed to alleviate these symptoms. For many CTR patients, surgery occurs during their working lifetime, but there is currently no evidence-based guidance to inform clinicians or patients when it might be safe to return to different types of work afterwards. The aim of this qualitative study was to explore the return to work experiences of patients who had recently undergone CTR.

Methods: Semi-structured 1:1 interviews were conducted with a subgroup of participants recruited to a multi-centre prospective cohort study. Interviewees were purposely selected to represent a range of demographic, clinical and occupational characteristics. All had recently undergone CTR and had returned to work. Interviews were audio recorded, transcribed verbatim and analysed using the framework method. Participants were recruited until data saturation was achieved.

Results: Fourteen participants were interviewed: 11 women (median age 49 years, range 27–61) and 3 men (age range 51–68 years). Three key themes were identified. Theme 1 centred on the level of functional disability experienced immediately after surgery. There was an expectation that CTR would be a 'minor' procedure, but this did not match the participants' experiences. Theme 2 explored the desire for validation for the time away from work, with participants recalling a need to justify their work absence to themselves as well as to their employers. Theme 3 focused on the participants' reflections of handing their return to work and function, with many reporting uncertainties about what constituted appropriate activity loads and durations. There was a desire for specific information relating to individual work roles.

Conclusion: Individual return to work decision-making was largely influenced by the recommendations received. According to the views of participants, clinicians may be able to prepare patients better pre-operatively, especially with respect to function in the immediate post-operative period and by providing return to work guidance that can be tailored for individual work roles.

Keywords: Carpal tunnel release, Carpal tunnel syndrome, Work, Return to work, Patient experience, Qualitative interviews

Background

Carpal tunnel syndrome (CTS) is a common peripheral nerve entrapment syndrome, occurring when the median nerve becomes compressed within the carpal tunnel. Symptoms include an unpleasant tingling or reduced sensation in the radial digits, and weakness of the thenar muscles. This reduces manual dexterity and often disturbs sleep [1]. As the peak incidence for CTS occurs during the working lifetime [2], both the symptoms from, and treatment of, CTS may affect people in the workplace. The US National Health Interview Survey found that among current/recent workers, the life-time prevalence of CTS was 6.7% [3]. Specific CTS incidence or prevalence data for UK workers were not found.

The first line of treatment for CTS involves wrist splints and/or corticosteroid injection, however in more

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severe cases, or when non-operative treatment has failed, carpal tunnel release (CTR) surgery is recommended [4]. More than 90,000 CTR procedures are expected annually by 2020 in the English NHS alone [5], but there is currently no evidence-based guidance advising when it might be safe to return to functional activities, including work, after CTR. Our recent systematic review of the duration of work absence after CTR highlighted considerable variation in reported return to work times [6]. Across 56 included studies, mean time to return to work ranged from 4 to 168 days (24 weeks). Unfortunately, occupational characteristics were only reported by a small minority of studies, but those which did suggested longer durations of work absence in the following scenarios: employed, rather than self-employed workers; part-time, rather than full-time workers; manual rather than non-manual workers; and for those receiving workers' compensation. Prognostic factors associated with earlier return to work have been reviewed by Peters et al. and included an expectation or desire for fewer days off work, lower pain anxiety and a work role that was unaffected by CTS [7].

To date, the research in this field has focused on quantitative measures of return to work with little attention given to patients' experiences. We were interested in exploring patients' perspectives of returning to their work after CTR and in identifying the factors that influenced this return to work experience.

Methods

Study design and research team

This semi-structured qualitative interview study was nested within an existing NIHR-funded cohort study, known as REACTS (Return to Employment After Carpal Tunnel release Surgery, NIHR DRF-2015-08-056). The lead author (LN) was a practising physiotherapist and PhD candidate and the research team also comprised academic and clinical academic healthcare researchers in the fields of rheumatology, occupational therapy and hand surgery. This research was supported by a group of patient advisors who had all previously undergone CTR.

Participants and recruitment

Interviewees were purposively recruited from the REACTS study. REACTS participants had been recruited from 16 sites across England and Wales and eligibility criteria were: referred for CTR, aged ≥18 years, routinely working in paid employment for ≥20 h per week and planning to return to work after CTR, no previous CTR to either hand. The sampling frame for the nested interview study took into account age, sex, type of work and work contract, study site and duration of work absence after CTR. Using this purposive sampling frame, REACTS participants were invited to take part in an interview after completing their final REACTS study questionnaire (approximately 3 months after CTR).

Data collection

Participant experiences of returning to work after CTR were explored using semi-structured one-to-one interviews conducted by the lead author (LN). The interviews were either conducted face-to-face or by telephone, according to participant preference, and were audio recorded and transcribed verbatim. All transcripts were checked against the original audio. The interview guide was developed and piloted with the patient advisory group and contained questions concerning: hand/wrist symptoms; return to work decision-making; and the individual's experience of returning to work. The full interview guide is provided in Additional file 1.

Recruitment continued until the research team were confident that data saturation was achieved, therefore data collection and the initial phases of analysis occurred concurrently. The definition of data saturation was two-fold to encompass both sampling and analytical saturation [8]. The first phase of saturation occurred when the interviewer began hearing the same comments repeated by different interviewees [9], and this was confirmed by the second phase of saturation when no new codes were identified during the data analysis [10].

Analysis

Data were managed and analysed using the Framework Method [11]. The first two transcripts were read and re-read and preliminary codes were identified independently by the research team. An additional transcript was independently reviewed and coded by LN and CB. The codes were then discussed and a coding framework was created and applied line by line to all transcripts by the lead author (LN) using NVivo software (Version 11, QSR International Ltd). Where new codes were identified in later transcripts, these were logged and discussed with the research team to ensure agreement and were applied to all transcripts, where appropriate. Analytical ideas were noted and discussed with the research team throughout this initial coding phase and were subsequently explored using the matrices function in NVivo. The coded text was summarised by the lead author to create a series of framework matrices illustrating the key points for each passage of text, which could be viewed across participants and coding topics. These charted framework matrices were reviewed by the research team and organised to illustrate the key themes discussed by interviewees and to identify situations in which there were obvious differences. As the developing themes were explored in detail, sub-themes were created to illustrate these differences. The themes were reviewed by the

patient advisory group and their comments incorporated into the final draft.

Results

Participants

Fourteen interviews were completed to a point where the research team agreed that data saturation had been achieved. These individuals were recruited from a total of 31 invitation letters. Variation was achieved for all demographic characteristics included in the sampling frame (Table 1). Eight healthcare facilities were represented by the interview participants, including NHS primary and secondary care services and private healthcare settings across southern and central England. All interviews took place between August 2017 and June 2018.

The majority of interviewees were female (11/14) and the median age was 51 years. Seventy-one percent were employed, although self-employed workers ($n = 3$) and those on zero hours contracts ($n = 1$) were also represented in similar proportions to those found across the whole REACTS cohort. Interviewees worked in a range of different industries with varied occupational roles. Participant demographics are illustrated in Table 1.

Thirteen interviews were conducted by telephone and one was conducted face to face. The mean interview duration was 27 min, and the range was 16–48 min. The median duration between CTR and interview was 127 days (range 94–160).

Key themes

Three key themes were identified from the interview texts, providing insight to the personal experience of returning to work (Fig. 1). The first theme centred on a perceived lack of preparedness for functional difficulties experienced in the immediate post-operative period: *CTR is not a 'minor' procedure*. The second theme explored the desire for *validation for time off* work, while the third encompassed the participants' reflections on *handling the return* to work and function. The three themes are explored below using illustrative quotes from the interviewees, presented with pseudonyms. Additional quotes to support each of the themes and sub-themes are shown in Table 2. One of the included quotes makes reference to occupational health (OH) services. In the UK, there is only a legislative requirement to provide OH services amongst larger employers. Consequently, OH services paid for by the employer are provided to around 60% of workers. Services vary considerably but may involve telephone or face to face access to physicians, nurses or other allied health professionals who specialise in occupational medicine.

Theme 1: CTR is not a 'minor' procedure

It appeared that the level of functional disability experienced by the interviewees in the immediate post-operative period was unexpected, therefore the procedure was not as 'minor' as they had initially thought. All interviewees recalled experiencing difficulty with hand function and many reported that they had required assistance from

Table 1 Participant demographic and occupational characteristics

Pseudonym	Sex	Age category (years)	Healthcare setting	Type of work contract[a]	Work role	Available sick pay	Dominant hand	Side of CTR	Post-operative work absence (days)		Interview timing (days after surgery)
									Expected	Actual	
Jill	F	51–60	NHS 2	Employed	Sales assistant	Unsure	Right	Right	14	21	119
Debbie	F	51–60	NHS 1	Employed	Nurse	> 6 months	Right	Right	21	21	152
Alan	M	51–60	NHS 1	Self-employed	Maintenance	< 1 week	Right	Right	7	7	151
Sarah	F	61–70	NHS 1	Self-employed	Stable owner	> 6 months	Right	Right	NR	0	123
Peter	M	51–60	NHS 2	Employed	Mechanic	< 1 week	Right	Left	21	16	130
Emma	F	51–60	NHS 2	Employed	Optician	1–6 months	Both	Left	42	42	115
George	M	61–70	NHS 2	Self-employed	Gardener	< 1 week	Left	Right	21	14	155
Helen	F	51–60	NHS 1	Employed	Nurse	> 6 months	Right	Right	21	8	149
Fiona	F	21–30	NHS 1	Employed	Animal technician	1–6 months	Right	Right	21	21	160
Donna	F	31–40	NHS 2	Employed	Police officer	1–6 months	Right	Left	14	42	118
Charlotte	F	41–50	NHS 2	Employed	Postal worker	1–6 months	Right	Right	21	98	119
Vicky	F	41–50	Private	Employed	Secretary	1–6 months	Right	Right	7	4	114
Amanda	F	41–50	Private	Employed	Administrator	> 6 months	Right	Right	14	6	155
Alison	F	41–50	NHS 2	Zero hours contract	Carer	< 1 week	Right	Right	21	28	94

[a]All participants listed as employed reported having a permanent work contract

CTR carpal tunnel release, *NR* not reported, *F* female, *M* male, *NHS 1* NHS primary care, *NHS 2* NHS secondary care, *private* private healthcare setting

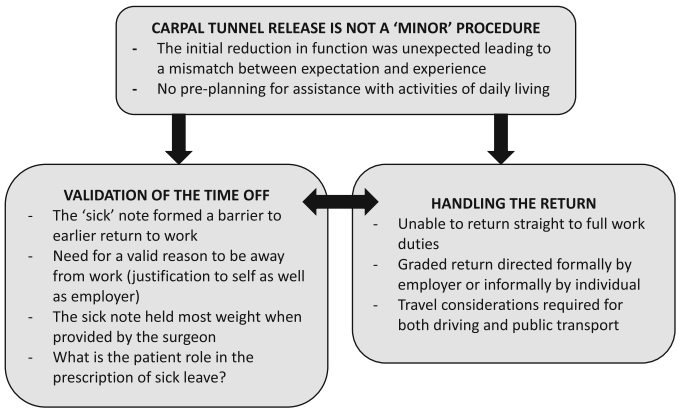

Fig. 1 Key themes identified in the return to work experiences of patients after carpal tunnel release

their partners or children with activities of daily living. Showering and cooking were in particular described as problematic, as were dressing and tying shoelaces. None of the interviewees reported that they had made any prior plans for how to manage their daily activities after surgery. There seemed to be a pre-operative expectation that CTR would be a minor procedure, but this did not appear to fit with the participants' experiences of their recovery. Despite this lack of preparation, many participants looked back on the immediate post-operative period with humour, recalling the unusual methods and strategies they had used to cope with having one hand out of action, as discussed by Debbie:

> *"You don't realise how much you depend on your hands until you can't use them. I managed to adapt with having a shower and sticking my hand out behind the curtain (laughter). But washing hair and drying hair was an absolute nightmare. It didn't happen properly. Cooking, yes, was a nightmare. I found I couldn't lift a saucepan properly with my left hand. It wasn't as strong as my dominant hand. And even cutting up your dinner, you really don't realise. You do find ways to adapt in the end, but you just don't realise how you rely on your dominant hand all the time. It was a good fortnight to be able to even grip a knife to cut anything properly. I just couldn't grip it. It was too painful across the palm of the hand where the cut was, to grip the knife… But I think I would have prepared for it a bit more. Yes. Or even roped a friend in more to come and do things for me."*
>
> Debbie, nurse (employed).

In probing how the mismatch occurred between the anticipation that CTR would be a 'minor' procedure and the level of functional disability experienced, participants recalled receiving some information peri-operatively, but reported that this focused on wound management and avoidance of infection, rather than hand movement or function. Furthermore, the method of information delivery was often reported to be difficult to access, as suggested by Emma:

> *"I was just told to keep it dry. No washing up. I was just told what I couldn't do, rather than anything that might help me do day-to-day tasks… I think the exercises could have been given in a different way. I was just given a sheet of paper. It was in my pack, it wasn't even pointed out to me. I found it in my pack. The trouble is in hospital, they give you lots of information, but it's in a pack".*
>
> Emma, optician (employed).

Participants added that they felt that they were left to interpret general guidance for their own situation, and suggested that their clinicians could take a more proactive role in flagging up daily activities that might be difficult and suggesting ways to tackle this.

Theme 2: validation of the time taken off work

The second theme concerned the process of obtaining validation for taking time away from work. This related to official validation in the form of sickness certification, and also to an internal validation, as individuals experienced a

Table 2 Additional participant quotes to support the identified themes and sub-themes

Theme 1: CTR is not a 'minor' procedure		
"I suppose actually just mentally preparing myself, because obviously, I'd never had any surgery done on a hand or a foot, or anything like that before. Obviously, you don't realise beforehand how frustrating it's going to be to not be able to use it, if that makes sense? I even struggled with going for a shower, trying to wash your hair and things like that. I had to get my partner, bless him, to wash my hair. It's just mentally preparing yourself- To not be able to do as much as you would normally, but I suppose that's the same for any surgery. I suppose I just didn't prepare myself for what I could and couldn't do." Fiona, animal technician (employed)		
"A lot of people don't realise, do they, how much is involved with carpal tunnel [surgery]. They think, "Oh, it's just your hand. It's just a minor op[eration]." But actually, it does affect you a lot in your working areas, wherever you are, whatever you do. They don't realise how much it is going to affect the daily activities of living afterwards." Debbie, nurse (employed)		
Theme 2: Validation of the time taken off work		
i. Is the sick note a barrier for earlier return to work?	ii. It held more weight coming from the surgeon	iii. The patient role in the prescription of sick leave
"Not really [I don't recall any advice about returning to work]. Not that I remember. Only more about how much time to take off" Amanda, administrator (employed)	*"At least I could give them fair warning, which was fine. And the fact that I had a doctor's certificate. I had the surgery, and the surgeon said, "No, I will give a certificate straight off for 2 weeks anyway." So I had warned the employers that 2 weeks [would be the] minimum."* Alison, carer (zero hours contract)	*"Probably just be more steadfast in our own opinion because I felt, not intimidated, that's the wrong word, I just thought, "Well, because they're an expert, they know better than me." I could see myself and I could feel myself that I wasn't ready to use my hand and it didn't feel as if I should have had the stitches out."* Emma, optician (employed)
"I just… Obviously took in my sick note that the hospital gave me and I just said I'll keep in touch and see how we go." Peter, Mechanic (employed)		
Theme 3: Handling the return		
i. Making a graded return to work duties	ii. Travelling to work	
"I was a bit anxious about coming back to work. I knew I still had trouble using my hand. I would have like a phased return to work. I don't think they would have been supportive... I needed someone to sit down and say, 'Look, [Emma] can't come back full time. She needs to come in at 2:00 pm and go home at 4:00 pm'." Whatever. Emma, optician (employed)	*"I had it done over the weekend, and within a couple of days I was back driving, because I had absolutely nil pain from the wound. The pain that I used to get when driving was totally gone."* Sarah, stable owner (self-employed)	
"I was never forced into anything. It was always my decision as to whether I was happy or not. Certainly, my sergeants and inspectors have been very good and were just keen to do whatever is necessary to get me back out on the frontline again." Donna, police officer (employed)	*"Like, getting in the car, I didn't drive for over 2 weeks... I didn't feel happy to because my wrist felt, I don't know, just not quite strong enough. I was worried. It's alright if the roads aren't busy and you could just go along, but if I had to react to something quickly, I didn't feel comfortable with that. Yes. I was told, advised for 2 weeks not to [drive] and then to see how I felt after that."* Amanda, administrator (employed)	

need to justify to themselves that there was a valid reason to be away from work.

Is the sick note a barrier for earlier return to work? Sickness certification was discussed by all employed participants. This was viewed as the formal process that allowed authorised work absence and was the method of communicating with employers about when the clinician had 'permitted' return to work. The language used by participants centred on the traditional *sick* note, which only recorded a prescribed duration of work absence, rather than its 2010 replacement, the *fit* note, which now includes sections for suggested activity modification to enable return to work [12]. It appeared that participants viewed the recommended time frame for work absence recorded on this document as a definite minimum period of absence. In effect, the fit/sick note could be perceived as a barrier, with participants only eligible to return to work after this prescribed time period. Importantly, this was the case for participants both with and without occupational sick pay. Interviewees appeared to trust their clinician that this was the correct thing to do in order to optimise their recovery. Having a certified period of work absence also appeared to validate their time off work, not just to the employer, but also to the individual themselves, as Fiona outlines:

> *"He did sign me off for 3 weeks. He said, "Because of my work," but obviously, after the 2 weeks, I went to see him and I had the stitches out… Yes. He said then, "You can return to work but on lighter duties." He said he's done the sick note for 3 weeks, so it was up to me really… I was thinking about going back to work after 2 weeks, but that's just because you get a bit bored at home when you've got nothing to do. I'm glad I took the 3 weeks, because if I went back after 2 weeks, I would have done more than what I should have done… If your surgeon signs you off for a certain*

amount of time, I would take that, all of that time, to recover properly."

Fiona, animal technician (employed).

Unlike the employed participants, who returned to work after the timescale documented on the fit/sick note, those who were self-employed all reported returning to work earlier than had been verbally recommended. As might be expected, the reasons for this were primarily financial. All self-employed interviewees worked in roles with elements of heavy manual activity and reported return to work within 1–3 weeks of their surgery. None of these participants reported significant negative effects of earlier return to work, but on reflection, the majority felt that they had returned too soon. It is possible that the awareness that they had returned to work earlier than advised contributed to this reflection, as discussed by Alan below:

"I went back to work as soon as I possibly could, you know, because no one's going to pay me if I don't earn money.... Probably a little bit too early, I did jump the gun a little bit, but now I'm okay, so it's all good".

Alan, maintenance worker (self-employed).

'It held more weight coming from the surgeon' The legitimisation of their period of work absence was discussed by several interviewees and formed an important part of their return to work experience. Participants appeared grateful when they received a fit/sick note from their surgical team. Some felt this 'held more weight' than a fit/sick note from their GP while others had been concerned that they would not be able to get an appointment with their GP to provide certification for their sick leave. It appeared that most employed interviewees felt that they needed strong justification for being off work and overwhelmingly, the surgeon was viewed as the optimal person to provide this justification, as illustrated by Emma below:

"[The fit/sick note] was given to me straight away, so I didn't have to ask for it. It did. That lasted the whole period. That was one of the most helpful things. Having the six-week note from the surgeon, rather than having to go to my GP. It held more weight, coming from the surgeon."

Emma, optician (employed).

After the initial post-operative period, a number of interviewees who worked in manual roles reported that they would have found a return to work interview or assessment beneficial at the end of their period of prescribed sick-leave. These individuals did not feel quite ready to return to work at this point, but seemed to feel unable to extend their period of sick leave. The key reason for this appeared to be that they felt a need for an external individual to guide and reassure them that additional work absence and/or job modifications were justified. Interestingly, in these interviews, they did not look to their surgeon to provide this information, rather someone from within their workplace, as described by Alison below. It appeared that these individuals were looking for someone with knowledge of their particular work role and pressures to be able to appropriately direct their return to work process and to endorse their belief that more time off was required.

"I think, on reflection, had I had an interview before returning to work, or had I had some sort of occupational health check, I think that would have guided me. Had they said to me at that check then, "Well, [Alison], let's give it another week," I would have said, "Alright then." Because I was being told officially, if you like. I've always been a little bit like that. I'm not the sort of person that will go off sick... You sort of get on with it, but then you realise that perhaps you should have given yourself another couple of weeks, I think. So that was it. There was no return to work interview or anything, which possibly in my previous employment I may well have had."

Alison, carer (zero hours contract).

The patient role in the prescription of sick leave Recommended times to return to work or other functional activities, such as driving, were primarily viewed as prescribed time points, specified by the surgeon for the patient to follow. However, Vicky reported negotiating a shorter period of work absence when her fit note was being written. Interestingly, this was on the day of surgery, suggesting that Vicky may have decided when she would be able to return to work, in advance of any experience of her post-operative symptoms or functional ability.

"I mean, to be fair, he tried to sign me off for 4 weeks, and I said, "How about one?" He said, "Well, let's just say on light duties," and gave me a sick note, do you see what I mean?... I said to him- because he laughed and he went, "Well, that's what I would do," So I said to him, "We're both singing on the same hymn sheet, then." I know some people would have been more than happy to go, "Yes, great, I have a month off." But like

he said to me, if you like your job, what's the point? Do you see what I mean?"

Vicky, secretary (employed).

While the large majority of participants highlighted the importance of following their clinician's recommendations, one interviewee held an opposing view on the role of advice. For this individual, a 68-year-old self-employed gardener, advice from any 'expert' was not something to simply follow, but rather one consideration in a personal decision-making process.

"Well, you've just got to play it by ear really. When it was all strapped up it was a bit awkward. I was advised not to work, but of course I did. I mean sod that. [I don't care about that]. I mean it's rather like accountants or anything else, you take the advice on board that they give you and adapt it to your own use."

George, gardener (self-employed).

Theme 3: handling the return

Two commonly reported sub-themes occurred as participants discussed handling the return to work process. The first was the need for a graded increase in hand function, while the second centred on travelling to work.

Making a graded return to work duties After their initial period of sick leave, most participants described features of a graded return to work. The degree of modification varied: for some individuals, this meant taking longer to carry out their work activities, asking co-workers to assist with heavier tasks, or wearing a protective wrist splint. For other interviewees, there was a formalised structure involving the employer and/or occupational health clinicians. None of the participants saw return to work as part of their post-operative rehabilitation, rather the emphasis was on resuming work roles without causing pain or damage to the healing hand.

The outcome of a workplace risk assessment was discussed by one interviewee. Fiona was very happy with her return to work and the processes in place to guide this, however it was interesting that she described the situation in terms of a prescribed return to work programme, rather than an active dialogue between herself and her employer.

"I had to do a risk assessment with the health and safety officer, my supervisor there. I wasn't allowed to do any cleaning for at least 3 to 4 weeks, I think it was… Yes, because of the heaviness, because of the actual manual work involved, they didn't want me to go back to that. Even when I did the feeding, they said, "Oh, you can try feeding," because sometimes, you're still lifting heavy things. I wasn't allowed to lift panels. I could only lift feed buckets that I felt I was comfortable to".

Fiona, animal technical (employed).

The return to work experience described by other interviewees was more informal and self-directed, but still had elements of gradually resuming normal activities, as Peter, who worked as a mechanic, discusses below:

"I was planning just to go back and go on the computer and do the invoices and things, but that didn't work out, so I just did light stuff that I could do with my right hand. If there was anything that I needed to move or lift then someone else moved or lifted it for me."

Peter, mechanic (employed).

Some interviewees reported hand/wrist pain associated with return to work. They linked the pain to specific work tasks, such as using hand-held machinery, opening jars and pushing down on a stapler. For many this served as a reminder to use the hand less forcefully or to modify the activity. Other interviewees reported that a lack of dexterity and/or strength were their main problems on return to work. This meant that there were certain activities they felt physically unable to do when they first returned. Interviewees described breaking down their work role into activities that they could and couldn't do, as Debbie recalled:

"I mean, I was there in body and useful to do some things, but I couldn't do the full job for a start. I couldn't grip, to be quite honest. I couldn't do the things like taking out stitches and things like that at work. I couldn't grip the scissors properly."

Debbie, nurse (employed).

Regardless of the job role or duration of work absence, all participants recognised a need to modify their work activities to some extent when they first returned. Interestingly only one participant reported receiving advice about how to return to work from their surgical team. Charlotte reported being advised to "go back on light duties; answering the phone and typing" (Charlotte, postal worker). In contrast, the majority of interviewees were surprised by an absence of tailored return to work

advice from their surgeon. Interviewees recalled that the principal advice from their surgeons was how long to take off work. For some, this led them to feel that they had returned to work too soon. This was particularly the case for interviewees with manual roles (i.e those who potentially required greater work modifications) and those without a formal work-based return to work process (i.e those without other 'official' sources of targeted return to work advice). This experience is illustrated by Emma's quote below, which revealed that she had to initiate the discussion about work and found the guidance unclear.

> *"I didn't have any advice on what to do when I went back…. None of them talked about work, unless I asked. I said to my surgeon, "What should I be doing?" He said, "Just treat it as normal now. Just use your hand as normal, but take it slowly." I thought, "What does that mean?"*
>
> Emma, optician (employed).

Travelling to work The need to drive was a limiting factor for return to work for a large group of interviewees.

Many reported that a lack of public transport made it extremely difficult to get to work if they were not able to drive; however, Charlotte, who was reliant on public transport to travel to work, also found this difficult in the early post-operative stages.

> *"[It was] a little bit of a struggle when I get- I use the public transport, because- I mean you've got only one hand and then when you want to get on and get off, it's quite difficult."* Charlotte, postal worker (employed).

Two recommendations were commonly recalled relating to return to driving: first, that they had been advised to return after removal of sutures, and second, to return from 2 weeks after surgery. In practice, these are similar time points, as sutures are usually removed at 10–14 days. As with the return to work time points discussed above, most interviewees reporting strictly adhering to the advice they were given: *"Obviously I couldn't drive until I had the stitches out"* (Vicky, secretary). In comparison, several interviewees reported driving at earlier time points, as illustrated by Alan:

> *"I mean, he said to me, a week before I drive, and I drove home. But I had an automatic at the time, so it didn't bother me".*
>
> Alan, maintenance worker (self-employed).

A number of other interviewees also raised the different requirements for driving depending on the side of surgery or the type of car. One interviewee, who had CTR to both hands within the REACTS study period, highlighted the main perceived differences:

> *"But the left was worse than the right, because of course I've got a manual car, so the gear change was particularly- I wouldn't say difficult. I wouldn't say I would have gone on a long journey, I wouldn't like to have done an emergency stop. Yes, so gear changing was probably challenging, I think the word is (laughter). I had to use two hands to pull the handbrake on when I had the left done, but the right, because - you don't use your right, you only use it on the steering wheel."*
>
> Vicky, secretary (employed).

Discussion

Through the use of qualitative interviews, we have gained an understanding of patients' experiences of returning to work after CTR and provided insight into the factors shaping decision-making for return to work. Three key themes were identified: the perception that CTR is *not a 'minor' procedure*; the desire for both internal and external *validation of the time off work*; and reflections on *handling the return* to work. These findings highlight important topics for clinicians to discuss with their CTR patients and provide context for the development of specific return to work guidance. We did not identify any explicit barriers or facilitators for return to work; instead the picture appeared more complex. Interviewees appeared to be seeking specific information from the surgeon regarding when they should return to work and how to make a graded return (potential facilitators for return to work), yet when a period of work absence was documented on a fit note, no interviewees returned to work before that time point (a barrier to earlier or self-directed return). A similar scenario was observed for return to driving. These findings suggest that there is a need to be mindful of both the potential positives and negatives of any change in return to work strategy after CTR, and that there is an expectation for surgeons to be able to understand the work demands of many very different work roles. The majority of interviewees appeared to be looking for specific authorisation regarding timings and strategies for returning to their work duties with an expectation that their surgeon could provide definitive information. Wound healing after CTR has been described in studies comparing different suture materials. Macfarlane et al. found that 2 weeks after CTR, 66% of participants had achieved wound

healing with mild bruising (Southampton grade 1) and by 6 weeks 98% had achieved complete healing (Southampton grade 0) [13]. However wound healing in the intervening period was not captured and therefore these findings do not easily translate to appropriate timescales for resuming different functional activities after CTR. Our previous survey of UK hand surgeons and hand therapists identified that these clinicians recommended a wide range of return to work times for the same occupational duties and reported divergent views on whether it was safe for patients to return to work before suture removal [14].

We found that interviewees had largely underestimated the immediate functional impacts of CTR, but the reason for this mismatch between expectation and experience was not clear. Some participants reported that they felt that they had been given insufficient information about this aspect of their recovery, while others suggested that there was a general perception of CTR as a 'minor' procedure, which may have shaped expectations at a more sub-conscious level. In healthcare nomenclature, CTR often is termed a 'minor procedure' as demonstrated by the National Institute for Health and Clinical Excellence surgery grades [15]. This terminology is misleading because 'minor' can be interpreted in a range of ways and may be understood differently by patients and clinicians. The reported reduced ability to grip and/or weight-bear through the hand after CTR, coupled with the described recommendations to keep the wound dry until removal of sutures had an important impact for the majority of interviewees. The level of complexity of the procedure did not seem to equate to the level of impact felt by the patients and this contributed to a reported lack of preparedness in the immediate post-operative period. Previous qualitative interviews with CTS patients found that their CTS symptoms detrimentally affected their quality of life and their hope was for CTR surgery to resolve this [16]. If high expectations for the benefit of surgery are common among CTS patients, unexpected post-operative problems with function may be particularly distressing. This could potentially be improved by clinicians communicating the likely post-operative impacts of the surgery and by suggesting strategies to help manage ADLs in the immediate post-operative period. Access to relevant information, including suggestions for how to manage at home post-operatively, has been identified as essential for positive patient experiences following other elective surgeries [17].

The concept of information provision was also raised in the third theme (handling the return) with many interviewees highlighting that they needed more advice about how to return to their work, including information that they could share with their employers. It seemed that employed interviewees saw themselves as information conduits to deliver medical recommendations between their surgeon/GP and employer, a finding that has also been reported in a qualitative study of employees returning after workplace injury [18]. It is not clear whether this is the optimal model of care for CTR patients (or indeed any patients), and future work might explore whether using the additional comments section of the fit note could be a way of providing the targeted information that the interviewees appeared to be seeking [12].

The interviewees placed a strong emphasis on the need for formally authorised work absence *(validation of time off work)*. This might be expected given that formal authorisation is often required by employers and for statutory sick pay, but for many interviewees this validation was also to justify to themselves that there was a real need to take time off work. It was interesting that the current 'fit note' system for authorising work absence was never referred to as such, rather as its previous incarnation, the 'sick note', or as simply a 'certificate' or 'being signed off'. Furthermore, the fit note appeared to have been used in the manner of a sick note to indicate a period of 'prescribed' work absence, rather than to indicate work adjustments under which the patient may be fit for return. A similar finding was reported in a systematic review of fit note use in the UK, which found that only a small minority of patients treated in primary care received the recommendation that they 'may be fit' for work with structured advice and/or comments on the functional effects of their condition [19]. Our recent survey of hand surgeons and hand therapists found that those who treated approximately 1–2 CTR patients each week recommended earlier return to work times than those who saw this patient group less frequently [14]. This perhaps suggests that those with more experience in treating CTR patients believe that earlier return to work (i.e. before the patient is 100% fit) is not detrimental to recovery. In the current study, interviewees appeared deterred from returning to work before the period of time documented on their fit/sick note due to the assumption that this would be going against clinical advice. This suggests the potential power that appropriate evidence-based return to work advice could have if delivered and documented by the surgeon. Receiving authorised time off work appeared to be beneficial to the interviewees' experience, but for some adherence to this prescribed time period became a barrier to earlier return to work. The current NHS guidance for patients, available on the 'common health questions' NHS website is potentially ambiguous [20]. It states that "You should go back to work as soon as you feel able to and, with your employer's agreement. This may be before your fit note runs out." However, two paragraphs later it states "You should not go back to work before the end date on your

fit note if your doctor has advised that you should stay off work for the full period covered by the fit note". In practice, it may not be clear to the patient which of these statements best applies to them. It is conceivable that the fit note could be better used to provide clarity for patients after CTR and that clinicians could better empower their patients to manage their post-operative rehabilitation and return to work without a focus on rigid timelines.

All interviewees discussed a need to modify their work activities on initial return to work. This ranged from a formalised graded return programme to more informal situations, such as asking co-workers for help with certain tasks. Only one interviewee recalled receiving information from their surgeon with suggestions for how to modify their work. In addition to the recommended timescale for returning to work, interviewees reflected that practical suggestions for how to build up activities would have been helpful and this may have reduced uncertainty regarding resuming work activities. This raises the question of whether surgeons can really be expected to understand the intimacies of the multitude of job roles. We propose that a coordinated approach is required, with the surgeon focusing on the clinical recovery from the surgery, aligned with the patient or employer's understanding of their work duties and available modifications. The current study found that patients appeared to value most highly the recommendations that they received from their surgeon. Therefore, in the absence of explicit evidence regarding when it is safe to return to different functional activities after CTR, it would be useful to explore a consensus among hand surgeons. This would enable the provision of consistent and appropriate advice for CTR patients regarding return to general work-related and functional activities.

Limitations

This interview study was designed, conducted and reported in accordance with the COREQ checklist [21]. However there are still a number of limitations. Firstly, individuals were only invited to participate in an interview after completing the associated REACTS cohort study and may therefore have differed from those who declined to participate or were lost to follow-up. Furthermore, the surgeons involved in the REACTS study may have given greater consideration to providing work-related advice than the wider hand surgery population, given the nature of the research. However, this recruitment approach was necessary to allow for a purposive sampling strategy.

The second limitation is that the proportion of male interviewees was lower than the proportion invited, and lower than across the cohort as a whole. This had the potential to over-represent the experiences of women. To address this, any marked differences in gender were explored in the early stages of the analyses and sex-effects were not apparent. Interviewees had been treated in a range of different healthcare settings (primary care, secondary care and private healthcare) and had encountered different CTR patient pathways; the research team are confident that the interviewees illustrated a broad range of experiences and that interviewing was continued until data saturation was met.

Thirdly, the interviewer was a practising physiotherapist, specialised in hand therapy. While none of the participants were known to the interviewer in a clinical capacity, it is possible that knowledge of the interviewer's background may have influenced the interviewees' responses. The potential impact of this was discussed during data analysis. In addition, steps were taken to ensure that the analysis was not conducted solely by clinicians working with CTR patients. This included the involvement of patient advisors and an experienced qualitative researcher without clinical or academic experience of CTS, CTR, hand therapy or hand surgery (CB).

Conclusions

The key themes identified from this interview study suggest that there is a desire for more information explaining *how* to return to work and function after CTR. Patient experiences may be improved by clinicians (most notably the surgeon) communicating the likely short-term functional impacts of the CTR procedure and strategies to assist with this; initiating a dialogue with patients to discuss their work, with examples of how the individual might grade their return (this may be documented on a fit note); and by providing sufficient information to empower patients to be confident in their own decision-making regarding return to work and function. Future research should focus on establishing evidence-based guidance to inform return to different types of work after CTR and on understanding how best to engage clinicians, patients and employers with this guidance. The impact of any guidance on patient experience and return to work outcomes should also be evaluated.

Additional file

Additional file 1: Qualitative Interview Topic Guide. (PDF 243 kb)

Abbreviations

CTR: Carpal tunnel release; CTS: Carpal tunnel syndrome; NHS: National Health Service; NIHR: National Institute for Healthcare Research; REACTS: Return to employment after carpal tunnel release surgery

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Availability of data and materials
The datasets generated and analysed during the current study are not publicly available at present. They are being used by the research team to answer additional research questions. The datasets are available from the corresponding author on reasonable request.

Authors' contributions
LN, KWB, DW and JA conceived the study. LN conducted the interviews and performed the data analysis with assistance and guidance from CB, JA and KWB. LN prepared the draft manuscript and all authors reviewed, contributed to, and approved the final manuscript.

Ethics approval and consent to participate
Ethics approval was granted by the NHS Health Research Authority (IRAS 209840: 16/WA/0390) and University of Southampton (ERGO 25757) Ethics Committees. All study interviewees provided written informed consent to participate.

Consent for publication
All interviewees provided written informed consent for anonymous quotes to be used in study reports and publications. The authors have ensured that the contributors are not identifiable from the include quotes by: (a) using broad job descriptors rather than actual job titles, (b) providing age in bands, and (c) by excluding information about the geographical location or recruitment site for each individual.

Competing interests
The authors declare that they have no competing interests.

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Appendix S COREQ checklist

Item	Guide questions	Response	Section
Domain 1: Research team and reflexivity			
Personal characteristics			
Interviewer	Which author conducted the interviews?	Thesis author (lead researcher)	Section 6.2.1.2
Credentials	What were the researcher's credentials?	PhD student	Appendix T
Occupation	What was their occupation at the time of the study?	Physiotherapist / PhD student	Appendix T
Gender	Was the researcher male or female?	Female	Appendix T
Experience and training	What experience or training did the researcher have?	Previous experience of conducting and analysing qualitative interview data. Specific training and support reported	Appendix T, Section 6.5.5
Relationship with participants			
Relationship established	Was a relationship established prior to study commencement?	Interviewees were participants on the established cohort study, but were not known to the interviewer	Appendix T, Section 6.3.1.2
Participant knowledge of the interview	What did participants know about the research?	From participation in the cohort study, interviewees had knowledge of the study theme	Section 6.3.1.2
Interviewer characteristics	What characteristics were reported about the interviewer?	Background characteristics and assumption are discussed	Appendix T
Domain 2: Study design			
Theoretical framework			
Methodological orientation and theory	What methodological orientation was stated to underpin the study?	Mixed method approach	Section 6.2
Participant selection			
Sampling	How were participants selected?	Purposive sampling strategy and criteria are reported	Section 6.3.1.2
Method of approach	How were participants approached?	By invitation letter after completion of the main cohort study	Section 6.3.1.2
Sample size	How many participants were in the study?	14	Section 6.4.1
Non-participation	How many people refused to participant or dropped out? Reasons?	15 did not respond to the invitation letter and one did not respond to the request to arrange the interview data	Section 6.4.1
Setting			
Setting of data collection	Where was the data collected?	Primarily by telephone interview with one face to face interview	Section 6.4.1
Presence of non-participants	Was anyone else present beside participants and researchers?	No additional people were present for the telephone interview. It was not possible to assess whether others were present with the interviewee during the telephone interviews	Section 6.3.1.2
Description of sample	What are the important characteristics of the sample	Demographic and key occupational characteristics are reported	Table 6.3, Table 6.4
Data collection			
Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	A pre-piloted interview schedule, including questions and prompts, was used throughout	Section 6.3.1.1, Appendix U

Item	Guide questions	Response	Section
Repeat interviews	Were repeat interviews carried out? If so, how many?	No repeat interviews were performed	Section 6.3.1
Audio / visual recording	How did the researchers record the data?	Interviews were audio recorded	Section 6.3.1.2
Field notes	Were field notes made during and/or after the interview?	Notes were made during and after the interviews and were recorded in the interview log	Appendix W, Section 6.3.1.3.1
Duration	What was the duration of the interviews?	Interview durations are reported	Section 6.4.1
Data saturation	Was data saturation discussed?	Data saturation was defined in advance and used to guide the number of interviews	Section 6.3.1.2
Transcripts returned	Were transcripts returned to participants for comment/correction?	Transcripts were reviewed by the lead researcher and compared with the audio file, but were not returned to participants. This is acknowledged	Section 6.5.5
Domain 3: Analysis and findings			
Data analysis			
Number of data coders	How many data coders coded the data?	Two researchers coded the initial two transcripts to develop the coding frame. Subsequent transcripts were coded by the lead researcher and reviewed by the research team	Section 6.3.1.3.2
Data coding tree	Did authors provide a description of the data coding tree?	The process of forming the tree is discussed and the structure is shown in an exemplar framework matrix	Figure 6.2
Derivation of themes	Were themes identified in advance or derived from the data?	Themes were derived from the data	Section 6.3.1.3
Software	What software was used to manage the data?	Nvivo	Section 6.3.1.3.4
Participant checking	Did participants provide feedback on the findings?	Feedback was provided by the patient advisory group	Section 2.2, Section 6.5.5
Reporting			
Quotations presented	Were participant quotations presented to illustrated themes? Was each quotation identified?	Quotations were provided for all themes and were identified by the interviewee's pseudonym	Section 6.4.2
Data and findings consistent	Was there consistency between the data presented and the findings?	The themes were reflective of the quotations. The conclusions were reflective of the data	Section 6.4.2 Section 6.5
Clarity of major themes	Were major themes clearly presented in the findings?	A hierarchy of themes and sub-themes were presented	Figure 6.4, Section 6.4.2
Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	Diverse cases and minor themes were presented	Section 6.4.2, Section 6.5.4

From: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care* 2007; 19(6): 349-57.

Appendix T Reflections on the lead researcher's role in data generation and analysis

As part of a reflexive approach to the qualitative element of this thesis, the following section includes a summary of the lead researcher's background (in my own words) and the steps taken to highlight any preconceptions that might have influenced the data and/or the analyses. These reflections are not unique to the qualitative component of this thesis, and apply to all aspects of the research.

I am a female physiotherapist with more than 10 years of experience in the field of hand therapy. I have continued to work clinically in the NHS throughout my time engaged on this thesis. I believe that maintaining a clinical role was important to enable me to focus on all aspects of patient care in light of the ever-changing pressures and influences within the health service. My physiotherapy training focused on both evidence-based and patient-centred healthcare and I attempt to incorporate these elements in to my clinical practice. However, I have found there to be a lack of robust evidence to support many hand therapy interventions and I have found this a challenge.

I had experience of qualitative research before embarking on this programme of work [307, 308] and had completed broad academic and practical qualitative research training. However, I was not an established qualitative researcher and a secondary aim of this interview study was to enable me to further develop these skills.

As a hand therapist, I am aware that I am personally responsible for giving return to work recommendations to patients and employers, including following CTR. I therefore made a conscious effort not to let my views of this influence the direction of my interview questions, or my interpretation of the resulting data. This was eased by the lack of existing evidence-based guidance on this topic. I understood that any timescales or return to work advice that I gave my patients was anecdotal, rather than evidence-based, and I was aware that my opinions might not promote the optimum patient outcome. For this reason, I positively explored areas of difference with my own practice. I was not looking to seek confirmation of my current practice, rather to explore the range of practices and the patient experiences that were associated with them. I attempted to approach each

interview with a deliberate naiveté. However, outside my research, I do believe I have changed my clinical practice as a result of this whole programme of research, with questions about my patients' work taking a much more prominent role in my history taking and directing my treatment strategies.

None of the REACTS participants were known to me and I did not work in any of the interviewees' healthcare settings. My clinical role was listed on the study documentation, but was not overtly advertised as part of the qualitative study. I was concerned that if the participants viewed me as a physiotherapist, i.e. someone inside the UK healthcare system, this could influence how they discussed their care and experiences, particularly relating to physiotherapy. However, as very few study participants saw a physiotherapist as part of their CTR pathway (Section 5.3.5), this may have given me a more neutral role compared to a hand surgeon or GP. When speaking to participants before their interview, I introduced myself as 'Lisa from the REACTS study'. This was not a deliberate attempt to avoid drawing attention to my clinical role or PhD student status, rather a short introduction that outlined my role and reason for calling without being unnecessarily formal.

Before carrying out this qualitative study, I was familiar with much of the published literature surrounding CTR and return to work, having completed the earlier chapters in this thesis. This influenced the development of the topic guide to specifically target gaps and uncertainties in the literature, however the data coding and analysis was not restricted to pre-identified concepts.

Appendix U Qualitative interview schedule

University Hospital Southampton NHS
NHS Foundation Trust

REACTS

Arthritis Research UK | MRC Versus Arthritis | centre for musculoskeletal health & work

UNIVERSITY OF Southampton

Qualitative Interview Topic Guide

Check agree to audio recording
Assure confidentiality

Introduction
The aim of this stage of the REACTS study is for me to talk to individuals who had carpal tunnel release surgery. I want to talk to you about your experience of the surgery and of returning to work afterwards. There are no right or wrong views. I am interested in hearing about your experience.

1. Can I start by asking: how does your work involve you using your arms and hands day-to-day?
   - *Prompt time schedule and breaks*
   - *Prompt repetitive activities – duration*
   - *Prompt heavy loads – frequency and duration*
   - *Prompt computer use - duration*
   - *Prompt any change in role as result of CTS/CTR*

2. Please tell me a bit about your hands and wrists felt before you had surgery?
   - *Prompt impact on work*
   - *Prompt impact on function and social activities*
   - *Prompt bilateral/unilateral*

3. How do your hands feel now?

4. How did you decide to have the carpal tunnel release surgery?
   - *Prompt clinic experience*
   - *Prompt referral process – any option to choose when to have the surgery*
   - *Prompt pre-operative information about expected outcomes*
   - *Prompt any discussion about work*
   - *Prompt trial of splints/injections – how did they work for you?*

5. What sort of information were you given about your surgery and going back to work afterwards?
   - *Prompt pre-operative information and from whom*
   - *Prompt sick note/fit note – from whom, and any extension to the initial note*
   - *Prompt other sources of information (internet, friends and family)*
   - *Prompt satisfaction with information/advice provided*
   - *Prompt any conflicting information*
   - *Prompt awareness of potential for complications eg infection, prolonged scar pain, weakness that could affect return to work*
   - *Prompt any other information that would have been useful*
   - *Prompt comments on the format of the information*

6. What medical treatment did you receive after your surgery?
   - *Prompt removal of sutures*
   - *Prompt physio/OT/splint*

- *Prompt any contact with GP or occupational health*
- *Prompt treatment for complications*

7. How did you decide when to return to work?
   - *Prompt clinical signs/advice given*
   - *Prompt – how confident in using hand*
   - *Prompt amended duties*
   - *Prompt altered hours*
   - *Prompt occupational health*
   - *Prompt RTW criteria specified by employer*
   - *Prompt any contact with workplace whilst off work*
   - *Prompt driving/transport*
   - *Prompt financial*
   - *Prompt co-workers*

8. Tell me about your return to work – and how it went?
   - *Prompt anything that was particularly helpful for you when returning to work?*
   - *Prompt anything about your job or workplace that made it harder for you to return to work?*
   - *Prompt hand dominance*
   - *Prompt boss/co-workers*
   - *Prompt job satisfaction*

9. Do you think you were 100% fit to do your job when you returned to work?
   - *Prompt what percentage 'fit' do you think you were?*
   - *Prompt components of your job could you do despite not being 100% fit?*
   - *Prompt anything you couldn't do?*
   - *Prompt thoughts about return for different jobs*
   - *Prompt what where your employer's views – amended duties*

10. While off work how did you manage with your home or family commitments?
    - *Prompt washing, showering, personal care*
    - *Prompt cooking, shopping*
    - *Prompt assistance from others*
    - *Prompt not doing all usual activities*

11. Now, with the benefit of your experience, what advice would you give about returning to work to a friend who needed a carpal tunnel release?

12. Is there that you would like to add about returning to work after your surgery that we haven't discussed?

Thank you
Assure confidentiality

Appendix V Interview study participant documents

V.1 Invitation letter

University Hospital Southampton NHS
NHS Foundation Trust

REACTS

Arthritis Research UK MRC centre for musculoskeletal health & work

UNIVERSITY OF Southampton

REACTS ID						

REACTS: Return to employment after carpal tunnel release surgery

(IRAS reference: 209840)

Thank you!

Dear

Thank you for completing your final REACTS study questionnaire. We really appreciate your contribution to our research.

When you initially decided to participate in our study, you informed the research team that you were willing to be contacted about the next stage of our research. This next stage involves a one-off interview to discuss your experiences of carpal tunnel release surgery and the return to work process.

Before deciding whether you would like to take part, please read the enclosed Participant Information Sheet, which has more detail about the study and what taking part will involve. If you have any questions, or would like more information, please contact the research team using the contact details below. The study has been approved by the NHS Research Ethics Committee (IRAS reference 209840).

You do not have to take part in this stage of the study and your care and treatment will not change whether you do or do not participate.

If you do decide to take part, please contact the research team, either by email or by returning the enclosed expression of interest sheet. Please do not hesitate to contact me if you have any questions about either part of the REACTS study. If you requested to be notified of the study findings, I will contact you again once we have all the results.

Very many thanks again for your involvement in our study and very best wishes,

Lisa Newington
NIHR Doctoral Research Fellow
Arthritis Research UK – MRC Centre for Musculoskeletal Health and Work
MRC Lifecourse Epidemiology Unit, University of Southampton
Southampton General Hospital, SO16 6YD

email: ln@mrc.soton.ac.uk | phone: 023 8077 7624 |mobile: 07866 997732

Research supervisors: Professor Karen Walker-Bone | Professor Jo Adams | Professor David Warwick

V.2 Participant information sheet

Participant Information Sheet

REACTS: Return to employment after carpal tunnel release surgery (interview study)

(IRAS reference: 209840)

Thank you for taking part in our questionnaire-based study looking at return to work after carpal tunnel release surgery. Your contribution is very much appreciated.

We are now looking for people to speak to on a one-to-one basis to find out more about your experience of returning to work.

Please read this information carefully before deciding whether to take part in this research. If you are happy to participate, you will be asked to sign a consent form.

What is the research about?

We would like to invite you to take part in a one-off interview to discuss your experience of returning to work after your surgery. The discussion will include the following themes:

- Factors that contributed to your decision of when to return to work
- Any issues you encountered when you returned to your work
- What you might recommend to other individuals in a similar situation

Why have you been chosen?

You have been invited to take part in this one-off interview because you took part in the REACTS questionnaire-based study.

We are looking for 15-30 patients who returned to work at different time points and would be very grateful if you feel willing and able to take part.

What will participation involve?

You will be invited to take part in a one-off discussion with the lead researcher, Lisa Newington. This can take place either in person at Southampton General Hospital or at your home; or over the telephone. The interview is likely to take between 30-45 minutes. Transport costs will be reimbursed for participants traveling to Southampton General Hospital. The discussion will be audio recorded and the researcher may also take some written notes. Afterwards, an anonymised transcript will be made of the audio recording and analysed together with those of the other study participants. The key themes and ideas across all participants will be identified.

Participating in this research will not affect your medical care.

Who can take part?

Any individual who took part in the REACTS questionnaire-based study.

Participation is voluntary, and you are under no obligation to take part. You are free to withdraw from the study at any point between agreeing to take part and two-weeks after the interview has taken place. After

this time, your comments will be combined with the comments from other individuals in order to analyse the overall results, and it will not be possible to remove your contribution from the study.

What are the benefits of taking part?

There are no specific benefits to you from taking part in this research, although the information you provide will help us to improve care for patients undergoing carpal tunnel release surgery in the future. By way of a thank you, we are able to provide a £10 High Street Voucher for individuals who take part in this study.

Are there any risks involved?

There are no expected risks associated with taking part in this research.

Will my participation be confidential?

In accordance with the UK Data Protection Act (1998), all information provided by study participants will be confidential and used only for research purposes. An external company will be used to transcribe the audio recordings; they will not have access to any identifiable information and will have signed a confidentiality and non-disclosure agreement. Once each audio recording is transcribed the audio file will be deleted.

Anonymous quotes from your interview may be used in the final report, but all identifying information will be removed. It will not be possible to identify any individual study participant in any of the outputs from this research.

How can I find out about the study results?

As part of your consent form, you will be invited to opt in, or out, of receiving a notification of the study findings by post/email. This research forms part of the lead researcher's PhD thesis.

Who has approved and funded this study?

This study has been approved by the NHS Research Ethics Committee (Wales Research Ethics Committee 6, Proportionate Review Sub Committee) and is funded by the National Institute for Health Research (DRF-2015-08-056). The research supervisors are Professor Karen Walker-Bone, Professor Jo Adams and Professor David Warwick.

Where can I get more information?

If you have any questions about this study, or would like any additional information, please contact the lead researcher: Lisa Newington | ln@mrc.soton.ac.uk | 023 8077 7624 | 07866 997732, or Professor Karen Walker-Bone | kwb@mrc.soton.ac.uk | 023 8077 7624.

In the unlikely event of a concern or complaint, please contact the University Hospital Southampton Research Governance Team: R&Doffice@uhs.nhs.uk | 023 8120 8215.

V.3 Consent form

CONSENT FORM (IRAS reference 209840)
You should complete this form after you have read the Participant Information Sheet.

REACTS: Return to employment after carpal tunnel release surgery (interview study)

Thank you for considering taking part in this research. If you have any questions arising from the Participant Information Sheet, please ask the research team before you decide whether to take part.

Please initial the boxes if you agree with each statement

1. I have read the Participant Information Sheet (version 2.0; 06.12.16) and have had the opportunity to ask questions about the study. ☐
2. I agree to take part in this research and agree for my data to being used for the purposes explained the in Participant Information Sheet (version 2.0; 06.12.16). I understand that this information will be handled in accordance with the terms of the UK Data Protection Act 1998. ☐
3. I agree to my interview being audio recorded. ☐
4. I understand that quotes from my interview may be included in the study reports and publications, but it will not be possible to identify me from this text. ☐
5. I understand that if I decide at any time during the research that I no longer wish to take part, I can notify the researchers and withdraw from the study immediately, without giving a reason. I understand that for two weeks from the date of the interview, I can ask for any contribution I have already made to be removed from the study. ☐

ADDITIONAL QUESTION
I would like to be notified of the findings from this research Yes / No

Signature _____ Date _____ / _____ / _____

Name _____

Researcher signature _____ Date ____ / ____ / ____

Researcher name _____

Research supervisors: Professor Karen Walker-Bone | Professor Jo Adams | Professor David Warwick

Interview consent form Version 2.0 06.12.16

Appendix W Extract from the interview reflective log

11. REACTS – 11-067

Location: Phone
03.01.18
16:00-16:25

Issues with the pathway and being referred to physio for pre-op treatment to exclude neck – 'understands' that there needs to be a pathway with the NHS, but did not think that she was eligible for CTR, so used her private insurance

High praise for surgeon. Interesting comparison between the different sites for right and left surgery.

RTW time driven by the patient – surgeon initially suggested 4/52 off work, pt reports negotiating 1/52 – both pro and retrospectively feels that this was an appropriate amount of time

Had bilateral surgery – how will this be dealt with in the cohort study?

Commented on the difference with driving for the right and left hand // should the driving recommendations be different depending on the side of surgery, automatic v manual car?

Support from colleagues with heavier tasks.

Return to work self-directed – discussed with boss, but did not seem to have a formal process. Mentioned that HR were informed, but did not discuss OH

Mentions being advised not to drive until sutures removed – but the surgeon

Individualised – no specific recommendations for others. Different work-related and personal factors // Is generalised advice helpful, or should it all be targeted to the individual's needs?

12. REACTS – 03-015

Location: Phone
05.01.18
20:00-20:40

Blames self for not moving hand earlier – as wasn't told – feels that there should have been more information given. // Fits in with the idea of expectations as important for patient outcome

Issues with pain, movement and scar – how much is related to heavier job and how much due to reluctance to move/concerns?
Are there any additional needs because of English as a second language?

What to expect, what to do, how to optimise recovery?
Information is really important

Has friends/colleagues who'd previously had CTR, but didn't ask for their advice. Is there a difference between outcomes for those with a more passive role in their post-op rehab and those who take a pro-active approach to finding information?

Can information provision help those with a more passive approach?

Appendix X Assessment of quality in the design and content of the qualitative study

Markers of the validity of qualitative research	Assessment of the validity of the current study
Triangulation: study includes comparison of the results from two or more different data collection methods	This thesis adopts a mixed-methods approach to triangulate the findings from quantitative and qualitative components.
Respondent validation: researcher's account is compared with the accounts of research participants to establish level of similarity	Respondent validation was not sought, instead the patient advisory group was involved in reviewing the qualitative analyses and provided feedback from their perspective as CTR patients.
Transparent data collection and analysis: research process clearly described, including presentation of sufficient data for reader to judge whether the interpretation is appropriate	The research process is described in detail, including the steps taken in the analysis. Long quotes are presented to illustrate the context of the analytical interpretation.
Reflexivity: sensitivity to the way the researcher and research process have shaped the data collected	The lead researcher's background is discussed, including inherent bias as a practising physiotherapist. None of the research participants were known to the interviewee, providing distance from their clinical care. External research support was provided by an experienced non-clinical researcher, in addition to feedback from the patient advisory group.
Attention to negative cases: seeks elements of the data that seem to contradict the emerging findings	Experiences reported by a minority of individuals were discussed and incorporated into the development of themes. Opposing views were reported.
Fair dealing: explicitly incorporates a wide range of different perspectives	A purposive sampling strategy was designed to promote the inclusion of individuals with different occupational, clinical and demographic characteristics.
Markers of the relevance of qualitative research	**Assessment of the relevance of the current study**
Transferability to other settings: sample included a full range of possible cases to allow conceptual generalisation	Interviewees were recruited from a range of sites to maximise the potential transferability of the findings. This included different types of clinical setting in addition to geographical location.

From: Mays N, Pope C. Assessing quality in qualitative research. *British Medical Journal* 2000; 320(7226): 50-52.

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