

TITLE

Reducing ambulance conveyance for older people with and without dementia: evidence of the role of social care from a regional, year-long service evaluation using retrospective routine data.

AUTHOR INFORMATION

Chloe Lofthouse-Jones¹, Phil King¹, Helen Pocock^{1,2}, Mary Ramsay³, Patryk Jadzinski^{1,4}, Ed England¹, Sarah Taylor¹, Julian Cavalier⁵, Carole Fogg^{1,6}

¹ South Central Ambulance Service NHS Foundation Trust

² University of Warwick

³ Public contributor

⁴ School of Health Sciences and Social Work, University of Portsmouth

⁵ Southern Health NHS Trust

⁶ School of Health Sciences, University of Southampton

Corresponding author: Chloe Lofthouse-Jones, South Central Ambulance Service NHS Foundation Trust,

Education and Recruitment Centre, Bone Lane, Newbury, RG14 5UE.

Chloe.Lofthouse-Jones@scas.nhs.uk (07557) 172216 ORCID: 0000-0001-8118-3934

Philip King, South Central Ambulance Service NHS Foundation Trust, Southern House, Sparrowgrove, Otterbourne, Winchester, Hampshire, SO21 2RU

Philip.King@scas.nhs.uk ORCID: 0000-0001-7736-7183

Helen Pocock, Bracknell Ambulance Station, Old Bracknell

Lane West, Bracknell, RG12 7AE. Helen.pocock@scas.nhs.uk ORCID: 0000-0001-7648-5313.

Mary Ramsay, 23 The Saltings, Farlington Portsmouth. PO6 1LG maryramsay23@icloud.com

Patryk Jadzinski, School of Health Sciences and Social Work, James Watson West, King Richard I Road, Portsmouth. PO1 2FR. Patryk.Jadzinski@port.ac.uk ORCID: 0000-0002-6752-0807

Ed England, South Central Ambulance Service NHS Foundation Trust, North Wing Southern House, Sparrowgrove, Winchester SO21 2RU Ed.England@scas.nhs.uk ORCID: 0000-0002-8009-2843

Sarah Taylor, South Central Ambulance Service NHS Foundation Trust, Southern House, Sparrowgrove, Otterbourne, Winchester, Hampshire, SO21 2RU sarah.taylor@scas.nhs.uk ORCID: 0000-0002-2488-7158.

Julian Cavalier, Southern Health NHS Foundation Trust, Tatchbury Mount, Calmore, Southampton, Hampshire, SO40 2RZ. Julian.cavalier2@southernhealth.nhs.uk

Carole Fogg, School of Health Sciences, University of Southampton, University Road,
Southampton. SO17 1BJ. c.l.fogg@soton.ac.uk ORCID: 0000-0002-3000-6185

WORD COUNT: 2928

KEYWORDS: emergency medical services, dementia, social care

ABSTRACT

Introduction

Older people, especially those with dementia, have a high risk of deterioration following admission to hospital. More than 60% of older people attended by South Central Ambulance Service (SCAS) clinicians are conveyed to hospital, although many conveyances may not have been life-threatening. We aimed to understand patterns of conveyance and alternative referral pathways used following ambulance attendance to an older person.

Methods

Service evaluation, using routinely collected, anonymised electronic records. Participants: electronic records of people aged ≥ 75 years for whom an ambulance was dispatched between April 2016 and March 2017 within the geographical boundaries of SCAS NHS Foundation Trust, who were alive on arrival of the ambulance. Conveyance rates are described according to patient and emergency-call characteristics. Logistic regression was used to produce adjusted odds ratios for conveyance. Alternative referral pathways used are described.

Results

Of 110,781 patients attended, 64% were conveyed to hospital. Factors associated with reduced odds of conveyance included out-of-hours calls (adjusted Odds Ratio (aOR) 0.82 [0.79-0.85]), living alone with a care package or with family plus care package (aOR 0.66 [0.62-0.69]; aOR 0.58 [0.54-0.62] respectively), and a record of dementia (0.91 [0.87-0.96]). Living in a nursing home was associated with an increased risk of conveyance (aOR 1.25 [1.15-1.36]). Patients with dementia with more income were significantly less likely to be conveyed than those with greater income deprivation. Alternative referral services were used in 22% of non-conveyed patients, most commonly GP, out-of-hours and falls services.

Discussion

People aged ≥ 75 have high rates of conveyance, which are influenced by factors such as out-of-hours calls, dementia and receipt of social care. Low use of alternative referral services may reflect limited availability or difficulty in access. A better understanding of how these factors influence ambulance clinician decision-making is integral to improvement of outcomes for older people.

INTRODUCTION

The number of older people requiring acute, secondary care services in the UK continues to rise, with an 11.3% increase in emergency department attendances and a 4.8% increase in hospital admissions between 2015 and 2017. (Care Quality Commission) Dementia is prevalent amongst older people, affecting 1 in 6 people over the age of 80, and it is estimated that over 1 million people will be living with dementia in the UK by 2025. (Alzheimer's Society) Emergency ambulance attendances for older people, particularly those with dementia, are common and often require provision of care not related to injury or urgent clinical need. (Buswell et al., 2016; Pocock H et al., 2018) Once the ambulance crew have addressed the patient's immediate medical needs, a decision must be made as to whether the patient will be conveyed to hospital for further care and assessment. However, older people frequently have long hospital stays which reduce independence, and their complex medical and social care needs may result in delayed transfers of care and new care home admissions. (Bradshaw et al., 2013; NHS Benchmarking Network; Timmons et al., 2015) Older patients with cognitive impairments or dementia have an even higher risk of deterioration in a hospital environment, and have higher mortality in hospital or shortly after discharge and more frequent readmissions. (C Fogg, Griffiths, Meredith, & Bridges, 2018; C. Fogg et al., 2019)

Between 2011/12 and 2016/17, the observed 70% increase in potentially avoidable emergency department attendances for people with dementia has corresponded to cuts in social care funding. (Hutchings, Carter, & Bennett, 2018) These instances of avoidable admissions may be better managed in a care setting appropriate to patient need, such as systems to support people to maintain their health and wellbeing at home. (Care Quality Commission; Steventon, 2018) It is also suggested that patients with dementia requiring assistance with certain activities of daily living and those with a history of falls have more frequent ambulance attendances and are more likely to be hospitalised. (Toot, Devine, Akporobaro, & Orrell, 2013; Voss et al., 2018) Actions to address this may include Computerised Clinical Decision Support, a series of menu-based decisions for call handlers, which has been shown to double patient referrals to falls services rather than convey to hospital, whilst maintaining patient safety outcomes. (Snooks et al., 2014)

A recent audit highlighted that around 60% of older people with dementia attended by the South Central Ambulance Service (SCAS) are conveyed to hospital. (Pocock H et al., 2018) Emergency ambulance clinicians' conveyance decisions regarding this patient group may be influenced by the alternative care provision available, which may vary according to times of the day or week. (O'Hara et al., 2015) We aimed to describe current care pathways for older people following emergency ambulance attendance and explore the association of patient and call characteristics with hospital conveyance to see if it was possible to identify ways to potentially decrease inappropriate emergency department admissions. We performed a service evaluation to explore associations between conveyance decisions made by ambulance staff for older people and factors such as out-of-hours periods, triage grade, social care provision and presence of dementia, and to describe the alternative referral pathways used during this period.

METHODS

Objectives

(1) To describe conveyance rates for older people with an emergency ambulance attendance. (2) To explore whether conveyance rates differed according to the characteristics of the call or the patient demographic, socioeconomic and clinical characteristics. (3) To describe alternative referral pathways used.

Design

Service evaluation using routinely collected, anonymised retrospective electronic records.

Setting

Patients with emergency ambulance attendances within the geographical boundaries of SCAS NHS Foundation Trust, including Hampshire, Berkshire, Buckinghamshire and Oxfordshire, serving more than 4 million people.

Population

Records from the following attendances were included: (i) patient aged ≥ 75 years; (ii) an electronic record with date and time of attendance available between 01/04/2016 and 31/03/2017; (iii) attendance by emergency ambulance clinicians, including registered paramedics, nurses or doctors, ambulance technicians and associate ambulance practitioners; (iv) within a Clinical Commissioning Group (CCG) area with $\geq 70\%$ electronic records available (i.e. reflecting areas staffed mainly by SCAS crews rather than private providers). Records for patients who were known to be deceased at the time of ambulance arrival on scene and visits from Patient Transport Services were excluded.

Data Sources and Extraction of Dataset

Electronic patient records (EPR) are created at the scene by emergency ambulance staff using the MobiMed Smart electronic tablet (Ortivus, Sweden). The EPR system is used to collect patient clinical and social history, incident details, and clinical information. Data is entered into the EPR via a touchscreen on a tablet at the scene, through menus and interactive, self-expanding boxes as well as sections of free text for additional detail about the examination where necessary. Data is transferred to a warehouse and downloaded daily to the SCAS Business Intelligence Team. Microsoft SQL Server Management Studio was used to extract data from the SCAS data warehouse. Records with the term 'dementia' entered in the EPR were identified using queries of free-text fields, as described previously. (Pocock H et al., 2018) Additional contextual data from several data sources, such the Clinical Commissioning Group (CCG) area, were accessed via Qlikview. The EPR dataset was anonymised, uploaded into a standalone application and matched with incident numbers using Computer Aided Dispatch (CAD) information to link to the triage grade.

Data analysis

Descriptive statistics were calculated for the total number of emergency attendances and the proportion of conveyances, and summarised according to: (1) a record of dementia; (2) year quarter (based on 3 monthly aggregations); (3) time period, i.e. (i) within GP opening

hours, defined as 08:00 to 18:00 Monday to Friday (ii) weekday 'out of hours' (18:00 to 08:00 Monday to Thursday, including 08:00 Friday morning), (iii) weekends (18:00 Friday evening to 08:00 Monday morning); (4) triage grade categorised as: 'Urgent' – healthcare professional pre-booked admissions where patient triage has already occurred; 'Red' – patient's condition considered to be life threatening; 'Green' – patient's condition considered not to be life threatening; (National Audit Office, 2017) (5) care arrangements, categorised as: (i) living alone, (ii) living alone with a care package, (iii) with family/carer for dependent, (iii) with family/carer for dependent and care package, (iv) residential care, (v) nursing care (if two or more categories were ticked, the record was categorised as the one with the highest care needs); (6) measures of deprivation: (i) Index of Multiple Deprivation (IMD) rank, and (ii) Income Deprivation Affecting Older People Index (IDAOPI) rank, matched through the Lower Super Output Area (LSOA) on the patient's home postcode, but if missing (n=5,431), matched to an 'on-scene' postcode where available, and categorised by quintiles. Univariable logistic regression was used to identify which factors were associated with conveyance. Categories for out-of-hours weekdays and weekends were combined due to similar results. A forward step-wise multivariable regression model was used to identify factors most relevant for consideration in adaptation of future care. Variables were retained in the model if both the Akaike and Bayesian Information Criterion (AIC/BIC) decreased following their introduction. As people with dementia have specific guidelines regarding conveyance which may influence conveyancing patterns, (National Institute of Clinical Excellence, June 2018) multivariable analyses were also stratified by presence of the term 'dementia' in the EPR. Analyses were performed using Stata version 15.1 (College Station, Texas).

Patient and Public Involvement

This need for this work was identified by the SCAS Patient Forum, who were concerned that sometimes their family, friends or neighbours were taken to hospital due to lack of alternative care, and that once in hospital, took a long time to return home. A Patient Public Involvement group based in a large acute hospital in the region highlighted difficulties in knowing how to access appropriate care for increasing care needs and wanted to know how the current organisation of care impacts on people's conveyance to hospital, and what could be done to improve the situation. The results of the evaluation will be shared with these groups, who will assist with dissemination to a public audience, and help to define next steps in the work.

RESULTS

Characteristics of emergency attendances and patients

The dataset comprised 110,781 ambulance attendances to people aged ≥ 75 years during one year (88.7% of total calls to this age group in the region). 64.1% (n=71,052) of patients were conveyed to hospital. 16.5% (n=18,288) of the sample had a record of 'dementia' in one or more of the free text fields in the EPR and 83.5% did not. Ambulance attendance and patient characteristics are presented in Table 1. The conveyance rate in patients with a record of 'dementia' was 59.0%, as compared to 65.2% in those without.

Attendances were more frequent between October and March, with higher conveyance rates in the same period. Mondays, Fridays and Saturdays were the busiest days for attendances, with highest conveyance rates on Mondays and Fridays. 58% of attendances were during out-of-hours periods (including weekends), and 50% were lower category emergency calls ('green' triage category). Overall, the conveyance rate reduced across age bands, from 67.9% in patients aged 75-79 to 59.9% in patients aged ≥ 90 , although there was less of a trend in patients with a record of 'dementia'. Ambulance attendances to female patients were more frequent (58.1% females vs 41.9% males), although conveyance rates were lower (62.7% females vs 66.3% males), and there was less difference in conveyance rates between the genders in patients with a record of 'dementia' (58.2% females vs 60.5% males). Around a quarter of all attendances had a fall recorded as the chief complaint, including mechanical (39.5%), fall from standing (23.0%) and unexplained (16.4%). Almost half the patients with falls were conveyed. Living/care arrangements were recorded for 75.6% of the cohort, with 42.5% of attendances to patients living alone, 43.9% with family, and 14% of attendances in nursing/residential homes. Conveyance rates for patients with a record of 'dementia' were lower than those with no record across all characteristics.

Table 1 Characteristics of ambulance attendances and conveyancing decisions for the total population and stratified by a record of 'dementia'

	All patients aged 75+ N=110,781				Patients with a record of 'dementia' N=18,288		Patients with no record of 'dementia' N=92,493	
	Total		Total conveyed: N=71,052		Total conveyed: N=10,796		Total conveyed: N=60,256	
	n	% ¹	n	% ²	n	% ²	n	% ²
Characteristics of attendance								
Quarter								
April-June 2004	27,043	24.4	17,256	63.8	2,535	58.6	14,721	64.8
July-Sept 2004	26,118	23.6	16,502	63.2	2,443	57.7	14,059	64.3
Oct-Dec 2004	28,022	25.3	18,064	64.5	2,832	59.7	15,232	65.4
Jan-March 2005	29,600	25.7	19,230	65.0	2,986	59.9	16,244	66.0
Day of the week								
Monday	16,017	14.5	10,549	65.9	1,532	60.5	9,017	66.9
Tuesday	15,260	13.8	9,783	64.1	1,486	59.1	8,297	65.1
Wednesday	15,463	14.0	10,047	65.0	1,468	57.6	8,579	66.4
Thursday	15,367	14.1	10,206	65.3	1,510	60.7	8,696	66.1
Friday	16,389	14.8	10,766	65.7	1,557	60.2	9,209	66.7
Saturday	16,354	14.8	10,056	61.5	1,689	58.5	8,367	62.1
Sunday	15,661	14.1	9,645	61.6	1,554	56.9	8,091	62.6
Time category								
In Hours	46,532	42.0	32,325	69.5	4,636	64.1	27,689	70.5
Out of hours (weekdays)	25,399	22.9	15,023	59.2	2,338	54.0	12,685	60.2
Weekends	38,850	35.1	23,704	61.0	3,822	56.9	19,882	61.9
Triage grade								
Green	55,064	50.0 ³	28,302	51.4	4,908	47.9	23,394	52.2
Red	42,770	38.8	30,200	70.6	4,055	66.0	26,145	71.4
Urgent response	12,411	11.3	12,169	98.1	1,775	97.5	10,394	98.2
Missing	536	-	381	71.1	58	74.4	323	70.5
Characteristics of patient								
Age Band								
75-79	23,806	21.5	16,160	67.9	1,417	60.3	14,743	68.7
80-84	30,004	27.1	19,564	65.2	2,587	59.2	16,977	66.2
85-89	30,592	27.6	19,523	63.8	3,561	60.0	15,962	64.7
90+	26,379	23.8	15,805	59.9	3,231	57.3	12,574	60.6
Gender								
Male	46,200	41.9 ³	30,611	66.3	4,119	60.5	26,492	67.3
Female	64,122	58.1	40,193	62.7	6,645	58.2	33,548	63.7
Not recorded	459	-	248	54.0	32	52.5	216	54.3

Chief Complaint

Falls	28,920	26.5 ³	13,837	47.9	2,994	46.9	10,843	48.1
Cardiovascular/cardiac arrest	9,512	8.71	8,168	85.9	593	76.6	7,575	86.7
Injury, accident	7,054	6.46	4,802	68.1	865	63.6	3,937	69.1
General medical	60,242	55.2	42,349	70.3	5,986	68.6	36,363	70.6
Mental health	631	0.58	219	34.7	76	45.5	143	30.8
Social	2,841	2.60	593	20.9	150	22.9	443	20.3
Not recorded	1,581	-	1,084	68.6	132	60.8	952	69.8

Care/living arrangements

Alone	24,268	29.0 ³	16,082	66.3	887	60.7	15,195	66.6
Alone plus care package	11,283	13.5	5,727	50.8	1,056	49.4	4,671	51.1
With family	31,578	37.7	21,766	68.9	1,941	59.2	19,825	70.1
With family plus care package	5,159	6.16	2,693	52.2	696	49.6	1,997	53.2
Residential care	7,127	8.51	4,629	65.0	2,266	62.9	2,363	67.1
Nursing home	4,306	5.14	3,171	73.6	1,431	70.5	1,740	76.5
Not recorded	27,060	-	16,984	62.8	2,519	57.6	14,465	63.8

Index of Multiple Deprivation (IMD) Quintile

Quintile 1 (most deprived)	7,629	7.03 ³	4,961	65.0	728	62.5	4,233	65.5
Quintile 2	14,000	12.9	8,887	63.5	1,342	60.1	7,545	64.1
Quintile 3	18,682	17.2	11,803	63.3	1,929	58.3	9,901	64.4
Quintile 4	26,075	24.0	16,945	65.0	2,506	59.7	14,439	66.0
Quintile 5 (least deprived)	42,128	38.8	27,005	64.1	4,011	58.2	22,994	65.3
Unavailable	2,267	-	1,424	62.8	280	57.5	1,144	64.3

Income Deprivation Affecting Older People Index (IDAOPI) Quintile

Quintile 1 (most deprived)	6,639	6.12 ³	4,274	64.4	582	62.7	3,692	64.7
Quintile 2	16,034	14.8	10,137	63.2	1,695	61.0	8,442	63.7
Quintile 3	20,574	19.0	13,081	63.6	1,921	57.6	11,160	64.7
Quintile 4	25,028	23.1	16,183	64.7	2,477	58.9	13,706	65.8
Quintile 5 (least deprived)	40,239	37.1	25,953	64.2	3,841	58.6	22,112	65.7
Unavailable	2,267	-	1,424	62.8	280	57.5	1,144	64.3

¹ Column percentages. i.e. proportion of characteristic in the category, divided by total population

² Row percentages. i.e. proportion of patients within each category characteristic who were conveyed, with the denominator for each column given in the header

³ Percentages calculated using the denominator of records with known values

Characteristics associated with conveyance

Most factors included in the service evaluation were associated with conveyance in the univariable analysis (Table 2). Characteristics significantly associated with reduced conveyance after adjustment included out-of-hours calls, age groups 80-84 and 90 and above, female gender, a record of 'dementia' in the EPR, and a main complaint of either fall, a general medical complaint, mental health or social reasons (as compared to 'injury/accident'). The presence of a care package for people living alone significantly

decreased the risk of conveyance (Odds Ratio (OR) 0.66 [0.62 to 0.69]) and living with family and a care package decreased the conveyance risk still further (OR 0.58 [0.54 to 0.62]). Whilst those in residential care had a similar risk of conveyance to those living alone, people in nursing homes were more likely to be conveyed to hospital. There was no strong evidence for an association between deprivation indicators and conveyance in the overall population, although the IMD quintile 3 showed a significant protective association.

Table 2 Characteristics associated with conveyance: results from univariable and multivariable regression

	UNIVARIABLE REGRESSION			MULTIVARIABLE REGRESSION		
	Unadjusted odds ratio	95% confidence interval	p-value	Adjusted odds ratio N=80,908	95% confidence interval	p-value
Call details						
Time category						
In hours ¹	1			1		
Out of hours	0.67	(0.65 to 0.68)	<0.001	0.82	(0.79 to 0.85)	<0.001
Triage						
Green ¹	1			1		
Red	2.27	(2.21 to 2.23)	<0.001	1.55	(1.49 to 1.61)	<0.001
Urgent response	47.5	(41.8 to 54.1)	<0.001	40.7	(34.6 to 47.9)	<0.001
Patient characteristics						
Age band						
75-79 ¹	1			1		
80-84	0.89	(0.86 to 0.92)	<0.001	0.95	(0.91 to 0.99)	0.024
85-89	0.83	(0.81 to 0.86)	<0.001	0.97	(0.93 to 1.02)	0.249
90 and above	0.71	(0.68 to 0.73)	<0.001	0.88	(0.84 to 0.90)	<0.001
Gender						
Male ¹	1			1		
Female	0.86	(0.83 to 0.88)	<0.001	0.95	(0.92 to 0.98)	0.004
Care/living arrangements						
Alone ¹	1			1		
Alone plus care package	0.52	(0.50 to 0.55)	<0.001	0.66	(0.62 to 0.69)	<0.001
With family	1.23	(1.09 to 1.17)	<0.001	1.00	(0.96 to 1.04)	0.986
With family plus care package	0.56	(0.52 to 0.59)	<0.001	0.58	(0.54 to 0.62)	<0.001
	0.94	(0.89 to 0.997)	0.390	1.00	(0.94 to 1.07)	0.956
Residential care						
Nursing home	1.42	(1.32 to 1.53)	<0.001	1.25	(1.15 to 1.36)	<0.001
Dementia						
No ¹	1			1		
Yes	0.77	(0.75 to 0.80)	<0.001	0.91	(0.87 to 0.96)	<0.001

Complaint						
Injury, accident ¹	1			1		
Falls	0.43	(0.41 to 0.45)	<0.001	0.51	(0.48 to 0.55)	<0.001
Cardiovascular/cardiac arrest	2.85	(2.64 to 3.08)	<0.001	2.11	(1.92 to 2.32)	<0.001
General medical	1.11	(1.05 to 1.17)	<0.001	0.82	(0.76 to 0.87)	<0.001
Mental health	0.25	(0.21 to 0.30)	<0.001	0.15	(0.12 to 0.19)	<0.001
Social	0.12	(0.11 to 0.14)	<0.001	0.13	(0.11 to 0.15)	<0.001
Index of Multiple Deprivation (IMD) Quintile						
Quintile 1 (most deprived) ¹	1			1		
Quintile 2	0.94	(0.88 to 0.99)	0.023	0.94	0.87 to 1.01	0.103
Quintile 3	0.93	(0.88 to 0.98)	0.009	0.93	0.87 to 0.998	0.045
Quintile 4	1.00	(0.95 to 1.05)	0.945	0.98	0.91 to 1.05	0.541
Quintile 5 (least deprived)	0.96	(0.91 to 1.01)	0.121	0.95	0.89 to 1.01	0.110
Income Deprivation Affecting Older People Index (IDAOPI) Quintile						
Quintile 1 (most deprived) ¹	1			²	-	-
Quintile 2	0.95	(0.90 to 1.01)	0.100	-	-	-
Quintile 3	0.97	(0.91 to 1.02)	0.240	-	-	-
Quintile 4	1.01	(0.96 to 1.07)	0.669	-	-	-
Quintile 5 (least deprived)	1.01	(0.95 to 1.06)	0.850	-	-	-

¹ Reference category

² Not included in multivariable model

When people with and without a record of dementia were considered separately, the factors associated with conveyance differed (Table 3). Factors such as older age, female gender and a main complaint in the 'general medical condition' category were associated with reduced odds of conveyance in patients without dementia, but no association was seen in patients with dementia. Although there was no association seen with the IMD quintile in both groups, patients with dementia who were in quintile 3 and above (less deprived) quintiles for the income deprivation affecting older people's index (IDAOPI) were significantly less likely to be conveyed.

Table 3 Characteristics associated with conveyance in multivariable regression stratified by a record of 'dementia'

		Patients with a record of 'dementia' N=13,424			Patients without a record of 'dementia' N=67,484		
		Adjusted odds ratio	95% confidence interval	p-value	Adjusted odds ratio	95% confidence interval	p-value
Characteristics of call							
Time category							
	In hours ¹	1			1		
	Out of hours	0.86	0.80-0.93	<0.001	0.81	0.78-0.84	<0.001
Triage							
	Green ¹	1			1		
	Red	1.47	1.34-1.61	<0.001	1.57	1.51-1.63	<0.001
	Urgent response	34.0	23.5-49.2	<0.001	42.4	35.4-50.9	<0.001
Characteristics of patient							
Age band							
	75-79 ¹	1	-	-	1		
	80-84	-	-	-	0.94	0.90-0.99	0.019
	85-89	-	-	-	0.97	0.92-1.02	0.178
	90 and above	-	-	-	0.87	0.82-0.91	<0.001
Gender							
	Male ¹	1			1		
	Female	0.98	0.91-1.06	0.640	0.95	0.91-0.98	0.002
Care/living arrangements							
	Alone ¹	1			1		
	Alone plus care package	0.71	0.62-0.83	<0.001	0.64	0.61-0.68	<0.001
	With family	0.87	0.76-1.01	0.061	1.01	0.97-1.06	0.571
	With family plus care package	0.60	0.51-0.71	<0.001	0.57	0.52-0.61	<0.001
	Residential care	1.00	0.87-1.15	0.987	0.99	0.91-1.08	0.853
	Nursing home	1.25	1.07-1.46	0.006	1.26	1.13-1.40	<0.001
Complaint							
	Injury, accident ¹	1			1		
	Falls	0.59	0.51-0.68	<0.001	0.49	0.46-0.53	<0.001
	Cardiovascular/cardiac arrest	1.69	1.31-2.18	<0.001	2.13	1.91-2.36	<0.001
	General medical	0.93	0.80-1.09	0.372	0.79	0.73-0.85	<0.001
	Mental health	0.32	0.20-0.50	<0.001	0.11	0.85-0.15	<0.001
	Social	0.20	0.15-0.26	<0.001	0.12	0.10-0.13	<0.001
Index of Multiple Deprivation (IMD) Quintile							

Quintile 1 (most deprived) ¹	-. ²	-	-	1		
Quintile 2	-	-	-	0.95	0.87-1.03	0.191
Quintile 3	-	-	-	0.94	0.87-1.02	0.125
Quintile 4	-	-	-	1.00	0.92-1.08	0.942
Quintile 5 (least deprived)	-	-	-	0.97	0.90-1.04	0.412

Income Deprivation Affecting Older People Index (IDAOPI) Quintile

Quintile 1 (most deprived) ¹	1			-. ²	-	-
Quintile 2	0.87	0.71-1.05	0.150	-	-	-
Quintile 3	0.80	0.66-0.97	0.022	-	-	-
Quintile 4	0.77	0.64-0.92	0.005	-	-	-
Quintile 5 (least deprived)	0.81	0.68-0.97	0.024	-	-	-

¹ Reference category

² Not included in multivariable model

Alternative referrals

Use of an alternative referral service for patients who were not conveyed was 22.2% (Table 4). Referral to the GP was most commonly used service (10.6%), followed by the out-of-hours service (6.6%). Social services and mental health services were used in <1% of non-conveyed cases, although conveyance rates for these main complaints were also very low. There were no differences in referral types for patients with or without dementia, although those with dementia had a slightly higher referral rate to falls services and social services.

Table 4 Alternative referrals recorded in Electronic Patient Record for patients who were not conveyed

Referral service	Emergency attendances with referral services recorded - TOTAL N=39,729	Emergency attendances with referral services recorded – patients with a dementia record N=7,492	Emergency attendances with referral services recorded – patients without a dementia record N=32,237
Patients with at least one referral pathway:	8,807, 22.2%	1,732, 23.1%	7,075, 22.0%
GP	4,223, 10.6%	777, 10.4%	3,446, 10.7%
Out-of-Hours	2,607, 6.6%	512, 6.8%	2,095, 6.5%
Falls service	2,153, 5.4%	495, 6.6%	1,658, 5.1%
TIA clinic	78, 0.2%	12, 0.2%	66, 0.2%
Social services	296, 0.8%	82, 1.1%	214, 0.7%
Mental health	41, 0.1%	16, 0.2%	25, 0.1%
District nurse	525, 1.3%	103, 1.4%	422, 1.3%

Other community
service

717, 1.8%

141, 1.9%

576, 1.8%

DISCUSSION

Principal findings

Overall, almost two thirds of people aged 75 and above who called an ambulance were conveyed to hospital, of which almost 50% were 'non-life-threatening' calls. There was an association between the provision of a care package at home and reduced hospital conveyance, with a reduction in risk of 34% for people living alone plus care package and 42% for those living with family plus care package, compared to those living alone without a package. Significantly fewer patients were conveyed to hospital during out-of-hours periods. Patients with dementia were less likely to be conveyed to hospital regardless of time period, triage grade and care arrangement, and patients with dementia who had higher incomes were less likely to be conveyed to hospital. Alternative referrals were made for one fifth of patients not taken to hospital, with the most common pathways being to a GP, out-of-hours or falls services.

Strengths and limitations

This evaluation reflects a large, generalizable region of the UK and includes a substantial dataset covering a calendar year, accounting for seasonal variation. Missing covariate data reflects the 'real-world' nature of information collected during front-line emergency situations where the data are not being collected for the purposes of research. Nonetheless, such data provide essential information to inform practice or research. The use of the term 'dementia' in the EPR to identify patients with a dementia diagnosis/suspected dementia could lead to misclassification, for example if dementia was recorded entered to the EPR in relation to another household member. However, the proportion of records with 'dementia' was almost identical to that recorded in a study hand-searching paper records. (Voss et al., 2018) Bias could also be introduced by recording practices, for example an increased tendency to record 'dementia' on the EPR for patients who remain at home. Further prospective studies would be useful to support these results, also including patient acuity, e.g. NEWS2, linked data from secondary care and more definitive recording of living arrangements and care available at home.

Relation to other studies and implications

Social care, unlike medical care, is means-tested, and studies suggest hospital admissions and readmissions may increase amongst people unable to access social care, for example care home beds. (Spiers et al., 2019; Steventon, 2018) Chronic underfunding, a separation of functions and a lack of information sharing have all contributed to a lack of holistic community-based care. (Care Quality Commission) This evaluation found lower hospital conveyance in patients living at home and receiving additional care, highlighting the importance of investing in the provision of social care, and the co-ordination of social and healthcare in the community. This may be contrasted with findings from an ecological study that found no evidence to suggest that reductions in social care funding (and possibly

reduced availability of social care) have led to increases in emergency hospital admissions.(Seamer, Brake, Moore, Mohammed, & Wyatt, 2019) However, our study uses individual-level data and focusses on the emergency department attendances as a consequence of an ambulance attendance, suggesting social care is an important factor determining use of acute care services.

The higher risk of conveyance in patients in a nursing home probably reflects the request for an ambulance only when the home reached the limits of care that medically-registered staff could provide. Wider implementation of schemes such as the 'Red Bag' (an easily accessible single source of information about the patient) in nursing/residential homes may better guide emergency ambulance clinicians decisions and thus reduce conveyance. (NHS England, 22nd June, 2018)

The lower rate of conveyance during out-of-hours could reflect some services being better able to operate during this time e.g. GP home visits, or that patients were less willing to be conveyed to hospital. Alternatively, given the publicity regarding increased mortality in hospital at weekends,(Freemantle et al., 2015) ambulance clinicians may anticipate fewer in-hospital services and would prefer to maintain patients at home.

Although patients with falls were less likely to be conveyed, still nearly 50% were taken to hospital, in line with a recent UK study. [12] Service improvement in assessment of older people for frailty, and linkage with specialised community frailty teams may decrease conveyance in future. Increased implementation of initiatives such as end-of-life care bundles, Respect and Advance Care Planning, (NHS England, 2018; "ReSPECT. Recommended Summary Plan for Emergency Care and Treatment. ,") and improved communication of this documentation with ambulance services should further reduce inappropriate conveyance for older people. Ambulance service level factors, including attendance by paramedics with extended skills and the perceptions of risk of senior management, are also factors which may impact on decisions made. (O'Cathain, Jacques, Stone, & Turner, 2018)

People with dementia were less likely to be conveyed at any time of day, in keeping with findings from another recent UK study. (Voss et al., 2018) Deprivation has been associated with increased emergency bed use, and lack of money, both in itself and as a means to access support and equipment, is a barrier to achieving what matters to older people with high support needs. (Imison CC, 2012; Katz J, 2011) The increased conveyance with greater income deprivation in people with dementia in this evaluation suggests that staying at home may be precluded if patients or families cannot pay for additional care or home adjustments to ensure safety and wellbeing in case of acute illness. The lack of association between age and conveyance in patients with dementia suggests that Advance Care Plans may be more likely to be in place across all age groups for patients with dementia than for those without.

Unanswered questions and future work

In order to inform planning of additional services or care that may safely retain older patients with unforeseen medical issues in the community, we need to understand specifically what it is about social care provision that influences ambulance clinicians' decisions, and how it influences patients/relatives' decisions to stay at home. Further evaluation of the appropriateness of lower conveyance rates in out-of-hours periods is

essential to inform equity of services and care over a 24-hour, 7-day week. Understanding how the composition of skills and experience in the attending team influences decision making in older people's care would also be valuable. The impact of other factors such as frailty assessments on conveyance decisions and referrals also need to be considered, as well as the communication between emergency staff and Frailty Intervention Teams at Emergency Department 'front doors'. (Paul Maloney et al., 2017) Greater individual-level knowledge of the complete emergency journey of such older patients across the health and social care pathway, including data linkage to community and secondary care, is needed to more clearly identify the impact of conveyance decisions, and assess the cost-effectiveness of providing supportive services before, rather than after, the event.

References

- Alzheimer's Society. Facts for the Media Retrieved from <https://www.alzheimers.org.uk/about-us/news-and-media/facts-media>
- Bradshaw, L. E., Goldberg, S. E., Lewis, S. A., Whittamore, K., Gladman, J., Jones, R., & Harwood, R. H. (2013). Six-month outcomes following an emergency hospital admission for older adults with co-morbid mental health problems indicate complexity of care needs. *Age and Ageing*, 42(5), 582-588. doi:<http://dx.doi.org/10.1093/ageing/aft074>
- Buswell, M., Lumbard, P., Prothero, L., Lee, C., Martin, S., Fleming, J., & Goodman, C. (2016). Unplanned, urgent and emergency care: what are the roles that EMS plays in providing for older people with dementia? An integrative review of policy, professional recommendations and evidence. *Emerg Med J*, 33(1), 61-70.
- Care Quality Commission. Beyond Barriers. How older people move between health and social care in England.
- Fogg, C., Griffiths, P., Meredith, P., & Bridges, J. (2018). Hospital outcomes of older people with cognitive impairment: an integrative review. *Int J Geriatr Psychiatry*, 33(9), 20.
- Fogg, C., Meredith, P., Culliford, D., Bridges, J., Spice, C., & Griffiths, P. (2019). Cognitive impairment is independently associated with mortality, extended hospital stays and early readmission of older people with emergency hospital admissions: A retrospective cohort study. *Int J Nurs Stud*, 96, 1-8. doi:10.1016/j.ijnurstu.2019.02.005
- Freemantle, N., Ray, D., McNulty, D., Rosser, D., Bennett, S., Keogh, B. E., & Pagano, D. (2015). Increased mortality associated with weekend hospital admission: a case for expanded seven day services? *BMJ*, 351, h4596. doi:10.1136/bmj.h4596
- Hutchings, R., Carter, D., & Bennett, K. (2018). *Dementia - the true cost: Fixing the care crisis*. Retrieved from
- Imison CC, P. E., Thompson J,. (2012). *Older people and emergency bed use: Exploring variation*. Retrieved from
- Katz J, H. C., Peace S, Taylor E. (2011). *A Better Life: what older people with high support needs value*. Retrieved from
- National Audit Office. (2017). *NHS Ambulance Services*. Retrieved from
- National Institute of Clinical Excellence. (June 2018). *Dementia: assessment, management and support for people living with dementia and their carers*
- NHS Benchmarking Network. *National Audit of Intermediate Care. Summary Report 2014. Assessing progress in services aimed at maximising independence and reducing use of hospitals*. Retrieved from
- NHS England. (22nd June, 2018). 'Red bags' to be rolled out across England's care homes getting patients home from hospital quicker. Retrieved from <https://www.england.nhs.uk/2018/06/red-bags-to-be-rolled-out-across-englands-care-homes-getting-patients-home-from-hospital-quicker/>
- NHS England. (2018). *My future wishes. Advance Care Planning (ACP) for people with dementia in all care settings*.
- O'Cathain, A., Jacques, R., Stone, T., & Turner, J. (2018). Why do ambulance services have different non-transport rates? A national cross sectional study. *PLoS One*, 13(9), e0204508.
- O'Hara, R., Johnson, M., Siriwardena, A. N., Weyman, A., Turner, J., Shaw, D., . . . Shewan, J. (2015). A qualitative study of systemic influences on paramedic decision making: care transitions and patient safety. *J Health Serv Res Policy*, 20(1 Suppl), 45-53.
- Paul Maloney , Ivan Clancy, Paul Bernard, Yvonne O'Riordan, Orla Lyons, Eilis Keogh, . . . Reddy, C. (2017). Frailty Intervention Therapy Team (FITT): A Step in the Right Direction - Integration of Early Interdisciplinary Assessment in the Emergency Department. *Int J Integr Care*, 17(5). doi:<http://doi.org/10.5334/ijic.3739>

- Pocock H, Jadzinski P, Taylor-Jones C, King P, England E, & Fogg C. (2018). A clinical audit of the electronic data capture of dementia in ambulance service patient records. *British Paramedic Journal*, 2(4), 10-18.
- ReSPECT. Recommended Summary Plan for Emergency Care and Treatment. . Retrieved from <https://www.respectprocess.org.uk/>
- Seamer, P., Brake, S., Moore, P., Mohammed, M. A., & Wyatt, S. (2019). Did government spending cuts to social care for older people lead to an increase in emergency hospital admissions? An ecological study, England 2005-2016. *BMJ Open*, 9(4), e024577. doi:10.1136/bmjopen-2018-024577
- Snooks, H. A., Carter, B., Dale, J., Foster, T., Humphreys, I., Logan, P. A., . . . Russell, I. T. (2014). Support and Assessment for Fall Emergency Referrals (SAFER 1): cluster randomised trial of computerised clinical decision support for paramedics. *PLoS One*, 9(9), e106436. doi:10.1371/journal.pone.0106436
- Spiers, G., Matthews, F. E., Moffatt, S., Barker, R. O., Jarvis, H., Stow, D., . . . Hanratty, B. (2019). Impact of social care supply on healthcare utilisation by older adults: a systematic review and meta-analysis. *Age Ageing*, 48(1), 57-66. doi:10.1093/ageing/afy147
- Steventon, A. D., S; Friebel, R; Gardner, T; Thorby, R; . (2018). *Emergency hospital admissions in England: which may be avoidable, and how?* Retrieved from
- Timmons, S., Manning, E., Barrett, A., Brady, N. M., Browne, V., O'Shea, E., . . . Linehan, J. G. (2015). Dementia in older people admitted to hospital: a regional multi-hospital observational study of prevalence, associations and case recognition. *Age & Ageing*, 44(6), 993-999. doi:10.1093/ageing/afv131
- Toot, S., Devine, M., Akporobaro, A., & Orrell, M. (2013). Causes of hospital admission for people with dementia: a systematic review and meta-analysis. *J Am Med Dir Assoc*, 14(7), 463-470. doi:10.1016/j.jamda.2013.01.011
- Voss, S., Brandling, J., Taylor, H., Black, S., Buswell, M., Cheston, R., . . . Benger, J. R. (2018). How do people with dementia use the ambulance service? A retrospective study in England: the HOMEWARD project. *BMJ Open*, 8(7).

ETHICS

The service evaluation was approved by the SCAS Clinical Review Group in July 2018. All data were anonymised. The large dataset and group sizes used for analysis further precludes unintended identification of any individuals.

FUNDING

No funding to declare.

AUTHOR CONTRIBUTIONS

All authors conceptualised the paper and designed the service evaluation and analyses. PK and CF performed the analyses. CLJ, CF, HP and PK drafted the paper. All authors contributed to the interpretation of the results and revising the paper.