TITLE PAGE

Observations of foot and ankle pain encounters reported by GPs in the UK, 2010-2013

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ABSTRACT

Background
Older patients who have foot pain report variation in access to services to manage their foot health. It is essential for planning services to understand the scale and burden of foot pain that exists for General Practitioners (GPs).

Aim
To provide UK wide population level data of the frequency of foot/ankle pain encounters recorded in general practice.

Design and setting
Population-based, cohort design drawn from the UK Clinical Practice Research Datalink (CPRD) (Jan2010-Dec2013).

Methods
All CPRD data were collected prospectively by participating GPs. Prevalence for foot/ankle pain GP encounters was the primary outcome and was stratified by age, gender and different sub-groups of causes.

Results
The number of patients with a recording of an encounter for foot/ankle pain was 346067. The number of recorded encounters of foot/ankle pain was 567,095 (mean per person:1.6, SD 1.3). The prevalence of recorded encounters of foot/ankle pain was 2980 per 100,000 (3%). The number of patients with a recorded encounter of foot/ankle pain was 1820 per 100,000 (1.8%).

Foot/ankle pain encounters were reported with all age groups (54.4% women) with those aged 61-70 years placing the greatest burden on GPs. The most common referrals were to orthopaedics (n=36,881) and physiotherapy (n=35,987), then podiatry (n=25,980).

Conclusion
The burden of foot/ankle pain encounters recorded by GPs is not insubstantial, spanning all ages, with a high proportion of referrals being to orthopaedics. We recommend further exploration of 'first contact practitioners' for foot/ankle pain in GP practices to alleviate the burden of foot/ankle pain encounters on GPs.

‘How this fits in’

Prevalence of foot and ankle pain is hard to determine due to inconsistency in case definitions of pain. Most population level data to date have used questionnaires that fous on patient reported foot pain. Using a large population-based, cohort design, our paper adds novel insights related to the burden of foot pain encountered by GPs alongside examination of consequent referral patterns for foot/ankle pain management. The information will be useful to clinicians and those involved in managing foot health services.

Introduction

Within the UK, the National Health Service (NHS) is increasingly stretched driving a need for change in its workforce distribution [1]. With limited funding for health-care, it is essential that the politicians and commissioners responsible for the resource allocation have a clear understanding of the population demands for healthcare [2].

Whilst policymakers require estimates of future demand for foot care, there are few data available from the UK NHS to produce these estimates. Recent investigation of GP encounters for foot and ankle osteoarthritis in Australia suggests that referrals to Allied Health Professionals were substantially less than those for pharamacological management and also less than referrals for surgical review [3]. Given that pain is often a key driving factor in why patients consult their GP, especially in the older population relative to feet and ankles [4], it is surprising that there is a corresponding lack of reports on referral and access to foot care services in the UK. Consultation rates for foot/ankle musculoskeletal complaints appear to be high in primary care [4-8] yet our systematic review found that the literature on foot-care and/or podiatry is concentrated around the assessment and prevention of foot and ankle problems related to the manifestations of diabetes [9].

The most recent published systematic review [5] that synthesized the evidence related to foot pain was limited to those aged 45 years and over. Potentially noteworthy data from the rest of the population is omitted; for example, one report identified the foot as the most common region for primary care consultation in children [6]. Data may also be confusing due to different case definitions used to record foot pain making comparisons between studies difficult with a wide range of foot pain being reported in the literature from 0.8% [10] through to 80% [11].

The aim for this investigation was to examine the frequency of foot/ankle pain encounters recorded in general practice in the UK over the most recent four-year period data. To better understand foot/ankle pain encounters by GPs, age, gender, health factors, socioeconomic status and referral patterns were also examined.

Methods

Participants

The participant sample population was drawn from the 2010 to 2013 data of the Clinical Practice Research Datalink (CPRD) [12], the most recent 4-year period when the study concept was formulated. The UK CPRD is a key database for large, longitudinal, anonymised, population based, electronic medical records. It has been used widely in research studies with many related publications across a broad range of health outcomes [13]. All data within the CPRD is collected prospectively in which participating GP's contribute data that includes medical diagnoses, lifestyle information, and referral and tests data covering 11.3 million patients since it started [12]. An 'acceptable patient metric' is followed with checks that practices are up to standard to maintain quality and reduce risk of bias.

For the purpose of this study, foot/ankle pain codes were defined *a priori*. A two-round consensus study with GP's in the Portsmouth region [13] was undertaken to form a comprehensive list of potential search terms for READ codes (the standard clinical terminology system used in General Practice in the UK) that may indicate pain in the foot/ankle. For patients to be included in this study, there had to be an associated GP encounter with one of these READ codes recorded on the CPRD system between 2010 and 2013 (Supplementary file 1).

Statistical analyses

Descriptive statistics and tests of significance used were chosen as appropriate (i.e. mean and standard deviation for continuous variables, number and percentage for categorical, Chi squared test for categorical comparison, Mann-Whitney or t test for continuous comparisons according to evidence of normality). Analysis was undertaken using SPSS version 24 and Microsoft Excel version 14.6.1.

The prevalence of patients with one or more foot/ankle pain encounters was calculated using the denominator of person-time years. Prevalence of recorded foot/ankle pain was stratified by age, gender and the sub-group categories for the different types of foot/ankle pain.

The total number of referrals and tests requested were also stratified by the covariates of interest which included age (0-10, 11-17, 18-30, 31-40, 41-50, 51-60, 61-70, 71-80, 91-100, 100+); gender; socio-economic status (Index of Multiple Deprivation deciles); BMI (<18.5, 18.5-24.9, 25-29.9, ⩾ 30kg); smoking status (non-smoker, smoker, ex-smoker); alcohol consumption (drinks alcohol, does not drink alcohol, ex drinker); musculoskeletal disease state (presence or absence of a systemic musculoskeletal disease); diabetes status (presence or absence), region (England, Northern Ireland, Scotland, Wales); type of foot/ankle pain cause (musculoskeletal, vascular, neurological, fracture, amputation, dermatological, tumours, infection and 'pain' (those not clear from the READ code but often recorded as a symptom code rather than pathology specific)).

Results

A total of 574083 code events were recorded across the sample relative to foot / ankle pain encounters. From those, 781 different READ codes were used to categorise foot/ankle pain encounters. The most common of these are shown in Table 1. The average annual sample of patients whose data fed into the CPRD database over the 4-year period 2010 to 2013 was 5230037. These patients accounted for 19048652 person years during that time.

Foot/ankle pain encounters

The total number of patients identified over the 4-year period with a recording of an encounter for foot/ankle pain was 346067 (54.4% women; mean age: 47.4, SD 22.3). The total number of recorded encounters for foot/ankle pain over the 4-year period from 2010-2013 was 567095 (Table 2).

The number of encounters per person varied considerably with a mean of 1.64 (SD:1.3) and recorded encounters for women were significantly higher than men ($p<0.001$, X^2 262.5, df 1).

Using the denominator of person time years, the prevalence of foot/ankle pain encounters over the 4-year period was 2980 per 100,000 (3%). The number of patients with a recorded encounter was 1820 per 100,000 (1.8%) (Table 2).

The prevalence of GP reported foot/ankle pain by age is presented in Figure 1. Those aged 51-60 and 61-70 placed the greatest burden on GPs in terms of encounters for foot/ankle pain with encounters being higher in women aged 71-80. The majority of encounters for foot / ankle pain were coded as 'pain' (51.5%) or 'musculoskeletal' events (27.2%).

Foot/ankle pain encounters by socio-economic status, region and various known health factors for foot/ankle pain

Analysis of foot /ankle pain encounters revealed no clear pattern of foot /ankle pain prevalence when analysed by socio-economic group, but regional variation in foot /ankle pain recording frequency was noted. The highest recorded encounters were seen in the North-West of England, with the lowest recorded in the Yorkshire and Humber regions. At a national level, England recorded the greatest total of foot and ankle pain encounters (N= 429135) (Figure 2).

There were significantly more encounters for foot /ankle pain (71.5%) in those in the overweight or obese categories ($p<0.001$, $X^2=582.8$, df=1). Non- smokers had significantly higher encounters for foot / ankle pain (55.1%) than smokers / ex-smokers ($p<0.001$, X^2 89.8, df 1) and those who drank alcohol had significantly higher encounters recorded for foot / ankle pain (76.5%) than those who did not ($p<0.001$, X^2 110.6, df 1) (Table 3).

Tests requested and referral patterns associated with foot/ankle pain encounters

Over the 4-year study period, the total number of referrals recorded by GP's linked within CPRD to foot pain encounters was 347754 (per patient mean:2.4, SD:2.5) and the total number of tests linked within CPRD to foot pain encounters was 291968 (per patient mean:3.0, SD:4.1). Figures 3 and 4 show the five most common referrals made and tests requested and their frequencies. The most common specified referrals for foot pain were to orthopaedics (n=36,881) and physiotherapy (n=35,987), then podiatry (n=25,980). A further category for non specified referrals that is used in the CPRD included 80,005 referrals. Further analysis (data not shown) showed those aged 61-70 were more likely to be referred by GPs for tests and to other health professionals.

The most common tests requested by GPs were blood tests (n=312,187), followed by x-ray (40,231), laboratory tests (27,117), monofilament tests for sensation (17,304) and ultrasound scans (7,162).

Discussion

Summary of main findings
In this first study using the UK CPRD to report foot/ ankle pain encounters, our analyses indicated that foot/ankle pain is not insubstantial with 346067 patients over the 4-year study period identified as reporting foot/ankle pain (1.8% of all GP encounters). Of those, 567095 encounters (3%) for foot/ankle pain were recorded during our study 4-year period with a mean number of encounters per person of 1.64 (SD:1.3).

Strengths and potential limitations
Our study data was drawn from the CPRD, a large database of anonymised medical records from general practitioners that is broadly representative of the population in terms of age, sex and ethnicity [12]. However, our study has some limitations that should be considered. Primarily, although validation of the CPRD database has been shown to be good [13] this is not specifically in the area of foot/ankle pain. Although GP's ideally are directed to record a diagnosis, in many cases symptom codes or generalized codes are used. It may be that we have underestimated the frequency of foot/ankle pain encounters due to including only the codes suggested by our initial GP consensus study. Our findings are however similar to those of others. In a UK based study [3] the authors demonstrated that 'foot pain' was the most frequently recorded code for musculoskeletal foot/ankle problems. Within our data, as well as 'foot pain', the most common codes recorded as 'foot pain' included ankle swelling, pain and injury, Achilles tendonitis, heel pain, plantarfasciitis, toe pain and ingrowing toenail pain.

A further limitation is that for chronic conditions, in the CPRD, the code only has to be recorded at its initial diagnosis unless a change in treatment occurs or a significant event such as a referral being generated occurs. Thus potentially we may have underestimated prevalence of musculoskeletal conditions [14].

Comparison with existing literature
Our estimates of foot/ankle pain GP encounter prevalence (3%) are much lower than those suggested by other authors giving a pooled prevalence estimate of 24% (foot pain) and 15% (ankle pain) [5]. A likely explanation is the variation in which foot pain data is collected and /or recorded. Data included within that systematic review was extracted from studies that utilised self-completed questionnaires, personal interviews and clinical/ physical examination [5]. Findings from a population-based computer-aided telephone survey of people (n=751) aged 18 to 65 years indicate chronic musculoskeletal ankle disorders affect almost 20% of the Australian community [11]. Further investigation of management of foot OA by GPs in Australia reported a rate of 1.1 per 1000 encounters which is closer to our rate of 1.8 per 1000 patients with a recorded encounter related to foot pain [3]. In a Dutch population based survey (n=7200 ≥ 65 years) 20% (1130) reported suffering non-traumatic foot complaints for more than four weeks. Of those, when GP encounters are calculated 26% (291) consulted a GP i.e. 4% from the source population [15]. In a similar UK study focussing on GP consultation for foot disorders, although confined to a smaller well–defined population in North Staffordshire, 40.8% had self-reported foot problems (n=5706) [7]. Of 4402 (77.1%) who consented to medical record review only 544 (12.4%) had a record of a previous consultation for a musculoskeletal foot problem [7]. Therefore, despite the high prevalence of foot/ankle pain reported in the community, people are not consulting their GP for it and this is consistent with international data.

Our finding that slightly more foot/ankle pain encounters were reported for women (54.4%) is consistent with those of similar studies [4, 6]. Of note is our inclusion of the full spectrum of ages whilst the majority of other similar investigations have focussed on older age groups. When we performed additional analyses excluding those in our younger age categories, our prevalence rate (32%) for those aged over 41 years was more comparable to those reported by others for those aged over 50 years [7,15]. This is consistent with other work that has reported consultation prevalence of musculoskeletal problems for any part of the lower limb increasing with age [4, 6, 15]. Whilst this highlights that foot/ankle pain encounters are higher in older populations, we found that there are encounters at all ages. Very few studies report consultation rates for foot problems in children. One investigation using the Consultations in Primary Care Archive (CiPCA), North Staffordshire UK, found that for children under 15, the most commonly recorded region for musculoskeletal consultation was the foot [6]. Our work further exposes a demand for children's foot care and although referral to a foot specialist such as a podiatrist is recommended for children's foot problems [16] such services remain under developed in the UK [17,18].

Within our findings, although there was no clear pattern of foot/ankle pain with socio-economic group and our data showed no significant difference between the varying socio-economic groups, regional variation in foot/ankle pain recording frequency was noted. Socioeconomic disadvantage has been linked to diabetic foot ulceration [19] yet, to our knowledge, there are no similar large population studies that have reported on socio-economic status and foot/ankle pain. Our observed patterns appear to match those of others using the CPRD to describe musculoskeletal phenomena in which deprivation levels were higher in Northern England, Scotland and South Wales than in Southern and Eastern England [20].

In our study those who drank alcohol also had higher foot/ankle pain encounters than those who did not, and surprisingly non-smokers had more recorded foot/ankle pain encounters than those who smoked or were ex-smokers. However, causality cannot be attributed to alcohol intake or not smoking from these results as we have no control group for comparison. It is probable that these findings may be due to the patients included and reflects the population prevalence of these characteristics, for example lifestyle factors such as smoking and alcohol intake are well established associates with lower socioeconomic status [21]. Less had an underlying diagnosis of diabetes (11.4%) and only 1.2% recorded encounters under the foot/ankle pain codes for circulation, both of which are linked to smoking [22]. Obesity is also greater amongst populations of lower socioeconomic status and is often linked to foot pain [5, 23, 24]. Findings in our study are consistent in that those with a higher BMI had more recorded GP encounters for foot/ankle pain than those with a lower BMI.

From our results, the demand for management of foot/ankle pain for older adults is predominant. When stratified by age, those in the 61-70 year age group have the highest recorded rate of foot/ankle pain and the highest number of referrals being made or tests instigated by their GP. Surprisingly, we identified that the majority of referrals related to foot/ankle pain were to orthopaedic services, and the most frequent tests requested were blood tests. This is not dissimilar to the Australian data in which patients defined as having foot OA were referred to orthopaedic surgeons 8.4 times per 100 foot/ankle encounters and podiatrists 6.3 times per foot/ankle problems [3].

Implications for research and/or practice

In summary, the burden of foot/ankle pain encounters recorded by UK GPs is not insubstantial and our data demonstrate that foot/ankle pain is reported at all age groups and that a high proportion of referrals for foot/ankle pain are to orthopaedics. We do not know how many of these patients may be more cost and clinically effectively managed within primary care foot care services/podiatry as we did not directly identify patients who may have been better served by referral to a foot care/ podiatry service. We recommend future work should focus on the design and implementation of a standardised referral template related to foot/ankle pain to help GPs in reducing the number of inappropriate referrals to orthopaedics or imaging [26]. Further work should also focus on investigation of a 'first contact practitioner service' for foot/ankle pain. Models of care for musculskeletal conditions in primary care in the UK have recently been transformed by the involvement of 'first contact' physiotherapists working within the GP practice [26, 27]. Enabling people who have foot pain to self refer to a similar model of care with a 'first contact' podiatrist/ foot care service has potential to significantly reduce the burden of foot/ankle pain on GP encounters.

Conflict of interest statement

Competing Interests: The authors have nothing to disclose.

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Ethical Approval: For the generation of the foot and ankle pain code list, ethical approval through the University of Southampton was granted (Ethics number 11557).
For the overall body of work the protocols were reviewed and approved by Independent Scientific Advisory Committee of the CPRD (protocol number 15_182R2Mn).

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Contribution Statement:
CB, RF, DPA, RPV, NA conceived the study.
Acquisition of Data was peformed by RF, AD, CB, DPA, RPV.
RF, DC and CB analysed the data.
RF, DC, AD, NA and CB interpreted the data.
RF, DC, AD, NA, DPA, RPV and CB critically reviewed the academic content and participated in producing the final draft.
All authors reviewed the paper prior to submission and approved it.

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Date accessed: 19.10.18

Figure Legends

Figure 1. Frequency of foot and ankle pain encounters stratified by age.

Figure 2. A chloropleth map showing the regional variation in frequency of foot and ankle pain (Mono Image)

Figure 3: A bar chart showing the 5 most common referrals made by GP's and their frequencies (mono image)

Figure 4: A bar chart showing the 5 most common test requests made by GP's and their frequencies (mono image)

Table Captions

Table 1: The ten most commonly recorded foot or ankle pain codes and their frequency

Table 2. Total numbers of patients registered with CPRD alongside consultations, number of recorded episodes for foot and ankle pain

Table 3. Encounter frequency for foot/ ankle pain stratified by life-style factors and presence of systemic musculoskeletal or diabetes conditions.
Table 3. Legend:
**Not all participants in the cohort had data on BMI, smoking or drinking status. As such, they were excluded from this part of the analyses.*

Figure 1

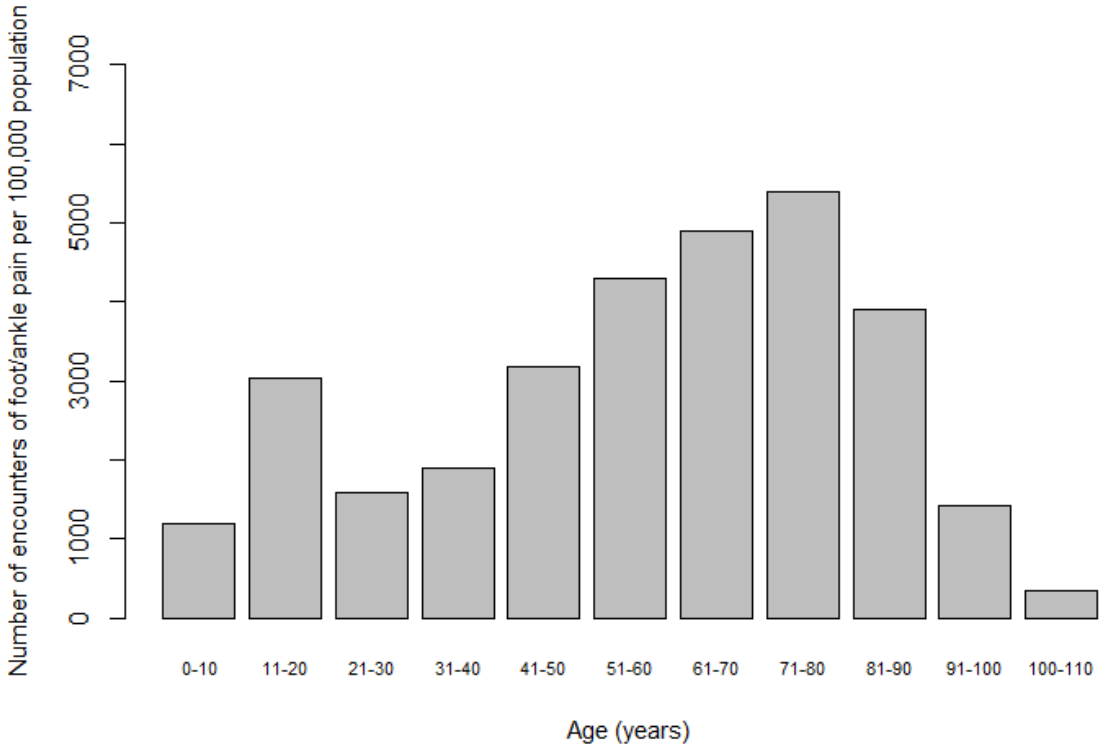
Number of encounters of foot/ankle pain per 100,000 population
0
1000
3000
5000
7000
0-10
11-20
21-30
31-40
41-50
51-60
61-70
71-80
81-90
91-100
100-110
Age (years)

Figure 2

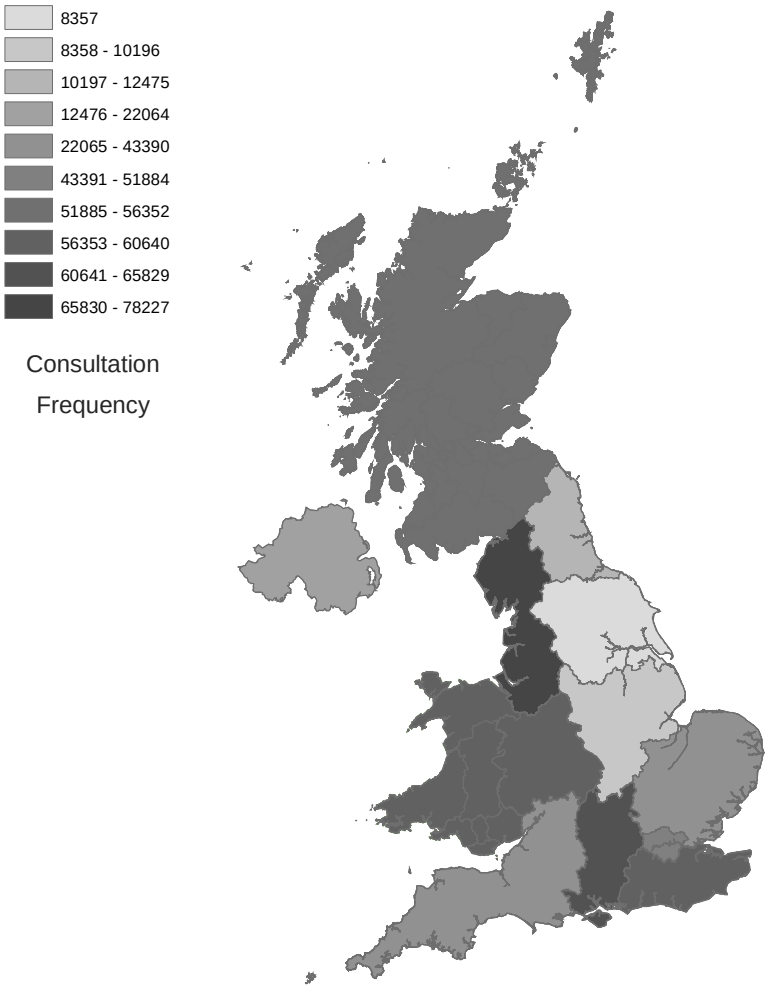
8357
8358 - 10196
10197 - 12475
12476 - 22064
22065 - 43390
43391 - 51884
51885 - 56352
56353 - 60640
60641 - 65829
65830 - 78227
Consultation
Frequency

Figure 3

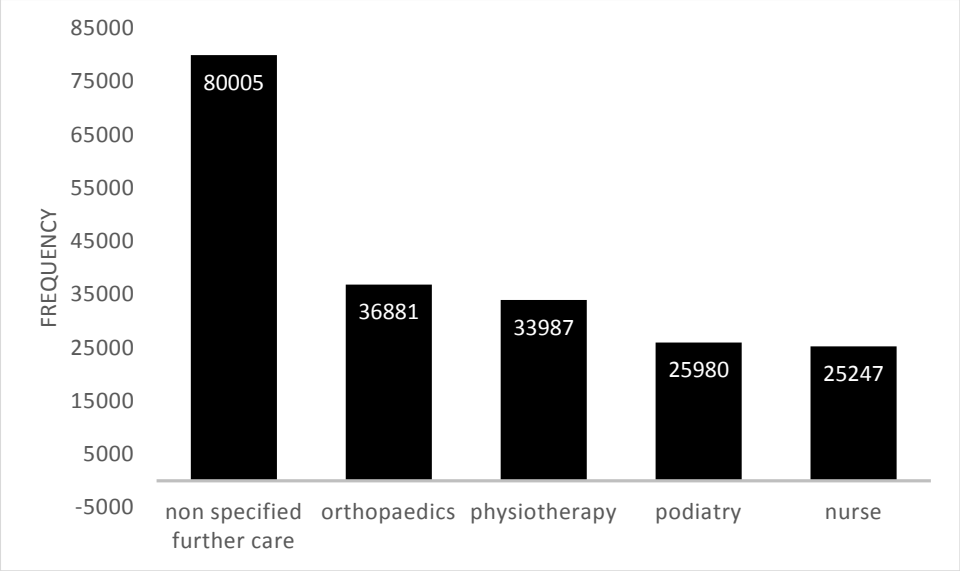

Figure 4

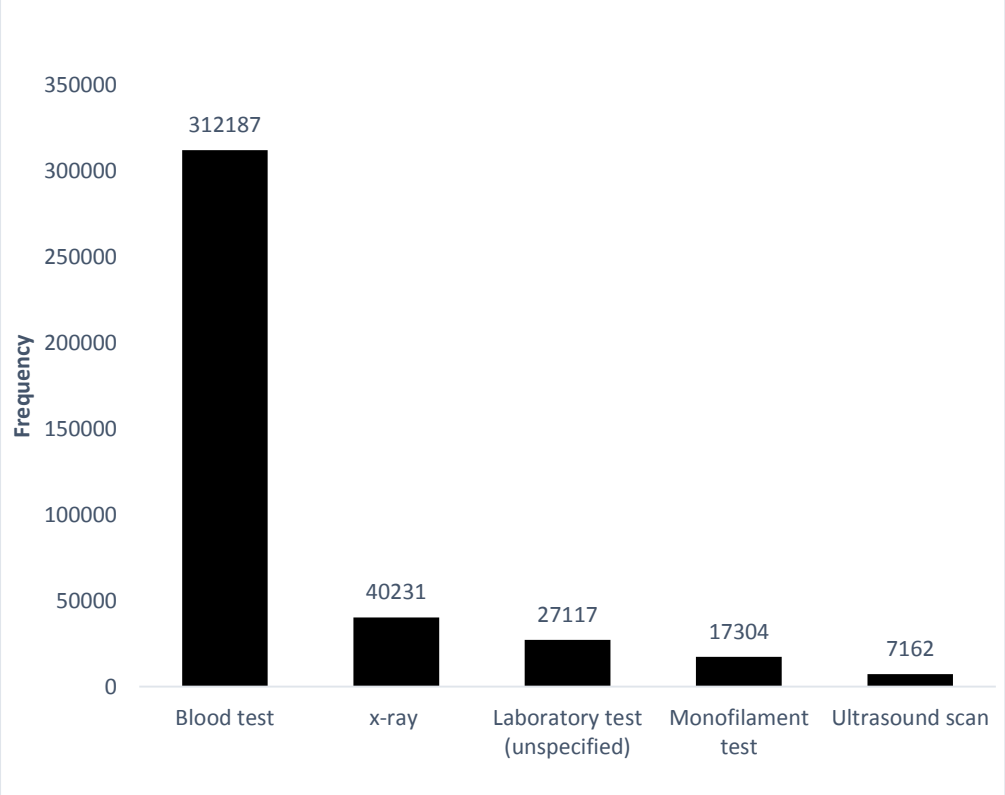

Table 1: The ten most commonly recorded foot or ankle pain codes and their frequency

	Code Description	**Frequency (percentage of overall code total %)**
1	Foot pain	112651 (19.6)
2	Ankle swelling/ ankle swelling symptom/ O/E ankle oedema	46559 (8.1)
3	Plantar Fasciitis	45301 (7.9)
4	Ankle Pain	42665 (7.4)
5	Toe Pain	25526 (4.4)
6	Ingrowing great toe nail	21842 (3.8)
7	Ankle Sprain	21211 (3.7)
8	Achilles tendonitis	17053 (3.0)
9	Heel Pain	16779 (2.9)
10	Other ankle injury	9851 (1.7)

Table 2.

Total numbers of patients registered with CPRD alongside consultations, number of recorded episodes for foot and ankle pain

	Year				Total
	2010	**2011**	**2012**	**2013**	
Number of patients with a recorded encounter	115228	93390	76884	60565	346067
Number of recorded encounters of foot/ankle pain	152,951	150,416	139,512	124,216	567095
CPRD person time denominator	4991539	4852729	4743114	4461270	19048652

Table 3.
Encounter frequency for foot/ ankle pain stratified by life-style factors and presence of systemic musculoskeletal or diabetes conditions.

	Number of patients	**Encounters for foot /ankle pain (%)**
Body Mass index (kg/m2) *		
<18.5BMI low	3906	6227 (1.5)
18.5-24.99	70644	114798 (27.1)
⩾ 25	87733	149754 (35.4)
⩾ 30	85232	152984 (36.1)
Smoking Status*		
Ex-smoker	77861	136620 (27.5)
Smoker	52518	86242 (17.4)
Non-smoker	165231	273410 (55.1)
Alcohol consumption*		
Ex drinker of alcohol	7394	13352 (3.5)
Drinks alcohol	171098	289411 (76.5)
Does not drink alcohol	42830	75637 (20.0)
Diabetes status		
Not diabetic	313297	502407 (88.6)
Diabetic	32770	64688 (11.4)
Musculoskeletal disease status		
Musculoskeletal disease diagnosis	38970	81071 (14.3)
No musculoskeletal disease diagnosis	307097	486024 (85.7)

**Not all participants in the cohort had data on BMI, smoking or drinking status. As such, they were excluded from this part of the analyses.*