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The Trend of Hallux Valgus Diagnosis and Treatment: NHS England, Population Level Data (1999-2019)

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Abstract

Introduction: There is a growing body of evidence supporting Minimally Invasive Surgery for Hallux Valgus which promises faster recovery times, quicker procedures, and smaller scaring. This study aims to determine the trends of Hallux Valgus diagnosis and minimally invasive treatment in England over the last 20 years.

Methods: Information and classification of disease code, M20.1 and OPCS 4-Character Procedure Codes were systematically searched from publicly available tabulated inpatient Hospital Episode Statistics produced by NHS digital, from 1999-2018/19. All admitted patient Hospital Episode Statistics were collected from NHS Digital. Population level statistics were collected from the office of national statistics using the London data base calculator of mid-year estimates for England. Trends and tabulation data were analysed through means in Microsoft Excel.

Results: The number of finished consultant episodes 1999-2018/19 with primary diagnosis of Hallux Valgus: 386,008 episodes; Male to Female ratio: 1:8; Mean time waited: 143 days; Mean length of stay: 1 day; Mean age of diagnosis: 54 years; Average total number of day cases per year: 10,157 new cases; Age bracket with highest Incidence per 100,000: 55-74 years of age; Age bracket with highest number of procedures: 60-64 years of age. The number of soft tissue procedures and osteotomies of the 1st Metatarsophalangeal (MTP) (not otherwise specified) have increased over the last 20 years by approximately 600%. And there has been a rise in the number of arthrodesis for the 1st MTP by almost 400%.

Conclusion: We were unable to differentiate minimally invasive surgical approaches with publicly available data. Likewise, we were unable to determine the surgical technique used by surgeons to correct Hallux Valgus deformity. However, we found interesting trends pertaining to diagnosis and treatment further validating the need for evidenced based minimally invasive techniques to improve patient outcomes. Our data concurs with previous findings of male to female ratio of 1:8 for diagnosis of Hallux Valgus.

Keywords: Hallux Valgus Surgery; Epidemiology; Hallux Valgus

Introduction

Greater than 100 procedures have been described for Hallux Valgus (HV) with no consensus as to which is the most effective [1]. There is a growing body of evidence supporting Minimally Invasive Surgery (MIS) for HV which promises faster recovery times, quicker procedures and smaller scaring [1]. The purpose of this analysis was to assess the incidence of HV surgery in England between 1999 and 2018/19 and to find out whether changes in HV operations have occurred. This study aims to validate the findings in a recent systematic review comparing MIS and Comparative Open Techniques, by the same authors. A similar study reported a significant decreasing trend of HV operations in Finland between 1997 and 2014 [2].

HV is an increasingly common condition [3]. Prevalence has been shown to increase with age and to be higher in the female population [4]. A pooled prevalence estimate of 23% in adults aged 18-65 years and 35.7% in elderly people aged over 65 years has been reported across the globe from America, Europe, Africa and Australia [4,5]. A study in a French population reported HV to be present only in people older than 30 years and to be correlated with the modern day era of narrow toe box footwear as found in high heel shoes [3]. Prevalence is also increased in dancers owing to specific pointe work in training [6]. While external causes are not the only factors implicated in HV deformity, genetics have also been implicated [7, 8]. In a study conducted in Africa in three populations: an urban White community, an urban Black community, and a rural Black community the prevalence of HV was found to be highest in the urban white community with no difference between urban or rural black communities [9]. The Medical Research Council United Kingdom, conducted a study looking at the prevalence of HV which was found to be 36.3% in patients older than 56 years of age and was associated with female sex, older age, and pain in other bodily regions.[10] The association with HV and decreased quality of life warranting intervention is well documented with special interest in the evolution of minimally invasive approaches to improve patient outcomes since the nineties.[10-14]

NHS digital aims to improve health care through using information and technology.[15] The National Health System (NHS) Digital is a body of the Department of Health and Social Care (England) that systematically collects data from across UK. The NHS has an unrivalled data set covering the entire population stretching back two decades. Gathering information about patients from hospitals or GP's can be used to influence the care of patients. Data on its own is useless unless it can be analyzed and interpreted.

Primary care services provide the first point of contact in the health and care system for most patients. They act as the 'front door' of the NHS. GP practices and local doctors' surgeries provide most primary care in England. [15] When a patient visits a GP practice, information about them and their health and care is recorded on the electronic health record (EHR) system. The system uses codes to define this patient information, which can be collected, analysed, and compared. Analysis of extracted data is made available to individuals, researchers, local providers and a central NHS organization in an anonymised form. [15]

Patient level secondary care data is submitted to NHS Digital by providers of NHS care. Admitted patient care data in maternity, inpatients, outpatients and accident and emergency (A&E) settings is submitted by hospital trusts. This information includes: clinical information, reason for attendance or cause, organisational data, geographical data, patient demographics and administrative data (such as length of stay). It is collected from: Patient Administration Systems (PAS) and Radiology Information Systems, patient health records, Patient Reported Outcome Measures (PROMS) questionnaires, Patient Level Information Costing Systems (PLICS) and supplementary collections. Through this collection Hospital Episode Statistics (HES) are formed.[15] Data requested from NHS Digital is population level data. This may be useful to compare findings from Systematic Reviews with thousands of people in the UK. Population level data further validates what is present in the literature.

The aim of this study was to determine the incidence of HV in England and to determine the incidence of surgical procedures for HV in England. This study made up part of a series of papers that aimed at determining the efficacy of MIS for HV.

Methods

This study included all patients (any age) with a primary diagnosis of HV, information and classification of disease code (ICD-10), M20.1. All admitted patient hospital episode statistics were collected from NHS Digital, England. Population level statistics were collected from the office of national statistics (ONS) using the London data base calculator of mid-year estimates for England. [16,17]

Search Strategy

OPCS Classification of Interventions and Procedures version 4 (OPCS-4), is the procedural classification used by clinical coders within National Health Service (NHS) hospitals of NHS England, NHS Scotland, NHS Wales and Health and Social Care in Northern Ireland.[18]

Clinical coders based in hospital trusts record diagnosis information using the International Classification of Diseases v10 (ICD10) classification system, coders record activity at as granular level as possible. The classification system allows reporting of information at multiple levels of granularity, where the summary diagnosis groups can be broken into 3-character codes, which in turn can be broken into 4-character codes. [19] The following codes were searched for systematically through HES data 1999/2000 until 2018/2019:

Diagnostic ICD-10 Codes [18]:

- M20.1 Hallux Valgus (acquired)

OPCS-4 character Procedure Codes [18]:

- W03.1 Excision of heads of multiple lesser metatarsals
- W03.2 Osteotomy of multiple metatarsals
- W15.1 Osteotomy of neck of first metatarsal bone
- W15.2 Osteotomy of base of first metatarsal bone
- W15.3 Osteotomy of first metatarsal bone NEC
- W15.4 Osteotomy of head of metatarsal bone
- W59.1 Fusion of first metatarsophalangeal joint and replacement of lesser metatarsophalangeal joint
- W59.2 Fusion of first metatarsophalangeal joint and excision of lesser metatarsophalangeal joint
- W59.3 Fusion of first metatarsophalangeal joint NEC
- W59.4 Fusion of interphalangeal joint of great toe
- W79.1 Soft tissue correction of hallux valgus
- W79.2 Excision of bunion NEC

In order to calculate the number of primary diagnosis or procedures per head of the population in England, estimates of the national population were searched for using publicly available data from the Office of National Statistics (ONS) [16] (https://www.ons.gov.uk/). Limits for the search included mid-year population estimates of England from 1999 until 2018/19, with specific ages searched to match the HES tabulation data. [16, 18]

Data Extraction

Raw data was extracted from HES and ONS statistics and placed into a Microsoft Excel spreadsheet. The following variables were available: Estimated mid-year population for all ages up to 90+ [16]; Finished consultant episodes; Admissions; Gender;, Waiting list; Planned; Other Admission Method; Mean time waited; Median time waited; Mean length of stay; Median length of stay; Mean age; Age stratification: Age 0, Age 1-4, Age 5-9, Age 10-14, Age 15, Age 16, Age 17, Age 18, Age 19, Age 20-24, Age 25-29, Age 30-34, Age 35-39, Age 40-44, Age 45-49, Age 50-54, Age 55-59, Age 60-64, Age 65-69, Age 70-74, Age 75-79, Age 80-84, Age 85-89, Age 90+; Day cases; Finished Consultant Episodes bed days; Emergency; and Elective Other.

Data Analysis

Tabulation data was analysed through means in Microsoft Excel. Total episodes, mean values, grouped means and stratified values for age were sorted and in turn developed into pictorial graphs to see trends over time. (See results) An estimate of primary diagnosis and procedures per head of the population in England (1999-2020) was performed based on data from the UK ONS and NHS Digital. It is important to note they are mid-year population estimates and represent the consensus definition of people who are usually resident in the UK for 12 months, excluding short term migrants, and counting students at their term addresses. [16]

Formulas Used

Results / Data:

Raw data for HV diagnosis and population estimates are set out in table 1-2. [20]

Key Results:

- Number of finished consultant episodes 1999-2018/19 with primary diagnosis of HV: 386,008 episodes
- Male to Female ratio: 1:8
- Mean time waited: 143 days
- Mean length of stay: 1 day
- Mean age of diagnosis: 54 years
- Average total number of day cases per year: 10,157 new cases
- Age bracket with highest Incidence per 100,000 55-74 years of age
- Age bracket with highest number of procedures 60-64 years of age

Graphs depicting the trends of the number of admitted patients with a primary diagnosis of HV from 1999-2018/19, NHS England are seen in Graph 1-3. There appears to be a steady decrease over the last 10 years, with a peak in 2010/2011. Age adjusted graphs are provided for an appreciation of the known increase in prevalence in the older population.

More specific age subgroup stratification was provided by NHS Digital for the years 2012-2018, as such we have depicted the age adjusted number per population, England. As depicted in graph 4, the age group which had the highest number of admitted patients with a primary diagnosis of HV was 55-74 years of age. With the peak age group being 60-64 years, achieving on average 101 admissions per 100,000 people, NHS England. Note for estimates against the total population, series 1, in graph 4 depicts this.

Graph 5-7 depict the number of osteotomy procedures in admitted patients within the NHS, England 2000-2019. Graph 5 depicts all procedures, with a pronounced increase between the ages 60-64, totaling 25,784 procedures. Graph 6 depicts procedures related to fusion of the 1st metatarsophalangeal joint, with OPCS-4 Code W59.3 (fusion of the first metatarsophalangeal joint procedure not otherwise specified) increasing dramatically over the last 20 years. Note, fusion is usually reserved for severe cases of HV. [7]

Graph 7 depicts all procedures other than fusion related to HV correction. The procedures that have markedly increased over the last 20 years include those related to OPCS-4 code W79.1 and W79.2, osteotomy of the 1st metatarsal not otherwise specified and soft tissue correction of HV. Osteotomy of the neck of the 1st metatarsal (OPCS-4 code W15.1) showed a steady decrease over the last 20 years, from approx. 4,500 to <1000 per year.

Graph 8 depicts the number of all lesser metatarsal procedures over the last 20 years. A steady number of procedures is evident with a rise to 2010 and a decrease to 2019. Note, these procedures are often done for transfer metatarsalgia, a common complication of severe HV. [7]

Discussion

This paper aims to show the incidence of HV diagnosis and all primary surgical treatment in NHS England over the last 20 years. To our knowledge this is the first study to show the trend of HV surgery in England over the last 20 years. This study's strengths are the use of population level data available through NHS Digital, which can provide a trustworthy estimate of several epidemiological factors around the condition. For example, we note an 8-fold increased incidence in females compared with males, which is consisted with other studies. [21] With the majority of patients being in the age bracket 55-74 years of age. The mean length of stay was 1 day indicating that most surgeons keep patients overnight.

Interestingly our data showed a stark increase in the number of fusions related surgical procedures of the 1st Metatarsophalangeal (MTP) joint, over the last 20 years. We show an almost 400% increase from the year 2000. Usually, fusion is reserved for severe cases of HV, potentially indicating the increased number of severe cases over the last 10 years. In a similar nationwide study in Finland, they too reported a significant increase in fusion procedures over the period 1997 to 2014. [21] Conversely, they showed a decrease in the total number of HV procedures where as our data indicates an increase in total number of all HV procedures.

While this study was unable to determine exact procedure technique, a recent Australian study looking at surgeon preference in Australia for Hallux Valgus showed a distinct correlation between choice of procedure and the age and experience of the surgeon, where older surgeons tended to prefer chevron osteotomies, and Australian Orthopedic Foot and Ankle Surgeons were more likely to use scarf osteotomies.[22] The Scarf osteotomy was the preferred procedure for moderate-severe HV in more than 50% of the 454 responding surgeons.[1,22,23] Historically, distal metatarsal osteotomies were reserved for mild-moderate HV, while moderate-severe cases were treated with either proximal osteotomies or metatarso-cuniform arthrodesis combined with other soft tissue procedures.[22,24] Additionally in a similar study understanding surgeon preference in Swiss Orthopaedic Foot and Ankle Society surgeons found surgical treatments differed as follows: in joint sparing procedures, older and busier surgeons were more likely to use Chevron osteotomies. However, more than 50 % preferred a Scarf-type of osteotomy. [11]

We show an increase in the number of osteotomies of the 1st Metatarsal non-otherwise (NEC) (W15.3) & soft tissue related surgical procedures (W79.1) specified for HV, which typically involves release of the adductor hallucis tendon worsening the valgus. There was an increase by almost 600% over the last 20 years. We did find a steady decrease in osteotomies of the neck of the 1st metatarsal (OPCS-code W15.1) over the last 20 years. We also note the slight decrease in Primary HV diagnosis in admitted patients over the last 10 years and hypothesize the cause of this may be due to earlier diagnosis and conservative management. Such management may include physiotherapy or education for footwear that applies less pressure to the hallux. We also note a steady decrease over the last 10 years in surgeries related to metatarsalgia (graph 8). We hypothesis that this may be due to improved operative techniques for HV and earlier diagnosis and treatment, preventing complications.

In 2018/2019 alone NHS Digital reported a total number of people with a primary diagnosis of HV (acquired) in England to be 17,859. [18] When pooling the data from NHS Digital from the years 2010-2019, we see a total number of HV finished consultant consultations to be 386,008 in England. With regards to the number of actual procedures for HV correction, reported numbers in England between 2010-2019 were 378,856. [18] This shows the importance of evidence based treatment as the number of people effected by the condition is significant. With so many different procedures there is little understanding of which is most efficacious in terms of surgical outcomes, patient outcomes and costs for both the patient and the NHS and the paucity of high quality evidence demonstrates this fact. [14,25]

HV is a common condition. A systematic review and meta-analysis in 2010 pooling data from 76 studies and 496,790 participants showed a pooled prevalence estimate of 23% in adults aged 18-65 years and 35.7% in elderly people aged over 65 years. Moreover, prevalence increased with age and was higher in the female population.[4] Twenty-eight studies (37%) were conducted in the USA, 21 (28%) in England, 8 (10%) in Australia, and 4 (5%) in Germany, with the remaining 15 studies (20%) conducted in other regions.[4] The numbers speak for themselves when considering the number of people that would benefit from potential advantages of less invasive procedures. Our study adds the number of patients admitted to hospital with a primary diagnosis of HV, requiring surgical intervention.

Another recent study in England looking at the prevalence of HV in the primary care population showed that the standardized prevalence of HV was 28.4%. [5] Although limitations of this study was self-reporting of signs as its mode of measurement.[5] The aforementioned numbers show how common HV procedures are and the number of people who would benefit in England alone, from cheaper and more efficacious procedures.

Percutaneous surgery for the foot and ankle was founded by Stephan-Isham in the United States in the nineties.[13] This subsequently formed a trend for minimally invasive techniques that were promoting smaller scars, less postoperative pain, quicker recovery, decreased rehabilitation times and reduced risk of infection and wound complications.[1, 13] The first generation was thus formed as described by Reverdin-Isham.[13] This technique was a percutaneous extra-articular oblique medial closing wedge osteotomy of the first meta-tarsal head with no further fixation. The second-generation Bosch osteotomy was developed to provide more stability and involved a distal transverse osteotomy of the 1st metatarsal stabilized with axial K-wire. However, whilst there were many advocates for this technique many abandoned it due reports of malunion in 61-69% of patients. [26] The complications attributed to both first and second generation techniques were in part due to the lack of fixation which in turn led to the development of the third generation of minimally invasive hallux valgus surgery by Vernois and Redfern, the Minimally Invasive Chevron Akin (MICA) or Percutaneous Chevron Akin osteotomy (PECA). The technique uses a stable method to fixate the distal fragment with one or two screws. Studies have reported no difference with these later MICA/PECA techniques when compared with open approaches. [26-29]

This study could be enhanced by engagement with NHS Digital for deeper tabulated data with limits, such as other co-morbidities (Rheumatoid arthritis, osteoarthritis, or other inflammatory conditions). We therefore assume that the data presented includes patients with these conditions. Additionally, there were no codes that specifically related to incision size and therefore we were unable to determine whether orthopedic surgeons are opting for the latest minimally invasive techniques or keeping to the traditional open large incision techniques. It was also impossible to determine the surgical technique chosen by surgeons, as extrapolating based on the site of osteotomy is unreliable. Our aim was thereby only partly met due to the limitations of the data. Requesting deeper tabulation data with specific filters may be a suitable option for further research if resources permit and, with the impressive statistics from NHS digital, we believe many associations and trends can be elucidated.

Conclusion

In admitted patients the incidence of primary diagnosis of HV has steadily decreased over the last 10 years in England. Whilst the number of soft tissue procedures and osteotomies of the 1st MTP (not otherwise specified) have increased over the last 20 years by approximately 600%. Osteotomies of the neck of the 1st metatarsal have decreased from 4,500 in the year 2000, to <1000 in 2019.

There has been a rise in the number of arthrodesis for the 1st MTP by almost 400%, over the last 20 years in England. The mean length of stay was found to be an average of 1 day. And the most likely age to have a HV procedure was between 60-64 years. Our data concurs with previous findings of male to female ratio of 1:8.

Conflicts of Interest

Each author declares that he or she has no commercial associations (e.g., consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

Supplementary Results

Primary diagnosis: 4-character codeand description	Finished consultant episodes	Male	Female	Mean time waited	Mean length of stay	Mean age	Day case	Age 0-14	Age 15-59	Age 60-74	Age 75+
M20.1 Hallux valgus (acquired)											
1999/2000	12,843	1,516	11,327	242	2	51	2,920	192	8375	3300	977
2000/2001	13,610	1,384	12,226	238	2	52	3,284	173	8930	3512	991
2001/2002	13,591	1,459	12,132	245	2	52	3,367	201	8891	3507	974
2002/2003	14,720	1,577	13,143	247	2	52	3,499	200	9800	3787	923
2003/2004	16,254	1,634	14,620	231	2	53	4,250	182	10532	4568	968
2004/2005	16,301	1,600	14,701	199	2	53	4,674	186	10540	4598	975
2005/2006	17,518	1,774	15,744	177	2	53	5,652	179	10895	5398	1038
2006/2007	18,769	1,886	16,883	162	1	54	7,453	166	11466	6071	1061
2007/2008	21,422	2,244	19,178	127	1	54	9,371	178	12800	7150	1286
2008/2009	21,060	2,197	18,863	90	1	54	10,277	146	12282	7328	1292
2009/2010	22,551	2,530	20,021	86	1	54	12,013	159	12788	8155	1446
2010/2011	24,750	2,583	22,167	87	1	54	14,509	192	13873	9126	1550
2011/2012	25,193	2,581	22,612	93	1	55	15,766	158	13938	9505	1573
2012/2013	22,629	2,408	20,213	89	1	55	14,726	139	12698	8408	1370
2013/2014	22,708	2,634	20,069	85	1	55	14,833	135	12596	8362	1518
2014/2015	22,437	2,570	19,865	83	1	55	15,355	162	12410	8349	1497
2015/2016	21,544	2,444	19,092	90	1	55	15,948	136	11963	7985	1441
2016/2017	20,962	2,570	18,391	91	1	55	15,749	134	11599	7731	1460
2017/2018	19,287	2,314	16,971	93	1	55	15,173	127	10645	7100	1378
2018/2019	17,859	2,378	15,479	101	1	56	14,323	125	9649	6565	1462
Sum Total:	**386,008**	42,283	343,697	2,855	30	1,077	203,142	3,270	226,670	130,505	25,180
Average:	19,300	2,114	17,185	**143**	**1**	**54**	**10,157**	164	11,334	6,525	1,259

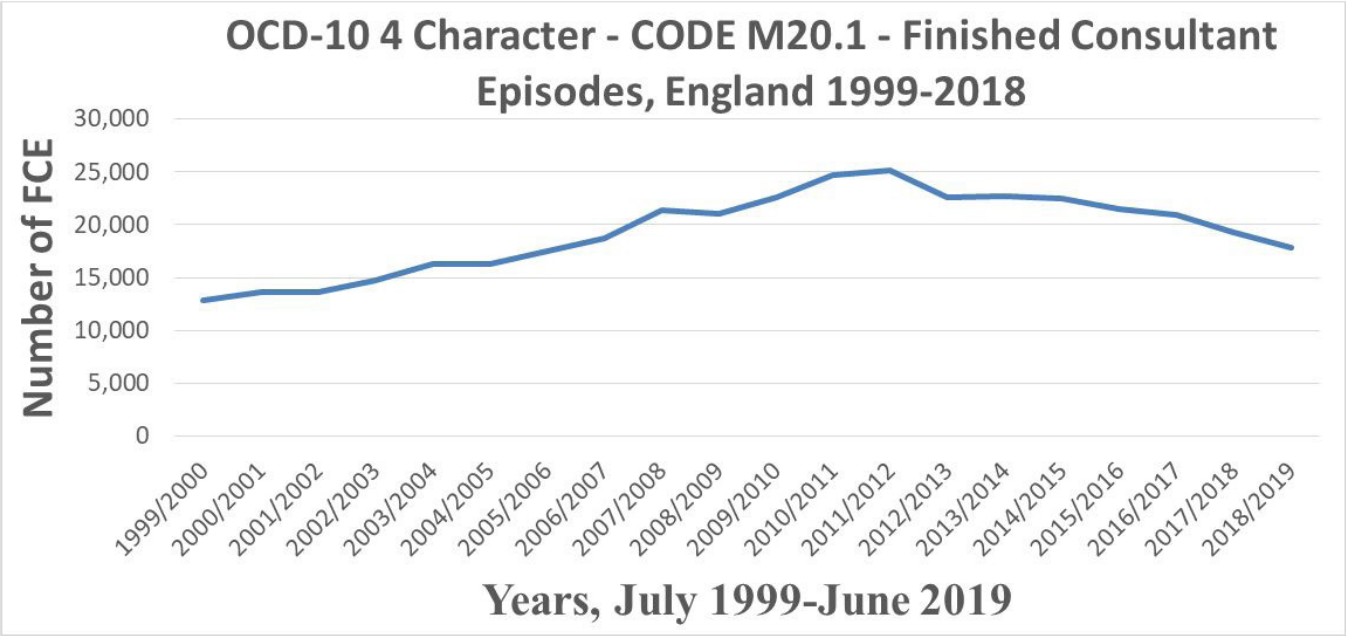
Table 1: Primary Diagnosis Hallux Valgus Tabulation Data. ICD-10 Code: M20.1 [18]

Age	Total:	Percentage %
0-14	3270	1
15-59	226670	59
60-74	130505	34
75+	25180	7

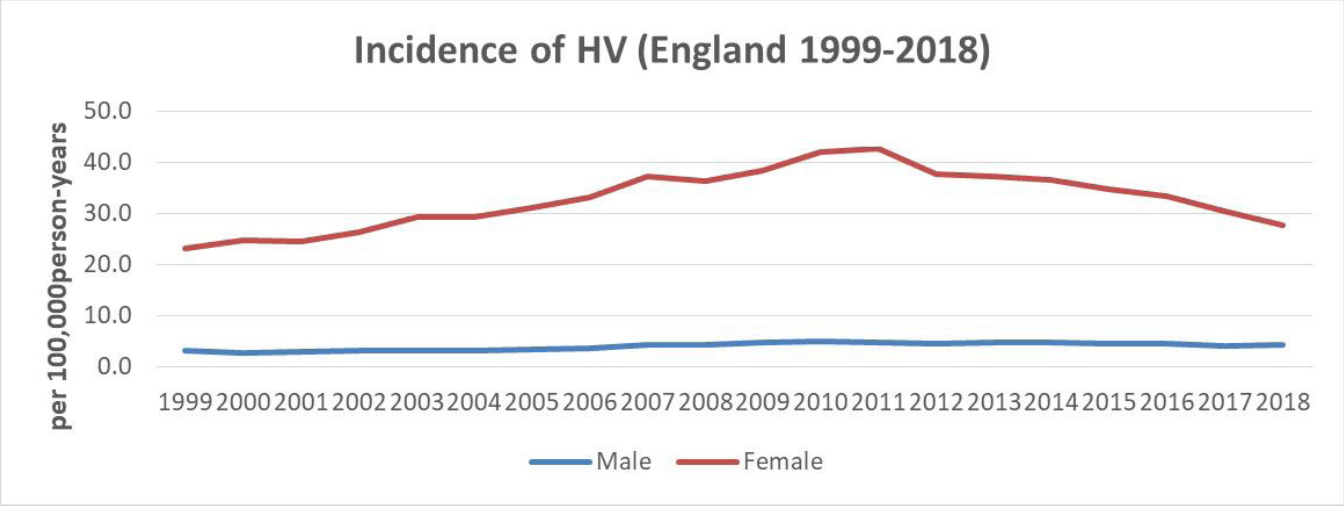
Year	Mid-Year Population Estimates, England[16]
1999	49,032,872
2000	49,233,311
2001	49,449,746
2002	49,679,267
2003	49,925,517
2004	50,194,600
2005	50,606,034
2006	50,965,186
2007	51,381,093
2008	51,815,853
2009	52,196,381
2010	52,642,452
2011	53,107,169
2012	53,493,729
2013	53,865,817
2014	54,316,618
2015	54,786,327
2016	55,268,067
2017	55,619,430
2018	55,977,178

Table 2: Number of primary hallux valgus diagnosis by age range, (1999-2019) England.

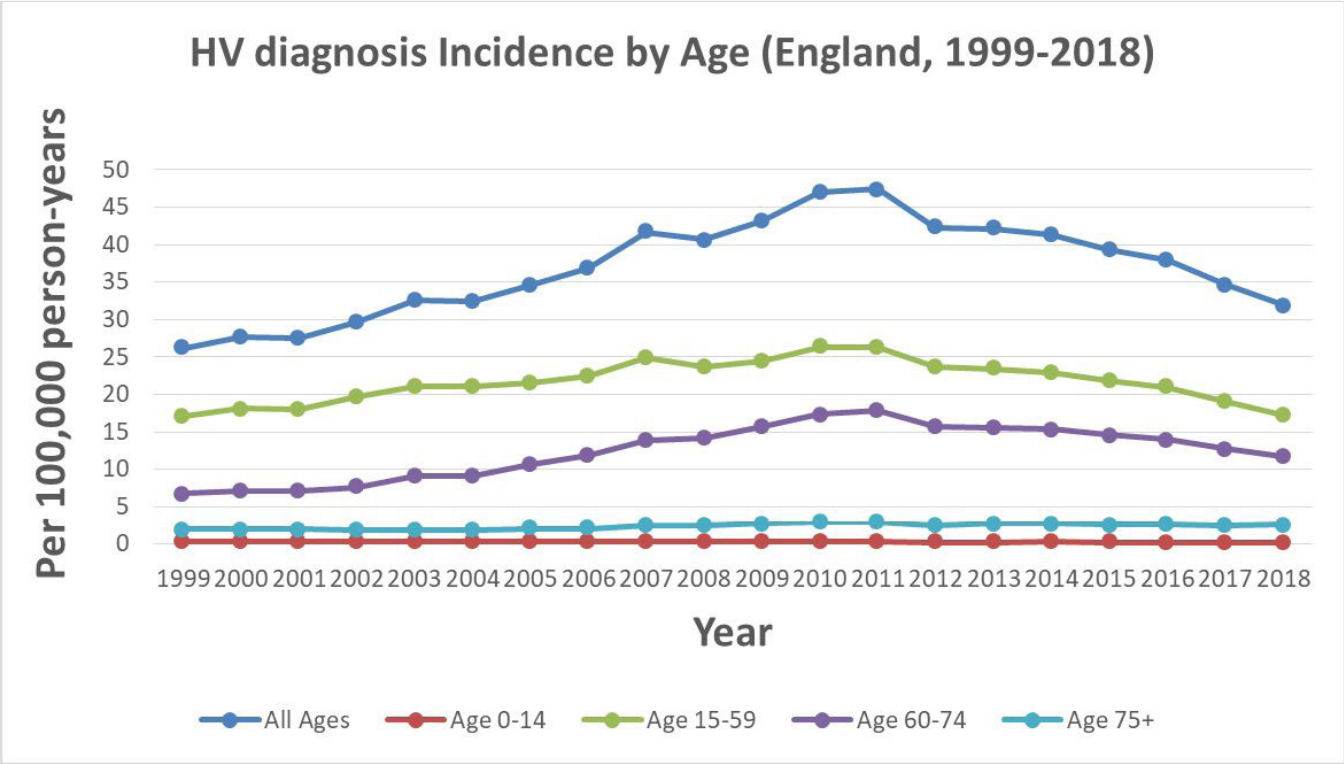
Supplementary Results Diagnosis



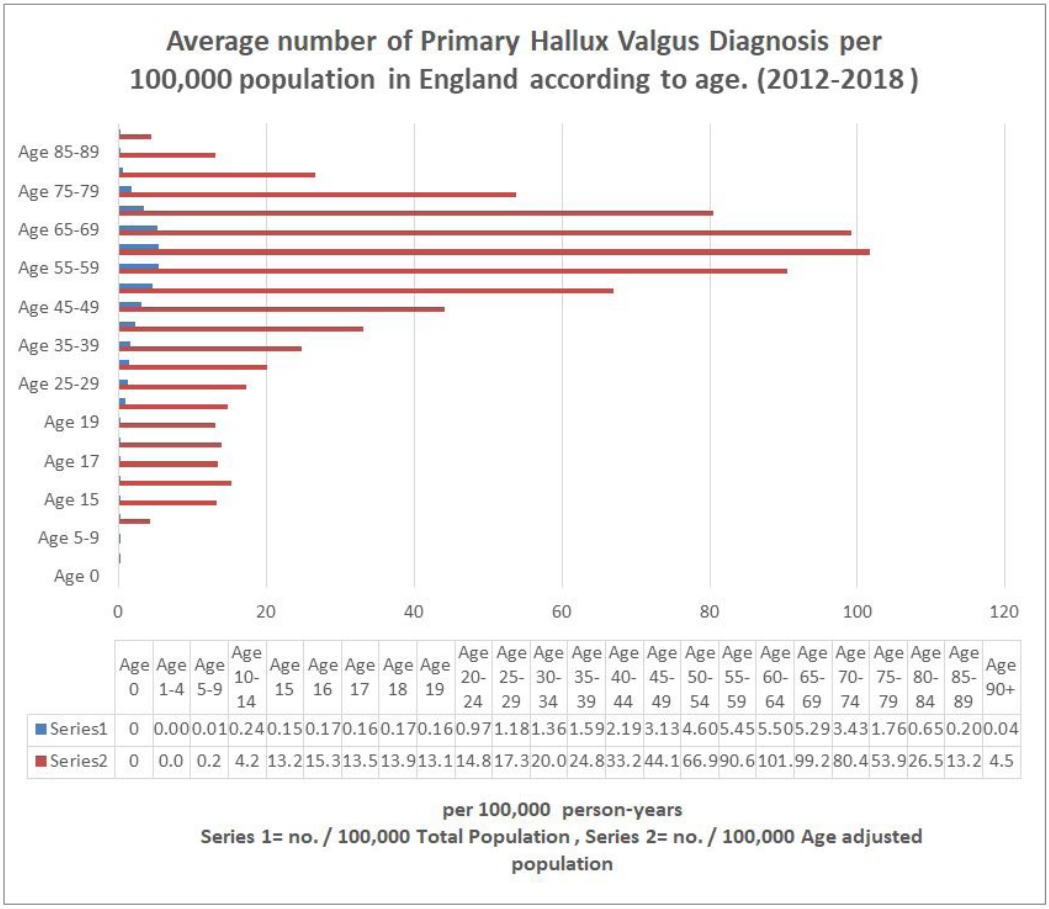
Graph 1: Trend in the number of admitted patients with a primary diagnosis of Hallux Valgus 1999-2018, NHS England.



Graph 2: Trend in the number of admitted patients with primary diagnosis of Hallux Valgus 1999-2018, NHS England, per 100,000 population



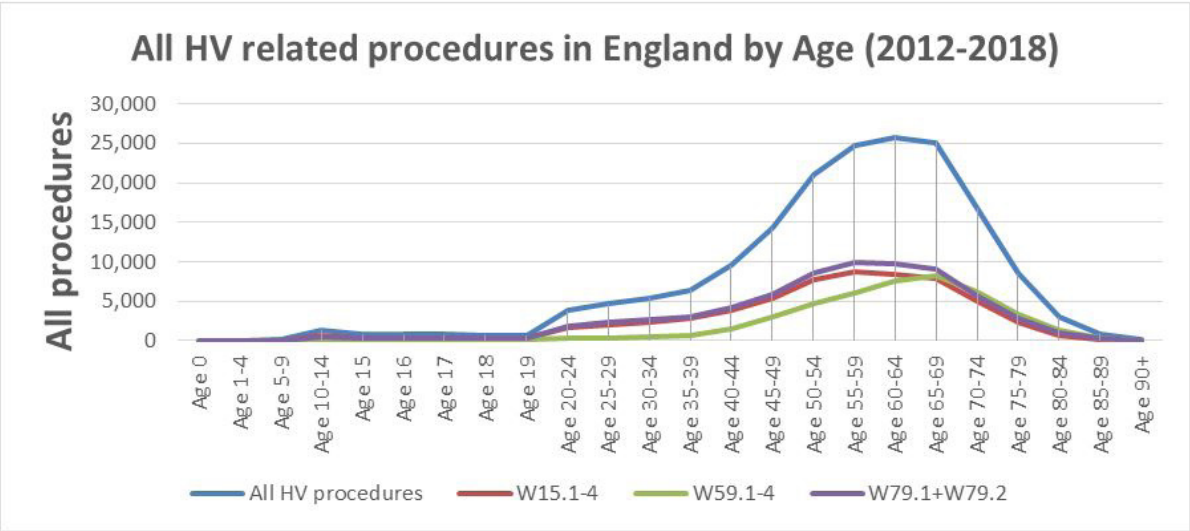
Graph 3: Trend in the number of admitted patients with primary diagnosis of Hallux Valgus 1999-2018, NHS England, per 100,000 population



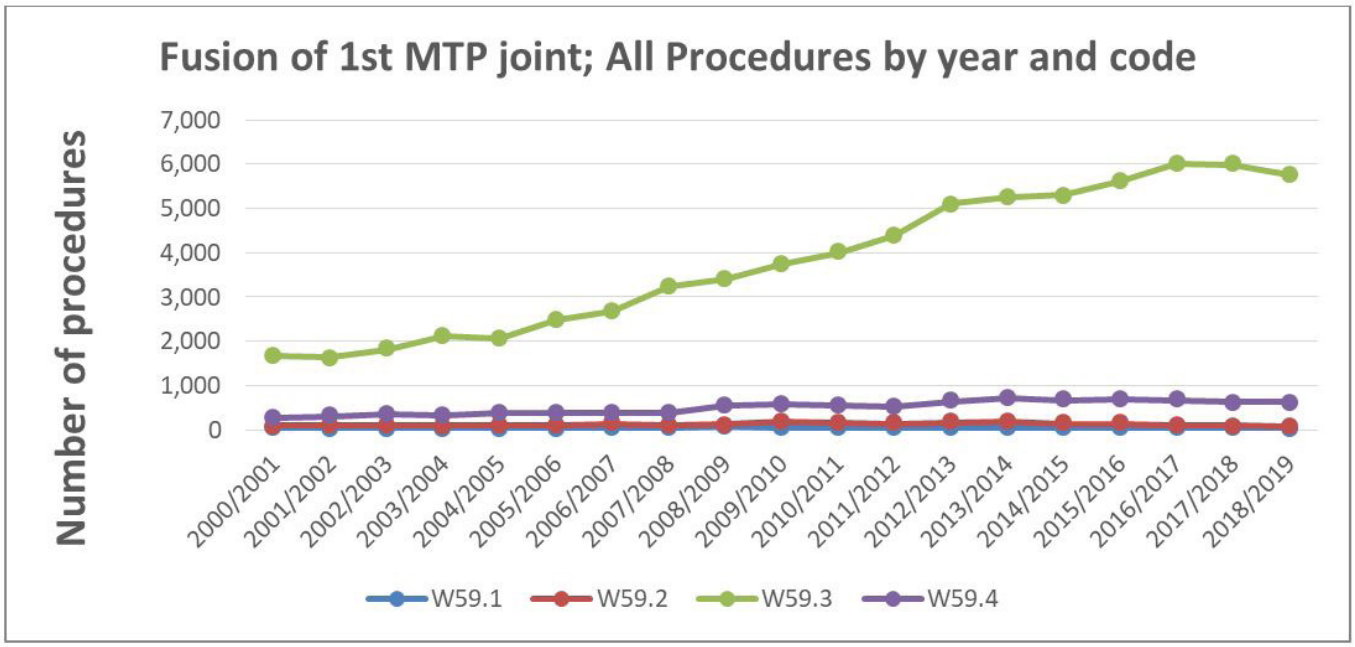
	Age 0	Age 1-4	Age 5-9	Age 10-14	Age 15	Age 16	Age 17	Age 18	Age 19	Age 20-24	Age 25-29	Age 30-34	Age 35-39	Age 40-44	Age 45-49	Age 50-54	Age 55-59	Age 60-64	Age 65-69	Age 70-74	Age 75-79	Age 80-84	Age 85-89	Age 90+
Series1	0	0.00	0.01	0.24	0.15	0.17	0.16	0.17	0.16	0.97	1.18	1.36	1.59	2.19	3.13	4.60	5.45	5.50	5.29	3.43	1.76	0.65	0.20	0.04
Series2	0	0.0	0.2	4.2	13.2	15.3	13.5	13.9	13.1	14.8	17.3	20.0	24.8	33.2	44.1	66.9	90.6	101.	99.2	80.4	53.9	26.5	13.2	4.5

Graph 4: Age adjusted trend in the number of admitted patients with primary diagnosis of Hallux Valgus 2012-2018, NHS England, per 100,000 population

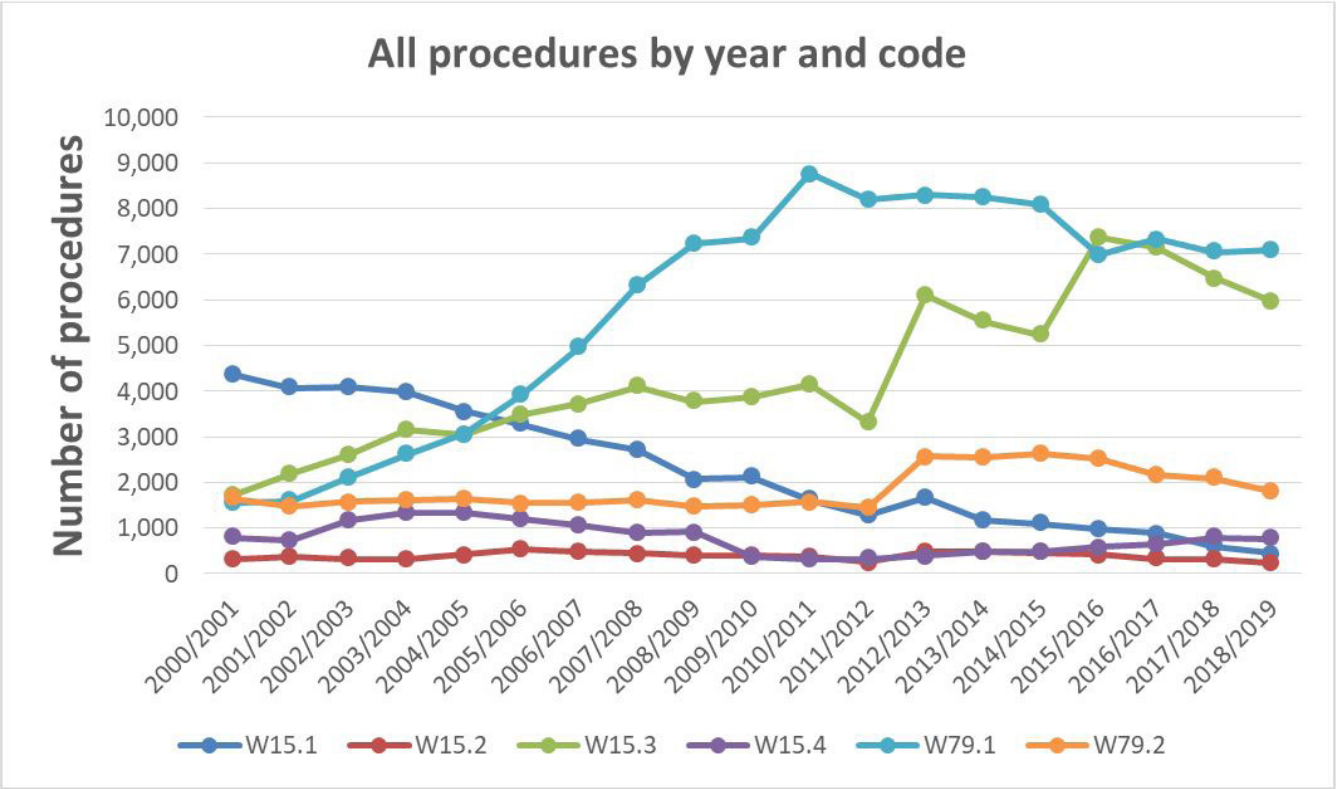
Supplementary Results, Procedures



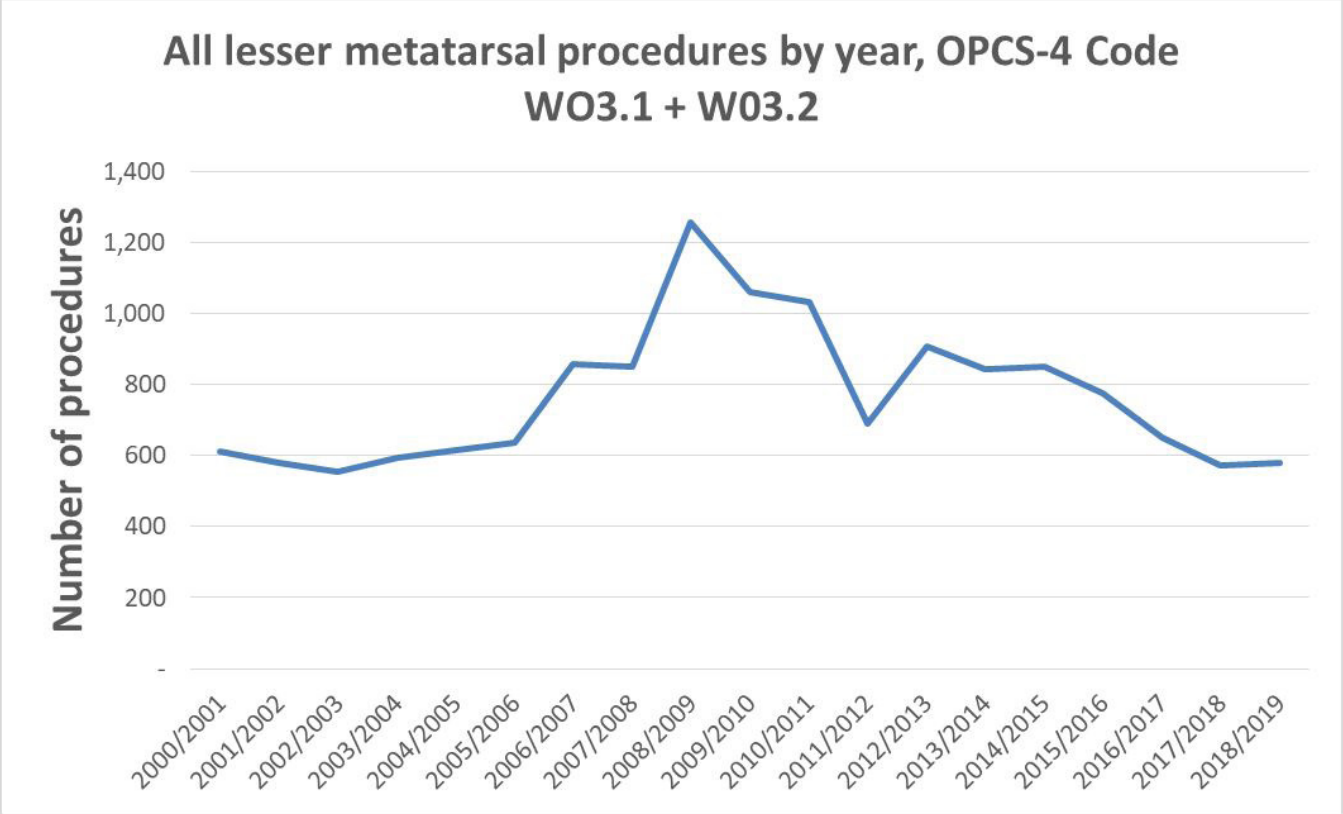
Graph 5: Age adjusted number of all Hallux Valgus related procedures between 2012-2018. W15.1 Osteotomy of neck of first metatarsal bone; W15.2 Osteotomy of base of first metatarsal bone; W15.3 Osteotomy of first metatarsal bone NEC; W15.4 Osteotomy of head of metatarsal bone; W59.1 Fusion of first metatarsophalangeal joint and replacement of lesser metatarsophalangeal joint; W59.2 Fusion of first metatarsophalangeal joint and excision of lesser metatarsophalangeal joint; W59.3 Fusion of first metatarsophalangeal joint NEC; W59.4 Fusion of interphalangeal joint of great toe; W79.1 Soft tissue correction of hallux valgus; W79.2 Excision of bunion NEC



Graph 6: Adjusted by procedure type, trend in the number of All Hallux Valgus related procedures between 2000-2019. W59.1 Fusion of first metatarsophalangeal joint and replacement of lesser metatarsophalangeal joint; W59.2 Fusion of first metatarsophalangeal joint and excision of lesser metatarsophalangeal joint; W59.3 Fusion of first metatarsophalangeal joint NEC; W59.4 Fusion of interphalangeal joint of great toe



Graph 7: Adjusted by procedure type, trend in the number of All Hallux Valgus related procedures between 2000-2019. W15.1 Osteotomy of neck of first metatarsal bone; W15.2 Osteotomy of base of first metatarsal bone; W15.3 Osteotomy of first metatarsal bone NEC; W15.4 Osteotomy of head of metatarsal bone; W79.1 Soft tissue correction of hallux valgus; W79.2 Excision of bunion NEC



Graph 8: Trend in the number of All Hallux Valgus related procedures (OPCS-4 W03.1 + W03.2) code between 2000-2019. W03.1 Excision of heads of multiple lesser metatarsals; W03.2 Osteotomy of multiple metatarsals

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