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The prevalence of foot problems in older women: a cause for concern

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Abstract

Background Painful feet are an extremely common problem amongst older women. Such problems increase the risk of falls and hamper mobility. The aetiology of painful and deformed feet is poorly understood.

Methods Data were obtained during a pilot case–control study about past high heel usage in women, in relation to osteoarthritis of the knee. A total of 127 women aged 50–70 were interviewed (31 cases, 96 controls); case–control sets were matched for age. The following information was obtained about footwear: (1) age when first wore shoes with heels 1, 2 and 3 inches high; (2) height of heels worn for work; (3) maximum height of heels worn regularly for work, going out socially and for dancing, in 10-year age bands. Information about work-related activities and lifetime occupational history was gathered using a Life-Grid. The interview included a foot inspection.

Results Foot problems, particularly foot arthritis, affected considerably more cases than controls (45 per cent versus 16 per cent, $p = 0.001$) and was considered a confounder. Cases were therefore excluded from subsequent analyses. Amongst controls, the prevalence of any foot problems was very high (83 per cent). All women had regularly worn one inch heels and few (8 per cent) had never worn 2 inch heels. Foot problems were significantly associated with a history of wearing relatively lower heels. Few work activities were related to foot problems; regular lifting was associated with foot pain ($p = 0.03$).

Conclusion Most women in this age-group have been exposed to high-heeled shoes over many years, making aetiological research difficult in this area. Foot pain and deformities are widespread. The relationship between footwear, occupational activities and foot problems is a complex one that deserves considerably more research.

Keywords: footwear, feet, heel, prevalence, aetiology

Introduction

Painful feet can be an important problem in older populations, particularly in women[1] and especially in those with abnormalities such as calluses or corns, hallux deformities and hammer toes.[2] These problems are rarely life-threatening, but they are associated with gait abnormalities and an increased likelihood of falling and overall reduced health-related quality of life.[3–5] Foot pain may also be a cause of functional deterioration in people who are not otherwise disabled.[2] Set against a background of inadequate provision of services for foot health,[6] and in view of the ageing profile of the UK population, the prevalence of foot problems in older women is an important public health issue.

Much has been written about the harmful effects of ill-fitting, poorly designed shoes.[7–9] Shoes with high heels have been increasingly worn by women since the First World War and this practice has been suggested as a cause of foot problems for decades.[8,10–14] However, no epidemiological studies have evaluated the long-term effects on foot health associated with wearing high-heeled shoes.

We report here data on foot problems and wearing of high heels in a population sample of older women in Oxfordshire. These data were obtained in the course of a pilot study for a case–control study of the aetiology of osteoarthritis of the knee, particularly with reference to the wearing of high-heeled shoes.

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In this paper we report the high prevalence of foot problems in control women, selected from women without any knee problems aged 50–70 years. We also describe the relationship between foot problems and demographic and occupational factors and past shoe-wearing practices.

Methods

The case–control study

The data reported here were collected as part of a pilot case–control study. Cases were women aged 50–70 years, who had been placed on a waiting list within the preceding 12 months for knee replacement surgery for primary idiopathic osteoarthritis. The study was limited to patients resident within 20 miles of the Nuffield Orthopaedic Centre, Oxford.

The control group

Six candidate controls were selected for each case. They were identified from the register of the general practice that the case was registered with and were matched for age to the case as closely as possible within 2 years of date of birth. The exclusion criteria for controls were regular moderate knee pain and consultation regarding a knee problem with a doctor within the last 3 years. The six controls were identified by the general practitioner and contacted by a letter (signed by the general practitioner), with an enclosed information sheet, reply card and a pre-paid envelope. Reminders were sent to non-responders after 2 weeks.

Sample size

This was a pilot study intended to test the feasibility of the case and control recruitment as well as the measurement instruments. The aim was to obtain the maximum number of matched case–control sets within the 10 month recruitment phase. A pragmatic approach was adopted rather than a formal power calculation, as no relevant population data existed.

Training of the interviewer and development of interview schedule

Interviews were carried out by a research nurse (S.-A.M.), who spent 3 months piloting the questionnaire and being trained in interviewing skills. Pilot interviews were carried out with volunteer women in the study age group. The research nurse was also trained by a podiatrist (G.L.) to carry out foot examinations.

Interview schedule and conduct

All interviews occurred in respondents' own homes. Respondents were asked to have available past photographs of themselves, preferably full-length. In addition, picture cues were available during the interview from two photograph files. One of these contained photographs and headlines about historical events and fashion styles taken from old newspapers, women's magazines and from reference books about fashion and shoes. The second picture file specifically concentrated on shoes and was used when collecting information on shoe wearing (described below).

A semi-structured interview schedule was used. Interviews began by gathering information on a Life-Grid. The method involves cross-referencing the dates of changes in areas of interest – for example, housing and occupation – against personal details of a person's life such as the death of a parent, the birth of a first child, as well as against events in the outside world, such as war and royal weddings. This method has been described elsewhere[15] and evidence has been presented to show that the technique aids recall[16] (further details are given in the Appendix). As the Life-Grid evolved, items of information were simultaneously recorded into standard tables. This permitted the calculation of variables such as number of years spent doing work that involved regular squatting, lifting or cleaning floors on knees. Part-time jobs were counted as half-time in all cases.

Once completed, the Life-Grid was used throughout the remainder of the interview as a cross-referencing aid to recall. In addition to asking about past shoe-wearing behaviour, the interview obtained information relating to education and social class, activities involved in any job or period of work, including home-work and child care that lasted for 1 year or more, past and present problems, symptoms or operations affecting the respondent's feet, and information regarding general health and lifestyle variables.

The final part of the interview involved a foot inspection for signs of bunions, crossed toes and other abnormalities that might be associated with previous footwear.

Variables measured

The following variables were recorded.

Age at first wearing high heels. Respondents were asked to say how old they were when they first wore a pair of shoes with heels that were 1, 2 and 3 inches high.

Shoes worn for work. For each job or period of work that was recorded, respondents were asked if they had been expected to regularly wear any particular types of shoes. They were also asked the height of the heel 'worn most often in this job'.

Shoe types worn in different circumstances. The respondent was asked to look through photographs of 38 different styles of shoes. For each shoe, the facing page showed life-size pictures of heels with a range of heights. Respondents were asked to say if they had ever owned, worn regularly for work, worn regularly for going out socially or worn regularly for dancing, any shoes similar to each picture. If they mentioned wearing any shoe, they were asked to identify the heel height.

Education level. The age when respondents completed their full-time education and their highest educational qualification were recorded.

Housing. Data included respondents' lifetime number of years spent living in accommodation that they or their family owned (including having a mortgage) and the number of years in accommodation that had no heating, or no inside lavatory. Another variable aggregated the number of years the respondent had lived in a large town, or city.

Sports participation. Information was obtained about participation in competitive sports. Questions took the form: 'Have you ever engaged in any of the following sporting activities?', and if so, 'Did you play competitively?' Further questions included the age when the participant engaged in sports and the regularity (number of years, weeks per year, hours per week) with which sports were played. An approximate 'lifetime total numbers of hours' was computed.

Anthropometry. Self-reported height, and approximate weight at the time women left school and when they were in their late thirties were recorded.

Statistical analysis

We compared recorded characteristics between those with and without foot problems. We used a χ^2 test for categorical variables, calculated the mean difference (plus 95 per cent confidence intervals (CI)) for normally distributed continuous variables and used a Mann–Whitney U-test to compare non-normally distributed continuous variables.

Results

Ninety-six control women were interviewed and underwent foot examination. The majority of them (83 per cent) reported at least one foot problem or exhibited a foot abnormality on inspection (Table 1). However, only 23 per cent reported foot pain lasting more than 1 week and 16 per cent reported arthritis affecting the feet. The cases (women with osteoarthritis of the knee) in this study are not discussed here, but it was noticeable that they reported considerably higher levels of foot morbidity than the already high levels reported by the control women.

There was no significant relationship with educational level or time spent in competitive sports and any of the foot problems listed (Table 2). In general, there was no relationship between age and presence of foot problems, except that women with curled or hammer toes had a greater mean age (2.19 years older). The only other significant difference related to a higher risk of corns in women with a lower body mass index (BMI) at school-leaving age.

Table 1 Reported and observed foot problems in 96 randomly selected women

	Controls (n = 96) No. (%)
Curled or hammer toes	35 (37)
Arthritis affecting the feet	15 (16)
Foot pain lasting more than 1 week	22 (23)
Bunion(s)	36 (38)
Crossed toes	4 (4)
Corns	59 (62)
Any of the above foot problems	79 (83)

Age at first wearing high heels

All the women had worn shoes with 1 inch heels regularly at some time, whereas 8 per cent (8/96) had never worn 2 inch heels and 33 per cent (32/96) reported never wearing 3 inch heels. The mean age and standard deviation (SD) for first wearing heels 1, 2 and 3 inches high was 15.1 (2.3), 16.7 (1.8) and 18.5 (3.6) years, respectively. The presence of bunions was associated with a significantly lower age at first wearing 1 inch heels ($p = 0.05$), but no other foot problems were related to the age at first wearing high heels (Table 3).

Shoe uniform at work

Twenty-six per cent of the respondents (25/96) had, at some time, had a job in which they were expected to wear particular types of shoes. These women were less likely to have ever worn heels $\geq$2 inches high to work than were other women [11 (44 per cent) versus 34 (52 per cent)], but there were no statistically significant differences between the type of work shoes worn by these, versus other women.

Highest heels worn at different ages

Table 4 shows the highest heels reported within 10 year age-bands for shoes worn regularly for going out socially, worn regularly for dancing and worn regularly for work or housework in relation to reported and observed foot problems. A number of consistent associations were found between having foot problems and regularly wearing lower maximum heel heights relative to those having no foot problems. This particularly applied to shoes worn out socially and for dancing. The majority of these findings were statistically significant.

Occupational activities, heels and foot problems

The majority of participants had spent many years engaged in physically demanding work-related activities. For example, 90.6 per cent of women had spent more than 10 years doing work that regularly required bending, and 91.7 per cent doing work that required lifting. However, few work activities showed any significant association with shoe-wearing practices. Table 5 shows the number of years that women engaged in occupational activities in relation to foot problems. Having painful feet for at least a week was associated with spending more years doing work that involved regular lifting (foot pain versus no foot pain: median 30.3 and 24.5 years, respectively; $p = 0.03$). There were no other significant relationships.

Table 2 Characteristics associated with particular reported or observed foot problems amongst the controls

		Any foot problems			Foot arthritis			Foot pain lasting >1 week		
n = 96	**All No. (%)**	**Yes No. (%)**	**No No. (%)**	**χ^2**	**Yes No. (%)**	**No No. (%)**	**χ^2**	**Yes No. (%)**	**No No. (%)**	**χ^2**
Highest qualification										
None	38 (40)	33 (42)	5 (31)		7 (47)	31 (38)		6 (27)	32 (43)	
Intermediate	45 (47)	36 (46)	9 (56)	$p = 0.71$	7 (47)	39 (48)	$p = 0.70$	12 (55)	34 (46)	$p = 0.35$
Degree +	12 (13)	10 (13)	2 (13)		1 (7)	11 (14)		4 (18)	8 (11)	
Ever lived in large town or city	78 (81)	65 (82)	12 (75)	$p = 0.50$	12 (80)	66 (82)	$p = 0.89$	19 (86)	59 (80)	$p = 0.48$
Currently has a driving licence	74 (77)	61 (77)	12 (75)	$p = 0.85$	13 (87)	61 (75)	$p = 0.34$	18 (82)	56 (76)	$p = 0.55$

Continuous variables (normally distributed)	**Mean (SD)**	**Mean difference* (95% CI) *t*-test *p* value**	**Mean difference (95% CI) *t*-test *p* value**	**Mean difference (95% CI) *t*-test *p* value**
Age (years)	63.41 (4.87)	0.99 (–1.68 to 3.67) $p = 0.46$	–0.24 (–2.98 to 2.49) $p = 0.86$	0.71 (–1.65 to 3.07) $p = 0.55$
Age when left full-time education	16.70 (2.60)	0.22 (–1.20 to 1.65) $p = 0.76$	0.42 (–1.50 to 1.50) $p = 0.95$	0.63 (–0.62 to 1.88) $p = 0.32$
BMI when left school $n = 81$	20.90 (3.17)	–0.50 (–2.29 to 1.28) $p = 0.58$	0.70 (–1.44 to 2.84) $p = 0.52$	0.13 (–1.53 to 1.80) $p = 0.87$
BMI age 35–40 years $n = 91$	22.67 (3.13)	0.13 (–1.60 to 1.87) $p = 0.88$	1.50 (–0.29 to 3.29) $p = 0.10$	1.07 (–0.53 to 2.66) $p = 0.19$
Height (metres)	1.63 (6.73)	0.01 (–0.02 to 0.05) $p = 0.56$	–0.00 (–0.05 to 2.90) $p = 0.65$	0.03 (–0.00 to 0.06) $p = 0.06$

Continuous variables (non-normally distributed)	**Median (range)**	**Median (range) Mann–Whitney U**		**Median (range) Mann–Whitney U**		**Median (range) Mann–Whitney U**	
		Yes	**No**	**Yes**	**No**	**Yes**	**No**
Parity	2.0 (0 to 7)	2.0 (0 to 7) $p = 0.61$	2.0 (0 to 4)	2.0 (0 to 7) $p = 0.88$	2.0 (0 to 4)	2.0 (0 to 4) $p = 0.22$	2.0 (0 to 7)
Lifetime hours engaged in competitive sports	192.00 (0 to 18 096)	192 (0 to 18 096) $p = 0.78$	96 (0 to 10 056)	384 (0 to 18096) $p = 0.31$	192 (0 to10 056)	336 (0 to 7152) $p = 0.11$	96 (0 to 18096)

	Bunion			**Curled or hammer toes**			**Corns**		
n = 96	**Yes No. (%)**	**No No. (%)**	**χ^2**	**Yes No. (%)**	**No No. (%)**	**χ^2**	**Yes No. (%)**	**No No. (%)**	**χ^2**
Highest qualification									
None	16 (44)	22 (39)		17 (49)	21 (34)		25 (42)	13 (35)	
Intermediate	16 (44)	28 (53)	$p = 0.86$	15 (43)	31 (51)	$p = 0.35$	28 (48)	18 (49)	$p = 0.62$
Degree +	4 (11)	7 (12)		3 (9)	9 (15)		6 (10)	6 (16)	
Ever lived in large town or city	28 (78)	47 (83)	$p = 0.58$	30 (86)	48 (79)	$p = 0.40$	48 (81)	30 (81)	$p = 0.97$
Currently has a driving licence	25 (69)	46 (81)	$p = 0.21$	29 (83)	45 (74)	$p = 0.31$	45 (76)	29 (78)	$p = 0.81$

Continuous variables (normally distributed)	**Mean difference (95% CI) *t*-test *p* value**	**Mean difference (95% CI) *t*-test *p* value**	**Mean difference (95% CI) *t*-test *p* value**
Age (years)	–0.54 (–2.62 to 1.55) $p = 0.61$	2.19 (0.32 to 4.07) $p = 0.02$	1.67 (–0.34 to 3.68) $p = 0.12$
Age when left full-time education	–0.36 (–1.46 to 0.73) $p = 0.51$	–0.51 (–1.61 to 0.58) $p = 0.35$	–0.14 (–1.23 to 0.95) $p = 0.80$
Parity	–0.62 (–1.26 to 0.05) $p = 0.06$	–0.10 (–0.65 to 0.63) $p = 0.98$	–0.35 (–0.98 to 0.28) $p = 0.27$
BMI when left school n = 80	–1.05 (–2.56 to 0.45) $p = 0.17$	–1.20 (–2.66 to 0.26) $p = 0.11$	–1.97 (–3.33 to –0.61) $p < 0.01$
BMI around age 35–40 $n = 90$	–0.62 (–1.99 to 0.75) $p = 0.37$	–0.13 (1.52 to 1.25) $p = 0.85$	–1.16 (–2.48 to 0.17) $p < 0.09$
Height (mm)	3.82 (–24.98 to 32.63) $p = 0.79$	21.55 (–6.59 to 49.68) $p = 0.13$	19.12 (–8.77 to 47.00) $p < 0.18$

Table 2 (Continued)

Continuous variables (non-normally distributed)	Median (range) Mann–Whitney U		Median (range) Mann–Whitney U		Median (range) Mann–Whitney U	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**
Parity	2.0 (0 to 4.0) $p = 0.50$	2.0 (0 to 7.0)	2.0 (0 to 4.0) $p = 0.53$	2.0 (0 to 7.0)	2.0 (0 to 4.0) $p = 0.14$	2.0 (0 to 7.0)
Lifetime hours engaged in competitive sports	0 (0 to 3264) $p = 0.13$	288 (0 to 18 096)	240 (0 to 18 096) $p = 0.65$	192 (0 to 10 056)	192 (0 to 7152) $p = 0.78$	192 (0 to18096)

*The mean difference is the mean age, BMI, etc. representing those who said they had a foot problem minus the mean of those who did not have a problem.

Table 3 Reported or observed foot problems in relation to the age (mean age is given, with SD in parentheses, and *p* value) when women first wore heels ≥1, 2, or 3 inches high (independent two samples t-tests)

	Age when first wore heels		
	≥1 inch high (*n* = 96)	**≥2 inches high (*n* = 88)**	**≥3 inches high (*n* = 64)**
Ever had a foot problem			
Yes	15.1 (2.2)	16.7 (1.8)	18.4 (3.9)
No	15.0 (2.5) $p = 0.81$	16.8 (2.0) $p = 0.93$	18.7 (2.1) $p = 0.86$
Foot arthritis			
Yes	15.4 (2.5)	16.6 (2.4)	18.1 (5.3)
No	15.0 (2.2) $p = 0.57$	16.8 (1.7) $p = 0.82$	18.5 (3.4) $p = 0.78$
Ever had foot pain lasting a week or more			
Yes	15.5 (2.0)	17.1 (1.7)	19.8 (4.7)
No	15.0 (2.3) $p = 0.30$	16.6 (1.9) $p = 0.31$	18.1 (3.3) $p = 0.13$
Ever had a bunion			
Yes	14.5 (2.5)	16.7 (1.9)	18.3 (3.6)
No	15.4 (2.0) $p = 0.05$	16.8 (1.9) $p = 0.84$	18.3 (3.3) $p = 0.99$
Curled or hammer toes			
Yes	15.5 (2.2)	16.7 (1.8)	19.3 (4.9)
No	14.9 (2.3) $p = 0.20$	16.7 (1.9) $p = 0.98$	18.1 (2.8) $p = 0.30$
Corns			
Yes	15.0 (2.4)	16.7 (2.0)	18.2 (3.7)
No	15.3 (2.0) $p = 0.49$	16.8 (1.7) $p = 0.68$	19.0 (3.6) $p = 0.35$

Discussion

We have reported the findings from a control population recruited as part of a pilot study of osteoarthritis of the knee. The study was not designed to test any hypothesis related to the aetiology of foot problems, and, as such, the findings should be regarded as no more than hypothesis generating, rather than hypothesis testing.

Over 80 per cent of women in this population sample had a foot problem of some kind, and at least a third had a problem (foot pain, bunion, curled or hammer toes) that would limit their mobility to some extent. This finding is similar to that obtained in a larger and earlier population survey of people over the age of 65, where 83 per cent of people were found to have at least one foot symptom or sign.[2] However, because women who had knee problems were excluded from our sample it is likely that our estimate of the prevalence of foot problems is an underestimate. The high prevalence of mobility-impairing problems has important implications. Impaired mobility inevitably leads to lower physical activity, which, in turn, has a number of deleterious health consequences. Interventions to prevent and to treat foot problems may prove to be highly cost-effective.

Corns (62 per cent), bunions (38 per cent) and curled or hammer toes (37 per cent) were the commonest foot complaints reported by these women. We did not find any social or biological characteristics associated with having any of these foot problems and only work that had involved regular lifting was significantly associated with any particular problem (foot pain lasting at least a week).

Table 4 Relationship between reported or observed foot problems and the maximum height of heel women reported wearing (regularly) for socializing, for dancing and for work, when they were in their twenties, thirties, forties and fifties (mean maximum heel height is given in inches, with SD in parentheses, and *p* value)*

	Mean maximum height heel (in inches) (with SD in parentheses) worn regularly											
	Shoes worn for going out socially				**Shoes worn for dancing**				**Shoes worn for work**			
***n* = 96**	**20s**	**30s**	**40s**	**50s**	**20s**	**30s**	**40s**	**50s**	**20s**	**30s**	**40s**	**50s**
Any foot problems												
Yes	2.75 (0.81)	2.75 (0.84)	2.58 (0.81)	2.34 (0.80)	2.82 (0.79)	2.72 (0.78)	2.61 (0.76)	2.38 (0.69)	2.17 (0.99)	1.95 (0.99)	1.87 (0.93)	1.75 (0.80)
No	2.84 (0.51)	2.81 (0.54)	2.47 (0.59)	2.47 (0.59)	2.86 (0.53)	2.81 (0.52)	2.62 (0.55)	2.62 (0.55)	2.25 (0.93)	2.09 (0.82)	1.88 (0.70)	1.97 (0.62)
	$p = 0.57$	$p = 0.72$	$p = 0.60$	$p = 0.53$	$p = 0.87$	$p = 0.69$	$p = 0.97$	$p = 0.25$	$p = 0.76$	$p = 0.60$	$p = 0.99$	$p = 0.30$
Foot arthritis												
Yes	2.40 (0.89)	2.43 (0.94)	2.33 (0.88)	1.90 (0.82)	2.50 (0.83)	2.64 (0.87)	2.45 (0.82)	2.16 (0.58)	2.03 (1.09)	1.88 (1.18)	1.58 (0.98)	1.33 (0.63)
No	2.82 (0.73)	2.80 (0.77)	2.59 (0.77)	2.43 (0.75)	2.86 (0.74)	2.72 (0.76)	2.61 (0.73)	2.45 (0.69)	2.19 (0.96)	1.98 (0.92)	1.91 (0.87)	1.86 (0.77)
	$p = 0.052$	$p = 0.10$	$p = 0.26$	$p = 0.015$	$p = 0.12$	$p = 0.74$	$p = 0.52$	$p = 0.11$	$p = 0.56$	$p = 0.72$	$p = 0.19$	$p = 0.02$
Ever had foot pain lasting for a week or more												
Yes	2.41 (0.84)	2.45 (0.83)	2.23 (0.83)	2.00 (0.78)	2.50 (0.87)	2.40 (0.85)	2.25 (0.83)	2.00 (0.71)	2.13 (0.98)	2.02 (0.97)	1.91 (0.93)	1.64 (0.74)
No	2.86 (0.72)	2.83 (0.79)	2.64 (0.76)	2.45 (0.75)	2.91 (0.70)	2.81 (0.73)	2.69 (0.69)	2.50 (0.65)	2.18 (0.99)	1.95 (0.97)	1.85 (0.88)	1.81 (0.78)
	$p = 0.016$	$p = 0.054$	$p = 0.030$	$p = 0.017$	$p = 0.034$	$p = 0.038$	$p = 0.026$	$p = 0.010$	$p = 0.81$	$p = 0.76$	$p = 0.78$	$p = 0.37$
Ever had a bunion												
Yes	2.57 (0.78)	2.54 (0.83)	2.38 (0.83)	2.15 (0.72)	2.66 (0.78)	2.60 (0.80)	2.48 (0.77)	2.24 (0.62)	1.99 (0.94)	1.78 (0.91)	1.77 (0.86)	1.66 (0.72)
No	2.87 (0.74)	2.88 (0.74)	2.66 (0.71)	2.46 (0.76)	2.91 (0.71)	2.79 (0.71)	2.66 (0.67)	2.50 (0.65)	2.31 (1.00)	2.12 (0.98)	1.96 (0.91)	1.88 (0.80)
	$p = 0.065$	$p = 0.045$	$p = 0.084$	$p = 0.38$	$p = 0.13$	$p = 0.26$	$p = 0.28$	$p = 0.093$	$p = 0.12$	$p = 0.10$	$p = 0.33$	$p = 0.18$
Currently has curled or hammer toes												
Yes	2.76 (0.84)	2.70 (0.86)	2.51 (0.84)	2.24 (0.85)	2.73 (0.91)	2.66 (0.91)	2.50 (0.86)	2.30 (0.75)	2.02 (1.06)	1.86 (0.10)	1.75 (1.03)	1.62 (0.86)
No	2.75 (0.73)	2.77 (0.78)	2.57 (0.76)	2.41 (0.73)	2.85 (0.66)	2.74 (0.70)	2.64 (0.67)	2.45 (0.65)	2.25 (0.93)	2.02 (0.88)	1.93 (0.80)	1.87 (0.71)
	$p = 0.99$	$p = 0.68$	$p = 0.76$	$p = 0.31$	$p = 0.52$	$p = 0.66$	$p = 0.42$	$p = 0.37$	$p = 0.27$	$p = 0.44$	$p = 0.35$	$p = 0.16$
Currently has corns												
Yes	2.78 (0.82)	2.79 (0.84)	2.58 (0.80)	2.32 (0.81)	2.86 (0.83)	2.74 (0.86)	2.62 (0.78)	2.40 (0.70)	2.11 (1.03)	1.90 (1.04)	1.85 (0.98)	1.69 (0.80)
No	2.72 (0.69)	2.68 (0.76)	2.49 (0.77)	2.38 (0.74)	2.74 (0.64)	2.67 (0.65)	2.55 (0.69)	2.40 (0.66)	2.26 (0.89)	2.07 (0.82)	1.88 (0.74)	1.91 (0.72)
	$p = 0.70$	$p = 0.51$	$p = 0.56$	$p = 0.73$	$p = 0.45$	$p = 0.68$	$p = 0.68$	$p = 0.98$	$p = 0.71$	$p = 0.42$	$p = 0.88$	$p = 0.20$

*Independent two samples *t*-tests.

Table 5 Relationship between time (given in years, median with interquartile range (IQR) in parentheses, and *p* values) spent regularly carrying out various occupational activities and reported or observed foot problems amongst control subjects

n = 96	Number of years doing work that regularly involved:								
Foot problems	**Lifting**	**Standing**	**Walking**	**Kneeling**	**Bending**	**Cleaning floors on knees**	**Sitting**	**Squatting**	**Climbing stairs**
Any foot problems									
Yes	26.0 (17.5)	28.3 (15.0)	27.5 (16.0)	19.0 (15.5)	27.0 (18.0)	10.0 (10.0)	13.0 (21.0)	20.5 (17.5)	24.0 (14.0)
No	25.8 (24.9)	27.3 (26.7)	26.5 (23.4)	11.8 (32.1)	23.3 (30.6)	11.5 (21.8)	10.0 (29.1)	21.7 (33.1)	27.8 (11.7)
	$p = 0.87$	$p = 0.66$	$p = 0.91$	$p = 0.18$	$p = 0.54$	$p = 0.80$	$p = 0.50$	$p = 0.84$	$p = 0.17$
Foot arthritis									
Yes	28.0 (16.0)	23.5 (17.5)	23.5 (13.5)	19.0 (18.5)	24.5 (10.8)	7.0 (13.5)	12.0 (15.0)	20.0 (19.0)	26.0 (12.5)
No	25.8 (20.5)	29.0 (19.0)	28.0 (17.0)	17.5 (18.3)	27.0 (22.5)	10.5 (10.5)	13.0 (22.9)	20.0 (21.8)	25.0 (15.0)
	$p = 0.82$	$p = 0.10$	$p = 0.16$	$p = 0.86$	$p = 0.98$	$p = 0.51$	$p = 0.53$	$p = 0.65$	$p = 0.96$
Foot pain									
Yes	30.3 (18.3)	30.3 (25.1)	25.1 (17.6)	23.5 (22.6)	28.8 (25.6)	4.5 (12.3)	12.3 (25.4)	26.8 (18.9)	25.0 (12.8)
No	24.5 (19.3)	27.8 (16.8)	27.8 (16.1)	16.3 (17.8)	24.8 (20.3)	10.5 (10.6)	13.0 (21.1)	17.5 (20.1)	25.5 (15.4)
	$p = 0.03$	$p = 0.51$	$p = 0.47$	$p = 0.46$	$p = 0.18$	$p = 0.10$	$p = 0.71$	$p = 0.20$	$p = 0.68$
Bunion(s)									
Yes	27.3 (21.1)	30.3 (17.3)	29.0 (17.1)	19.0 (18.8)	28.8 (18.8)	8.5 (13.0)	13.0 (20.9)	20.5 (20.1)	22.0 (14.4)
No	26.0 (18.0)	27.5 (16.5)	26.5 (16.0)	17.5 (18.8)	25.5 (18.5)	10.5 (9.8)	12.5 (21.9)	20.5 (20.3)	26.5 (14.3)
	$p = 0.74$	$p = 0.28$	$p = 0.48$	$p = 0.56$	$p = 0.09$	$p = 0.86$	$p = 0.99$	$p = 0.79$	$p = 0.27$
Curled or hammer toes									
Yes	28.0 (15.0)	28.3 (14.5)	29.0 (15.0)	21.5 (14.0)	28.0 (15.0)	10.5 (16.0)	13.0 (16.5)	25.0 (16.0)	26.0 (10.5)
No	25.0 (21.5)	28.0 (20.5)	26.5 (19.9)	15.0 (20.3)	25.0 (23.5)	10.0 (10.3)	13.0 (22.8)	16.0 (25.5)	24.0 (17.4)
	$p = 0.15$	$p = 0.65$	$p = 0.34$	$p = 0.15$	$p = 0.23$	$p = 0.58$	$p = 0.74$	$p = 0.07$	$p = 0.85$
Corns									
Yes	26.0 (18.5)	28.0 (15.0)	27.5 (15.5)	20.0 (14.5)	26.0 (18.3)	10.0 (10.0)	13.0 (16.8)	20.5 (17.0)	23.0 (13.0)
No	25.0 (22.8)	29.0 (24.3)	24.0 (23.0)	15.0 (27.0)	26.0 (25.8)	8.0 (13.3)	13.0 (28.6)	16.0 (27.8)	28.0 (13.3)
	$p = 0.19$	$p = 0.46$	$p = 0.44$	$p = 0.17$	$p = 0.40$	$p = 0.40$	$p = 0.93$	$p = 0.48$	$p = 0.15$

All subjects had worn 1 inch high heels at some time, the vast majority (92 per cent) had worn 2 inch heels and two-thirds had worn heels 3 inches high. There was a suggestion that an earlier age at starting to wear 1 inch heels was related to the occurrence of bunions ($p = 0.05$). However, a number of foot problems were associated with wearing lower than average heels. An apparent 'protective effect' of wearing higher heels in relation to foot problems remains unlikely. This surprising finding could be explained by a tendency for women with foot problems to recall lower heel sizes (recall bias), or by measurement error in estimating exposure to wearing high heels. It could also be due to confounding by variables, particularly socio-economic variables, that are related to high-heel wearing. Nevertheless, our findings do not support the commonly held belief that wearing high heels is bad for feet, and at the very least support the need for greater caution in ascribing harm, and for more research on the subject.

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Appendix

The Life-Grid

The Life-Grid comprised four vertical lines on A3 size graph paper. The first line on the left-hand side represented the (pre-prepared) 'external' line, which listed past decades down its length. Notable historical events and fashion notes such as the 1939–1945 war, 1953 Coronation, 'the New Look' (*c*. 1952), the first man on the moon (1969), were recorded alongside as cues to memory recall. Three more vertical lines were drawn on the paper corresponding to the 'personal line', 'residence line' and 'occupation line'. To the personal line was added the subject's birth and that of their siblings, events such as leaving school and leaving the parental home, marriage, birth of children, death of parents, etc. Each event was marked on the line at the point corresponding to the year when the event occurred. To the residence line was added each residence where the respondent had lived during their lifetime. The same method was employed in completing the 'occupation line'. Here, periods of unemployment or home-making, and brief details of part-time and full-time jobs were all recorded. Each new piece of information added to the residence and occupation lines was sensitively negotiated and confirmed with reference to other information and dates already provided on the Life-Grid. Throughout, corrections and adjustments invariably needed to be made to information already provided as respondents improved the accuracy of dating through the process of cross-referencing between the different lines.

Once the Life-Grid had been completed, information about possible exposures was collected – all with reference to the Life-Grid. In some instances, information from the Life-Grid (such as jobs or particular periods of employment) was copied into a table so that further details (e.g. number of years in this job, part-time or full-time, (named) regular work activities) could be obtained in a straightforward, standard format. This form of data collection allowed exposure variables such as 'total number of years doing work that involved regular lifting' to be computed.

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