

Onset and Persistence of Disabling Foot Pain in Community-Dwelling Older Adults Over a 3-Year Period: A Prospective Cohort Study

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Background. Foot pain and related disability in older adults are common yet understudied problems. This study aimed to determine the onset and persistence of disabling foot pain in community-dwelling older adults over a 3-year period.

Methods. A 3-year follow-up postal survey was conducted in a population sample of older adults aged 50 years and older, recruited previously as part of the North Staffordshire Osteoarthritis Project. Disabling foot pain was defined as the report of problems on at least 1 of the 10 function items of the Manchester Foot Pain and Disability Index occurring on most/every day(s).

Results. Of persons without disabling foot pain at baseline, 8.1% had developed it at 3 years. Onset was greater with increasing age (50–59 years, 6.7%; 60–69 years, 9.1%; and ≥70 years, 9.5%; $p = .037$), in females (2.5% difference; 95% confidence interval 0.3%–4.8%), and in those with nondisabling foot pain at baseline than those without foot pain (14.2% difference; 95% confidence interval: 10.0%–19.1%). Persistence of disabling foot pain at 3 years was 71.7%, more common in females (9.3% difference; 95% confidence interval: 0.8%–18.0%) but not associated with age.

Conclusions. Accelerated onset with increasing age and frequent persistence suggests considerable public health impact of disabling foot pain as the population ages. Prevention of disabling foot pain in later life should be prioritized and predisposing factors identified as potential intervention targets.

Key Words: Foot—Pain—Population—Epidemiology—Older people.

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FOOT pain is a common problem among community-dwelling older adults. The importance of foot pain to the individual and from a public health perspective relates to its frequent association with physical impairments, such as poor balance (1), risk of falling (2), and locomotor disability (1,3–11).

Estimates of the population prevalence of foot pain in older adults range from 18% to 42% (1,3,4,8,10). Foot pain is more prevalent in women than in men (4,7,8)], but the relationship with age is less clear, with reports of higher, lower, and unchanged prevalence in older people (4,7,8,10)]. There are fewer estimates of the population prevalence of disabling foot pain, but they vary between 8% and 22% (6,12).

These existing estimates are cross-sectional and provide one indication of the current burden of disabling foot pain. Prospective data about the natural history of disabling foot pain are lacking. Such data would provide estimates of future burden and help to identify factors that could be targeted to prevent onset of or aid recovery from the problem.

The objectives of this study were (i) to determine the onset and persistence of disabling foot pain over 3 years and

how this relates to the prior presence of nondisabling foot pain and (ii) to examine the influence of age and gender on the onset and persistence of disabling foot pain.

METHODS

The study design was a prospective cohort study (recruitment and 3-year follow-up) of an older adult population using postal questionnaires. Both baseline and 3-year follow-up surveys consisted of a two-stage process involving an initial health survey questionnaire and a subsequent more intensive regional pains survey questionnaire. Ethical approval for all stages was obtained from the North Staffordshire Local Research Ethics Committee. The health survey questionnaire included a consent form on which participants indicated their consent for use of their health care data and for further postal contact.

Baseline Survey

The North Staffordshire Osteoarthritis Project (NorStOP) study protocol, data collection, and recruitment results have

been published previously (13,14). In summary, the sampling frame at recruitment consisted of all adults aged 50 years and older registered with three general practices from the North Staffordshire Primary Care Research Consortium ($n = 11,309$). Practice registers were examined by the general practitioners for exclusions (eg, severe psychiatric illness or terminal illness) prior to mailing.

In the first stage health survey questionnaire, participants were asked if they had experienced pain in and around the hands, hips, knees, or feet or problems in and around their hands in the last year. Those responding positively to any of these five screening questions and giving permission for recontact were mailed the second stage regional pain survey questionnaire. This repeated the screening question regarding foot pain in the last year and included the Manchester Foot Pain and Disability Index (MFPDI) (15).

Three-Year Follow-Up Survey

The same two-stage mailing procedure was repeated at 3-year follow-up in participants who had given written permission at baseline for further contact. Practice registers were screened for exclusions as at baseline. The records of persons no longer registered with their original practice were traced via the National Health Service registration system to establish their current address or whether they had died.

Definitions of Disabling Foot Pain, Onset, and Persistence

Definition of any foot pain.—At recruitment and 3-year follow-up, people were defined as having any foot pain if they responded “yes” to the item regarding foot pain on both the health survey questionnaire and the regional pain survey questionnaire and as not having any foot pain if they responded “no” to this item on both questionnaires. Persons responding inconsistently in the two questionnaires, at either baseline or 3-year follow-up, were excluded from the current analysis.

Definition of disabling foot pain.—The MFPDI is a 19-item self-completed questionnaire that assesses foot pain-related problems across four constructs: pain (5 items), function (10 items), appearance (2 items), and work and leisure (2 items) (15). All 19 items are prefixed by the phrase “Because of pain in my feet,” and the 10 function items include avoiding standing for a long time, difficulty walking (eg, avoiding walking long distances, not walking in a normal way, having to walk slowly, avoiding hard, or rough surfaces), having to catch the bus or use the car more often, and needing help with housework and/or shopping (15). For the purpose of this study, respondents were considered to have disabling foot pain if they reported any foot pain (see definition earlier) and responded “on most/every day(s)” to at least 1 of the 10 items contained within Garrow’s function construct (15,16). All other people with any foot pain

who completed the 10 function items of the MFPDI were defined as having nondisabling foot pain. This method has been shown to be valid and repeatable and to provide a meaningful differentiation between disabling and nondisabling foot pain (16). People with any foot pain who did not complete all 10 function items of the MFPDI were excluded.

Definition of onset and persistence of disabling foot pain.—

Onset of disabling foot pain was defined as the absence of disabling foot pain in the baseline survey and the presence of disabling foot pain in the 3-year follow-up survey. Persistent disabling foot pain was defined as disabling foot pain present in both baseline and 3-year follow-up surveys.

Statistical Analysis

All included respondents were placed into two groups at baseline and follow-up: any foot pain and no foot pain. Those with any foot pain were separated into two subgroups: nondisabling and disabling foot pain.

In order to assess the impact of response bias at 3 years, age, gender, and baseline foot pain status were compared between three groups at 3 years: 3-year responders with complete foot pain data at both timepoints, 3-year responders with incomplete foot pain data at either/both time point(s), and those lost to follow-up.

Onset of disabling foot pain at 3-year follow-up was calculated as a percentage of the people who were without disabling foot pain at baseline, overall and then by gender and age group. These latter figures were then broken down, overall and by gender and age group, into (i) those people who were without any foot pain at baseline and (ii) those people who had nondisabling foot pain at baseline. Among those people who reported onset of disabling foot pain at 3-year follow-up, disabling foot pain onset was further categorized by the number of MFPDI function items on which people reported problems (1 only, 2–4, 5–7, and 8–10). The frequency with which each MFPDI function item was reported as occurring on most/every day(s) at 3-year follow-up was also calculated as a percentage of all those experiencing onset of disabling foot pain.

The persistence of any foot pain and disabling foot pain at the 3-year follow-up was calculated as a percentage of the people who were in the corresponding subgroup at baseline, overall and by gender and age group.

Percentage differences (95% confidence interval) were used to assess differences between gender groups, and chi-square tests for linear trend were used to assess the differences across age groups.

RESULTS

Response to Baseline and 3-Year Follow-Up Surveys

Of the 11,309 people sent the baseline health survey questionnaire, 7,878 responded (adjusted response: 71.3%) (14).

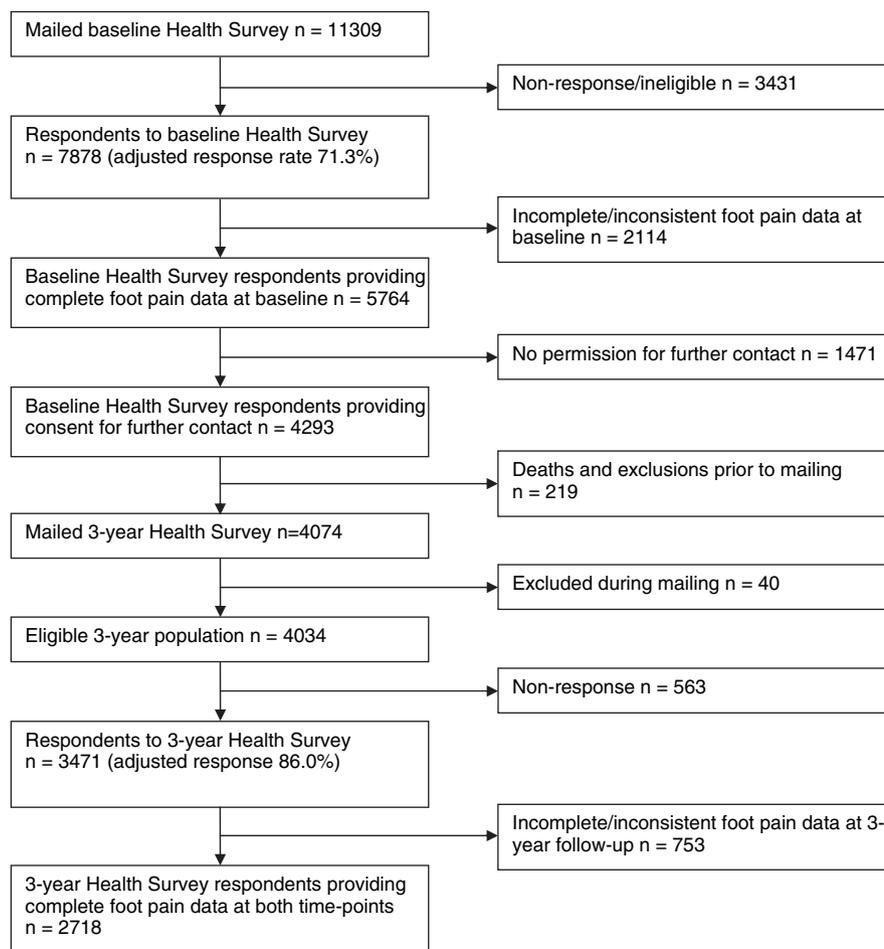


Figure 1. Flow diagram showing study participants.

Following checks with the general practice for deaths, departures, and serious illness in the follow-up period, 5,001 people remained eligible and consented to be followed up at 3 years, 4,234 of whom responded (adjusted response 84.7%) (17). After excluding those people who gave contradictory responses to the foot pain question on the health survey and regional pains survey questionnaires, there were 2,718 persons with data at both timepoints for the analysis of onset and persistence of foot pain over 3 years (Figure 1).

Baseline Differences Between 3-Year Responders With Complete Foot Pain Data, Incomplete Foot Pain Data, and Those Lost to Follow-Up

Responders at 3 years with complete foot pain data at both timepoints ($n = 2,718$) were younger than those with incomplete foot pain data at either/both timepoint(s) ($n = 1,516$) and those lost to 3-year follow-up ($n = 3,644$) (Table 1). There were no gender differences between the three groups. The proportion with disabling foot pain at baseline was greater in both 3-year responders with complete foot pain data at both timepoints and 3-year responders with incomplete foot pain data at both/either timepoints than in those

lost to 3-year follow-up (16.9%, 34.4%, and 7.6%, respectively), although baseline foot pain data were frequently incomplete in these two latter groups.

Onset of Disabling Foot Pain Over 3 Years

Of 2,718 persons with complete data at both timepoints, 779 (28.7%) reported any foot pain at baseline, and 460 of these (16.9% of the study population) had disabling foot pain at baseline.

Of 2,258 people without disabling foot pain at baseline, 184 (8.1%) had developed the problem by 3-year follow-up (Table 2). Of these, problems were reported on only 1 MFPDI function item by 66 (35.9%), on 2–4 items by 69 (37.5%), on 5–7 items by 33 (17.9%), and on 8–10 items by 16 (8.7%). The frequency with which each MFPDI function item was reported as occurring on most/every day(s) at 3-year follow-up among those reporting onset of disabling foot pain is shown in Table 3. The onset of disabling foot pain was significantly greater in those with nondisabling foot pain at baseline than in persons without any foot pain (% difference: 14.2% [95% confidence interval: 10.0%–19.1%]) and in females compared with males (% difference: 2.5%

Table 1. Baseline Characteristics of 3-Year Responders (stratified according to completeness of foot pain data) and Those Lost to Follow-Up at 3 Years

	Responders at 3 y		
	Foot Pain Data Complete at Both Timepoints (<i>n</i> = 2,718), No (%)	Foot Pain Data Incomplete at Either/Both Timepoints (<i>n</i> = 1,516), No (%)	Lost to 3 y Follow-Up (<i>n</i> = 3,644), No (%)
Age (y)			
50–59	1115 (41.0)	451 (29.7)	955 (26.2)
60–69	905 (33.3)	508 (33.5)	939 (25.8)
70+	698 (25.7)	557 (36.7)	1750 (48.0)
Gender			
Female	1452 (53.4)	898 (59.2)	2066 (56.7)
Male	1266 (46.6)	618 (40.8)	1578 (43.3)
Baseline foot pain status in those who provided baseline information	<i>n</i> = 2,718	<i>n</i> = 753	<i>n</i> = 2,293
No foot pain	1939 (71.3)	366 (48.6)	2061 (89.9)
Nondisabling foot pain	319 (11.7)	128 (17.0)	57 (2.5)
Disabling foot pain	460 (16.9)	259 (34.4)	175 (7.6)

[95% confidence interval: 0.3%–4.8%]). Overall, the onset of disabling foot pain was higher at older ages. When considering this trend within each gender, it was true only for females. The age-related trend was especially marked in those with nondisabling foot pain at baseline, and there was no significant trend in the onset of disabling foot pain in those with no foot pain at baseline.

Foot Pain Persistence Over 3 Years

The persistence of foot pain, both any foot pain and disabling foot pain, was high (73.9% and 71.7%, respectively)

and significantly more likely in females than in males (Table 4). There were no significant age-related trends in relation to persistence in either foot pain group, overall or by gender.

DISCUSSION

In this population of older people, onset of disabling foot pain at 3 years was reported by 8.1% of people who did not have disabling foot pain at baseline. Onset of disability related to foot pain was most frequently associated with needing to rely upon vehicular transport more often, difficulty walking (such as walking slowly, avoiding adverse terrain, or

Table 2. Onset of Disabling Foot Pain at 3 Years in 2,258 Persons Who Did Not Have Disabling Foot Pain at Baseline: Stratified by the Presence (*n* = 319) or Absence (*n* = 1,939) of Nondisabling Foot Pain at Baseline

	Onset of Disabling Foot Pain at 3 y, Frequencies (%)		
	Overall (<i>n</i> = 2,258)	No Foot Pain at Baseline (<i>n</i> = 1,939)	Nondisabling Foot Pain at Baseline (<i>n</i> = 319)
Overall	184 (8.1)	119 (6.1)	65 (20.4)
Gender			
Females	109 (9.4)	69 (7.1)	40 (21.5)
Males	75 (6.8)	50 (5.2)	25 (18.8)
Difference (95% confidence interval)	2.5% (0.3%–4.8%)	1.9% (–0.3%–4.0%)	2.7% (–6.5%–11.3%)
Age group at baseline			
Overall			
50–59 y	65 (6.7)	39 (4.7)	26 (17.7)
60–69 y	68 (9.1)	47 (7.5)	21 (17.6)
70+ y	51 (9.5)	33 (6.8)	18 (34.0)
χ^2 (<i>df</i>)	4.34 (1)	3.11 (1)	4.44 (1)
<i>p</i>	.037	.078	.035
Females			
50–59 y	43 (8.3)	28 (6.5)	15 (17.0)
60–69 y	34 (9.1)	21 (6.9)	13 (18.8)
70+ y	32 (11.7)	20 (8.2)	12 (41.4)
χ^2 (<i>df</i>)	2.22 (1)	0.60 (1)	5.63 (1)
<i>p</i>	.137	.439	.018
Males			
50–59 y	22 (4.8)	11 (2.8)	11 (18.6)
60–69 y	34 (9.1)	26 (8.0)	8 (16.0)
70+ y	19 (7.2)	13 (5.4)	6 (25.0)
χ^2 (<i>df</i>)	2.37 (1)	3.44 (1)	0.22 (1)
<i>p</i>	.124	.064	.639

Table 3. Frequency With Which Each MFPDI Function Item Was Reported as Occurring on Most/Every Day(s) at 3-Year Follow-Up in Those Experiencing Onset of Disabling Foot Pain

MFPDI Function Construct Items*	Onset at 3 y in Those Free of Disabling Foot Pain at Baseline (n = 184)
I avoid walking outside at all	14 (2.4)
I avoid walking long distances	88 (14.8)
I don't walk in a normal way	70 (11.9)
I walk slowly	102 (17.2)
I have to stop and rest my feet	40 (6.7)
I avoid hard or rough surfaces when possible	97 (16.3)
I avoid standing for a long time	71 (11.9)
I catch the bus or use the car more often	139 (23.3)
I need help with housework/shopping	30 (5.1)
I get irritable when my feet hurt	23 (3.9)

Notes: MFPDI = Manchester Foot Pain and Disability Index.

* Each item is introduced with the prefix "Because of pain in my feet."

long distances), and avoiding prolonged standing. The frequency of onset increased with age, particularly among women generally and those women who had non-disabling foot pain at baseline rather than those without foot pain. The majority of persons with disabling foot pain at baseline continued to be affected 3 years later. The proportion of people reporting persistence at 3 years was higher in females than in males but did not appear to be influenced by age.

Table 4. Persistence of Any Foot Pain and Disabling Foot Pain Over 3 Years

	Foot Pain Persistence (n = 779), Frequency (%)	Disabling Foot Pain Persistence (n = 460), Frequency (%)
Overall	576 (73.9)	330 (71.7)
Gender		
Females	364 (76.5)	218 (75.2)
Males	212 (70.0)	112 (65.9)
Difference (95% confidence interval)	6.5% (0.2%–13.0%)	9.3% (0.8%–18.0%)
Age group at baseline		
Overall		
50–59 y	204 (70.8)	100 (70.9)
60–69 y	211 (75.9)	116 (73.0)
70+ y	161 (75.6)	114 (71.3)
χ^2 (df)	1.63 (1)	0.00 (1)
p	.202	.962
Females		
50–59 y	130 (72.2)	67 (72.8)
60–69 y	130 (79.3)	76 (80.0)
70+ y	104 (78.8)	75 (72.8)
χ^2 (df)	2.07 (1)	0.00 (1)
p	.150	.964
Males		
50–59 y	74 (68.5)	33 (67.3)
60–69 y	81 (71.1)	40 (62.5)
70+ y	57 (70.4)	39 (68.4)
χ^2 (df)	0.09 (1)	0.02 (1)
p	.763	.881

There are a number of implications of these findings. First, onset of disabling foot pain increases with increasing age. Hence, as the general population ages, the prevalence of disabling foot pain is likely to increase. Second, once disabling foot pain has developed, it is highly likely to persist not only suggesting that prevention of disabling foot pain should be a priority but also raising the question of whether there is no effective treatment or whether effective treatment is, in general, not reaching people with the problem. However, 30%–40% of men and 20%–30% of women who reported disabling foot pain at baseline did not report it at 3 years, an observation that could reflect either successful treatment or a natural history of resolution or perhaps more likely, given evidence from other pain syndromes, that the natural history for some people is of intermittent episodes that come and go. Third, because the frequency of onset of disabling foot pain is greater in those who already have non disabling foot pain, the latter might be useful as a marker of future disability and present a potential target for interventions to prevent progression to disability.

Efforts for prevention could be targeted either at the onset of foot pain per se or at the secondary prevention of development of physical disability by intervening early in those presenting with nondisabling foot pain. Early intervention would require early detection of nondisabling foot pain and wide recognition of its importance as a risk factor for disabling foot pain. Future research should examine whether other physical, comorbid, social, or environmental factors predict the onset of disabling foot pain. Because onset is higher in older age groups, such risk factors may either be specific to or have a greater effect in older age groups. In this way, suitable targets for intervention at the level of both public health and individual patient care may be identified to prevent the onset of disabling foot pain in later life.

The implications and significance of these findings depend clearly on the relevance of our measure of disabling foot pain. Several approaches to using the MFPDI to define disabling foot pain have been previously proposed. The original description of the MFPDI excluded the work and leisure items and identified a three-factor structure: pain (5 items), function (10 items), and appearance (2 items) (15). Subsequent exploratory factor analyses by Menz and colleagues (18) and Cook and colleagues (19) have proposed different factor structures for these items (18,19). Recently, confirmatory factor analysis has found the three-factor solution put forward by Garrow and colleagues (15) to have the better fit (16).

Previous studies have defined disabling foot pain as the occurrence of a problem on at least 1 of the 17 MFPDI items (excluding the 2 items relating to work/leisure) on at least some days in the last month (6,18,19). However, this approach does not appear to distinguish between disabling and nondisabling foot pain in older adults (16). Hence in this study, we defined disabling foot pain as the occurrence of a problem on at least 1 of 10 items contained within Garrow's

function construct (15) on most/every day(s) in the last month, which we have previously shown to be valid and reliable (16).

The importance of foot pain is not simply its relevance as an isolated health problem but its potential to interfere substantially with mobility and quality of life, particularly in older people. Several previous studies have highlighted the contribution made by foot pain to locomotor disability (1,3–11) and estimated the population prevalence of foot pain associated with physical disability (4,6,20). To our knowledge, there have been no previous prospective studies describing the onset or persistence of disabling foot pain. However, our findings are comparable to estimates of the onset and persistence of musculoskeletal pain at other sites (21–27).

Limitations of our study warrant further discussion. A degree of attrition over 3 years is inevitable in a study of this design. Age and gender differences between responders and nonresponders at 3 years have been reported previously (17). In this analysis, responders at 3 years were younger and had more frequently reported disabling foot pain at baseline than persons lost to follow-up. The onset of disabling foot pain at 3 years could therefore have been over estimated if response at 3 years among persons free of foot pain and disability at baseline was selectively higher in those experiencing onset of disabling foot pain than in those lost to follow-up. A separate point is that our definition of disabling foot pain at both baseline and 3-year follow-up was based only on a report of foot pain in the previous 12 months and completion of the MFPDI with reference to the previous month, and so, fluctuations in either pain or disability between baseline and 3-year follow-up would not be captured.

In summary, the frequency of onset of disabling foot pain increases with age, particularly among women, suggesting that the prevalence of disabling foot pain will increase as the population ages. Nondisabling foot pain appears to be an important risk factor for the development of disabling pain and presents a potential target for intervention to prevent the onset of this significant health problem, which, once established, is likely to persist. Further research is required to identify other predictors of disabling foot pain and identify targets for intervention and prevention.

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