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ARTICLE

Most older pedestrians are unable to cross the road in time: a cross-sectional study

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Abstract

Objectives
To compare walking speed in the UK older population with the speed required to utilise pedestrian crossings (≥1.2m/s), and determine health and socio-demographic associations with walking impairment.
Design
Cross-sectional study using Health Survey for England 2005 data
Setting
Private households in England
Participants
Random population sample of 3,145 adults (1,444 men) aged ≥65 years
Main outcome measures
Walking speed was assessed by timing a walk of 8 feet at normal pace. Walking impairment was defined as walking speed <1.2m/s or non-participation in the test due to being unsafe or unable.
Results
Mean walking speed was 0.9m/s in men and 0.8m/s in women. 84% of men and 93% of women ≥65 years had walking impairment. Female gender, increasing age, lower socio-economic status, poorer health and lower grip strength were predictors of walking impairment.
Conclusion
Most older adults either cannot walk 8 feet safely or cannot walk fast enough to use a pedestrian crossing in the UK. The health impacts on older adults include limiting independence and opportunities for physical activity and social interaction. An assumed normal walking speed for pedestrian crossings of 1.2m/s is inappropriate for older adults and revision of these timings should be considered.

Keywords walking speed, traffic collisions**,** safety**,** aged**,** socio-economic factors**,** older people

Introduction

The ability to cross the road safely is important for the health of older people. Walking by older adults, is greater in pedestrian-friendly neighbourhoods(1;2). The divisive effects a road has on local residents, known as ‘community severance’(3), reduces access to goods, health services and social contacts, adversely affecting health, particularly among older adults (4).

Older pedestrians are more likely to die(5-7) or be seriously injured(6) in road traffic collisions than younger people, due to decreased walking speed, slower decision making, and perceptual difficulties(8).

Having enough time is important for crossing the road safely. UK pedestrian crossing timings assume a minimum walking speed of 1.2m/s (2.7miles/hr). Normal gait speeds of healthy people range from 0.94m/s (2.1 miles/hr) for women aged 80-99y, to 1.43m/s (3.2 miles/hr) in men aged 40- 49y(9). However these norms are not representative of the population who would like to use pedestrian crossings.

Studies in Ireland(10), the USA(11;12), South Africa(13) and Spain (14) have shown that older adults have insufficient time at pedestrian crossings. Yet most studies are limited by the 'healthy' sample(10), small size(13), non-random sample(10;13) and/or selection only of individuals actually crossing the road(11;13).
There is some evidence that walking speed is socially patterned; (15). negative health impacts of inappropriate crossing timings may be greatest amongst more deprived groups.

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This cross-sectional study aims to 'normal' assess the proportion of the older population in England who walked at ≥1.2m/s, to assess the appropriateness of this speed as the basis for pedestrian crossing timings, and the socio-demographic and health predictors of walking impairment.

Method

The Health Survey for England (HSE) is an annual, cross-sectional survey of a nationally-representative sample of adults and children living in private households in England. HSE2005 included a boost sample of people ≥65y. (16;17). The London Multi-centre Research Ethics Committee approved the study.

Household response rates were 71% in the core and 74% in the boost samples. Data collection took place at an interview and a nurse visit. 4,269 people (1,897 men) aged ≥65 were interviewed, of whom 74% had a nurse visit.

'Normal' walking speed was assessed by timing how long it took the participant to walk 8 feet at their normal pace(18). The test was not carried out if they were unable to walk the distance, were unsafe, were unwilling, if there was no suitable space, or if their walking aid was unavailable. The walk was carried out twice, and the mean result used. Maximal grip strength was measured with a gripometer.

At the interview, data were collected on health (self-reported health, limiting longstanding illness, mobility, falls, functional limitations and BMI), health behaviours (smoking and alcohol consumption), and demographic information (age, sex, ethnicity). Area deprivation was assessed using the Index of multiple deprivation (IMD) 2004(19).

Further details of the sampling, recruitment, and data collection are available in Appendix XX(16).

Statistical analysis

Median, mean and standard deviation of walking speed, and the proportion of participants with a walking speed <1.2m/s were calculated. Walking impairment was defined as being unable or unsafe to take the walking speed or having a walking speed <1.2m/s.

Logistic regression modelling was used to determine associations with walking impairment. Possible explanatory variables were tested; significant variables were included in the final model. Statistics were adjusted for clustered stratified sampling and weighted to reduce non-response bias, except when describing participant characteristics (Table 1). Statistical analysis was conducted in Stata Version 11.0.

Results

3,145 older adults (46% men) received a nurse home visit. Supplementary Table w1 shows participants' characteristics. 90% of men and 87% of women took the walking speed test; 5.7% of men and 7.2% of women were unable to walk short distances or felt unsafe; 133 (4.3%) participants were not tested because of unwillingness (1.8%) or technical problems (2.5%).

Mean 'normal' walking speed was 0.9m/s in men and 0.8m/s in women, with a decrease in speed as age increased. 76% men and 85%

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women had a walking speed <1.2m/s; 93% of woman and 84% of men had walking impairment (Table 1).

After mutual adjustment, functional disabilities (excluding walking disabilities), alcohol consumption, and falls were not associated with walking impairment so were excluded from the final model. Female gender, current smoking, living in a deprived area, fair or poor self-reported health, low grip strength, and limiting longstanding illness were associated with walking impairment in the unadjusted and fully adjusted analyses (Table 2).

Discussion

Mean walking speed in both men and women was below the speed required to use a pedestrian crossing in the UK and many other countries(10,12,14). 93% of women and 84% of men aged ≥65 years either could not walk 8 feet safely or their normal walking speed was too slow to cross the road in time using pedestrian crossings.

Mean walking speeds were lower than established norms(9).. possibly because our study did not exclude

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unhealthy participants.

Our findings are consistent with other studies: older pedestrians have insufficient time to use pedestrian crossings(10,12,14). The walking speeds determined in this study were generally similar to or lower than in other studies.

It is well-established that walking speed is lower in women and decreases with age(22). In addition to women and the 'oldest old', those in deprived areas, smokers, those with poor grip strength (indicative of sarcopenia (loss of muscle mass)) and those whose general health was not good or who had longstanding illness were most likely to have walking impairment. The walking impaired participants may therefore be characterised as 'frail'(21), though definitions of this term vary. Grip strength is an independent predictor of walking impairment(10). However poor mobility and history of falls have also been found to be risk factors,(10) but falls were not significant in our multivariable model.

Similar patterns of social inequality in walking speed have also been found in early old age(15). . Residual confounding by health problems not captured in our study (16;23) may explain some of the association between low socio-economic status and walking impairment. However, only one-third of observed social inequality in walking speed can be explained by health conditions or demographic, psychosocial, biologic and behavioural factors(15).

The main strength of this study is that it provides an accurate picture of the proportion of people aged ≥65 years in the general population who are likely to be unable to use pedestrian crossings safely. The large sample size, random sample, and the fact that participants were not excluded on the basis of disability means that the data are representative of the older population who may wish to use a pedestrian crossing.

A further strength is that those people who were unable or unsafe to participate in the walking speed test were included in the analysis (classed as walking impaired alongside those with gait speed <1.2m/s). The advantage of using a general population sample rather than surveying people using a pedestrian crossing(11;13;24) is that those people who have difficulty using pedestrian crossings, and are therefore not utilising them, are captured.

A limitation of this study is the non-response bias that would result from differential participation in the survey. This study could have underestimated the prevalence of walking impairment, although the data were weighted to adjust for non-response.

Insufficient crossing time amongst older adults may not increase the risk of pedestrian fatalities, which are uncommon at pedestrian crossings (REF), but it is likely to deter this group from even trying to cross the road. For older people, maintenance of mobility outside the home not only has direct health benefits but is also an important way to maintain independence (3;26;27). Physical activity in older people may depend on the ability to negotiate their local environment, including crossing the road safely The groups most likely to having walking impairment are also least likely to have access to more expensive forms of transport. (28).. Puffin crossings (with timings regulated by sensors) may enable older adults to cross in time, but more are needed and their profile must be raised for benefits to be realised.
The assumed 'normal' walking speed of 1.2m/s is utilised internationally as the basis for pedestrian crossing timings. Pedestrian crossings requiring a walking speed of 0.8m/s may be more appropriate as this would allow the 'average' man or woman ≥65 years sufficient time to cross. The current assumed walking speed excludes most of the older population in England from using pedestrian crossings and therefore should be revised.

Table 1 Walking speed test performance by age and sex (n=3,145)

	Age					
	65-69	**70-74**	**75-79**	**80-84**	**85+**	**ALL 65+**
Men						
Unable to do test [a] (%)	5	6	7	6	13	6
Walking speed <1.2 m/s (%)	73	76	80	85	85	76
Total Walking impaired [a] (%)	*77*	*82*	*87*	*91*	*98*	*84*
Walking speed (metres/second) [b]						
Mean, in metres/second	1.0	0.9	0.9	0.8	0.7	0.9
(SE)	(0.01)	(0.02)	(0.02)	(0.02)	(0.03)	(0.01)
5th centile	0.5	0.5	0.4	0.3	0.4	0.4
25th centile	0.8	0.8	0.7	0.6	0.5	0.7
50th centile	1.0	0.9	0.9	0.8	0.7	0.9
75th centile	1.2	1.1	1.1	1.0	0.9	1.1
95th centile	1.4	1.4	1.4	1.3	1.1	1.4
Women						
Unable to do test [a] (%)	5	5	7	14	17	8
Walking speed <1.2 m/s (%)	82	84	89	84	83	85
Total Walking impaired [a] (%)	*87*	*89*	*96*	*98*	*100*	*93*
Walking speed (metres/second) [b]						
Mean	0.9	0.9	0.8	0.7	0.5	0.8
(SE)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)
5th centile	0.4	0.4	0.3	0.3	0.2	0.3
25th centile	0.7	0.7	0.5	0.4	0.4	0.6
50th centile	0.9	0.9	0.8	0.7	0.5	0.8
75th centile	1.1	1.1	0.9	0.9	0.7	1.0
95th centile	1.4	1.3	1.2	1.1	1.0	1.3

[a] Including those who felt unable or unsafe to perform the test
[b] Among those doing the gait speed test

Table 2. Prevalence of walking impairment and univariable and multivariable associations

Variable	Walking impairment (%)	Univariable associations		Multivariable associations [a]	
		OR (95% CI)	p value	OR (95% CI)	p value
Sex			<0.001		<0.001
Male	1105 (84)	1		1	
Female	1566 (93)	2.40 (1.89,3.05)		2.64 (2.02, 3.34)	
Age (years)			<0.001		<0.001
65-69	730 (83)	1		1	
70-74	653 (86)	1.26 (0.96, 1.66)		1.09 (0.81, 1.45)	
75-79	563 (92)	2.33 (1.65, 3.28)		1.54 (1.07, 2.22)	
≥80	726 (97)	6.63 (3.89, 11.28)		3.65 (2.12, 6.27)	
Index of multiple deprivation (IMD 2004)			<0.001		<0.001
0.59-<8.35 (least deprived)	574 (83)	1		1	
8.35-<21.16 (middle tertile)	1141 (87)	1.41 (1.06, 1.86)		1.40 (1.03, 1.89)	
21.16-86.36 (most deprived)	956 (94)	3.40 (2.37, 4.86)		2.50 (1.70, 3.68)	
Highest educational qualification [b]			<0.001		-
University degree	185 (74)	1		-	
Other qualification	917 (85)	1.91 (1.39, 2.61)		-	
None	1566 (94)	5.20 (3.74, 7.23)		-	
Smoking status			0.010		0.012
Never smoker	1238 (87)	1		1	
Ex-smoker	1109 (89)	1.20 (0.94, 1.53)		1.39 (1.06, 1.82)	
Current smoker	322 (93)	1.99 (1.24, 3.19)		1.84 (1.11, 3.05)	
Alcohol consumption (estimated units consumed on heaviest drinking day in last week)			<0.001		-
None	702 (92)	1		-	
Less than or equal to recommended limit [c]	1272 (86)	0.54 (0.40, 0.72)		-	
Over recommended limit	267 (84)	0.47 (0.33, 0.66)		-	
General health			<0.001		<0.001
Good or very good	1402 (83)	1		1	
Fair	892 (95)	4.41 (3.14, 6.20)		2.87 (1.99, 4.14)	
Poor or very poor	377 (99)	36.32 (8.98, 146.99)		15.99 (3.96, 64.51)	
Longstanding illness			<0.001		0.012
No longstanding illness	704 (83)	1		1	
Non-limiting longstanding illness	681 (84)	1.10 (0.82, 1.46)		0.98 (0.72, 1.34)	
Limiting longstanding illness	1286 (95)	4.04 (2.95, 5.54)		1.54 (1.10, 2.15)	
Functional disabilities [d]			0.005		-
0	2189 (88)	1		-	
≥1	481 (92)	1.66 (1.16, 2.38)		-	
Fall in previous 12 months			0.001		-
No	1928 (88)	1		-	
Yes	742 (92)	1.63 (1.21, 2.19)		-	
Grip strength [e]			<0.001		<0.001
Median or above	1161 (82)	1		1	
Below median	1407 (95)	4.44 (3.36, 5.85)		2.49 (1.84, 3.37)	

[a] All results are mutually adjusted

[b] Education was not included in the multivariable model due to collinearity with area level deprivation (IMD 2004)
[c] 4 units for men, 3 units for women
[d] Excluding walking disabilities
[e] Median grip strength 36kg in men, 21kg in women

Supplementary material: Table w1 Participants' characteristics by sex [a]

	Male (%) N=1,444	Female (%) N=1,701	Total (%) [a] N=3,145
Age (years)			
65-69	476 (33)	487 (29)	963 (31)
70-74	385 (27)	448 (26)	833 (26)
75-79	317 (22)	347 (20)	664 (21)
≥80	266 (18)	419 (25)	685 (22)
Index of multiple deprivation (IMD)			
0.59-<8.35 (least deprived)	355 (25)	375 (22)	730 (23)
8.35-<21.16 (middle tertile)	646 (45)	731 (43)	1377 (44)
21.16-86.36 (most deprived)	443 (31)	595 (35)	1038 (33)
Highest educational qualification			
University degree	206 (14)	74 (4)	280 (9)
Other qualification	574 (40)	585 (34)	1159 (37)
None	663 (46)	1041 (61)	1704 (54)
Smoking status			
Never smoker	486 (34)	986 (58)	1472 (47)
Ex-smoker	794 (55)	533 (31)	1327 (42)
Current smoker	164 (11)	180 (11)	344 (11)
Alcohol consumption (estimated units consumed on heaviest drinking day in last week)			
None	260 (20)	536 (38)	796 (30)
Less than or equal to recommended limit [b]	771 (60)	780 (56)	1551 (57)
Over recommended limit	260 (20)	89 (6)	349 (13)
General health			
Good or very good	846 (59)	978 (58)	1824 (58)
Fair	435 (30)	534(31)	969(31)
Poor or very poor	163 (11)	189 (11)	352 (11)
Mobility problems			
No	916 (63)	929 (55)	1845 (59)
Yes	528 (37)	772 (45)	1300 (41)
Functional disabilities [c]			
0	1163(81)	1464(86)	2627(84)
≥1	281(19)	237(14)	518 (16)
Uses walking aid			
No	1149 (80)	1265 (74)	2414 (77)
Yes	294 (20)	436 (26)	730 (23)
Fall in last 12 months			
No	1112 (77)	1209 (71)	2321 (74)
Yes	332 (23)	492 (29)	824 (26)
Longstanding illness			
No longstanding illness	416 (29)	491 (29)	907 (29)

Non-limiting longstanding illness	433 (30)	433 (26)	866 (27)
Limiting longstanding illness	595 (41)	777 (46)	1372 (44)
Grip strength (kg)			
Mean (S. E.)	35.5 (0.2)	20.4 (0.2)	27.4 (0.2)
BMI			
<25	339 (28)	426 (31)	765 (29)
25-29.9	583 (48)	539 (39)	1122 (43)
≥30	299 (24)	413 (30)	712 (27)

[a] Data in this table are unweighted [b] 4 units for men, 3 units for women [c] Excluding walking disabilities

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