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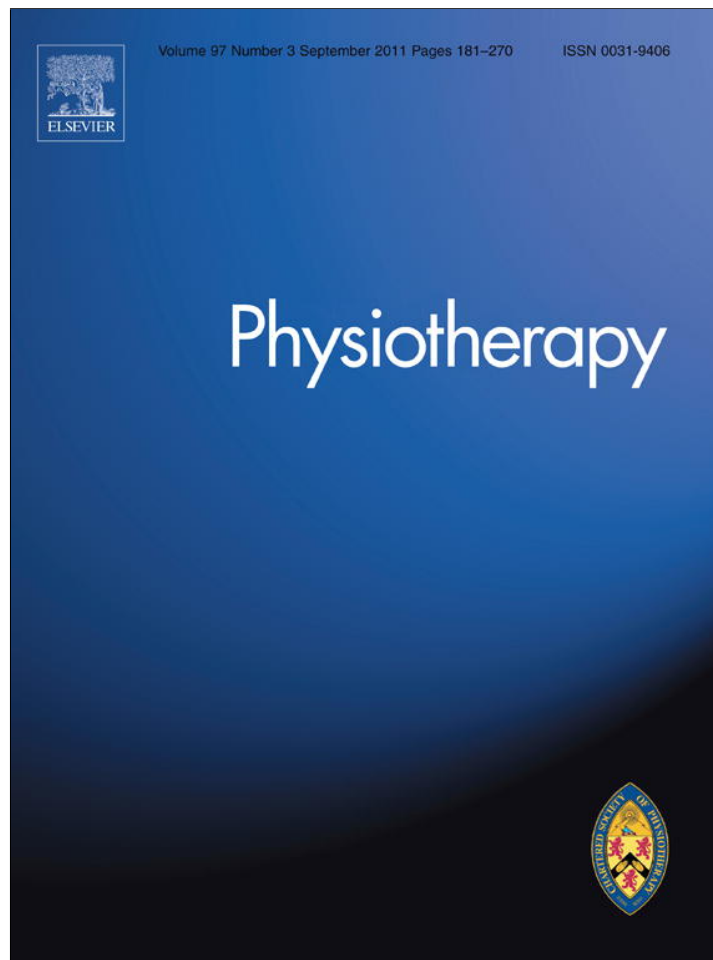
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Systematic review

Normal walking speed: a descriptive meta-analysis

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Abstract

Background Walking speed has implications for community functioning and is predictive of important outcomes. Determining whether an individual's walking speed is limited requires normal values for comparison.

Objectives To use meta-analysis to describe normal gait speed for healthy individuals within age and gender strata.

Data sources PubMed, the Cumulative Index of Nursing and Allied Health (CINAHL), Scopus, Science Citation Index and articles identified by hand searches.

Study selection criteria Inclusion required that the gait speed of apparently healthy adults was documented as they walked at a normal pace over a course of 3 to 30 m. Summary data were excluded unless obtained from at least 10 participants within a gender and decade stratum.

Study appraisal and synthesis methods The two authors independently reviewed articles and extracted data. Accuracy was confirmed by the other author. Data were grouped within gender and decade strata. A meta-analysis macro was used to consolidate data by strata and to determine homogeneity.

Results Forty-one articles contributed data to the analysis. Combined, they provided data from 23 111 subjects. The gait speed was homogeneous within strata and ranged from a mean of 143.4 cm/second for men aged 40 to 49 years to a mean of 94.3 cm/second for women aged 80 to 99 years.

Limitations The data presented herein may not be useful as a standard of normal if gait is measured over short distances from the command 'go' or if a turn is involved.

Conclusions and implications The consolidation of data from multiple studies reported in this meta-analysis provides normative data that can serve as a standard against which individuals can be compared. Doing so will aid the interpretation of their performance.

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Keywords: Gait; Measurement; Meta-analysis; Normative values

Introduction

Walking is second only to private cars as the most common means by which individuals get from place to place in the USA and Europe [1]. The speed at which individuals walk is relevant to their functioning in the community [2,3]. Moreover, gait speed is an important predictor of outcomes such as: length of stay and discharge disposition for patients admitted for acute rehabilitation after stroke [4], mortality of older adults [5], incident ischaemic stroke among postmenopausal women [6], and incident dementia among older adults [7]. It should not be surprising, therefore, that gait speed is com-

monly measured by physical therapists and other clinicians [8,9].

Judgements about how an individual's task performance compares with that of a relevant population requires the availability of normative reference values (norms) for that population [10]. Several studies have presented data purported to be normative for comfortable walking speed [12–17]. Other studies, not normative by intent, present walking speed data for apparently healthy individuals. These studies, regardless of purpose, involve samples that vary greatly in number and composition. They also incorporate instructions, courses and timing procedures that vary considerably [18].

If the data from these seemingly diverse studies could be legitimately consolidated, a better sense of normal might

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be obtained than is provided by individual studies. Meta-analysis is a means by which relevant data from multiple sources can be consolidated if homogeneous. Such analysis has been used previously to estimate norms for other physical performance tests, such as the single-limb stance test [19], five repetition sit-to-stand test [20], and 6-minute walk test [21]. The purpose of this meta-analysis was to use the data from multiple relevant but diverse studies to estimate norms for normal gait speed that could be used in clinical practice.

Methods

Identification of potentially relevant literature began with the electronic search of four databases: PubMed, the Cumulative Index of Nursing and Allied Health (CINAHL), Scopus and Science Citation Index. The terms and Boolean mode used were (gait speed OR walking speed) AND (normal OR comfortable OR usual OR preferred OR self-selected). Databases were searched up to the end of 2008. Searches were limited to human subjects, adults aged ≥ 19 years and published in the English language. The two authors examined the search outputs for articles independently with a focus on articles that purported to report normative or reference values or values for population-based samples. The abstracts of articles deemed to be potentially relevant by either author were examined to determine if perusal of the full-text was warranted. Each author inspected the full-text of articles that he deemed likely to contain relevant information on gait speed. Thereafter, hand searches of articles in reference lists and personal files were performed. These searches permitted the inclusion of articles published after the electronic search end-date.

For data in an article to be included, the source article had to describe: (1) normal speed (or equivalent) as opposed to fast or maximum speed gait; (2) overground gait as opposed to treadmill gait; (3) gait speed measured over a distance of at least 3 m (10 feet) but no more than 30.5 m (100 feet); and (4) gait speed measured with an allowance for acceleration and deceleration (i.e. not from the command 'go') unless the distance was more than 25 m. This last criterion was included to exclude reaction time and to help ensure that steady-state speed was approached before timing began. Previous research has shown that steady-state speed can be reached by the end of a first step [22]. Data were excluded if they were: (1) gathered from patients with pathology (e.g. stroke); (2) obtained from a decade and age stratum with less than 10 male or female subjects; (3) collected from walking trials involving a turn [23]; or (4) acquired by the observation of pedestrians. Potentially relevant literature was abstracted for the following information: (1) source; (2) participants' characteristics (sample type, country, number, age and gender); (3) method of measuring speed; and (4) mean and standard deviation of walking speed. Where important information regarding methods or walking speed was not presented in an article, the authors were contacted by e-mail to obtain the necessary details. Of the 39 authors contacted, 26 responded

with the necessary information. Data were entered into a Statistical Package for the Social Sciences database (SPSS Inc., Chicago, IL, USA). The inverse variance of gait speed was computed from the standard deviation of gait speed. A macro provided by Wilson [24] used this inverse variance along with the mean gait speed and sample size (n) for each gender and age stratum (e.g. male, 20 to 29 years) from all relevant studies to determine effect size (weighted grand mean) and homogeneity. Homogeneity, the degree to which the effect sizes from contributing studies estimate the same population mean, was described using the Q statistic [25].

Results

The yield of potentially relevant articles for the four databases was: PubMed, 621; CINAHL, 509; Scopus, 1622; and Science Citation Index, 674. Based on the focus of this study, adherence to inclusion and exclusion criteria, and ability to obtain clarification from authors, 41 articles were ultimately judged to be relevant sources of data for normal gait speed (Table 1) [12–17,26–61]. Most of the investigations employed convenience samples. However, 15 articles presented data gathered, at least in part, from population-based samples. Individual studies contributed from 10 to 8883 subjects. The total number of subjects for all studies was 23 111. The distances over which speed was measured ranged from 3.7 to 30 m. A stopwatch was used in most studies ($n = 19$), but instrumented walkways, photocells and other methods were also used.

The results of the meta-analysis are presented by strata in Table 2. Depending on the stratum, grand mean speed ranged from 94.3 cm/second (women aged 80 to 99 years) to 143.4 cm/second (men aged 40 to 49 years). The grand mean gait speed was relatively consistent for the decades 20 to 29 years to 60 to 69 years for men (133.9 to 143.3 cm/second) and women (124.1 to 139.0 cm/second). Thereafter, the grand means fell outside the lower level of the confidence intervals of all previous decades. By the time subjects were aged 80 years or more, their mean gait speed declined to less than 100 cm/second. The Q statistics for all strata had probability levels exceeding 0.05. Consequently, within strata, studies were homogeneous and consolidation of their data was justified [25].

Discussion

Given the relevance of gait speed to community ambulation [2,3] and its value as a predictor of important outcomes [4–9], it should not be surprising that gait speed has been recommended as a 'vital sign' [62,63]. As such, an individual's gait speed can be interpreted relative to a criterion reference or a normative reference [10,11], the focus of this meta-analysis. By consolidating data from numerous diverse studies, this meta-analysis provides strata-specific estimates

Table 1
Summary of studies included in meta-analysis.

Study	Study sample Type (location)	Test specifics				Stratified speed data (cm/second) Mean (SD)
		Distance (m)	Timing	Gender (n)	Age group (years)	
Al-Obaidi 2003 [17]	Convenience (Kuwait)	3.8	Gait mat	Male (15)	20 to 29	121.7 (19.9)
Aniansson 1980 [26]	Population-based (Sweden)	30	Stopwatch	Female (15)	20 to 29	108.2 (14.6)
				Male (160)	70 to 79	120.0 (20.0)
Aoyagi 2001 [27]	Population-based (Japan) ^a	6	Stopwatch	Female (194)	70 to 79	110.0 (20.0)
				Female (82)	60 to 69	108.0 (32.0)
				Female (50)	70 to 79	99.0 (29.0)
				Female (19)	70 to 79	89.0 (31.0)
	Population-based (Japan and USA) ^b	6	Stopwatch	Female (12)	80 to 99	86.0 (28.0)
				Female (113)	60 to 69	118.0 (38.0)
				Female (273)	70 to 79	112.0 (34.0)
				Female (218)	70 to 79	101.0 (38.0)
	Population-based (USA) ^c	6	Stopwatch	Female (76)	80 to 99	87.0 (36.0)
				Female (3535)	60 to 69	97.0 (30.0)
Arnadottir 2000 [28]	Convenience (USA)	10	Stopwatch	Female (2557)	70 to 79	90.0 (26.0)
				Female (1258)	70 to 79	83.0 (36.0)
Atkinson 2007 [29]	Population-based (USA) ^d	20	Stopwatch	Female (690)	80 to 99	74.0 (27.0)
				Female (14)	70 to 79	126.0 (28.0)
Ble 2005 [61]	Population-based (Italy) ^e	4	Photocell	Female (17)	80 to 99	117.0 (24.0)
				Male (1120)	70 to 79	120.0 (21.0)
				Female (1229)	70 to 79	111.0 (21.0)
				Male (27)	20 to 29	131.1 (19.7)
				Male (30)	30 to 39	137.5 (18.3)
				Male (27)	40 to 49	127.0 (16.8)
				Male (28)	50 to 59	126.5 (16.4)
				Male (157)	60 to 69	119.4 (23.1)
				Male (213)	70 to 79	106.8 (23.9)
				Male (65)	80 to 99	87.6 (25.7)
				Male (15)	80 to 99	60.8 (30.3)
				Female (24)	20 to 29	126.6 (21.5)
				Female (32)	30 to 39	125.6 (15.5)
				Female (27)	40 to 49	128.3 (14.6)
				Female (37)	50 to 59	123.9 (18.2)
				Female (180)	60 to 69	105.7 (18.8)
				Female (253)	70 to 79	94.7 (25.6)
				Female (111)	80 to 99	71.2 (25.0)
				Female (22)	80 to 99	55.7 (24.5)
Bohannon 1997 [12]	Convenience (USA)	7	Stopwatch	Male (15)	20 to 29	139.3 (15.3)
				Male (13)	30 to 39	145.8 (9.4)
				Male (22)	40 to 49	146.2 (16.4)
				Male (22)	50 to 59	139.3 (22.9)
				Male (18)	60 to 69	135.9 (20.5)
				Male (22)	70 to 79	133.0 (19.6)
				Female (22)	20 to 29	140.7 (17.5)
				Female (23)	30 to 39	141.5 (12.7)
				Female (21)	40 to 49	139.1 (15.8)
				Female (21)	50 to 59	139.5 (15.1)
				Female (18)	60 to 69	129.6 (21.3)
				Female (20)	70 to 79	127.2 (21.1)
Bohannon 2008 [31]	Population-based (USA) ^f	6.1	Stopwatch	Male (311)	50 to 59	112.2 (21.0)
				Male (292)	60 to 69	103.3 (21.0)
				Male (237)	70 to 79	95.7 (22.9)
				Male (134)	80 to 99	83.2 (22.2)
				Female (281)	50 to 59	110.9 (22.2)
				Female (318)	60 to 69	100.6 (22.9)
				Female (210)	70 to 79	93.0 (22.9)
				Female (140)	80 to 99	78.3 (21.9)
Bohannon 1996 [30]	Convenience (USA)	7.6	Stopwatch	Male (20)	50 to 59	149.1 (19.0)
				Male (22)	60 to 69	147.9 (11.3)
				Male (22)	70 to 79	141.8 (21.3)
				Female (20)	50 to 59	140.4 (21.0)

Table 1 (Continued)

Study	Study sample	Test specifics				Stratified speed data (cm/second)
	Type (location)	Distance (m)	Timing	Gender (<i>n</i>)	Age group (years)	Mean (SD)
Brach 2007 [32]	Population-based (USA) ^g	4	Gait mat	Female (27)	60 to 69	143.2 (16.8)
				Female (21)	70 to 79	134.3 (19.6)
				Male (108)	70 to 79	112.0 (20.0)
				Male (84)	80 to 99	106.0 (21.0)
				Female (183)	70 to 79	104.0 (19.0)
Busse 2006 [34]	Convenience (UK)	10	Camera	Female (120)	80 to 99	94.0 (20.0)
				Male (11)	30 to 39	153.8 (16.0)
				Female (15)	20 to 29	149.9 (18.9)
				Female (14)	30 to 39	138.1 (23.5)
				Female (13)	40 to 49	133.6 (27.6)
Button 2005 [35]	Convenience (UK)	15	Camera	Female (11)	50 to 59	123.2 (10.5)
				Male (17)	20 to 29	147.4 (13.6)
				Male (14)	30 to 39	143.2 (13.6)
				Female (22)	20 to 29	144.8 (25.1)
Callisaya 2008 [36]	Population-based (Australia) ^h	4.2	Gait mat	Male (15)	60 to 69	126.3 (21.0)
				Male (28)	60 to 69	120.6 (15.0)
				Male (27)	70 to 79	113.7 (12.4)
				Male (26)	70 to 79	108.6 (22.0)
				Male (24)	80 to 99	103.9 (14.9)
				Female (22)	60 to 69	116.5 (17.0)
				Female (21)	60 to 69	116.6 (15.5)
				Female (15)	70 to 79	121.9 (19.2)
				Female (27)	70 to 79	104.4 (16.4)
				Female (18)	80 to 99	88.6 (19.4)
Cyarto 2004 [37]	Convenience (Canada)	7	Photo cell	Female (14)	70 to 79	122.0 (18.0)
Delval 2006 [38]	Convenience (France)	10	Camera	Male (11)	20 to 29	135.3 (9.3)
DePasquale 2009 [43]	Convenience (USA)	3	Stopwatch	Male (13)	80 to 99	117.9 (32.2)
				Female (10)	70 to 79	117.5 (18.0)
				Female (23)	80 to 99	110.8 (20.9)
				Male (1083)	70 to 79	98.9 (20.1)
				Male (564)	80 to 99	93.4 (27.3)
Fitzpatrick 2007 [33]	Population-based/convenience (USA) ⁱ	4.6	Stopwatch	Female (939)	70 to 79	94.3 (23.0)
				Female (467)	80 to 99	87.0 (23.0)
				Male (141)	70 to 79	139.6 (27.6)
				Male (35)	80 to 99	122.1 (29.7)
				Female (106)	70 to 79	129.9 (25.2)
Freiberger 2007 [40]	Population-based (Germany)	8	Stopwatch	Female (35)	80 to 99	113.8 (24.0)
				Male (20)	20 to 29	138.0 (16.0)
Goble 2003 [41]	Convenience (USA)	4	Radar gun	Male (10)	20 to 29	144.0 (25.0)
Haghani 2000 [42]	Convenience (Canada)	8	Stopwatch	Female (12)	20 to 29	137.0 (22.0)
Hansen 2004 [44]	Convenience (USA)	3.7	Camera	Female (60)	70 to 79	116.3 (66.8)
Hill 1999 [45]	Convenience (Australia)	6	Stopwatch	Female (27)	70 to 79	109.2 (77.8)
				Female (10)	20 to 29	138.7 (12.6)
Hollman 2007 [46]	Convenience (USA)	8.3	Gait mat	Female (20)	60 to 69	143.0 (16.0)
Kamide 2009 [59]	Convenience (Japan)	7.0	Stopwatch	Female (56)	70 to 79	135.0 (22.0)
				Female (23)	80 to 99	116.0 (16.0)
				Male (14)	20 to 29	146.5 (18.5)
				Female (15)	20 to 29	144.5 (16.6)
				Female (11)	70 to 79	96.2 (27.2)
Leiper 1991 [47]	Convenience (USA)	3.8	Gait mat	Female (20)	60 to 69	113.0 (13.0)
				Female (35)	70 to 79	97.0 (21.0)
				Female (26)	80 to 99	86.0 (22.0)
				Female (10)	50 to 59	155.0 (25.0)
				Female (67)	60 to 69	145.0 (22.0)
Lindsey 2005 [48]	Convenience (USA)	8	Stopwatch	Female (34)	70 to 79	136.0 (28.0)
				Female (21)	20 to 29	138.0 (16.0)
				Female (20)	30 to 39	132.0 (17.0)
				Female (19)	40 to 49	129.0 (12.0)
				Female (18)	50 to 59	
Lord 1996 [49]	Population-based (Australia) ^j	7.2	Sensors			

Table 1 (Continued)

Study	Study sample	Test specifics				Stratified speed data (cm/second)
	Type (location)	Distance (m)	Timing	Gender (<i>n</i>)	Age group (years)	Mean (SD)
	124.0 (19.0)					
				Female (37)	60 to 69	113.0 (16.0)
				Female (22)	70 to 79	107.0 (17.0)
				Female (26)	70 to 79	101.0 (19.0)
				Female (11)	80 to 99	96.0 (19.0)
Lusardi 2003 [13]	Convenience (USA)	3.7	Gait mat	Female (10)	70 to 79	125.0 (18.0)
				Female (17)	80 to 99	87.0 (16.0)
Mills 2001 [50]	Convenience (Australia)	5	Photocell	Male (10)	20 to 29	141.0 (12.6)
Mündermann 2004 [50]	Convenience (USA)	9.1	Camera	Male (18)	60 to 69	107.7 (16.0)
				Female (10)	40 to 49	122.0 (11.0)
				Female (14)	50 to 59	135.0 (24.0)
				Female (18)	60 to 69	119.0 (10.0)
Nagasaki 1996 [52]	Population-based (Japan)	5.0	Stopwatch	Male (208)	60 to 69	128.6 (23.8)
				Male (135)	70 to 79	118.0 (24.3)
				Male (84)	70 to 79	110.5 (26.5)
				Male (48)	80 to 99	92.3 (21.8)
				Female (260)	60 to 69	118.3 (24.0)
				Female (213)	70 to 79	103.8 (27.0)
				Female (108)	70 to 79	97.0 (23.2)
				Female (75)	80 to 99	80.3 (24.2)
Öberg 1993 [14]	Convenience (Sweden)	5.5	Photocell	Male (15)	20 to 29	123.0 (11.0)
				Male (15)	30 to 39	132.0 (15.0)
				Male (15)	40 to 49	133.0 (10.0)
				Male (15)	50 to 59	125.0 (18.0)
				Male (15)	60 to 69	128.0 (12.0)
				Male (15)	70 to 79	118.0 (15.0)
				Female (15)	20 to 29	124.0 (17.0)
				Female (15)	30 to 39	128.0 (19.0)
				Female (15)	40 to 49	125.0 (14.0)
				Female (15)	50 to 59	110.0 (10.0)
				Female (15)	60 to 69	116.0 (17.0)
				Female (15)	70 to 79	111.0 (12.0)
Obuchi 1994 [53]	Population (Japan)	5	Stopwatch	Male (107)	60 to 69	126.2 (23.7)
				Female (146)	60 to 69	116.5 (19.7)
Purser 2003 [54]	Convenience (USA)	10	Stopwatch	Male (10)	60 to 69	121.3 (11.8)
				Male (28)	70 to 79	119.8 (14.7)
				Female (38)	60 to 69	112.8 (15.0)
				Female (48)	70 to 79	108.9 (18.3)
Rogers 2005 [55]	Convenience (USA)	10	Camera	Female (10)	20 to 29	135.0 (15.9)
Steffen 2002 [15]	Convenience (USA)	6	Stopwatch	Male (15)	60 to 69	159.0 (24.0)
				Male (14)	70 to 79	138.0 (23.0)
				Female (22)	60 to 69	144.0 (25.0)
				Female (22)	70 to 79	133.0 (22.0)
				Female (15)	80 to 99	115.0 (21.0)
Tiedemann 2005 [56]	Population-based (Australia)	6	Stopwatch	Male 124	70 to 79	115.6 (24.9)
				Male (98)	80 to 99	109.6 (23.9)
				Male (11)	80 to 99	86.0 (18.9)
				Female (225)	70 to 79	110.8 (19.9)
				Female (199)	80 to 99	98.2 (22.3)
				Female (11)	80 to 99	79.6 (25.2)
Van Iersel 2007 [57]	Convenience (Holland)	6	Gait mat	Male (17)	70 to 79	140.7 (13.1)
				Female (41)	70 to 79	150.0 (18.7)
Willén 2004 [58]	Population-based (Sweden)	30	Stopwatch	Male (16)	40 to 49	147.0 (22.0)
				Male (20)	50 to 59	143.0 (16.0)
				Male (18)	60 to 69	139.0 (13.0)
				Male (15)	70 to 79	132.0 (16.0)
				Female (18)	40 to 49	140.0 (14.0)
				Female (14)	50 to 59	143.0 (19.0)
				Female (27)	60 to 69	128.0 (24.0)
				Female (14)	70 to 79	116.0 (23.0)

Table 1 (Continued)

Study	Study sample	Test specifics				Stratified speed data (cm/second)
	Type (location)	Distance (m)	Timing	Gender (<i>n</i>)	Age group (years)	Mean (SD)
Wolfson 1996 [39]	Population-based (USA)	8	Photo cell	Male (39)	70 to 79	123.2 (16.3)
				Male (24)	80 to 99	113.0 (25.1)
				Female (26)	70 to 79	113.2 (19.1)
				Female (20)	80 to 99	99.1 (18.4)

SD, standard deviation.

^a Mitsugi Bone and Joint Study.

^b Hawaii Osteoporosis Study.

^c Study of Osteoporotic Fractures.

^d Health Male: ABC.

^e InCHIANTI.

^f NHANES.

^g Cardiovascular Health Study.

^h TASCOG.

ⁱ Ginkgo Evaluation of Memory Study.

^j Radwiche Falls and Fractures Study.

Table 2

Results of meta-analysis.

Strata gender (age in years)	Source articles (<i>n</i>)	Subjects (<i>n</i>)	Gait speed (cm/second)	Grand mean (95% CI) range	Homogeneity <i>Q</i> (<i>P</i>)
Men (20 to 29)	10	155	135.8 (127.0 to 144.7)	121.7 to 147.4	3.255 (0.953)
Men (30 to 39)	5	83	143.3 (131.6 to 155.0)	132.0 to 153.8	1.169 (0.883)
Men (40 to 49)	4	96	143.4 (135.3 to 151.4)	127.0 to 147.0	2.609 (0.625)
Men (50 to 59)	6	436	143.3 (137.9 to 148.8)	112.2 to 149.1	4.721 (0.580)
Men (60 to 69)	12	941	133.9 (126.6 to 141.2)	103.3 to 159.0	15.217 (0.294)
Men (70 to 79)	18	3671	126.2 (121.0 to 132.2)	95.7 to 141.8	12.848 (0.914)
Men (80 to 99)	10	1091	96.8 (83.4 to 110.1)	60.8 to 122.1	4.159 (0.940)
Women (20 to 29)	11	180	134.1 (123.9 to 144.3)	108.2 to 149.9	5.307 (0.870)
Women (30 to 39)	5	104	133.7 (119.3 to 148.2)	125.6 to 141.5	0.785 (0.940)
Women (40 to 49)	7	142	139.0 (133.9 to 141.1)	122.0 to 142.0	5.666 (0.579)
Women (50 to 59)	10	456	131.3 (122.2 to 140.5)	110.0 to 155.5	12.291 (0.266)
Women (60 to 69)	17	5013	124.1 (118.3 to 130.0)	97.0 to 145.0	11.515 (0.932)
Women (70 to 79)	29	8591	113.2 (107.2 to 119.2)	83.0 to 150.0	16.775 (0.998)
Women (80 to 99)	17	2152	94.3 (85.2 to 103.4)	55.7 to 117.0	11.428 (0.954)

CI, confidence interval.

of normal gait speed that are more precise than those possible with individual studies. Despite the diversity of subject pools and procedures employed in studies included in this meta-analysis, the consolidated studies were homogeneous. While this was not a foregone conclusion, many of the factors that might have influenced gait speed [64] were controlled via inclusion and exclusion criteria.

This study does have several limitations. First, it is not comprehensive. Although four databases were used to find relevant literature, the final search was up to the end of 2008. Between that time and the present, relevant articles other than the two identified through hand searches may have been published. Of the relevant articles identified, some did not provide data in a manner that enabled inclusion. If the authors of a study could not be reached, failed to respond or refused to provide the necessary information, the data could not be incorporated. This resulted in the loss of several thousand subjects. Second, the quality of the studies included was not rated. While quality 'is of obvious relevance to meta-

analysis' [65], quality rating scales are typically designed for use with clinical trials. This meta-analysis merely used descriptive data. Third, no sensitivity analysis was performed. As data within strata were homogeneous, such analysis was not deemed to be necessary or informative. Fourth, factors other than age and gender (e.g. stature) that are known to affect gait speed [66] were not addressed. They were too infrequently reported to consider.

Conclusions

This meta-analysis consolidates measurements of normal gait speed from over 23 000 subjects tested in 41 different studies. Normative reference values are provided for gender- and age-specific strata. The norms provided can be used to determine how an individual's speed compares with the average for healthy individuals of the same gender and age.

Ethical approval: Not applicable.

Conflict of interest: None declared.

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