Average Grip Strength: A Meta-Analysis of Data Obtained with a Jamar Dynamometer from Individuals 75 Years or More of Age

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ABSTRACT

Background and Purpose: Although strength diminishes with age, average values for grip strength have not been available heretofore for discrete strata after 75 years. The purpose of this meta-analysis was to provide average values for the left and right hands of men and women 75-79, 80-84, 85-89, and 90-99 years. **Methods:** Contributing to the analysis were 7 studies and 739 subjects with whom the Jamar dynamometer and standard procedures were employed. **Results:** Based on the analysis, average values for the left and right hands of men and women in each age stratum were derived. **Conclusions:** The derived values can serve as a standard of comparison for individual patients. An individual whose grip strength is below the lower limit of the confidence intervals of each stratum can be confidently considered to have less than average grip strength.

Key Words: muscle, strength, normative values, hand, dynamometry

INTRODUCTION

Grip strength is an established predictor of untoward outcomes such as mortality, postsurgical complications, and future disability.[1] Nevertheless, judgments about whether an individual is impaired are best determined by comparing his or her performance to reference values obtained from a relevant population.[2] In the case of grip strength, there are reference values available from individual studies,[3-6] as well as values generated by meta-analysis that can serve as a basis of comparison.[7] In either case, the values for older adults are typically presented corporately for individuals that have reached a certain age (eg, 75 years). As decreases in strength accelerate after 75 years of age,[8] more delineated reference values are warranted for individuals beyond this age. The purpose of this meta-analysis, therefore, is to present average values for grip strength derived from data consolidated from multiple studies of individuals at least 75 years of age. Specifically, of interest are average values stratified according to specific age (ie, 75-79, 80-84, 85-89, 90-99) and gender categories.

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METHODS

Relevant articles were sought via MEDLINE/PubMed, Cumulative Index of Nursing and Allied Health, EMBASE, and Science Citation Index (through 2005). The terms hand, grip, grasp, dynamometer, dynamometry, and strength were used in various combinations with the terms norms, normative, reference, and average. No a priori limits were placed on the searches. Abstracts of articles identified by the search were examined for relevance. Articles appearing to be relevant were examined in their entirety as were articles identified in the reference lists of the articles. Inclusion criteria were that a study: (1) tested apparently unimpaired individuals at least 75 years of age, (2) used a Jamar dynamometer, and (3) applied procedures consistent with the recommendations of the American Society of Hand Therapists (ie, subject seated, shoulder adducted, elbow flexed 90°, forearm in neutral position).[9] As our intent was to coalesce grip strength data from the left and right hands of men and women of specific age groups (75-79, 80-84, 85-89,90-99 years), we examined studies for data amenable to such breakdowns. For data not so presented, the corresponding author was contacted about provision of data in a usable format. Unpublished data relevant to published studies were also sought from authors. Articles were excluded if they presented data according to dominant side or from only one side (eg, strong side).

Data were entered into an SPSS (version 11.0) database suitable for meta-analysis. Specifically entered for individual strata (eg, left hand, women, 75-79 years) were the mean and standard deviation of grip strength from each source study. Consequently, only strata for which at least 2 subjects contributed data were relevant. The inverse of the variance was then computed and used along with the associated mean and sample size to generate separate pooled outcomes (mean and 95% confidence intervals [CIs]) for grip strength of men and women. The MetaF.sps macro provided by Wilson was used to generate these descriptive statistics.[10] The macro was also used to determine if strength differed between age groups and if strength was homogeneous overall and within age groups.

RESULTS

The database searches and article reference list searches yielded more than 1000 potentially relevant articles. Based on our inclusion and exclusion criteria, all but 7 studies were culled. The 7 studies involved 270 men and 469 women subjects.[3,5,6,11-14] A description of the studies is provided in Table 1. The majority of tested subjects were from the United States and involved convenience samples.

Table 2 summarizes grip strength for the left and right hands of men in the 4 age groups. Application of the MetaF.sps macro to their data demonstrated that grip strength was not homogeneous and differed significantly between age groups ($Q = 29.715$, $p < .001$). However, data within each of the 4 age groups were homogeneous ($Q = .342$-2.646, $p > .750$). Table 3 summarizes grip strength for the left and right hands of women in the 4 age groups. Application of the MetatF.sps macro to their data demonstrated that grip strength was homgeneous but not strongly so ($Q = 3.968$, $p = .265$). Data within each of the 4 age groups demonstrated strong homogeneity ($Q = .225$-1.900, $p > .780$).

DISCUSSION

Grip strength is of known value as a predictor of important outcomes.[1] Although reference values for grip strength have been published previously, the values have been restricted to samples of limited size from confined geographic regions. The present meta-analysis consolidated data from Canada, Australia, and several locations within the United States.

Most previous research has presented reference values for older adults that encompass a broad age range. Our analysis supports and provides strength averages for more restricted age groups (eg, 75-79 years) of men and women. By doing so, we offer clinicians values that are better suited for judging the performance of older individuals. For example, the confidence intervals reported in a recent meta-analysis for women greater than 75 years would suggest that an 87-year-old woman whose right grip strength is less than 35.3 pounds has less than average grip strength.[7] The present analysis, however, suggests that her right grip strength would have to be less than 28.3 pounds for her strength to be considered less than average.

The benefits of the present meta-analysis notwithstanding, several limitations are worth noting. First, data are presented as left versus right rather than as dominant versus nondominant. While such a presentation has precedence, it does not account for differences between dominant and nondominant sides. That difference can surpass 10% for right handed individuals.[15] Moreover, it does not highlight the measurement from the best side, which some research does. Second, the number of older subjects (ie, 90-99 years) contributing to the meta-analysis was far fewer than the number of less old subjects (ie, 75-79). Consequently, the estimate of average strength for the oldest subjects may be less precise. An oversampling of old-old individuals may be in order. Third, individuals who survive into their nineties may not be representative of all older adults. While this may not be a problem for comparisons within an age group, it may distort a sense of how strength decreases with aging. Fourth, while age associated values have utility, they do not provide an indication of the grip strength necessary to manage everyday tasks. Moreover, they are not equivalent to cut scores that identify older adults as frail or at risk for untoward outcomes. Such scores certainly need to be known and established.

CONCLUSIONS

We have presented some grip strength values to which older adults of specific age groups can be compared to judge subaverage performance. These values are more specific than those previously available. Nevertheless, they are limited to performance stratified by left and right side. Further data from diverse settings is still required, particularly for the oldest old.

Table 1. Summary of Descriptive Data of 7 Studies Contributing to the Meta-Analysis

Source	Location	Sample Type (n)	Age Groups (yr)	Measure Used
Albert et al[13]	USA	Convenience (260)	75-99	Mean of 2
Bear-Lehman et al[14]	USA	Convenience (110)	75-99	Mean of 3
Bohannon & Schaubert[11]	USA	Convenience (9)	75-84	First of 2
Brennan et al[12]	USA	Convenience (87)	75-99	Mean of 2
Desrosiers et al[6]	Canada	Random: community (165)	75-99	Mean of 3
Massy-Westropp et al[5]	Australia	Convenience (61)	75-89	One trial
Mathiowetz et al[3]	USA	Convenience (47)	75-84	Mean of 3

Table 2. Results of Meta-Analysis of Grip Strength Data Obtained from Men 75 or More Years of Age

Age Group (yrs)	Side	Studies/Subjects	Homogeneity Q (p)	Strength (lb) Mean (95% CI)	Strength (kg) Mean (95% CI)
75-79	Left	6/114	2.011 (.848)	68.5 (56.4-80.6)	31.1 (25.6-36.6)
	Right	6/114	1.136 (.951)	72.7 (59.7-85.7)	33.0 (27.1-38.9)
80-84	Left	6/107	2.646 (.754)	59.6 (49.0-70.2)	27.0 (22.2-31.8)
	Right	6/107	1.724 (.886)	66.4 (53.6-79.1)	30.1 (24.3-35.9)
85-89	Left	5/35	.739 (.946)	55.3 (45.1-65.5)	25.1 (20.5-29.7)
	Right	5/35	.940 (.919)	56.9 (50.3-63.5)	25.8 (22.8-28.8)
90-99	Left	4/14	.342 (.952)	41.6 (38.3-44.8)	18.9 (17.4-20.3)
	Right	4/14	.630 (.889)	41.5 (31.1-51.9)	18.8 (14.1-23.5)

Table 3. Results of Meta-Analysis of Grip Strength Data Obtained from Women 75 or More Years of Age

Age Group (yrs)	Side	Studies/Subjects	Homogeneity Q (p)	Strength (lb) Mean (95% CI)	Strength (kg) Mean (95% CI)
75-79	Left	7/207	1.168 (.978)	42.5 (35.5-49.4)	19.3 (16.1-22.4)
	Right	7/207	1.618 (.951)	47.6 (40.9-54.2)	21.6 (18.6-24.6)
80-84	Left	7/166	1.685 (.946)	37.6 (31.9-43.3)	17.1 (14.5-19.6)
	Right	7/166	1.900 (.929)	38.2 (32.6-43.8)	17.3 (14.8-19.9)
85-89	Left	5/75	1.719 (.787)	34.6 (26.9-42.3)	15.7 (12.2-19.2)
	Right	5/75	.956 (.916)	37.7 (28.3-47.1)	17.1 (12.8-21.4)
90-99	Left	3/21	.225 (.894)	32.6 (24.6-40.5)	14.8 (11.2-18.4)
	Right	3/21	.408 (.815)	33.6 (25.3-42.0)	15.2 (11.5-19.1)

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