Midlife Hand Grip Strength as a Predictor of Old Age Disability

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In old age, decreased muscle strength predisposes people to functional limitations and disability.1-3 Cross-sectionally, muscle strength is significantly, but not linearly, associated with functional limitations such as walking speed.4-7 A minimum level of strength is needed to perform tasks. Conversely, when strength is well above the minimum required level, a reserve capacity exists.1,5,7 Reserve capacity serves as a safety margin that helps prevent functional limitations from developing, e.g., following inactivity and deconditioning associated with surgery or an acute illness.

The purpose of this research was to study midlife muscle strength as a predictor of late life functional limitations and disability among initially healthy men with an average age of 54.0 years (range, 45-68 years) at baseline. The average follow-up time was 25.3 years.

METHODS

Subjects in these analyses are from the Honolulu Heart Program and the Honolulu-Asia Aging Study.8 From 1965 through 1968, 8006 men aged 45 to 68 years participated in exam 1. Exam 2 took place 3 years later (1968 through 1970), with 7498 men participating. Exam 4 data were collected from 1991 through 1993 when participants were 71 to 93 years old.

The current analyses were limited to those participants who were healthy at baseline. Persons who had missing data on disease status (n = 37); who had diabetes, gout, arthritis, stroke, heart attack, angina pectoris, or other heart disease at exam 1 or exam 2 (n = 1454); who dropped out or died between exams 1 and 2 (n = 406); or who reported at exam 4 that difficulty in upper extremity, mobility, or self-care tasks had been present for 25 years or more (n = 20) were excluded. Altogether, 6089 men qualified for the study cohort.

Hand grip strength was measured using a dynamometer (Smedley Hand Dynamometer, Stoelting Co, Wood Dale, Ill) at exams 1 and 2 with midlife strength determined as the average of the best results in these 2 exams.9 Measures of functional limitations at exam 4 included customary walking speed (≤0.4 m/s) and inability to rise from a seated position without using the arms, and multiple self-reported upper extremity, mobility, and self-care disability outcomes.

Results

After adjustment for multiple potential confounders, risk of functional limitations and disability 25 years later increased as baseline hand grip strength, divided into tertiles, declined. The odds ratio (OR) of walking speed of 0.4 m/s or slower was 2.87 (95% confidence interval [CI], 1.76-4.67) in those in the lowest third and 1.79 (95% CI, 1.14-2.81) in the middle third of grip strength vs those in the highest third. The risk of self-care disability was more than 2 times greater in the lowest vs the highest grip strength tertile. Adding chronic conditions identified at follow-up to the models predicting disability reduced the ORs related to grip strength only minimally.

Conclusions

Among healthy 45- to 68-year-old men, hand grip strength was highly predictive of functional limitations and disability 25 years later. Good muscle strength in midlife may protect people from old age disability by providing a greater safety margin above the threshold of disability.

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Figure. Functional Limitations 25 Years After Assessing Grip Strength

![Figure](image)


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The page contains a table listing odds ratios and confidence intervals for various activities related to disability. The table is titled "STRENGTH AS A PREDICTOR OF DISABILITY." The table columns include "Age, Weight, and Height," and "Middle Age, Health, Occupation, Smoking, and Physical Activity." The rows list different activities and their odds ratios with 95% confidence intervals.

There are also other potential explanations for our results. Grip strength may be a marker of physical activity, which itself preserves function and prevents disability. Low grip strength may indicate some general intrinsic disease. Finally, good grip strength may mark some general intrinsic disease, which later develops into clinical disease. After 25 years, the study suggests that hand grip strength could be used for early screening of people at increased risk of physical disability in old age.

**REFERENCES**