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Association between cardiovascular health metrics and self-reported walking difficulty in community-dwelling middle-aged and older adults: results from the longevity check-up (Lookup) 8+

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HIGHLIGHTS

- Cardiovascular health (CVH) is inversely associated with walking difficulty.
- Physical activity, body mass index, and sleep are predictors of walking ability.
- Mediterranean diet adherence is linked to mobility, especially in older adults.
- Promoting CVH may help prevent functional decline in late life.

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ABSTRACT

Objectives: To examine the association between cardiovascular health, assessed through an 8-factor cardiovascular health (8F–CVH) score, and self-reported walking difficulty in middle-aged (40–64 years) and older adults ($\geq$65 years) living in the community.
Study design: Cross-sectional study.
Main outcome measures: Self-reported walking difficulty was evaluated by a single-item question: "Do you have any difficulty in walking 400 meters?". Cardiovascular health was assessed using a composite 8F–CVH score inspired by Life's Essential 8, including diet, physical activity, body mass index, blood pressure, total cholesterol, fasting blood glucose, smoking status, and sleep quality.
Results: Among 4141 participants (mean age 60.5 ± 11.2 years; 53.1 % women), 16.0 % reported walking difficulty. Prevalence was higher in older adults (25.0 %) than in middle-aged individuals (11.0 %; p for trend $<$0.001). Self-reported walking difficulty was more frequent in participants with low 8F–CVH scores (32.8 %), compared to moderate (15.5 %) and high (4.8 %) scores (p $<$0.001). ROC curve analysis showed modest discrimination for the total score (area under the curve [AUC] 0.67; 95 % confidence interval [CI] 0.65–0.69), with physical activity performing best among individual components (AUC 0.69; 95 % CI 0.67–0.71). After adjusting for confounders, moderate and high scores were associated with 61 % (OR 0.39, 95 % CI 0.31–0.48) and 84 % (OR 0.16, 95 % CI 0.10–0.24) lower odds of self-reported walking difficulty, respectively.
Conclusions: Better cardiovascular health is independently associated with lower odds of self-reported walking difficulty. Promoting cardiovascular health may help preserve mobility in late life.

1. Introduction

Mobility is a cornerstone of healthy aging, influencing independence, quality of life, and overall well-being (Cesari et al., 2018, Cacciatore & Marzetti, 2023). Mobility impairment is a hallmark of frailty, a clinical syndrome characterized by diminished physiological reserves and increased vulnerability to stressors (Cesari et al., 2014). Notably, the frailty phenotype, as defined by Fried et al. (Fried et al.,

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2001), includes slow gait speed, low physical activity, weakness, exhaustion, and unintentional weight loss, all of which contribute to or stem from mobility limitations. Although more prevalent in older adults, early signs of mobility loss and frailty can also appear in middle age (Hanlon et al., 2018). The clinical significance and underlying mechanisms of mobility limitations vary across the life course. In early life, mobility is essential for physical, cognitive, and social development, with peak performance achieved in young adulthood. Early deficits, such as low bone mass or reduced muscle strength, may predispose to conditions including osteoporosis and sarcopenia later in life, underscoring the value of preventive strategies like regular physical activity from youth (Ferrucci et al., 2016). In late life, mobility becomes a critical marker of functional capacity and independence, as its decline represents the first step toward disability, institutionalization, and mortality (Brown & Flood, 2013). Age-related mobility loss reflects cumulative impairments across musculoskeletal, neurological, cardiovascular, and sensory systems, and gait speed has emerged as a robust prognostic indicator, including in older adults with cardiovascular disease (Forman et al., 2017). Healthy individuals typically sustain faster gait speed, higher levels of physical activity, and preserved strength, whereas those with chronic conditions such as diabetes, osteoarthritis, or heart failure experience slower gait, reduced endurance, and heightened vulnerability to frailty (Brown & Flood, 2013, Kriegsman et al., 1997). Ultimately, chronic diseases accelerate mobility decline and amplify the risk of functional dependence, with slow gait and low activity levels being among the most informative indicators of future disability (Hoogendijk et al., 2015, Rothman et al., 2008, Liu et al., 2017).

Among simple yet effective screening tools, self-reported difficulty walking 400 m has gained attention for its ability to identify early mobility limitations and probable sarcopenia (Salini et al., 2022, Chen et al., 2018). Individuals reporting such difficulty are over twice as likely to have reduced muscle strength (dynapenia), highlighting a strong link between self-perceived mobility and physical decline (Salini et al., 2022). Cardiovascular health plays a central role in preserving mobility and functional autonomy throughout life. A growing body of research underscores a bidirectional relationship between cardiovascular disease (CVD) and frailty, with shared biological mechanisms such as chronic inflammation, mitochondrial dysfunction, oxidative stress, metabolic dysregulation, and vascular aging. This interplay can create a self-reinforcing cycle, where frailty heightens vulnerability to CVD, and CVD accelerates frailty progression by impairing organ function and resilience (James et al., 2024). To address the rising burden of CVD, the American Heart Association (AHA) launched the Life's Simple 7 framework in 2010, targeting modifiable health behaviors and risk factors including diet, physical activity, smoking, weight, blood glucose, cholesterol, and blood pressure (Lloyd-Jones et al., 2010). In 2022, this framework evolved into Life's Essential 8 with the addition of sleep health, recognizing its critical role in cardiovascular and overall health (Lloyd-Jones et al., 2022). Beyond cardiovascular protection, adherence to Life's Essential 8 has been associated with better physical function, reduced risk of frailty, and slower biological aging (Landi et al., 2018a; Jin et al., 2017; Windham et al., 2017; Kumar et al., 2023; Zhang et al., 2023; Zhao et al., 2024; Carbonneau et al., 2024). However, while the impact of individual health metrics on mobility is well documented, data on their cumulative effect remain scarce, especially concerning early identification of mobility decline in middle-aged and older adults.

In this context, the present study investigated the relationship between cardiovascular health metrics, assessed using an 8–Factor Cardiovascular Health (8F–CVH) score inspired by the Life's Essential 8, and self-reported walking difficulty in community-dwelling middle-aged (40–64 years) and older adults (≥65 years) from the Longevity Check-up (Lookup) 8+ cohort.

2. Materials and methods

We performed a retrospective cross-sectional study, analyzing data from the Lookup 8+ initiative, an ongoing research project led by the Department of Geriatrics at the Università Cattolica del Sacro Cuore and the Fondazione Policlinico Universitario "Agostino Gemelli" IRCCS in Rome, Italy. Participants were excluded if they declined to undergo capillary blood tests for cholesterol and glucose or did not provide written informed consent. The study protocol was reviewed and approved by the Ethics Committee of the Università Cattolica del Sacro Cuore (Protocol #A.1220/CE/2011). Prior to participation, all individuals provided written informed consent. Methodological details and study procedures have been extensively documented in previous publications (Landi et al., 2017; Cacciatore et al., 2025a).

2.1. *Sample selection*

For the present analysis, we included individuals aged 40 years and older. Recruitment took place in public venues across multiple cities, ensuring broad geographic representation from both mainland Italy and its islands. In major urban centers (>250,000 residents), multiple recruitment events were held in different districts to capture diverse demographic characteristics.

2.2. *Data collection*

Participants took part in a comprehensive assessment process that involved a structured survey, clinical health evaluations, and physical measurements (Landi et al., 2018b).

Smoking status was categorized into three groups: current smokers, never smokers, and former smokers. Body weight was measured with an analog scale, while height was determined using a stadiometer. The body mass index (BMI) was calculated by dividing body weight (kg) by height squared (m^2). Dietary data were gathered via a simplified food frequency questionnaire (FFQ), which covered major food groups (Coelho-Junior et al., 2023). The Italian standard portion reference was used to estimate portion size (Società Italiana di Nutrizione Umana (SINU) 2025). Physical activity was defined as engagement in any form of exercise lasting at least 30 min, twice a week in the previous year (American College of Sports Medicine et al., 2009). Information on the type of physical activity was collected (Landi et al., 2018c). For the analysis, participants were categorized as physically active or inactive. Self-reported sleep quality was assessed using a single question: "How would you rate your sleep quality over the past month?". Participants could choose from the following responses: "Very good", "Quite good", "Quite poor", or "Very poor" (Cacciatore et al., 2025a). A portable instrument with disposable strips (MultiCare-In, Biomedical Systems International srl, Florence, Italy) was used to measure total blood cholesterol (Rapi et al., 2009). Blood glucose was assessed using a MultiCare-In handheld device (Rapi et al., 2009). Blood pressure was measured using an electronic sphygmomanometer in accordance with European guideline recommendations (McEvoy et al., 2024). Handgrip strength was measured using a hydraulic dynamometer (North Coast Medical, Inc., Morgan Hill, CA, USA). Participants performed the test while seated, with their elbows flexed at 90°, following standardized procedures. The highest reading from either hand was used for analysis. Dynapenia was defined as muscle strength lower than two standard deviations of the mean value within each age class, as recommended by the European Working Group on Sarcopenia in Older People (Supplementary Table S1) (Cruz-Jentoft et al., 2019). Muscle mass was estimated using calf circumference and the equation proposed by the COCONUT study group (Santos et al., 2019), which has been validated for predicting appendicular skeletal muscle mass (ASM). According to the criteria of the Foundation for the National Institutes of Health Sarcopenia Project (Studenski et al., 2014), low absolute muscle mass was defined as ASM values lower than 19.75 kg in men and below 15.02 kg in women. Low BMI-adjusted muscle mass was defined for ASM adjusted for BMI (ASM/BMI) values lower than 0.789 and 0.512 in men and women, respectively (Studenski et al., 2014).

2.3. Calculation of the 8–Factor cardiovascular health score

The 8F–CVH score was calculated as a composite measure encompassing eight key health behaviors and risk factors: diet, physical activity, smoking, sleep, BMI, blood pressure, total blood cholesterol, and blood glucose. Each component was assigned a scaled score ranging from 0 to 100, with higher values indicating optimal cardiovascular health, and the final 8F–CVH score was derived as the average of these components (Supplementary Table S2). Adherence to a Mediterranean-style diet as an indicator of a healthy dietary pattern was calculated through a modified version of the Medi-Lite score (Sofi et al., 2017; Sofi et al., 2014; Cacciatore et al., 2023a,b). To ensure greater comparability with the scoring system employed in the Life's Essential 8, only participants with available data from fasting blood glucose measurements were included in the analysis. The final 8F–CVH score was calculated as the average of these eight individual scores, ensuring equal weighting across all health behaviors and risk factors. Similarly to the AHA's Life's Essential 8 (Lloyd-Jones et al., 2022), the score was classified into three categories: high cardiovascular health (≥80 points), moderate cardiovascular health (50–79.9 points), and low cardiovascular health (<50 points).

2.4. Self-reported walking difficulty

Perceived physical performance was evaluated through a single-question assessment: "Do you experience any difficulty walking 400 m?". To facilitate comprehension, practical references were provided during the interview, such as walking to a nearby grocery store, covering the distance between two bus stops, or completing one lap around an athletic track. Response options included: "No difficulty", "A little difficulty", "A lot of difficulty", and "Unable to walk this distance". For analysis, the variable was dichotomized into two categories: walking difficulty or inability, which included participants reporting "a little difficulty", "a lot of difficulty", or being "unable to walk this distance", and no walking difficulty for those who reported "no difficulty".

2.5. Statistical analysis

Continuous variables were summarized as mean ± standard deviation (SD), while categorical variables were presented as absolute frequencies and percentages. Differences between groups were assessed using Student's t test or analysis of variance for continuous variables, when appropriate, and the chi-square test for categorical variables. To evaluate the association between cardiovascular health metrics scores and self-reported difficulty in walking 400 m, a multivariable logistic regression model was performed. Odds ratios (OR) with 95 % confidence intervals (CI) were estimated for each cardiovascular health metric, adjusting for potential confounders. To assess the presence of multicollinearity among covariates included in the multivariable models, variance inflation factors (VIF) were calculated. A threshold of VIF <5 was considered acceptable, indicating no significant collinearity. Receiver operating characteristic (ROC) curves were generated to evaluate the discriminatory ability of the total 8F–CVH score and each of its individual components in predicting self-reported walking difficulty, both in the total sample and stratified by age group (40–64 and ≥65 years). The area under the curve (AUC) and 95 % CI were computed for each metric. Pairwise comparisons between AUCs were conducted using the DeLong test to assess significant differences. Results were visualized using comparative ROC plots, specifically forest plots displaying AUC values with CI for each predictor. Significance level was set at $p < 0.05$. Analyses were conducted using R software, version 4.2.3 (R Core Team, Vienna, Austria).

3. Results

Between 10 May 2019 and 1 November 2024, a total of 8743 participants aged 40 years or older were recruited across Italy. We excluded 1371 individuals due to missing data in variables of interest (including 60 for self-reported walking difficulty, 361 for blood pressure, 549 for cholesterol, 371 for diabetes, 164 for diet, 70 for BMI, 46 for smoking status, 210 for physical activity, and 67 for sleep quality). A further group of 3231 participants was excluded because their blood glucose was measured in a non-fasting state (Supplementary Table S3). Eventually, a total of 4141 participants were included in the analysis. No significant differences in personal or anthropometric characteristics were observed between those included and excluded.

3.1. General characteristics of the study population

The general characteristics of the study population, stratified according to self-reported difficulty in walking 400 m, are presented in Table 1. The mean age of the total sample was 60.2 ± 11.3 years, of whom 53.3 % were women. Approximately two-thirds were between 40 and 64 years of age (66.0 %), while the remaining one-third were 65 years or older (34.0 %). Walking difficulty was reported by 661 participants (16.0 %). Participants with self-reported walking difficulty were significantly older (66.2 ± 12.0 years vs. 59.5 ± 10.7 years, $p < 0.001$) and more likely to be females (61.1 % vs. 51.5 %, $p < 0.001$). Those with walking difficulty had a higher prevalence of poor sleep quality (39.6 % vs. 28.6 %, $p < 0.001$), lower levels of physical activity (39.8 % vs. 64.9 %, $p < 0.001$), and higher blood glucose levels (109.0 ± 28.0 mg/dL vs. 102.0 ± 18.8 mg/dL, $p < 0.001$) and BMI values (26.7 ± 4.6 kg/m^2 vs. 24.4 ± 3.6 kg/m^2, $p < 0.001$) compared to those without walking difficulty. Regarding muscle mass and strength, individuals with self-reported walking difficulty had lower handgrip strength (men: 34.9 ± 9.0 kg vs. 39.4 ± 9.0 kg, $p < 0.001$; women: 21.9 ± 5.8 kg vs. 24.9 ± 5.4 kg, $p < 0.001$), with a higher prevalence of dynapenia (4.1 % vs. 1.9 %, $p < 0.001$). ASM did not significantly differ between those with and without self-reported walking difficulty in either men (23.5 ± 2.5 kg vs. 23.6 ± 2.4 kg, $p = 0.523$) or women (14.9 ± 2.7 kg vs. 14.9 ± 2.4 kg, $p = 0.902$), while a significantly higher proportion of individuals with walking difficulty had low ASM (34.6 % vs. 29.2 %, $p < 0.001$). To account for body size, ASM/BMI was evaluated. Men with walking difficulty had significantly lower ASM/BMI (0.873 ± 0.109 vs. 0.938 ± 0.113, $p < 0.001$), as did women (0.583 ± 0.101 vs. 0.643 ± 0.101, $p < 0.001$). Moreover, low ASM/BMI was more prevalent in individuals reporting walking difficulty (23.6 % vs. 8.7 %, $p < 0.001$). Individuals with self-reported walking difficulty had significantly lower 8F–CVH scores (59.1 ± 12.5 vs. 66.9 ± 12.4, $p < 0.001$). A low 8F–CVH score (<50) was more prevalent among those with walking difficulty (23.0 % vs. 8.9 %, $p < 0.001$), whereas a high 8F–CVH score (≥80) was significantly less frequent in this group (4.2 % vs. 15.9 %, $p < 0.001$).

When stratified by 8F–CVH score categories, individuals with a low cardiovascular health score exhibited markedly worse profiles across all cardiovascular health metrics in the whole sample ($p < 0.001$ for all, Supplementary Table S4) as well as in middle-aged ($p < 0.001$ for all, Supplementary Table S5) and older groups ($p < 0.001$ for all, Supplementary Table S6).

3.2. Prevalence of self-reported walking difficulty

The prevalence of self-reported walking difficulty was significantly higher among older adults (≥65 years) compared to younger individuals (40–64 years). Specifically, 25.0 % of those 65 years or older reported difficulty with walking 400 m, whereas only 11.0 % of those aged 40–64 years reported the same issue. The prevalence of walking difficulty increased progressively with age (p for trend <0.001, Fig. 1). Among participants aged 40–44 years, 9.5 % reported difficulty with walking 400 m, and this percentage increased to 41.1 % among those 80 years or older. The largest difference in the prevalence of self-reported difficulty was observed after the age of 70, with 34.4 % of individuals over 75 years reporting walking limitations.

Table 1
Characteristics of the study sample according to the ability of walking 400 m.

	Self-reported walking difficulty (n = 661)	No self-reported walking difficulty (n = 3480)	Total sample (n = 4141)	*p*
General characteristics				
Age, years	66.2 (12.0)	59.5 (10.7)	60.5 (11.2)	<0.001
40–64 years old	293 (44.3 %)	2378 (68.3 %)	2671 (64.5 %)	<0.001
≥ 65 years old	368 (55.7 %)	1102 (31.7 %)	1470 (35.5 %)	
Sex, female	404 (61.1 %)	1793 (51.5 %)	2197 (53.1 %)	<0.001
Current smoking	126 (19.1 %)	616 (17.7 %)	742 (17.9 %)	0.442
Physically active	263 (39.8 %)	2258 (64.9 %)	2521 (60.9 %)	<0.001
Systolic blood pressure, mmHg	126 (15.9)	125 (16.0)	125 (15.9)	0.092
Diastolic blood pressure, mmHg	75.6 (10.0)	76.5 (9.9)	76.4 (9.9)	0.039
Blood glucose, mg/dL	109.0 (28.0)	102.0 (18.8)	103 (20.7)	<0.001
Total cholesterol, mg/dL	190 (37.5)	192 (37.0)	191 (37.1)	0.245
BMI, kg/m^2	26.7 (4.6)	24.4 (3.7)	24.8 (3.9)	<0.001
Poor sleep quality	262 (39.6 %)	995 (28.6 %)	1257 (30.4 %)	<0.001
Muscle mass, strength and physical performance				
Handgrip strength, kg				
Men	34.9 (9.0)	39.4 (9.0)	38.8 (9.2)	<0.001
Women	21.9 (5.8)	24.9 (5.4)	24.3 (5.6)	<0.001
Dynapenia	27 (4.1 %)	66 (1.9 %)	93 (2.2 %)	<0.001
ASM, kg				
Men	23.5 (2.5)	23.6 (2.4)	23.6 (2.5)	0.523
Women	14.9 (2.7)	14.9 (2.4)	14.9 (2.5)	0.902
Low ASM	229 (34.6 %)	1016 (29.2 %)	1245 (30.1 %)	<0.001
ASM/BMI				
Men	0.873 (0.109)	0.938 (0.113)	0.930 (0.115)	<0.001
Women	0.583 (0.101)	0.643 (0.101)	0.632 (0.103)	<0.001
Low ASM/BMI	156 (23.6 %)	303 (8.7 %)	459 (11.1 %)	<0.001
Cardiovascular health scores				
8F–CVH Score	59.1 (12.5)	66.9 (12.4)	65.6 (12.7)	<0.001
Low 8F–CVH score (<50)	152 (23.0 %)	311 (8.9 %)	463 (11.2 %)	<0.001
Moderate 8F–CVH Score (50–79.9)	481 (72.8 %)	2614 (75.1 %)	3095 (74.7 %)	<0.001
High 8F–CVH Score (≥ 80)	28 (4.2 %)	555 (15.9 %)	583 (14.1 %)	<0.001
Physical activity score	29.3 (29.4)	52.3 (34.4)	48.6 (34.7)	<0.001
Blood pressure score	55.8 (36.9)	62.0 (36.7)	61.0 (36.8)	<0.001
Blood glucose score	71.7 (28.9)	78.3 (24.9)	77.3 (25.7)	<0.001
Blood cholesterol score	75.6 (26.8)	76.2 (27.0)	76.1 (26.9)	0.598
BMI score	73.0 (27.2)	85.0 (21.5)	83.1 (22.9)	<0.001
Smoking score	71.8 (36.7)	73.0 (36.2)	72.8 (36.3)	0.423
Sleep score	53.4 (32.6)	61.0 (30.7)	59.8 (31.1)	<0.001
Diet score	42.2 (34.0)	47.2 (34.4)	46.4 (34.4)	<0.001

Data are reported as absolute numbers (percentages) for categorical variables, such as sex, dynapenia, and difficulty in walking 400 m. Continuous variables are reported as means (standard deviations). Dynapenia is defined as handgrip strength below 2 standard deviations from the mean value within each age class. Abbreviation: 8F–CVH score, 8–Factor Cardiovascular Health score; ASM: appendicular skeletal mass; ASM/BMI: body mass index-adjusted appendicular skeletal mass; BMI, body mass index.

Individuals with difficulty walking 400 m had lower 8F–CVH scores in both 40–64 years (59.8 ± 13.6 vs. 68.2 ± 12.5, $p < 0.001$) and ≥65 years (58.6 ± 11.6 vs. 64.1 ± 11.6, $p < 0.001$) groups (Fig. 2, Supplementary Table S7). Differences were observed for physical activity, sleep, diet, BMI, and metabolic parameters, with significantly lower physical activity ($p < 0.001$), poorer sleep ($p < 0.001$), and poorer diet scores ($p < 0.01$) among those reporting walking difficulty. BMI scores were higher in participants without walking difficulty ($p < 0.001$). Blood glucose scores were significantly lower in participants aged ≥65 years with difficulty in walking 400 m ($p < 0.001$), but no significant differences were found in the 40–64 years old group ($p = 0.094$). Differences in blood cholesterol and blood pressure scores were not statistically significant in either the 40–64 years group ($p = 0.233$ and $p = 0.215$, respectively) or the ≥65 years group ($p = 0.267$ and $p = 0.492$, respectively). The smoking score did not significantly differ between those with and without walking difficulty in the whole sample ($p = 0.423$) or the ≥65 years group ($p = 0.499$) but was significantly lower in those with walking difficulty in the 40–64 years group ($p = 0.015$).

3.3. Discriminatory ability of cardiovascular health metrics for walking difficulty

Fig. 3 illustrates the AUCs with 95 % CIs for the prediction of self-reported difficulty in walking 400 m based on the 8F–CVH total score and its individual components. The analysis was conducted in the whole sample (Fig. 3A), as well as in the age groups considered (Fig. 3B and 3C).

In the whole sample, the highest discriminatory ability was observed for physical activity (AUC 0.69; 95 % CI 0.67–0.71), followed by the 8F–CVH total score (AUC 0.67; 95 % CI 0.65–0.69) and BMI (AUC 0.63; 95 % CI 0.60–0.65). Other components showed lower predictive capacity: sleep (AUC 0.56; 95 % CI 0.54–0.59), glucose (AUC 0.56; 95 % CI 0.54–0.58), blood pressure (AUC 0.55; 95 % CI 0.52–0.57), diet (AUC 0.54; 95 % CI 0.52–0.56), cholesterol (AUC 0.51; 95 % CI 0.49–0.53), and smoking (AUC 0.51; 95 % CI 0.49–0.53).

In middle-aged adults (40–64 years), a similar pattern was observed. Physical activity remained the most discriminative metric (AUC 0.69; 95 % CI: 0.66–0.72), followed by the 8F–CVH total score (AUC 0.68; 95 % CI 0.64–0.71) and BMI (AUC 0.63; 95 % CI 0.59–0.66). The remaining components had modest AUCs: sleep (AUC 0.59; 95 % CI 0.55–0.62), diet (AUC 0.55; 95 % CI 0.51–0.58), smoking (AUC 0.54; 95 % CI 0.50–0.57), cholesterol, blood pressure, and glucose (AUC 0.52; 95 % CI 0.49–0.55 for all).

Likewise, among older adults (≥ 65 years), the physical activity score again showed the highest AUC (AUC 0.66; 95 % CI 0.63–0.69), followed by the 8F–CVH total score (AUC 0.63; 95 % CI 0.60–0.66) and BMI (AUC 0.60; 95 % CI 0.56–0.63). Discrimination remained limited for diet (AUC 0.56; 95 % CI 0.53–0.60), sleep (AUC 0.55; 95 % CI 0.52–0.59), glucose (AUC 0.55; 95 % CI 0.52–0.58), cholesterol (AUC 0.52; 95 % CI 0.49–0.55), blood pressure (AUC 0.51; 95 % CI 0.47–0.54), and smoking (AUC 0.51; 95 % CI 0.48–0.54).

Pairwise comparisons using the DeLong test indicated statistically significant differences in AUC values between the 8F–CVH total score and its individual components both in the whole sample and individual age groups ($p < 0.05$ for all), confirming the superior discriminatory capacity of the composite score and physical activity in identifying individuals reporting difficulty in walking 400 m.

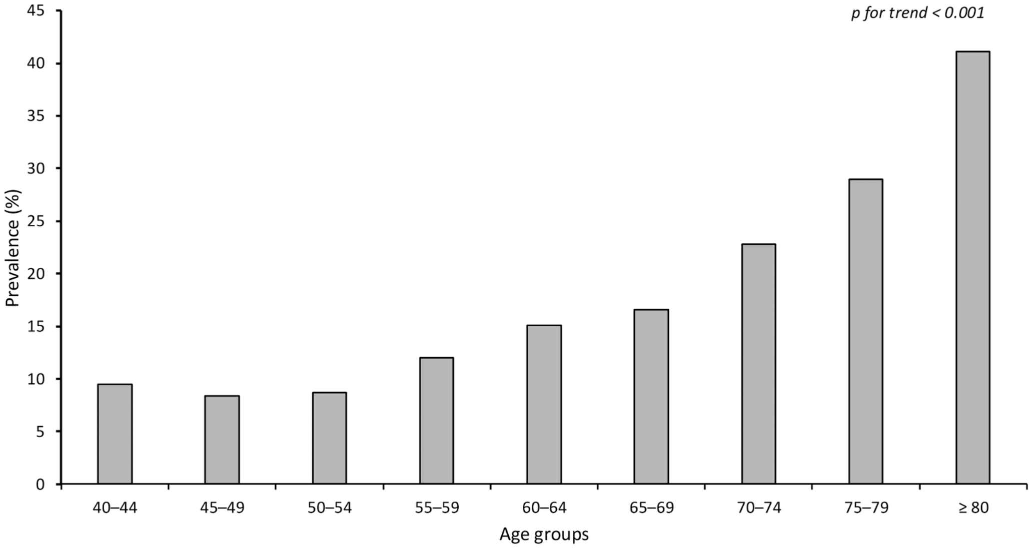

Fig. 1. Prevalence of self-reported difficulty in walking 400 m by age groups.

3.4. Association between cardiovascular health metrics and walking difficulty

Table 2 presents the unadjusted and adjusted logistic regression models evaluating the association between the 8F–CVH score and self-reported difficulty in walking 400 m.

In the whole sample, individuals with a moderate 8F–CVH score had 62 % lower odds of reporting walking difficulty compared to those with a low score (OR 0.38, 95 % CI 0.30–0.47, p <0.001). This association remained significant in age- and sex-adjusted models (OR 0.39, 95 % CI 0.31–0.48, p <0.001) and after additional adjustments for low ASM/BMI and dynapenia (OR 0.41, 95 % CI 0.33–0.52, p <0.001). Likewise, participants with a high 8F–CVH score had 90 % lower odds of reporting walking difficulty (unadjusted OR 0.10, 95 % CI 0.07–0.16, p <0.001), with this association remaining statistically significant in fully adjusted models (OR 0.16, 95 % CI 0.10–0.24, p <0.001). When analyzed as a continuous variable, each one-point increase in the 8F–CVH score was associated with a 4–5 % reduction in the odds of walking difficulty across all models (unadjusted OR 0.95, 95 % CI 0.95–0.96, p <0.001; fully adjusted OR 0.96, 95 % CI 0.95–0.97, p <0.001). Covariates were selected based on clinical relevance and prior evidence as potential confounders, and included age, sex, low ASM/BMI, and dynapenia. To ensure the absence of multicollinearity among these variables, VIF values were calculated. All covariates showed VIF values adjusted for degrees of freedom ranging from 1.004 to 1.014, indicating no collinearity issues and supporting the robustness of the regression estimates. Among covariates, older age, female sex, low ASM/BMI, and dynapenia were all significantly associated with increased odds of walking difficulty (p <0.001 for all).

In middle-aged adults (40–64 years), the association between better cardiovascular health metrics and reduced odds of walking difficulty was even stronger. Compared to those with a low 8F–CVH score, individuals with a moderate score had 69 % lower odds of reporting walking difficulty (OR 0.31, 95 % CI 0.22–0.42, p <0.001), with a persistent effect in the fully adjusted model (OR 0.34, 95 % CI 0.25–0.48, p <0.001). Those with a high score had an 86–89 % lower risk of walking difficulty (unadjusted OR 0.11, 95 % CI 0.07–0.19, p <0.001; fully adjusted OR 0.14, 95 % CI 0.08–0.23, p <0.001). Among covariates, female sex (OR 1.98, 95 % CI 1.52–2.60, p <0.001), low ASM/BMI (OR 2.94, 95 % CI 1.96–4.34, p <0.001), and dynapenia (OR 2.94, 95 % CI 1.96–4.34, p <0.001) were all strong predictors of walking difficulty in this age group.

In older adults (≥65 years), the association between better cardiovascular health metrics and lower odds of walking difficulty remained significant but was slightly attenuated. Compared to the low 8F–CVH score group, in the unadjusted model those with a moderate score had 51 % lower odds of reporting difficulty (OR 0.49, 95 % CI 0.36–0.67, p <0.001), while those with a high score had 87 % lower odds (OR 0.13, 95 % CI 0.06–0.27, p <0.001), with similar trends in fully adjusted models. Notably, older age (OR 1.08, 95 % CI 1.06–1.10, p <0.001), female sex (OR 1.39, 95 % CI 1.08–1.80, p <0.001), and low ASM/BMI (OR 1.62, 95 % CI 1.21–2.17, p <0.001) remained significant risk factors for walking difficulty in this group.

Table 3 presents the unadjusted and adjusted logistic regression models evaluating the association between individual cardiovascular health metric scores and difficulty in walking 400 m in the whole sample and stratified by age group. In the whole sample, higher physical activity, BMI, and sleep scores were associated with greater odds of walking difficulty in both unadjusted and adjusted models (p <0.001 for all). Diet score was significantly associated with walking difficulty in the adjusted model only (OR 1.00, 95 % CI 1.00–1.01, p = 0.010). In contrast, blood pressure, blood glucose, blood cholesterol, and smoking scores were not significantly associated with walking difficulty in the adjusted model. In the 40–65 years group, physical activity (OR 1.01, 95 % CI 1.01–1.02, p <0.001), BMI (OR = 1.02, 95 % CI 1.01–1.02, p <0.001), and sleep scores (OR = 1.01, 95 % CI 1.00–1.01, p <0.001) remained significant predictors of walking difficulty, while blood cholesterol and diet scores were not significantly associated with walking difficulty in the adjusted model (p = 0.900 and p = 0.300, respectively). Among participants 65 years or older, similar patterns were observed, with physical activity (OR 1.02, 95 % CI 1.01–1.02, p <0.001), BMI (OR 1.01, 95 % CI 1.01–1.02, p <0.001), sleep scores (OR 1.01, 95 % CI 1.00–1.01, p <0.001), and diet score (OR 1.00, 95 % CI 1.00–1.01, p = 0.012) showing significant associations with walking difficulty. Blood pressure, blood glucose, blood cholesterol, and smoking scores did not reach statistical significance in the adjusted model.

4. Discussion

In this study, we analyzed data from 4141 community-dwelling middle-aged and older adults to examine the relationship between cardiovascular health metrics and self-reported walking difficulty. The 8F-CVH score, inspired by the AHA's Life's Essential 8, demonstrated a strong inverse association with mobility limitations. Participants with higher cardiovascular health scores had significantly lower odds of reporting difficulty walking 400 m, with those in the highest category

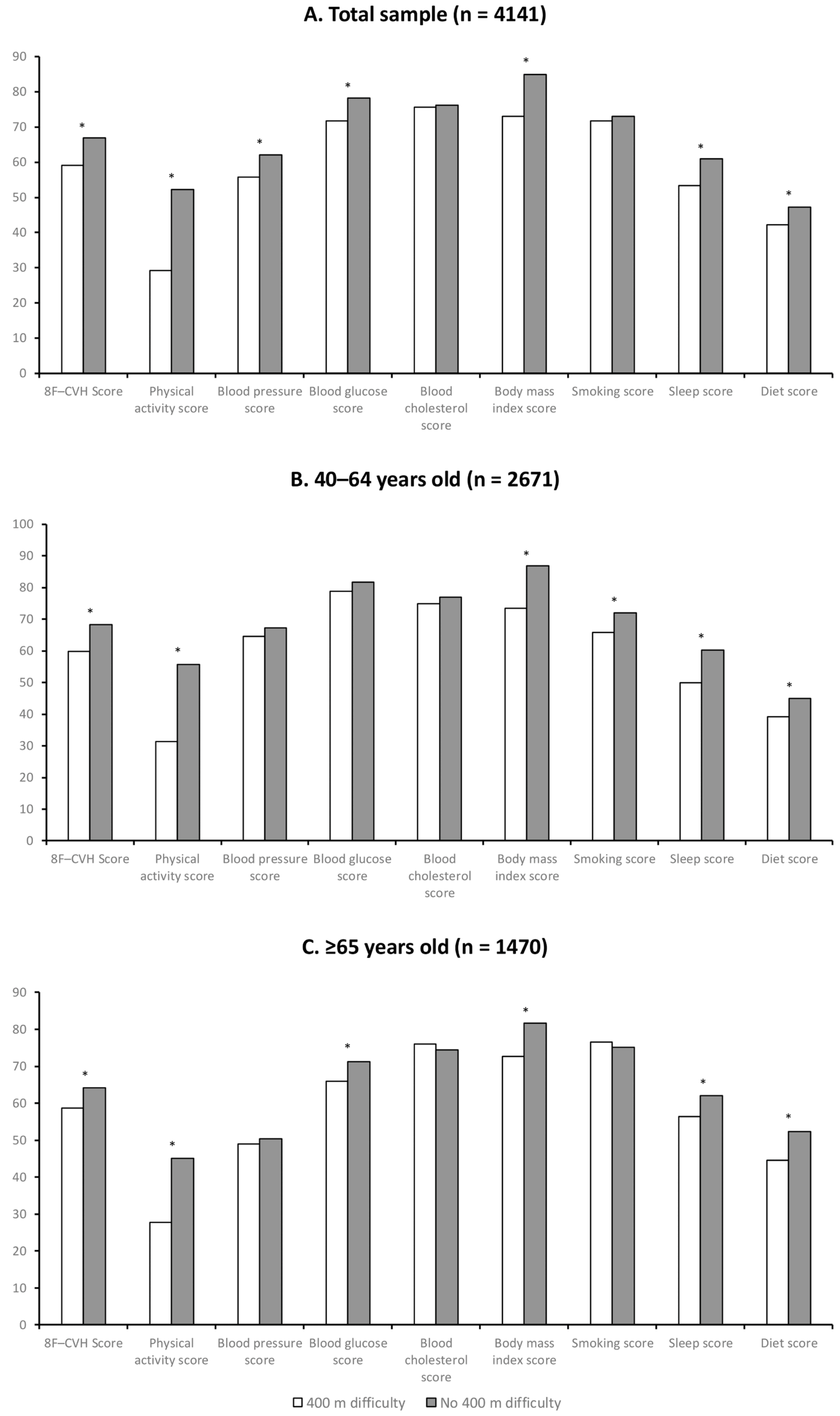

Fig. 2. Mean scores for cardiovascular health metrics stratified by difficulty in walking 400 m. Abbreviations: 8F–CVH score, 8–Factor Cardiovascular Health score; BMI, body mass index.

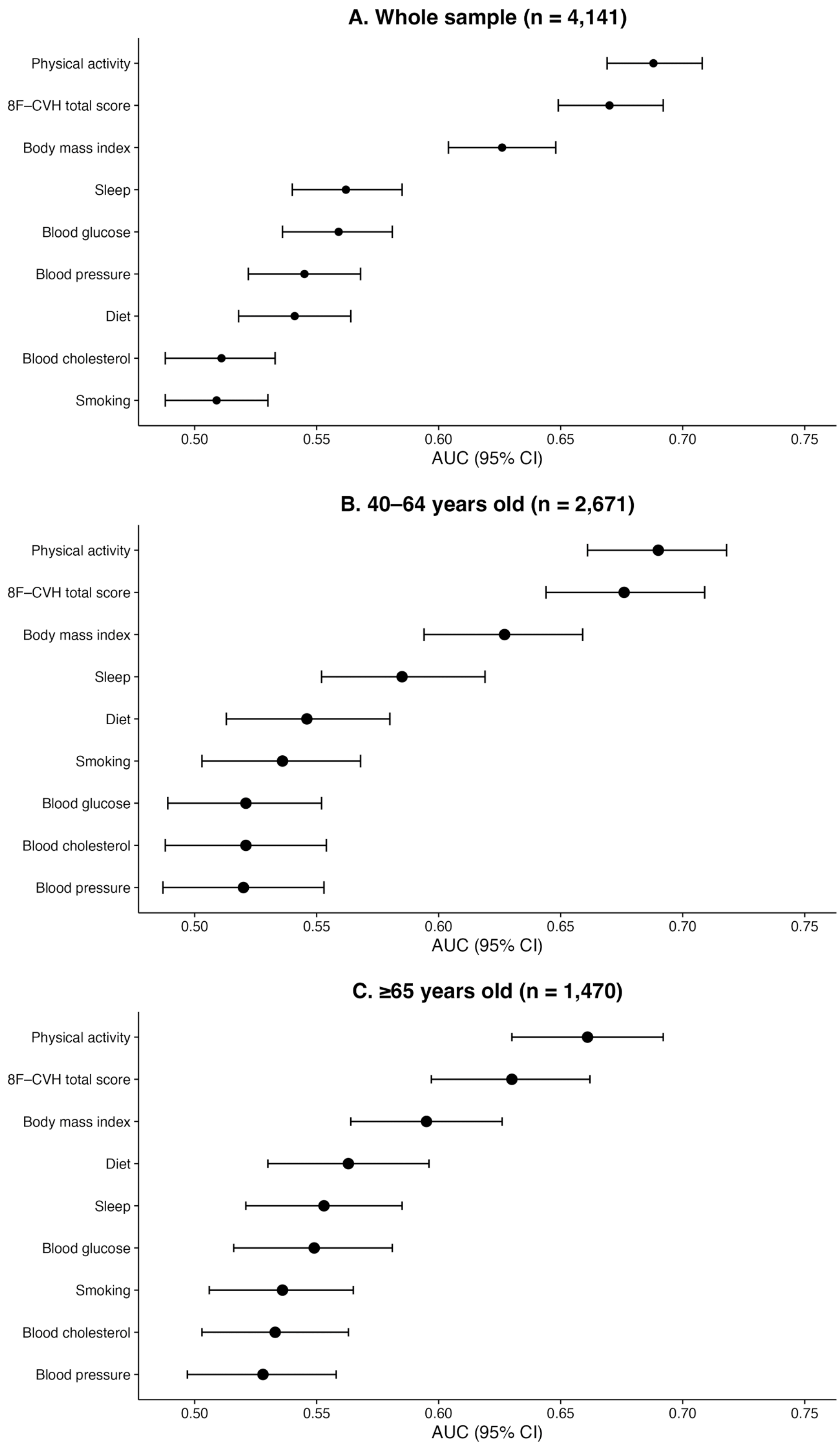

Fig. 3. Area under the curve (AUC) with 95 % confidence intervals for the prediction of self-reported walking difficulty based on the 8-factor cardiovascular health (8F–CVH) total score and its individual components. Analyses are stratified by: a) whole sample, b) middle-aged adults (40–64 years), and c) older adults (≥65 years). Higher AUC values indicate greater discriminatory ability for identifying individuals reporting difficulty walking 400 m.

(≥80 points) exhibiting nearly 90 % lower odds compared to those with poor cardiovascular health (<50 points). This trend was consistent across age groups, with slightly stronger associations observed in middle-aged adults. Each one-point increase in the 8F-CVH score conferred a 4–5 % reduction in the likelihood of reporting walking difficulty, even after adjusting for sex, age, muscle strength, and muscle mass indices. Our findings underscore the significant relationship between cardiovascular health metrics and mobility and align with a growing body of evidence linking cardiovascular health to physical function, emphasizing the importance of lifestyle factors in maintaining functional independence with aging.

Previous research has suggested important interactions between poor cardiovascular health with mobility limitations, frailty, and disability at all ages. Longitudinal data from the Physicians' Health Study demonstrated an inverse association between walking speed with incident ischemic heart disease and cardiovascular mortality (Imran

Table 2
Unadjusted and adjusted logistic regression models exploring the association between the 8–Factor Cardiovascular Health score and difficulty in walking 400 m.

Whole sample	Unadjusted OR (95 % CI)	*p*	Model 1 OR (95 % CI)	*p*	Model 2 OR (95 % CI)	*p*
8F–CVH score (categorical)						
Low	1.00 (reference)	–	1.00 (reference)	–	1.00 (reference)	–
Moderate	0.38 (0.30–0.47)	<0.001	0.39 (0.31–0.48)	<0.001	0.41 (0.33–0.52)	<0.001
High	0.10 (0.07–0.16)	<0.001	0.14 (0.09–0.21)	<0.001	0.16 (0.10–0.24)	<0.001
Age			1.05 (1.04–1.06)	<0.001	1.05 (1.04–1.05)	<0.001
Sex, women			1.64 (1.37–1.96)	<0.001	1.60 (1.34–1.92)	<0.001
Low ASM/BMI					1.94 (1.53–2.45)	<0.001
Dynapenia					2.26 (1.37–3.65)	<0.001
8F–CVH score (continuous)	0.95 (0.95–0.96)	<0.001	0.96 (0.95–0.96)	<0.001	0.96 (0.95–0.97)	<0.001
Age			1.05 (1.04–1.06)	<0.001	1.04 (1.04–1.05)	<0.001
Sex, women			1.65 (1.38–1.97)	<0.001	1.89 (1.64–2.17)	<0.001
Low ASM/BMI					1.79 (1.50–2.13)	<0.001
Dynapenia					1.79 (1.58–2.25)	<0.001
Middle-aged adults (40–64 years old)						
8F–CVH score (categorical)						
Low	1.00 (reference)	–	1.00 (reference)	–	1.00 (reference)	–
Moderate	0.31 (0.22–0.42)	<0.001	0.31 (0.22–0.42)	<0.001	0.34 (0.25–0.48)	<0.001
High	0.11 (0.07–0.19)	<0.001	0.12 (0.07–0.19)	<0.001	0.14 (0.08–0.23)	<0.001
Age			1.03 (1.01–1.05)	0.008	1.02 (1.00–1.04)	0.051
Sex, women			1.83 (1.41–2.38)	<0.001	1.98 (1.52–2.60)	<0.001
Low ASM/BMI					2.94 (1.96–4.34)	<0.001
Dynapenia					3.16 (1.60–5.92)	<0.001
8F–CVH score (continuous)	0.95 (0.94–0.96)	<0.001	0.95 (0.94–0.96)	<0.001	0.95 (0.94–0.96)	<0.001
Age			1.03 (1.01–1.05)	<0.001	1.03 (1.01–1.04)	<0.001
Sex, women			2.26 (1.85–2.78)	<0.001	2.37 (1.93–2.92)	<0.001
Low ASM/BMI					2.27 (1.67–3.06)	<0.001
Dynapenia					1.72 (1.40–2.11)	<0.001
Older adults (≥65 years old)						
8F–CVH score (categorical)						
Low	1.00 (reference)	–	1.00 (reference)	–	1.00 (reference)	–
Moderate	0.49 (0.36–0.67)	<0.001	0.45 (0.32–0.62)	<0.001	0.47 (0.34–0.65)	<0.001
High	0.13 (0.06–0.27)	<0.001	0.14 (0.06–0.29)	<0.001	0.15 (0.06–0.32)	<0.001
Age			1.08 (1.06–1.10)	<0.001	1.08 (1.06–1.10)	<0.001
Sex, women			1.49 (1.16–1.91)	0.002	1.39 (1.08–1.80)	<0.001
Low ASM/BMI					1.62 (1.21–2.17)	<0.001
Dynapenia					1.64 (0.76–3.37)	0.200
8F–CVH score (continuous)	0.96 (0.95–0.97)	<0.001	0.96 (0.95–0.97)	<0.001	0.96 (0.95–0.97)	<0.001
Age			1.08 (1.06–1.10)	<0.001	1.07 (1.05–1.10)	<0.001
Sex, women			1.51 (1.18–1.93)	<0.001	1.42 (1.10–1.82)	<0.001
Low ASM/BMI					1.55 (1.15–2.07)	0.004
Dynapenia					1.55 (0.72–3.20)	0.200

Abbreviations: 8F–CVH score, 8–Factor Cardiovascular Health score; ASM/BMI, body mass index-adjusted appendicular skeletal mass; CI, confidence interval; OR, odds ratio. Model 1: age- and sex-adjusted. Model 2: adjusted for age, female sex, low ASM/BMI and dynapenia.

et al., 2019). More specifically, authors identified a dose-response relationship, with the highest reduction in ischemic heart disease incidence in those walking at ≥4 mph (≥1.79 m/s). Similarly, a study on 3, 090,048 Japanese healthy adults found a significant association between subjective gait speed and incident CVD (including heart failure, myocardial infarction, angina pectoris, and ischemic stroke) (Ueno et al., 2023), which was more pronounced in participants with pre-diabetes or diabetes, suggesting that maintaining exercise capacity could be more important in individuals with impaired glucose regulation for preventing future cardiovascular events. A meta-analysis of 44 articles including a total of 101,945 older adults found an 8 % increase in incident CVD for each 0.1 m/s reduction in gait speed (Veronese et al., 2018). The association between ideal cardiovascular health, walking speed and CVD incidence and mortality can be two-sided. On the one hand, a slow walking speed or inability to walk can serve as an early predictor of declining overall health status, reflecting underlying cardiovascular dysfunction, reduced physical fitness, or frailty. A study on 4313 Chinese adults aged 18–65 years demonstrated an inverse association with greater adherence to ideal cardiovascular health metrics as defined by AHA's Life's Simple 7 and suboptimal health status, defined as a reversible intermediate state between optimal health and disease, characterized by persistent but non-specific symptoms such as fatigue, weakness, and low energy, without a diagnosed medical condition (Wang et al., 2017). On the other hand, adherence to optimal cardiovascular health behaviors and risk factor management may contribute to better physical performance and mobility, thereby reducing the risk of CVD. Evidence from the Aerobics Center Longitudinal Study, which included over 11,000 U.S. adults, showed that those with higher cardiorespiratory fitness had significantly better cardiovascular health scores and a markedly lower likelihood of poor cardiovascular health classification (Ross et al., 2019). Likewise, data from European adolescents revealed that higher cardiorespiratory fitness levels were consistently associated with more favorable cardiovascular health profiles, with specific thresholds of fitness predicting the presence of multiple ideal cardiovascular health components (Ruiz et al., 2015).

In our study, participants with higher 8F-CVH scores exhibited greater muscle strength and mass, as well as a lower prevalence of dynapenia. Growing evidence supports a link between poor cardiovascular health and the progression toward sarcopenia, frailty, and disability. Sarcopenia, characterized by reduced muscle mass and strength, is a pivotal factor in the loss of mobility and independence, particularly in aging populations. Several studies have demonstrated that individuals with low levels of physical activity, poor dietary habits, poor metabolic control, and disrupted sleep, all components of the cardiovascular health construct, are more likely to develop pre-sarcopenia, sarcopenia, and accelerated functional decline (Long et al., 2024, Zhang et al., 2024, Liu et al., 2025, Lin et al., 2024). Multiple

Table 3
Odds ratios for cardiovascular health metrics scores associated with difficulty walking 400 m based on unadjusted and adjusted logistic regression analysis.

Whole sample	Unadjusted OR (95 % CI)	*p*	Adjusted* OR (95 % CI)	*p*
Physical activity score	1.02 (1.02–1.02)	<0.001	1.02 (1.01–1.02)	<0.001
Blood pressure score	1.00 (1.00–1.00)	0.500	1.00 (1.00–1.00)	0.200
Blood glucose score	1.01 (1.00–1.01)	<0.001	1.00 (1.00–1.01)	0.140
Blood cholesterol score	1.00 (1.00–1.00)	0.600	1.00 (0.99–1.00)	0.300
Body mass index score	1.01 (1.01–1.02)	<0.001	1.01 (1.01–1.02)	<0.001
Smoking score	1.00 (1.00–1.00)	0.300	1.00 (1.00–1.00)	0.300
Sleep score	1.01 (1.00–1.01)	<0.001	1.01 (1.00–1.01)	<0.001
Diet score	1.00 (1.00–1.00)	0.200	1.00 (1.00–1.01)	0.010
Middle-aged adults (40–64 years)				
Physical activity score	1.02 (1.01–1.02)	<0.001	1.01 (1.01–1.02)	<0.001
Blood pressure score	1.00 (1.00–1.00)	0.500	1.00 (1.00–1.00)	0.600
Blood glucose score	1.00 (1.00–1.01)	0.800	1.00 (1.00–1.01)	0.999
Blood cholesterol score	1.00 (1.00–1.01)	0.020	1.00 (1.00–1.01)	0.900
Body mass index score	1.02 (1.01–1.02)	<0.001	1.02 (1.01–1.02)	<0.001
Smoking score	1.00 (1.00–1.00)	0.500	1.00 (1.00–1.01)	0.300
Sleep score	1.01 (1.00–1.01)	<0.001	1.01 (1.00–1.01)	<0.001
Diet score	1.00 (1.00–1.01)	0.500	1.00 (1.00–1.01)	0.300
Older adults (≥ 65 years)				
Physical activity score	1.02 (1.02–1.02)	<0.001	1.02 (1.01–1.02)	<0.001
Blood pressure score	1.00 (1.00–1.00)	0.500	1.00 (0.99–1.00)	0.300
Blood glucose score	1.01 (1.00–1.01)	0.007	1.00 (1.00–1.01)	0.056
Blood cholesterol score	1.00 (0.99–1.00)	0.300	1.00 (0.99–1.00)	0.120
Body mass index score	1.01 (1.01–1.02)	<0.001	1.01 (1.01–1.02)	<0.001
Smoking score	1.00 (0.99–1.00)	0.300	1.00 (1.00–1.00)	0.700
Sleep score	1.01 (1.00–1.00)	<0.001	1.01 (1.00–1.01)	<0.001
Diet score	1.00 (1.00–1.01)	0.008	1.00 (1.00–1.01)	0.012

* Adjusted for age, female sex, low ASM/BMI and dynapenia. Abbreviations: ASM/BMI: body mass index-adjusted appendicular skeletal mass; CI, confidence interval; OR, odds ratio.

mechanisms may underlie the observed associations. CVD and mobility limitations share pathophysiological pathways, including chronic inflammation, endothelial dysfunction, oxidative stress, and metabolic derangements. These processes can accelerate muscle wasting, impair neuromuscular coordination, and reduce aerobic capacity (Damluji et al., 2023). In this context, ideal cardiovascular health metrics, as captured by the 8F-CVH score, are not only protective against cardiovascular events but also act as key determinants of musculoskeletal integrity and functional performance. Regular physical activity, particularly when it includes resistance training, is instrumental in counteracting age-related declines in muscle mass and strength, thereby delaying the onset of sarcopenia (Sanchez-Sanchez et al., 2024). It also supports cardiovascular efficiency, reduces systemic inflammation, and enhances mitochondrial function, all of which are vital for maintaining physical performance (Izquierdo et al., 2025). BMI showed a significant and independent association with walking difficulty. Maintaining an optimal weight range contributes to joint health and reduces biomechanical stress, while also limiting low-grade systemic inflammation, a known driver of muscle catabolism and frailty. In contrast, excessive adiposity may exacerbate mobility impairment through increased load bearing and a pro-inflammatory metabolic profile that negatively affects both vascular and muscular systems (Mikkola et al., 2018, Porter Starr et al., 2014). Diet quality, operationalized based on adherence to a Mediterranean-style dietary pattern, was another strong predictor of mobility preservation. Diets rich in antioxidants, polyunsaturated fats, and anti-inflammatory nutrients may protect against muscle degradation and support endothelial function (Cacciatore et al., 2023a; Dominguez et al., 2023). Nutritional adequacy is also essential for maintaining anabolic processes and muscle protein synthesis, particularly in older adults at risk of sarcopenia (Calvani et al., 2023). Sleep quality, although often overlooked, emerged as a relevant modifiable factor. Poor sleep has been associated with reduced muscle regeneration, hormonal imbalance (e.g., reduced growth hormone, increased cortisol), and elevated markers of inflammation, all of which can contribute to physical frailty (Cacciatore et al., 2025a; Pourmotabbed et al., 2020). In our cohort, individuals reporting poor sleep quality had higher odds of walking difficulty, supporting the growing recognition of sleep health as a significant component of healthy aging.

Although not designed as a diagnostic tool, the 8F–CVH score demonstrated a fair ability to distinguish individuals with mobility limitations, as shown by ROC curve analyses. The total score achieved AUC values of 0.67 in the whole sample, 0.68 in middle-aged adults, and 0.64 in older adults. Among its components, physical activity consistently showed the strongest discriminatory capacity (AUCs ranging from 0.66 to 0.69), followed by BMI. Traditional biomedical metrics such as blood pressure, cholesterol, and glucose exhibited limited discrimination (AUCs generally <0.56). These findings reinforce the relevance of lifestyle-related behaviors in shaping functional health, especially in midlife and beyond. Conventional biomedical markers showed relatively limited discriminative ability, whereas lifestyle-related components such as physical activity, BMI, sleep, and diet performed better. Adopting an integrative approach to health behaviors may therefore offer a more meaningful framework for identifying individuals at risk of early functional decline and mobility limitations. Our findings are also in line with recent evidence from the InCHIANTI study, which demonstrated that greater Life's Essential 8 scores were associated with significantly lower risks of both all-cause and cardiovascular mortality in community-dwelling older adults over a median follow-up of 14.5 years (Sarma et al., 2025). This prospective evidence supports the prognostic value of cardiovascular health metrics not only for functional outcomes, as in our study, but also for hard clinical endpoints such as survival, further emphasizing the importance of promoting ideal cardiovascular health across the lifespan.

The public health implications of these findings are substantial and warrant attention. The components of the AHA's Life's Essential 8, by encompassing simple and modifiable factors, offer a pragmatic framework for early identification of individuals at risk and for guiding preventive efforts. Evidence consistently demonstrates that promoting cardiovascular health and mobility through population-level interventions targeting physical activity, healthy diet, adequate sleep, and smoking avoidance is a powerful strategy to preserve mobility, delay functional decline, and support healthy aging (Lloyd-Jones et al., 2022, Kumar et al., 2023, Sakaniwa et al., 2022). Importantly, these are not abstract or medically complex targets; rather they are accessible behaviors that can be modified through community-based education, public policy, and clinical counseling (Lloyd-Jones et al., 2022, Sterling et al., 2024). The AHA and the US Preventive Services Task Force highlight that interventions focused on behavior change, such as structured physical activity programs, dietary counseling, sleep hygiene promotion, and smoking cessation, yield greater impact on mobility and healthy aging than biomedical risk factor management alone (Kris-Etherton et al., 2021, Laddu et al., 2021, Mangione et al., 2022). Community engagement, culturally tailored approaches, and addressing barriers to participation are essential to maximize the reach and effectiveness of these behavioral interventions, ultimately reducing the burden of disability and enhancing healthspan at the population level (Dogra et al., 2022, Spring et al., 2013). In our study, 15.8 % of the entire cohort reported difficulty walking 400 m. As expected, this burden was higher in older adults (26.1 %), but notably, 10.5 % of participants aged 40–64 years reported walking difficulty. This is a critical finding, consistent with previous literature indicating that features of frailty or early markers of physiological decline may already be present in middle-aged individuals, well before reaching older age (Hanlon et al., 2018, Walsh et al., 2023). However, in the absence of detailed information on comorbidities or additional functional measures, these findings should be interpreted with caution, as the underlying causes of walking difficulty in this age group could not be ascertained. Although often overlooked, the presence of mobility limitations in middle age may reflect early physiological decline and predict a trajectory toward future frailty and reduced independence (Fallah et al., 2011). These data underscore the importance of fostering cardiovascular health from early adulthood and midlife. Intervening before the onset of overt decline allows for greater potential impact, particularly considering that each one-point increase in the 8F-CVH score was associated with a 4–5 % reduction in the odds of walking difficulty. Encouraging widespread adherence to the Life's Essential 8 metrics through public health campaigns, integration into primary care, and workplace wellness programs could substantially reduce the burden of mobility-related disability at the population level. Moreover, evidence also highlights how urban environments and health inequities influence the feasibility of lifestyle interventions, underscoring the need for integrated strategies that address both individual behaviors and structural determinants of cardiovascular health (Cacciatore et al., 2025b).

This study presents several limitations that should be acknowledged. First, the cross-sectional design prevents the determination of causal relationships between cardiovascular health and mobility status. Longitudinal studies are needed to confirm the directionality and potential bidirectional nature of these associations. Second, lifestyle factors, including physical activity, diet, and sleep, were assessed via self-report, which may be subject to recall and reporting biases. In particular, physical activity was not measured using objective tools such as accelerometry or wearable monitoring systems. However, the use of standardized questionnaires ensured consistency across a large sample and was appropriate for the context of large-scale, community-based campaigns. Third, although the cardiovascular health score adopted in this study was based on the eight components of the Life's Essential 8 framework, it was adapted to suit the specific context of the Lookup 8+ initiative. These methodological differences limit direct comparability with studies using the AHA's original framework. Future research should evaluate the performance of this adapted score in longitudinal settings and in comparison with the Life's Essential 8. Fourth, mobility limitation was assessed through a single self-reported item, without the use of standardized performance-based measures. Practical constraints related to the setting of the events did not allow implementation of direct assessments such as gait speed or other walking tests. Although this represents a limitation, prior evidence supports the validity of self-reported difficulty in walking 400 m as a reasonable proxy for objectively defined mobility disability, with similar trajectories over time and predictive capacity for adverse outcomes (Salini et al., 2022, Chen et al., 2018, Alexander et al., 2000). Therefore, while our findings should be interpreted with caution, they nonetheless provide useful information on early indicators of mobility decline in community-dwelling adults. Fifth, the study did not include information on comorbidities such as musculoskeletal or neurological disorders, which may independently affect mobility. Nonetheless, the voluntary nature of participation and the community setting suggest that most individuals were in relatively stable health and free from acute disabling conditions. Moreover, we did not collect data on cognitive status or psychological conditions, such as depression, which may independently affect both cardiovascular health and self-reported mobility. The absence of these measures represents an additional limitation that should be addressed in future studies. Sixth, no data on socioeconomic status, including education level, income, or employment, were collected. This limits the ability to explore how social determinants may influence cardiovascular health and physical function. However, to promote inclusiveness and minimize participation barriers, all assessments were offered free of charge and conducted in accessible public locations across a variety of urban and semi-urban settings. Seventh, the sample was predominantly composed of Caucasian participants, which may impede the generalizability of findings to other ethnic groups. Ethnic differences in cardiovascular risk, physical function, and frailty have been previously described and should be addressed in future studies involving more diverse populations. Finally, the study population consisted exclusively of community-dwelling middle-aged and older adults, and thus findings may not be generalizable to institutionalized individuals or those with advanced disability. Despite these limitations, the study design enabled the investigation of the relationship between cardiovascular health and early indicators of mobility decline within a large, relatively healthy, and independent population of middle-aged and older individuals.

5. Conclusion

Our findings highlight a strong and independent association between cardiovascular health and early mobility impairment in both middle-aged and older adults. Promoting adherence to the components of Life's Essential 8, namely, healthy diet, regular physical activity, non-smoking status, healthy weight, normal blood pressure, optimal blood lipid and glucose levels, and good sleep quality, as ideal cardiovascular health metrics may represent a key strategy for preventing functional decline and fostering healthy aging across the population.

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CRediT authorship contribution statement

Stefano Cacciatore: Writing – original draft, Visualization, Methodology, Investigation, Conceptualization. **Emanuele Marzetti:** Writing – review & editing, Visualization, Validation, Supervision, Methodology, Investigation, Funding acquisition, Conceptualization. **Riccardo Calvani:** Writing – review & editing, Validation, Investigation, Conceptualization. **Matteo Tosato:** Writing – review & editing, Validation, Investigation, Conceptualization. **Francesco Landi:** Writing – original draft, Supervision, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

Members of the Lookup 8+ project team are listed in the supplementary material.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.archger.2025.106027.

Data availability

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to their containing information that could compromise the privacy of the research participants.

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