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Adapted Stopping Elderly Accidents, Deaths, and Injuries Questions for Falls Risk Screening: Predictive Ability in Older Drivers

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Abstract

Introduction: Fall fatality rates among U.S. older adults increased 30% from 2007 to 2016. In response, the Centers for Disease Control and Prevention developed the Stopping Elderly Accidents, Deaths, and Injuries (STEADI) algorithm for fall risk screening, assessment, and intervention. The current STEADI algorithm with 2 levels (at risk, not at risk) was adapted to an existing cohort of older adult drivers.

Methods: A U.S. multisite prospective cohort (N=2,990) of drivers (aged 65–79 years), from 2015 to 2017, was used for these analyses completed January–October 2020. To measure the adapted STEADI key questions for fall risk screening performance in predicting future falls, adjusted logistic regression determined the area of the receiver operating characteristic curve. An adjusted mixed logistic regression modeled the association between the adapted STEADI key questions and future falls.

Results: The adapted STEADI key questions yielded an area under the curve of 0.65 in determining any fall over 2 years. The adjusted mixed logistic regression model suggests that those at risk for falls at baseline were associated with 2.37 times higher odds of any fall (95% CI=2.00, 2.80), and 3.60 times higher odds of multiple falls (95% CI=2.88, 4.51) over 2 years.

Conclusions: The adapted STEADI key questions for fall risk screening yielded fair predictive ability for falls over 2 years and were strongly associated with future falls for older adult drivers.

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The adapted STEADI key questions can be applied to existing data in nonclinical settings to strengthen falls screening and prevention at a population level.

INTRODUCTION

Fall fatality rates among older adults increased by 30% in the U.S. from 2007 to 2016.[1] Furthermore, in 2018 alone, there were 35,522 deaths from fall-related injuries in older adults aged ≥65 years.[2] Falls contribute to deteriorated physical health, lack of mobility, and reduced social engagement.[3,4] Lack of mobility and social engagement can limit older adults' independence and adversely affect mental health.[5] The estimated cost of fall-related morbidity, mortality, and institutionalization is projected to climb to $100 billion in 2030.[6] Thus, systemic- and individual-level consequences of falls underscore the importance of this public health issue.

To address this public health issue, the Centers for Disease Control and Prevention began an initiative for healthcare providers, Stopping Elderly Accidents, Deaths, and Injuries (STEADI), organizing established guidelines from the American and British Geriatric Societies.[7–9] The STEADI initiative uses an algorithm for fall risk screening, assessment, and intervention for community-dwelling adults ≥65 years to be completed in the context of clinical practice.[7] Owing to limited uptake of STEADI or perhaps failure to de-implement already ongoing falls screening in the clinic, there is underutilization of the STEADI intiative.[10,11] For example, only one fifth of New York healthcare providers reported that they referred their older adult patients to community-based fall prevention programs.[10] There is a growing body of research on implementation strategies of the STEADI initiative in primary care.[3,11–15] Perhaps the STEADI initiative can be adapted for successful application in the community setting to help with fall prevention on a population level.

Lohman and colleagues[16] adapted, operationalized, and validated the STEADI algorithm for the original designations of low, moderate, or high risk for future falls, utilizing the 3 key questions and functional assessments with community-dwelling older adults from the National Health and Aging Trends Study cohort. Given that limited studies have evaluated the current STEADI algorithm with 2 levels (at risk, not at risk), the goal was to operationalize and validate the adapted STEADI key questions, in an existing older adult cohort of drivers, to see how well it predicts future falls in this cohort.[17,18] The hypothesis was that the current STEADI algorithm with 2 levels (at risk, not at risk) will yield predictive ability and an association with future falls among an older adult driver cohort.

METHODS

Study Sample

The goal of the American Automobile Association Longitudinal Research on Aging Drivers (LongROAD) multisite prospective cohort (N=2,990) was to gauge physical, psychological, and environmental factors associated with aging drivers.[19] Participants were recruited from 5 study sites (Cooperstown, New York; Baltimore, Maryland; Denver, Colorado; San Diego, California; Ann Arbor, Michigan) from July 2015 to March 2017. Older adults who operated vehicles and were aged 65–79 years were eligible for the study. The eligibility criteria are detailed elsewhere.[19] For the purpose of this study, participants were removed (*n*=13) if they had missing baseline data for the adapted STEADI key questions. This yielded a sample size of 2,977 participants.

Participants will be followed for 5 years with planned alternating in-person visits and telephone interviews each year; data for these secondary analyses are based on the first 2 years. During the in-person visits, participants completed 5 components, including: (1) a driving, health and functioning questionnaire; (2) performance-based assessments for cognitive, perceptual, and motor functioning; (3) a listing of all medications that the participant was taking; (4) a vehicle technology questionnaire; and (5) a vehicle inspection.[19] During the 1-hour telephone interviews, study staff only administered the driving, health, and functioning questionnaire; an abbreviated medication review questionnaire; and the vehicle technology questionnaire. Further descriptions regarding the study design and sample are detailed elsewhere.[19] The Columbia University Medical Center IRB approved the American Automobile Association LongROAD study (IRB-AAAN9950).

Measures

The STEADI algorithm has 3 core elements: Fall Risk Screening, Assessment, and Intervention.[7] The screening either can be the Stay Independent 12-item tool or the 3 key questions (Figure 1). The current STEADI algorithm for fall risk screening was adapted and operationalized using existing baseline data from the LongROAD study and following similar though not identical methods used by Lohman et al.[16] with the National Health and Aging Trends Study cohort. Lohman and colleagues used the older STEADI algorithm with 3 levels of risks stratification and this study used the current STEADI algorithm with 2 levels of risks stratification to determine whether participants at baseline were either at risk or not at risk for future falls (Figure 1). STEADI's 3 key screening questions were emulated as closely as possible with the available data. The 3 key questions are *yes* to any question: (1) *Do you feel unsteady when standing or walking?* (2) *Do you worry about falling?* and (3) *Have you fallen in the past year?*

From the existing LongROAD data, 2 of the STEADI's 3 key questions were available exactly: (1) had fallen in the past year and (2) experienced problems with balance or coordination. One question asking the participants whether they were worried about falling was not available to the authors. Instead, to evaluate the construct "worries about falling," the Short International Falls Self-Efficacy Score was used.[20] A participant with a score >9 demonstrated that the participant was worried about falling.[20]

Overall, if the participant answered *no* to all 3 key questions, then the participant was identified as not at risk for future falls. If the participant answered *yes* to one of the key questions' constructs, then that participant was identified as at risk for future falls.[7] Figure 1 describes the wording of the adapted STEADI key questions.

Participants reported whether they had fallen once in the past year or had fallen more than once in the past year during their telephonic interview at 1-year follow-up and their in-person interview at 2-year follow-up. Two dichotomous variables were created if the participant experienced a fall or did not experience a fall at any time or experienced multiple falls or did not experience multiple falls over the course of the 2 years. Additionally, if a participant reported that they had fallen more than once during the follow-up, then the participant was identified as having experienced multiple falls over the course of the 2 years.

Demographics included age (65–69 years, 70–74 years, 75–79 years), sex (male, female), race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, Asian, Native American, other), education (less than high school, high school or vocational school, some college or higher), and marital status (partner, no partner).[16] Related to varying fall risk in the literature as well as Lohman et al.,[16] visual and hearing impairments, scored on a Likert scale (excellent, very good, good, fair, poor), baseline alcohol use (yes/no), and lifetime incidence of health conditions (yes/no) were considered covariates. Health conditions included either cancer, diabetes mellitus, stroke, myocardial infarction, rheumatoid arthritis, osteoporosis, dementia, depression, or anxiety. Site was adjusted for to account for variations by states (i.e., different laws and standards for older adult drivers that may influence who can operate a motor vehicle) and thus who would be included in the sample.

As part of the physical performance battery, the Four-Stage Balance Test (FSBT) was collected in LongROAD with the single-leg stance held until 30 seconds, similar to other balance tests.[21–24] The FSBT is supported as a reliable, valid test and has normative data in community-dwelling older adults.[21–24] The FSBT tests of balance provide an assessment of the participant's ability to hold 4 standing positions with the eyes open. The 4 positions are side-by-side stand, semi-tandem stand, full tandem stand (or heel-to-toe stand), and single-leg stand with eyes open, performed in this order. Participants taking this test must be able to stand unassisted without using a cane or a walker. Each of the 4 balance tests are timed and the participant is allowed only 1 chance to maintain each position.

Statistical Analysis

To examine the distribution of the adapted STEADI key questions for fall risk screening, the self-reported falls outcomes, and covariates in the LongROAD cohort, Pearson's chi-square tests of independence were conducted. Following a similar protocol as Lohman and colleagues,[16] a logistic regression model was built to examine the predictive ability of the adapted STEADI key questions for fall risk screening. The model was adjusted for potential confounder variables, such as age, sex, race/ethnicity, education, marital status, hearing impairment, visual impairment, physical function (FSBT), health conditions, health behaviors, and study site, in determining any falls over 2 years in this cohort of older drivers. To assess the predictive ability of this model, a receiver operating characteristic curve was plotted to determine the area under the curve (AUC).[25]

A mixed logistic regression model using the same covariates was used to determine the association between the adapted STEADI key questions for fall risk screening and fall outcomes such as any falls and multiple falls over time. The adjusted mixed logistic regression model then determined the magnitude and statistical significance of the relationship between the adapted STEADI key questions for fall risk screening at baseline and future fall incidence, regarding any falls and multiple falls, over the 2-year period. Stata/SE, version 16.0 was used for all analyses.

RESULTS

Of the 2,990 participants at baseline, 2,977 had baseline information on all of the adapted STEADI key questions. More than half (55.6%) of the sample of older adult drivers (1,656/2,977) were at risk for falls at baseline. There were statistically significant differences across variables including sex, age category, marital status, visual/hearing impairments, health conditions, FSBT, use of assistive devices, and site between those identified as at risk for falls and not at risk for falls at baseline via the adapted STEADI key questions for fall risk screening (Table 1). There was a higher proportion of female participants in the at-risk level compared with the not-at-risk level (58.4% vs 46.1%, $p<0.001$), higher proportion of participants in the age 75–79 years category in the at-risk level compared with the not-at-risk level (26.7% vs 20.1.5%, $p<0.001$), and higher proportion of participants exhibiting ≥1 health condition in the at-risk level compared with the not-at-risk level (73.9% vs 59.6%, $p<0.001$).

The receiver operating characteristic curve for the adapted STEADI key questions for fall risk screening, adjusting for age, sex, race/ethnicity, education, marital status, hearing impairment, visual impairment, FSBT, health conditions, health behaviors, and site, yielded an AUC of 0.6529 (Figure 2).

In regard to "any fall" incidence, 2,739 participants reported data on whether they had experienced any falls over the 2 years; the incidence of any self-reported falls during this period was 42.7%. Regarding "multiple fall" incidence, 2,704 participants reported data on whether they had experienced multiple falls over the 2 years, leading to an incidence of 22.3% for multiple falls. Using the adjusted mixed logistic regression model in Table 2, older adults identified as at risk for falls yielded a 2.37 (95% CI=2.00, 2.80) times higher odds of any fall and a 3.60 (95% CI=2.88, 4.51) times higher odds of multiple falls at 2-year follow-up compared with those who were identified as not at risk for falls.

DISCUSSION

The current STEADI algorithm with 2 levels (at risk, not at risk) for fall risk screening had fair predictive validity, in a model adjusting for important covariates, in determining 2-year falls in a cohort of U.S. older adult drivers. The algorithm yielded an AUC of 0.65, indicating predictive accuracy somewhat better than chance (AUC=0.50). In addition, participants classified as at risk for falls at baseline using these adapted STEADI key questions for fall risk screening demonstrated 2.37 times higher odds for any fall and 3.60 times higher odds for multiple falls at 2-year follow-up, after adjusting for participant sociodemographics, health characteristics, and site. The overall study findings supported the findings of Lohman et al.,[16] who applied the STEADI fall risk screening algorithm to older adult populations. More specifically, this nationally representative cohort study of U.S. older adults using the National Health and Aging Trends Study previously adapted, operationalized, and validated the older STEADI algorithm with 3 levels (low, moderate, or high risk) as the outcome.[16] The current STEADI algorithm with 2 levels (at risk or not at risk) was the outcome for this study. The adapted current STEADI algorithm with 2 levels (AUC=0.65) and the adapted older STEADI algorithm with 3 levels (AUC=0.64) yielded an almost identical predictive validity.[16] Those classified as at risk for falls, according to the adapted current STEADI algorithm with 2 levels (at risk, not at risk), yielded a similar association with future falls (AOR=2.37 for any falls, AOR=3.60 for multiple falls) as those classified as at moderate risk for future falls by the adapted older STEADI algorithm with 3 levels, (low, moderate, high risk; AOR=2.62 for any falls, AOR=4.05 for multiple falls), and a lower association with future falls compared with those classified as at high risk according to the adapted older STEADI algorithm with 3 levels (AOR=4.76 for any falls, AOR=13.7 for multiple falls).[16]

This study supplements the falls literature by addressing the validation of the current STEADI algorithm with 2 levels (at risk, not at risk) adapting the 3 key questions for fall risk screening in a prospective cohort of older adult drivers, with both strengths and limitations.

Given the iteration of the current STEADI algorithm with 2 levels (at risk, not at risk), this study is among the first to evaluate this new version using with a larger sample size (n=2,977). In comparing the operationalization of the current STEADI algorithm with 2 levels and the older STEADI algorithm with 3 levels, the current STEADI algorithm with 2 levels uses only the 3 key questions, whereas the older STEADI algorithm with 3 levels uses physical assessments, the 30-Second Chair Stand Test, and FSBT.[16] Although this is a secondary analysis evaluating the adapted STEADI key questions' constructs (i.e., Short International Falls Self-Efficacy Score was used instead of the *yes*/*no* question: *Worried about falling?*).[7] Thus, this study provided less breadth in measuring the construct of physical function and more depth in measuring the construct of participant fall concern compared with the older STEADI algorithm with the 3 levels reported by Lohman and colleagues.[16]

Limitations

Limitations of the study include a potential lack of generalizability, given the homogenous distribution of race, ethnicity, and education level within the sample. Participants were predominantly non-Hispanic White (86%), highly educated (41% had an advanced degree), and yielded high incomes (32% made ≥$100,000).[19] Thus, the study may not generalize to minority subgroups, or subgroups with low education and income levels. Nonetheless, the sample was relatively balanced across age and sex. A direction for future research in the current STEADI algorithm with 2 levels (at risk, not at risk) screening validation may include procuring a larger and more diverse catchment sample of older adults. Furthermore, the sample only included a population of driving older adults, indicating that the sample may not demonstrate generalizability toward a population of non-driving older adults, who may have a higher degree of comorbidities and disabilities. Additionally, the study relied on self-report data regarding fall events. Social desirability and recall bias are factors that may influence self-reported data regarding fall events. Nevertheless, Lohman et al.[16] also used self-reported falls data and both the older and current STEADI algorithms rely on self-reported data, indicating consistency across falls literature.

Furthermore, evaluation of the adapted STEADI key questions screening is a feasible approach to apply to existing longitudinal cohorts of older adults in community settings.

In ongoing population-based studies, the current STEADI algorithm with 2 levels can be applied in a similar manner as this study; participants at risk for falls can potentially be contacted to follow up with their primary provider for implementation of the STEADI initiative. The current STEADI initiative will further assess and intervene including referring to evidence-based community fall prevention programs.[26,27] With improved utilization of particular fall prevention programs, a potential 40% reduction in fall incidence among older adults may be documented.[15,28,29] Future research should evaluate the predictive validity of the current STEADI algorithm with 2 levels among more diverse subpopulations. Furthermore, subsequent implementation studies of the current STEADI algorithm with 2 levels can focus on the delivery medium of the fall risk screening questions (using the exact STEADI 3 key questions), regarding whether it should be distributed via in-person, phone, or electronic questionnaires, to enable optimal access to the screening tool for older adults again to begin fall risk discussions with their own providers.

Thus, this study validated the current STEADI algorithm with 2 levels (at risk, not at risk) by adapting the 3 key questions for the fall risk screening in an existing community-dwelling older adult population to allow for broader implementation in community settings, population planning, and uptake of STEADI by providers. With a reduction in overall fall risk amid the context of an aging population, an effective decrease in the volume of necessary inpatient care, post-acute care, and emergency department admissions in the healthcare system may be observed. Accordingly, older adults would have the opportunity to lead more independent and healthier lives.

CONCLUSIONS

This study is the first to validate the current STEADI algorithm with 2 levels for fall risk screening, using a prospective cohort of older adult drivers. The adapted STEADI key questions for fall risk screening, adjusting for sociodemographic and health characteristics, yielded fair predictive validity and a strong association with future fall incidence, specifically any fall or multiple fall incidence at 2-year follow-up for this older adult driver sample. Demonstrating the predictive validity of the adapted STEADI key questions for the current STEADI algorithm with 2 levels (at risk, not at risk) can encourage the uptake of STEADI in the clinic by identifying community-dwelling older adults at risk in other settings. Thus, applying the current STEADI algorithm with 2 levels of risk to existing older adult cohorts can streamline population assessment to promote healthier living among older adults.

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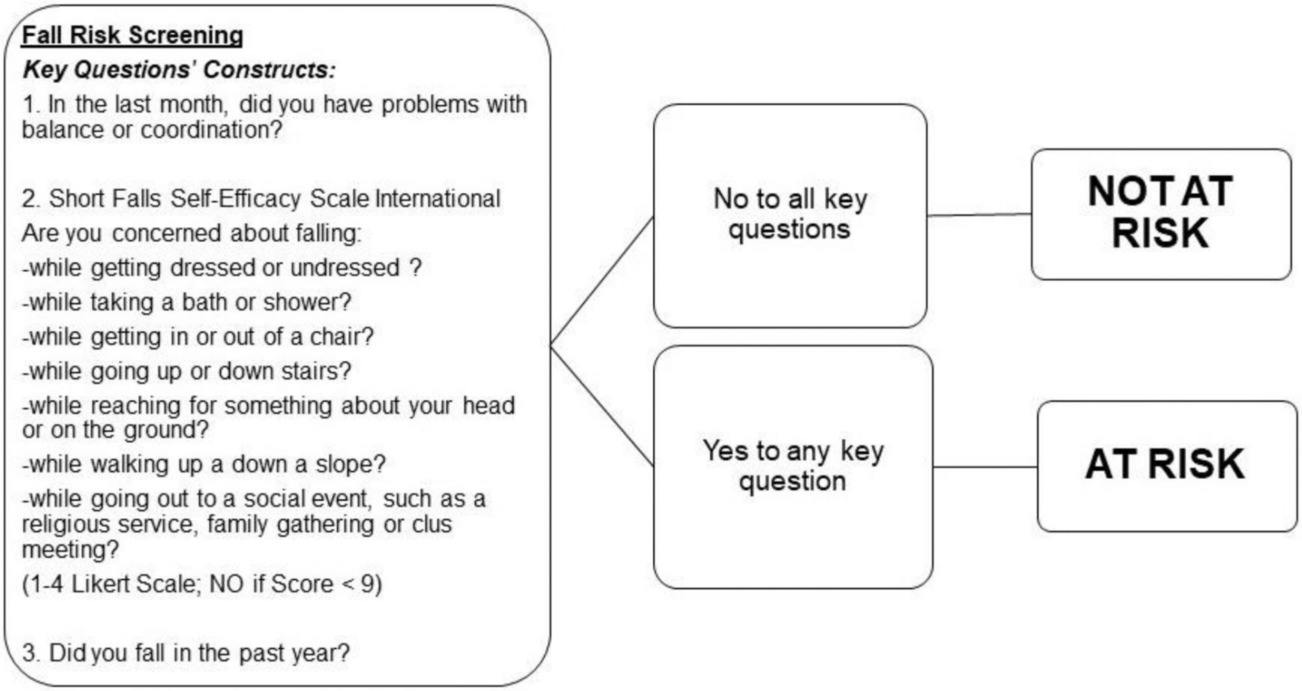

Figure 1.

The adapted STEADI key questions for the 2-level STEADI algorithm for fall risk screening.

STEADI, Stopping Elderly Accidents, Deaths, and Injuries.

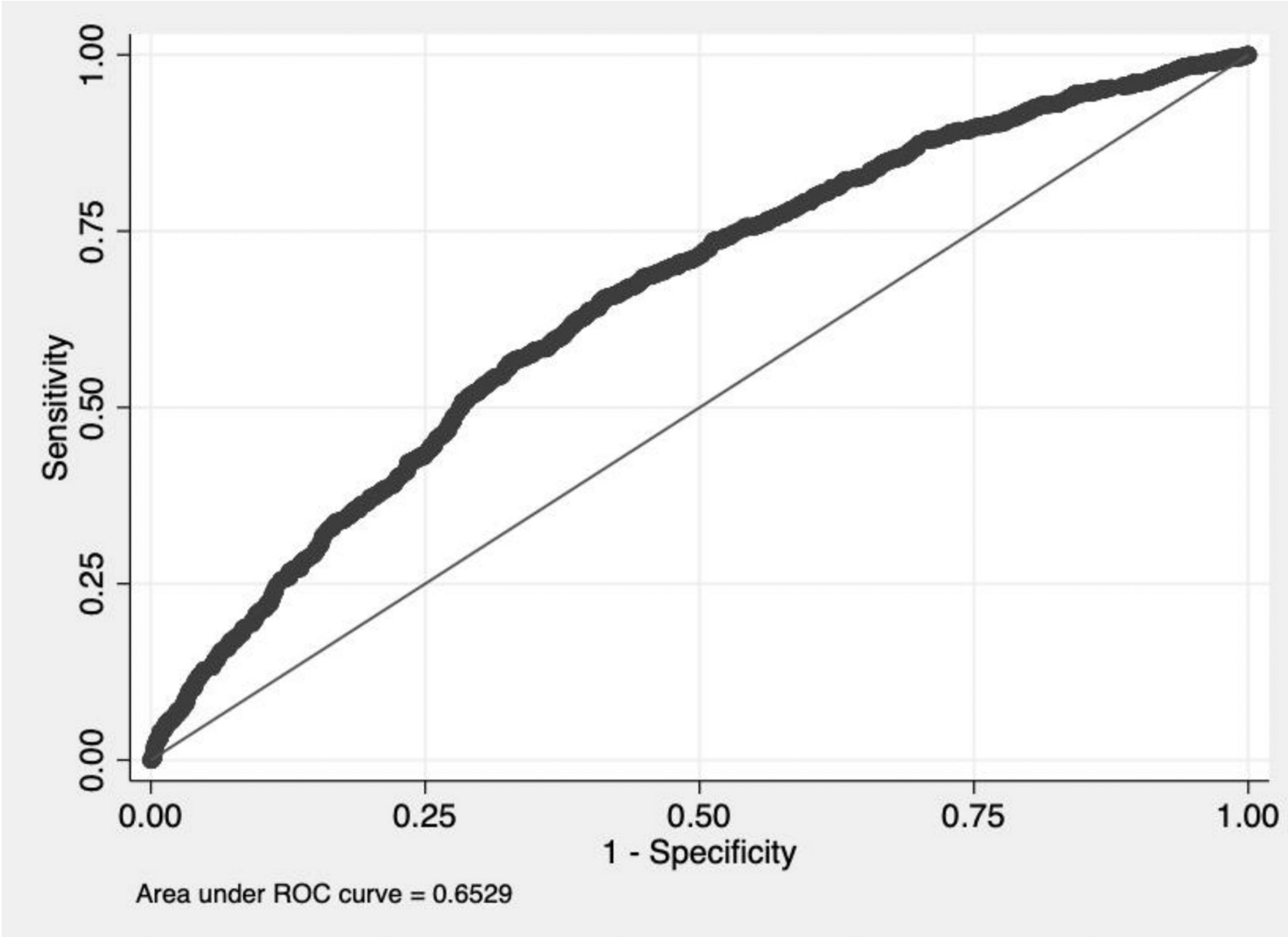

Figure 2.

AUC for adjusted 2-level adapted STEADI algorithm for fall risk screening in predicting any falls at 2-years follow-up (N=2,687).[a,b]

[a]From an adjusted logistic regression model using the American Automobile Association (AAA) Longitudinal Research on Aging Drivers (LongROAD) study, a U.S. population-based cohort for older adults (65–79 years), from 2015–2017.

[b]Model covariates include age, sex, race/ethnicity, education, marital status, hearing impairment, visual impairment, health conditions, health behaviors, and 4-stage balance test measured at baseline.

ROC, receiver operator curve; AUC, area under the ROC; STEADI, Stopping Elderly Accidents, Deaths, and Injuries.

Table 1.

Sociodemographic and Health Characteristics of the Baseline Sample (N=2,977)[a,b],

Characteristics	Total sample	STEADI fall risk screening levels based on 3 key questions	
	N=2,977	Not at risk N=1,321	At risk N=1,656
	N (%)	n (%)	n (%)
Sex **			
Female	1,576 (52.9)	609 (46.1)	967 (58.4)
Male	1,401 (47.1)	712 (53.9)	689 (41.6)
Age category **			
65–69 years	1,236 (41.5)	611 (46.3)	625 (37.7)
70–74 years	1,033 (34.7)	444 (33.6)	589 (35.6)
75–79 years	708 (23.8)	266 (20.1)	442 (26.7)
Race/Ethnicity			
White, Non-Hispanic	2,549 (85.7)	1,124 (85.2)	1,425 (86.2)
Black, Non-Hispanic	210 (7.1)	94 (7.1)	116 (7.0)
Hispanic	80 (2.7)	35 (2.7)	45 (2.7)
Asian	65 (2.2)	31 (2.3)	34 (2.1)
Native American	18 (0.6)	9 (0.7)	9 (0.5)
Other	51 (1.7)	27 (2.0)	24 (1.5)
Education			
Less than high school	62 (2.1)	20 (1.5)	42 (2.5)
High school or vocational school	349 (11.8)	148 (11.3)	201 (12.2)
Some college or higher	2,557 (86.2)	1,147 (87.2)	1,410 (85.3)
Marital status **			
Partner	1,970 (66.8)	925 (70.8)	1,045 (63.6)
No partner	980 (33.2)	381 (29.2)	599 (36.4)
Impairments and symptoms			
Current eyesight (with corrective lenses) **			
Excellent	746 (25.1)	392 (29.7)	354 (21.4)
Very good	1,249 (42.0)	559 (42.4)	690 (41.7)
Good	878 (29.5)	337 (25.5)	541 (32.7)
Fair	92 (3.1)	28 (2.1)	64 (3.9)
Poor	10 (0.3)	3 (0.2)	7 (0.4)
Current hearing (with hearing aid) **			
Excellent	634 (21.3)	333 (25.2)	301 (18.2)
Very good	1,094 (36.8)	502 (38.0)	592 (35.8)
Good	900 (30.3)	370 (28.0)	530 (32.1)
Fair	315 (10.6)	107 (8.1)	208 (12.6)

Characteristics	Total sample	STEADI fall risk screening levels based on 3 key questions	
	N=2,977	Not at risk N=1,321	At risk N=1,656
	N (%)	n (%)	n (%)
Poor	30 (1.0)	8 (0.6)	22 (1.3)
Health conditions[b,**]			
0	967 (32.5)	534 (40.4)	433 (26.1)
≥1	2,010 (67.5)	787 (59.6)	1,223 (73.9)
Health behaviors			
Alcohol use			
No	813 (27.3)	339 (25.7)	474 (28.6)
Yes	2,163 (72.7)	981 (74.3)	1,182 (71.4)
Four-stage balance test**			
Passed	2,445 (82.3)	1,184 (89.6)	1,261 (76.4)
Did not pass	527 (17.7)	137 (10.4)	390 (23.6)
Assistive device use**			
No	2,691 (90.5)	1,285 (97.4)	1,406 (84.9)
Yes	284 (9.5)	34 (2.6)	250 (15.1)
Site*			
Denver, Colorado	598 (20.1)	291 (22.0)	307 (18.5)
Cooperstown, New York	600 (20.2)	265 (20.1)	335 (20.2)
Baltimore, Maryland	581 (19.5)	241 (18.2)	340 (20.5)
Ann Arbor, Michigan	600 (20.2)	247 (18.7)	353 (21.3)
San Diego, California	598 (20.1)	277 (21.0)	321 (19.4)

Notes:

Asterisks indicate statistical significance (*****$p<0.01$; ******$p<0.001$).

[a]Baseline sample derived from the American Automobile Association (AAA) Longitudinal Research on Aging Drivers (LongROAD) study, a U.S. population-based cohort for older adults (65–79 years), in 2015.

[b]Health conditions include lifetime incidence of cancer, diabetes mellitus, stroke, myocardial infarction, rheumatoid arthritis, osteoporosis, dementia, depression, or anxiety.

STEADI, Stopping Elderly Accidents, Deaths, and Injuries.

Table 2.

Adjusted Mixed Logistic Regression Model of 2-Level Adapted STEADI Fall Risk Level and Fall Incidence at 2-Years Follow-up[a,b]

Variable	Any fall (n=2,687)	Multiple falls (n=2,652)
	OR (95% CI)	OR (95% CI)
STEADI fall risk level (3 key questions)		
Not at risk	1.00	1.00
At risk	**2.37 (2.00, 2.80)** ***	**3.60 (2.88, 4.51)** ***
Sex		
Male	1.00	1.00
Female	**1.27 (1.07, 1.51)** **	1.13 (0.92, 1.40)
Age category		
65–69 years	1.00	1.00
70–74 years	1.07 (0.89, 1.29)	1.02 (0.81, 1.27)
75–79 years	0.91 (0.73, 1.12)	0.92 (0.71, 1.18)
Race/Ethnicity		
White, non-Hispanic	1.00	1.00
Black, non-Hispanic	**0.56 (0.39, 0.79)** **	**0.49 (0.30, 0.80)** **
Hispanic	1.24 (0.74, 2.09)	1.32 (0.72, 2.42)
Asian	**0.53 (0.29, 0.98)** *	0.69 (0.32, 1.47)
Native American	1.44 (0.53, 3.94)	**3.25 (1.09, 9.68)** *
Other	0.76 (0.40, 1.47)	0.89 (0.40, 2.00)
Education		
Less than high school	1.00	1.00
High school and vocational school	0.70 (0.38, 1.30)	**0.49 (0.25, 0.99)** *
Some college or higher	0.96 (0.54, 1.71)	0.78 (0.41, 1.48)
Marital status		
Partner	1.00	1.00
No partner	1.04 (0.87, 1.25)	1.17 (0.95, 1.45)
Visual impairment		
Excellent	1.00	1.00
Very good	1.04 (0.85, 1.28)	1.25 (0.97, 1.62)
Good	1.06 (0.84, 1.33)	1.19 (0.90, 1.58)
Fair	0.96 (0.58, 1.59)	1.12 (0.63, 2.02)
Poor	1.69 (0.38, 7.46)	3.20 (0.66, 15.58)
Hearing impairment		
Excellent	1.00	1.00
Very good	0.94 (0.75, 1.17)	0.90 (0.68, 1.20)

Variable	Any fall (n=2,687)	Multiple falls (n=2,652)
	OR (95% CI)	**OR (95% CI)**
Good	0.99 (0.78, 1.26)	1.13 (0.84, 1.51)
Fair	1.18 (0.86, 1.62)	1.40 (0.97, 2.02)
Poor	1.88 (0.78, 4.54)	2.14 (0.89, 5.14)
Health conditions[b]		
0	1.00	1.00
≥1	**1.26 (1.06, 1.51)** **	**1.25 (1.001, 1.56)** *
Health behaviors		
No alcohol use	1.00	1.00
Alcohol use	1.11 (0.92, 1.34)	1.02 (0.82, 1.27)
Four-stage balance test		
Passed	1.00	1.00
Did not pass	1.13 (0.91, 1.41)	**1.49 (1.17, 1.90)** **
Site		
Denver, Colorado	1.00	
Cooperstown, New York	0.83 (0.64, 1.07)	0.92 (0.68, 1.26)
Baltimore, Maryland	1.01 (0.77, 1.32)	0.81 (0.58, 1.12)
Ann Arbor, Michigan	1.28 (0.99, 1.65)	1.03 (0.76, 1.39)
San Diego, California	**0.76 (0.59, 0.99)** *	**0.72 (0.52, 0.996)** *

Notes:

Boldface indicates statistical significance (*****$p<0.05$; ******$p<0.01$; *******$p<0.001$).

[a]Derived from a mixed logistic regression model adjusting for age, sex, race/ethnicity, education, marital status, hearing impairment, visual impairment, health conditions, health behaviors, 4-stage balance test, and study site using the American Automobile Association (AAA) Longitudinal Research on Aging Drivers (LongROAD) study, a U.S. population-based cohort for older adults (65–79 years), from 2015–2017.

[b]Health conditions include lifetime incidence of cancer, diabetes mellitus, stroke, myocardial infarction, rheumatoid arthritis, osteoporosis, dementia, depression, or anxiety.

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