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Manhattan Vision Screening and Follow-up Study (NYC-SIGHT): a nested cross-sectional assessment of falls risk within a cluster randomised trial

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Abstract

Background—To investigate the feasibility of using the Stopping Elderly Accidents, Deaths and Injuries (STEADI) Falls Risk Tool Kit during community-based eye health screenings to assess falls risk of participants enrolled in the Manhattan Vision Screening and Follow-Up Study (NYC-SIGHT).

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Disclaimer The findings and conclusions in this report are those of the authors, and do not necessarily represent the official position of the US Centers for Disease Control and Prevention. The sponsor or funding organisation had no role in the design or conduct of this research.

Competing interests None declared.

Ethics approval The study protocol was approved by the Columbia University Irving Medical Center Institutional Review Board (IRB) (#AAAR9162). All aspects of the study were conducted in accordance with the Declaration of Helsinki. Informed consent was obtained from all participants before enrolment.

Methods—Cross-sectional analysis of data from a 5-year prospective, duster-randomised clinical trial conducted in affordable housing developments in New York City in adults age 40 years and older. Prescreening questions determined whether participants were at risk of falling. STEADI tests classified participants at low, moderate or high risk of falling. Multivariate logistic regression determined odds of falls risk of all enrolled participants.

Results—708 participants completed the eye health screening; 351 (49.6%) performed STEADI tests; mean age: 71.0 years (SD±11.3); 72.1 % female; 53.6% Black, non-Hispanic, 37.6% Hispanic/Latino. Level of falls risk: 32 (9.1%) low, 188 (53.6%) moderate and 131 (37.3%) high. Individuals age >80 (OR 5.921,95% Cl (2.383 to 14.708), p=0.000), had blurry vision (OR 1.978,95% Cl (1.186 to 3.300), p=0.009), high blood pressure (OR 2.131,95% Cl (1.252 to 3.628), p=0.005), arthritis (OR 2.29876,95% Cl (1.362 to 3.875), p=0.002) or foot problems (OR 5.239,95% Cl (2.947 to 9.314), p=0.000) had significantly higher odds of falling, emergency department visits or hospitalisation due to falling.

Conclusion—This study detected a significant amount of falls risk in an underserved population. The STEADI Falls Risk screening questions were easy for eye care providers to ask, were highly predictive of falls risk and may be adequate for referral to occupational health and/or physical therapy.

INTRODUCTION

Falling in older adults, defined as an external cause of unintentional injury, is a major public health problem in the USA, UK and worldwide.[1] According to the US Centers for Disease Control and Prevention (CDC), falls are the leading cause of injury and accidental death among adults aged 65 years and older.[2] Close to 36 million adults aged 65 years and older living in the USA reported at least one fall in 2018 and 8.4 million falls-related injuries during that same year.[3] By 2030, the number of falls in older adults is projected to reach 49 million in the US resulting in 12 million falls-related injuries, a significant economic burden to the health-care system and international implications.[2–5] The substantial falls-related medical costs are projected to reach US$101 billion by 2030 and worldwide efforts are needed from all practitioners.[6–8] The CDC developed Stopping Elderly Accidents, Deaths and Injuries (STEADI) Falls Risk Tool Kit, which has been validated for screening, assessing and intervening in clinical, hospital and community settings.[9–11]

Falls among older adults are related to gait instability, foot problems, poor balance, cognitive impairment, urinary incontinence and frequency, medication interactions and taking certain psychoactive medications.[12–14] Physical limitations and inactivity, poor mobility, poor muscle strength, and poor postural stability also contribute to falls risk.[15 16]

Vision impairment and blindness are highly prevalent and affect 1 out of every 11 older adults and are associated with an increased risk of falling and falls-related injuries.[17–19] Vision impairment due to visual field loss, impaired contrast sensitivity and the presence of visually significant cataracts is associated with two or more falls in a 12-month period.[20 21] Reducing unnecessary vision impairment with eyeglasses, cataract surgery and developing interventions to prevent falls and improve falls-related outcomes are needed.[22–24] The

recently updated STEADI Falls Risk Tool Kit algorithm now includes checking visual acuity using the Snellen eye chart.[9]

The Manhattan Vision Screening and Follow-Up Study (NYC-SIGHT) is a 5-year community-based study which aims to investigate whether community-based eye health screenings can improve detection and management of glaucoma, vision impairment, cataract and other eye diseases among high-risk populations living in affordable housing developments in Upper Manhattan. The CDC's STEADI Falls Risk Tool Kit has been incorporated into the study protocol to investigate the feasibility of falls risk assessment during community-based eye health screenings for all enrolled participants.[25] The purpose of this paper is to describe a nested cross-sectional assessment of falls risk within a cluster-randomised trial.

METHODS

Study design

This is a cross-sectional analysis of data from a 5-year prospective, cluster randomised clinical trial. The methods and study design have been previously published and are summarised below.[25] The housing development was the unit of randomisation, which was designed by the study biostatistician. The study is registered on ClinicalTrials.gov (NCT04271709).

Study population

The study was conducted in NYC Housing Authority affordable (public) housing developments and the NYC Department for the Aging Senior Centers in Harlem and Washington Heights to reach high-risk individuals with inadequate eye care who are living at or below the NYC.gov poverty measure.[26]

Inclusion criteria

Age 40 years and older, living independently in an affordable housing development or age 60 years and older and a member of a senior centre and able to provide informed consent.

Prescreening assessment

Demographics, social determinants of health data, medical and ocular history, family history of glaucoma and blindness, last dilated eye exam and access to eye care were collected. Clinical factors related to falls risk were captured according to the STEADI assessment procedures.[9]

STEADI Tool Kit (screening)

The STEADI Falls Risk Tool Kit contains three core elements: All participants were asked the following screening questions:

1. Do you worry about falling or feel unsteady when standing or walking?
2. Have you fallen in the past year? If you have fallen, how many times?

3. Were you injured from falling and visited the emergency department or been hospitalised due to falling in the past year?

Participants who answered yes to any of these questions were deemed to be at risk of falling. They were scheduled to complete the STEADI tests during the eye health screening to evaluate gait, strength, and balance.

STEADI Falls Risk tests during eye health screening

Timed-Up-and-Go Test—This test evaluates mobility and participants were asked to stand up unaided from a chair, walk 3 m, turn around and walk back (figure 1). If they took longer than 12seconds or were unable to complete the task, they were at risk of falling.[9]

30-Second Chair Stand Test—This test assesses leg strength and endurance (figure 1). Participants were asked to stand up and down from a seated position with their hands crossed over their chests and repeat multiple times. The number of times they can stand in 30 seconds was measured and if they used their hands for support or were unable to stand, the number was recorded as 0. Results were compared with the STEADI nomogram depending on their age.[9]

Four-Stage Balance Test—This test assesses participants' static balance in four different postures: feet side by side, feet offset at the instep, feet in line and standing on one foot (figure 1). If a participant was unable to maintain unsupported balance in any of the postures for; 10 seconds, they were at risk of falling.[9]

Falls risk classification

Participants were characterised as low falls risk if they completed the STEADI tests successfully, had no history of falling or fall-related injuries in the past year, and scored 5 seconds or higher on the Four-Stage Balance Test. Participants were characterised as moderate falls risk if they had fallen in the past year less than 2 times but did not have any injuries, they were unable to complete any of the STEADI tests, or scored 4 seconds or lower on the Four-Stage Balance Test. Participants were characterised as having a high risk of falling if they were using a walker, cane or wheelchair; had fallen two or more times in the past year; visited the emergency department or were hospitalised due to falling, or were unable to perform any of the STEADI tests (figure 2).

All participants who completed the STEADI tests were given IRB-approved Falls Prevention handouts in English and Spanish, which were developed by the CDC.[9]

Vision-related quality-of-life

The National Eye Institute Visual Function Questionnaire (NEI-VFQ-9) was administered by the study coordinators over the phone or in person to all participants prior to the eye health screening. The NEI-VFQ-9 includes seven subscales: general vision, well-being/mental health, near vision, distance vision, driving, role limitation and peripheral vision.

Eye health screening

During the screening, visual acuity (Snellen) and intraocular pressure were measured and fundus images were taken of the retina and optic nerve. Participants with a visual acuity of 20/40 or worse in either eye failed the screening. Intraocular pressure was measured in both eyes using the TA01I iCare rebound tonometer (iCare, Helsinki, Finland). Screening failure was defined as intraocular pressure of 23–29 mm Hg in either eye. Fundus images were taken using the non-mydriatic, autofocus, hand-held fundus camera (Volk Pictor Prestige, Volk Optical, Mentor, Ohio, USA), then read and graded by two study ophthalmologists specialising in retina and glaucoma. All participants who failed the eye health screening were scheduled to see the on-site study optometrist within 3 weeks. Those with an abnormal image or intraocular pressure >30mm Hg were referred to ophthalmology and scheduled for their first in-office eye exam appointment.

Optometric exam

The optometrist assessed the refractive error of participants who failed the eye health screening using an autorefractor (QuickSee Autorefractor, Plenoptika, Cambridge, Massachusetts, USA). The optometrist also performed a non-dilated eye exam of the anterior segment using a portable slit lamp and a posterior segment exam using a direct ophthalmoscope (Welch Allyn Panoptic V3.5V Skaneateles Falls, New York, USA).

Data collection and statistical analysis

Data were entered into the Research Electronic Data Capture (REDCap) database.[27 28] Statistical analyses were performed with IBM SPSS software V.25 (IBM) and R statistical package V.4.1.2 (R Foundation for Statistical Computing, Vienna, Austria).[29 30] Participant characteristics were summarised for the entire sample using means and SD for continuous variables and frequencies and percentages for categorical variables. Falls risk was the outcome measure and was defined by a positive response to any of the questions included in the STEADI Falls Risk Tool Kit. To screen for potentially significant predictors of falls risk, we performed univariate tests as follows. A two-sample t-test was used to determine statistical significance for continuous variables, such as age. χ^2 and Fisher's exact tests were used for categorical variables to determine if there were any statistically significant differences in those demographic and clinical characteristics between those participants who were invited to conduct the STEADI tests during the eye health screening and those who were not invited.

A stepwise multivariate logistic regression model was constructed using the significant variables from the univariate analyses to identify possible predictors associated with falling, emergency department visits or hospitalisation due to falling to determine OR at the 95% CIs. At each step, variables were added based on the alpha-to-enter significance level of 0.05 and the alpha-to-remove significance level was set at 0.1 to exclude variables in the final model. For all analyses, P values of <0.05 were considered statistically significant.

The composite score for the NEI-VFQ-9 was determined by means and SD among the study population and question 6 (driving) was excluded from the analysis because so few people drive in New York City. These scores were averaged to compute the overall NEI-VFQ-8

composite score and a two-sample t-test was used to determine statistical significance of the NEI-VFQ-9 composite score between the groups.

RESULTS

Demographics/social determinants of health

From 1 March 2021 to 31 May 2022, 708 participants completed the eye health screening. During prescreening, 296 (41.8%) participants stated they worried about falling or felt unsteady when standing or walking and 176 (24.9%) fell at least once in the past year (table 1). Of those who fell in the past year, 99 (56.3%) fell once, 43 (24.4%) fell two times and 34 (19.3%) participants fell 3–5 times (figure 2). Therefore, 351 participants (49.6%) were invited to perform STEADI tests during the eye health screening. Mean age of the participants who performed the STEADI tests was 71.0 years (SD±11.3); 253 (72.1%) were female, 188 (53.6%) were black, non-Hispanic and 132 (37.6%) were Hispanic/Latino (table 1).

Most participants who completed the STEADI were single, divorced, separated or widowed (81.2%) and retired (65.2%). Nearly all had health insurance (96.6%), however, only 34.2% reported having an eye doctor. Age (>80 years), gender (female), race/ethnicity (multiracial and Puerto Rican), employment (retired or disabled), marital status (single, divorced, separated or widowed), insurance type (Medicare and Medicaid) and access to eye care were significantly greater for those who performed the STEADI tests compared with those who were not invited ($p<0.05$) (table 1).

Clinical characteristics

Of the 351 participants who completed the STEADI tests, rates of self-reported diabetes, hypertension, arthritis/osteoporosis, foot problems, heart problems, depression, asthma/chronic obstructive pulmonary disease, and cancer were significantly greater in those who completed the STEADI tests ($p<0.05$) (table 2). Significantly higher rates of self-reported dry eye, blurry vision, diabetic retinopathy and cataracts were reported by participants who completed the STEADI tests compared with those not at risk of falling ($p<0.05$) (table 2).

Falls risk assessment

Based on the screening questions, 296 (41.8%) participants worried about falling or felt unsteadying when standing or walking and 176 (24.9%) participants had fallen at least one time in the past year. After completing the STEADI tests, 32 (9.1%) participants were low risk, 188 (53.6%) participants were moderate risk and 131 (37.3%) participants were high risk of falling. There were 121 participants unable to perform any of the STEADI tests because they were in a wheelchair or using a walker (figure 2). The mean age for low risk was 70.2 years (SD±11.42), moderate risk was 70.9 years (SD±10.77) and high risk was 71.5 years (SD±11.98).

National Eye Institute Vision Function Questionnaire

Of the 351 participants who performed the STEADI tests, the mean NEI-VFQ composite score was significantly lower in those who performed the STEADI tests compared with

those who did not perform the STEADI tests (65.0 vs 71.5) ($p<0.05$) (table 1), indicating lower quality-of-life.

Eye health screening

Of those who completed the STEADI tests, 292 (83.2%) participants failed the eye health screening (table 2). A total of 200 participants (57%) who completed the STEADI tests were referred to ophthalmology for follow-up (figure 2). Visual acuity 20/40 or worse, level of vision impairment (moderate), referral to optometrist and optometrist diagnosis requiring referral to ophthalmology (retina) were significantly higher in those who completed the STEADI tests at the $p<0.05$ level (table 2).

Stepwise multivariate logistic regression

A stepwise multivariate regression analysis was completed for all variables deemed significantly associated with falling, emergency department visits or hospitalised due to falling. Of the 351 participants invited to conduct the STEADI, those who were at least 80 years old (OR 5.921, 95% Cl (2.383 to 14.708), p=0.000) and had blurry vision (OR 1.978, 95% CI (1.186 to 3.3), p=0.009) had significantly higher odds of falling. Of these 351 participants who self-reported high blood pressure (OR 2.131, 95% CI (1.252 to 3.628), p=0.005), arthritis (OR 2.298, 95% CI (1.362 to 3.875), p=0.002) or foot problems (OR 5.239, 95% CI (2.947 to 9.314), p=0.000) also had significantly higher odds of falling, emergency department visits or hospitalisations due to falling. Participants who were Hispanic (OR 0.240, 95% CI (0.086 to 0.665), p=0.006) or were married or had a domestic partner (OR 0.378, 95% CI (0.196 to 0.730), p=0.004) had significantly lower odds of falling, emergency department visits or hospitalisations due to falling (table 3).

DISCUSSION

Main findings

The NYC-SIGHT is a community-based study in NYC that incorporated the CDC's STEADI Falls Risk Tool Kit.[25] Nearly half of the screened population reported either having had a fall in the past year, feeling unsteady when standing or walking, or worry about falling (figure 2). Therefore, targeting these participants to perform STEADI tests on the same day as the eye health screening was an efficient assessment method to capture those at risk of falls. Nearly all of those who performed the STEADI tests were classified as 'at risk' of falling.

Clinical implications

The STEADI Falls Risk Tool Kit was an effective, quick and simple method to incorporate into any community-based screening programme, clinical setting or study. Individuals who were at least 80 years old, had high blood pressure, foot problems or blurry vision had significantly higher odds of falling, emergency department visits or hospitalisations due to falling. Self-reported medical and ocular conditions reported by our study participants are consistent with the known falls risk factors but new information that participants with hypertension and blurry vision had greater odds of falling.[31]

In addition to serious injuries and deaths, falls can affect quality-of-life in older adults, sometimes making it harder for them to safely live independently and/or age in place.[31–33] The quality-of-life instrument (NEI-VFQ-9) vision scores were significantly lower in the 544 participants who had a higher falls risk ($p<0.05$) (table 1). The correlation between visual impairment and falls is an additional factor to consider and impacts one's ability to safely navigate and participate in daily roles and activities including events and activities in the community.[31–33]

Other studies

We were very successful in identifying those at risk of falling due to a recruitment strategy of public housing residents and senior centre members, resulting in almost 50% being invited for the STEADI tests. Our research supports prior studies which show that vision problems may increase the risk of falls and other injuries, leading to further complications and decreased quality-of-life.[21] The connection between vision health and falls risk has been well documented and early detection and effective treatment of ocular conditions is paramount.[17 18]

Strengths and limitation

The strength of the study is that we used the STEADI questions and STEADI Tool Kit in the community, which allowed the team to educate participants about the connection between eye health and falls risk. One-third of older adults have experienced a fall in the community and falls are considered one of the most serious health issues, resulting in increased mortality.[2] Because poor vision is a contributing factor in falls risk, the consideration of vision in adults and seniors is imperative.[9] Additional strengths also include the racially and ethnically diverse study population is composed of 51.8% black and 42% Hispanic/Latino participants. Limitations of this study include a self-selected group of participants who may have signed up for the eye health screening because their vision is worsening and they know they have blurry vision, adding bias to the sample which may overestimate the rates of vision impairment and eye disease.

CONCLUSION

Incorporating the STEADI Falls Risk Tool Kit and materials into primary care settings worldwide, community-based programmes, health screening events and studies with older adults can easily identify individuals at high falls risk. In this study, we found that the 'self-reported' screening questions

1. Do you worry about falling or feel unsteady when standing or walking?
2. Have you fallen in the past year? If you have fallen, how many times
3. Were you injured from falling and visited the emergency department or been hospitalised due to falling in the past year?

were highly predictive of falls risk and provide a simple and quick method for ophthalmologists and eye care providers to refer to occupational health and/or physical

therapy, as was shown previously by Ritchey *et al*.[34] The connection between any level of visual impairment and falls risk cannot be over-looked and are supported by our data.

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Data availability statement

Data are available on reasonable request.

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WHAT IS ALREADY KNOWN ON THIS TOPIC

- Falls are a major public health problem in older adults and recently, the Centers for Disease Control and Prevention Stopping Elderly Accidents, Deaths and Injuries Falls Risk Tool Kit added checking visual acuity with the Snellen eye chart, due to the link between falling and impaired vision as a modifiable risk factor.

WHAT THIS STUDY ADDS

- This study provides strong evidence that eye care providers should consider assessing falls risk when evaluating vision impairment. This study found that individuals with blurry vision, hypertension, arthritis, foot problems or those over age 80 had a higher odds of falling, emergency department visits or been hospitalised due to falling.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- Eye care providers can ask three simple questions and anyone who says yes, consider referring to physical therapy or occupational therapy for evaluation. (1) Do you worry about falling or feel unsteady when standing or walking? (2) Have you fallen in the past year? If you have fallen, how many times? (3) Were you injured from falling and visited the emergency department or been hospitalised due to falling in the past year?

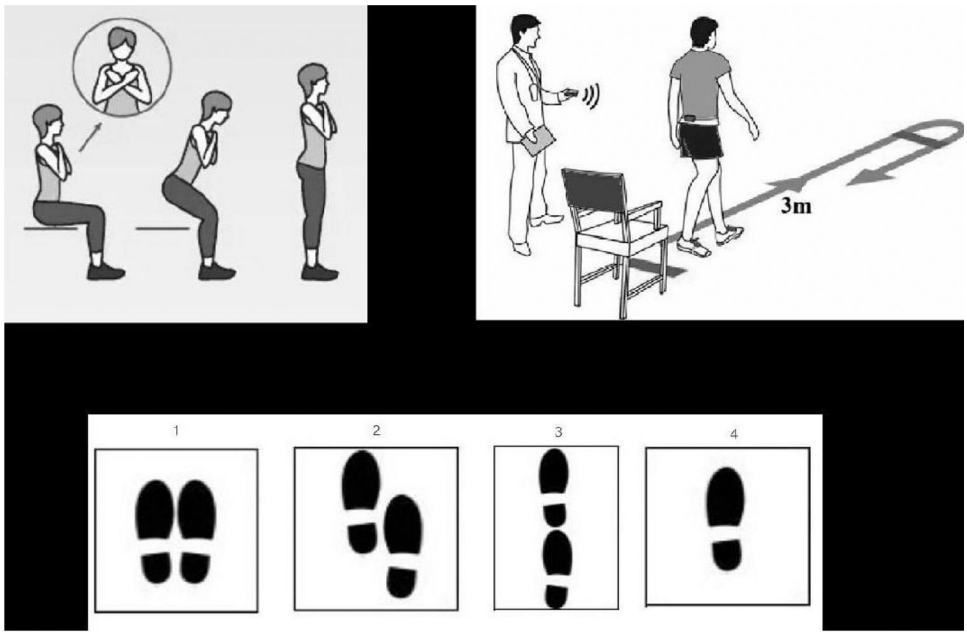

Figure 1.
Stopping Elderly Accidents, Deaths and Injuries Falls Risk Assessment. (A) 30-Second Chair Stand, (B) Timed-Up-and-Go, (C) Four-Stage Balance Test.

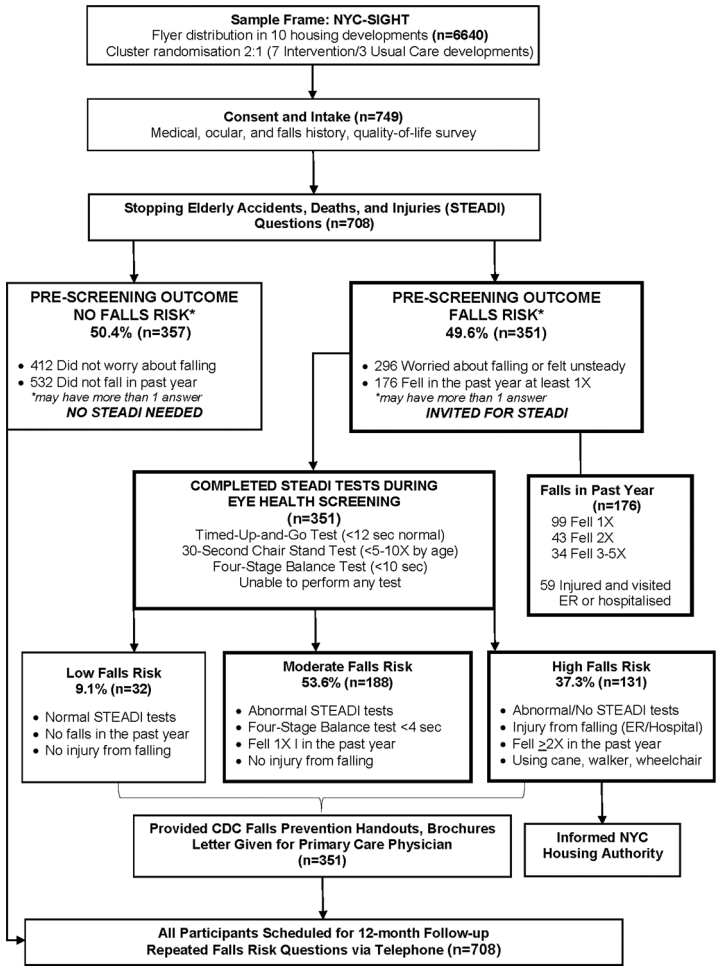

Figure 2.

CONSORT flow diagram: Manhattan Vision Screening and Follow-up Study (NYC-SIGHT): STEADI Algorithm for Falls Risk Screening Assessment Participants were recruited by flyer distribution (top centre), verbal informed consent and intake data were obtained. Medical and ocular history, falls risk, and vision-related quality-of-life were assessed by the call centre (second row) before eye health screening. All enrolled participants were asked the STEADI questions (third row). All participants were separated into two groups based on falls risk/no falls risk criteria and outcomes (fourth row). All participants who were at risk of falling were invited to complete the STEADI test during on-site eye health screening (fifth row). The number of falls participants had in the past year (fifth row right). Participants were rated by level of risk for falling, low, moderate or high (sixth row). All participants who complete the STEADI test were provided with the CDC Falls Prevention handout (seventh row). Agencies were informed of those at high risk for falling (seventh row right). All enrolled participants were invited and scheduled for a 12-month follow-up visit, falls risk questionnaire and quality-of-life survey were readministered (last row). CDC, Centers for Disease Control and Prevention.

Table 1

Manhattan Vision Screening and Follow-up Study: baseline demographics, social determinants of health and Vision-Related Quality-of-Life Score

Variables	Completed STEADI (n=351)	Did not complete STEADI (n=357)	P value
Age (years), mean±SD	71.0±11.3	66.1±12.0	**0.000** *
Age category, n (%)			**0.000**
40–59 years	61 (17.4)	109 (30.5)	
60–79 years	212 (60.4)	204 (57.1)	
≥80 years	78 (22.2)	44 (12.3)	
Sex, n (%)			**0.000**
Female	253 (72.1)	208 (58.3)	
Male	98 (27.9)	149 (41.7)	
Ethnicity/race, n (%)			**0.004**
Hispanic/Latino	132 (37.6)	165 (46.2)	
Black, non-Hispanic	188 (53.6)	179 (50.1)	
Others	31 (8.8)	13 (3.6)	
Education level, n (%)			0.327
Less than high school	115 (32.8)	99 (27.7)	
High school	109 (31.1)	123 (34.5)	
Some college, college, graduate	127 (36.2)	135 (37.8)	
Employment status, n (%)			**0.000**
Employed (full time, part time or self-employed)	39 (11.1)	102 (28.6)	
Unemployed	30 (8.5)	44 (12.3)	
Retired	229 (65.2)	183 (51.3)	
Disabled/unable to work	53 (15.1)	28 (7.8)	
Marital status, n (%)			**0.000**
Single, divorced, separated, widowed	285 (81.2)	249 (69.7)	
Married/domestic partner	66 (18.8)	108 (30.3)	
Needs transportation, n (%)	33 (9.4)	27 (7.6)	0.380
Has health insurance, n (%)	339 (96.6)	336 (94.1)	0.120
Insurance type, n (%)			
Medicare	226 (64.4)	179 (50.1)	**0.000**
Medicaid	209 (59.5)	180 (50.4)	**0.015**
Private or supplemental	96 (27.4)	113 (31.7)	0.214
Primary language, n (%)			0.087
English	223 (63.5)	204 (57.1)	
Spanish	117 (33.3)	146 (40.9)	
Other (French/Creole/Arabic/Bengali/Russian)	11 (3.1)	7 (2.0)	
Has own eye doctor (access to eye care), n (%)	120 (34.2)	94 (26.3)	**0.023**

Variables	Completed STEADI (n=351)	Did not complete STEADI (n=357)	P value
Last dilated eye exam, n (%)			0.343
Within the past year	87 (24.8)	80 (22.4)	
Within 1–2 years	86 (24.5)	77 (21.6)	
More than 2 years	119 (33.9)	131 (36.7)	
Can't remember	42 (12.0)	40 (11.2)	
Never had eye exam	17 (4.8)	29 (8.1)	
Reason for no eye exam in 2 years, n (%)			**0.008** †
No reason to go	34 (19.2)	74 (37.6)	
Not thought about it	35 (19.8)	24 (12.2)	
No vision insurance	13 (7.3)	12 (6.1)	
Cost of eye exam	5 (2.8)	5 (2.5)	
No eye doctor	9 (5.1)	7 (3.6)	
Couldn't get appointment	4 (2.3)	7 (3.6)	
No transportation to office	3 (1.7)	1 (0.5)	
Other, including COVID-19	74 (41.8)	67 (34.0)	
NEI-VFQ-9 mean composite score±SD	65.0±12.7	71.5±9.4	**0.000** *

Bold P value indicates statistical significance at the alpha=0.05 level.

*P values refer to two-sample t-tests. All other P values refer to the χ^2 test.

†P values refer to Fisher's exact test.

NEI-VFQ-9, National Eye Institute Visual Function Questionnaire; STEADI, Stopping Elderly Accidents, Deaths and Injuries.

Table 2

Manhattan Vision Screening and Follow-up Study: baseline medical, ocular and falls history and eye health screening results

Variables	Completed STEADI (n=351)	Did not complete STEADI (n=357)	P value
Medical conditions (self-reported), n, (%)			
Hypertension	255 (72.6)	189 (52.9)	**0.000**
Diabetes	122 (34.8)	84 (23.5)	**0.001**
Arthritis/osteoporosis	214 (61.0)	113 (31.7)	**0.000**
Foot problems	173 (49.3)	78 (21.8)	**0.000**
Heart problems	94 (26.8)	45 (12.6)	**0.000**
Depression	93 (26.5)	32 (9.0)	**0.000**
Asthma/COPD	82 (23.4)	36 (10.1)	**0.000**
Cancer	31 (8.8)	16 (4.5)	**0.020**
Other medical conditions	42 (12.0)	38 (10.6)	0.549
No medical conditions	16 (4.6)	64 (17.9)	**0.000**
Current smoker, n, (%)	59 (16.8)	44 (12.3)	0.091
Ocular conditions (self-reported), n (%)			
Dry eye	178 (50.7)	153 (42.9)	**0.036**
Blurry vision	159 (45.3)	113 (31.7)	**0.000**
Cataract	115 (32.8)	84 (23.5)	**0.006**
Glaucoma	41 (11.7)	42 (11.8)	0.972
Floaters	59 (16.8)	52 (14.6)	0.412
Double vision	32 (9.1)	19 (5.3)	0.051
Diabetic retinopathy	10 (2.8)	3 (0.8)	0.053 *
Macular degeneration	3 (0.9)	5 (1.4)	0.725 *
No ocular conditions	65 (18.5)	89 (24.9)	**0.039**
Family history, n (%)			
Family history of glaucoma	86 (24.5)	82 (23.0)	0.632
Family history of blindness	40 (11.4)	32 (9.0)	0.284
Wears eyeglasses, n (%)	262 (74.6)	242 (67.8)	**0.044**
Age of eyeglasses, n (%)			0.739
Less than 1 year	50 (19.1)	51 (21.1)	
1–2 years	61 (23.3)	62 (25.6)	
More than 2 years	130 (49.6)	108 (44.6)	
Can’t remember	21 (8.0)	21 (8.7)	
Failed eye health screening, n (%)	292 (83.2)	263 (73.7)	**0.002**
Reason for failure			
Visual acuity 20/40 or worse	265 (75.5)	232 (65.0)	**0.002**
IOP 23–29mm Hg	23 (6.6)	26 (7.3)	0.702

Variables	Completed STEADI (n=351)	Did not complete STEADI (n=357)	P value
Unreadable image	91 (25.9)	84 (23.5)	0.460
Visual acuity based on worse eye (Snellen), mean logMAR±SD	0.52±0.49	0.45±0.50	0.068†
Level of vision impairment			**0.007**
No vision impairment logMAR 0.0–0.18 (20/20, 20/25, 20/30)	86 (24.6)	125 (35.0)	
Mild vision impairment logMAR 0.3–0.4 (20/40, 20/50)	105 (30.1)	104 (29.1)	
Moderate vision impairment logMAR 0.48–0.7 (20/60,20/70,20/80,20/100)	111 (31.8)	80 (22.4)	
Severe vision impairment logMAR 1.0–3.0 (20/200, CF, HM, LP, NLP)	47 (13.5)	48 (13.4)	
Telemedicine results by worse eye, n (%) (n=704)			**0.020**
Normal image	125 (35.6)	130 (36.4)	
Abnormal image, no significance	20 (5.7)	6 (1.7)	
Abnormal image	113 (32.2)	135 (37.8)	
Unreadable image	91 (25.9)	84 (23.5)	
Optometric exam findings, n (%)			
Glaucoma/suspect	27 (7.7)	24 (6.7)	0.618
Retinal abnormalities	15 (4.3)	2 (0.6)	**0.001***
Cataract	40 (11.4)	34 (9.5)	0.416
Other ocular diagnoses	9 (2.6)	13 (3.6)	0.517*
Refraction	4 (1.1)	3 (0.8)	0.723*
Annual dilated eye exam	56 (16.0)	47 (13.2)	0.293

Bold P value indicates statistical significance at the alpha=0.05 level.

*P values refer to Fisher's exact test.

†P values refer to two-sample t-tests. All other P values refer to the χ^2 test.

CF, count fingers; COPD, chronic obstructive pulmonary disease; HM, hand motion; IOP, intraocular pressure; logMAR, logarithm of the minimum angle of resolution; LP, light perception; NLP, no light perception; STEADI, Stopping Elderly Accidents, Deaths and Injuries.

Table 3

Stepwise multivariate logistic regression model of the association between demographics, social determinants of Health, clinical conditions and falls risk (n=351)

Variables	OR (95% CI)	P value
Age		
40–59 years	Ref	**Ref**
≥80 years	5.921 (2.383 to 14.708)	**0.000**
Race		
Others	Ref	**Ref**
Hispanics	0.240 (0.086 to 0.665)	**0.006**
Marital status		
Single, divorced, separated or widowed	Ref	**Ref**
Married/domestic partner	0.378 (0.196 to 0.730)	**0.004**
High blood pressure		
No	Ref	**Ref**
Yes	2.131 (1.252 to 3.628)	**0.005**
Arthritis		
No	Ref	**Ref**
Yes	2.298 (1.362 to 3.875)	**0.002**
Foot problems		
No	Ref	**Ref**
Yes	5.239 (2.947 to 9.314)	**0.000**
Blurry vision		
No	Ref	**Ref**
Yes	1.978 (1.186 to 3.300)	**0.009**

CI, confidence interval; OR, odds ration; Ref, reference value. Bold P value* indicates statistical significance at the p≤0.05 level *At each step, variables were added based on the alpha-to-enter significance level of 0.05 and the alpha-to-remove significance level was set at 0.1 to exclude variables in the final model.