HHS Public Access

Author manuscript

Gerontologist. Author manuscript; available in PMC 2020 November 16.

Published in final edited form as:

Gerontologist. 2019 November 16; 59(6): 1182–1191. doi:10.1093/geront/gny101.

Implementation of the Stopping Elderly Accidents, Deaths, and Injuries Initiative in Primary Care: An Outcome Evaluation

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Abstract

Background and Objectives: Older adult falls pose a growing burden on the U.S. health care system. The Centers for Disease Control and Prevention's Stopping Elderly Accidents, Deaths, and Injuries (STEADI) initiative was developed as a multifactorial approach to fall prevention that includes screening for fall risk, assessing for modifiable risk factors, and prescribing evidence-based interventions to reduce fall risk. The purpose of this study was to determine the impact of a STEADI initiative on medically treated falls within a large health care system in Upstate New York.

Research Design and Methods: This cohort study classified older adults who were screened for fall risk into 3 groups: (a) At-risk and no Fall Plan of Care (FPOC), (b) At-risk with a FPOC, and (c) Not-at-risk. Poisson regression examined the group's effect on medically treated falls when controlling for other variables. The sample consisted of 12,346 adults age 65 or older who had a primary care visit at one of 14 outpatient clinics between September 11, 2012, and October 30, 2015. A medically treated fall was defined as a fall-related treat-and-release emergency department visit or hospitalization.

Results: Older adults at risk for fall with a FPOC were 0.6 times less likely to have a fall-related hospitalization than those without a FPOC ($p = .041$), and their postintervention odds were similar to those who were not at risk.

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Discussion and Implications: This study demonstrated that implementation of STEADI fall risk screening and prevention strategies among older adults in the primary care setting can reduce fall-related hospitalizations and may lower associated health care expenditures.

Keywords

Falls; Intervention; Screening

Falls among community-dwelling older adults pose a significant and growing public health concern globally (Peel, 2011; Williams et al., 2015) as well as in the United States (Verma et al., 2016). Older adults reported 29 million falls in 2014 with 7 million of these resulting in injury (Bergen, Stevens, & Burns, 2016). In 2016, older adult falls resulted in over 29,000 deaths, and 3.2 million emergency department (ED) visits, of which 963,000 were hospitalized (Centers for Disease Control and Prevention [CDC], National Center for Injury Prevention and Control, 2017). Between 2007 and 2016, there was a 31% increase in the age-adjusted death rate due to falls among older adults (Burns & Kakara, 2018). These falls impose an economic burden on the U.S. health care system, resulting in approximately $50 billion in medical costs for 2015 (Florence et al., 2018). With the older adult population in the United States projected to increase 55% by 2030, an estimated 49 million falls and 12 million fall injuries are expected to occur in that year alone unless the rate of older adult falls is reduced (Bergen et al., 2016; Burns, Stevens, & Lee, 2016).

In an analysis of the 2005 U.S. Medicare Current Beneficiary Survey, less than half of older adults who fell talked to their health care provider about it (Stevens et al., 2012). The American Geriatric Society and British Geriatrics Society's (AGS/BGS) Clinical Practice Guideline recommends a multifactorial approach to fall prevention including having the health care provider ask older adult patients about falls; assess for modifiable risk factors such as gait, balance, and medications; and prescribe interventions such as strength and balance exercises or medication adjustments (Kenny et al., 2011). Despite the availability of these clinical guidelines, primary care providers (PCPs) often fail to use them; thus, the development of educational materials and referral resources has been recommended to improve provider fall prevention practices (Jones, Ghosh, Horn, Smith, & Vogt, 2011). The CDC National Center for Injury Prevention and Control developed the Stopping Elderly Accidents, Deaths, and Injuries (STEADI) initiative (www.cdc.gov/STEADI) based on AGS/BGS guidelines, health behavior theory, and input from health care providers; and offers health care providers a conceptual framework for older adult falls prevention (Stevens & Phelan, 2013).

The STEADI Initiative

The STEADI initiative includes a suite of materials (e.g., clinical algorithm, fact sheets, training videos) to help health care providers discuss fall risks with older adults and incorporate effective fall prevention into their practices. STEADI includes these core elements:

1. *Screening* to identify older adults with an increased falls risk.

2. *Assessing* to identify modifiable risk factors (e.g., medication review, functional ability test, measuring visual acuity, orthostatic blood pressure, podiatry review, and home hazard evaluation).

3. *Intervening* to reduce fall risk using evidence-based strategies (e.g., strength and balance program, medication management, occupational therapy, and corrective eyewear).

In 2011, the CDC funded the New York State Department of Health (NYSDOH) to implement the STEADI initiative in New York State (Stevens, Smith, Parker, Jiang, & Floyd, 2017). NYSDOH partnered with the Broome County Health Department and United Health Services (UHS)—the largest health care provider in the county—to implement the STEADI initiative into UHS's outpatient practices by:

1. *Integrating* the core elements of STEADI into the UHS workflow.

2. *Modifying* the outpatient electronic health record (EHR) to prompt health care providers to apply STEADI and record associated data.

3. *Training* health care providers in the use of STEADI.

STEADI was implemented in the first UHS primary care practice in September 2012 with rollout to 18 other primary care practices in 2013 and 2014 (Stevens et al., 2017).

Multifactorial fall prevention interventions, which first identify an individual's fall risk factors and subsequently intervene to address those factors, have been associated with a 24% reduction in falls (Gillespie et al., 2012). The CDC's STEADI initiative was developed as a multifactorial intervention, though to date its effects have not been systematically examined.

The UHS implementation offered a unique opportunity for outcome evaluation of the STEADI initiative. UHS had organizational capacity to retrieve data related to fall screening, assessment, and intervention from the outpatient EHR as well as medically treated falls from ED and hospital EHRs both pre- and postimplementation. The purpose of this study was to evaluate the impact of the UHS Broome County implementation of STEADI on medically treated falls with the hypothesis that the implementation of STEADI would result in fewer medically treated falls.

Design and Methods

The RE-AIM Framework

The RE-AIM Framework is a comprehensive model for planning and evaluation of health interventions that can inform both research and practice (Glasgow, Klesges, Dzewaltowski, Bull, & Estabrooks, 2004; Kessler et al., 2013; Klesges, Estabrooks, Dzewaltowski, Bull, & Glasgow, 2005). This framework conceptualizes the impact of these health interventions as a function of five key dimensions: Reach, Effectiveness, Adoption, Implementation, and Maintenance (Glasgow, Vogt, & Boles, 1999). The RE-AIM Framework was used for both process and outcome evaluation of the UHS STEADI initiative. This article reports on the outcome evaluation with a focus on effectiveness.

Effectiveness of the UHS STEADI Initiative

For this study, effectiveness was evaluated based on patient utilization of hospital services (Schwenk et al., 2012), for fall-related events both before and after implementation of the STEADI intervention. The two measures of patient utilization, available from the inpatient EHR, were fall-related treated-and-released ED visits and fall-related hospitalizations (hereafter referred to as medically treated falls). To provide context for our findings, an analysis of population trends for the county was conducted.

The UHS STEADI Initiative

The EHR was modified to prompt nurses to annually screen patients aged 65 and older ("older adult patients") by asking whether the patient had: (1) two or more falls in the past 12 months, (2) one fall in the past 12 months with an injury, (3) one fall in the past 12 months and gait and balance problems, (4) any gait or balance problems, and/or (5) presented with an acute fall (Stevens et al., 2017). Answers to these five questions were recorded in the outpatient EHR and a patient with an affirmative response to any question was considered to have an increased falls risk. For these patients, the nurse was to: (a) conduct a medication review, (b) provide educational materials, (c) administer the Timed Up and Go (TUG) test to identify gait and balance issues, (d) record TUG results in the EHR, and (e) place the Fall Prevention Referral Form (a triplicate form available in online Supplemental Materials), on the computer keyboard for the PCP to complete during the patient examination. The Fall Prevention Referral Form listed evidence-based fall prevention interventions available in Broome County that the PCP might prescribe including outpatient physical therapy and fall prevention programs available in the community (e.g., Tai Chi).

On the basis of the patient's screening results, the PCP would then perform a medical assessment and develop a Fall Plan of Care (FPOC) to address any identified issues. The PCP checked the recommended interventions on the Fall Prevention Referral Form and checked the box labeled "Fall prevention referral completed" in the EHR along with documenting the plan of care in the EHR. After the visit, the wellness coordinator or an office staff member scanned the Fall Prevention Referral Form and added it to the patient's EHR.

In practice, health care providers did not follow every step for all patients. For many patients, the TUG test was not administered, in part due to challenges with fitting the TUG into the clinic workflow and/or provider resistance (Stevens et al., 2017). Not all at-risk patients received a FPOC. In this article, we take advantage of this variation in implementation to compare at-risk patients who received a FPOC—that is, fall prevention interventions—with those who did not.

UHS STEADI Outcome Evaluation

The outcome evaluation has two analyses. First, we conduct bivariate and regression analyses on the UHS EHR data to examine the relationship between receiving a FPOC and

Supplementary Material
Supplementary data are available at *The Gerontologist* online.

subsequent health outcomes (i.e., ED visits or hospitalizations). Second, we examine the overall trends in fall-related ED visits and hospitalizations for older adults in Broome County between 2007 and 2015, including time periods both before and after implementation of STEADI.

UHS Medically Treated Falls Outcome Analysis

The sample consisted of 12,346 adults aged 65 or older in 2015 who had a primary care visit at one of 14 Broome County outpatient UHS clinics between September 11, 2012 (first implementation of STEADI) and October 30, 2015 (end of the study). The criterion of age 65 or older in 2015 was used to capture the universe of older adults who would be eligible for screening during the study period. Primary care visit data for the sample were obtained from the UHS outpatient EHR, which included demographic information and STEADI fall risk assessment variables. For those patients identified as being at risk for falls, medical charts were reviewed for any documentation related to prescribed fall risk intervention and these data were abstracted manually. Fall-related ED visits and hospitalizations for the sample at either of the two Broome County UHS hospitals were obtained from the inpatient EHR for visits between January 1, 2009, and October 30, 2015—both pre- and post-STEADI implementation. This project received expedited review and approval by the UHS Institutional Review Board and the Human Subjects Research Review Committee at Binghamton University deferred to this decision.

Variables

Older adults who were asked any of the screening questions were considered *screened* (Figure 1). If a patient was screened more than once during the study period, the first screening was used to determine screening status and the date of this visit was used as the screening date for analysis. Those who did not have any fall risk screening information recorded were considered *unscreened* and were excluded from the outcomes analysis as it was not possible to determine fall risk for these patients.

Among those who were screened, subjects were considered *at risk* if they answered yes to any of the five screening questions. Older adults who answered no to all five screening questions were considered to be *not at risk.* Older adults who did not have any “yes” responses and who answered “no” to some but not all screening questions were considered to have an *incomplete screen* (undetermined risk) and were excluded from the outcome analyses.

The FPOC variable was used to measure the implementation of strategies to prevent falls. Among those who were identified as at risk, they were considered to have a FPOC if any of the following items were documented in their EHR: (a) physical therapy/fall prevention program referral, (b) assistive device prescription, (c) fall risk brochure or a home safety checklist provided, or (d) fall risk addressed in a narrative note by a nurse or a PCP. Older adults who were identified as being *at risk* for a fall were categorized as *not having a fall plan of care* (no FPOC) if there was no documentation of any of the earlier mentioned fall risk prevention strategies in the medical record.

All outcome analyses were conducted on these three groups—Group 1: At-risk and no FPOC, Group 2: At-risk with FPOC, and Group 3: Not-at-risk.

The outcome variables were medically treated falls defined as a treat-and-release ED visit or hospitalization for a fall. Both ED visits and hospitalizations were identified from the inpatient EHRs of the two UHS hospitals in Broome County based on the criteria that (a) the principal diagnosis field in the record was for injury, and (b) the first valid external cause of injury was coded E880-E888 (excluding E887) (Centers for Disease Control and Prevention, 2017). Fall-related events were categorized as occurring either before (pre-) or after (post-) the initial screening. Person-months were calculated as the number of months between the patient's first screening date and the end of the study, and used in multivariate analyses to control for the varying postscreening exposures among patients.

The number of ED visits and the number of hospitalizations were determined for each patient pre- and post-STEADI screening.

Analytic Methods

Univariate and multivariate analyses were conducted using SPSS for Windows, version 24 (2016, IBM Corporation). Descriptive statistics for demographic variables as well as prescreening ED visits and hospitalizations were generated including percentages and 95% confidence intervals (CI) by group. Bivariate analyses examined relationships between demographic and grouping variables. Baseline rates of fall-related events among groups were compared using one-way analysis of variance and post hoc analysis was conducted using Dunnett's T3 as the Levene's test revealed unequal variances. Poisson regression was conducted to examine the group's effect on the number of postscreening fall-related ED visits and hospitalizations. Regression analyses controlled for sex, age, and exposure in person-months. An alpha level of .05 was used for tests of statistical significance.

Broome County Trend Analysis

ED visit and hospitalization data for Broome County older adult falls were extracted from the NYSDOH's Statewide Planning and Research Cooperative System (New York State Department of Health, 2016) and analyzed for 35 full quarters from January 1, 2007, through September 30, 2015. Falls were determined based on the CDC *State Injury Indicators Report: Instructions for Preparing 2015 Data* (Thomas & Johnson, 2017).

Rates of ED visits and hospitalizations for falls were calculated for the total older adult population and by gender using quarterly treatment data. As quarterly census data were not available for the denominator, the yearly population of Broome County for the relevant year was used. The rate was multiplied by 100,000 to obtain a rate of ED visits and hospitalizations for falls per 100,000 population. These rates were regressed by quarter to determine the trend. Data were extracted and analyzed using SAS 9.4 software (SAS Institute Inc., Cary, NC).

Results

UHS Medically Treated Falls Outcomes.

Among the 12,346 older adults with a primary care visit during the study period, 89.7% (n = 11,080) were screened (Figure 1). Of those screened, 601 older adults had incomplete screening data and were excluded from the analyses. The excluded adults compared with the screened were more often men (47% vs 42%, $p < .001$), in the youngest age group (71% vs 57%, $p < .001$), and of a minority race (11% vs 6%, $p < .001$). The final sample consisted of 10,479 adults aged 65 or older at the time of screening. Within this cohort, 18.3% (n = 2,032) were identified as being at risk for a fall and 76.2% (n = 8,447) were not at risk. Among older adults with a fall risk, 60.9% (n = 1,237) had documentation in the EHR for at least one element of a FPOC and 39.1% (n = 1,237) did not have any documented evidence of a FPOC. The percent of at-risk patients who received a FPOC varied by clinic location from 32% to 85% (data not shown).

The sample was composed of 4,406 men (42.0%) and 6,073 women (58.0%) (Table 1). A higher proportion of older adults at risk for fall were women (66.7%) compared with those not at risk (55.8%). The mean age in 2012 was 72.7 years (SD = 7.8 years), with 39.1% of the sample aged 62–69 years, 38.5% aged 70–79 years, and 22.4% aged 80 or older. When compared to those not at risk for a fall, a lower proportion were aged 62–69 years (25.1% vs 42.5%, $p < .001$) and a higher percentage were aged 80 or older (38.2% vs 18.6%, $p < .001$). The sample was predominantly white (94.3%) and there was no significant association between race and risk group (Table 1).

Those at risk who received a FPOC and those who did not had similar rates of prescreening fall-related ED visits (34.3 [95% CI: 29.0, 39.6] and 34.7 [95% CI: 27.5, 41.9], respectively) and hospitalizations (51.7 [95% CI: 38.6, 64.9] and 46.5 [95% CI: 31.1, 62.0], respectively) (Table 1). Those not at risk had significantly lower rates of prescreening fall-related ED visits (9.5, 95% CI: 8.4, 10.5) and hospitalizations (11.4, 95% CI: 9.1, 13.9).

Women were 1.4 times more likely to have a fall-related ED visit postscreening compared with men when controlling for age in 2012, postscreening months of exposure, and risk-treatment group (Table 2). The likelihood of an ED visit increased 1.1 times with age for each additional year. Older adults who were not at risk for a fall were 0.6 times as likely to have a fall-related ED visit when compared to those who were at risk for a fall but did not receive a FPOC (odds ratio [OR]= 0.6, 95% CI 0.4, 0.7). Those at risk for a fall who received a FPOC were not significantly more or less likely to have a fall-related ED visit when compared to those at risk for a fall who did not receive a FPOC (OR = 1.3, 95% CI: 1.0, 1.7).

Women were 1.5 times more likely to have a fall-related hospitalization postscreening compared with men when controlling for other variables (Table 2). Age was significantly associated with the likelihood of hospitalization, increasing 1.1 times for each additional year. Older adults not at risk for a fall were half as likely to have a fall-related hospitalization when compared to those who were at risk and did not receive a FPOC (OR = 0.5, 95% CI: 0.4, 0.8). Those at risk for a fall who received a FPOC were 0.6 times (95% CI:

0.3, 1.0) as likely to have a fall-related hospitalization when compared to those at risk for a fall who did not receive a FPOC ($p = .041$).

Broome County Trends

Hospitalizations for falls among older adults trended downward at a statistically significant rate reduction of 2.5 admissions per 100,000 residents per quarter (Figure 2). When stratified by gender, much of this reduction was due to declines in the female fall hospitalization rate, which was statistically significant. Although the rate among men also trended downward, it was not significant. For ED visits, there was a nonsignificant upward trend over time of 1.1 cases per 100,000 residents per quarter (Figure 2). However, when stratified by gender, men appeared to have a statistically significant increase, whereas women did not.

Discussion and Implications

Effectiveness of the UHS STEADI Initiative

Implementation of the STEADI initiative into the out-patient clinic workflow at UHS was associated with a reduced number of fall-related hospitalizations for older adults prescribed a FPOC. For this group, the odds of a fall-related hospitalization postintervention were similar to older adults who were not at risk for a fall and were 40% lower than those at risk without a FPOC. Relatively few other studies have examined the effects of multifactorial falls interventions on fall injuries.

A meta-analysis of multifactorial fall risk interventions found that such interventions significantly reduced the rate of falls (rate ratio = 0.76 [95% CI: 0.67, 0.86]) but not the risk of falling (risk ratio = 0.93 [95% CI: 0.86, 1.02]) (Gillespie et al., 2012). A collaborative effort promoting fall prevention interventions in Connecticut saw an increase in the use of fall prevention visits and a reduction in serious fall-related injuries and fall-related use of medical services in intervention regions compared to regions with usual care (Tinetti et al., 2008). More recently, older adults who participated in a multifactorial falls intervention in Finland were 26% less likely to experience a fall-induced injury compared with the control group (Palvanen et al., 2014).

However, other studies of multifactorial fall prevention programs found some beneficial effects in the first year but did not find a decrease in the incidence of falls requiring medical treatment in the long term (Salminen, Vahlberg, & Kivela, 2009). In a study with a 9-month follow-up, there was no decrease in the incidence or overall costs of falls requiring visits to the ED or admissions to the hospital (Landis & Galvin, 2014). These authors, however, noted a nonsignificant trend toward fewer hospitalizations for falls if the patient was fully assessed, had a plan of care, and adhered to it.

In a systematic review and analysis, Sherrington, Tiedemann, Fairhall, Close, and Lord (2011) found that exercise programs as a single intervention reduced the rate of falls among community-dwelling older adults by 21%. The recent U.S. Preventive Services Task Force evidence review found that multifactorial interventions reduced the incidence of falls whereas exercise interventions were associated with broader range of fall outcomes including fewer older adults experiencing a fall and fewer injurious falls(Guirguis-Blake,

Michael, Perdue, Coppola, & Bell, 2018). None of these studies examined the effects of a multifactorial intervention based on STEADI.

The UHS implementation of the STEADI initiative was the first and largest to date, demonstrating the feasibility of implementing a multifactorial intervention across a large health care system. The 14 UHS clinics in this study screened nearly 90% of older adults or over 11,000 patients at least once over a 3-year period, of which about 18% were determined to be at risk. About 61% of those at risk received documentation of a FPOC in their medical record. In comparison, a pilot of the STEADI initiative in Oregon screened 360 older adults or 19% of eligible patients over a 3-month period (Casey et al., 2016). Stevens and coworkers (2017) suggest factors that contributed to the success of the UHS program included a strong clinical champion who led the integration of STEADI into the clinical workflow and trained clinical and administrative staff to ensure everyone understood how to appropriately assess and record STEADI activities.

The 90% screening rate found in this study is high, but gaps remain in implementation. About 40% of those identified as at risk did not have a FPOC documented in their medical record. These results suggest that increasing the proportion of at-risk older adults with a FPOC has the potential to further reduce falls. However, time constraints and competing demands are a recurring challenge in implementing clinical fall prevention efforts (Baker et al., 2005).

The trend regression results suggest that fall prevention activities, such as STEADI, Tai Chi, and Stepping On, may be associated with a decline in hospitalizations at UHS hospitals in Broome County and that gender may moderate the effects of fall programs over time. Significant rate decreases are seen in female hospitalizations but not in female ED visits whereas no changes are seen in male hospitalization rates, and male ED visit rates increased. Men are less likely than women to report falling, seek medical care for a fall, and discuss falls and fall prevention with a health care provider (Bergen et al., 2016; Stevens & Sogolow, 2005) so health care providers may be less likely to consider fall risk in older men. This study found that the unscreened/partially screened group had a higher proportion of men compared with the screened group. In disseminating STEADI and other fall prevention activities, special efforts may be needed to educate health care providers on the threat of falls to older men and to tailor initiatives to include and address both genders.

This study has other implications for future dissemination. The STEADI initiative (https://www.cdc.gov/STEADI/) recommends a screening protocol of 12 questions to identify older adults at risk of a fall. In this implementation, five screening questions were integrated into the UHS workflow to accommodate the time available in a visit for screening (Stevens et al., 2017). This approach effectively identified those most at risk for a fall as evidenced by the prescreening rates of medically treated falls for those screened at risk compared with those not at risk. In addition, screening alone was not sufficient to prevent a fall. Our findings suggest that establishing a FPOC—that is, actually implementing strategies to address fall risk factors—is required to reduce adverse fall outcomes. Notably, the STEADI core elements of screening, assessment, and intervention were tailored to the UHS outpatient and Broome County community settings. Adhering to the three core elements while customizing

them to the clinical environment made implementation feasible, while still resulting in reduced fall hospitalizations.

Limitations of the Study

This study is subject to several limitations. First, receipt of a FPOC was not randomized. If prescribing a FPOC is related to other unmeasured fall risk factors, this would result in selection bias. However, the demographic characteristics and the rate of medically treated injuries that occurred prior to screening were similar for those who received a FPOC and those who did not—suggesting that the two groups had similar risks. Furthermore, the percent of at-risk patients who received a FPOC varied by clinic (data not shown), suggesting clinic factors may play a bigger part than patient factors. Second, the FPOC elements were identified based on manual review of the medical record and it is possible that fall prevention activities were missed, or that FPOC elements were recommended but not documented. Third, it was not possible to determine whether those who received a FPOC followed the recommendations or which elements they followed. Fourth, FPOC elements ranged from handing the patient a brochure to a physical therapy recommendation and ranged widely in their potential impact on falls. Fifth, outcome data only included fall-related events within the UHS system. If a UHS patient sought medical care for a fall outside the UHS system, those medically treated falls would not be captured. To mitigate this issue, data were restricted to the 14 primary care practices where patients were likely to use one of the Broome County UHS hospitals. These 14 practices represent 76.9% of the UHS older adult patient population. Sixth, the Broome County data included older adults outside of the UHS study intervention sites and the population size is calculated yearly rather than quarterly. Finally, the current multifactorial intervention at UHS was based on STEADI and included the core elements of screening, assessing, and prescribing (www.cdc.gov/STEADI); however, these elements were tailored to the UHS and Broome County setting. There may be setting-specific characteristics that affected the success of this initiative. Health care organizations wishing to adopt STEADI will need to consider the unique context of this implementation as well as the barriers, facilitators, and feasibility of implementing the core elements in their settings. This study has demonstrated, however, that health systems can adapt the core elements and still achieve measurable improvements in health outcomes by screening for fall risk among older adults and intervening with older adults who are at risk by prescribing a plan of care that addresses underlying risk factors.

Conclusions

Older adult falls pose a large and growing burden on the U.S. health care system. This study shows that the STEADI conceptual framework for fall prevention can be used to identify and address modifiable risk factors in primary care settings to reduce the number of older adult fall-related hospitalizations. This study included a limited number of interventions such as providing fall prevention educational materials, prescribing an assistive device, and/or referring at-risk older adults to physical therapy or a community falls prevention program. Implementing additional evidence-based falls prevention interventions such as vision checks, podiatrist referrals, and medication review and management would address additional modifiable risk factors and have the potential to reduce fall injuries even further

(Stevens & Burns, 2015). The UHS STEADI initiative demonstrated that fall risk screening and prevention strategies among older adults in the primary care setting can result in reduced fall injuries among their patients. Given the aging U.S. population, these findings are particularly noteworthy. With an average cost of over $30,000 for a fall-related hospitalization (Burns et al., 2016) and the increased burden on informal caregivers (Wilkinson et al., 2018), wider implementation of STEADI in primary care across the United States may be able to reduce expensive health care expenditures for fall injuries among older adults.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

The authors wish to thank Dr. Frank Floyd, Bridget Talbut, Leah Miller, Amy Booth, Srikanth Poranki, and Chris Alderman of United Health Services Hospitals, Inc., as well as Meaghan Tartaglia and Harrison Moss of the New York State Department of Health, Amy Roma of Mercy House of the Southern Tier, and Kara Burke of Albany Medical Center.

Funding

This work was supported by the Centers for Disease Control and Prevention Cooperative Agreement 3U17CE001997. The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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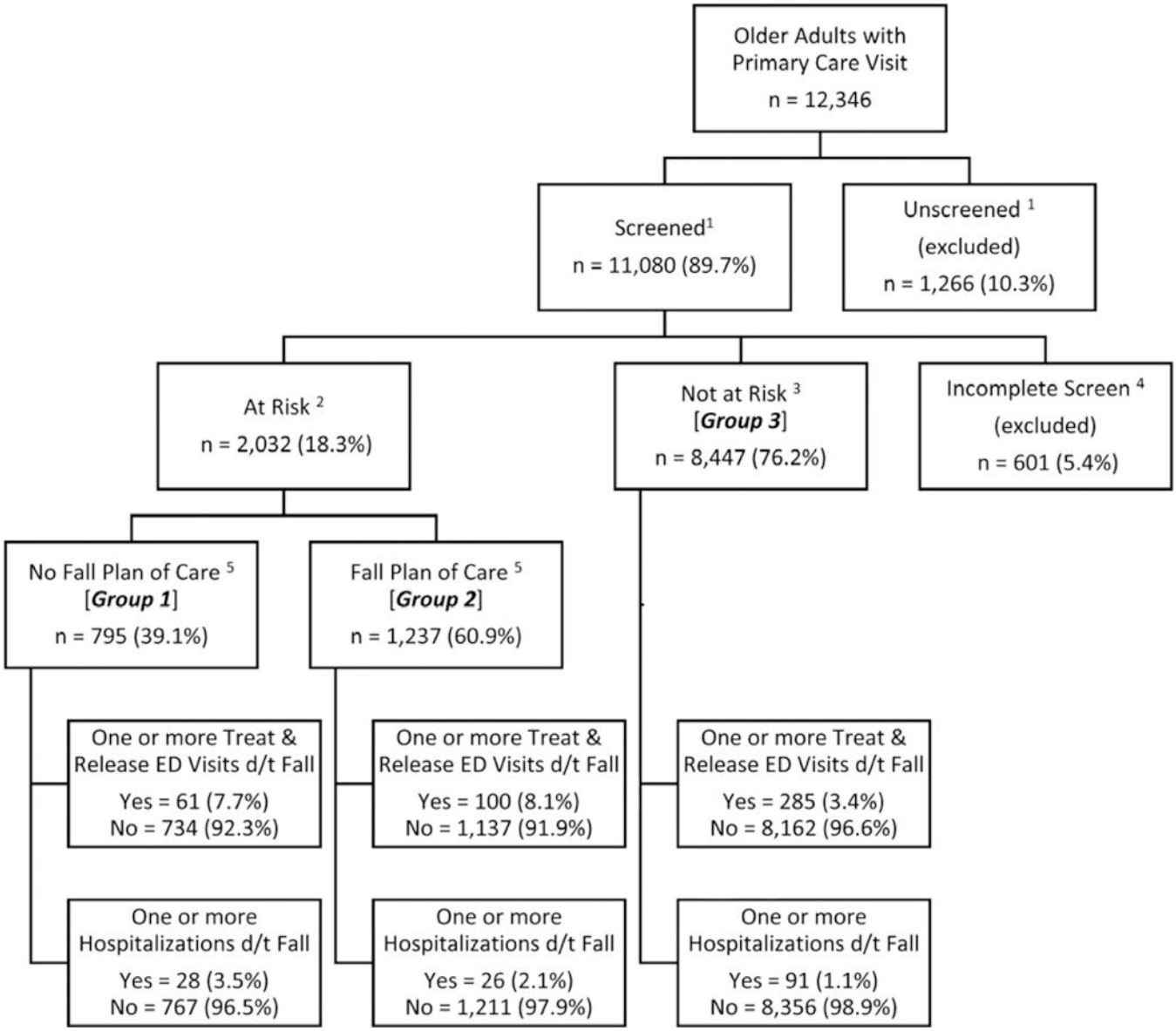

Figure 1.

Flow of older adult* patients through the United Health Services Modified Stopping Elderly Accidents, Deaths, and Injuries (STEADI) fall prevention initiative, 2012–2015. *Note:* *Older adult defined as patients aged 65 years and older. [1]Screening determined by whether or not older adult was asked 5 questions about falls history in the past year. [2]Older adults who answered yes to one of the 5 questions. [3]Older adults who answered no to all 5 questions. [4]Older adults who did not answer yes to any question but did not answer no to all 5 questions. [5]Older adults were considered to have a Fall Plan of Care if there was documentation in the electronic health record for: (a) referral to physical therapy or a fall prevention program, (b) prescription for an assistive device, (c) fall risk addressed in a narrative note by nurse or primary care provider, or (d) fall risk brochure or home safety checklist provided.

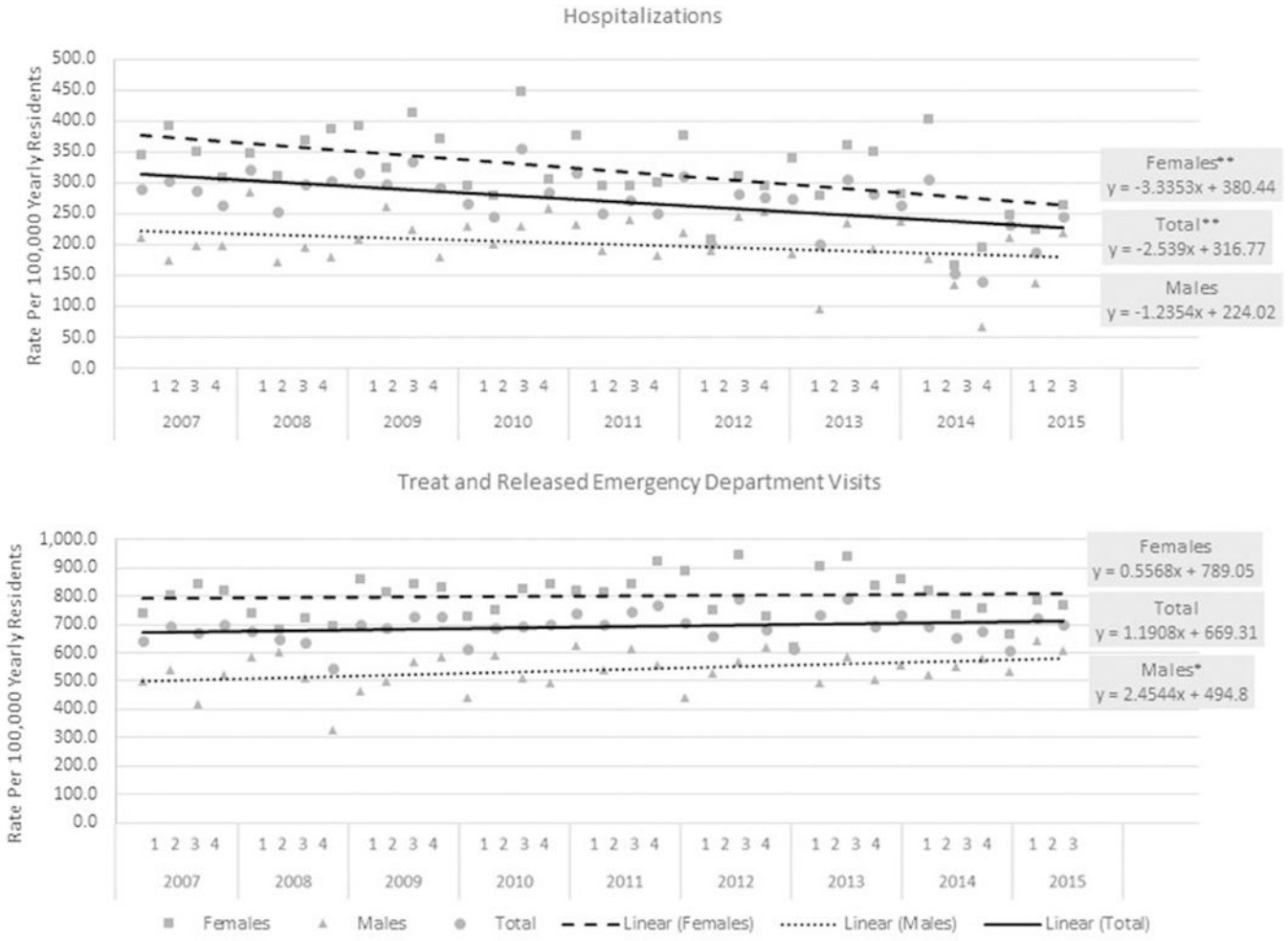

Figure 2.

Linear rate regression by gender for United Health Services Hospitalizations and treat-and-release emergency department visits for adults age 65+; Broome County, New York, Quarter 1, 2007-Quarter 3, 2015. *Note:* *$p < .05$. **p < .01. 1. Rates are made using the yearly population for each quarter within that year, Rate = (Quarterly # cases)/(Broome County Yearly Population)*100,000. 2. Data are regressed by quarterly Interval (1 = Quarter 1 2007, 35 = Quarter 3 2015).

Table 1.

Demographic Characteristics of Older Adults[a] Screened for Fall Risk by Fall Risk andTreatment Group; United Health Services Outpatient Clinics; Broome County, New York, 2009–2015

	Group 1: At-risk and no Fall Plan of Care (*reference group*) (*n* = 795)		Group 2: At-risk and with Fall Plan of Care (*n* = 1,237)		Groups 1 and 2: Total At-risk (*n* = 2,032)		Group 3: Not-at-risk (*n* = 8,447)		Groups 1,2, and 3: Total (*n* = 10,479)	
Characteristic	**% (*N*)**	**95% CI**	**% (*N*)**	**95% CI**	**% (*N*)**	**95% CI**	**% (*N*)**	**95% CI**	**% (*N*)**	**95% CI**
Sex										
Male	36.7 (292)	(33.5%, 40.2%)	31.0 (384)	(28.4%, 33.6%)	33.3 (676)	(31.2%, 35.3%)	44.2 (3,730)	(43.1%, 45.3%)	42.0 (4,406)	(41.1%, 42.9%)
Female	63.3 (503)	(59.9%, 66.7%)	69.0 (853)	(66.4%, 71.6%)	66.7 (1,356)	(64.7%, 68.8%)	55.8 (4,717)	(54.7%, 56.9%)	58.0 (6,073)	(57.1%, 58.9%)
Age group (age in 2012)										
62–69	24.9 (198)	(21.9%, 27.9%)	25.3 (313)	(22.9%, 27.7%)	25.1 (511)	(23.3%, 27.0%)	42.5 (3,588)	(41.4%, 43.6%)	39.1 (4,099)	(38.2%, 40.0%)
70–79	37.4 (297)	(34.0%, 40.8%)	36.2 (448)	(33.5%, 38.9%)	36.7 (745)	(34.6%, 38.8%)	38.9 (3,290)	(37.9%, 39.9%)	38.5 (4,035)	(37.7%, 39.4%)
≥80	37.7 (300)	(34.3%, 41.1%)	38.5 (476)	(35.8%, 41.2%)	38.2 (776)	(36.1%, 40.3%)	18.6 (1,569)	(17.8%, 19.4%)	22.4 (2,345)	(21.6%, 23.2%)
Race										
White	95.3 (758)	(93.8%, 96.8%)	95.4 (1,180)	(94.2%, 96.6%)	95.4 (1,938)	(94.5%, 96.3%)	94.1 (7,946)	(93.6%, 94.6%)	94.3 (9,884)	(93.9%, 94.7%)
Other	2.9 (23)	(1.7%, 4.1%)	1.9 (24)	(1.1%, 2.7%)	2.3 (47)	(1.7%, 3.0%)	3.7 (310)	(3.3%, 4.1%)	3.4 (357)	(3.1%, 3.7%)
Unknown	1.8 (14)	(0.9%, 2.7%)	2.7(33)	(1.8%, 3.6%)	2.3 (47)	(1.7%, 3.0%)	2.3 (191)	(2.0%, 2.6%)	2.3 (238)	(2.0%, 2.6%)
Prescreening fall-related ED visit rate[d]	34.7	(27.5,41.9)	34.3	(29.0,39.6)	34.5	(30.2,38.8)	9.5	(8.4,10.5)	14.3	(13.2, 15.5)
Prescreening fall-related hospitalization rate[d]	46.5	(31.1,62.0)	51.7	(38.6,64.9)	49.7	(39.7, 59.7)	11.4	(9.1,13.9)	18.9	(16.1,21.7)

[a] Older adults defined as patients who were age 65 years or older in 2015.

[b] At-risk denotes that the patient was screened as being at risk for a fall.

[c] Fall Plan of Care includes any one or more of the following: (a) referral to physical therapy or a fall prevention program, (b) prescription for an assistive device, (c) fall risk addressed in a narrative note by nurse or primary care provider, or (d) fall risk brochure or home safety checklist provided.

[d] Event rate (rate per 1,000 person-months).

Table 2.

Occurrence of Medically Treated Falls (Treat-and-Release Emergency Department Visits or Hospitalizations) Among Older Adults by Fall Risk and Treatment Group; United Health Services; Broome County, New York, 2012–2015

	Treat-and-release ED visits			Hospitalizations		
Variable	**OR**	**95% CI**	***p* Value**	**OR**	**95% CI**	***p* Value**
Intercept	0.0	(0.0–0.0)	.000**	0.0	(0.0–0.0)	.000**
Gender						
Male	(ref)			(ref)		
Female	1.4	(1.2, 1.7)	.000**	1.5	(1.1, 2.2)	.020**
Age as of 2015 (years)[a]	1.1	(1.0, 1.1)	.000**	1.1	(1.1, 1.1)	.000**
Exposure (months)[a]	1.0	(1.0, 1.1)	.000**	1.0	(1.0, 1.1)	.000**
Risk-treatment group comparisons						
Group 1: At-risk—no Fall Plan of Care[b]	(ref)			(ref)		
Group 3: Not-at-risk[b] vs Group 1: At-risk—no Fall Plan of Care[b]	0.6	(0.4, 0.7)	.000**	0.5	(0.4, 0.8)	.003**
Group 2: At-risk-with Fall Plan of Care[b] vs Group 1: At-risk—no Fall Plan of Care	1.3	(1.0, 1.7)	.085	0.6	(0.3, 1.0)	.041*

Note: ED = emergency department; (ref) = reference group.

[a]Age and exposure are continuous variables.

[b]Fall Plan of Care includes: (a) referral to physical therapy or a fall prevention program, (b) prescription for an assistive device, (c) fall risk addressed in a narrative note by nurse or primary care provider, or (d) fall risk brochure or home safety checklist provided.

*$p < .05$.

**$p < .01$.