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GAPcare: The Geriatric Acute and Post-Acute Fall Prevention Intervention in the Emergency Department – Preliminary Data

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Abstract

Objectives: Describe a new, multidisciplinary team fall prevention intervention for older adults who seek care in the emergency department (ED) after having a fall, assess its feasibility and acceptability, and to review lessons learned during its initiation

Design: Single-blind, randomized controlled pilot study

Setting: Two urban academic EDs

Participants: Adults ≥ 65 years old (n=110) who presented to the ED within seven days of a fall

Intervention: Participants were randomized to a usual care (UC) and an intervention (INT) arm. Participants in the INT arm received a brief medication therapy management session delivered by a pharmacist and a fall risk assessment and plan by a physical therapist (PT). INT participants received referrals to outpatient services (e.g. home safety evaluation, outpatient PT).

Measurements: We used participant, caregiver, and clinician surveys, as well as electronic health record review, to assess feasibility and acceptability of the intervention.

Results: Of the 110 participants, the median participant age was 81 years old, 67% were female, 94% were white, and 16.3% had cognitive impairment. Of the 55 in the INT arm, all but one participant received the pharmacy consult (98.2%), while the PT consult was delivered to 83.6%. Median consult time was 20 mins for pharmacy and 20 mins for PT. ED length of stay was not

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increased in the INT arm: UC 5.25 hr. vs. INT 5.0 hrs. (p<0.94). After receiving the GAPcare intervention, 100% of participants and 97.6% of clinicians recommended the pharmacy consult and 95% of participants and 95.8% of clinicians recommended the PT consult.

Conclusion: These findings support the feasibility and acceptability of the GAPcare model in the ED. A future, larger RCT is planned to determine whether GAPcare can reduce recurrent falls and healthcare visits in older adults.

INTRODUCTION

Falls are the leading cause of injury-related emergency department (ED) visits in older adults,[1] result in $50 billion health care expenditures per year,[2] and are often preventable. Prior research of community-dwelling older adults who present to the ED after falls shows that their 6-month fall risk was 29.5% higher than age-matched controls and that their functional ability, balance confidence, and depression all worsened over six months.[3] Multicomponent fall prevention programs that determine the reasons for falls and modify known fall risk factors have been demonstrated to be helpful in preventing future falls.[4] Geriatric Emergency Medicine Guidelines developed and endorsed by national geriatric and emergency medicine specialty organizations suggest ED staff should initiate fall prevention efforts.[5] However, when older adults present to the ED after a fall, ED physicians often perform an injury assessment alone, deferring fall risk assessments and interventions to primary care providers (PCPs).[3] Unfortunately, only 28% of older adults recall their last fall when presenting to their annual wellness visit.[6] As a result, many older adults do not receive fall risk prevention measures after their falls.[6,7]

Despite the need for an effective, ED-based fall prevention approach, no applicable model exists to guide this care in the US.[8] A London based study of 397 patients recruited after falls from the ED into a home-based occupational therapy assessment significantly reduced falls (OR 0.39 (95% CI 0.23–0.60),[9] but when this program was implemented in the Netherlands, there was no reduction in falls.[10] In the latter study, fall assessments were completed on average 5 to 10 weeks after the initial ED visit. Prompt evaluation and fall risk assessment - as can be done immediately after the injury in the ED - may prevent falls in the high risk immediate post-fall period.[7,11–13] The ED visit is an opportune time to initiate fall prevention measures because patients are optimally engaged, caregivers are often present, and hospital-based staff, such as pharmacists and physical therapists (PTs) are available[14]. However, EDs are busy environments and ED clinicians lack the time and training[15] to perform fall risk assessments. A multidisciplinary team with expertise in fall prevention that evaluates these patients in the ED could address these limitations.

We developed and pilot tested a novel fall prevention intervention, which we believe could serve as a model of care for other EDs. With this research we address two research questions identified by geriatric emergency medicine leaders as critical to improve the care of older adults in the ED who fall[16]: “1) Can simple ED-feasible interventions reduce injurious falls; 2) Would rapid response geriatric evaluation and management services evaluating all geriatric fallers prior to ED disposition reduce injurious falls and inpatient resource utilization?” In this manuscript, we report on the development of the GAPcare, the Geriatric

Acute and Post-acute Fall Prevention intervention, and an assessment of its acceptability and feasibility. Specifically, our primary objective was to assess the feasibility of conducting a fall prevention intervention in the ED. Our secondary objective was to determine acceptability of the intervention by patients, caregivers, and clinicians.

MODEL OF CARE

Intervention setting and research context

We initiated a pilot randomized clinical trial of the GAPcare intervention at two urban academic EDs in Providence, Rhode Island: The Miriam Hospital and Rhode Island Hospital. The Miriam Hospital is an academic community hospital with 75,000 ED patient visits per year. The Rhode Island Hospital ED is the only level I trauma and tertiary referral center in the state and has an annual volume of 105,000 ED patients.

Sample and recruitment

ED patients 65 years old and older were eligible to participate if they presented to the ED within 7 days of a fall, could communicate in English or Spanish, and their ED clinician determined they were likely to be discharged from the ED (i.e., not admitted). Patients with cognitive impairment were eligible if a legally authorized representative was present in the ED to provide informed consent to participate. Individuals with altered mental status (e.g., intoxicated), who were undomiciled, or could not provide a phone number for follow-up were excluded.

Research staff reviewed the electronic health record (EHR) of potentially study eligible ED patients when pharmacy and PT were available for consultation; Monday through Friday from 7am to 4pm. Research staff approached all patients 65 and older who were presenting from the community (not from a nursing home) and were not clearly ineligible based on chart review (e.g., fall due to acute stroke or assault). Patients were asked if they experienced a “slip, trip, or fall” in the past seven days. If they replied in the affirmative, research staff asked the remaining eligibility questions and confirmed the ED clinician intended to discharge the patient home. Additionally, research staff performed the Six-Item Screener[17] on all patients to determine whether the patient was at risk for cognitive impairment. The principal investigator (EG) trained the research staff how to perform this screening test. For patients that scored less than four on the Six-Item Screener (high risk for cognitive impairment) and were interested in participating in the study, the legally authorized representatives were asked to provide written consent.

After consent, research staff used REDCap[18] to randomly assigned participants to the usual care (UC) or the intervention (INT) arm (1:1 allocation). We used randomization tables that stratified patients by study site with block sizes of six and four. The hospital institutional review board (IRB) approved this study. The trial was registered at www.clinicaltrials.gov (ClinicalTrials.gov identifier:).

The GAPcare intervention

After conducting a review of the available research on this topic, we formed a multidisciplinary team of emergency physicians, geriatric-trained PTs, an ED-specialized pharmacist, and health services researchers who designed an in-ED intervention aimed to reduce fall risk. As part of the intervention, participants first were assessed by an ED clinician who directed the medical care. Thereafter they were evaluated consecutively by a pharmacist and a PT (Supplementary Figure S1). The pharmacist and PT documented their encounter using a standardized note that was integrated into the EHR to enhance information sharing with other hospital-based and outpatient providers (Supplementary Figures S2 and S3). We purposely included pharmacists and PTs as integral parts of the intervention because most hospitals have these specialists available,[19] face-to-face patient-to-pharmacist medication therapy management (MTM) sessions have been demonstrated to be useful in reducing fall risk[20,21], and 35% of older adults have an adverse drug event annually.[22] In addition, ED-initiated PT has been shown to reduce future fall-related ED visits.[23] Since we did not have pharmacists and PTs available in both study sites in the ED, we established an agreement with the health system's Director of Pharmacy Services and Rehabilitation Services that inpatient pharmacists and PT personnel would come to the ED for these consultations.

We worked together with information technology specialists to automate the transmission of GAPcare consultation notes to the participant's PCP. The newly created EHR structure contained a headline in the ED visit summary that alerted the PCP that the individual was part of the GAPcare intervention and that recommendations made by the pharmacist and the PT were appended to the standard ED visit summary. This process was automated to ensure the PCP received the information and to reduce burden on the ED clinician.

Research staff procedures

Research staff completed a Timed Up and Go (TUG)[24] assessment to ascertain the level of mobility and fall risk of the patient. The principal investigator (EG) and a geriatric-specialized PT completed training with the research staff using simulated and real patients to ensure they could mobilize participants safely and perform the TUG prior to study initiation. The research staff performed a brief inventory of the patient's activities of daily living (Barthel Index of Activities of Daily Living), and recorded information about the participants' health history, prior falls, circumstances surrounding the current fall, and demographics. For patients randomized to the INT arm, the research staff initiated a pharmacist and PT consult. They recorded the time to pharmacist/PT arrival at the bedside, and time to consult completion in the data collection software. The type and timing of all study assessments are summarized in Supplementary Table S1.

Research staff were trained to report all potential adverse events to the research coordinator and principal investigator. As per local IRB guidance, a serious adverse event was defined as death. All adverse events, expected and unexpected, related to the participant's participation in the study were reported to the Data Safety Monitoring Board on a semi-annual basis and to the IRB.

Pharmacist-led MTM session

During the brief MTM session, pharmacists evaluated participants at their bedside and asked open-ended questions to determine their knowledge of their medications and willingness to change medications to reduce fall risk. The pharmacists performed the following steps:

1. Reviewed the research staff-obtained medication list for accuracy using previously published best practices for medication reconciliation[25]
2. Performed motivational interviewing with participants and/or caregivers to identify one to three medications that could be stopped or modified to reduce fall risk
3. Communicated the medication-related action plan in writing to participants and ED treatment team. The medication-related action plan was automatically faxed to each participants' PCP at the end of the ED visit via the newly created EHR structure.

Pharmacists communicated with the patient in person and the PCP in writing that the responsibility to change prescription medication remained with the PCP.

PT-led fall risk assessment and plan

After diagnostic imaging was reviewed by the ED clinicians and they determined it was safe to perform exercises with the participants, PT evaluated GAPcare participants at the bedside. The GAPcare PTs performed the following steps:

1. Performed a gait, balance, and lower extremity strength assessment (see Supplementary Table S1 for instruments)
2. Assessed each participants' ability to function independently on discharge and assisted with discharge planning
3. Recommended outpatient services/referrals, such as referral to outpatient or home PT and occupational therapy, a home-safety evaluation, community fall prevention program, or if necessary, direct admission to a skilled nursing facility
4. Communicated the PT action plan in writing and in person to each participant and ED treatment team. The PT action plan was automatically faxed together with the medication-related action plan to PCPs at the conclusion of the visit via the newly created EHR structure.

Usual care arm

Participants randomly assigned to the UC arm received standard medical care as guided by the ED clinician. No consults were initiated by the research staff. Research staff reviewed the contents of a brochure created by the Centers for Disease Control and Prevention for the STEADI (Stop Elderly Accidents, Deaths, and Injuries) program, with the participant.[26] It was at the discretion of the ED clinician to contact the PCP, consult case management, and provide medical equipment (e.g. walkers, canes) for participants in both arms.

Evaluation

ED visit outcomes—Our primary objective was to determine feasibility of GAPcare. We obtained key measures of feasibility, including participant enrollment, reasons for accepting or declining enrollment, and drop-out rates. We also collected measures important to ED clinical operations, including time to pharmacy and PT consult, length of each consult, and ED length of stay (LOS) for participants in both study arms. We assessed acceptability by surveying patients, caregivers, and ED clinicians at the conclusion of the ED visit. In this survey, participants were asked whether they would recommend the GAPcare intervention to their peers, if they had suggestions for improvement of the intervention, and how they would rate their satisfaction with their ED visit. The survey was adapted from the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey[27] and participants had the option of entering survey results on the research tablets on their own or having the research staff input their verbal answers to questions (e.g. to accommodate participants with vision impairment). We followed the recommendations of the CONSORT extension for pilot or feasibility trials for reporting this work.[28] Additional details on the methods of the GAPcare intervention can be found in our protocol manuscript.[29]

RESULTS

Of 478 assessed for study eligibility from January 25, 2018 to March 31, 2019, 287 were eligible for inclusion, and 110 consented to participate (Figure 1). The main reasons for ineligibility were that the ED clinician planned to admit the patient to the hospital, the patient resided in a SNF, or the patient had altered mental status. The primary reasons patients cited for declining to participate were a belief that falls were not a problem for them and because family members were present in the ED. Other reasons for exclusion and declining participation are listed in Supplementary Tables S2 and S3.

We enrolled 110 participants in GAPcare. Although the study team initially intended to recruit 120 not 110 participants, the study was closed early to recruitment upon the receipt of advice by the Data Safety Monitoring Board who felt feasibility was sufficiently established. There were no statistically significant differences in key demographic factors between groups (Table 1). Participants were predominantly female, white, and living at home with others. 14.5% of the 55 UC participants and 18.1% of the 55 INT participants were at high risk for cognitive impairment per the Six Item Screener.

Feasibility

Participants in the INT arm did not have a longer ED LOS than the UC arm participants (5.0 hrs. vs. 5.25 hrs.; $p<0.94$) (see Table 2.). Of the 55 INT participants, 98.2% underwent pharmacy consultation and 83.6% PT evaluation. Both the pharmacy and PT evaluation lasted a median of 20 minutes. Reasons cited for PT not conducting their evaluation were that one participant had a newly diagnosed spine fracture, one wanted to leave the ED prior to PT arrival, one had intractable dizziness, one was not cleared to ambulate by the ED physician after intracranial hemorrhage was discovered on CT brain imaging, and one participant was advised not to ambulate by the orthopedic surgeon due to fall-related

injuries. Three additional participants were admitted to the hospital and PT consultation was deferred and one participant was deemed inappropriate by PT for an ED consult.

Acceptability

Of the 110 participants, 90% completed the index visit satisfaction survey. 96.7% of these participants were satisfied or very satisfied with their care in the INT arm, compared to 92.3% in the UC arm. Participants recommended the pharmacy consult 100% of the time and PT consult 95% of the time. Thirty-five caregivers completed their survey. 94.1% of caregivers were satisfied or very satisfied with the care their loved one received in the INT arm, compared to 94.4% in the UC arm. ED clinicians responded to the survey for 48 participants. When asked whether they believed these consultations should be integrated into routine care of ED patients with falls, most ED clinicians indicated that they were in favor of integration of pharmacy consultation (95.8%) and PT consultation (97.6%) (Supplementary Table S4).

Lessons Learned

In Table 3. we outline several lessons learned during the GAPcare intervention initiation and possible solutions when challenges were encountered.

Adverse Events

No participants experienced any serious adverse events during the ED visit as a result of participating in the intervention. We followed the CONSORT guidelines for pilot and feasibility studies and the completed CONSORT checklist can be viewed in the supplement (Supplementary Table S5).

DISCUSSION

Our data suggest that GAPcare can be delivered in the ED without prolonging ED LOS and has high acceptability to patients, caregivers, and ED clinicians. We were able successfully to incorporate pharmacist-led medication review and motivational interviewing and PT fall risk assessment into routine ED care. Lessons learned include that older individuals may not believe fall prevention is necessary for them and efforts to tailor recruitment to better address why fall prevention is helpful may lead to fewer refusals of the intervention. Because not all patients may benefit from both the PT and pharmacy component of the intervention, we are conducting a follow-up study to understand the benefit and impact of these consultations on participants and caregivers.

Although the efficacy of GAPcare to reduce recurrent falls and healthcare utilization has not yet been established, these preliminary findings suggest that a multidisciplinary fall prevention intervention can be initiated in the ED setting. There is a notable lack of research in EDs evaluating interventions to reduce the occurrence of recurrent falls among older adults.[4,8,30,31] The STRIDE study and other current fall prevention protocols have attempted to address this need; however, they are not initiated in the ED immediately after a fall when patients and caregivers are highly engaged in care and fall prevention.[32–35] A multicenter randomized trial in the Netherlands, which recruited older adults within two and a half

months of an ED visit for a fall did not show a reduction in recurrent falls by targeting the cessation of fall-risk increasing medication.[36] This trial had to prolong its recruitment window from two to four years in order to recruit its desired sample size of 620 individuals, likely in part because the investigators required patients to follow-up at their outpatient research clinic and be available for another in-person follow-up one year later.[37] A strength of GAPcare is that the intervention is initiated while the participant is in the ED immediately after the fall. We believe the participants at highest risk for recurrent falls are likely those that would face the greatest difficulties with follow-up in a research clinic, and are likely to have higher rates of frailty, multimorbidity, and poor caregiver support. Therefore, it is plausible that the aforementioned deprescribing trial inadvertently recruited the patients that were least likely to benefit.

The GAPcare model differs from other fall prevention trials in its generalizability. We recruited patients with and without cognitive impairment and did not perform a fall risk stratification in order to enroll only those with traditional risk factors for recurrent falls. The American Geriatric Society recommends *all* patients presenting to the ED for a fall receive a fall risk assessment and often the professionals best able to perform risk stratification are also best able to offer interventions.[38] Fortunately, our intervention is brief (20 minutes per consultation) and our pharmacy and PT professionals could provide both an assessment and actionable advice to participants in this short period of time. There is no universally acceptable screening method for falls in EDs and fall frequency and mortality are increasing.[39] This argues for a prompt response to this epidemic. However, there is evidence that not all older adults with falls presenting to the ED may need an intervention.[40,41] As the science on fall screening progresses, it will be worthwhile to revisit the criteria for which patients should be included in fall prevention interventions to prevent the potential over-testing that can be a burden to patients.[42]

Approaches to address fall prevention in US EDs have included studies evaluating staff-directed educational initiatives[43,44] and fall risk factors[45–47] with and without referral to outpatient resources. ED interventions that consist of outpatient referrals alone suffer from poor compliance, with patients often citing lack of transportation, disinterest, and lack of sufficient motivation as the reason they do not present for follow-up after a fall.[7,8] GAPcare addresses these barriers by initiating assessments *immediately* after the fall while the patient is in the ED. In another study of 117 older adult ED patients, only half of those discharged after a fall were scheduled for follow-up for their fall-related injury.[48] None were provided with follow-up to initiate fall prevention measures. This finding demonstrates that the status quo in US EDs is to defer fall prevention to PCPs. Even amongst self-reported geriatric EDs, only 57% have a falls screening or prevention protocol.[49] In our study, all of the INT participants received a tailored plan from a pharmacist and PT to reduce fall risk. This plan was communicated to PCPs to alert them of the need for follow-up and provide guidance to reduce future fall risk. Since only one-quarter of older adults report falls to their PCPs this communication is likely to improve the uptake of fall prevention measures.[6]

Some EDs currently employ pharmacists and PTs to evaluate geriatric patients once the individual is moved to an ED observation unit. A recent retrospective study of 221 older patients evaluated in an ED observation unit by a multidisciplinary team including

pharmacists, PTs, case managers, and geriatricians had a mean length of stay of 12.2 (+/− 5) hours and a hospital admission rate of 41.7%.[50] Subsequent healthcare utilization and falls were not reported. The authors of that study concluded that incorporating elements of multidisciplinary geriatric assessment is feasible within an observation time frame; however, it has not previously been demonstrated to be feasible in the ED without prolonging ED LOS. ED LOS is a nationally reported hospital metric and an important consideration for patients and administrators.[51] While fall prevention interventions could be initiated in the observation unit, interventions that prolong ED LOS are unlikely to be adopted given the association of long ED wait times with increased mortality, hospital admission, and lower patient satisfaction.[51,52] Another recent study of patients admitted to an older adult emergency medicine unit in France after a fall received a pharmacist-led medication reconciliation intervention and demonstrated a significant reduction in 90-day unplanned rehospitalization (OR 0.45 (0.26, 0.79).[53] The authors do not report on the length of stay or recurrent fall events.

How was it possible for the GAPcare intervention to provide more care without prolonging ED LOS? We believe that there are efficiencies to be gained in the standard ED evaluation of patients with a fall by recognizing the patient's post-injury level of functional impairment and discharge needs early in the ED visit. Usual care in our EDs is to complete an ambulatory trial at the *end of the ED visit* to determine if traumatic injuries were missed during the initial ED evaluation and gauge the appropriateness of discharge (Can the patient walk home?). By completing the TUG early on and bringing other specialists to the bedside to help with discharge planning "more" could be done without increasing ED LOS.

Policy implications

The mortality of falls[54] and fall-related ED visits by older adults are increasing.[1,39,55] Falls are a leading reason for skilled nursing facility placement, which are more costly than community-based care.[56] Geriatric assessments are associated with a higher likelihood of discharge to the community.[55] Our research shows that geriatric assessments by pharmacists and PTs can be feasibly integrated into ED care for older adults. The Centers for Medicare and Medicaid Services and accountable care organizations could provide incentives to provide improved care transitions from the ED by investing in interventions such as GAPcare and other geriatric ED initiatives.[57] This paper describes our GAPcare model and the feasibility of the intervention. We address further policy questions raised in peer-review in Table 4. Additional policy implications could be supported when there are more outcomes.

LIMITATIONS

The GAPcare intervention was designed to be delivered by pharmacists and PTs. While most hospitals have these professionals available[14], they may not perform consultations in the ED, thereby limiting the potential scalability of the intervention. However, the two academic EDs where we initiated this intervention also did not have PTs or pharmacists available for consultation and the intervention was still feasible at those sites. In addition, ideally ED clinicians would communicate directly with PCPs about the pharmacy and PT

recommendations. However, it was important to us to integrate the model into ED care without increasing ED clinician burden. Therefore, we leveraged the EHR to facilitate communication with PCPs and other in-hospital providers. While the GAPcare intervention does not address all possible risk factors for falls, it improves upon the current evaluation, requires no additional actions from busy ED clinicians, and does not prolong ED LOS. This study was supported by a grant, but US EDs who hope to institute this intervention could have PTs and pharmacists bill for their services. Medicare recipients taking multiple medications have pharmacist-delivered MTM services covered by Medicare and PTs can bill payors for their ED-based assessments. This manuscript summarizes the feasibility and acceptability outcomes of GAPcare, but work is underway to report on the initial efficacy of the intervention including whether it reduces recurrent falls and healthcare utilization at six months.

CONCLUSION

GAPcare is a novel fall prevention intervention that is feasible in the ED and acceptable to patients, caregivers, and ED clinicians. GAPcare has the potential to provide a model of care to other EDs in the US and provide age-appropriate care for the millions of older adults who seek care after a fall.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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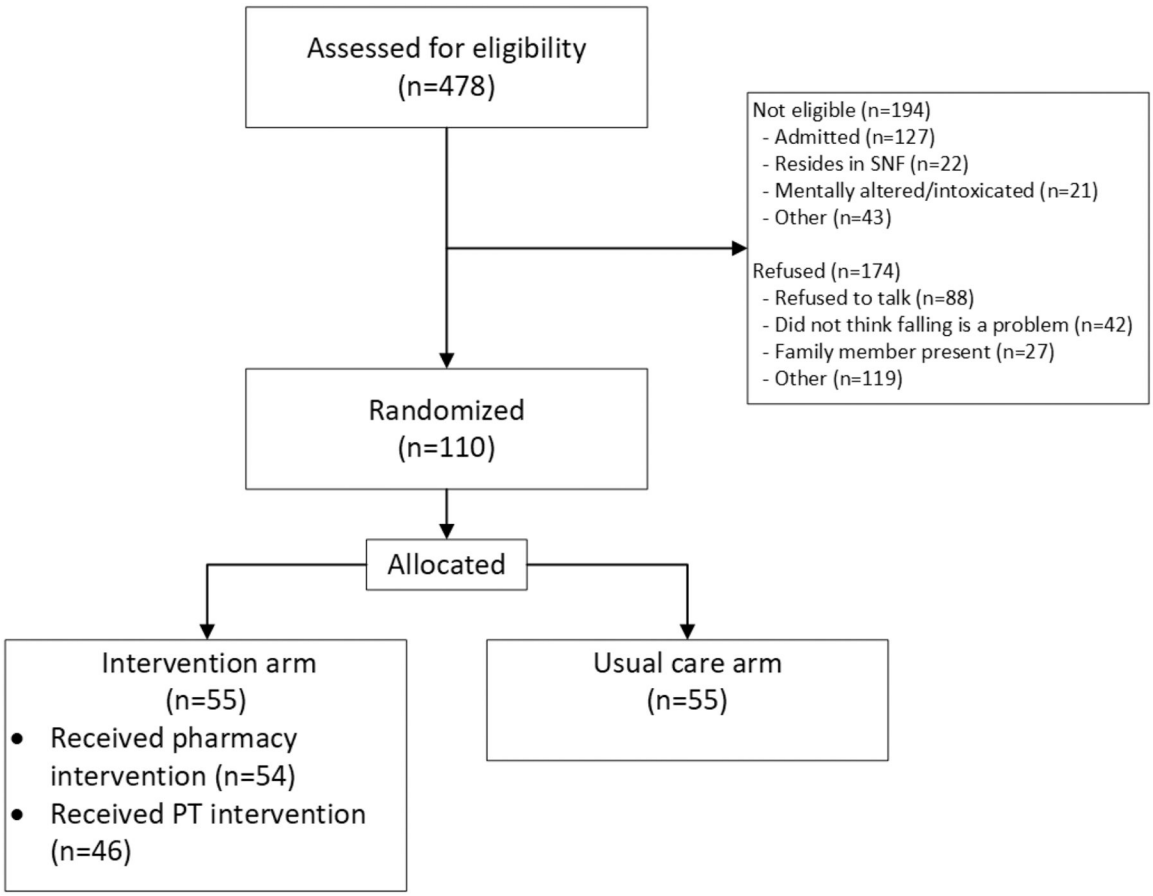

FIGURE 1. CONSORT flow diagram showing eligibility and inclusion

This figure shows the main reasons for ineligibility and exclusion in the study.

Table 1.

Participant characteristics and outcomes among 110 participants in the Geriatric Acute and Post- Acute Fall Prevention Intervention in the Emergency Department

Characteristics	Control (n=55)	Intervention (n=55)	p-value
Age, median (IQR)	78 (74, 88)	82 (76, 90)	0.17
Female, n (%)	37 (67.3)	37 (67.3)	>0.99
Race			0.37
White	53 (96.4)	51 (92.7)	
Black		2 (3.6)	
American Indian/Alaskan Native		1 (1.8)	
Other	1 (1.8)		
White and Asian		1 (1.8)	
Refused	1 (1.8)		
Hispanic[1]	2 (1.8)		0.49
Living situation			0.89
At home alone	18 (32.5)	17 (30.9)	
At home with others	26 (47.3)	25 (45.5)	
Assisted living	10 (18.2)	12 (21.8)	
Missing	1 (1.8)	1 (1.8)	
Use assistive device	40 (72.7)	40 (72.7)[2]	>0.99
Number of prior falls in the last three months, (median (IQR))	1 (0, 2)	0 (0, 2)	0.39
Cognition (SIS) (median (IQR))[3]	5 (4, 6)	5 (5, 6)	0.18
Cognitively impaired as indicated by SIS, n (%)	8 (14.5)	10 (18.1)	0.61
Function (Number of ADL deficiencies, median (IQR)	18 (16, 20)	18 (15, 20)	0.34
ED Disposition, n (%)			
Discharged to home	39 (70.9)	35 (63.6)	0.58
Discharged to SNF	6 (10.9)	10 (18.8)	
Admitted	10 (18.8)	10 (18.8)	

[1]Missing one intervention group participant

[2]Missing one usual care group participant

[3]One SIS score missing. One SIS score is incomplete (one item missing)- this score is excluded from median/IQR, but included in the pass/fail breakdown.

Table 2.

GAPcare intervention and services delivered

Characteristic	Value
Services provided during ED visit	
Number and % of eligible participants received pharmacy consult[4]	54 (98.2)
Time to pharmacy consult, minutes (median (IQR))	14 (10, 20)
Length of pharmacy consult, minutes (median (IQR))	19.5 (13, 24)
Number and % of eligible participants received PT consult	46 (83.6)
Time to PT consult, minutes (median (IQR))	21.5 (14, 34)
Length of PT consult, minutes (median (IQR))	19.5 (14, 29)
ED LOS (intervention vs. control) (Median (p-value))	5.0 hrs. vs. 5.25 hrs. (<0.94)
Recommendations by pharmacy during ED visit[5]	
Stop fall risk increasing medication	19 (35.2)
Adjust dose of fall risk increasing medication	12 (22.2)
Change timing of medication	20 (37.0)
Start new medication	6 (11.1)
Recommendations by PT during ED visit[5]	
Assistive device use	27 (58.7)
Outpatient services (PT, OT, home safety)	26 (56.5)
Discharge to SNF	19 (41.3)
Hospital admission	0 (0)

[4]One participant withdrew from the study after consent and randomization. They stated they did not want to stay in the ED to receive research procedures after the ED clinician told them they were ready for discharge.

[5]Several recommendations could be made for each participant.

Table 3.

Lessons learned during GAPcare implementation and possible solutions

Category	Lessons learned	Adaptations and planned improvements
Recruitment	Patients did not self-identify as “fallers”	Change approach to ask about slips, trips, or falls.
Recruitment	Delayed identification of potentially eligible participants with falls by the research staff, and disqualification due to missed falls	Instituted automated alert in EHR to research staff for ≥65-year-old patient receiving head/neck imaging (probable fall). Broadened eligibility to include falls one week prior to ED visit.
Eligibility criteria	PT assessment of INT participants changed planned ED disposition to rehabilitation instead of home for INT participants	Changed eligibility criteria - participants remained in study regardless of ED disposition to allow for observation of PT effect on disposition (intention-to-treat principle)
Staffing	Limited availability of PT and pharmacists during evening and weekend hours	Board-certified resident pharmacists will be trained to supplement the main ED pharmacist’s activities. Consider using pharmacy students or community health workers for some tasks.
PCP communication	Limited communication with PCPs	EHR tools created to allow PTs, pharmacists and clinicians to share notes and fax notes automatically at discharge to PCPs to engage them more in care.

Table 4.

Practice and policy questions raised in peer-review and lessons learned from GAPcare

Question	Lessons learned from GAPcare
What are the ramifications of these results for future emergency medicine falls interventional and implementation scientists?	A multidisciplinary approach to falls in the ED is overdue and ripe for implementation.[30] Older adults will soon outnumber pediatric patients and the demand for valuable hospital beds will grow.[58] A standardized, individually-tailored approach like GAPcare can be implemented without a negative impact on ED operations.
Can this early feasibility trial inform downstream implementation scientists?	This work was championed by an emergency medicine and aging research fellowship-trained champion with over ten years of clinical experience at both hospital sites. A pharmacy and PT champion were engaged early on in the planning of this trial. We conducted quarterly meetings to share early results and came up with solutions for early challenges. Patients that present to EDs for a fall are at higher risk than the general population for recurrent falls and many develop functional impairment. A team-based approach to fall risk assessment with pre-defined assessments and coaching on elements of motivational interviewing may help accelerate uptake. It is paramount to minimize disruptions to normal ED workflow.
How should ED-based fall risk assessment be adapted to accelerate efforts to reduce injurious falls?[40]	There are many barriers to fall risk assessment in the ED; time, lack of personnel, and willingness of patients to engage in fall prevention measures. Even among patients who presented for falls during the study period, 1 in 4 did not want to participate in fall prevention measures. Efforts to use machine learning that do not require ED staff to perform screening and do not add additional burden on ED patients may be most likely to be adopted and are already underway.[46]
Since a substantial proportion of fallers never reach the ED, could Emergency Medical Services (EMS) systems adapt to deliver falls interventions in the home?[59]	In order for interventions to reach most older adults with falls in the United States more attention will need to be paid on providing these assessments in the home. Expediency is important and providing fall risk assessments early and consistently after a fall could be achieved through EMS training programs. EMS personnel could follow a template similar to the GAPcare consultation notes provided in the supplement (e.g. assess footwear, recommend walkers, check for home safety).
Could falls be an emergency marker of frailty[60] or delirium?	GAPcare is not a comprehensive multifactorial fall risk assessment program and did not use validated frailty or delirium screening instruments. A 2015 systematic review of risk stratification tools using in prior ED-based research concluded that none sufficiently predicted post-ED adverse outcomes.[61] Falls, however, could be a marker of future adverse outcomes. More research is needed to follow patients who present to the ED with a fall prospectively.
Should post-ED visit falls become a patient safety trigger tool?	Falls have been identified as a predictor of subsequent adverse events[62] and should trigger intervention. Like GAPcare, interventions could be brief and focused on identifying high-risk medications, functional impairment, and determining the safety of discharge.