PAIN & AGING SECTION

Predicting Pain-Related 30-Day Emergency Department Return Visits in Middle-Aged and Older Adults

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Abstract

Objective. The objective of this study was to determine predictive factors for pain-related emergency department returns in middle-aged and older adults. **Design, Setting, and Subjects.** This was a subanalysis of patients > 55 years of age enrolled in a prospective observational study of adult patients presenting within 30 days of an index visit to a large, urban, academic center. **Methods.** Demographic and clinical data were collected and compared to determine significant differences between patients who returned for pain and those who did not. Multiple logistic regressions were used to determine significant predictive variables for return visits. **Results.** The majority of the 130 enrolled patients > 55 years of age returned for pain (57%), were African American (78%), were younger (55–64 years old, 67%), had a high emergency department acuity level (level 1 or 2) at their index visit (56%), had low health literacy (Rapid Estimate of Adult Literacy in Medicine [REALM] score, 62%), lived in an area of extreme deprivation (69%), and were admitted (61%) during their index visit. Age (odds ratio [OR] = 0.9, 95% CI = 0.8–0.9, $P = 0.047$), health literacy (REALM scores; OR = 3.1, 95% CI = 1.3–7.5, $P = 0.011$), and index visit pain scores (OR = 1.1, 95% CI = 1.0–1.2, $P = 0.004$) were predictive of emergency department returns for pain in middle-aged and older adults. **Conclusions.** The likelihood of emergency department return visits for pain in middle-aged and older adults decreased with older age, increased with higher health literacy (REALM scores), and increased with increase in pain scores.

Key Words: PainEmergency DepartmentReturnsOlder Adults

Introduction

Older adults are more likely to return to the emergency department (ED) compared with younger adults [1, 2]. Numerous studies have identified risk factors for ED returns in older adults [3]. Features that may contribute to ED recidivism include poor health literacy, poor

cognitive health, chronic comorbid conditions, and lack of social support [4–7]. Certain chief complaints, some relating to pain, also appear to be associated with increased ED returns [8, 9]. Our objectives were to 1) further characterize pain's influence on ED returns and 2) identify predictive factors for pain-related ED return

visits by older adults. It is critical that modifiable risk factors be identified and effective prevention strategies targeting older adults be developed given the projected rise in the older adult population and their high rates of ED recidivism [10].

Methods

Study Setting

Enrollment for this study occurred in the ED of a large, urban, not-for-profit hospital located on one (the downtown campus) of two campuses within a larger hospital system. The downtown campus is a large 700-bed urban safety net hospital with ~25,000 inpatient admissions annually. The average ED patient is 50 years old, with 50% male, 51% African American, and 25% on Medicare. The ED at the downtown campus has a Comprehensive Stroke Center as well as the state's only Comprehensive Resuscitation Center. It provides emergency care to >70,000 adult and pediatric patients annually (~29% are adults aged 55 and older) and is the region's only Level I Adult and Pediatric Trauma Center. The acuity levels for the ED are 4% for level 1 (immediate), 35% for level 2 (emergent), 51% for level 3 (urgent), 10% for level 4 (semi-urgent), and <1% for level 5 (nonurgent). The admission rate is 24%, with an ICU admission rate of 4%. The ED average length of stay is ~3.5 hours, the unplanned 30-day hospital readmission

rate ranges from 12% to 14%, and the annual 30-day ED visit return rate in patients aged ≥ 55 years is about 6%.

Study Enrollment

This institutional review board–approved prospective observational study used systematic time-block sampling. Investigators prospectively enrolled 130 patients ≥ 55 years of age presenting within 30 days of an index (first) visit between November 2016 and July 2017 at a large urban safety net academic institution (Figure 1). Any patient ≥ 55 years of age returning to the ED within 30 days of their index visit was included if they did not meet exclusion criteria. Patients were excluded if they were unable to consent, lived in a nursing or assisted living facility, or were prisoners. Additionally, patients who were specifically instructed during their index visit to return to the ED within a set time frame (e.g., scheduled return for suture removal or wound check) were also excluded.

We employed systematic time block sampling to reduce bias and to mimic ED utilization rates by shift times at our institution. We determined the proportion of patients presenting within each shift between January 1, 2015, and December 31, 2015 and used these proportions to guide patient recruitment. Approximately 45% of patients presented to the ED between 7 AM and 2:59

Figure 1. Determination of patient eligibility and group designation.

PM, 38% between 3 PM and 10:59 PM, and 17% between 11 PM and 6:59 AM. Additionally, every third patient presenting within 30 days of an index visit was approached for enrollment when a research assistant was on site. Research staff were available seven days a week, 7 AM–11 PM, for most days during the study period. Therefore, eligible patients presenting during the overnight shift (11 PM–6:59 AM) who were still in the ED after 7 AM, when research staff were available, were approached for enrollment. Study data were collected and managed using REDCap electronic data capture tools hosted at the University of Florida [11, 12].

Variables Collected

The primary outcome of this study was an ED return for pain within 30 days of an index visit. Trained ED research assistants collected demographics, medical and medication history, numeric rating scale pain scores, mode of arrival, reason for index and return visit(s), number of returns within 30 days of index visit, and disposition and completed a Rapid Estimate of Adult Literacy in Medicine (REALM) score for all patients [13]. Survival rates for the next 10 years were estimated for each patient using the Charlson Comorbidity Index (CCI). Data sources included review of the electronic medical record and patient interviews. Socioeconomic disadvantage was determined from the Area of Deprivation Index (ADI) using Census data from the 2011–2015 American Community Survey [14]. Patients returning for an unscheduled pain-related reason were categorized as the pain group (PG), regardless of the reason for their index visit. All others were categorized as the nonpain group (NPG). Patients with a reading level below or equal to eighth grade as measured by REALM were categorized as having a low REALM score (health literacy). The minimum clinically significant difference (MCSD) in pain scores was defined as an absolute difference of ≥ 2 [15].

Data Analysis

Descriptive summaries were used for categorical variables and averages, medians, and quartiles for numeric variables. Unadjusted comparisons between groups (PG vs NPG) were done using the Pearson chi-square test (or Fisher exact test if some cell frequencies were small) for categorical data and using the Wilcoxon rank sum test for continuous data. Univariate analyses included comparisons of patients' age, both continuous and categorical (55–64 years, 65–75 years, vs ≥ 76 years); race (African American vs non-African American); gender (female vs male); insurance (Medicaid/city assistance, Medicare/private, vs other/self-pay); acuity level at index visit, both continuous and categorical (index acuity 1 or 2 vs index acuity 3 or 4); mode of arrival (medical transport vs non-medical transport); pain score at index visit, both continuous and ordinal (mild pain score = 1–3, moderate pain

score = 4–6, vs severe pain score = 7–10); disposition at index visit (discharge vs admitted to the hospital); as well as ADI (ADI <75th percentile vs ADI ≥ 75 th percentile). Presence (yes/no) of index visit chief complaints by body system such as musculoskeletal, circulatory, respiratory, nervous, digestive, skin, endocrine, immune, reproductive, urinary, or psychiatric (including substance abuse) was also compared between the two groups.

Multiple logistic regressions were used to determine significant predictor variables. Factors found to be significant at the 0.20 level in the unadjusted analyses were eligible for inclusion in the multivariable analyses. The backward variable selection method was used in the multiple logistic regression, and the goodness of fit of the final model was assessed using the residual chi-square score statistic. The magnitude of the associations was described using odds ratios (ORs), along with their 95% confidence intervals. The level of significance was set at 5%.

In addition, two sensitivity analyses were performed to investigate if the association of age with the likelihood of returns for pain was similar between patients with and without an index visit for pain, and between patients with or without a history of chronic pain, respectively. Thus, a separate generalized logit model was used for each sensitivity analysis, including age as a covariate with separate regressions by type of index visit (for pain or not for pain) and by history of chronic pain (yes or no), respectively, and the homogeneity of those two regressions was tested in each analysis. All analyses were performed in SAS for Windows, version 9.4.

Methodology Used to Determine Socioeconomic Disadvantage

Block group Census data from the 2011–2015 American Community Survey were applied to previously published methodology to derive an ADI map for our county [14]. The depravity index was calculated as a linear combination of 17 variables following Singh's previously published methodology [14]. In our study, there were 816 Census block groups (CBGs). The information on a few variables was missing in a few CBGs. We used regression methods to impute missing values for these geographic units [16]. Patient ADI scores were categorized as <75th percentile (ADI score <112.97) and ≥ 75 th percentile (ADI score ≥ 112.97).

Results

Demographics

A total of 130 patients age 55 years or older returning to the ED within 30 days of their index visit were enrolled in this study. Of these, 74 (57%) returned for a pain-related reason. The median age (interquartile range [IQR]) was 61.5 (58.5–64.5) years in the PG and 64.6 (60.0–71.4) years in the NPG ($P=0.016$). The pain scores at

Table 1. Characteristics of the study population

Variable	Category	Pain Group(N = 74, 57%)	Nonpain Group(N = 56, 43%)	Overall(N = 130)	P Value
Age range	55–64 y	57 (77)	30 (54)	87 (67)	0.014
	65–75 y	13 (18)	17 (30)	30 (23)	
	≥76 y	4 (5)	9 (16)	13 (10)	
African American	No	17 (23)	12 (21)	29 (22)	0.834
	Yes	57 (77)	44 (79)	101 (78)	
Gender	Female	33 (45)	29 (52)	62 (48)	0.416
	Male	41 (55)	27 (48)	68 (52)	
Insurance	Medicaid/city assistance	30 (41)	12 (21)	42 (32)	0.067
	Medicare/private	36 (49)	37 (66)	73 (56)	
	Other/self-pay	8 (11)	7 (13)	15 (12)	
Chronic pain history	No	55 (74)	50 (89)	105 (81)	0.032
	Yes	19 (26)	6 (11)	25 (19)	
Low health literacy (REALM)	No	32 (50)	13 (25)	45 (38)	0.005
	Yes	32 (50)	40 (75)	72 (62)	
Days elapsed from index visit to ED return	0–7 d	17 (23)	15 (27)	32 (25)	0.246
	8–14 d	9 (12)	12 (21)	21 (16)	
	15–30 d	48 (65)	29 (52)	77 (59)	
Acuity level at index visit*	Index acuity 1 or 2	33 (46)	37 (67)	70 (56)	0.020
	Index acuity 3 or 4	38 (54)	18 (33)	56 (44)	
Arrival mode	Medical transport	20 (27)	17 (30)	37 (28)	0.677
	Nonmedical transport	54 (73)	39 (70)	93 (72)	
Index visit due to pain	No	29 (39)	40 (71)	69 (53)	<0.001
	Yes	45 (61)	16 (29)	61 (47)	
Pain score at index visit	Pain score 1–3 (mild)	1 (1)	3 (6)	4 (3)	0.410 [†]
	Pain score 4–6 (moderate)	7 (10)	4 (7)	11 (9)	
	Pain score 7–10 (severe)	64 (89)	47 (87)	111 (88)	
MCSD at index visit	No	23 (43)	24 (60)	47 (51)	0.113
	Yes	30 (57)	16 (40)	46 (49)	
Disposition at index visit	Discharge	35 (48)	15 (27)	50 (39)	0.018
	Admitted	38 (52)	40 (73)	78 (61)	
Area of Deprivation Index	<75th percentile	20 (27)	20 (36)	40 (31)	0.288
	≥75th percentile	54 (73)	36 (64)	90 (69)	

ED = emergency department; MCSD = minimum clinically significant difference; REALM = Rapid Estimate of Adult Literacy in Medicine.

*Emergency Severity Index Triage Tool acuity level: 1 = immediate, level 2 = emergent, level 3 = urgent, level 4 = semi-urgent, and level 5 = nonurgent.

All tests were done using the chi-square or [†]Fisher exact test.

the index visit were different (PG median [IQR] = 8.5 [5.5–10], NPG median [IQR] = 5 [0–8], $P = 0.0002$), as well as the index visit acuity (PG median [IQR] = 3 [2–3], NPG median [IQR] = 2 [2–3], $P = 0.029$). [Table 1](#) displays the characteristics of the PG and NPG. Compared with the PG, the NPG had lower health literacy (REALM scores; 75%, $P = 0.005$) and were less likely to have a history of chronic pain ($P = 0.032$). Most patients (59%) returned within 15–30 days of their index visit. The mean number of returns for both groups were similar, 2.54 (NPG) and 2.95 (PG). Socioeconomic disadvantage, gender, ethnicity, mode of arrival to the index visit, and insurance type were not significantly different between groups.

Reasons for Return Visits

Reported reasons for returning to the ED were similarly distributed between both groups ([Table 2](#)): worsening/progression of symptoms, a new problem since index visit, and a medication issue. In the PG, 20% returned because of issues relating to pain medications ([Table 2](#)), namely an ineffective home pain management regiment

and/or needing a refill of their medications due to inability to follow up with their normal prescriber or lack of a primary care physician. Of the seven PG patients who were unable to follow up, two patients reported that they were unable to follow up with pain management because of marijuana and illicit drug use. Of the 60 patients returning because of worsening/progression of their pain symptoms, 19 patients presented for acute pain, 20 for acute-on-chronic pain, and 20 for chronic pain at the time of their index visit.

Nearly 53% of the PG returned for the same or a similar chief complaint within 30 days. All others returned for a different pain complaint. From the PG, only one patient reported an opioid adverse event (change in mental status) from tramadol use as the reason for returning. Of the NPG, 32% presented with a pain-related chief complaint at their index visit but then later returned for a non-pain-related reason. The NPG was more likely to present with a respiratory chief complaint at their index visit ($P = 0.004$). Compared with the PG, more NPG patients were admitted (74%, $P = 0.018$) at their index visit.

Table 2. Reasons for returns by group*

	Pain Group, No. (%)	Nonpain Group, No. (%)
Worsening/progression of symptoms	60 (45)	41 (51)
New problem	28 (21)	21 (26)
Medication issue	27 (20)	11 (14) [†]
Medication reaction (tramadol, hydrocodone-acetaminophen)	2 (7)	
Home opioid medications not effective	6 (23)	
Home nonopioid medications not effective	2 (7)	
Requesting refill of pain medications	15 (56)	
Unable to fill pain medications due to lack of insurance/financial coverage	2 (7)	1 (9)
Did not follow up or unable to obtain appointment with primary care physician or specialist	7 (5)	4 (5)
Sent by medical provider	5 (4)	2 (2)
Unsatisfied with original care or seeking a second opinion	3 (3)	2 (2)
Communication issue (did not understand discharge instructions or how to take prescribed medications, etc.)	2 (2)	0
Did not understand he was to follow up with his specialist	1 (50)	
Does not understand his health care needs, reports lack of communication with his primary care doctor	1 (50)	

*More than one reason may have been reported.

[†]Pain medication issue was not the primary reason for emergency department return visit.

Morbidity and Mortality

The PG and NPG had the same average Charlson Comorbidity Index score (3) and average 10-year survival rate (69%). During the study, no enrolled patients died.

Pain Scores, Pain Medications, and Opioid Prescriptions

The PG had higher pain scores at the index visit (median = 8.5, quartile = 5.5–10, $P=0.0002$) with a little over half achieving an MCSD in their index visit pain scores (57%) (Table 3). Only 17 (23%) PG patients were discharged with a prescription opioid, but these accounted for 46% (100) of the total 30-day return visits made by the PG. PG patients with discharge pain scores >3 at their index visit had an 11 times greater odds (95% CI = 1.26–96.21, $P=0.015$) of receiving a pain medication prescription.

Risk Factors Predictive of Returns

The continuous variables (age, $P=0.016$; index visit pain scores, $P\leq 0.001$; index visit acuity, $P=0.028$) and the categorical variables (low REALM, $P=0.005$; disposition at index visit, $P=0.018$; index visit respiratory chief complaints, $P=0.004$) that were significant at 0.05 in the unadjusted analyses were included in the multivariable analyses, along with ADI. In addition, index visit musculoskeletal chief complaints ($P=0.177$) and medical insurance type ($P=0.067$) were significant at 0.20 in the unadjusted analyses; therefore, they were included as candidates for predictors of pain-related ED return in the multivariable analyses. The backward variable selection method in the multivariable logistic regression revealed that index visit acuity (adjusted $P=0.897$), index visit musculoskeletal chief complaints (adjusted $P=0.701$), medical insurance (adjusted $P=0.416$), index visit respiratory chief complaints (adjusted $P=0.199$), ED

disposition (adjusted $P=0.111$), and ADI (adjusted $P=0.067$) were not significant predictors of ED returns for pain, and thus were excluded from the model. The residual chi-square score statistic was 9.5 with a P value of 0.221, indicating that the reduced model was a good fit for the data. Age (OR = 0.9, 95% CI = 0.8–0.9, $P=0.047$), health literacy (REALM scores; OR = 3.1, 95% CI = 1.3–7.5, $P=0.011$), and index visit pain scores (OR = 1.1, 95% CI = 1.0–1.2, $P=0.004$) were predictive of ED returns for pain (Table 4). The likelihood of returns for pain decreased with age, increased with higher health literacy (REALM scores), and increased by 1.1 times for each point escalation in pain scores. The sensitivity analyses revealed that the association of age with the likelihood of returns for pain was similar between patients with and without an index visit for pain ($P=0.165$) and between patients with or without a history of chronic pain ($P=0.244$). The same inverse relationship between age and the likelihood of returns for pain was maintained in patients with and without an index visit for pain, respectively. Similarly, age was inversely associated with the likelihood of returns for pain in both patients with or without a history of chronic pain.

Discussion

We identified three risk factors, age, health literacy (REALM scores), and pain scores, that were associated with revisits for pain. Compared with patients who returned to the ED for reasons other than pain, the likelihood of returning for pain decreased with advancing age, increased with higher health literacy (REALM scores), and increased by 1.1 times for each point escalation in pain scores. Our findings validate previous findings suggesting that pain complaints are associated with frequent ED visits (more than five visits in one year), particularly in those discharged from the ED with a prescription

Table 3. Characteristics of the study population by group (as continuous variables)

Variable	Group	No.	1st Quartile	Median	3rd Quartile	P Value
Age, y	Nonpain group	56	60.17	64.64	71.43	0.0161
	Pain group	74	58.45	61.46	64.54	
Total ED return visits*	Nonpain group	56	2	2	3	0.1188
	Pain group	74	2	2	3	
Index visit pain score [†]	Nonpain group	54	0	5	8	0.0002
	Pain group	72	5.5	8.5	10	
Index visit acuity [‡]	Nonpain group	55	2	2	3	0.0287
	Pain group	71	2	3	3	
ADI score [§]	Nonpain group	56	110.02	116.33	120.57	0.2532
	Pain group	74	112.31	117.65	120.41	

All tests were done using Wilcoxon's rank sum test.

ADI = Area of Deprivation Index; ED = emergency department.

*Total number of ED returns in 30 days.

[†]The numeric rating scale was used to measure pain (range = 0–11).

[‡]Emergency Severity Index Triage Tool acuity level: 1 = immediate, level 2 = emergent, level 3 = urgent, level 4 = semi-urgent, and level 5 = nonurgent.

[§]ADI score: ≤75th percentile, ≤112.97; >75th–95th percentiles, 120.21; >95th percentile, >120.21.

opioid [8]. We found that 20% of the PG returned because of issues relating to pain medications (Table 2), namely an ineffective home pain management regimen and/or needing a refill of their medications due to inability to follow up with their normal prescriber or lack of a primary care physician. This suggests that the ED serves as a safety net for some patients in pain (whether acute or chronic) who may not have regular or timely access to the physician managing their pain condition.

Chief Complaints Associated with Pain-Related Return Visits

Abdominal and chest pain were the most frequent reasons for returning to the ED reported by the PG. More than half (51%) reported returning because of worsening or progression of their chest or abdominal pain. According to the National Health Statistics Reports of 2007, abdominal pain was the third most common reason for ED visits among all adults aged 65 years or older [17]. Patients are often instructed to return to the ED if their symptoms worsen and/or if new concerning symptoms develop, such as abdominal pain with new-onset fever. However, these return instructions are not specific to abdominal and chest pain. Patients presenting to the ED with abdominal pain or chest pain often do not receive a definitive diagnosis for the cause of their complaint despite extensive diagnostic testing. While clinicians feel safe discharging a patient with negative test results, believing that testing did not reveal any cause for emergent

treatment or admission, these results may produce the opposite effect in patients due to the lack of diagnostic certainty and fear of the unknown cause of their complaints. Diagnostic uncertainty may lead patients to return to the ED or seek care in another ED to find an explanation for their symptoms or from fear if the symptoms return or do not resolve as quickly as they expected [18–22]. The psychological component experienced by patients during their ED encounter is often overlooked by the ED treatment team and is a potential area of focus for future study and improvement.

Age as a Predictor for Pain-Related Returns

We found that the likelihood of ED returns for pain in older adults declined with increasing age. This finding is interesting, as a significant percentage of the older adult population suffers from pain, up to 76% of older people living in the community and from 85% to 93% of those living in residential care [23]. Therefore, we would not have expected age to have differed significantly between the PG and NPG. A possible explanation for our finding is that 26% of the PG reported a history of chronic pain compared with only 11% of the NPG. Additionally, our exclusion of patients living in nursing facilities also may have contributed to our findings, although the effect of excluding this patient population would have been seen in both the PG and NPG.

Our findings are also contrary to the literature demonstrating that advancing age, in general, increases the odds

Table 4. Odds ratio estimates

Effect	Point Estimate	95% Wald Confidence Limits		P Value
REALM scores	3.135	1.301	7.555	0.011
Age	0.939	0.883	0.999	0.047
Index visit pain scores	1.166	1.049	1.296	0.004

REALM = Rapid Estimate of Adult Literacy in Medicine.

of ED returns in older adults [1, 3, 24]. In a study of the general ED population within the United States, patients over 65 years of age were three times more likely to return and to be hospitalized within 72 hours of an ED visit compared with those under age 30 and twice as likely as those under age 46. An increase in age of one year above the age of 70 was found to be an independent predictor for 30-day ED returns in Dutch older adults [25]. This increase in risk, however, appears to decline after age 85 [24]. The “protective effect” of advanced age (>85 years) could not have been the reason for our difference in findings, as we had only three total patients over age 85, perhaps as patients living in nursing homes and assisted living facilities were excluded from enrollment. However, the racial make-up of our study population, nearly 80% of whom self-reported as African American, significantly differed from the populations studied in the literature and might be a potential explanation for our findings as compared with previous reports. Increasing age may be predictive of ED returns, except for when the ED return visit is for pain in a racially diverse patient population. Further study, though, is needed to confirm and further characterize this possibility.

Health Literacy as a Predictor for Pain-Related Returns

Health literacy is “the degree to which individuals can obtain, process, and understand basic health information and services they need to make appropriate health decisions” [26]. There are several sociodemographic contributors to poor health literacy, and increasing age has been found to be one of the most significant factors [27]. Older adults with low health literacy engage in less preventative services and care, utilize acute care settings and resources more, and tend to have poorer health outcomes compared with older adults with adequate health literacy [28–30]. Studies have shown that >70% of elderly patients are not questioned about their ability to care for themselves before discharge, and 20% disclose that they do not understand their discharge instructions [20, 31, 32]. This subset of the older adult population may have difficulty comprehending and following discharge instructions provided to them at their index visit. These patients may return to the ED when their initial complaints do not improve due to uncertainty and lack of comprehension regarding their discharge diagnoses, treatment, and follow-up plans [33].

Contrary to the literature supporting increased ED returns in patients with low health literacy, we did not find low health literacy to be predictive of pain-related ED returns. We found that patients with a reading level of eighth grade or higher were three times more likely to return for pain. There were no significant differences between the groups in terms of having medical insurance, gender, or ethnicity. Additionally, only 2% of the PG and none of NPG patients reported returning to the ED

due to a lack of understanding regarding their index visit discharge plan. Thus, poor health literacy and other sociodemographic factors were not the reason why patients returned to the ED for pain. Many of the PG patients reported returning to the ED because of worsening symptoms, suggesting that the pain management plan developed either by their primary care provider, specialist, or the index ED provider may not have been effective. Further study is needed to explore and clarify the role of health literacy in ED pain management and its influence on ED revisits for pain.

Limitations

Our study had several limitations, including single enrollment site, few study participants who were 76 years of age or older, and a gap in study enrollment during the overnight hours (11 PM–7 AM). Enrolling from only one study site may under-represent return rates if patients presented to other acute care facilities. However, as the objective of this study was not to report incidence of ED returns but rather to characterize ED returns and identify predictive factors for these returns, the predictive factors we identified are likely to be accurate but potentially limited in scope. Additionally, it is possible that patients presenting during the 11 PM–7 AM time interval may differ from those presenting during other times of the day. Exclusion of this patient population, along with the limited number of enrolled elderly adults, may have affected identification of other predictive factors. We also did not collect data on other factors that may have been contributory, such as those pertaining to the home environment (lives alone, presence of a caregiver, received assistance with medications, etc).

Another limitation of our findings is that our results may not be reflective of the general US population. This study was conducted at a large urban safety net hospital. The majority of our study population self-identified as African American, with nearly 70% living in an area of extreme deprivation. To our knowledge, this is the first study to identify predictive factors for ED returns, for pain and non-pain-related reasons, in such a highly vulnerable patient population in the United States.

Conclusions

In summary, the likelihood of returns for pain in older adults increased with higher health literacy (REALM scores) and increased 1.1 times for each point escalation in pain scores. However, confirmation in a larger multi-center study is needed. We found that predictive factors for pain-related ED returns in a vulnerable older adult patient population appear to be substantially different from predictive factors for general ED returns reported in the literature. The most surprising difference was that poor health literacy, a known predictor for increased emergency services use, was not predictive of ED returns

for pain. Unfortunately, with the exception of pain scores, the other identified predictors for pain-related returns are not easily modifiable, posing a significant problem when developing prevention strategies. Our conclusions are particularly noteworthy in that they are derived from patients who are especially vulnerable, older adults, mostly African American, living in socioeconomic disadvantage.

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Authors' Contributions

SS, ABN, CK, and PH conceived the study, designed the trial, and obtained research funding. SS, ABN, CK, MH, and PH supervised the conduct of the trial and data collection. MH, CK, and SS undertook recruitment of patients and managed the data, including quality control. CS, KLB, EG, and SG provided statistical advice on study design and analyzed the data. SS drafted the manuscript, and all authors contributed substantially to its revision. SS takes responsibility for the paper as a whole.

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