

Predictors of Older Adult Adherence With Emergency Department Discharge Instructions

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ABSTRACT

Objective: Older adults discharged from the emergency department (ED) are at high risk for adverse outcomes. Adherence to ED discharge instructions is necessary to reduce those risks. The objective of this study is to determine the individual-level factors associated with adherence with ED discharge instructions among older adult ED outpatients.

Methods: We performed a secondary analysis of data from the control group of a randomized controlled trial testing a care transitions intervention among older adults (age ≥ 60 years) discharged home from the ED in two states. Taking data from patient surveys and chart reviews, we used multivariable logistic regression to identify patient characteristics associated with adherence to printed discharge instructions. Outcomes were patient-reported medication adherence, provider follow-up visit adherence, and knowledge of “red flags” (signs of worsening health requiring further medical attention).

Results: A total 824 patients were potentially eligible, and 699 had data in at least one pillar. A total of 35% adhered to medication instructions, 76% adhered to follow-up instructions, and 35% recalled at least one red flag. In the multivariate analysis, no factors were significantly associated with failure to adhere to medications. Participants with poor health status (adjusted odds ratio [AOR] = 0.55, 95% confidence interval [CI] = 0.31 to 0.98) were less likely to adhere to follow-up instructions. Participants who were older (AORs trended downward as age category increased) or depressed (AOR = 0.39, 95% CI = 0.17 to 0.85) or had one or more functional limitations (AOR = 0.62, 95% CI = 0.41 to 0.94) were less likely to recall red flags.

Conclusion: Older adults discharged home from the ED have mixed rates of adherence to discharge instructions. Although it is thought that some subgroups may be higher risk than others, given the opportunity to improve ED-to-home transitions, EDs and health systems should consider providing additional care transition support to all older adults discharged home from the ED.

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Annually, over 20 million emergency department (ED) visits are made by older adults.¹ While the sickest ED patients are admitted to the hospital, approximately 60% of older adult ED patients are healthy enough to be discharged home.^{2,3} The ED-to-home transition period is a vulnerable time for these individuals, because more than 10% of older adult patients discharged to home from the ED either are hospitalized or die within 30 days, and 22% return to the ED for further care.^{4,5} The vulnerability of older adults during these transitions has been recognized by the Society for Academic Emergency Medicine, the American College of Emergency Physicians, the Emergency Nurses Association, and the American Geriatrics Society in their multisociety Geriatric Emergency Department Guidelines.⁶

Adherence to ED discharge instructions is important to facilitate a safe transition home. Previous work has found that focusing on medication adherence, follow-up appointments, and knowledge of clinical warning signs during hospital-to-home care transition for adult patients of all ages can reduce hospital revisits.⁷ Studies examining these domains of care during ED-to-home care transitions for adults of all ages have found generally low rates of adherence, with 69% to 88% of patients filling prescriptions for new medications,^{8–11} 29% to 67% following up with primary care providers,^{11–13} and 50% understanding reasons to return to the ED.¹⁴ Unfortunately, few studies have specifically focused on the transition from ED to home by older adult ED patients, who have high rates of conditions (e.g., depression, cognitive impairment) that may limit their capacity to access and use health care as well as engage in self-care behaviors.^{15,16} Consequently, little is known about the characteristics of community-dwelling older adult ED patients who adhere or do not adhere to instructions provided upon discharge.

The objective of this study was to measure rates of adherence to key care transition processes among older adult patients discharged home from the ED, particularly in the current era of value-based payment models, patient-centered medical homes, and electronic health records. Furthermore, we aimed to identify patient-level characteristics associated with nonadherence among this population.

METHODS

Study Design and Setting

We conducted a secondary data analysis of data collected from the control arm of a randomized controlled trial (RCT) of an ED-to-home care transition intervention (CTI) for community-dwelling older adults. The protocol for the RCT has been previously published.¹⁷ The subjects in the control arm of this trial received the usual ED discharge process, which is typically conducted by both the physician and the nurse at the institutions included in the study. All patients are provided with written discharge instructions printed from the electronic medical record (Epic). The study data contain comprehensive survey data verbally collected by research associates as well as abstracted EHR data from the participants' ED and outpatient records. Study participants were enrolled in either the ED of an academic medical center in Madison, Wisconsin, or one of two affiliated academic medical center EDs in Rochester, New York. This study was approved by the institutional review boards at the University of Wisconsin and the University of Rochester.

Selection of Participants

Participants were recruited from the three EDs prior to discharge. Eligibility criteria for the primary study included age ≥ 60 years, English speaking, having a primary care physician within the ED's health care system, community-dwelling, and having a working phone. Patients were excluded from the study if they were subsequently admitted to the hospital, stayed in the ED longer than 24 hours, were discharged from the ED to hospice or a long-term care facility, were homeless, had a transitional care team or intensive care management team in place, or were in the ED primarily for a behavioral health indication. If the patient (or their surrogate, if the patient lacked capacity) consented to the study, the patient was blindly randomized to the intervention or control group.

We did not include the treatment group for this study because those subjects received a care coordination intervention, interfering with the objective of this analysis. The control group of the study was composed of 881 subjects. We excluded 57 subjects due to missing data for a final analytic sample of 824. A post hoc comparison found that excluded individuals were similar to the analytic sample with respect to age, sex, and number of chronic conditions.

Measurements

Care Transition Processes or “Pillars”. We selected care transition processes based on the CTI designed by Eric Coleman and colleagues.⁷ The CTI emphasizes that care transitions have a greater chance of success if patients feel knowledgeable about and can self-manage their condition as it pertains to the four conceptual areas known as “pillars.” These four pillars are: 1) medication self-management, 2) use of a personal health record, 3) primary care and specialist follow-up, and 4) knowledge of red flags.⁷ Care transition programs based on the CTI have been found to reduce readmissions among hospitalized older adults and increase older adult ED patients’ engagement in their care.^{18–20}

For this study, we examined three of the care transition pillars highlighted in the CTI model: medication self-management, primary care and specialist follow-up, and knowledge of red flags. We did not examine use of a personal health record because it is a unique component of the CTI and thus patients not receiving CTI-based care coordination services would not likely have one. We defined all three measures as binary variables: the patient either adhered to the pillar or did not adhere to the pillar.

We defined adherence with the medication self-management pillar as self-reported adherence with *all* routine medication instructions listed on the ED discharge instructions during a telephone survey conducted 4 days after discharge. These instructions include starting of new medications; stopping existing medications; or changing the dose, frequency, or timing of existing medications. If subjects were only given one medication instruction (e.g., start aspirin), they only had to follow the one instruction to be deemed adherent. If subjects were given multiple medication instructions (e.g., start acetaminophen, stop ibuprofen), they had to report changing each of the medications to be classified adherent. As part of their self-report, participants had to provide either generic name, brand name, classification, or purpose of each medication (e.g. Keflex, cephalexin, antibiotic, or medication for my infection). We did not assess the dosage, timing, or frequency of the medication. We included all subjects that had a recommendation to start, stop, or change a medication on their ED discharge instructions. We excluded medications with “as needed” instructions.

We defined adherence with the primary care and specialist follow-up pillar as having at least one in-person, telephone, or electronic (messaging through online patient portals) contact with their primary care

provider or medical/surgical specialist within the time frame indicated on the ED discharge instructions, as documented in the patient’s EHR. For example, if the ED discharge instructions recommended following up within 3 days, we considered subjects to be adherent to the measure if they followed-up with *any* eligible provider within that time frame. All patients who contacted an eligible outpatient provider’s office (telephone or electronic) were counted as having followed-up, even if they did not schedule an in-person appointment or were unable to have one during the 30-day study window.

We defined adherence with the knowledge of red flags pillar as the ability to correctly recall *at least one* specific red flag listed on the discharge instructions during the 4-day postdischarge phone survey. We defined red flags as specific clinical signs and symptoms (e.g. nausea, back pain, swelling) that a patient was instructed to watch for and seek out medical care if observed. We excluded more general instructions (e.g., if symptoms return, any other concerns). We accepted red flags reported by subjects if they were similar to the red flags listed on the discharge instructions (e.g., weakness instead of fatigue or tiredness) or described the broader classification of red flags listed on the discharge instruction (e.g., signs of infection, instead of redness, swelling, warmth, bad smell, drainage, red streaks, or pus from wound). We did not require subjects to correctly specify severity or location associated with red flags listed on the discharge instructions (e.g., pain instead of chest pain or severe pain). This analysis only included subjects with specific red flags listed on their discharge instructions.

Characteristics. Based on the Aday-Andersen Health Behavior Model, we focused on individual-level characteristics that predispose one to use health services, enable one to use health services, and require one to use health services due to need.²¹ We examined the correlation of potential variables and excluded selected variables that were highly correlated with each other (e.g., marital status and living alone). Aside from age, we treated all variables as binary. Predisposing characteristics included age, sex, and race/ethnicity. Enabling resources included living arrangements, education, health literacy,²² feeling known by health care team,²³ and length of time seeing primary care provider. Need variables included self-rated health, functional limitation, and alcohol abuse (defined as > 7 drinks/week for women or > 14 drinks/week for men based on National Institute on Aging guidelines)²⁴ as

well as widely utilized screening tools for depression (Patient Health Questionnaire-9 or PHQ-9),²⁵ anxiety (Generalized Anxiety Disorder-2 or GAD-2),²⁴ symptoms of cognitive impairment (Blessed Orientation Memory Concentration Test or BOMC),²⁶ and multimorbidity (self-reported Charlson Comorbidity Index or CCI).²⁷ The GAD-2 has been validated with older adults in the general population²⁸ and PHQ-2,²⁹ the BOMC,³⁰ and the self-reported CCI have all been validated with older adults in the ED. An advantage of using this model is that enabling and need factors have also been found to be predictors of patients' ability to self-manage their conditions, a potentially important component of care transitions.³¹

Data Collection

Research associates surveyed subjects while in the ED and by phone regarding their adherence to care transition processes 4 days after discharge from the ED. We abstracted information about the ED visit, including the content of ED discharge instructions from the EHR by one staff member and reviewed by a second staff member for quality assurance. The details of data collection have been described previously.¹⁷ Study data were collected and managed using REDCap.³²

Table 1
Sample Descriptive Characteristics (N = 824)

Age group (years)	
60–64	189 (22.9)
65–69	212 (25.7)
70–74	149 (18.1)
75–79	108 (13.1)
80–84	87 (10.6)
85+	79 (9.6)
Gender: male	382 (46.4)
Race: white	762 (92.5)
Education: not a college graduate	321 (39.0)
Living status: alone	268 (32.5)
Health literacy: inadequate	87 (10.6)
Medical team familiarity: poor	341 (41.4)
Primary care physician relationship: <5 years	321 (39.0)
Chronic conditions: three or more	418 (50.7)
Alcohol abuse: at risk	71 (8.6)
Anxiety: Generalized Anxiety Disorder-2 score > 3	145 (17.6)
Depressive symptoms: PHQ-9 score ≥ 10	88 (10.7)
Functional limitations: one or more	276 (33.5)
Self-rated health status: rated as fair or poor	163 (19.8)
Cognitive impairment (Blessed Orientation Memory Concentration score > 10)	155 (18.8)

Data are reported as *n* (%).

We asked subjects to identify medications that they started, stopped, or changed and to identify red flags that they recalled during the 4-day postdischarge survey. We compared abstracted discharge instructions to subjects' survey responses. Each medication and red flag listed on the discharge instructions was coded as either being adhered to or not adhered to. The coding guidelines were developed by the entire study team and were pilot tested with a test data set. A nurse reviewer (I.B.) coded medications, and the coding was validated by the emergency medicine physician reviewer (M.S.). Red flags were coded independently by two reviewers: a nurse reviewer (I.B.) and a trained research assistant (N.C.). The two reviewers discussed and resolved discrepancies through consensus. Unresolved discrepancies were adjudicated by the physician reviewer (M.S.).³³

Data Analysis

We used descriptive statistics to compare the individual predisposing, enabling, and need factors of the sample by eligibility and then by adherence among the eligible sample. We tested for significant differences in characteristics between adherent and nonadherent groups (bivariate) using chi-square tests. We also used multivariable logistic regression to examine the association between individual predisposing, enabling, and need factors and adherence to each pillar. Prior to running our model, we conducted several diagnostic assessments of our data including assessments of multicollinearity and influential outliers. We report the regression results as adjusted odds ratios (AORs) with 95% confidence intervals (CIs), which provide a sense of the precision of the estimates. All analyses were conducted in R statistical software.³⁴ We defined *p*-values of less than 0.05 to be statistically significant.

RESULTS

Characteristics of Study Subjects

Of the 824 potential subjects in the study sample, the number of eligible subjects for each pillar's analysis varied based on the content of their discharge instructions and the completeness of data obtained: 216 eligible subjects for medication adherence, 428 subjects for follow-up adherence, and 526 subjects for red flag adherence. Overall, 699 subjects were eligible for analysis of at least one pillar, and 125 were not eligible for any pillars. We used chi-square tests to compare differences in characteristics between subjects included and

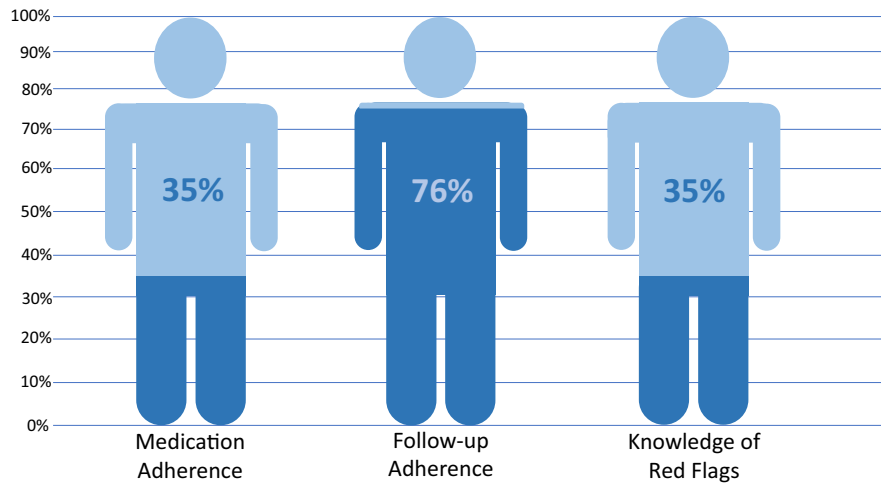


Figure 1. Observed rates of adherence to care transitions processes. A total of 35% of participants adhered to medication instructions, 76% adhered to follow-up instructions, and 35% exhibited knowledge of red flags listed on instructions.

Table 2

Comparisons of Characteristics Between Nonadherent and Adherent Groups in All Three Pillars

	Medication Management		Follow-up with Providers		Knowledge of Red Flags	
	Nonadherent	Adherent	Nonadherent	Adherent	Nonadherent	Adherent
Number (%)	140 (64.8)	76 (35.2)	104 (24.3)	324 (75.7)	390 (65.4)	206 (34.6)
Age (years), mean (\pm SD)	71.85 (\pm 8.96)	72.66 (\pm 8.93)	71.86 (\pm 8.81)	72.10 (\pm 8.22)	73.62 (\pm 8.84)**	70.65 (\pm 7.50)**
Gender: female	78 (55.7)	40 (52.6)	52 (50.0)	182 (56.2)	205 (52.6)	117 (56.8)
Race: white	129 (92.1)	73 (96.1)	97 (93.3)	305 (94.1)	359 (92.1)	193 (93.7)
Education: not a college graduate	64 (45.7)	31 (40.8)	44 (42.3)	117 (36.1)	158 (40.5)*	65 (31.6)*
Living status: alone	45 (32.1)	21 (27.6)	33 (31.7)	100 (30.9)	144 (36.9)*	58 (28.2)*
Health literacy: inadequate	14 (10.0)	8 (10.5)	10 (9.6)	37 (11.4)	44 (11.3)*	11 (5.3)*
Medical team familiarity: poor	57 (40.7)	33 (43.4)	49 (47.1)	137 (42.3)	152 (39.0)	97 (47.1)
Primary care physician relationship < 5 years	56 (40.0)	32 (42.1)	42 (40.4)	129 (39.8)	144 (36.9)	86 (41.7)
Chronic conditions: three or more	81 (57.9)	38 (50.0)	53 (51.0)	174 (53.7)	198 (50.8)	106 (51.5)
Alcohol abuse: at risk	15 (10.7)	8 (10.5)	10 (9.6)	28 (8.6)	33 (8.5)	20 (9.7)
Anxiety: Generalized Anxiety Disorder-2 score > 3	16 (11.4)	13 (17.1)	17 (16.3)	58 (17.9)	74 (19.0)	28 (13.6)
Depressive symptoms: PHQ-9 score \geq 10	15 (10.7)	9 (11.8)	8 (7.7)	37 (11.4)	50 (12.8)**	10 (4.9)**
Functional limitations: one or more	51 (36.4)	26 (34.2)	38 (36.5)	110 (34.0)	154 (39.5)**	50 (24.3)**
Self-rated health status: rated as fair or poor	27 (19.3)	16 (21.1)	26 (25.0)	69 (21.3)	73 (18.7)	33 (16.0)
Cognitive impairment: Blessed Orientation Memory Concentration score > 10	31 (22.1)	12 (15.8)	26 (25.0)	55 (17.0)	87 (22.3)**	25 (12.1)**

Data are reported as *n* (%), unless otherwise stated. **p* < 0.05, ***p* < 0.01.

excluded in each analysis, finding minimal differences (data not shown).

Table 1 presents the characteristics of the sample. Percentages were representative of the older adult population of the communities in which the study was conducted.³⁵

Main Results

For the medication pillar, 35% of eligible subjects were adherent to start, stop, and change instructions. For the follow-up pillar, 76% of eligible subjects followed up with an outpatient clinician within the

Table 3
Multivariable Analysis of Adherence in the Three Pillars

	Medication Adherence	Follow-Up Adherence	Red flag Adherence
Number	216	428	596
Age	1.03 (0.99–1.06)	1.01 (0.98–1.04)	0.96 (0.94–0.98)*
Gender: male	0.96 (0.53–1.76)	1.35 (0.84–2.19)	1.38 (0.95–2.01)
Race: white	2.21 (0.62–10.49)	1.05 (0.39–2.56)	1.34 (0.67–2.80)
Education: not a college graduate	0.78 (0.40–1.48)	0.69 (0.42–1.12)	0.69 (0.46–1.02)
Living status: alone	0.86 (0.44–1.67)	0.90 (0.54–1.53)	0.73 (0.49–1.09)
Health literacy: inadequate	1.05 (0.36–2.90)	1.59 (0.72–3.78)	0.93 (0.42–1.92)
Medical team familiarity: poor	1.18 (0.65–2.16)	0.79 (0.49–1.28)	1.31 (0.91–1.90)
Primary care physician relationship: <5 years	1.03 (0.56–1.89)	1.01 (0.63–1.63)	1.10 (0.75–1.59)
Chronic conditions: three or more	0.69 (0.36–1.30)	1.22 (0.75–1.98)	1.43 (0.98–2.09)
Alcohol abuse: at risk	0.75 (0.27–1.92)	0.85 (0.40–1.93)	0.87 (0.46–1.59)
Anxiety: Generalized Anxiety Disorder-2 score > 3	1.98 (0.79–5.00)	0.93 (0.49–1.81)	0.87 (0.50–1.50)
Depressive symptoms: PHQ-9 score ≥ 10	1.01 (0.32–3.06)	1.88 (0.80–4.93)	0.39 (0.17–0.85)*
Functional limitations: one or more	0.87 (0.44–1.67)	0.83 (0.50–1.40)	0.62 (0.41–0.94)*
Self-rated health status: rated as fair or poor	0.62 (0.27–1.34)	0.55 (0.31–0.98)*	0.66 (0.39–1.09)
Cognitive impairment: Blessed Orientation Memory Concentration score > 10	1.28 (0.55–2.93)	0.72 (0.41–1.28)	1.16 (0.69–1.95]

Data are reported as AOR (95% CI). * $p < 0.05$. All variables included in the model are presented in the table.

recommended time frame. For the red flag pillar, 35% of eligible subjects could report at least one red flag

For each pillar, we compared the characteristics of subjects who adhered to the discharge instructions to those who did not. Table 2 shows the bivariate comparisons and Table 3 shows the multivariate analyses.

Medication Pillar. Neither the bivariate analyses nor the multivariable logistic regression model identified significant differences in predisposing, enabling, and need factors in adherence to the medication pillar.

Follow-up Pillar. Bivariate analyses did not yield any significant predictors of adherence to health care follow-up instructions. After regression adjustment, participants with poor health status were less likely to adhere to follow-up instructions (AOR = 0.55, 95% CI = 0.31 to 0.98).

Red Flag Pillar. Bivariate analyses found that with increasing age, subjects were less likely to be able to recall one or more red flags (Table 2, $p < 0.01$). Study subjects reporting depressive symptoms (12.8% vs. 4.9%, $p < 0.01$), who live alone (36.9% vs. 28.2%, $p < 0.05$), with less than a college degree (40.5% vs. 31.6%, $p < 0.05$), with low health literacy (11.3% vs. 5.3%, $p < 0.05$), with at least one functional limitation (39.5% vs. 24.3%, $p < 0.001$), or with symptoms

of cognitive impairment (22.3% vs. 12.1%, $p < 0.01$) were also less likely to recall a red flag. In the regression model, older age (AOR = 0.96, 95% CI = 0.94 to 0.98), depressive symptoms (AOR = 0.39, 95% CI = 0.17 to 0.85), and having one or more functional limitations (AOR = 0.62, 95% CI = 0.41 to 0.94) were associated lower odds of recalling a red flag.

DISCUSSION

We found that among older adult ED patients discharged home, a low proportion reported adherence to medication instructions (35%) and recalled at least one red flag (35%) related to their illness 4 days after discharge. A better, but still less than ideal, proportion of patients (76%) adhered to follow-up recommendations. Adjusted analyses did not identify a consistent set of individual-level factors associated with nonadherence for the three examined domains, preventing us from identifying a particular patient type at particularly high risk and in need of support. Thus, despite this era of value-based payment models, patient-centered medical homes, and electronic health records, we find that the typical discharge-to-home transition process leaves many older ED patients underprepared for self-managing their conditions at home and at risk of adverse events.

Our findings are consistent with previous studies among ED patients of all ages examining patient comprehension of discharge instructions, which typically find low rates of comprehension and adherence.^{36–39} Studies have found that as many as one-third of adult patients do not understand their post-ED care instructions and that most patients with deficient understanding of their post-ED care are unaware of their lack of knowledge.^{36,37} A small study of 92 adults over 65 years of age found that over half did not understand the circumstances for which they should return to the ED.³⁷

One explanation of the low rates of adherence to the CTI discharge pillars is that ED providers do not emphasize these topics in the discharge process. Past research has shown that patients may be better able to follow instructions when instructions are meaningful and actionable, reviewed in an unhurried matter, and address language and physical disability barriers, which may be difficult to do in a busy ED environment.⁴⁰ In a single urban ED study including patients of all ages, Rhodes et al.⁴¹ found that only 28% of ED patients are verbally educated on their medication instructions, only 24% are educated to follow-up, and only 20% were educated about red flags. The written discharge instructions themselves may be difficult to comprehend; a number of studies have found that ED discharge instructions are often at written at inappropriately high reading levels and many suffer from a large amount of complicated text.^{39,42,43}

Alternatively, patients may receive too much information during the discharge process, making it difficult to understand and remember what is most important.⁴⁴ New instructions, which may conflict with prior information that they have received from their outpatient providers, may actually exacerbate treatment burden (patient's perceived burden with health care regimen), which could contribute to non-adherence.^{45,46} Treatment plans need to be tailored to patient needs and level of self-management capacity.¹⁶ Whenever possible, family members and caregivers should be included in the discharge process to promote understanding and adherence.⁴⁷ More work is generally needed to better support older adult ED patients being discharged home.

Another possible explanation of the low rates of medication adherence and red flag knowledge is that unrecognized cognitive impairment, which is common in the ED setting, may prevent patients from retaining the information provided.⁴⁸ Other work has found that teach-back techniques improve patient comprehension of discharge

instructions in the ED setting,⁴⁹ but it is infrequently used in practice.^{50,51} Finally, it is important to consider that older adults typically have high rates of polypharmacy, which can add additional layers of complication when trying to explain additions or modifications to multiple medications (or even changing one of many).⁵²

While we found adherence to the medication pillar to be very low, in reality adherence with this pillar is likely even lower, because studies have found that self-reported information is overestimated.⁵³ Compared to other studies of all adult ED patients, our adherence rate to medication instructions was lower; however, similar rates have been found in studies of older adults discharged from inpatient units.^{9,11,54} It is concerning that patients did not follow medication instructions because many of the medications prescribed, such as antibiotics for infections, are important interventions.

We did not find significant differences between individuals who adhered to their medication instructions and those who did not. This finding likely results from the relatively small number of patients in our sample who received instructions to add, change, or stop a regularly scheduled medication. Additional research is needed to understand why many older patients do not follow medication instructions. For instance, some may not understand their discharge instructions, experience barriers to filling their prescriptions or removing medications from prefilled medication boxes, or decide not to make the change without confirmation by their outpatient provider. Nonetheless, our findings support the call for EDs and health systems focus on transitional care in the ED context as a way to improve adherence, including options such as developing programs with pharmacist-based counseling,⁵⁵ follow-up reminder phone calls,⁵⁶ or on-site pharmacies.⁵⁷

We found similar rates for recall of red flags. Similar to the medication pillar, our approach likely overestimated patients' knowledge of the reasons to seek further care, because patients who were able to name a *single* red flag were categorized positively. We also found that subjects who were older or depressed and had one or more functional limitations had the lowest rates of red flag recall. While it is not surprising that these are the characteristics of patients with the lowest rates of recall, it is especially concerning as they are also at higher risk for adverse events and declines in health and functionality.^{58,59} Due to their low rates of knowledge, as well as their general risk factors of

adverse outcomes, EDs and health systems should consider additional care transition supports to reinforce the information given at discharge. These supports may include follow-up phone calls; telemedicine visits; or home visits from nurses,⁶⁰ community health workers, or community paramedics.⁶¹ ED providers may also benefit from formal training on interpersonal and relational skills to enhance their ability to deliver and design patient-centered discharge instructions in a meaningful manner.^{62,63}

We found better rates of adherence to the follow-up pillar. Adherence may be higher than those seen in previous studies because we included both in-person and electronic (telephone and online) contacts or because of the primary care transformation occurring over the past decade.^{64–66} Both health systems in which the study was conducted participate in accountable care organization contracts. Under these contracts, providers are held accountable for the excess medical expenditures of their patients.⁶⁷ To reduce preventable acute care utilization, both systems have interventions that could have contributed to the higher follow-up rates in our sample.⁶⁸ That said, 24% of subjects that were deemed to require timely follow-up care did not receive that care within the recommended time frame, regardless of setting. Despite the changes in primary care, patients are still falling through the cracks and failing to receive necessary evaluation and monitoring.

LIMITATIONS

There are several limitations to this study. The sample reflects those who are willing to enroll in a RCT and may not be generalizable to the broader population of older adult ED users. Volunteer bias^{69,70} is a systemic issue in RCTs that may result in our findings being more positive than what may be seen in the broader communities. We also note that we drew on ED patients in mid-sized urban areas with higher education levels than the average older adult, limiting generalizability.

Because we did not directly observe ED encounters, we do not have data describing the details of the discharge process for each patient. As a result, we cannot include those factors in our analyses.

Our analytic sample was relatively small, especially for the medication pillar, which limited our ability to see differences in patient-level characteristic between our adherent and nonadherent groups. Thus, even though the point estimates for the AORs were notable, the CIs were wide. We measured follow-up

adherence based on visits to providers within the ED's health system. Because the subjects in our study all reported having a primary care physician in the health system, and local insurance plans strongly incentivize within-network care, we believe that this approach captured the vast majority of follow-up appointments.

CONCLUSION

Older adult ED patients discharged home after care have low rates of medication adherence, poor recall of red flags related to their illness, and better but still less-than-ideal rates of follow-up adherence. These findings may partially explain the high morbidity after ED discharge. EDs and health systems should consider providing additional care transitions supports, such as transforming the discharge process, for all older adults discharged home from the ED to address these deficiencies, rather than attempting to identify subgroups or characteristics of those more likely not to adhere to instructions.

References

1. Rui P, Kang K, Ashman J. National Hospital Ambulatory Medical Care Survey: 2016 Emergency Department Summary Tables. Available at: https://www.cdc.gov/nchs/data/nhamcs/web_tables/2016_ed_web_tables.pdf. Accessed Jul 25, 2019.
2. Albert M, Rui P, McCaig L. Emergency Department Visits for Injury and Illness Among Adults Aged 65 and Over: United States, 2012–2013. Centers for Disease Control and Prevention, National Center for Health Statistics. 2017. Available at: <http://www.cdc.gov/nchs/products/databriefs/db272.htm>. Accessed Jun 19, 2019.
3. Sun R, Karaca Z, Wong H. Trends in Hospital Emergency Department Visits by Age and Payer, 2006–2015 #238. Healthcare Cost and Utilization Project. 2018. Available at: <https://www.hcup-us.ahrq.gov/reports/statbriefs/sb238-Emergency-Department-Age-Payer-2006-2015.jsp>. Accessed Jun 19, 2019.
4. Hastings SN, Whitson HE, Purser JL, Sloane RJ, Johnson KS. Emergency department discharge diagnosis and adverse health outcomes in older adults. *J Am Geriatr Soc* 2009;57:1856–61.
5. Duseja R, Bardach NS, Lin GA et al. Revisit rates and associated costs after an emergency department encounter: a multistate analysis. *Ann Intern Med* 2015;162:750.
6. American College of Emergency Physicians; American Geriatrics Society; Emergency Nurses Association; Society for Academic Emergency Medicine; Geriatric Emergency Department Guidelines Task Force. Geriatric emergency department guidelines. *Ann Emerg Med* 2014;63:e7–25.

7. Parry C, Coleman EA, Smith JD, Frank J, Kramer AM. The care transitions intervention: a patient-centered approach to ensuring effective transfers between sites of geriatric care. *Home Health Care Serv Q* 2003;22:1–17.
8. McCarthy ML, Ding R, Roderer NK et al Does providing prescription information or services improve medication adherence among patients discharged from the emergency department? A randomized controlled trial. *Ann Emerg Med* 2013;62:212–23.e1.
9. Hohl CM, Abu-Laban RB, Brubacher JR et al Adherence to emergency department discharge prescriptions. *CJEM* 2009;11:131–8.
10. Brian S, Jaclyn C, Anthony R, Clifton C, Yealy DM. A mobile phone text message program to measure oral antibiotic use and provide feedback on adherence to patients discharged from the emergency department. *Acad Emerg Med* 2012;19:949–58.
11. Thomas EJ, Burstin HR, O’Neil AC, Orav EJ, Brennan TA. Patient noncompliance with medical advice after the emergency department visit. *Ann Emerg Med* 1996;27:49–55.
12. Kyriacou DN, Handel D, Stein AC, Nelson RR. BRIEF REPORT: factors affecting outpatient follow-up compliance of emergency department patients. *J Gen Intern Med* 2005;20:938–42.
13. Baren JM, Shofer FS, Ivey B et al A randomized, controlled trial of a simple emergency department intervention to improve the rate of primary care follow-up for patients with acute asthma exacerbations. *Ann Emerg Med* 2001;38:115–22.
14. Engel KG, Buckley BA, Forth VE et al Patient understanding of emergency department discharge instructions: where are knowledge deficits greatest? *Acad Emerg Med* 2012;19:E1035–44.
15. Samaras N, Chevalley T, Samaras D, Gold G. Older patients in the emergency department: a review. *Ann Emerg Med* 2010;56:261–9.
16. Boehmer KR, Kyriacou M, Behnken E, Branda M, Montori VM. Patient capacity for self-care in the medical record of patients with chronic conditions: a mixed-methods retrospective study. *BMC Fam Pract* 2018;19:164.
17. Mi R, Hollander MM, Jones CM et al A randomized controlled trial testing the effectiveness of a paramedic-delivered care transitions intervention to reduce emergency department revisits. *BMC Geriatr* 2018;18:104.
18. Coleman EA, Parry C, Chalmers S, Min S. The care transitions intervention: results of a randomized controlled trial. *Arch Intern Med* 2006;166:1822–8.
19. Gardner R, Li Q, Baier RR, Butterfield K, Coleman EA, Gravenstein S. Is implementation of the care transitions intervention associated with cost avoidance after hospital discharge? *J Gen Intern Med* 2014;29:878–84.
20. Schumacher JR, Lutz BJ, Hall AG et al Feasibility of an ED-to-home intervention to engage patients: a mixed-methods investigation. *West J Emerg Med* 2017;18:743–51.
21. Aday LA, Andersen R. A framework for the study of access to medical care. *Health Serv Res* 1974;9:208–20.
22. Wynia MK, Osborn CY. Health literacy and communication quality in health care organizations. *J Health Commun* 2010;15:102–15.
23. Haggerty JL, Roberge D, Freeman GK, Beaulieu C, Bréton M. Validation of a generic measure of continuity of care: when patients encounter several clinicians. *Ann Fam Med* 2012;10:443–51.
24. NIAAA. Drinking Levels Defined. National Institute on Alcohol Abuse and Alcoholism (NIAAA). 2011. Available at: <https://www.niaaa.nih.gov/alcohol-health/overview-alcohol-consumption/moderate-binge-drinking>. Accessed Jul 9, 2019
25. Spitzer RL, Kroenke K, Williams JB. Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. *Primary Care Evaluation of Mental Disorders. Patient Health Questionnaire. JAMA* 1999;282:1737–44.
26. Katzman R, Brown T, Fuld P, Peck A, Schechter R, Schimmel H. Validation of a short orientation-memory-concentration test of cognitive impairment. *Am J Psychiatry* 1983;140:734–9.
27. Chaudhry S, Jin L, Meltzer D. Use of a self-report-generated Charlson comorbidity index for predicting mortality. *Med Care* 2005;43:607–15.
28. Wild B, Eckl A, Herzog W et al Assessing generalized anxiety disorder in elderly people using the GAD-7 and GAD-2 scales: results of a validation study. *Am J Geriatr Psychiatry* 2014;10:1029–38.
29. Shah MN, Karuza J, Rueckmann E, Swanson P, Conwell Y, Katz P. Reliability and validity of prehospital case finding for depression and cognitive impairment. *J Am Geriatr Soc* 2009;57:697–702.
30. Carpenter CR, Bassett ER, Fischer GM, Shirshakan J, Galvin JE, Morris JC. Four sensitive screening tools to detect cognitive dysfunction in geriatric emergency department patients: brief Alzheimer’s screen, short blessed test, Ottawa 3DY, and the caregiver-completed AD8. *Acad Emerg Med* 2011;18:374–84.
31. Schulman-Green D, Jaser SS, Park C, Whittemore R. A metasynthesis of factors affecting self-management of chronic illness. *J Adv Nurs* 2016;72:1469–89.
32. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research Electronic Data Capture (REDCap)—A metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform* 2009;42:377–81.
33. Kaji AH, Schriger D, Green S. Looking through the retro-spectoscope: reducing bias in emergency medicine chart review studies. *Ann Emerg Med* 2014;64:292–8.

34. Core R, Team R. The R Project for Statistical Computing. R Foundation for Statistical Computing. 2013. Available at: <https://www.r-project.org/>. Accessed Jan 14, 2019
35. Administration for Community Living, Administration on Aging. 2017 profile of older Americans. Administration for Community Living. 2018. Available at: <https://acl.gov/sites/default/files/Aging%20and%20Disability%20in%20America/2017OlderAmericansProfile.pdf>. Accessed Jun 19, 2019
36. Spandorfer JM, Karras DJ, Hughes LA, Caputo C. Comprehension of discharge instructions by patients in an urban emergency department. *Ann Emerg Med* 1995;25:71–4.
37. Engel KG, Heisler M, Smith DM, Robinson CH, Forman JH, Ubel PA. Patient comprehension of emergency department care and instructions: are patients aware of when they do not understand? *Ann Emerg Med* 2009;53:454–61.e15.
38. Hastings SN, Barrett A, Weinberger M et al Older patients' understanding of emergency department discharge information and its relationship with adverse outcomes. *J Patient Saf* 2011;7:19.
39. Samuels-Kalow ME, Stack AM, Porter SC. Effective discharge communication in the emergency department. *Ann Emerg Med* 2012;60:152–59.
40. Okrainec K, Hahn-Goldberg S, Abrams H et al Patients' and caregivers' perspectives on factors that influence understanding of and adherence to hospital discharge instructions: a qualitative study. *CMAJ Open* 2019;7:E478–83.
41. Rhodes KV, Vieth T, He T et al Resuscitating the physician-patient relationship: emergency department communication in an academic medical center. *Ann Emerg Med* 2004;44:262–7.
42. Buckley BA, McCarthy DM, Forth VE et al Patient input into the development and enhancement of ED discharge instructions: a focus group study. *J Emerg Nurs* 2013;39:553–61.
43. Cadogan MP, Phillips LR, Ziminski CE. A perfect storm: care transitions for vulnerable older adults discharged home from the emergency department without a hospital admission. *Gerontologist* 2016;56:326–34.
44. Leamy K, Thompson J, Mitra B. Awareness of diagnosis and follow up care after discharge from the emergency department. *Australas Emerg Care* 2019;22:221–6.
45. Eton DT, Ramalho de Oliveira D, Egginton JS et al Building a measurement framework of burden of treatment in complex patients with chronic conditions: a qualitative study. *Patient Relat Outcome Meas* 2012;3:39–49.
46. Sheehan OC, Leff B, Ritchie CS et al A systematic literature review of the assessment of treatment burden experienced by patients and their caregivers. *BMC Geriatr* 2019;19:262.
47. Alberti TL, Crawford SL. Health information-seeking behaviors and adherence to urgent care discharge instructions. *J Am Assoc Nurse Pract* 2020;32:438–46.
48. Hustey FM, Meldon SW, Smith MD, Lex CK. The effect of mental status screening on the care of elderly emergency department patients. *Ann Emerg Med* 2003;41:678–84.
49. Griffey RT, Shin N, Jones S et al The impact of teach-back on comprehension of discharge instructions and satisfaction among emergency patients with limited health literacy: a randomized, controlled study. *J Commun Healthc* 2015;8:10–21.
50. Dinh TH, Bonner A, Clark R, Ramsbotham J, Hines S. The effectiveness of the teach-back method on adherence and self-management in health education for people with chronic disease: a systematic review. *JBI Database Syst Rev Implement Rep* 2016;14:210–47.
51. Feinberg I, Ogrodnick MM, Hendrick RC, Bates K, Johnson K, Wang B. Perception versus reality: the use of teach back by medical residents. *Health Lit Res Pract* 2019;3:e117–e126.
52. Charlesworth CJ, Smit E, Lee DS, Alramadhan F, Odden MC. Polypharmacy among adults aged 65 years and older in the United States: 1988–2010. *J Gerontol A Biol Sci Med Sci* 2015;70:989–95.
53. Ding R, Zeger SL, Steinwachs DM, Ortmann MJ, McCarthy ML. The validity of self-reported primary adherence among Medicaid patients discharged from the emergency department with a prescription medication. *Ann Emerg Med* 2013;62:225–34.
54. Syed Q, Rask K. Patients' understanding of and adherence to postdischarge medication regimens. *Am J Health Syst Pharm* 2016;73:1299.
55. Leguelinel-Blache G, Dubois F, Bouvet S et al Improving patient's primary medication adherence. *Medicine (Baltimore)* 2015;94:e1805.
56. Sanchez GM, Douglass MA, Mancuso MA. Revisiting project re-engineered discharge (RED): the impact of a pharmacist telephone intervention on hospital readmission rates. *Pharmacother J Hum Pharmacol Drug Ther* 2015;35:805–12.
57. Christy S, Sin B, Gim S. Impact of an integrated pharmacy transitions of care pilot program in an urban hospital. *J Pharm Pract* 2016;29:490–4.
58. McCusker J, Healey E, Bellavance F, Connolly B. Predictors of repeat emergency department visits by elders. *Acad Emerg Med* 1997;4:581–8.
59. Biese K, Massing M, Platts-Mills TF et al Predictors of 30-day return following an emergency department visit for older adults. *N C Med J* 2019;80:12–8.
60. Biese K, LaMantia M, Shofer F et al A randomized trial exploring the effect of a telephone call follow-up on care plan compliance among older adults discharged home

- from the emergency department. *Acad Emerg Med* 2014;21:188–95.
61. Shah MN, Hollander MM, Jones CM et al Improving the ED-to-home transition: the community paramedic-delivered care transitions intervention—preliminary findings. *J Am Geriatr Soc* 2018;66:2213–20.
 62. Eton DT, Ridgeway JL, Linzer M et al Healthcare provider relational quality is associated with better self-management and less treatment burden in people with multiple chronic conditions. *Patient Prefer Adherence* 2017;11:1635–46.
 63. Eton DT, Yost KJ, Lai JS et al Development and validation of the Patient Experience with Treatment and Self-management (PETS): a patient-reported measure of treatment burden. *Qual Life Res Int J Qual Life Asp Treat Care Rehabil* 2017;26:489–503.
 64. Harvey J. How Primary Care Is Transforming Itself. *NEJM Catalyst*. 2017. Available at: <https://catalyst.nejm.org/primary-care-transforming-itself/>. Accessed Jul 25, 2019
 65. Gill JM, Bagley B. Practice transformation? Opportunities and costs for primary care practices. *Ann Fam Med* 2013;11:202–5.
 66. Goldberg DG, Beeson T, Kuzel AJ, Love LE, Carver MC. Team-based care: a critical element of primary care practice transformation. *Popul Health Manag* 2013;16:150–6.
 67. Muhlestein DB, Saunders R, Richards R, McClellan M. Recent Progress in the Value Journey: Growth of ACOs and Value-Based Payment Models in 2018. *Health Affairs Blog*. 2018. Available at: <https://www.healthaffairs.org/doi/10.1377/hblog20180810.481968/full/>. Accessed Jun 20, 2019
 68. Hong YR, Huo J, Mainous AG. Care coordination management in patient-centered medical home: analysis of the 2015 medical organizations survey. *J Gen Intern Med* 2018;33:1004–6.
 69. Martinson BC, Crain AL, Sherwood NE, Hayes MG, Pronk NP, O'Connor PJ. Population reach and recruitment bias in a maintenance RCT in physically active older adults. *J Phys Act Health* 2010;7:127–35.
 70. van Heuvelen MJ, Hochstenbach JB, Brouwer WH et al Differences between participants and non-participants in an RCT on physical activity and psychological interventions for older persons. *Aging Clin Exp Res* 2005;17:236–45.