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Postdischarge Adverse Events Among Patients Who Received Home Health Care Services

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Abstract

Adverse events that occur in urban and rural adults during the posthospitalization period have become a major public health concern. However, postdischarge adverse events for patients receiving home health care have been understudied. The objective of this study was to identify the prevalence and risk factors associated with postdischarge adverse events for patients who received home health care services. We analyzed data from a prospective cohort study that was conducted among patients who were hospitalized in the Tallahassee Memorial Hospital from December 2011 to October 2012. Telephone interviews were conducted by trained nurses who contacted patients within 4 weeks after discharge. Physicians reviewed cases with possible adverse events that were triaged by the nurses. The adverse events that were identified were categorized as preventable, ameliorable, and nonpreventable/nonameliorable. Nearly 39% of 85 patients who received home health care experienced postdischarge adverse events that were predominantly preventable or ameliorable. The associated risk factors were living alone (odds ratio [OR] = 7.860, $p = .020$), insured by Medicare or Medicaid (OR = 6.402, $p = .048$), type 2 diabetes mellitus (OR = 6.323, $p = .004$), pneumonia (OR = 5.504, $p = .004$), and other infections (OR = 4.618, $p = .031$). This study was able to identify that nearly one in every two patients who received home health care after hospital discharge experienced an adverse event. Patient safety research needs to focus in the home by developing specific interventions to avert adverse events and improve patient safety during the delivery of home health care services.

Keywords

home health care, postdischarge adverse events, medical errors, transitions in care, patient safety, injury

Introduction

Adverse events that occur in urban and rural adults during the posthospitalization period have become a major public health concern.[1] These are termed postdischarge adverse events and defined as the injury that results from the care that patients receive from health care professionals approximately a month after hospital discharge.[2-4] Nearly one in three patients discharged from the hospital is likely to experience a postdischarge adverse event, and the majority of these adverse events result from medications.[2-4]

Several studies have examined adverse events in the home. A prospective cohort study identified a 20% incidence rate of adverse drug events in elderly patients receiving home health care after discharge from the hospital.[5] A retrospective home health care cohort study found that needing wound assistance, medication management, and behavioral problems as the most common adverse events in elderly patients discharged to the community.[6] A different home health care retrospective cohort study found an incidence rate of 4.2%, where most of these events were preventable and resulted from falls, wound infections, mental health problems, and medication errors.[7]

However, these studies were mostly retrospective, focused predominantly on the elderly, and did not examine all types of postdischarge adverse events among urban and rural adult patients who received home health care services within a month after discharge from a community hospital. The objective of this study was to identify the rate and types of postdischarge adverse events for patients who received home health care services, and also to examine the risk factors that were associated with postdischarge adverse events for patients who received home health care services to assist researchers to develop specific interventions to improve patient safety in the home.

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Materials and Methods

Setting, Participants, and Study Recruitment

This analysis was conducted as part of a study evaluating postdischarge adverse events in urban and rural patients discharge from a community hospital in the state of Florida. The methods and results of the postdischarge adverse events study have been reported.[2] In summary, eligible patients for this study were recruited from Tallahassee Memorial Hospital (TMH) from December 14, 2011, through October 8, 2012. Patients were approached by two study nurses who described the study and received a written consent from the patients who agreed to participate. We recruited urban and rural adults admitted to the medical service and under the care of TMH hospitalist physicians who were being discharged to home, spoke English, and could be contacted 30 days after discharge to participate in a telephone interview that was conducted by the study nurses. Patient surrogates were allowed to complete the telephone interview in cases where the recruited patients were not able to complete the interview themselves.[2] Prior to discharge, study nurses obtained health records from other institutions that patients may have received care to allow study investigators to review health records and administered a brief demographic survey regarding exposure variables difficult to obtain from health records that included education level, household income and living arrangements, transportation, and caregiver status. The study was approved by Florida state University, TMH, and Wayne State University Institutional Review Boards.

Telephone Interviews

Study nurses begin contacting study patients by telephone within 3 to 4 weeks of hospital discharge. If the study nurses were unable to reach patients after 10 attempts or within 6 weeks after discharge from the hospital, these patients were recorded as nonresponders, and efforts were initiated to gather postdischarge health records, including health care utilization from TMH electronic data sources and review of local newspapers for obituaries and the State of Florida Vital Statistics registry to assist in the identification of deceased patients. The 20-minute telephone interview included questions to determine a patient's use of health services since discharge, both inside and outside the hospital system that discharged study patients, including all outpatient follow-up visits after discharge, and a full review of organ systems.[2,8] If patients identified any of these symptoms as new or worse since discharge, the study nurse had additional follow-up questions regarding the severity of the symptoms, the timing of symptoms in relation to hospitalization and treatments, and the resolution of symptoms, to determine the relationship between these symptoms and the care that was delivered. If patients mentioned that they were receiving home health care, the nurse reviewers were able to collect information on the type of services that were provided such as nursing care which included the administration of medications and the collection of blood for laboratory evaluation. Other services that were mentioned during the telephone interview were physical, occupational, and speech-language therapy. As in previous similar studies, the 20-minute telephone interview has been utilized successfully in identifying postdischarge adverse events.[3,4]

Health Record Reviews

The study nurses combined information obtained from the telephone interview and/or the outpatient health records to screen for (1) new or worsening symptoms, (2) unplanned health services utilization, and (3) abnormal laboratory test results. If the study nurses identified any of the above information, they referred these cases to physician-adjudicators who independently reviewed all information prepared by nurse reviewers to determine the occurrence of postdischarge adverse events. Two physician-adjudicators independently created case summaries for patients they identified with possible postdischarge adverse events.[2-4,9-11] For each possible adverse event, the same physician-adjudicators then rated their confidence that the patient injury was a result of medical management and not the patient's underlying medical conditions, including the absence of needed treatment when clinically indicated,[2-4,9-11] on a scale of 1 to 6.[2-4,9-13] If the physician-adjudicator's rating was 4, 5, or 6, the event was considered an adverse event.

Statistical Analysis

Descriptive statistics were used for demographic characteristics. Statistically significant differences of sociodemographic factors between two groups (e.g., home health care used, not used) were tested using a t test for continuous variables and a χ^2 test for categorical variables. Multivariate logistic regression analysis was performed to examine the association of predisposing risk factors with home health care services. Multiple imputation was used for missing income data. Because each patient may have more than one adverse event, only the first adverse event per patient was included in the multiple logistic regression analysis. Adjusted odds ratios (ORs) and their 95% confidence intervals were calculated. All statistical analyses were performed using SPSS 25.0 version for Windows.

Results

We identified 809 eligible patients who consented their participation in the study. We excluded 96 patients because they were discharged to skilled nursing facilities or by nonhospitalist physicians, withdrew their consent, or were discharged to hospice or died prior to discharge, and 29 patients were lost to follow-up. We also excluded 81 patients without postdischarge follow-up health records and 518 patients without home health care services.

Table 1 presents the patient characteristics of 85 patients who were included in the study, of which 54% resided in urban areas and 46% resided in rural areas. Female patients experienced more adverse events than male patients. Patients who were 60 years or older experienced more adverse events than younger patients. Patients who were insured by Medicare or Medicaid experienced more adverse events than patients with private insurance. Also, patients with hypertension and type 2 diabetes mellitus experienced more adverse events.

In Table 2, the incidence rate of post-discharge adverse events among patients who received home health care services within 30 days after hospital discharge was close to 39%. Of these adverse events, more than 47% were preventable and more than 30% were ameliorable. Drugs were involved with more than 87% of the adverse events followed by procedural complications, diagnostic errors, and management errors.

In Table 3, the multiple logistic regression analysis indicated that after controlling for other factors, patients who lived alone (OR = 7.860, $p = .02$) and were insured by Medicare or Medicaid (OR = 6.402, $p = .048$) were more likely to have an adverse event. Also, patients with diabetes mellitus (OR = 6.323, $p = .004$), pneumonia (OR = 5.504, $p = .05$), and other infections (OR = 4.618, $p = .031$) were more likely to have an adverse event.

In Table 4, we have included admission diagnoses to illustrate the reason for admission to the hospital. The majority of patients were admitted with shortness of breath ($n = 15$), malaise and fatigue ($n = 6$), and abdominal pain ($n = 6$).

In Table 5, we have included examples of postdischarge adverse drug events. Certain examples included diarrhea, nausea, delirium, falls, constipation, and bleeding.

Discussion

This prospective cohort study found that the incidence rate of postdischarge adverse events in patients who received home health care services within a month after discharge from an urban community hospital was close to 39%. We found that this incidence rate is much higher than previous home health care studies (20%, 13%, and 4.2%).[5-7] While this rate may be associated with differences in health care systems or patient populations, the difference may also be in the extensive review of outpatient health records in the present study. Also, we found that the majority of the adverse events were preventable, which is consistent with a previous study.[7]

Living alone was strongly associated with postdischarge adverse events in patients who received home health care services. In our primary study of postdischarge adverse events among rural and urban community hospital patients, which included many patients who did not receive home health care services, the living situation was not associated with adverse events.[2] However, in that study, we also found no difference in the rate of adverse events between rural and urban patients, which may have been an indicator that the

Table 1. Patient Characteristics.

Variables	Total *N* (%)	Without an AE *n* (%)	With an AE *n* (%)
N	85	52	33
Race			
African American/ Others	19 (22.4)	12 (23.1)	7 (21.2)
White	66 (77.6)	40 (76.9)	26 (78.8)
Place of living			
Rural	39 (45.9)	25 (48.1)	14 (42.4)
Urban	46 (54.1)	27 (51.9)	19 (57.6)
Age			
<59 years	21 (24.7)	15 (28.8)	6 (18.2)
≥60 years	64 (75.3)	37 (71.2)	27 (81.8)
Gender			
Male	33 (38.8)	21 (40.4)	12 (36.4)
Female	52 (61.2)	31 (59.6)	21 (63.6)
Living arrangement			
Not living alone	72 (84.7)	46 (88.5)	26 (78.8)
Living alone	13 (15.3)	6 (11.5)	7 (21.2)
Household annual income			
<$25,000~	41 (48.2)	25 (48.1)	16 (48.5)
$25,000~	18 (21.2)	11 (21.2)	7 (21.2)
$50,000~	17 (20.0)	9 (17.3)	8 (24.2)
$75,000+	9 (10.6)	7 (13.5)	2 (6.1)
Health insurance			
Private health insurance	20 (23.5)	15 (28.8)	5 (15.2)
Medicare/ Medicaid	65 (76.5)	37 (71.2)	28 (84.8)
Number of secondary discharge diagnoses			
Mean (SD)	15.01 (6.43)	14.75 (7.05)	15.42 (5.39)
Median	15.0	14.5	15.0
Hypertension			
No	23 (27.1)	16 (30.8)	7 (21.2)
Yes	62 (72.9)	36 (69.2)	26 (78.8)
Type 2 diabetes mellitus			
No	44 (51.8)	33 (63.5)	11 (33.3)
Yes	41 (48.2)	19 (36.5)	22 (66.7)
Atrial fibrillation			
No	60 (70.6)	37 (71.2)	23 (69.7)
Yes	25 (29.4)	15 (28.8)	10 (30.3)
Cardiovascular disease			
No	55 (64.7)	36 (69.2)	19 (57.6)
Yes	30 (35.3)	16 (30.8)	14 (42.4)
Pneumonia			
No	72 (84.7)	45 (86.5)	27 (81.8)
Yes	13 (15.3)	7 (13.5)	6 (18.2)
Other infections			
No	60 (70.6)	38 (73.1)	22 (66.7)
Yes	25 (29.4)	14 (26.9)	11 (33.3)

Note. Private health insurance = Blue cross, Commercial, and Health Maintenance Organization. AE = adverse event.

Table 2. Postdischarge Adverse Events Among Patients Who Received Home Health Care Services Within 30 Days After Hospital Discharge.

		Preventable AEs	Ameliorable AEs	Nonpreventable/nonameliorable AEs
Patients with an AE	33/85			
Incidence rate of AEs	38.8%			
AEs[a]	89			
Overall proportion of AEs		42/89 (47.2%)	27/89 (30.3%)	20/89 (22.5%)
Type of AEs				
Adverse drug events	78/89 (87.6%)	34/78 (43.6%)	26/78 (33.3%)	18/78 (23.1%)
Procedure complications	4/89 (4.5%)	2/4 (50%)	0/4 (0%)	2/4 (50%)
Diagnostic errors	4/89 (4.5%)	4/4 (100%)	0/4 (0%)	0/4 (0%)
Management errors	3/89 (3.4%)	2/3 (66.7%)	1/3 (33.3%)	0/3 (0%)

Note. AE = adverse event.
[a]The number of AEs exceeds the number of unique patients with AEs because patients can have more than one AE.

Table 3. Multiple Logistic Regression of the Likelihood of Postdischarge Adverse Events Among Patients Who Received Home Health Care Services ($N = 85$).

					95% CI		
	B	*SE*	Wald	OR	Lower	Upper	*p*
White vs. African American	−0.298	0.668	0.199	0.742	0.201	2.747	.655
Urban vs. rural	0.339	0.675	0.253	1.404	0.374	5.267	.615
Age (≥60 years vs. <59 years)	−0.709	0.828	0.734	0.492	0.097	2.492	.391
Female vs. male	0.143	0.592	0.058	1.153	0.362	3.680	.809
Living alone vs. not living alone	2.062	0.885	5.424	7.860	1.386	44.559	.020*
Income	0.487	0.305	2.556	1.628	0.896	2.960	.110
Medicare/Medicaid vs. private HI	1.857	0.938	3.920	6.402	1.019	40.229	.048*
Number of secondary diagnosis	−0.099	0.055	3.294	0.905	0.813	1.008	.070
Hypertension	0.787	0.779	1.020	2.196	0.477	10.109	.313
Type 2 diabetes mellitus	1.844	0.632	8.518	6.323	1.833	21.815	.004**
Atrial fibrillation	−0.063	0.605	0.011	0.939	0.287	3.070	.917
Coronary artery disease	0.038	0.649	0.003	1.039	0.291	3.707	.953
Pneumonia	1.705	0.871	3.833	5.504	0.998	30.351	.050*
Other infections	1.530	0.709	4.653	4.618	1.150	18.545	.031*

Note. Private HI = Blue Cross Blue Shield, Commercial, and Health Maintenance Organization. OR = odds ratio; CI = confidence interval; HI = health insurance.
*$p < .05$. **$p < .01$.

living situation was not a major contributor for adverse events. Although, in a different study where patients received home health care, living alone was significantly associated with major adverse cardiovascular events.[14]

Patients insured by Medicare or Medicaid and receiving home health care services were more likely to experience postdischarge adverse events. It is likely that patients with private health insurance may have received more frequent home health care than those with insurance that may have reduced the risk for adverse events. In a recent study, privately insured patients received better quality of care and had improved outcomes than those who had nonprivate insurance.[15] Thus, further research is needed to determine the robustness of these findings.

Patients with type 2 diabetes mellitus who received home health care services were very likely to experience postdischarge adverse events. In our primary study of postdischarge adverse events which included many patients who did not receive home health care services, type 2 diabetes mellitus was associated with postdischarge adverse events only in urban patients.[2] This may be a result of the fact that rural patients are less likely to seek health care utilization and therefore less likely to receive a secondary diagnosis of type 2 diabetes mellitus when compared with urban patients who more frequently utilize the health care system.[16,17]

Patients with pneumonia and other infections who received home health care services were likely to experience postdischarge adverse events. These findings indicate that hospitalist physicians accurately identified these high-risk patients for adverse events during hospital discharge and were able to discharge these patients with instructions for home health care and to schedule a visit with a primary care physician (PCP). In our study, 41.2% of the patients who received home health care services had a scheduled visit with

Table 4. Distribution of Patients by Admission Diagnosis.

Admission diagnosis description	*n*	%
Abdominal pain	6	7.1
Acute myocardial infarction	2	2.4
Altered mental status	2	2.4
Asthma, unspecified with (acute) exacerbation	1	1.2
Atherosclerosis of native arteries of the extremities with intermittent claudication	1	1.2
Backache	1	1.2
Blood in stool	1	1.2
Cellulitis and abscess of leg	3	3.5
Cerebral artery occlusion (with cerebral infarction)	1	1.2
Chronic osteomyelitis involving ankle and foot	1	1.2
Closed fracture of sacrum and coccyx without mention of spinal cord injury	1	1.2
Congestive heart failure	1	1.2
Diabetes mellitus with peripheral circulatory disorders	1	1.2
Dizziness and giddiness	2	2.4
Dysphagia	1	1.2
Fever	2	2.4
Hemorrhage of gastrointestinal tract	1	1.2
Hemorrhage of rectum and anus	1	1.2
Hepatic encephalopathy	1	1.2
Hypopotassemia	1	1.2
Hypotension	1	1.2
Infection and inflammatory reaction due to cardiac device	1	1.2
Implant and graft	1	1.2
Nausea with vomiting	4	4.7
Chest pain	4	4.7
Dyspnea and respiratory abnormality	1	1.2
Malaise and fatigue	6	7.1
Musculoskeletal symptoms referable to limbs	2	2.4
Nonspecific abnormal serum enzyme levels	1	1.2
Pulmonary embolism and infarction	2	2.4
Pain in joint involving lower leg	1	1.2
Pneumonia	2	2.4
Shortness of breath	15	17.6
Swelling of limb	1	1.2
Syncope and collapse	3	3.5
Chest pain	1	1.2
Disorder of skin and subcutaneous tissue	1	1.2
Disorder of stomach and duodenum	1	1.2
Fracture of ankle	1	1.2
Osteomyelitis involving ankle and foot	1	1.2
Psychosis	1	1.2
Urinary tract infection	3	3.5
Total	85	100.0

Table 5. Examples of Postdischarge Adverse Drug Events.

	Adverse drug event description
Delirium	Delirium was likely caused by the combination of Mirapex & Tramadol which should have been addressed during admission or discharge.
Bleeding	A patient was newly placed on Coumadin and required a plan for Coumadin and the international normalized ratio follow-up to prevent the bleeding.
Nausea	A patient had increased levels of Glimepiride to better control the glycemic index and experienced nausea as a result which was not addressed by the physician.
Diarrhea	Metformin diarrhea is very common and the patient could have been given a warning and a contingency plan.
Congestive pulmonary edema	A patient with a new onset of pneumonia was started on a typical dose of prednisone which likely caused sodium retention leading to congestive pulmonary edema.
Urinary tract infection	A patient with multiple underlying conditions received prednisone during hospitalization and a tapering dose postdischarge. Prednisone may certainly increase the susceptibility to infection.
Bleeding	Bleeding is a known risk of chemotherapy. The patient was receiving chemotherapy and Coumadin concurrently which may have led to the bleeding.
Fall	A patient with low blood pressure during the hospitalization and outpatient clinic visit was found to be on multiple medications which may cause disorientation and result in a fall.
Diarrhea	A patient received Zyvox & Primaxin which often causes diarrhea and the patient was not been given a warning and a contingency plan.
Dizziness/ lightheadedness/ fainting	A patient received Lisinopril which may cause lightheadedness but the patient did not receive a warning.
Fatigue	A patient received chemotherapy which may cause fatigue but the patient was not given a warning or contingency plan.
Diarrhea	A patient received Levaquin which often causes diarrhea but the patient was not given a warning or contingency plan.
Constipation	A patient received Effexor along with laxatives which can cause constipation but the patient was not given a warning or contingency plan.

a PCP. Also, several other factors may have contributed to the physicians risk assessment such as psychosocial complexity, health literacy, perceived stability at discharge, or functional status, which we were not able to capture except for living arrangement and insurance status as mentioned previously. Patients with these infections had no association with postdischarge adverse events in our primary analysis.[2]

Our study had a few limitations. First, our study focused specifically on the 1-month postdischarge transition of care

from the hospital to home, and therefore, we did not collect specific home health care variables other than the information that was collected by the nurse reviewers if patients mentioned that they were receiving home health care during the 1-month postdischarge telephone interview. Second, we were not able to capture a patient's psychosocial complexity, health literacy, perceived stability at discharge, or functional status that may have strengthened a physician's risk assessment of triaging high-risk patients to home health care, and this may have been a contributing factor to why we identified few patients ($N = 85$) who received home health care services. Third, the relatively small sample of patients who received home health care may have limited our ability to examine additional risk factors for patients receiving home health care and experiencing post-discharge adverse events. Fourth, we recruited patients from one community hospital in Florida and our results may not be generalizable to other parts of the country. Future research with larger samples and in different parts of the country is needed to corroborate our results of patients experiencing postdischarge adverse events and receiving home health care services.

Conclusion

Despite the limitations of our study, we were able to identify that nearly one in every two patients who received home health care after hospital discharge experienced an adverse event. Also, the contributing risk factors for adverse events were living alone, having nonprivate insurance, type 2 diabetes mellitus, and pneumonia and other infections. However, these findings should be treated with caution due to the small sample of patients we studied. Future research is needed to capture risk assessment factors such as psychosocial complexity and health literacy to improve a physician's assessment for triaging high-risk patients to home health care. Future research is also needed to identify home health care factors that may contribute to adverse events. Finally, patient safety research needs to focus in the home by developing specific interventions to avert adverse events and improve patient safety during the delivery of home health care services.

Authors' Note

The content is solely the responsibility of the authors and does not necessarily represent the official views of the Agency for Healthcare Research and Quality.

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