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Qualitative Factors in Patients who Die Shortly After Emergency Department Discharge

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Abstract

Objective—Early death after ED discharge may signal opportunities to improve care. Prior studies are limited by incomplete mortality ascertainment and lack of clinically important information in administrative data. Our goal in this hypothesis-generating study was to identify patient and process of care-level themes that may provide possible explanations for early post-discharge mortality.

Methods—We conducted a qualitative analysis of medical records of adult patients who visited any of six hospitals in an integrated health system (Kaiser Permanente Southern California – KPSC) ED and died within 7 days of discharge in 2007 and 2008. We excluded non-members, visits to non-health plan hospitals, patients receiving or referred to hospice care, and patient with Do Not Resuscitate or Do Not Intubate orders. Under the guidance of two qualitative research scientists, a team of three emergency physicians utilized grounded theory techniques to identify patient clinical presentations and processes of care that serve as potential explanations for poor outcome after discharge.

Results—The source population consisted of a total of 290,092 members with 446,120 discharges from 6 Kaiser Permanente Southern California EDs in 2007 and 2008. A total of 203

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deaths occurred within 7 days of ED discharge (0.05%). Sixty-one randomly chosen cases were reviewed. Patient level themes that emerged included an unexplained persistent acute change in mental status, recent fall, abnormal vital signs, ill appearing presentation, malfunctioning indwelling device, and presenting symptoms remaining at discharge. Process of care factors included a discrepancy in history of present illness, incomplete physical exam, and change of discharge plan by a third party, such as a consulting or admitting physician.

Conclusions—In this hypothesis-generating study, we used qualitative research techniques to identify clinical and process of care factors in patients who die within 7-days after discharge from an ED. These potential predictors will be formally tested in a future quantitative study.

INTRODUCTION

Early mortality after an ED discharge may represent opportunities to improve diagnosis, treatment, and post-discharge care. Contributing factors to such events may include the inherent high risk nature of ED care[1,2], ED crowding[3–10], and an increasing illness severity of the US population.[4,5,11] Current estimates suggest that 41,500 patients discharged from emergency departments die within 7 days annually in the U.S.[12,13]

Although early death after discharge from the ED has important patient safety and quality improvement implications, there is insufficient understanding of such events. Prior US studies are limited by an incomplete capture of deaths.[14,15] Our study team recently analyzed predictors of early death using administrative data; however, that study omitted critically important information on clinical and process factors that can only be abstracted through chart review. [12]

The objective of this study is to identify patient and process of care factors that may be associated with early death after discharge. We performed a qualitative chart review to identify potential predictors, which are not measured by existing administrative data. This methodology is well suited for generating hypotheses that can be formally tested in future studies.

METHODS

Study Design

We conducted a qualitative chart review analysis of patients who died within 7-days of an ED evaluation and discharge. The study protocol was approved by the Institutional Review Board of Kaiser Permanente Southern California and the University of California at Los Angeles.

Setting

Study subjects were members of Kaiser Permanente Southern California (KPSC), an integrated health system which provides comprehensive care to 3.5 million members throughout Southern California. Health care is delivered at over 100 outpatient clinics and emergency services provided at 14 medical centers. Electronic ED charts were available from six health plan medical centers; the remaining eight EDs had not completed implementing the electronic record system during the study period.

All health plan members have similar health care benefits, including coverage of emergency services both within and outside the health system. Electronic administrative databases track all health care encounters within the health system and provide access to notes, vital signs, laboratory, pharmacy, imaging, and many other clinical care data. A claims reimbursement

system tracks health care encounters at outside facilities. A specialized administrative database provides information on the use of hospice services.

Selection of Participants

Study subjects were patients who died within 7 days of discharge from a health plan ED between January 1, 2007 to December 31, 2008. To arrive at our cohort, we used administrative data to identify member visits to any of six emergency departments within an integrated health system from January 1, 2007 to December 31, 2008. Death within 7 days of the ED visit and discharge was identified using the California Vital Statistics files and the Social Security Death Index. We chose the 7-day time frame because of its clinical relevance, implications for health policy decisions, and prior use in related studies.[12,14–17]

Each subject had to be a member of the health plan at the time of the ED visit; however, no minimum health plan enrollment period was required. Subjects were restricted to age 18 years and older because of the inherent difference between pediatric and adult presentations and outcomes. Patients seen and discharged from an ED to home or a non-acute care facility (nursing or rehabilitation) were eligible. A discharge to a non-acute care facility was considered eligible as these facilities lack either on-site or off-site continuous physician coverage and diagnostic abilities and require patients be transferred to emergency departments for acute evaluations. Patients admitted to an inpatient or observation status bed were excluded. Patients in hospice care were excluded on the assumption that this status implies an intention to provide end-of-life comfort therapy rather than to prolong life. Members who visited a non-health plan emergency department were also excluded as we did not have an ED chart for these patients.

From the 203 patients who died within 7 days after ED discharge, we randomly assigned a rank order and proceeded down the list with a goal of reviewing a set of charts to arrive at preliminary themes through theme saturation (Phase 1) and a set of charts to validate the previously identified themes (Phase II). A total of 64 charts were extracted but 3 excluded during manual chart review because they were found to have Do Not Resuscitate/Do Not Intubate (DNR/DNI) orders in the chart or were offered hospice services during the ED visit. The final analysis involved the review of 61 charts (30 in Phase I and 31 in Phase II).

Qualitative Review

De-identified printed medical records were reviewed by three emergency physicians utilizing grounded theory techniques. Grounded theory is a form of qualitative analysis that uses social research methods to acquire theories from data. Chart data included the ED physician, nursing, and consultant records, the reported laboratory and imaging findings, and the most recent primary medical doctor visit prior to the ED visit. The most recent primary medical doctor visit gave reviewers insight into the patient's condition prior to the ED visit. Using the qualitative methods and coding techniques described below[18–20] and after receiving training in qualitative methodology, a team of three emergency physicians reviewed charts both independently and as a team to identify a set of themes.

Training of the reviewers involved multiple meetings to discuss the theory and practice of qualitative methodology[15,19–21] and to sample chart reviews with the team lead qualitative scientist (ST). Reviewers were advised to assess each chart based on the written information present; for example, if there was no documentation or mention of the vital signs, the chart was assumed to lack vital signs.

We used grounded theory to identify salient themes such as patient presentations and processes of care to build a conceptual framework that provides possible explanations for death within 7 days of ED discharge. The process of data collection and analysis was based

on prior literature[19,20] and the recommendations of our team qualitative researchers (ST, GWR).

Three emergency medicine physician reviewers (GZG, NJM, DF), iteratively reviewed charts both independently and as a team to arrive at a set of preliminary codes. The group met monthly to discuss and refine the codes, often described as single words such as “fall”, into preliminary themes, defined as broader categories such as “fall in elderly”. This process continued until thematic saturation was achieved at approximately 30 charts and no new concepts were being generated. To ensure that we had achieved thematic saturation, a second set of charts were reviewed (n=31) using the same iterative grounded theory methodology. Throughout the reviews, the team lead qualitative researcher (ST) regularly evaluated the coding scheme to ensure that the observations were comprehensive and that narrative accounts were being generated. Per qualitative research guidelines[19,20], the final data was then reviewed by the study team (GZG, SFD, BCS) to ensure that the interpretations were credible.

Data Analysis

With qualitative expertise from fields in sociology (ST) and anthropology (GWR), the preliminary themes were sorted into a final set of analytic themes by the study lead author (GZG) that could potentially explain early death after discharge. All cases had multiple themes. For each case, we assigned a single theme that was felt to be the most important contributor to death after ED discharge. The process of categorizing the themes involved twelve inductive data reviews (defined as reviews of the charts that derived overarching analytic themes from preliminary themes), and discussions of the analytic themes with the study team to arrive at final themes that were thought to be the most probable contributor to death after ED discharge. To qualify as a final theme at least three cases needed to have the same finding. The analysis yielded eleven final themes that were categorized as occurring either at the patient level or process level. Coding data were managed with Microsoft Excel. (Redmond, WA) Descriptive statistics for the cohort were obtained using SAS 9.2 (Cary, NC).

RESULTS

Characteristics of Study Subjects

Over the two years, there were 497,996 patients who accounted for 813,232 visits to six emergency departments (Figure). The source population contained 290,092 health plan members with 446,120 visits to emergency departments. The characteristics of the source population and their comorbidities are presented in Table 1. The mean age of the source population was 46.8 years (SD 18.2). A total of 203 patients died within 7 days after ED discharge with a mean age of 71.1 years (SD 14.7). Of the patients who died, 61 were included in the final analysis (Figure) of which the mean age was 72.0 years (SD 12.5).

Qualitative Analysis Findings

The themes were classified into Patient or Process level categories as described below. Patient factors describe characteristics of patients, their medical history, or their presentation in the ED. Process of care factors are defined as characteristics of the care the patient received during their ED stay. For cases that had overlapping themes, the case was categorized in the one unique theme that the reviewers believed was most likely associated with death after ED discharge. Table 2 summarizes the themes and provides example cases. Of the 61 charts reviewed, 4 charts did not to have a theme that fell into a category. These cases most likely had deaths that were not related to the ED presentation, such as being hit by a car or suffering an accidental death.

Patient Factors (Table 2)

- *Unexplained Persistent Acute change in mental status:* The mental status change was identified by either someone accompanying the patient or the emergency physician and could not be explained based on the acquired history, exam, or results of ancillary tests. In addition, all patients with this presentation continued to be confused at the time of discharge.
- *Recent fall in the elderly*: A history of a recent fall in a patient age 65 years or older, occurring within the week prior to the ED visit, in most cases was attributed to mechanical causes without mention of associated symptoms.
- *Abnormal vital signs:* Abnormal vital signs were defined based on clinical consensus and previous literature[15] as heart rate greater than 99 and less than 60 beats per minute, systolic blood pressure greater than 179 or less than 90 mm Hg or diastolic greater than 109 mm Hg, respiratory greater than 20 or less than 12 breaths/min, temperature greater than 100.2°F (37.9°C), and oxygen saturation less than 93%. Cases in this category often had initial abnormal vital signs that persisted throughout the ED visit despite interventions. Also, reasons for the abnormal vital signs were seldom addressed in the ED note. The vital sign abnormality most common to the cases was tachycardia.
- *Ill appearing presentation:* The determination of ill appearance was based on documentation of “ill appearance” or “distressed” in the general portion of the physical exam. All these patients also were found to have an abnormal lung exam of either respiratory distress or decreased breath sounds.
- *Malfunctioning Indwelling Device:* An indwelling device was defined as an external object not naturally contained in the body, such as a nasogastric tube, catheter or shunt.
- *Presenting symptoms remain at discharge:* The persistence of the presenting complaint was based on documentation of a complaint by the nurse or the physician at the time of discharge. In most cases, the nurse’s note provided a more comprehensive account of the patient’s condition throughout the ED stay and at discharge.

Process Factors (Table 3)

- *Discrepancy in history of present illness*: The discrepancy occurred as a result of another practitioner providing additional or conflicting information when compared to the ED physician note. In all cases, these practitioners saw the patient prior to (primary medical doctor) or during (nurse) the patients’ stay in the ED and there is no acknowledgment in the ED note of the third party assessments.
- *Incomplete physical exam:* An incomplete exam was defined as an exam that did not address the physiologic location and neurologic components of the body part that was relevant to the chief complaint. For example, if the patient complained of back pain, an incomplete exam would include the absence of a documented complete back and/or neurological exam.
- *Misdiagnosis due to a narrow differential diagnosis:* Cases with potential misdiagnoses were often characterized by normal laboratory or imaging results that prematurely ended the consideration for a dangerous condition.
- *Underestimation of sickness level despite concerning evaluation*: Cases that were found to have their sickness level underestimated had a mismatch between their

documented clinical assessment and objective abnormalities, such as vital signs, laboratory, or imaging results.

- *Admission Plan Changed:* The change took place either by an inpatient admitting physician (7/9) or the patient wanting to leave against medical advice (2/9). In the Kaiser system, the recommendation for an admission can be placed by the ED physician, but the final decision to admit is made by the admitting hospitalist physician. In all instances, the ED physician indicated in their note that the patient appeared ill.

DISCUSSION

We identified a set of patient-level and process-level factors that characterized ED encounters that resulted in early death after discharge. Our hypothesis-generating study not only provides clinicians and QI directors with important information regarding high-risk conditions, but it sets the foundation for future confirmatory studies. The ultimate goal of this research program is to develop interventions, such as a patient discharge tool or electronic reminder at discharge, to prevent early deaths after discharge.

Two case studies and one administrative data study evaluating death after ED discharge have been conducted in past years. Using state coroners data and qualitative methods, Sklar et al. found of 35 error cases the following themes: abnormal vital signs, atypical presentation, decompensation of a chronic disease, and abnormal mental status.[15] A case report of 42 charts by Kefer et al. using state medical examiner data found 9 unexpected related deaths to be caused by thoracic or abdominal aortic aneurysms, congestive heart failure, head injury, ischemic bowel, pneumonia, pulmonary embolism, and aortic outflow obstruction. Both studies were limited by incomplete event capture, i.e. deaths that were not reviewed by the coroner would have been excluded. We previously reported an analysis of administrative data using the same source cohort as the current study. We found that 7-day death after ED discharge occurs 0.05% of the time (357/728,312). The following predictors were associated with death after discharge: older age, male gender, and the top 3 primary discharge diagnoses of non-infectious lung disease, renal disease, and ischemic heart disease.[12] The current study builds on our prior analyses by assessing potentially important patient and process factors that are not captured by administrative data.

In the current study, we found certain patient presentations to be present in cases of early mortality after discharge. A common historical theme was an unexplained persistent acute mental status change in any age adult or recent fall in an elderly patient. An altered mental state is often due to systemic illness, drug intoxication or withdrawal, organ system dysfunction, psychiatric disease, or neurological illness. This finding is consistent with prior literature.[15,22] The presence of this recurrent theme suggests that ED physicians may underestimate the sickness level of a confused patient possibly as a result of a lack of obvious systemic findings, inability to assess symptoms, or a lack of positive ancillary tests.

Falls are a leading cause of injury-related complaints in US emergency departments.[23] Numerous studies have found that a fall predicts an increased likelihood of one year mortality in the elderly.[24,25] Older adults often fall due to de-conditioning or poor health. The falls identified in our study were often attributed to a mechanical cause with little additional information acquired in the note. Our findings suggest that clinicians consider acquiring a better understanding of the patients' physical state leading up to the fall along with a detailed account of the fall event.

We found abnormal vital signs to be a prevalent theme in our population. Although this marker lacks specificity, it does indicate a potentially high-risk condition. Of all vital signs,

we identified tachycardia to be the most common abnormal vital sign. In all cases, the abnormality in vital signs either persisted despite interventions or there was no notation of improvement. This finding reaffirms the significance of vital signs, the importance of a broad differential diagnoses, and the need to address the underlying cause of the abnormality.

We also found the malfunctioning of an indwelling device to potentially indicate an impending poor outcome. We recognize that this is a common complaint that often does not mark illness, but our findings suggest that the evaluation of such a patient be more thorough. Another theme we identified was the persistence of symptoms at discharge. A persistent complaint, such as abdominal pain, could warrant further investigation or treatment, more specific return precautions, or more aggressive care following the ED visit, such as next day follow-up or phone conversation.

We identified several processes in the areas of assessment, diagnosis, and disposition. A history of present illness and a discrepancy in view between providers was thought to contribute to potential misdiagnosis. In most instances this discrepancy was noted between the ED physician and ED nurse documentation. In the KPSC electronic health record system, charting by each provider occurs separate of the other. Our findings suggest that ED providers maintain open communication with all health care personnel involved in patient care and consider a review of all documentation prior to patient discharge.

A narrow differential diagnosis was a recurrent theme. Often the ED physician would identify one potential cause of the complaint and failed to broaden the differential diagnosis when the initial presumptive cause was not confirmed. There were additional cases where the provider appeared to underestimate the level of illness despite concerning objective evaluation. Patients would often present with a number of mild physical exam and test abnormalities. These abnormalities when considered together were more concerning then when interpreted individually.

For a number of patients, the ED physician’s plan of admission was changed by a third party, including an admitting physician, a consultant, or by the patient leaving against medical advice. In the Kaiser Permanente health system, all patients are screened by a consulting admitting physician prior to admission. The admitting physician has the authority to discharge patients if they choose. Our findings suggests that provider disagreement over patient disposition may indicate a possible risk for unexpected death.

LIMITATIONS

Our study has potential limitations. Most importantly, our qualitative analysis lacked a control group and is not intended to answer causal questions, but instead to generate hypotheses for future confirmatory studies. We acknowledge the possibility of hindsight bias, as reviewers were aware that all of the study patients had died. We also recognize that despite excluding hospice or DNR/DNI patients, there may have been patients that had an anticipated death. In addition, although the analyzed cohort was similar to the patients who were not analyzed on 17 measured variables, the analyzed cohort had a lower rate of pre-existing cerebrovascular disease. This may have potentially reduced our ability to identify process factors unique to patients with cerebrovascular disease. We are currently conducting a case-control study, with abstractors blinded to outcome, to formally test the association between the themes identified in this manuscript with a poor outcome after ED discharge. Finally, our team did not investigate the potential relationship between a theme and the post-discharge day of death.

We did not interview physicians involved in the cases due to resource constraints. Consequently, we did not obtain the physicians perspective and their thought process behind the management plan. We assumed that missing chart documentation indicated that a process was not performed or that the evaluation did not fully consider the missing information. However, we acknowledge that chart documentation may not capture all events and decision-making processes that occur during a patient encounter.

We performed our study in an integrated health system and our results may not generalize to other settings. Uninsured patients, which may potentially be at greater risk for death following discharge from the ED, are underrepresented in our study. In addition, health plan members may have access to a rapid outpatient evaluation that may not be available to the general population, and as a consequence, the practice patterns of emergency physicians in our study EDs may differ from other health systems. Our findings should be confirmed in other settings.

We recognize that previous work in this area reported on the patient cause of death and whether the death was related to the ED evaluation. We did not report cause of death information due to the questionable reliability of cause of death data[26] and the scarcity of autopsy information in our study cohort. In addition, we felt that an assessment of the 'relatedness' of ED care with subsequent death to be highly subjective; thus we did not attempt to infer a cause of death or assign a judgment of medical error. Rather, we focused on describing the factors common to patients and processes of care in patients who died shortly after ED discharge. We also recognize that in addition to the 7-day time window, we could have evaluated outcomes in either a shorter or longer time frame.

CONCLUSIONS

We conducted a qualitative analysis to identify patient characteristics and processes of care that may be seen in patients who suffer early death after ED discharge. Our hypothesis-generating results provide insight for clinicians and QI directors regarding these "high-risk" patients. These findings lay the foundation for future efforts to quantitatively test the themes identified in this paper and to develop interventions aimed at reducing preventable death.

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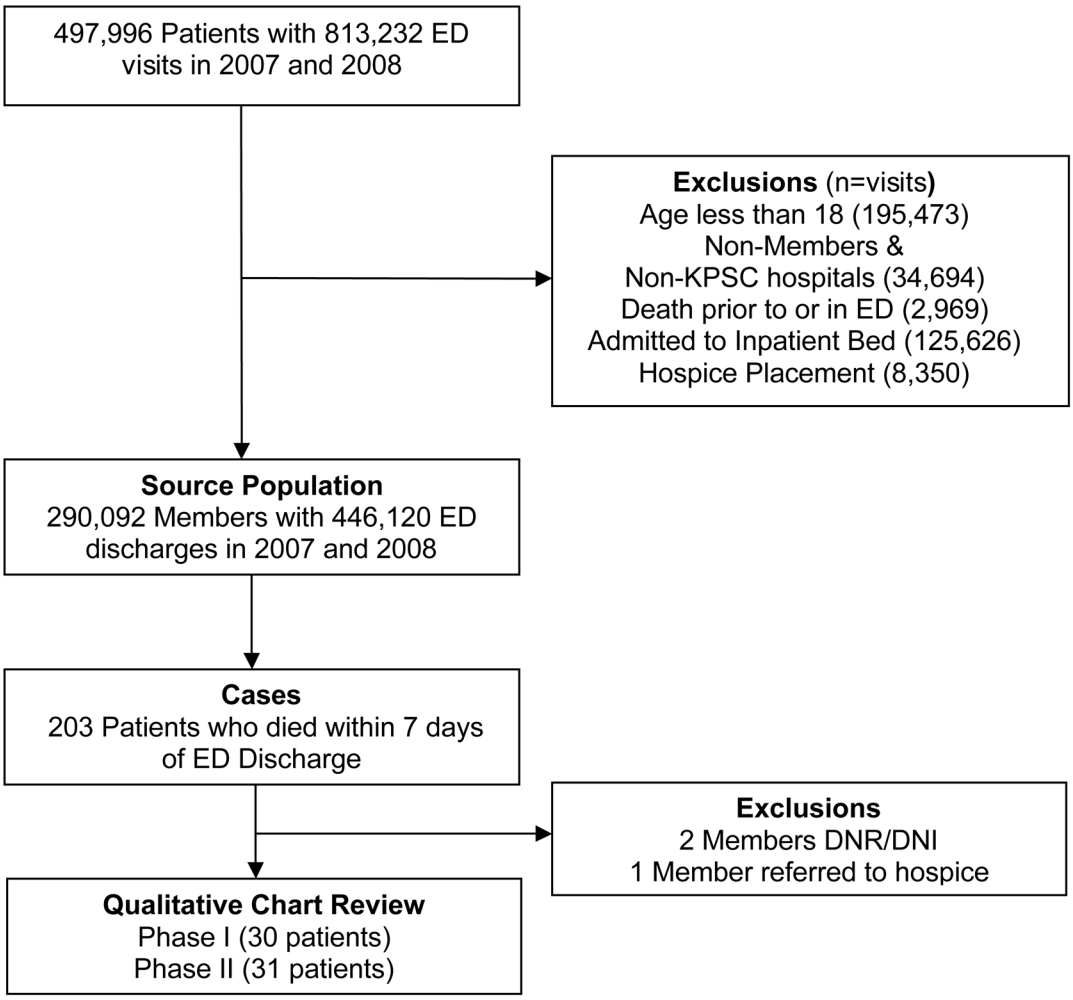

Figure 1.
Flow diagram of study cohort

Table 1

Characteristics of Study Source Population and the Sample of Patients who Died

Characteristics	Total Source Population (%) (N=290,092)	Died within 7 days (%) (N=203)	Analyzed Patients (%) (N=61)	Patients not Analyzed (%) (N=142)
Age (yrs)				
18–39	112,526 (38.8)	6 (3.0)	0	6 (4.2)
40–59	104,551 (36.0)	38 (18.7)	12 (19.7)	26 (18.3)
60–79	58,272 (20.1)	89 (43.8)	30 (49.2)	59 (41.6)
≥80	14,743 (5.1)	70 (34.5)	19 (31,1)	51(35.9)
Sex				
Female	168,166 (58.0)	91 (44.8)	29 (47.5)	62 (43.7)
Male	121,922 (42.0)	112 (55.2)	32 (52.5)	80 (56.3)
Unknown	4 (0.001)	0	0	0
Race/Ethnicity				
White	94,535 (32.6)	90 (44.3)	22 (36.1)	68 (47.9)
Asian/Pacific Islander	21,548 (7.4)	8 (3.9)	3 (4.9)	5 (3.5)
Black	48,207 (16.6)	52 (25.6)	19 (31.1)	33 (23.2)
Hispanic	104,498 (36.0)	49 (24.1)	16 (26.2)	33 (23.2)
Other/Unknown	21,304 (7.3)	4 (2.0)	1 (1.6)	3 (2.1)
Household Income ($)[1]				
<=39169	57,063 (19.7)	40 (19.7)	11 (18.0)	29 (20.4)
39170–51087	57,126 (19.7)	40 (19.7)	13 (21.3)	27 (19.0)
51088–63470	57,082 (19.7)	37 (18.2)	15 (24.6)	22 (15.5)
63471–80797	57,046 (19.7)	43 (21.2)	11 (18.0)	32 (22.5)
80798+	57,143 (19.7)	43 (21.2)	11 (18.0)	32 (22.5)
Unknown	4,632 (1.6)	0	0	0
Comorbidities				
Myocardial infarction	12,553 (4.3)	52 (25.6)	14 (23.0)	38 (26,8)
Congestive heart failure	13,005 (4.5)	74 (36.5)	21 (34.4)	53 (37.3)
Peripheral vascular disease	8,895 (3.1)	53 (26.1)	15 (24.6)	38 (26.8)
Cerebrovascular disease	16,914 (5.8)	63 (31.0)	**11 (18.0)**	**52 (36.6)**
Dementia	1,562 (0.5)	9 (4.4)	4 (6.6)	5 (3.5)
Chronic pulmonary disease	57,963 (20.0)	80 (39.4)	18 (29.5)	62 (43.7)
Rheumatologic disease	5,758 (2.0)	16 (7.9)	5 (8.2)	11 (7.8)
Peptic ulcer disease	2,450 (0.8)	7 (3.5)	2 (3.3)	5 (3.5)
Mild liver disease	1,732 (0.6)	5 (2.5)	2 (3.3)	3 (2.1)
Diabetes	20,169 (7.0)	19 (9.4)	5 (8.2)	14 (9.9)
Diabetes with chronic complications	22,567 (7.8)	61 (30.1)	16 (26.2)	45 (31.7)
Hemiplegia or paraplegia	2,966 (1.0)	13 (6.4)	3 (4.9)	10 (7.0)
Renal disease	23,349 (8.0)	90 (44.3)	29 (48.0)	61 (43.0)
Any (primary) malignancy	15,605 (5.4)	37 (18.2)	14 (23.0)	23 (16.2)
Moderate or severe liver disease	1,029 (0.4)	6 (3.0)	2 (3.3)	4 (2.8)

Characteristics	Total Source Population (%) (N=290,092)	Died within 7 days (%) (N=203)	Analyzed Patients (%) (N=61)	Patients not Analyzed (%) (N=142)
Metastatic solid tumor	4,750 (1.6)	29 (14.3)	7 (11.5)	22 (15.5)
AIDS	824 (0.3)	0	0	0

[1] Presented in quintiles

Bolded numbers refer to the characteristic of patients who died that were significantly different ($p<0.05$) between the sample whose charts were randomly chosen for review and the remainder who were not reviewed.

Table 2

Themes in patients who die shortly after ED discharge

Theme	Example Case[1]
Patient-level	
Unexplained Persistent Acute change in mental status (3[2])	63 y/o w/h/o Parkinson's Disease who presents with 1 day of confusion and headache. Exam notes lack of coordination. ED care involves a normal head CT. Patient returns to the ED on same day with a subdural hemorrhage.
Recent fall in the elderly (7)	84 y/o with morbid obesity, insulin dependent diabetes, and CKD[3] presents with fall, unknown cause. Exam is unremarkable. ED care involves discharge planning for placement. Patient discharged with diagnosis of mechanical fall.
Abnormal vital signs (5)	69 y/o w/h/o CAD[4] and COPD[5] presents with 1 week of chest pain and shortness of breath. Exam includes abnormal vitals of pulse oxygenation of 89% that remain unchanged during the ED visit. ED care involves a chest xray with a right lower lobe infiltrate. Patient discharged with antibiotics. Patient readmitted on day 2 with pneumonia.
Ill appearing presentation (4)	86 y/o w/h/o CHF[6] and COPD presents with 4 days of dyspnea on exertion. Exam includes abnormal vitals of respiration of 22. Exam notes "ill appearing" in "moderate distress" and positive for diminished breath sounds. ED care involves a negative chest xray, laboratory tests positive for a borderline troponin, and nebulizer treatments. Patient discharge with nebulizers. Patient readmitted on day 4 with bilateral pneumonia.
Malfunctioning Indwelling Device (5)	69 y/o w/ESRD[7] presents with a bleeding dialysis shunt. Pt reports no fever or rash at the site. Exam is "non-toxic" with a bleeding dialysis catheter at the left upper extremity. ED care involves laboratory tests positive for a low hemoglobin of 9.8, an elevated INR of 5.9, and removal of the shunt by the dialysis nurse. Pt expires at home.
Presenting symptoms remain at discharge (3)	43 y/o w/h/o developmental delay, Lupus, and ESRD[6] presents with abdominal pain. Exam is unremarkable. ED care involves pain medication that does not resolve the pain. Patient expires at home.
Process-level	
Discrepancy in history of present illness (3)	81 y/o w/h/o dementia and obesity presents after a fall. Exam is unremarkable. ED care involves a normal Head CT, elevated bicarbonate, and slightly elevated creatinine. Patient is sent home with a diagnosis of accidental fall. Nurses note indicates that patient has had 2 weeks of severe diarrhea. Patient expires at home.
Incomplete physical exam (4)	56 y/o w/h/o Liver Cirrhosis presents with shortness of breath. ED care involves a physical exam with no mention of the lung exam. Patient discharged with follow-up to receive a paracentesis. Patient expires at home.
Misdiagnosis due to a narrow differential diagnosis (7)	50 y/o w/h/o CAD and migraines presents with 1 weak of headaches and vomiting. Exam is positive for being ill appearing in moderate distress and normal strength/sensation on neurological assessment. ED care involves normal laboratory tests. Patient diagnosed with benign positional vertigo and migraine headaches. Patient returns on day 1 with diagnoses of cerebellar stroke and expires in the hospital.
Underestimation of sickness level despite concerning evaluation (7)	61 y/o trached patient presents with 1 day of agitation. Exam is positive for tachycardia. ED care involves a normal Chest XR, elevated WBC, UA with trace leukocyte esterase, and insertion of a foley catheter to resolve urinary retention. Patient discharged with diagnosis of urinary retention. Patient expires at home.
Admission plan changed (9)	76 y/o w/h/o CAD and DM[7] presents with weakness that came on prior to arrival. Exam indicates a fever. ED care involves an elevated WBC and Chest XR with possible sign of infiltrate. ED MD plan is to admit for IV antibiotics. Plan changed by IM consultant. Patient returns on day 1 with an acute MI.

[1] Patient presentation to the ED is day 0 with all subsequent visits, day 1–7. Case is presented with pertinent medical history, exam findings, and ancillary tests.

[2] Although all cases had multiple themes, the numbers represent the number of unique cases that had that given theme as the most probable reason the patient died

[3] Chronic Kidney Disease

[4] Coronary Artery Disease

[5] Chronic Obstructive Pulmonary Disease

[6] Congestive Heart Failure

[7] End Stage Renal Disease