The Sociodemographic Characteristics of Patients Who Experience Postdischarge Adverse Events

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Abstract
In the decade since the publication of Institute of Medicine reports on patient safety, much remains unknown about the patient-level characteristics that may increase or decrease vulnerabilities to postdischarge adverse events. We reviewed the patient safety literature to determine whether specific sociodemographic groups are vulnerable to postdischarge adverse events. We found substantial inconsistencies in how postdischarge adverse events were defined, which was largely driven by innovations and developments in research methodology that have occurred since the publication of the IOM reports. Additionally, we found the literature to be inconclusive on which patients represent the greatest vulnerabilities for postdischarge adverse events. We suggest that the field could benefit from standardized definitions of what constitutes an adverse event, as well as adequately powering studies in order to achieve statistical significance for the influence of sociodemographic characteristics on patient experience of poor patient safety.

Keywords
Patient safety, Postdischarge adverse events, Readmission, Sociodemographic characteristics, Age, Race, SES

Introduction
It has been over a decade since the publication of two seminal works on patient safety including the IOM Reports To Err Is Human [1] and Crossing the Quality Chasm [2]. These reports were among the first to highlight the need for a national agenda to improve patient safety and reduce adverse events in the U.S. health care system. Moreover, recent interest in improving patient outcomes in order to decrease costs associated with the Affordable Care Act puts patient safety in the American healthcare system at the forefront research on health services.

Early work in this area focused on adverse events during hospitalizations, estimating an incidence rate between 2.9%-3.7% [3,4]. Adjusting for inflation, estimates of the national cost of total healthcare by Johnson, et al. [5] would top $115 billion a year in the United States. Moreover, these costs do not account for lost productivity or disabilities that occur when patients experience adverse events. Recent studies have underscored the need to consider adverse events after hospital discharge. Forster, et al. [6] documented the incidence rate for postdischarge adverse events as 19%, five times higher than that for in-hospital events. Using Forster’s estimate of the incidence rate of adverse events and Johnson’s estimates for cost, it’s possible that the US healthcare system may be spending $575 (inflation adjusted) billion per year on postdischarge adverse events.

Much remains unknown about the degree to which some social and demographic groups experience unequal risk of postdischarge adverse events. Sociologists and demographers have long understood the role of non-medical influences of health, documenting differences in mortality, overall health, disability, mental illness, active life expectancy, and chronic disease across social and demographic groups [7,8]. In as much as medical sociology is predicated on the idea that social conditions fundamentally influence health and disease.
[9], it seems plausible that social conditions shape the health of patients before they ever present to hospitals, predisposing some to increased vulnerability of postdischarge adverse events. This may mean that some patient groups bear a disproportionate amount of the risk for poor patient safety outcomes.

Moreover, patient characteristics, such as socioeconomic status, social support, and mental health may predispose some types of patients towards vulnerability in terms of postdischarge adverse events. Excess risk of poor outcomes may be driven by socioeconomic disparities through inequalities in health insurance and healthcare access. Further, important components of patient safety, such as health literacy and compliance with discharge instructions, may be related to educational differences among patients who experience postdischarge adverse events and those who do not.

There are several reasons why much about the characteristics of patients who experience postdischarge adverse events is unknown. First, the medical literature tends to place greater emphasis on understanding the medical and physiological influences on health. This is understandable, given the wide variety of definitions and variable operationalizations employed in the social science and medical literature, not only for items such as socioeconomic status, but also increasingly as of late, gender and race [10,11]. These construct issues become increasingly difficult to confront when considering that many patient safety studies are not adequately powered to register socio-demographic differences in the risk of poor patient outcomes, because they often include only 400-700 participants.

Complicating matters further is the discrepancy in the patient safety literature regarding what qualifies as an adverse event. The bulk of patient safety literature has relied heavily on analyses of administrative data generated by hospitals, government reporting agencies, and insurance companies (e.g. lezzoni 1999) [12]. At first pass, these exceptionally rich and detailed data may seem well-suited to such an endeavor. However, computerized monitoring of adverse events is attractive because it is inexpensive and creates a high yield of adverse events. However, it is less sensitive to medication errors (ADEs) and potential ADEs, which constitute a substantial proportion of adverse events [13]. Moreover, these data preclude determining the patient characteristics of interest beyond how often patients died or were readmitted, because they cannot account for medical management of patient cases, which is the issue that adverse events hinge on. The result has been confusion about what constitutes an “adverse event”.

Without consideration of the medical management of a particular case, which can only be determined with physician review and adjudication, events that appear in administrative data, such as readmissions, emergency department (ED) visits, and mortality are indistinguishable from “adverse events” as defined by Brennan, et al. [4], Forster, et al. [6,14]. This is vital, as not all readmissions, ED visits, and deaths are due to poor medical management. In some cases, these events occur to patients who have had appropriate and exceptional care.

The methodology offered by Forster, et al. [6,14] and Brennan, et al. [4] is integral to understanding the role of patient safety for postdischarge adverse events. This consists of a two-stage sampling process: A chart review of patient records combined with an adjudication or assessment to determine what characteristics were influential in the adverse event. The methods employed by Forster, et al. [6,14] improved upon those used by Brennan, et al. [4] in the Harvard Medical Practice Study (HMPS). While the studies undertaken by Forster, et al. established the importance of the postdischarge period for patient safety Brennan, et al.’s., HMPS [4] provided the methodological standard by which adverse events should be considered.

The two-stage process offered by Forster, et al. [6,14] and Brennan and colleagues [4] represent the most rigorous methodology for examining the adverse patient outcomes from a quality of care perspective. Their method of collecting primary data on new or worsening symptoms through patient interviews combined with medical record reviews and adjudications by physician reviewers identifies the instances when death, ED visits, adverse drug reactions, and readmissions were due to medical management. Unfortunately, these studies are often restricted (due to logistical and funding constraints) to sample sizes below the threshold needed to support analysis of socio-demographic differences in patient risk of adverse events [15,16]. Moreover, publication biases towards significant results documented by some [17-19] may result in these results not being emphasized or discussed at length.

Forster’s approach departed from previous attempts at estimating adverse events by stipulating that not all negative events following a hospitalization were due to negligence, poor management of patients, and miscommunication among healthcare professionals. In defining postdischarge adverse events as “injuries caused by medical management, rather than by the underlying disease or condition of the patient”, Forster and colleagues changed the standard of how adverse events were considered. By acknowledging that “medical management” had to be an integral component of the definition of adverse events, it is possible to locate within the patient case file the factors that may be associated with poor patient outcomes.

**Materials and Methods**

In this article we examine the socio-demographic predictors from patient safety studies to determine whether there is increased risk of adverse events after discharge in certain patient populations. We began...
We identified 2211 articles in our initial search of the PubMed database, of which 296 were included for full review (see Figure 1). Hand searches of reference lists of other relevant articles produced an additional 135 articles for full review. After excluding 320 articles that did meet inclusion criteria or for being duplicates, 111 were ultimately included in our review.

**Results**

**Age**

Despite its ease of collection and interpretation, the patient safety literature has not universally documented the relationship between age and risk of postdischarge adverse events. Some studies demonstrated no statistically significant differences in patient age and risk of adverse events [6, 21]. There may be a reason to exercise caution in the interpretation of the lack of age effects suggested by these studies. The non-relationships reported by Forster, et al. and Gandhi, et al. [6, 21] may be an artifact of their analyses being underpowered. Because their articles represented a time and resource heavy methodology that improved upon prior patient safety research (many of which relied on analyses of administrative data), their studies included fewer participants. This may have precluded them from establishing statistical power for analyses on age on other socio-demographic characteristics.

Other research has identified a positive relationship between age and likelihood of postdischarge adverse events, particularly adverse drug reactions, increased healthcare utilization, and mortality [4, 14, 22-29]. In considering age, it is important to note that much of the excess risk for older patients is related to medication use.

Several studies found that elderly patients have a higher risk for ADEs than younger patients [26, 30-34].

**Figure 1:** Collected, excluded and included citations.
Increased vulnerability of the elderly for adverse drug events has been documented widely as a cause for concern; with several studies urging caution in prescribing for elderly patients [35-46]. Comparing patients older than 30 years of age to those younger than 30, Benkirane, et al. [8] found that the former had a lower risk for ADEs than the latter. One in six hospital admissions among older adults were due to an adverse drug event, many of which were common and preventable [24,47].

Some studies on health care utilization as an outcome have reported conflicting results. Iezzoni, et al. [48] found increased odds of older patients developing medical complications, which require increased healthcare utilization. Other research has shown that elderly patients were more likely to require an emergency department visit or readmission after discharge [29,49-58].

Findings are inconsistent, as other research has documented no such association [59,60] or that younger patients the greater risk of adverse events. This was the case for Ryvicker, et al. [61], who identified less risk of 60-day readmission for older patients than for younger ones, using the Care Transition Measure algorithm.

Several studies examined the relationship between age and mortality as an adverse event. Consistently, these studies demonstrated positive associations between age and death following discharge from the hospital [52,62-64]. The reasons for the excess mortality of older patients following discharge are unknown. It is possible that this relationship reflects the increased vulnerability with age that is demonstrated universally in population studies.

The influence of age on postdischarge adverse events might have been understood in the context of the physiological alterations caused by aging that affect the therapy options available to physicians [65-67]. It may be that older age influences sensitivity to alterations in homeostasis caused by medical care, where older patients may be more greatly affected by changes in diet and sleep routine that occur during hospitalization. This would make them particularly vulnerable during the postdischarge period. Others have suggested that the increased risk of adverse events for this population is related to rates of noncompliance with discharge instructions for medications or diet, inadequate patient education and discharge planning, as well as poor social support [68].

Sex

The results on the influence of gender for adverse events have been inconsistent. Several patient safety studies documented no relationship between sex and risk of postdischarge adverse events [4,6,21,33,69]. With the exception of Brennan, et al. [4] and Bates, et al. [33], the majority of these studies utilized relatively small samples; comprising fewer than 700 participants and finding no statistical association between sex and risk of adverse events. However, as Freiman, et al. [70] cautioned, not detecting a relationship isn’t the equivalent of detecting no relationship; some studies may simply be underpowered and not reliable for reporting on the impact of gender. We assert that the greater number of participants utilized by Brennan, et al. [4] and Bates, et al. [33], n = 7743 and 2019, respectively, provides ample evidence that at least some portion of the medical literature found no statistical no association between gender and likelihood to experience an adverse event.

Studies utilizing patient populations outside the US found some gender differences in AES. Davis, et al. [22] found that 36% of AEs for women and 38.5% of AES for men scored a four or higher in a 10-question item on preventability in a retrospective review of 6579 randomly sampled records from generalist admissions in Australia in 1998. In two other studies, Jarvinen, et al. [64] and Benkirane, et al. [71] found a higher risk of ADEs for women. However, Trifiro, et al. [32] found no such association.

For adverse events associated with health service utilization, conclusions about the role of gender were mixed. Some have suggested no gender-related excess risk of increased health service utilization, ED visits, or readmissions following discharge [59,60,72]. Others, however, documented gender differences in health service utilization.

Women were less likely than men to complete follow-up appointments after discharge [73], which may increase their risk of experiencing a postdischarge adverse event when compared to men. Budnitz, et al. [26] found that women were more likely than men to have ED visits for ADEs. Men and women seem to differ in their lengths of stay, where Philbin, et al. [74] determined that women stayed in hospital 9.8 days, compared to 9.2 days for men. Further, Babyan, et al. [75] found higher readmission rates for patients with ischemic heart failure in women, but not for men.

Conversely, other research has reported excess risk of higher rates of healthcare utilization for men than for women. Boul, et al. [51] and Krumholz, et al. [76] found that men were more likely to be readmitted following discharge than women. This was confirmed by Silverstein, et al. [58], who determined men had higher risk of readmission within 30 days of index hospitalization.

Regarding mortality, Philbin, et al. [77] suggested that female congestive heart failure patients (CHF) were less likely to die following discharge than male patients. This was confirmed later by Salaszar, et al. [62] who documented lower odds of mortality for female patients than for male patients.

Race/Ethnicity

The results on the influence of race and ethnicity on
adverse events have been inconsistent. Several patient safety studies documented no relationship between sex and risk of postdischarge adverse events [4,6,21,69]. This was the case for adverse drug events, where Bates, et al. [33], found no substantial contribution of race or ethnicity for explaining risk of ADEs.

Certain racial and ethnic differences have been identified in health service utilization. Pines, et al. [72] found that African-American and white patients had similar odds of having a re-admission, but Krumholz, et al. [76] suggested it was whites who had the excess odds of being readmitted, compared to non-whites. Kind, et al. [54] found that African-American patients were more likely to experience one or more complicated transitions and return to the emergency department when compared to white patients. This was reflected in later studies by Silverstein, et al. [58] and Philbin, et al. [77], the latter of which found blacks had higher odds of readmission following discharge than whites. Philbin and colleagues [77] also documented longer lengths of stays for blacks and whites, suggesting that blacks tended to return to the hospital after whites and were likely sicker and in worse health, which would require longer stays in hospital. Studies published by Friedman, et al. and Kassin, et al. [59,60] failed to find significant increased risk of readmission on the basis of race.

Regarding mortality, some studies have documented a higher risk of 30-day postdischarge mortality for African-Americans [78] and higher odds of complications for whites [48]. Others however, came to different conclusions, finding that blacks had lower rates of mortality in the postdischarge period [74].

**Socioeconomic Status (SES)**

Lower SES has been consistently related to increased healthcare utilization in several studies. Both Weissman, et al. and Marcantonio, et al. [79,80] documented increased risk of hospital readmission for individuals with lower SES. Others studies documented higher odds of early readmission for less educated and low income patients [49,56,81]. Among heart failure patients in New York, Philbin, et al. [82] found that low income was a positive predictor for readmission. Coleman, et al. [83] found that patients with higher SES were more likely to experience uncomplicated transitions of care, moving from higher to lower intensity care. This is in contrast to their lower SES peers, where patients experienced complicated transitions, moving from lower to higher intensity care.

Socioeconomic status may be causally related to healthcare utilization. In considering education as a proxy for SES, less educated individuals have less understanding of postdischarge instructions, which may place them at greater risk of hospital readmission and additional ED visits. This was documented by Davis, et al. [84], who investigated the role of patient understanding and prescription label instructions. They found that patients with low levels of literacy were more likely to misinterpret medication instructions. The implications for this are stark; the IOM cited poor patient comprehension and subsequent medication misuse as integral in medication errors and other negative health outcomes (2006) [85].

In terms of mortality risk, findings have been consistent. Long-term mortality risk was shown to be higher for low SES patients compared to higher SES patients by as much as 1-7.5 years after discharge [86,87]. This suggests that there are real consequences for social inequality on patient safety.

**Family social support**

Findings on the influence of social support on post-discharge adverse events are mixed. Gall and Bull [88] found that 30% of patients discharged from hospitals would have been unable to take care of themselves once home. Preyde and Chapman [89] found that elderly patients faced a number of challenges upon discharge, including difficulty with personal and household activities. In this vulnerable state, social support from friends, family, and neighbors ensures that patients adhere to postdischarge instructions and care. Some studies have shown that lacking this kind of support increases the odds of return visits to the ED and readmissions increased health service utilization [51,81,90,91].

However, other research has shown that some social support actually increases the risk of readmission. For example, in their 2010 study, Hasan and colleagues documented excess readmissions for married patients, compared to those who were not married (2010) [92]. What this may suggest is that social support has multidimensional effects on the health of recently discharged hospital patients.

Krumholz [93] suggested that many patients suffer from a transient condition called “post-hospital syndrome”, which is a state of acquired, continued vulnerability extending into the postdischarge period. This condition afflicts patients who have been subject to disruptions in their normal sleep, food, and medication routines. Social support may be an important component of recovery for recently discharged patients who arrive home suffering from post-hospital syndrome as well as the lasting effects of what caused their hospitalization in the first place.

Spouses become advocates when their partners are not well. Patients with adequate social support may be more likely to seek out increased healthcare utilization because they are urged to do so by their advocates. If this were true, one would expect rebound rises in readmission rates after 30 days, which Hasan, et al. [92] did not find. It may be that the benefits of social support for patients in the postdischarge period is its influence on components of mental health, like self-efficacy may have a strong influence in the health and recovery of patients in the postdischarge period.
It is possible social support is not as important for postdischarge adverse events as functional ability. There is a well-established relationship between self-management skills/abilities and outcomes such as healthcare utilization [94], and mortality [95]. Much of this research suggests that individuals with functional decline, unmet functional need, cognitive impairment, and deficits in self-management skills tend to experience higher levels of disability and healthcare utilization [49,52,81,90,96].

It is possible that social support is merely an indicator of functional status whereby patients with greater independence and functional ability require less social support and vice versa. These two considerations of the role of social support for risk of postdischarge adverse events may explain why some studies demonstrate positive effects and others negative effects. However, other than increased risk of postdischarge health care utilization, there is a lack of direct evidence for the impact of lack of social supports on postdischarge adverse events. Therefore, it is impossible to know the true relationship between social support and postdischarge adverse events.

Mental health

Relatively few studies have investigated the influence of mental health on risk of adverse events. One reason for this is the multi-dimensional impact that poor mental health has on physical health, primarily through behavior and lifestyle factors. An important component of patient safety; health seeking behavior, is influenced by mental health. This requires patients be aware of changes in their physical health, in order to report to physicians that they are experiencing problems they are experiencing after discharge from the hospital. Robson, et al. [97] suggested that serious mental illness impacts patient health and likelihood of readmission through help-seeking behavior. Others, such as Jeste, et al. [98] noted that patients with some types of mental illness are less likely to report physical symptoms they experience. Other symptoms of serious mental illness like schizophrenia have symptoms that mask the symptoms of medical mismanagement like pain, which can indicate an adverse event such as a medication error [99]. For example, cognitive impairments due to medication might be indistinguishable from those impairments that occur naturally in patients with schizophrenia [100].

Other studies such as Drake, et al. [101] and Sullivan, et al. [102], focused on the influence of mental illness and substance abuse on healthcare utilization, finding substance abuse to be an independent risk factor for rehospitalization. Yellowlees [103] suggested that the needs for caring for these types of patients may exceed capabilities of the healthcare system and that appropriate targeted resources and assertive, continuous case management would be key to reducing readmissions among this population.

More recently, Davydow, et al. [104] investigated neuropsychiatric disorders and potentially preventable hospitalizations, finding that patients with depression, cognitive impairments without dementia, and dementia were independently associated with potentially preventable hospitalizations in older Americans. This expanded previous research by Burke, Donze, and Schnipper (2013), who found that patients who were prescribed anxiolytics (drugs that inhibit anxiety) and those prescribed two or more outpatient psychiatric medications had increased odds of all-cause readmission. Individuals with depression and substance abuse diagnoses were less likely to be readmitted following discharge.

Comorbidities

Findings on the influence of poor chronic health related to adverse events were also inconclusive. Using Charlson morbidity index scores, Forster, et al. [6] found that patients with poorer chronic health, as measured by more comorbidities did not have a higher risk of experiencing a postdischarge adverse event. Similar conclusions were reached by van Walraven, et al. [105], who used the Charlson scores in conjunction with other indicators to index probability to predict early death or readmission after discharge. More recently, Donze, et al. [106,107], found that while comorbidity rates did not predict early readmission, certain health conditions were related to potentially avoidable readmission, including cancer, heart failure, and chronic renal failure.

Others, however, have documented the influence of poor overall health on risk of adverse events, finding that less healthy patients had increased odds of adverse outcomes such as higher mortality and more health care utilization, including complicated transitions, readmissions, and frequent emergency department visits [54,62,72,76,108]. We conclude that there is much that is still unknown about the relationship between comorbidities and risk of adverse events, since patient safety literature is inconsistent.

Conclusion

From a socio-demographic perspective, much is unknown about the characteristics of patients who experience postdischarge adverse events. Considering the four main types of patient safety indicators (adverse events, adverse drug events, increased healthcare utilization, and mortality), we have documented inconsistent and conflicting results across most characteristics we examined (see Table 1). Findings for postdischarge mortality reflect what is known about the health of various demographic groups, such as higher mortality rates among the elderly, males, those with greater morbidity, and likely African Americans and those of lower SES. We find the most consistent results were those for SES, where we found that higher SES was associated with lower risk less healthcare utilization and lower mortality.
However, as previously noted, much of the patient safety research is not adequately powered to support statistical analysis of the socio-demographic characteristics of patients who experience postdischarge adverse events. We contend that this presents missed opportunities to decrease postdischarge adverse events through greater understanding of the risks that increase patient vulnerabilities to such events. Understanding socio-demographic groups at greatest risk of poor patient safety outcomes, will allow the patient safety community to begin quantifying the variables that predict response to interventions meant to reduce postdischarge adverse events.

We assert that there are two main ways to improve the state of research on socio-demographic characteristics of patients who experience postdischarge adverse events. The first is by increasing study populations in primary data collection efforts. As we have noted previously, the threshold for establishing causal associations among sociodemographic variables and medical characteristics is quite high. We contend that researchers using an interdisciplinary approach to the problem of patient safety are likely to adequately power their studies in order to determine the effect that sociodemographic characteristics have on postdischarge adverse events.

Our second suggestion involves the continued utilization of administrative and patient data to develop sophisticated algorithms for detecting trends and patterns in patient outcomes. Obviously, such endeavors should utilize sociodemographic data to determine whether re-admissions, ED visits, adverse drug events, and deaths are related to poor patient safety. Analyses using these data would allow for the creation of “profiles of risk” that index patients in terms of vulnerabilities they represent following discharge from the hospital.

The first of these may not feasible for many investigators doing patient safety research. This is due to the high cost of conducting primary research with participant interview and chart review by expert adjudicators. The latter requires more consistent risk estimates based findings from adequately powered patient safety studies.

Until these are more widely available, it may be necessary to take a “big data” approach to this problem, combining multiple datasets across various realms in patients’ lives. Innovative analytical solutions to this problem may require not only the medical and medication related data already available from large healthcare systems, but also that which may be gleaned from other data sources.

As noted previously, many of the studies that rigorously defined postdischarge adverse events were small in terms of study populations, and may have been not powered adequately to demonstrate significantly statistical differences among various demographic groups. Additionally, this review is limited by the wide range of variable definitions across studies. We found that definitions of exposure variables and outcomes differed greatly, precluding the use of meta-analysis to summarize the findings. Chaudhry, et al. [63] noted great difficulty in considering definitions of errors suggesting that the lack of consensus regarding definitions of “error”, “adverse event”, and “near miss” made direct comparisons of their rate of errors with those in other studies difficult. Standardized definitions and operationalization of key variables would assist in such future endeavors.

### References


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<th>Table 1: Summary of findings from literature review.</th>
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Consistent: Most or all studies show a relationship in the same direction between that variable and outcome
+ : Positive relationship between variable and outcome (e.g., greater age and higher ADE risk)
- : Negative relationship between variable and outcome (e.g., lower SES and higher health care utilization)
M: Higher risk (e.g., mortality) among males
AA: Higher risk (e.g., mortality) among African Americans
Inconsistent: Some studies show relationship in one direction, others show no relationship
Conflicting: Some studies show relationship in one direction, others show relationship in opposite direction
NA: No studies available for that variable-outcome relationship


