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Racial/ethnic disparities in disability outcomes among post-acute home care patients

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Abstract

Objectives—To examine activities of daily living (ADL) disability outcomes among racially/ethnically diverse elders receiving home care (HC) after hospitalization.

Methods—We conducted a retrospective cohort analysis of single-agency, 2013–2014 Outcome and Assessment Information Set data from older adults who received post-hospitalization HC (n=20,674). We measured overall change in ADL disability by summing the difference of standardized admission and discharge scores from nine individual ADL. Associations between race/ethnicity and overall ADL change scores were modeled using general linear regression, adjusting for covariates consistent with the Disablement Model.

Results—Overall, patients experienced improvement in ADL disability from HC admission to discharge. However, Asian, African-American, and Hispanic patients experienced significantly less improvement compared to non-Hispanic Whites (all $p < .001$), even after controlling for covariates.

Discussion—Racial/ethnic disparities exist in ADL disability improvement among HC patients. Research is needed to clarify mechanisms underlying these disparities. Disablement Model factors may be targets for clinical intervention.

Keywords

Home health care; disability; health disparities; post-acute care

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Conflict of Interest:

The authors declare that there is no conflict of interest.

INTRODUCTION

In 2013, approximately 21% of adults age 65 and older were from racial or ethnic minorities (Administration on Aging, 2014). This percentage is expected to climb to almost 29% by 2030 (Administration on Aging, 2014). Disparities between racial/ethnic groups in the prevalence and outcomes of chronic illnesses are well-documented in the general older adult population (Centers for Disease Control and Prevention, 2014; Centers for Medicare and Medicaid Services, 2012). However, health disparities in the home care (HC) setting have been inadequately researched despite almost 17% of HC patients being from a racial/ethnic minority (Alliance for Home Health Quality and Innovation, 2013).

In particular, very little literature exists examining disparities in disability outcomes among racially/ethnically diverse older adults receiving HC after hospitalization. Activities of daily living (ADL) disability, defined as difficulty in independently performing ADL, is an important patient-centered outcome associated with increased risk of 30-day all-cause hospital readmission (Greysen, Stijacic Cenzer, Auerbach, & Covinsky, 2015) and mortality (Matzen, Jepsen, Ryg, & Masud, 2012). Chronically ill older adults are especially susceptible to worsening ADL disability during episodes of hospitalization (Anderson, 2010; Boyd et al., 2008, 2009; Boyd, Xue, Guralnik, & Fried, 2005). Furthermore, poor recovery of ADL performance in the month after hospital discharge predicts worsening ADL disability and death in the following year (Boyd et al., 2008). The HC service period is an opportunity to employ post-acute interventions to optimize physical functioning (Cook et al., 2013). However, we must first identify and understand racial/ethnic disparities in ADL disability outcomes to inform and tailor such interventions.

Theoretical Framework and Existing Literature

The Disablement Model initially proposed by Nagi (1991) and refined by Verbrugge and Jette (1994), describes factors associated with disability progression, and could be used to examine ADL disability disparities among racially/ethnically diverse older HC patients. The Model suggests pathology related to chronic illness leads to impairments in specific body systems. Impairments contribute to functional limitations affecting an individual's ability to complete discrete tasks. Disability occurs when functional limitations significantly impact an individual's capacity to interact with their environment (Verbrugge & Jette, 1994). For example, knee osteoarthritis (pathology) could result in knee pain with movement (impairment), affecting an individual's ability to get up from a chair or bed or walk distances (functional limitation), and ultimately her ability to independently transfer out of a bed or chair, and ambulate at home (disability).

Disability progression is moderated by *risk factors*, *intra-individual factors*, and *extra-individual factors* (Nagi, 1991; Verbrugge & Jette, 1994). *Risk factors* include sociodemographic characteristics, such as older age (Barnes et al., 2013; Gill, Gahbauer, Murphy, Han, & Allore, 2012), socioeconomic disadvantage (Fuller-Thomson et al., 2009; Gjonça, Tabassum, & Breeze, 2009), and race/ethnicity (Brega, Goodrich, Powell, & Grigsby, 2005; Graham, Chang, Bergés, Granger, & Ottenbacher, 2008; Peng, Navaie-Waliser, & Feldman, 2003). Socioeconomic disadvantage is common among patients who are dually-eligible for Medicare and Medicaid, and these patients are more vulnerable to

poor clinical outcomes (Allen, Piette, & Mor, 2014). A small body of literature has also identified racial/ethnic disparities in ADL disability after hospitalization among older adults. For example, Graham and colleagues (2008) found that, among patients who received inpatient rehabilitation for hip or femur fracture, Hispanics and non-Hispanic Blacks had significantly lower functional scores at three- and six-month follow-ups post-discharge compared to non-Hispanic Whites.

In the Disablement Model, potentially modifiable *intra-* and *extra-individual factors* also moderate disability progression (Nagi, 1991; Verbrugge & Jette, 1994). *Intra-individual factors* encompass person-level characteristics, such as health behaviors (e.g., physical activity) or psychosocial attributes (e.g., coping). *Extra-individual factors* include external supportive or environmental conditions, such as living arrangements, medical and rehabilitative care, and caregiver support. For example, evidence suggests caregiver support in the HC setting differs by race/ethnicity, with Asian and Hispanic patients reporting the most support, and is associated with worse ADL disability outcomes (Peng et al., 2003). These modifiable factors could be targets for individual-, community-, or system-level interventions to not only attenuate disability progression, but also to reduce disparities in disability outcomes in HC.

The scant research examining the relationship between ADL disability and race/ethnicity in the HC setting has been mixed. Peng and colleagues (2003) found no difference in stability and improvement in ADL disability from HC admission to discharge across racial/ethnic groups. However, another study found disparities in improvement of ADL disability impacting only African-American HC patients (Brega et al., 2005). These studies had methodological limitations warranting additional research to identify and describe ADL disability disparities in HC. For example, neither study disaggregated samples by admission source (e.g., hospital, nursing home, community) despite evidence that older adults discharged from the hospital with new or increased ADL disability experience poorer prognoses and higher rates of death and disability (Boyd et al., 2008). Additionally, prior studies have not utilized a disablement framework to guide variable selection and analyses; therefore, the understanding of evidence-based factors associated with ADL disability in the HC setting remains limited.

The purpose of this study was to describe overall change in ADL disability in a sample of racially/ethnically diverse older adults receiving HC after hospitalization. We used single-agency clinical and administrative data to identify differences in ADL disability outcomes among older adults receiving HC after hospitalization. We hypothesized that non-Hispanic whites would experience greater improvements in ADL disability on HC discharge compared to other racial/ethnic minority groups, after accounting for diverse factors consistent with the Disablement Model (Nagi, 1991; Verbrugge & Jette, 1994).

METHODS

Study Setting and Data Sources

This retrospective cohort study examined the electronic medical records of adult patients served by a large nonprofit certified home healthcare agency in New York City between

2013 and 2014. Eligible patients included those who were 65 years or older and received skilled HC services immediately following hospitalization. These criteria yielded a study population of 28,052 patients. Patients were excluded from the analytic sample if they were discharged from HC to the hospital or another institutional setting ($n=3,098$), independent in ADL at the start of HC ($n=2,574$), or missing information about race/ethnicity ($n=155$) or other covariates ($n=1551$). Our final analytic sample included 20,674 patients. Patient data were obtained from administrative records, medication records, and the Outcome and Assessment Information Set, version C (OASIS)—a comprehensive assessment instrument used by clinicians to gather information about patients' demographic, clinical, and functional characteristics during the sixty-day episodes of care provided under the Medicare Prospective Payment System (Centers for Medicare and Medicaid Services, Baltimore, & USA, 2012). Prior research has established the validity and interrater reliability of OASIS items, including those measuring ADL functioning (Hittle et al., 2003; O'Connor & Davitt, 2012; Tullai-McGuinness, Madigan, & Fortinsky, 2009). The Institutional Review Boards at the Visiting Nurse Service of New York, University of Pennsylvania, and University of Missouri approved all study procedures.

Measures

Outcome Variable—We used a standardization method employed in past HC research to create the outcome variable: overall change in ADL disability from admission to discharge from HC (Brega et al., 2005; Peng et al., 2003; Scharpf & Madigan, 2010). ADL performance was measured using nine OASIS items that assessed patients' ability to perform the following activities: ambulation/locomotion, bathing, dressing upper body, dressing lower body, eating, grooming, toileting/hygiene, toilet transferring, and transferring. Each ADL item is scored on an ordinal scale where lower scores indicate less disability. Scale ranges vary across individual ADL (e.g., ambulation 0–6, grooming 0–3, transferring 0–5), however. Given the heterogeneity of scales for each ADL item, item responses were standardized by dividing the patient's score by the highest possible response, so that every item was scored on a scale from 0 to 1, and lower standardized scores indicated better ADL performance (Brega et al., 2005; Peng et al., 2003; Scharpf & Madigan, 2010). To measure change in individual ADL disability from admission to discharge from HC, we used the following formula where the individual ADL change score equals standardized admission ADL score minus standardized discharge ADL score. Individual ADL change scores were then summed to provide an overall change in ADL disability score. *Higher overall scores indicated greater improvement in ADL disability from admission to discharge.*

Explanatory Variables within Disablement Model—The primary independent variable, race/ethnicity, was represented by four categories: Asian ($n=1,505$), Black/African American ($n=3,337$), Hispanic/Latino ($n=3,132$), and non-Hispanic white ($n=12,700$). Hispanic patients were categorized as Hispanic regardless of their race. Due to small sample sizes, American Indian and Native Hawaiian patients were omitted.

Table 1 contains operational definitions for Disablement Model factors. *Risk factors* included gender and age. We did not have access to individual indicators of socioeconomic disadvantage; however, similar to past research in HC (Brega et al., 2005), we used

Medicaid status as a proxy. *Intra-individual factors* included number of behavioral risk factors (e.g., smoking, obesity, alcohol/drug dependency) listed on the OASIS. *Extra-individual factors* included caregiver availability for ADL assistance and frequency of caregiver assistance, total number of prescribed medications listed in patients' medication record, and living arrangements (living alone, living with others). We also calculated the mean number of therapy visits by first creating a variable for the total number of physical, occupational, and speech therapy visits received, then averaging the number of therapy visits for each race/ethnicity. Number of therapy visits was not included in the final multivariable model because we viewed it as endogenous. Although this variable would influence our dependent variable, therapy visits were likely affected by independent variables in our model, such as chronic conditions and prior function, as well as the level of ADL disability at the start of care. *Pathology* variables were clinical characteristics of patients such as total number of chronic conditions (Murtaugh et al., 2009) and prognosis (no risk, temporary risk, or high risk). *Impairment* variables included vision and hearing impairment, the presence of a surgical wound, and urinary and bowel incontinence. *Functional Limitation* variables included having pain interfering with normal activities, shortness of breath with exertion, cognitive impairment, confusion, anxiety, positive screen for depression, and total number of cognitive/behavioral/psychiatric symptoms. Prior *disability* was defined as prior function. Data from the OASIS was used to construct an ordinal variable representing level of independence in self-care, ambulation, transferring, and performance of household tasks prior to the current hospitalization and HC episode. Higher values indicate poorer prior function.

Statistical analysis

Mean and standard deviation (overall and by race/ethnicity) for continuous variables including age, total number of prescribed medications, and total number of chronic conditions were calculated. Frequency and proportion (overall and by race/ethnicity) for categorical variables including gender, Medicaid status, caregiver assistance, frequency of caregiver assistance, living arrangement, overall health risk status, number of behavior risk factors, prognosis, vision impairment, hearing impairment, urinary incontinence, bowel incontinence, surgical wound existence, cognitive impairment, confusion, anxiety, depression, cognitive/behavioral/psychiatric symptoms, pain interfering with activity, shortness of breath, and prior function were calculated.

Multivariable ordinary least squares linear modeling was used to regress overall change in ADL scores, on race/ethnic groups, while adjusting for explanatory variables within the Disablement Model (Nagi, 1991; Verbrugge & Jette, 1994). Model diagnostics included collinearity test for covariates and residual diagnostics. All covariates had variance inflation factors less than 4 (most of them were less than 2), indicating no evidence for multicollinearity. Residual plots showed a fairly random and symmetric pattern and most studentized residuals were within three standard deviations, indicating that the linear regression model is appropriate for the data. All analyses were performed using SAS 9.3 (SAS Institute, Inc., Cary, NC).

RESULTS

Characteristics of Study Population

Table 2 presents sample characteristics. The sample was predominantly female (62%) and the sample mean age was 79 ($SD \pm 8.61$). Sixty-one percent of the sample was non-Hispanic white, 16% were African-American, 15% were Hispanic, and 7% were Asian. A majority of the HC patients (64%) lived with others in their household; however, larger proportions of African-American (39%) and Hispanic (38%) patients lived alone compared to non-Hispanic Whites (37%) and Asians (24%). Most patients had a caregiver (78%), and about 81% of patients reported that a caregiver assisted with ADL at least daily. Eight percent of the sample had Medicaid, with non-Hispanic Whites having the smallest proportion (3%) compared to Asians (27%), Hispanics (21%) and African-American (10%). Seventeen percent of the sample had vision impairment, and 22% had a hearing impairment. Only about 19% of the sample were completely independent in ADL prior to hospitalization. Patients were reported as having symptoms of pain interfering with activity or movement (75%), shortness of breath with any exertion (49%), urinary incontinence (41%), and bowel incontinence (13%). Forty-five percent of patients had confusion; 28% had depression symptoms and 30% had anxiety symptoms. Thirty-one percent of patients were cognitively impaired. Compared to non-Hispanic White patients, racial/ethnic minority patients in our sample tended to have a greater number of chronic conditions, poorer prognosis, and a higher prevalence of sensory impairment, incontinence, pain, and shortness of breath. Overall, patients improved in ADL disability from admission to discharge from HC (change score mean 1.97, $SD \pm 1.42$). Several characteristics measured from the Disablement Model differed significantly between race/ethnic groups (Table 2).

Racial/Ethnic Disparities in ADL Disability

Table 3 presents results from the multivariable model. These results suggest that non-Hispanic whites experienced greater overall improvement in ADL disability compared to Asians ($b = -0.31$, $p < .001$), African-Americans ($b = -0.21$, $p < .001$), and Hispanics ($b = -0.24$, $p < .001$), after accounting for covariates. As a possible explanation for our findings, we examined mean number of therapy visits across race/ethnicities. In our patient sample, the mean number of therapy visits was significantly different by race/ethnicity, with Non-Hispanic Whites having the most visits on average (9.81, $SD \pm 7.98$) compared to Asians (8.71, $SD \pm 7.12$), African-Americans (8.74, $SD \pm 6.75$), and Hispanics (8.67, $SD \pm 6.37$).

Disablement Model Factors

Several Disablement Model factors were associated with overall change in ADL disability in this sample (Table 3). Older age ($b = -0.01$; $p < .001$) and Medicaid status were associated with less improvement in ADL disability ($b = -0.25$, $p < .001$). Among extra-individual factors, caregiver assistance for ADL was associated with less improvement ($b = -0.15$; $p < .001$). However, patients who had reported daily caregiver assistance with ADL or instrumental ADL had greater improvements in ADL disability ($b = 0.12$; $p = .004$). Living alone was also significantly associated with greater ADL improvement ($b = 0.04$; $p = .034$).

Patients' clinical status was associated with ADL disability. For example, having more chronic conditions was associated with less improvement in ADL disability ($b=-0.10$; $p<.01$). In contrast, patients who were stable and considered to have no risk for serious complications had greater improvement in ADL disability compared to patients who were seen as high risk ($b=0.08$; $p=.033$). Under impairment factors, having a surgical wound ($b=0.48$; $p<.001$) or having a vision impairment ($b=0.06$; $p=.033$) was significantly and positively associated with improvement in ADL disability. Some functional limitation factors were associated with change in ADL disability. Pain associated with greater improvement in ADL disability ($b=0.06$; $p=.006$). Conversely, reporting no shortness of breath symptoms ($b=-0.24$; $p<.001$) or reporting shortness of breath only with heavy exertion (walking more than 20 feet, climbing stairs) ($b=-0.17$; $p<.001$) was associated with less improvement in ADL disability. Prior function was significantly associated with improvement in ADL disability. Patients who were completely independent ($b=0.36$; $p<.001$) or had fewer functional deficits prior to hospitalization ($b=0.17$; $p<.001$) experienced greater improvements in ADL disability at discharge from HC compared to patients with greater ADL performance deficits.

DISCUSSION

Our study advances the understanding of health disparities in the HC setting. Although patients in our study experienced an overall improvement in ADL disability, we observed significant racial/ethnic disparities in the extent of that improvement. For every point of increase in the standardized ADL disability score among non-Hispanic White patients, Asian patients would only experience a .69 increase, Hispanic patients a .76 increase and African-American patients a .79 increase, suggesting lower rates of ADL disability recovery among minority patients in our sample. Our findings differ somewhat from previous studies of diverse HC patients that found either no significant ADL disability disparities among racial/ethnic groups (Peng et al., 2003) or disparities only affecting one group (Brega et al., 2005). To capture a high-risk population (Boyd et al., 2008), we selected a sample of patients admitted to HC after hospitalization, rather than patients admitted from varied sources (Brega et al., 2005). Our findings highlight the post-acute period as a crucial juncture to address health disparities for multiple racial/ethnic groups. Additionally, In contrast to prior research that utilized a categorical variable of stability or improvement in ADL disability (Peng et al., 2003), we used a continuous measure. This methodology led to uncovering incremental differences in change in ADL disability across diverse groups from HC admission to discharge.

Skilled HC delivers supports and services critical to post-acute care recovery and the prevention of institutionalization (de Almeida Mello et al., 2016). We observed poorer clinical status among racial/ethnic minority patients in our sample compared to non-Hispanic White patients. However, some impairment and functional limitation factors indicating poorer clinical status, such as pain and surgical wounds, were associated with greater improvement in ADL disability, which may be an indication of the effectiveness of HC services to address pain and wound healing to position patients for better functioning. These findings are encouraging as they demonstrate the potential for ADL disability

recovery among racially/ethnically diverse, clinically complex HC patients if their post-acute care needs are met.

These post-acute care needs may include rehabilitative therapy services. In our sample, however, non-Hispanic Whites received the greatest number of rehabilitative therapy visits across all racial/ethnic groups. This observation aligns with past research documenting greater receipt of occupational and physical therapy in HC among non-Hispanic Whites compared to other race/ethnic groups (Peng et al., 2003). The rationale behind differences in therapy visits for our sample is unclear. Physical and occupational therapy are typically ordered based on clinical status at the start of care; however, prior functional status of minority patients was worse compared to non-Hispanic Whites in our sample. The differences in therapy visits may be an important contributor to disparities in ADL disability outcomes. Thus, further research is needed to explore the mechanisms of disparities in HC service utilization across racial/ethnic groups to ensure equitable delivery of quality care.

We identified additional Disablement Model factors that could serve as potential targets for intervention. Among extra-individual factors, living alone was associated with greater recovery of ADL performance. Older patients who were living alone may have had fewer functional dependencies prior to their hospitalization (Weissman & Russell, 2016). Interventions to preserve functional status and support independence at home could include nurse-led care coordination (Popejoy et al., 2015), function-focused care strategies (Resnick et al., 2009; Resnick et al., 2011), or home environment modifications (Szanton, Leff, Wolff, Roberts, & Gitlin, 2016). Future research could test the effects of the above interventions on reducing disparities in ADL disability outcomes among post-acute HC patients.

Caregiver variables, which are also extra-individual factors, were associated with ADL disability outcomes among HC patients. Consistent with prior research (Peng et al., 2003), patients in our sample who had caregivers experienced less improvement in ADL performance compared to patients without caregivers. It is possible that patients with caregivers assisting with ADL were more clinically complex and had poorer functional status. We also found that patients whose caregivers assisted at least daily with ADL had greater improvement in ADL disability. Taken together, these findings suggest that the mere presence of a caregiver is not enough to positively impact ADL disability among post-acute HC patients, but that the activities and frequency of caregiver assistance is what may lead to greater recovery from ADL disability. This finding may be especially critical to improving disparities in ADL disability outcomes in the post-acute HC setting since over 70% of all racial/ethnic minority groups in our sample reported the availability of an informal caregiver to assist with ADL. Clinicians in the HC and outpatient setting should engage and educate caregivers on strategies to support and encourage ADL performance in the post-acute setting (Resnick et al., 2009; Resnick et al., 2011), as well as connect caregivers with resources to facilitate their ability to provide needed assistance.

There are some important limitations of our study. Study data were obtained from a single HC agency in the northeast; thus, study findings may have limited generalizability. Additionally, we were not able to examine long-term outcomes past HC discharge in our data; therefore, we were unable to determine if ADL disability for this sample was

associated with more distal outcomes such as nursing home placement. We did not examine specific interactions between race/ethnicity and Disablement Model factors. Additional research is needed to examine the effects of potential interactions between race/ethnicity and key variables, such as gender and socioeconomic status, on ADL disability disparities.

We relied on data from past medical records for our analysis, which limited the identification of exact mechanisms contributing to ADL disability disparities in our sample. For example, we did not have access to detailed measures of intra-individual factors, such as physical activity or psychosocial factors, or other extra-individual factors, such as additional home and community-based resources that might affect ADL disability during the HC service period. Furthermore, our data did not include fully detailed descriptions of caregiver availability, willingness, ability, or activities. The absence of these data precluded us from identifying characteristics of daily caregiving tasks that might affect ADL disability outcomes. We also had limited social determinants of health variables. Medicaid status, has been used in past similar research (Brega et al., 2005) as a proxy of socioeconomic disadvantage; however, more direct indicators such as educational attainment (Louie & Ward, 2011; Thorpe et al., 2011), housing and neighborhood characteristics (Clarke & Gallagher, 2013; Samuel, Glass, Thorpe, Szanton, & Roth, 2015), and income (Zaninotto, Sacker, & Head, 2013) could provide greater insight into the contribution of socioeconomic disadvantage in disparities in ADL disability outcomes. Future research should incorporate more in-depth individual-, community-, and system-level variables, to include social determinants of health, which may impact health disparities across diverse race/ethnicities.

Although older adults receiving HC after hospitalization experience an overall improvement in ADL disability, racial/ethnic disparities exist in the magnitude of improvement. Additional research is needed to clarify mechanisms underlying these disparities. Our findings suggest clinicians in the HC and outpatient setting could employ interventions targeted towards caregiver training, management of clinical conditions, such as pain and wound care, and physical and occupational therapy to promote recovery of ADL performance.

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Table 1**Conceptual and Operational Definitions of Disablement Model Factors**

Variable	Type	Description (OASIS item)
Risk Factors		
Race	Categorical	Asian, Black or African American, Non-Hispanic White (M1040)
Ethnicity	Dichotomous	Hispanic/Latino (M1040)
Age	Continuous	From administrative data
Gender	Dichotomous	Male/Female (M069)
Socioeconomic disadvantage	Dichotomous	Medicaid status used as proxy for socioeconomic disadvantage (M1050)
Intra-individual Factors		
Behavioral risk factors	Categorical	Total number of behavioral risk factors (e.g., smoking, alcohol dependency, drug dependency, obesity) summed. Categories created for no behavioral risk factors; one behavioral risk factor; two or more behavioral risk factors (M1036)
Extra-individual Factors		
Caregiver ADL assistance	Dichotomous	Categorized as patient has a current caregiver to assist with ADL; or patient needs ADL assistance but does not have a caregiver to assist with ADL (M2100)
Frequency of assistance	Categorical	Categorized as daily; at least weekly; less often than weekly (M2110)
Total prescribed medications	Continuous	Total number of prescribed medications listed in administrative data
Living arrangements	Dichotomous	Categorized as patient lives alone, or with others (M1100)
Pathology		
Total chronic conditions	Continuous	Sum of all flagged diagnoses from the Chronic Conditions Warehouse found in administrative data (range 0–16)
Prognosis	Categorical	Patients were assessed for clinical stability based on the following categories: 0=no heightened risk; 1=temporarily facing high health risks but is likely to return to being stable without heightened risk for serious complications; 2=fragile health and ongoing high risk for serious complications and death; or 3=serious progressive conditions that could lead to death within a year. The original OASIS categories were collapsed into either no risk, temporary risk, or high risk (encompassing the categories 2 and 3) (M1034)
Impairment		
Vision impairment	Dichotomous	Yes/No for any vision impairment (M1200)
Hearing impairment	Dichotomous	Yes/No for any hearing impairment (M1210)
Has a surgical wound	Dichotomous	Yes/No for current surgical wound (M1340)
Urinary incontinence	Dichotomous	Yes/No for urinary incontinence or catheter (M1610)
Bowel incontinence	Dichotomous	Yes/No for bowel incontinence (M1620)
Functional Limitation		
Pain	Dichotomous	Yes/No for pain interfering with activity or movement (M1242)
Shortness of breath	Categorical	Categorized as no shortness of breath; shortness of breath with heavy exertion only; shortness of breath with mild-moderate exertion (M1400)
Cognitive impairment	Dichotomous	Yes/No for any cognitive impairment based on assessment of alertness, orientation, comprehension, concentration, and immediate memory of simple commands (M1700)
Confusion	Dichotomous	Yes/No for any reported/observed confusion symptoms within past 14 days (M1710)
Anxiety	Dichotomous	Yes/No for any reported or observed anxiety symptoms within the last 14 days (M1720)
Cognitive, behavioral, or psychiatric symptoms	Categorical	Categorized as no symptoms, one symptom, or 2 symptoms based on reported or observed symptoms (e.g., memory deficit impaired decision-making, physical aggression, verbal disruption, or delusional, hallucinatory, paranoid behavior) for at least 1 week (M1740)

Variable	Type	Description (OASIS item)
Disability		
Prior function	Ordinal	Assessment of patient's ability to perform self-care, ambulation, transfer, and household tasks prior to current hospitalization and home care episode. Activities are rated 0=independent, 1=needs assistance, 2=dependent. Ratings were summed and variable created where higher value equals poorer prior functional status (M1900)

Table 2

Sample Characteristics, $n=20,674$

Variable	All ($n=20674$)	By Race/Ethnicity*		
		Asian ($n=1505$)	African-American ($n=3337$)	Hispanic ($n=3132$)
				Non-Hispanic White ($n=12700$)
Risk Factors				
Age	79.44 (± 8.61)	80.03 (± 7.94)	78.47 (± 8.60)	79.07 (± 8.42)
Female gender	12897 (62.4%)	887 (58.9%)	2343 (70.2%)	2234 (71.3%)
Has Medicaid	1736 (8.4%)	412 (27.4%)	322 (9.7%)	641 (20.5%)
Intra-individual Factors				
Behavioral risk factors				
At least one	19854 (96.0%)	1470 (97.7%)	3204 (96.0%)	3020 (96.4%)
Two or more	267 (1.3%)	6 (0.4%)	67 (2.0%)	50 (1.6%)
Extra-individual Factors				
Caregiver ADL assistance	1126 (74.8%)	2526 (75.7%)	2303 (73.5%)	10069 (79.3%)
Frequency of assistance				
Daily	16788 (81.2%)	1290 (85.7%)	2643 (79.2%)	2515 (80.3%)
Weekly	2674 (12.9%)	144 (9.6%)	492 (14.7%)	447 (14.3%)
< than weekly	1212 (5.9%)	71 (4.7%)	202 (6.1%)	170 (5.4%)
Lives alone	7528 (36.4%)	365 (24.3%)	1311 (39.3%)	1204 (38.4%)
Prescribed RX	3.47 (± 4.02)	4.44 (± 4.50)	3.41 (± 3.99)	3.70 (± 4.18)
Pathology				
Chronic conditions	2.39 (± 1.29)	2.54 (± 1.20)	2.74 (± 1.23)	2.85 (± 1.28)
Prognosis				
No risk	2210 (10.7%)	121 (8.0%)	463 (13.9%)	319 (10.2%)
Temporary risk	15666 (75.8%)	1126 (74.8%)	2442 (73.2%)	2462 (78.6%)
High risk	2798 (13.5%)	258 (17.1%)	432 (13.0%)	351 (11.2%)
Impairment				

Variable	By Race/Ethnicity*				
	All (n=20674)	Asian (n=1505)	African-American (n=3337)	Hispanic (n=3132)	Non-Hispanic White (n=12700)
Vision impairment	3532 (17.1%)	321 (21.3%)	697 (20.9%)	662 (21.1%)	1852 (14.6%)
Hearing impairment	4543 (22.0%)	381 (25.3%)	518 (15.5%)	589 (18.8%)	3055 (24.1%)
Surgical wound	8530 (41.3%)	535 (35.6%)	914 (27.4%)	868 (27.7%)	6213 (48.9%)
Urinary incontinence	8546 (41.3%)	754 (50.1%)	1575 (47.2%)	1384 (44.2%)	4833 (38.1%)
Bowel incontinence	2704 (13.1%)	272 (18.1%)	495 (14.8%)	414 (13.2%)	1523 (12.0%)
Functional Limitation					
Pain	15470 (74.8%)	1211 (80.5%)	2307 (69.1%)	2189 (69.9%)	9763 (76.9%)
Shortness of breath					
None	10620 (51.4%)	669 (44.5%)	1676 (50.2%)	1437 (45.9%)	6838 (53.8%)
Heavy exertion	5402 (26.1%)	440 (29.2%)	913 (27.4%)	925 (29.5%)	3124 (24.6%)
Mild-moderate exertion	4652 (22.5%)	396 (26.3%)	748 (22.4%)	770 (24.6)	2738 (21.6)
Cognitive impairment	6430 (31.1%)	633 (42.1%)	1086 (32.5%)	1288 (41.1%)	3423 (27.0%)
Depression symptoms	5717 (27.7%)	398 (26.5%)	843 (25.3%)	994 (31.7%)	3482 (27.4%)
Confusion	9194 (44.5%)	844 (56.1%)	1672 (50.1%)	1744 (55.7%)	4934 (38.9%)
Anxiety	6283 (30.4%)	420 (27.9%)	850 (25.5%)	988 (31.6%)	4025 (31.7%)
Cognitive, behavioral, psychiatric symptoms					
No symptoms	18548 (89.7%)	1335 (88.7%)	2969 (89.0%)	2730 (87.2%)	11514 (90.7%)
1 symptom	1570 (7.6%)	119 (7.9%)	277 (8.3%)	291 (9.3%)	883 (7.0%)
2 symptoms	556 (2.7%)	51 (3.4%)	91 (2.7%)	111 (3.5%)	303 (2.4%)
Disability					
Prior function					
0 (best)	3900 (18.9%)	151 (10.0%)	381 (11.4%)	331 (10.6%)	3037 (23.9%)
1	2682 (13.0%)	136 (9.0%)	296 (8.9%)	223 (7.1%)	2027 (16.0%)
2	1540 (7.4%)	109 (7.2%)	242 (7.3%)	262 (8.4%)	927 (7.3%)
3	1661 (8.0%)	113 (7.5%)	303 (9.1%)	316 (10.1%)	929 (7.3%)
4 (poorest)	10891 (52.7%)	996 (66.2%)	2115 (63.4%)	2000 (63.9%)	5780 (45.5%)

Note: Data presented as mean ($\pm$ SD) or n (%). RX=medications.

*p-values from Chi-Square test for categorical variables or F-test for continuous variables were statistically significant for all variables.

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Table 3Full Multivariable Regression Model of ADL Disability, Race/Ethnicity, and Disablement Model Factors, $n=20,674$

Variable	b	SE	95% CILL	95% CI UL	p
Risk Factors					
Race (REF=non-Hispanic White)					
Asian	-0.31	0.04	-0.38	-0.23	<.001
African-American	-0.21	0.03	-0.26	-0.15	<.001
Hispanic	-0.24	0.03	-0.3	-0.19	<.001
Age	-0.01	0	-0.01	-0.01	<.001
Female (REF=Male)	0.01	0.02	-0.03	0.05	0.733
Has Medicaid	-0.25	0.04	-0.32	-0.18	<.001
Intra-individual Factors					
Behavioral risk factors (REF= 2)					
None	-0.01	0.1	-0.21	0.19	0.921
At least one	-0.08	0.08	-0.24	0.08	0.350
Extra-Individual Factors					
Caregiver ADL assistance	-0.15	0.02	-0.2	-0.1	<.001
Frequency of assistance (REF=<weekly)					
Daily	0.12	0.04	0.04	0.21	0.004
Weekly	0.01	0.05	-0.08	0.1	0.776
Lives alone	0.04	0.02	0	0.09	0.034
Prescribed RX	0	0	0	0	0.949
Pathology					
Chronic Conditions	-0.1	0.01	-0.11	-0.08	<.001
Prognosis (REF= high risk)					
No risk	0.08	0.04	0.01	0.16	0.033
Temporary risk	0.02	0.03	-0.03	0.08	0.440

Variable	b	SE	95% CI LL	95% CI UL	p
Impairment					
Vision impairment	0.06	0.03	0	0.11	0.033
Hearing impairment	0.03	0.03	-0.02	0.08	0.172
Surgical wound	0.48	0.02	0.44	0.52	<.001
Urinary incontinence	-0.01	0.02	-0.06	0.03	0.528
Bowel incontinence	-0.05	0.03	-0.11	0.01	0.083
Functional Limitation					
Pain	0.06	0.02	0.02	0.11	0.006
Shortness of breath (REF= mild-mod exertion)					
None	-0.24	0.02	-0.29	-0.19	<.001
With heavy exertion	-0.17	0.03	-0.22	-0.12	<.001
Cognitive impairment	-0.02	0.03	-0.07	0.04	0.591
Depression symptoms	0.01	0.02	-0.03	0.06	0.506
Confusion	0.01	0.03	-0.04	0.07	0.598
Anxiety	0.01	0.02	-0.04	0.05	0.780
Cognitive, behavioral, psychiatric symptoms (REF= 2 symptoms)					
No symptoms	0.1	0.06	-0.02	0.21	0.111
One symptom	0.04	0.07	-0.09	0.17	0.507
Disability					
Prior Function (REF=4, poorest prior function)					
0	0.36	0.03	0.30	0.41	<.001
1	0.17	0.03	0.11	0.23	<.001
2	-0.08	0.04	-0.16	-0.01	0.022
3	-0.14	0.04	-0.21	-0.07	<.001

Note. b=unstandardized regression coefficient; SE=standard error of the estimate 95% CI LL- lower limit; 95% CI UL - upper limit; RX=medications; REF=Reference categories; Reference categories for dichotomous variables were absence of the characteristic