JAMA Internal Medicine | Original Investigation

Association of Functional Status, Cognition, Social Support, and Geriatric Syndrome With Admission From the Emergency Department

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Invited Commentary page 793

Supplemental content

IMPORTANCE The role of patient-level factors that are unrelated to the specific clinical condition leading to an emergency department (ED) visit, such as functional status, cognitive status, social supports, and geriatric syndromes, in admission decisions is not well understood, partly because these data are not available in administrative databases.

OBJECTIVE To determine the extent to which patient-level factors are associated with rates of hospital admission from the ED.

DESIGN, SETTING, AND PARTICIPANTS This cohort study analyzed survey data collected from participants (or their proxies, such as family members) enrolled in the Health and Retirement Study (HRS) from January 1, 2000, to December 31, 2018. These HRS data were linked to Medicare fee-for-service claims data from January 1, 1999, to December 31, 2018. Information on functional status, cognitive status, social supports, and geriatric syndromes was obtained from the HRS data, whereas ED visits, subsequent hospital admission or ED discharge, and other claims-derived comorbidities and sociodemographic characteristics were obtained from Medicare data. Data were analyzed from September 2021 to April 2023.

MAIN OUTCOMES AND MEASURES The primary outcome measure was hospital admission after an ED visit. A baseline logistic regression model was estimated, with a binary indicator of admission as the dependent variable of interest. For each primary variable of interest derived from the HRS data, the model was reestimated, including the HRS variable of interest as an independent variable. For each of these models, the odds ratio (OR) and average marginal effect (AME) of changing the value of the variable of interest were calculated.

RESULTS A total of 42 392 ED visits by 11 783 unique patients were included. At the time of the ED visit, patients had a mean (SD) age of 77.4 (9.6) years, and visits were predominantly for female (25 719 visits [60.7%]) and White (32 148 visits [75.8%]) individuals. The overall percentage of patients admitted was 42.5%. After controlling for ED diagnosis and demographic characteristics, functional status, cognition status, and social supports all were associated with the likelihood of admission. For instance, difficulty performing 5 activities of daily living was associated with an 8.5–percentage point (OR, 1.47; 95% CI, 1.29-1.66) AME increase in the likelihood of admission. Having dementia was associated with an AME increase in the likelihood of admission of 4.6 percentage points (OR, 1.23; 95% CI, 1.14-1.33). Living with a spouse was associated with an AME decrease in the likelihood of admission of 3.9 percentage points (OR, 0.84; 95% CI, 0.79-0.89), and having children living within 10 miles was associated with an AME decrease in the likelihood of admission of 5.0 percentage points (OR, 0.80; 95% CI, 0.71-0.89). Other common geriatric syndromes, including trouble falling asleep, waking early, trouble with vision, glaucoma or cataract, use of hearing aids or trouble with hearing, falls in past 2 years, incontinence, depression, and polypharmacy, were not meaningfully associated with the likelihood of admission.

CONCLUSION AND RELEVANCE Results of this cohort study suggest that the key patient-level characteristics, including social supports, cognitive status, and functional status, were associated with the decision to admit older patients to the hospital from the ED. These factors are critical to consider when devising strategies to reduce low-value admissions among older adult patients from the ED.

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JAMA Intern Med. 2023;183(8):784-792. doi:10.1001/jamainternmed.2023.2149
Published online June 12, 2023.

The emergency department (ED) is the most frequent source of hospitalizations for older adults in the US, accounting for more than 70% of admissions.[1,2] Variation in admission rates is associated with differences between hospitals across regions, hospitals within regions, and even individual physicians within the same hospital. However, patient-level factors that are distinct from but relevant to the clinical presentation of the older adult population, such as low-level functional status, cognitive impairment, limited social supports, and geriatric syndromes, also need to be considered as potential variables in admission. Such factors are not readily obtainable from administrative data but often are apparent to physicians caring for older patients in the ED and likely affect the decision to admit.

Previous studies have suggested that some of these factors (lack of social supports, dementia, and difficulty with activities of daily living [ADLs]) may be associated with admission or readmission, overall cost of care, and worse outcomes in hospitalized patients.[3-11] Several other studies have focused on the extent to which these characteristics should be considered in risk-adjustment models such as for calculating adjusted readmission rates under the Hospital Readmissions Reduction Program or admission rates for ambulatory care-sensitive conditions.[3,4,7,8,10,11] Other investigations have examined the association of these factors with total medical expenses or postacute spending.[5,6,9,12] However, it is not clear which factors either individually or in combination are most associated with the decision to admit across the spectrum of conditions treated in the ED.

The present study examined this topic with a unique lens, evaluating a number of these age-related variables in terms of their individual or cumulative contribution to the likelihood of admission after an ED visit. Although the factors themselves may not be directly modifiable (eg, level of dementia), an understanding of which factors are associated with admission can serve to identify areas of focus for hospitals or accountable care organizations looking to prevent unnecessary admissions from ED visits. In this study, we used detailed data on functional status, cognitive status, geriatric syndromes, and social supports that were collected over time from patients and their families or support givers who were enrolled in the Health and Retirement Study (HRS). These data were linked to administrative claims data from Medicare. Our objective was to determine the extent to which these patient-level factors were associated with rates of hospital admission from the ED.

Key Points

Question Are patient-related factors that disproportionately affect older adults, including lower functional status, cognitive impairment, limited social supports, and geriatric syndromes, associated with emergency department (ED) clinicians' decision to admit patients to the hospital?

Findings In this cohort study of 42 392 ED visits by 11 783 unique patients, functional status, cognitive status, and social supports were associated with the likelihood of admission from the ED, whereas no association was found with other common geriatric syndromes.

Meaning Findings of this study suggest that incorporating patient-level factors is essential to understanding the factors associated with hospital admission of older patients from the ED and the potential areas for devising interventions to reduce low-value admissions that may be treated in other settings.

Methods

Study Population and Data Source

We used survey data collected from participants in the HRS from January 1, 2000, to December 31, 2018 (HRS waves 5-14). The Harvard Medical School Institutional Review Board and the Centers for Medicare & Medicaid Services Privacy Board approved this cohort study and waived the informed consent requirement because the claims data used were deidentified and not collected for this study. We followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline.

The HRS is a longitudinal panel study that surveys approximately 20 000 US residents older than 50 years or their partners or spouses every 2 years, periodically adding new cohorts to maintain the size and age distribution of the panel.[13] Survey data collection method is split equally between telephone and face-to-face interviews.[14] Response rates are more than 80%, varying slightly by wave.[13] Proxies respond to the survey on behalf of participants who are unable to complete the survey themselves.[15]

In addition to the raw data files from the HRS, we used a preprocessed version of the data, which standardized variable names across years and included several derived variables.[16] These survey data were then linked to Medicare fee-for-service claims from January 1, 1999, to December 31, 2018. These claims data were used to ascertain visits to the ED, subsequent admissions to the hospital or discharges from the ED, and other claims data–derived comorbidities and sociodemographic characteristics. In general, more than 80% of all HRS participants provide information that can be used for linkage to Medicare claims.[17] We included HRS participants of any age who were continuously enrolled in Medicare Parts A and B but were not enrolled in Medicare Advantage during the prior year because claims data were not available for those enrolled in Medicare Advantage.

ED Visits and Admission Status

We used the Carrier File (with Healthcare Common Procedure Coding System codes 99281-99285, 99291, 99292, 99234-6, 99217-20, 99224-6 and Place of Service code 23 [emergency room–hospital]) to identify for each patient the ED visits that occurred at any point during the study period. When multiple waves of responses were available for a single patient, we used the response immediately preceding the ED visit. Therefore, functional limitations observed in the HRS were unlikely to be affected by the event causing the ED visit or by subsequent treatment. We removed ED visits when the most recent response was 4 or more years before those visits. We also

excluded ED visits that occurred within 30 days of a previous ED visit to exclude return visits to the ED.

Following past studies, we limited the sample to ED visits for medical complaints. We grouped these complaints into clinically meaningful categories using the Clinical Classification Software for *International Classification of Diseases, Ninth Revision* and *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision,* which are available from the Agency for Healthcare Research and Quality (eTable 1 in Supplement 1).[18,19]

For each ED visit, we determined whether the patient was discharged from the ED or admitted to the hospital by identifying a matching record in the Medicare outpatient or inpatient files, respectively, within 2 days of the Carrier File-defined ED event. Approximately 1% of ED visits had matches in both the outpatient and inpatient files, and these matches were classified as inpatient following prior work.[18,19] We excluded approximately 5% of ED visits without a match in either file. Patients under observation status, identified by revenue code 0762 on the outpatient claim, were included only if they were subsequently admitted as inpatient. In a separate sensitivity analysis, we treated all observation status as an inpatient admission.

Patient Variables Derived From Medicare Claims Data

We assessed patient data obtained from Medicare enrollment files, such as age, race and ethnicity (categorized as Hispanic; non-Hispanic Black; non-Hispanic White; or other such as American Indian or Alaska Native, Asian and Pacific Islander, or unknown), sex, dual eligibility for Medicaid and Medicare, and disability as the original reason for Medicare eligibility. To measure patient comorbidities, we used the Chronic Conditions Data Warehouse to assess whether a patient had any of the 27 included conditions and created markers to indicate the presence of 0 to 5, 6 to 8, or 9 or more conditions. We also calculated Hierarchical Condition Category scores from demographic and diagnostic data in enrollment and claims files over the 12-month period preceding the date of the patient's ED visit. We divided the observed Hierarchical Condition Category scores into quartiles and constructed a variable to record the risk quartile to which each patient was assigned at the time of their ED visit. Quartiles were calculated separately for each year to account for patterns in coding intensity.

Patient Variables Derived From the HRS Survey

The HRS assesses the ability to perform ADLs and instrumental activities of daily living (IADLs). The ADLs were walking, bathing, eating, dressing, and bedding.[20] The IADLs were making phone calls, managing money, taking medications, shopping for groceries, and preparing a hot meal. We used derived binary indicators that were based on answers to yes-or-no questions about the difficulty of performing each of the activities, and we summed these responses to construct scores, ranging from 0 to 5, corresponding with the number of ADLs and IADLs that patients had difficulty performing.[16]

We used a validated measure of cognitive status to identify the level of cognitive impairment.[21,22] Patients were given cognition scores, ranging from 0 to 27 (with scores of 0-6 indicating dementia, 7-11 indicating cognitive impairment no dementia [CIND], and 12-27 indicating normal cognition), based on their performance on a battery of tests similar to the Telephone Interview for Cognitive Status.[23] A separate scale, ranging from 0 to 11 (with scores of 0-2 indicating dementia, 3-5 indicating CIND, and 6-11 indicating normal cognition), was created to reflect the proxy's view of the patient's memory and functional status and the interviewer's judgment of cognitive limitation.

We constructed 2 social support variables to measure the availability of family members who helped patients manage at home. The first variable was a binary variable indicating the presence of a spouse in the home. The second variable assessed the physical proximity of children to patients: no children, children living 10 or more miles away, children living within 10 miles, and children living with them.

We constructed binary indicators for other common geriatric syndromes, including trouble falling asleep, waking early, trouble with vision, glaucoma or cataract, use of hearing aids or trouble with hearing, falls in past 2 years, incontinence, depression, and polypharmacy (as measured by the number of medications used). Because the HRS omitted questions about sleep in some waves, we imputed missing values for the trouble falling asleep and waking early variables based on responses from the prior wave. The number of medications variable was based on responses to questions about specific medication use (eg, Do you take medication for high blood pressure?) and therefore did not capture medication use exhaustively. Instead, the variable measured whether the patient reported use of 5 or more of the medication types included in the HRS survey beginning in 2006. To identify depression, we used an abridged version of the Centers for Epidemiologic Studies Depression (CES-D) Scale, a validated measure based on questions about depressive symptoms.[24] We chose a cutoff in the abridged CES-D index corresponding to the common cutoff in the unabridged CES-D index.[25] Details on the HRS survey questions and logic used to construct the binary indicators are provided in eTable 2 in Supplement 1.

Statistical Analysis

Following prior investigations, we first estimated a baseline logistic regression model with a binary indicator of admission as the dependent variable of interest that included the clinical and sociodemographic characteristics derived from the Medicare claims data.[18,19] For each of the primary variables of interest derived from the HRS survey, including indicators of functional status, cognitive status, social supports, and other geriatric syndromes, we then reestimated the baseline logistic regression model to include the HRS variable of interest as an independent variable. We also estimated 2 combined models: 1 including all variables of functional status, cognitive status, and social supports, and the other 1 including all geriatric syndromes except number of medications. In all models, we clustered SEs at the patient level to help account for unobserved patient-related factors affecting admission decisions.

For each regression model, we presented the odds ratio (OR) and the average marginal effect (AME) of changing the value of the variable of interest. The AME measured the mean change in estimated likelihood of admission as the value of

a single variable that was set to some constant vs another variable while all other variables were held constant. When the variable was binary, the AME measured the difference between setting that variable equal to 0 vs 1. For continuous variables (number of geriatric syndromes), we substituted the first and last quartile values of the variable, respectively, so that the AME reflected a plausible shift in the variable value. We repeated these steps for geriatric syndromes using a subset of the data with nonmissing values for all geriatric syndromes except the number of medications, which was available only starting in the 2006 HRS survey. We created a subset of the sample again using cases after 2006 to estimate the number of medications model. To maximize the sample size, we excluded the number of medications variable from the combined model of geriatric syndrome variables. We removed 1148 cases with missing values in the functional status, cognitive status, and social supports variables; 10 982 cases for analyses of geriatric syndromes; and 8415 cases for analysis of the number of medications variable (eTable 1 in Supplement 1).

We chose a significance threshold of $P = .05$. Analyses were performed using Python, version 3.8 (Python Software Foundation); R, version 3.6 (R Foundation for Statistical Computing); and SAS, version 9.4 (SAS Institute Inc). Data were analyzed from September 2021 to April 2023.

To better illustrate the practical application of the findings, we evaluated estimated probabilities of admission for hypothetical patients by constructing 6 clinical vignettes with the key factors set to specific values that were designed to span the typical range of these factors. Specifically, we defined 2 personas based on claims-derived and demographic variables: (1) a 70-year-old White female in the second risk score quartile with 0 to 5 chronic conditions presenting with cardiovascular symptoms, and (2) a 90-year-old Black male in the third risk score quartile with 6 to 8 chronic conditions presenting with pulmonary symptoms. For each persona, we selected 3 existing visits with varying levels of functional status, cognitive status, and social supports. We estimated the probability of admission for each visit based on the regression results. By holding the claims data–derived variables constant while varying the variables of interest, we used these visits to demonstrate how these variables affected the estimated likelihood of admission for actual patients.

Results

The study sample included 42 392 ED visits by 11 783 unique patients (**Table 1**). These patients had a mean (SD) age at the time of ED visits of 77.4 (9.6) years, and 25 719 visits (60.7%) were for females and 4631 (39.3%) were for males with Black (19.7%), Hispanic (2.7%), White (75.8%), or other (1.8%) race and ethnicity. The percentage of patients admitted to the hospital was 42.5% overall (Table 1). The most common geriatric syndrome was trouble falling asleep (51.5%) and the least common was glaucoma (15.4%) (eTable 3 in Supplement 1).

The HRS data were collected a median of 13 months prior to the ED visits (90th decile, 24 months), and 10% of visits occurred more than 24 months after an interview. Using dichotomous versions of the functional status, cognitive status, and social support variables, the association for each pair of variables ranged from −0.49 (marital and child social supports) to 0.74 (ADLs and IADLs). Among the geriatric syndrome variables, associations ranged from −0.16 (glaucoma) to 0.60 (trouble falling asleep and waking early) (eTable 4 in Supplement 1).

Older Adult–Specific Factors and Geriatric Syndromes

Difficulty with an increasing number of ADLs or IADLs was associated with the rate of admission, with 5 ADLs (OR, 1.47; 95% CI, 1.29-1.66) and 5 IADLs (OR, 1.46; 95% CI, 1.30-1.65) each resulting in an 8.5-percentage point AME increase in the estimated likelihood of admission. The presence of dementia vs normal cognition was associated with the estimated likelihood of admission, increasing the AME by 4.6 percentage points (OR, 1.23; 95% CI, 1.14-1.33), but the association with CIND was not significant. Living with a spouse was associated with an AME decrease in estimated likelihood of admission of 3.9 percentage points (OR, 0.84; 95% CI, 0.79-0.89), and having children living within 10 miles of the patient was associated with an AME reduction in the estimated likelihood of admission of 5.0 percentage points (OR, 0.80; 95% CI, 0.71-0.89). When all variables were included together, the ORs for each variable moved closer to 1 due to collinearity, but most remained significant (**Table 2**).

The other common geriatric syndromes we examined were not associated with a higher likelihood of admission. All of the variables, except trouble with vision and depression, demonstrated no significant or inverse associations with the likelihood of admission (**Table 3**).

Application to Clinical Vignettes

The first persona had an estimated likelihood of admission of 30.9% (95% CI, 29.7%-32.3%) with no functional or cognitive deficits, a spouse in the home, and children living within 10 miles (**Figure**). The same persona with lower functional status (difficulties with 5 ADLs and 5 IADLs), dementia, and children living 10 or more miles away had an estimated likelihood of admission of 41.2% (95% CI, 39.0%-43.4%), a 10.3-absolute percentage point and more than one-third relative increase in estimated likelihood. A persona with the same functional and cognitive limitations but without a spouse and children had an estimated likelihood of admission of 50.1% (95% CI, 47.7%-52.2%).

The second persona had a 58.1% (95% CI, 56.5%-59.7%) estimated likelihood of admission without functional or cognitive limitations and with a spouse in the home and children living within 10 miles. The same persona with less social support (no spouse and living with children) had an estimated likelihood of admission of 64.3% (95% CI, 62.8%-65.9%). This persona with functional limitations (difficulties with 4 ADLs and 4 IADLs), dementia, and no spouse and no children had an even higher estimated likelihood of admission: 74.6% (95% CI, 72.7%-76.4%).

Sensitivity Analysis

Thirteen percent of outpatient cases were observation stays. Estimates of ORs were substantially similar when observation stays were considered as inpatient admissions (eTable 5 in Supplement 1).

Table 1. Description of Study Sample

Variable	Patients, No. (%)[d] All	Not admitted to hospitals	Admitted to hospitals
ED visits	42 392 (100)	24 357 (57.5)	18 035 (42.5)
Age, mean (SD), y	77.4 (9.6)	76.4 (9.6)	78.8 (9.5)
Sex			
Female	25 719 (60.7)	15 295 (62.8)	10 424 (57.8)
Male	16 673 (39.3)	9062 (37.2)	7611 (42.2)
Race and ethnicity[a]			
Hispanic	1150 (2.7)	625 (2.6)	525 (2.9)
non-Hispanic Black	8331 (19.7)	4926 (20.2)	3405 (18.9)
non-Hispanic White	32 148 (75.8)	18 339 (75.3)	13 809 (76.6)
Other[b]	763 (1.8)	467 (1.9)	296 (1.6)
Grouping			
Cardiovascular	11 337 (26.7)	5543 (22.8)	5794 (32.1)
Pulmonary	7728 (18.2)	3900 (16.0)	3828 (21.2)
Gastrointestinal	5873 (13.9)	3632 (14.9)	2241 (12.4)
Neurological	3302 (7.8)	1981 (8.1)	1321 (7.3)
Genitourinary	2662 (6.3)	1960 (8.0)	702 (3.9)
Other[c]	11 490 (27.1)	7341 (30.1)	4149 (23.0)
No. of chronic conditions			
0-5	16 742 (39.5)	12 263 (50.3)	7222 (40.0)
6-8	15 087 (35.6)	7865 (32.3)	6334 (35.1)
≥9	10 563 (24.9)	4229 (17.4)	4479 (24.8)
No. of difficult-to-perform ADLs			
0	26 275 (62.0)	15 956 (65.5)	10 319 (57.2)
1	6158 (14.5)	3371 (13.8)	2787 (15.5)
2	3448 (8.1)	1852 (7.6)	1596 (8.8)
3	2369 (5.6)	1205 (4.9)	1164 (6.5)
4	2153 (5.1)	1040 (4.3)	1113 (6.2)
5	1989 (4.7)	933 (3.8)	1056 (5.9)
No. of difficult-to-perform IADLs			
0	26 927 (63.5)	16 358 (67.2)	10 569 (58.6)
1	5996 (14.1)	3248 (13.3)	2748 (15.2)
2	3552 (8.4)	1870 (7.7)	1682 (9.3)
3	2039 (4.8)	1057 (4.3)	1087 (6.0)
4	1855 (4.4)	888 (3.6)	967 (5.4)
5	2023 (4.8)	936 (3.8)	982 (5.4)
Cognitive status			
Normal cognition	20 610 (48.6)	12 546 (51.5)	8064 (44.7)
CIND	14 535 (34.3)	8153 (33.5)	6382 (35.4)
Dementia	7247 (17.1)	3658 (15.0)	3589 (19.9)
Marital social support			
Married	18 810 (44.4)	11 226 (46.1)	7584 (42.1)
Unmarried	23 582 (55.6)	13 131 (53.9)	10 451 (57.9)
Child social support			
Living with children	9352 (22.1)	5171 (21.2)	4181 (23.2)
Children living within 10 miles	18 614 (43.9)	10 832 (44.5)	7782 (43.1)
Children living ≥10 miles away	11 471 (27.1)	6771 (27.8)	4700 (26.1)
No children	2 955 (7.0)	1583 (6.5)	1372 (7.6)

Abbreviations: ADLs, activities of daily living; CIND, cognitive impairment no dementia; ED, emergency department; IADLs, instrumental activities of daily living.

[a] Race and ethnicity data were obtained from Medicare enrollment files using the Research Triangle Institute race code.

[b] Other category included American Indian or Alaska Native, Asian and Pacific Islander, or unknown.

[c] Other grouping included every other grouping from the Clinical Classification software that is not included in these 5 main categories.

[d] Due to rounding, percentages may not equal 100.

Table 2. Association of Functional Status, Cognitive Impairment, and Social Supports With the Estimated Likelihood of Admission

Model	Estimated separately		Estimated together	
	OR (95% CI)	AME, percentage points	OR (95% CI)	AME, percentage points
No. of difficult-to-perform ADLs				
0	1 [Reference]	NA	1 [Reference]	NA
1	1.11 (1.04-1.20)	2.4	1.07 (0.99-1.15)	1.4
2	1.18 (1.08-1.29)	3.6	1.11 (1.00-1.22)	2.2
3	1.27 (1.14-1.41)	5.3	1.17 (1.05-1.32)	3.5
4	1.35 (1.20-1.52)	6.7	1.22 (1.07-1.39)	4.5
5	1.47 (1.29-1.66)	8.5	1.26 (1.09-1.47)	5.2
No. of difficult-to-perform IADLs				
0	1 [Reference]	NA	1 [Reference]	NA
1	1.14 (1.06-1.22)	2.9	1.08 (1.01-1.17)	1.8
2	1.20 (1.09-1.32)	4.1	1.10 (0.99-1.21)	2.0
3	1.18 (1.05-1.32)	3.6	1.03 (0.91-1.17)	0.6
4	1.38 (1.21-1.57)	7.1	1.15 (0.99-1.33)	3.0
5	1.46 (1.30-1.65)	8.5	1.18 (1.01-1.38)	3.6
Cognitive status				
Normal cognition	1 [Reference]	NA	1 [Reference]	NA
CIND	1.05 (0.99-1.11)	1.0	1.02 (0.96-1.08)	0.5
Dementia	1.23 (1.14-1.33)	4.6	1.07 (0.98-1.18)	1.6
Marital social support				
Unmarried	1 [Reference]	NA	1 [Reference]	NA
Married	0.84 (0.79-0.89)	−3.9	0.87 (0.81-0.92)	−3.1
Child social support				
No children	1 [Reference]	NA	1 [Reference]	NA
Children living ≥10 miles away	0.77 (0.69-0.87)	−5.7	0.81 (0.72-0.91)	−4.7
Children living within 10 miles	0.80 (0.71-0.89)	−5.0	0.82 (0.74-0.92)	−4.2
Living with children	0.92 (0.82-1.04)	−1.8	0.93 (0.82-1.05)	−1.6

Abbreviations: ADLs, activities of daily living; AME, average marginal effect; CIND, cognitive impairment no dementia; IADLs, instrumental activities of daily living; NA, not applicable; OR, odds ratio.

Discussion

Using HRS survey data linked to Medicare administrative claims data, we found that intrinsic factors specific to older patients and unrelated to the presenting clinical condition were associated with the decision to admit a patient. Factors related to social supports, cognitive status, and functional status were consistently associated with admission. In contrast, other common geriatric syndromes we examined were not associated with increased risk of admission.

These findings suggest that physicians are aware of and consider some of these key observable patient characteristics when deciding whether or not to hospitalize an older patient. For patients with limitations in functional status, physicians might be concerned about their ability to care for themselves at home when acutely ill. In the case of cognition, it is plausible that difficulty communicating with a patient with cognitive impairment creates greater uncertainty over the diagnosis or the ability of the patient to return if symptoms worsen. A similar argument could be made for patients with lack of social supports. While this study did not permit us to examine how ED clinicians incorporate these observations into their admission decisions, these results enable a sharper focus on designing interventions targeted at these factors.

The findings are consistent with reports from prior studies that suggested physicians take into account factors that are unrelated to the specific clinical presentation when determining patient disposition. For example, previous work on ED patients of all ages pointed to factors, such as frailty, homelessness, unemployment, and educational level, likely to play a role in the decision to admit.[26,27] In a small qualitative study, Pope et al[28] highlighted that levels of social support and community follow-up were believed to be important factors in admission. Greysen et al[8] showed that increasing difficulty with ADLs was associated with readmission. Several studies found that patient-level characteristics (including those we examined) were factors in admission, readmission, or overall costs.[4-7,9-11] Many of these studies argued that these characteristics should be considered in risk-adjustment models such that hospitals or clinicians serving socially, functionally (neuropsychologically and physically), and economically vulnerable populations are not penalized inappropriately. Johnston et al[4] examined the association of social, cognitive, and functional risk factors with admission rates for ambulatory care–sensitive conditions. This study, however, was focused on the extent to

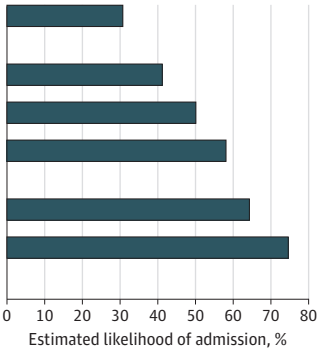
Table 3. Association of Geriatric Syndromes With the Estimated Likelihood of Admission

Geriatric syndrome	Estimated separately		Estimated together	
	OR (95% CI)	AME, percentage points	OR (95% CI)	AME, percentage points
Trouble falling asleep				
Never	NA	NA	NA	NA
Sometimes or usually	0.90 (0.85-0.96)	−2.2	0.91 (0.85-0.97)	−2.0
Waking early				
Never	NA	NA	NA	NA
Sometimes or usually	0.93 (0.87-0.98)	−1.7	0.96 (0.90-1.02)	−1.0
Trouble with vision				
Good or better	NA	NA	NA	NA
Fair or worse	1.01 (0.95-1.08)	0.3	1.03 (0.97-1.11)	0.7
Cataract or glaucoma				
No	NA	NA	NA	NA
Yes	0.87 (0.79-0.94)	−3.1	0.87 (0.80-0.95)	−3.0
Trouble with hearing and use of hearing aids				
Good or better, without hearing aids	NA	NA	NA	NA
Fair or worse, with hearing aids	0.98 (0.92-1.04)	−0.4	0.98 (0.92-1.05)	−0.4
Fall in past 2 y				
No	NA	NA	NA	NA
Yes	0.95 (0.90-1.01)	−1.0	0.96 (0.90-1.02)	−0.9
Incontinence				
No	NA	NA	NA	NA
Yes	0.95 (0.89-1.02)	−1.0	0.96 (0.90-1.03)	−0.8
Depression				
No	NA	NA	NA	NA
Yes	1.02 (0.96-1.09)	0.4	1.06 (0.99-1.13)	1.2
No. of medications				
0-4	NA	NA	NA	NA
≥5	0.82 (0.76-0.89)	−4.1	NA	NA

Abbreviations: AME, average marginal effect; NA, not applicable; OR, odds ratio.

Figure. Estimated Likelihood of Emergency Department Admission for Clinical Vignettes

Persona	Functional status: ADL difficulties	Functional status: IADL difficulties	Cognitive impairment	Social supports: Married	Social supports: Children
70-Year-old White female in second risk score quartile	0	0	Normal cognition	Yes	Children live within 10 mi
0-5 Chronic conditions	5	5	Dementia	Yes	Children live ≥10 mi
Presents with cardiovascular symptoms	5	5	Dementia	No	None
90-Year-old Black male in third risk score quartile	0	0	Normal cognition	Yes	Children live within 10 mi
6-8 Chronic conditions	0	0	Normal cognition	No	Living with children
Presents with pulmonary symptoms	4	4	Dementia	No	None



ADLs indicates activities of daily living; IADLs, instrumental activities of daily living.

which these factors needed to be considered when measuring the ability of primary care physicians to prevent admissions for patients with these characteristics. In related work, Schüssler-Fiorenza Rose et al[10] evaluated overall population-based rates of ambulatory care–sensitive admissions for patients with or without ADL limitations. The present investigation built on these prior studies by using more recent data and including a more comprehensive set of conditions.

To our knowledge, the present study was the first to evaluate a number of age-specific variables in terms of their indi-

vidual and cumulative contributions to the likelihood of admission. We also were able to parse out the contribution of key categories of variables, distinguishing between cognitive status, functional status, social supports, and other common geriatric syndromes. Moreover, while several studies assessed the association of these characteristics with total costs,[5,6,9] the present study focused on 1 potential mechanism whereby the factors we studied might lead to higher spending.

Part of the challenge of these prior studies is that they reflect the uncertainty regarding the definition of geriatric syndromes. Inouye et al[29] delineated that the final common pathway of these syndromes was frailty, which in turn can lead to poor outcomes such as disability or dependence, nursing home placement, and death. Yet even the definition of frailty varied across screening instruments, and 1 ED-based study found little agreement on frailty as defined by physician perception, patient perception, and a standardized screening instrument.[30] We believe that this study alleviates this definition challenge by highlighting key characteristics among older patients that are associated with greater rates of admission. While we did not assess why social supports, cognitive status, and functional status may be more relevant to the decision to admit compared with these other geriatric syndromes, the other syndromes included are likely indicative of an overall higher level of functional status, less indicative of true frailty, and thus may be perceived less by the treating ED clinician as risk factors for morbidity or mortality after discharge.

National payment reform initiatives are putting health systems, clinicians, and patients in the middle of efforts to reduce wasteful health spending. Under these pressures, the identification of risk factors might be an organizing strategy to effectively reduce potentially avoidable admissions and provide a safe admissions alternative that is influenced by these nonclinical factors. While these measures of functional status or social support often are not in and of themselves modifiable, additional levels of support for patients with functional limitations or lack of support could be put in place that might allow for safe discharge from the ED. In addition, it is likely that efforts to reduce admissions among patients with lower risk using clinical risk scores for conditions, such as heart failure, syncope, and chest pain, may be limited by factors that are unrelated to the primary clinical condition.[31] Physicians may focus on these factors when caring for older adults and thus choose to admit patients who may otherwise be safe and appropriate for discharge. However, instead of including these types of characteristics in clinical risk scores for certain conditions, we believe an understanding that these factors are altering the decision to admit adults across a spectrum of clinical conditions will help to focus comprehensive interventions to support the discharge of older adults with perceived frailty. Furthermore, it is likely that systems interventions even before patients end up in the ED (for example by primary care, telemedicine, community paramedicine, or visiting nurses) could proactively address some of these same limitations. However, since these characteristics are generally not available in administrative data, an infrastructure within the electronic medical record may be built to capture measures that are similar to those examined in this study. Within the context of the ED visit, these characteristics are readily identifiable and thus amenable to interventions by care teams prior to the decision to admit.

In attempts by policy makers and insurance companies to identify and potentially restrict payment for avoidable admissions, it is paramount to emphasize that the factors we have identified are associated with a greater chance of admission, are not observed in administrative data, and thus are not readily available for incorporating into models used for risk adjustment. It is clear that current risk-adjustment models are biased against hospitals and clinicians who care for socially, functionally (neuropsychologically and physically), and economically vulnerable populations. Cognitive decline, functional impairment, and lack of social supports are specific characteristics of these populations that could be incorporated into risk-adjustment models but are not currently included because these data are not widely available. Nonetheless, it should be recognized that clinicians caring for such patients may be penalized under current risk-adjustment systems.

Limitations

This study has several limitations. First, due to a complex sample design and differential nonresponse rates, the HRS participants in this sample were not representative of the national US population. However, we did not attempt to estimate the impact of the study variables at a national scale, but rather we aimed to identify the association between the measures of interest and the likelihood of admission. However, the sample had representation across sex, race and ethnicity groups and all 50 states; thus, the findings are broadly generalizable. Second, the data may not fully reflect the status of clinical conditions at the time of the index ED visit. Third, use of administrative claims data did not allow us to ascertain other potentially relevant factors in admission, such as vital signs, presenting symptoms, and the ED or hospital occupancy level.

Conclusions

The results of this cohort study highlighted that patient-level factors that were not derived from claims data, including social supports, cognitive status, and functional status, were associated with hospital admission from the ED. These factors, which are not typically included in studies of factors associated with the decision to admit but are easily observable by ED clinicians, need to be considered in devising strategies to reduce admissions in older patients.

ARTICLE INFORMATION

Accepted for Publication: April 13, 2023.

Published Online: June 12, 2023. doi:10.1001/jamainternmed.2023.2149

Author Contributions: Mr Weinreb and Dr Landon had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.
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Acquisition, analysis, or interpretation of data: All authors.
Drafting of the manuscript: Smulowitz, Weinreb.
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Statistical analysis: McWilliams, O'Malley.
Obtained funding: Smulowitz, O'Malley, Landon.
Administrative, technical, or material support: Weinreb.
Supervision: Smulowitz, O'Malley, Landon.

Conflict of Interest Disclosures: Dr. Smulowitz reported receiving grants from the Agency for Healthcare Research and Quality (AHRQ) outside the submitted work. Dr McWilliams reported receiving personal fees from RTI International, Oak Ridge Associated Universities, and The ACI Group Inc; being Associate Editor of *JAMA Internal Medicine*; and serving as an unpaid member of the board of directors for the Institute for Accountable Care outside the submitted work. Dr O'Malley reported receiving grants from the National Institutes of Health outside the submitted work. Dr. Landon reported receiving personal fees from RTI International, Freedman Healthcare Consulting, and UpToDate and grants from the National Institutes of Aging and the AHRQ outside the submitted work. No other disclosures were reported.

Funding/Support: The study was supported by grant 1R01HS025408-01 from the AHRQ.

Role of the Funder/Sponsor: The funder had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Data Sharing Statement: See Supplement 2.

Disclaimer: The content of this article is solely the responsibility of the authors and does not necessarily reflect the official views of any of the organizations with which the authors are affiliated.

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