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# Managing postacute hospital care: A case for biopsychosocial needs

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## Abstract

**Objective:** This study aimed to investigate whether, for an identical diagnosis, patients who were transferred to a postacute care (PAC) facility had a higher biopsychosocial complexity than patients who were discharged home. **Methods:** This prospective study employed group comparison that included 166 patients who were consecutively admitted to an acute care internal medicine ward for acute congestive heart failure, pneumonia or exacerbation of chronic obstructive pulmonary disease, and malaise or fall. Patients were evaluated within their first 48 h of stay. Biomedical, functional, quality of life, and case complexity data were collected. Factors associated with a transfer to the PAC facility were identified through logistic regression modeling. **Results:** Fifty-eight patients (34.9%) were transferred. In the multivariate analyses, case complexity score [per point: odds ratio (OR)=1.29; 95% CI=1.18–1.41] and nursing workload (OR=1.06; 95% CI=1.01–1.12) were associated with the transfer. At a cutoff point of ≥33, the case complexity score predicted transfer to the PAC facility with a sensitivity of 79% and a specificity of 84% (positive predictive value=73.0%; negative predictive value=88.4%) and correctly classified 83% of the cases. **Conclusions:** Biomedical characteristics alone did not differentiate patients who were transferred versus those who were discharged home, nor did it predict PAC use. This was also true for specific severity scores of cardiac failure and pneumonia as well as for the comorbidity index. Psychosocial parameters were significantly associated to this process as well as a higher nursing workload.
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*Keywords:* Biopsychosocial assessment; Case complexity; Hospital care; Postacute care

## Introduction

Major efforts have been made to reduce the length of acute in-hospital stay in response to financial, political, and medical pressures [1]. However, although most patients may be discharged after a short stay in acute care wards, others need longer stays due to parameters that do not justify high-intensity hospital care. A transfer to less acute and less costly hospital wards, such as postacute care (PAC) facilities, could address the needs of these patients [2,3]. Furthermore, as the need to bolster rehabilitation is increasingly recognized for frailer elders for whom adequate subacute care is a pressing health policy issue, the role of these facilities is increasingly recognized [4,5].

Various severity indexes have been developed to predict disease-specific mortality or the need for hospitalization [6,7], but they failed to identify predictors of hospital resources utilization [8]. Along this line, the development of standardized instruments could help the early identification of patients who will necessitate PAC. This identification may be linked not only to disease-specific variables but also to other patients' characteristics including the nonlinear—that is, very often unpredictable—evolution of medical conditions and the impact of psychosocial parameters. These variables pertain to case complexity; they call upon a biopsychosocial perspective and the necessity to integrate biomedical as well as psychosocial comorbidities when

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assessing PAC needs. Indeed, not only the array of morbid conditions affecting the patients but also the impact of psychosocial factors may decrease the patients' quality of life (QoL), increase health care utilization, prolong hospital stays, and heighten rehospitalization rates [9,10].

In this study, we sought to prospectively estimate biomedical and psychosocial characteristics of patients admitted to acute internal medicine wards and to assess their association with PAC utilization. The main research question was to determine whether, for an identical principal diagnosis, patients who were transferred to a PAC facility had a higher biopsychosocial complexity than patients who were directly discharged home.

## Methods

### *Patients and setting*

The study population consisted of patients aged ≥18 years, who were consecutively admitted to the acute internal medicine ward of the Geneva University Hospitals during a 3-month period in 2003. This 184-bed ward is part of a 1200-bed urban public and teaching hospital, which is the major primary care hospital for the area. All patients with a diagnosis of acute congestive heart failure, community-acquired pneumonia, and malaise or fall who necessitate further investigations were recruited. These groups have been chosen to mirror the characteristics of the patients who, in our setting, are most often transferred from the acute medicine wards to the PAC facility; this allowed for a population that is as close to the everyday clinical practice as possible. Patients were screened at the emergency room. They were considered as eligible if they presented symptoms and clinical signs that were compatible with one of the three aforementioned causes of hospitalization. Patients were evaluated, for the purpose of the study, within their first 48 h of stay by a trained investigator, who was independent from the health care team, before any decision concerning their discharge was made. The health care team was informed of the aims of the study but was blinded to the results of the evaluation and was given no treatment/discharge recommendation. They provided coordinated care as usual—including somatic and psychological investigation and treatment along with possible social assistance through the availability of liaison psychiatry and social services. Thus, all patients received usual care throughout the hospitalization period and were discharged home or transferred to the PAC facility according to the usual practices. The PAC facility is an internal medicine ward that is devoted to general medical rehabilitation and psychosocial care, with a specific emphasis on comprehensive active rehabilitation and multidisciplinary treatment (involving physicians, nurses, liaison psychiatrists, psychologists, physical therapists, occupational therapists, and social workers). Median and mean length of stay are 16 and 21 days, respectively. A vast majority of the patients are discharged home; 7–8% of the patients die, and only very few (1–2%) require a definitive institutionalization. The study protocol was approved by the hospital ethics committee, and all included patients gave their written informed consent.

### *Interview and measurements*

Several types of data were collected on admission.

### *Biomedical data*

The Charlson comorbidity index [11] was used as a generic assessment of severity; specific severity indexes were used for heart failure [New York Heart Association (NYHA) class] and pneumonia [Pneumonia Severity Index (PSI) [7]]. Additional data included blood pressure, cardiac frequency, height, weight, and laboratory data including blood count, electrolytes, and renal and liver function tests.

### *Nursing workload*

The mean nursing workload during the hospital stay (minutes per day) as assessed by the PRN 80—Information System for Nursing Care Management—was chosen as an indicator of the use of nursing resources [12]. The PRN 80 has been devised in Canada and is now used in various settings. Points are assigned to each nursing activity according to, for example, their frequency, duration, or need for more than one nurse [13]. The instrument applied in this study is a workload system that has been utilized and validated in previous studies [13–15]. It is also the way nursing workload is routinely assessed in our hospital.

The length of the hospital stay was also recorded.

### *Functional status and QoL*

Activities of Daily Living (ADL; [16]) and Instrumental ADL (IADL; [17]) were assessed as indicators of functional status, along with the presence of formal and/or informal help at home. Health-related QoL was evaluated using the SF-36 [18], a widely used generic QoL questionnaire that focuses on physical, social, and emotional aspects of health and functioning [18–21].

### *Combined biopsychosocial assessment*

This evaluation was performed by means of the INTERMED questionnaire, an instrument that consists of 20 items that explore four dimensions: physical health (e.g., severity of symptoms, complications, and life threat), psychological health (e.g., restrictions in coping, psychiatric symptoms), social environment (e.g., social dysfunctioning, restrictions in network), and intensity of care (e.g., intensity of previous treatment, need for coordination of care). Each

Table 1
Transfer to rehabilitation facility as related to patients' characteristics

| Patients' characteristics | Transfer to rehabilitation facility Yes, $n$=58 (35%) | No, $n$=108 (65%) | $P$ |
|---|---|---|---|
| Women, $n$ (%) | 30 (52) | 44 (41) | .18 |
| Age, mean (±S.D.) | 74.6 (±15.6) | 70.4 (±12.0) | .33 |
| Living alone, $n$ (%) | 32 (55) | 46 (43) | .14 |
| Formal help at home, $n$ (%) | 38 (65) | 54 (50) | .04 |
| Informal help at home, $n$ (%) | 49 (85) | 86 (80) | .53 |
| Diagnosis at admission, $n$ (%) | | | |
| Heart failure | 16 (32) | 35 (68) | |
| Pneumonia | 19 (25) | 56 (75) | |
| Malaise or fall | 23 (57) | 17 (43) | |
| Charlson comorbidity index, mean (±S.D.) | 3.6 (±1.9) | 4.1 (±2.5) | .48 |
| NYHA class, $n$ (%) | | | |
| Stage 3 | 10 (30) | 24 (70) | |
| Stage 4 | 6 (35) | 11 (65) | .83 |
| Pneumonia severity score, mean (±S.D.) | 103 (±34) | 93 (±27) | .71 |
| Length of stay in acute internal medicine wards, in days before transfer or discharge, mean (±S.D.) | 14.7 (±8) | 11.4 (±6) | .006 |
| Nursing workload in acute internal medicine wards, in minutes per day, mean (±S.D.) | 250 (±102) | 182 (±60) | <.001 |

dimension is evaluated in the context of time (history of illness, current status, and prognosis). For each of the four dimensions, five variables are rated 0 (*best*) to 3 (*worst*), resulting in a score ranging from 0 to 60. The basis for rating is a 20- to 30-min structured interview with the patient, which can be part of the normal history taking, and a review of the medical chart [22,23]. The ratings of the INTERMED are generic and not disease specific; it has been used in various clinical conditions and medical environments [24–28]. It has been shown to offer a valid and reliable standardized instrument to assess case complexity within a longitudinal perspective and to allow for the identification of patients who have complex needs, which involve somatic and psychosocial care [22–25]. All interviews were conducted by an experienced medical doctor, who was trained in the use of the INTERMED questionnaire by the developers of the instrument, in order to maximize the quality of the assessment throughout the study.

### *Power calculation*

A mean INTERMED score of 30±5.2 points was found in a pilot study conducted on a sample of 24 patients presenting with characteristics similar to those of the study population, who were transferred to the PAC facility. The assumptions made to calculate the study sample size considered a 5-point difference between patients of each diagnostic group to be significant. We calculated that a group of 50 patients with a mean INTERMED score of 30 points for transferred patients versus 25 points for patients directly discharged home would reach enough power to detect a 5-point difference with a significance level of .05. Since we did not know the exact proportion of patients experiencing a transfer to the PAC facility and since we aimed at a power of 0.90, we planned to recruit patients until 15 of them, at least, in each diagnostic group, achieved transfer to the PAC facility.

### *Statistical analysis*

Characteristics of the patients were compared using chi-square tests for categorical variables and Student's $t$ tests for continuous variables. The main analysis consisted of the comparison of biomedical and psychosocial complexity between patients who were transferred to the subacute care facility and those discharged home directly. Variables reflecting patients' sociodemographic and clinical characteristics, as well as the type of diagnosis, that were significantly associated with transfer to the PAC facility in bivariate analysis were incorporated into a multivariate model. Logistic regression analysis was used to evaluate the association between the occurrence of transfer to the PAC facility and the independent variables. Two-way interaction terms were created as well. All variables were included in the initial multivariable model. We then performed a backward elimination in which the least significant variable was discarded at each step until all remaining variables in the model reached a significance level of .05 or less. The accuracy of the INTERMED score in identifying transferred patients was then assessed by means of its receiver operating characteristic (ROC).

Table 2
Transfer to rehabilitation facility as related to patients' functional status and QoL

| Functional status and QoL | Transfer to rehabilitation facility Yes, $n$=58 | No, $n$=108 | $P$ |
|---|---|---|---|
| Number of impairments in ADL (0–6)[a], mean (±S.D.) | 2.0 (±1.9) | 1.8 (±2.3) | .18 |
| Number of impairments in IADL (0–8)[a], mean (±S.D.) | 2.8 (±1.5) | 2.2 (±1.8) | .02 |
| INTERMED score (0–60)[a], mean (±S.D.) | 35 (±4) | 25 (±7) | <.001 |
| Heart failure | 35 (±3) | 26 (±7) | <.001 |
| Pneumonia | 35 (±6) | 23 (±7) | <.001 |
| Syncope, malaise, or fall | 35 (±4) | 30 (±8) | .01 |
| SF-36 scores (0–100)[b], $n$=151, mean (±S.D.) | | | |
| Physical functioning | 26 (±20) | 49 (±27) | <.001 |
| Physical role | 8 (±17) | 55 (±25) | <.001 |
| Bodily pain | 31 (±18) | 55 (±25) | <.001 |
| General health | 21 (±16) | 43 (±24) | <.001 |
| Energy/Vitality | 17 (±12) | 33 (±18) | <.001 |
| Social functioning | 19 (±19) | 42 (±22) | <.001 |
| Emotional role | 25 (±31) | 65 (±40) | <.001 |
| Mental health | 43(±9) | 53 (±14) | <.001 |

[a] Lower scores indicate better results.
[b] Higher scores indicate better results.

Analyses were performed using Stata release 8.0 (Stata Corporation, College Station, TX, USA).

## Results

During the study period, 196 patients were recruited; 18 patients could not give informed consent [poor fluency in French ($n$=8); cognitive impairments ($n$=9)] or refused to participate ($n$=1). Thus, 178 patients were included, of whom 58 were transferred to the PAC facility and 108 were directly discharged home after their stay in the acute wards (Table 1); 12 patients died during their stay in the acute wards and were excluded from the subsequent analyses. Of 166 patients included in the final analyses, 74 (44.6%) were women, and mean age was 74.4 (S.D.=12.7). Seventy-eight patients (47%) were living alone, 92 (55.4%) were receiving formal help at home, and 135 (81.3%) benefited from some kind of informal help. Fifty-one patients (30.7%) were diagnosed with heart failure, 76 (45.8%) had pneumonia, and 39 (23.5%) had suffered malaise or fall; mean Charlson comorbidity index was 3.7 (S.D.=2.1). The mean length of stay in acute wards before transfer or discharge was 12.5 days (S.D.=7.1).

Patients transferred to the PAC wards and those discharged directly home did not differ in terms of gender, age, living arrangement, proportion of patients receiving informal help at home, and the number of impairments in ADL. There were no differences on the comorbidity index on admission (Charlson), on the specific severity scores (NYHA and PSI; Table 1), or on other biomedical parameters [blood pressure, cardiac frequency, height, weight, and laboratory data such as blood count, electrolytes, and renal and hepatic function indicators (data not shown)].

The results showed statistically significant between-group differences, with patients who were transferred to the PAC facility having more formal help at home ($P$=.04), a longer stay in the acute wards ($P$=.006), a greater need of nursing time ($P$<.001; Table 1), a higher number of impairments in IADL ($P$=.02), a greater case complexity as measured by the INTERMED score ($P$<.001), and a significantly lower QoL as measured by the SF-36 and all of its subscales (Table 2). In the bivariate analysis, increased odds of being transferred to the PAC facility were associated with a longer stay in acute wards [odds ratio (OR)=1.07; 95% CI=1.02–1.12], a higher mean nursing workload (OR=1.12; 95% CI=1.06–1.17), higher number of impairments in IADL (OR=1.24; 95% CI=1.02–1.50), higher INTERMED score (per point: OR=1.31; 95% CI=1.20–1.44), and a poorer QoL as measured by the SF-36 (Table 3).

In the multivariate analysis, only the INTERMED score (per point: OR=1.29; 95% CI=1.18–1.41) and mean nursing workload (OR=1.06; 95% CI=1.01–1.12) were associated with transfer to the PAC facility. Controlling for diagnosis and other severity variables did not modify these findings.

A cutoff value of ≥33 points for the INTERMED score identified patients who were transferred to the PAC facility with a sensitivity of 79% and a specificity of 84% (positive predictive value=73.0%, negative predictive value=88.4%); the area under the ROC curve was 0.88 (95% CI=0.82–0.93; Fig. 1). Sixty-three (38%) out of 166 patients had an INTERMED score ≥33 points; more than half (58%) of the patients in the malaise or fall group and about a third of the

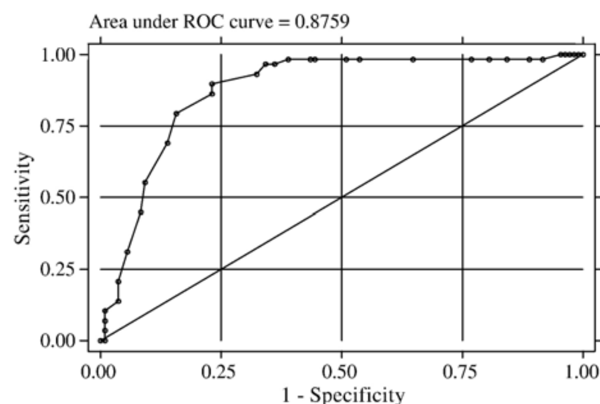


Fig. 1. ROC curve of the INTERMED score predicting a transfer to the medical rehabilitation facility. At a cutoff point of ≥33, the INTERMED score could predict a transfer to the medical rehabilitation facility with a sensitivity of 79% and a specificity of 84% and could classify correctly 83% of the cases.

Table 3
Bivariate association between independent variables and transfer to medical rehabilitation facility

| Independent variables | OR | 95% CI | $P$ |
|---|---|---|---|
| Sex (women vs. men) | 1.55 | 0.82–2.96 | .18 |
| Age (per additional decade) | 1.26 | 0.96–1.67 | .10 |
| Living alone | 1.66 | 0.87–3.15 | .12 |
| Formal help at home (yes vs. no) | 1.90 | 0.98–3.68 | .06 |
| Informal help at home (yes vs. no) | 1.39 | 0.59–3.26 | .45 |
| Charlson comorbidity index (per point) | 1.11 | 0.96–1.29 | .16 |
| Mean length of hospital stay in acute internal medicine wards (per day) | 1.07 | 1.02–1.12 | .005 |
| Nursing workload (per 10 additional minutes) | 1.12 | 1.06–1.17 | <.001 |
| Mean number of impairments in ADL (per additional impairment) | 1.03 | 0.89–1.19 | .71 |
| Mean number of impairments in IADL (per additional impairment) | 1.24 | 1.02–1.50 | .03 |
| INTERMED score (per point) | 1.31 | 1.20–1.44 | <.001 |
| SF-36 scores (per point) | | | |
| Physical functioning | 0.96 | 0.95–0.98 | <.001 |
| Physical role | 0.96 | 0.94–0.98 | <.001 |
| Bodily pain | 0.95 | 0.93–0.97 | <.001 |
| General health | 0.95 | 0.93–0.97 | <.001 |
| Energy/Vitality | 0.94 | 0.91–0.96 | <.001 |
| Social functioning | 0.95 | 0.93–0.97 | <.001 |
| Emotional role | 0.97 | 0.96–0.98 | <.001 |
| Mental health | 0.94 | 0.91–0.97 | <.001 |

patients in the heart failure (35%) and the pneumonia (30%) groups reached the cutoff.

## Discussion

This prospective study assessed biomedical and psychosocial characteristics of patients upon hospital admission and showed that for an identical principal diagnosis, patients who were transferred from acute medicine wards to a PAC facility had a higher biopsychosocial complexity than those who were directly discharged home. Furthermore, biopsychosocial complexity was identified as a predictor of the clinicians' decision to transfer or discharge the patient.

Biomedical characteristics alone did not allow for a differentiation of patients who were transferred versus those who were discharged home, nor did it predict PAC use. This was also true for specific severity scores of cardiac failure and pneumonia as well as for the comorbidity index. Thus, for the same principal diagnosis, transferred/discharged patients did not differ in biomedical terms; however, their health care use was not similar. Other parameters that mostly pertain to functional, psychological, and social aspects were significantly associated to this health care use, which encompassed not only transfer or discharge but also a longer stay in the acute wards and a higher nursing workload. These parameters included a significantly more important use of formal help at home and a higher number of impairments in IADL in transferred patients. This need for formal support, such as the services offered by health and social organizations, as well as a loss in IADL, that is, in competence in tasks that are required for independent living, which are more complex than those in ADL, points to a greater vulnerability and dependence in these patients. In clinical terms, it is noteworthy, however, that functional, psychological, or social aspects alone did not allow for this prediction any more than biomedical aspects alone. These results emphasize the importance of an integrated biopsychosocial approach of the patient as well as of health care use.

The fact that "groups of patients" that cannot be distinguished according to their principal diagnosis, comorbidities, and disease-specific severity indexes or sociodemographic characteristics have diverging needs and a different utilization of hospital resources illustrates the concept of both patient and care complexity [29,30]. In this study, the level of case complexity was assessed by the INTERMED questionnaire. At a cutoff point of ≥33, the INTERMED score could predict transfer to our PAC facility with satisfactory sensitivity and specificity scores. Used during the first 48 h following the admission, this tool could correctly classify 83% of the cases that will require additional in-hospital stay after discharge from acute care wards. To our knowledge, this is the first attempt to use an instrument that was designed to estimate case complexity as a predictor of PAC use. It should be noted that the cutoff score found in this study is higher (33 vs. 20/21 points) than the cutoff reported in other studies using the INTERMED questionnaire [26,31]. This cutoff determines risk factors for patients who have complex needs: most of them necessitate coordinated care involving somatic and psychological care as well as social assistance. According to the medical environment, coordinated care may already be part of the acute care management and/or may be available in the community so that no further in-hospital care is needed. In this study, the acute medicine ward provided an array of services including the availability of liaison psychiatry and social services. This might explain why transfer would then be necessary only for more complex cases that require further specialized in-hospital coordinated care. Besides, this study did not investigate the use of hospital services within the acute wards or case complexity per se but rather examined it as a possible predictor of the use of in-hospital PAC. Taken together, these elements may account for the higher cutoff found in this study.

The precocity (<48 h after admission) and the accuracy with which it is possible to identify patients who will eventually be transferred in a PAC facility can contribute when facing a clinical challenge, that is, in anticipating and explicitly addressing these patients' needs. The necessity of an instrument that evaluates biopsychosocial case complexity is also induced by the increasing specialization of health care systems, which, in turn, enhances the requirement for information sharing and cooperation to ensure continuity, efficiency, and individualization of care. Besides, prospective payment systems are strong incentives for hospital administrators and physicians to better characterize subgroups of such patients. For an identical principal diagnosis, complexity scores could help identify patients who need longer stays and could be included in reimbursement calculations as an additional case-mix indicator. Furthermore, as discharge processes are known to generate many inappropriate hospital days due to administrative factors, optimization of the discharge planning should be part of any global strategy that aims at controlling length of stay and health care expenditures [32,33]. Numerous studies have addressed the development of standardized tools, such as the Appropriateness Evaluation Protocol, which aims at the objective assessment of appropriateness of hospital bed use [34–36]. However, these instruments hardly allow to distinguish patients who might require extended PAC from those who do not [37]. This may be linked to the fact that most of these instruments focus on biomedical reasons for hospitalization and disregard criteria of physical, mental, or social suffering and their entanglement, which are often prominent in PAC settings. Global regulatory practices, including the availability and type of such facilities, are other important determinants of PAC use [38–40].

Case complexity calls upon several dimensions of care. In clinical care, it refers to the complexity of the disease, the absence of linearity and predictability of its symptoms, health care needs and use of the health care resources, as

well as its insertion within a given social and affective network [30,41,42]. Facing this complexity is a major challenge for the clinician as it requires the combination of evidence-based data and clinical judgment. It involves an irreducible element of factual uncertainty and the integration of the patient's illness in a biopsychosocial perspective [30]. In such conditions, the question should focus less on the search for a tool, allowing for the labeling of case complexity, and more on the necessity of an indicator of this complexity, allowing for the orientation of the patient in the health care system. Indeed, comprehensive understanding of patients' needs fosters effectiveness of health care delivery [42,43]. Various studies that assess case complexity have already shown that better therapeutic results can be obtained in subgroups of patients when biopsychosocial complexity is taken into account (e.g., decrease in the hospital length of stay and increase in patient satisfaction [28]). Case complexity has also been shown to be highly correlated with several outcomes such as health care use [27,44,45], HbA1c level [46], or return to work [27].

This study has limitations. It has been conducted in a teaching hospital, and it raises the question of the extent to which the results can be generalized to other settings. Moreover, prospective controlled studies that aim to evaluate the predictive value of integrative instruments that are designed to evaluate biopsychosocial issues are required to establish the validity of such tools when it comes to anticipating PAC use in various types of patients and health care environments [38]. Indeed, the use of a combined biopsychosocial assessment like the INTERMED to better orient patients in the health care system requires further validation in order to determine its impact on patient's care and health care resources utilization. Inpatient treatment is the most expensive form of medical care; therefore, an increased length of stay is of importance when the limited resources of the health care system is considered. The instrument used to appraise biopsychosocial complexity is not designed for routine use in emergency settings; however, it is close to an informed medical interview that would consider the integration of psychosocial aspects.

The decision to transfer or discharge a patient is multifaceted, especially when it comes to evaluate health care needs of patients with psychological and social conditions. Our results suggest that one of the potential utilities of the evaluation of case complexity could be to clarify the rationale of the decision regarding the modalities of PAC, that is, community-based or in-hospital rehabilitation. With the current emphasis on the efficient management of health care organizations and supported by the data from this study, further efforts should aim at better identifying the patients in need of postacute in-hospital care in order to improve the use of these facilities. The results of this study also indicate that the combination of the psychological, social, and biomedical dimensions of the disease can be evidenced as playing a role in the determination of patients' health care use. Indeed, patients who require longer stays in acute wards or transfer in postacute facilities can be identified early in acute settings as presenting with illness-specific, rather than disease-specific, characteristics that necessitate adapted treatment modalities.

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