

# Hospital Readmission Among Older Adults Who Return Home With Unmet Need for ADL Disability

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**Purpose:** This study determined whether returning to the community from a recent hospitalization with unmet activities of daily living (ADL) need was associated with probability of readmission. **Methods:** A total of 584 respondents to the 1994, 1999, and/or 2004 National Long-Term Care Surveys (NLTCS) who were hospitalized within 90 days prior to the interview and reported ADL disability at the time of the interview were considered for analysis. Medicare claims linked to the NLTCS provided information about hospital episodes, so those enrolled in Health Maintenance Organizations or Veterans Affairs Medical Centers were not included ( $n = 62$ ), resulting in a total sample size of 522. ADL disability was defined as needing human help or equipment to complete the task. Unmet ADL need was defined as receiving inadequate or no help for one or more ADL disabilities. Disability that began within 90 days of the interview was considered new disability. **Results:** After adjusting for demographic, health, and functioning characteristics, unmet ADL need was associated with increased risk for hospital readmission (HR: 1.37, 95% CI: 1.03–1.82). Risk of readmission was

greater for those with unmet need for new disabilities than those with unmet need for disabilities that were present before the index hospitalization (HR: 1.66, 95% CI: 1.01–2.73). **Implications:** Many older patients are discharged from the hospital with ADL disability. Those who report unmet need for new ADL disabilities after they return home from the hospital are particularly vulnerable to readmission. Patients' functional needs after discharge should be carefully evaluated and addressed.

**Key Words:** *Activities of daily living, Insufficient help*

More than half of hospitalized Medicare beneficiaries are readmitted within a year (Jencks, Williams, & Coleman, 2009). There is increasing concern that readmissions may reflect gaps in care. The Patient Protection and Affordable Care Act, Hospital Readmissions Reduction Program addresses these concerns by stating that hospitals with high risk-adjusted readmission rates will receive reduced Medicare payments for excess

readmissions for specific conditions beginning in 2013. In addition, Section 3026 of the Affordable Care Act describes the Community Care Transitions Program, which provides funds for implementation of evidence-based care transition interventions for adults who are vulnerable for readmission. It is critical to determine which patients are most vulnerable for readmission so that interventions can be efficiently targeted toward, and effectively tailored to, these patients.

Andersen's recursive model of health care utilization posits that outcomes of health services can affect patients' predisposing risks (e.g., prior illness status), enabling resources (e.g., access to needed care) and illness risks (e.g., illness level) for subsequent use of health services (Andersen, 1995). This model provides a framework for understanding that postdischarge health status, health needs, and access to needed health care affect vulnerability for readmission. Prior studies have considered pre-discharge patient characteristics that predispose, enable, and create need for readmission (Jencks et al., 2009; Ross et al., 2008). However, little is known about postdischarge patient characteristics that contribute to hospital readmission.

Many hospitalized older adults are discharged with new or worse activities of daily living (ADL) disabilities from which they do not recover in the months after discharge (Boyd et al., 2008; Sands et al., 2003). Despite the high prevalence of functional disability at discharge, many discharge planners are unaware of patients' resources for addressing their functional disabilities when they return home from the hospital (Bowles, Naylor, & Foust, 2002). An older study reported that 11% of patients reported that their functional needs were not met after discharge (Mamon et al., 1992), but that study did not consider whether unmet functional needs were associated with readmission. Although recent studies provide evidence that unmet need for functional disabilities increases risk for future hospital admissions, those studies do not specifically assess whether patients had unmet ADL needs after they returned home from a recent hospitalization and whether unmet ADL needs after discharge were associated with readmission (Arbaje et al., 2008; Sands et al., 2006; Xu, Covinsky, Stallard, Thomas, & Sands, 2012). The purpose of this study is to build upon prior studies by assessing whether returning home from the hospital with unmet need for new or existing ADL disabilities increases vulnerability for readmission. In the context of Andersen's recursive model, access to needed

ADL care after discharge is an enabling characteristic that could affect risk for readmission. The results of this study will inform whether discharge planning and transitional care interventions should include postdischarge access to resources to meet new and existing disabilities following discharge.

## Methods

### Overview

Data from a national community survey and linked Medicare claims were reviewed to identify a subset of participants who were living in the community with ADL disability within three months after hospital discharge. Participants were observed forward for one year to determine post-discharge risks for readmission.

### Data Sources

Data were from the 1994, 1999 and 2004 community interviews from the NLTCs. The interview, conducted by trained census takers, provided information about participants' demographic characteristics, ADL functioning, ADL help, and health status at the time of the interview. Medicare claims data from 1993 through 2005 provided information about hospital episodes.

### Sample

Respondents to the NLTCs community interviews were randomly selected community-living Medicare enrollees. Response rates were 95% or higher except for 2004 in which the response rate was closer to 90%. Included in this study was a subset of 844 respondents to the 1994, 1999, and 2004 community surveys that were living in the community and responded to the survey within three months after hospital discharge. Of these, 62 were excluded, because they received health care from a Health Maintenance Organization or a Veterans Affairs Medical Center, and their hospital episodes were unlikely to be recorded in the Medicare claims data. Of the remaining 782 respondents, an additional 260 were excluded, because they did not have ADL disability at the time of the interview. Only respondents with current ADL disabilities were included, because, presumably, one cannot have unmet ADL need unless one has an ADL disability. The final analytic sample size was 522 (see Figure 1). A subset of the analytic sample from this study was included in a larger study of 5,884 community-living

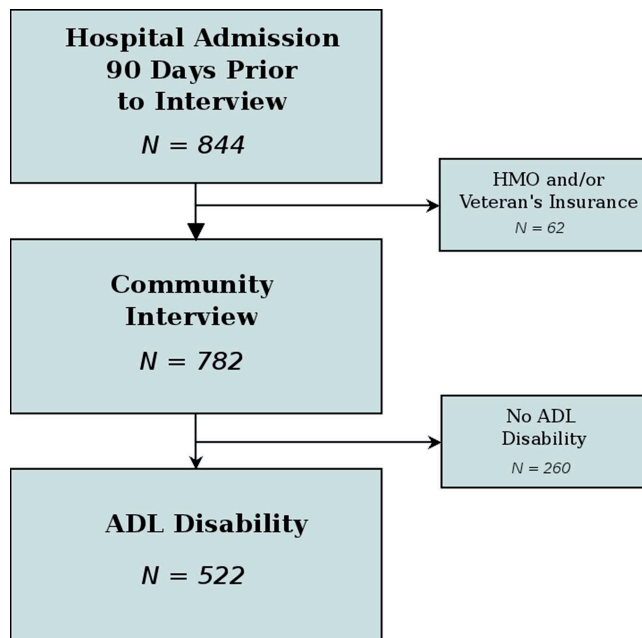


Figure 1. Flowchart of how sample was selected.

older adults (Xu et al., 2012). That study did not focus on risks for readmission, nor did it include respondents with newly acquired ADL disability associated with a recent hospitalization.

### ADL Disability and Unmet ADL Need

For each ADL task (bathing, dressing, eating, toileting, and either getting out of bed or moving around a room), a respondent was considered to have a disability if they received help, required standby help, needed help but did not receive help, or used equipment to complete the task.

Participants were considered to have unmet ADL need if they reported that they did not receive needed help, could have used more help or had to wait to do the task, because they did not have enough help. This definition is similar to that used in previous studies of unmet need for ADL disabilities (Allen & Mor, 1997; Kennedy, 2001; LaPlante, Kaye, Kang, & Harrington, 2004).

New ADL disability was defined as disability that began less than three months prior to the interview. Existing ADL disability began more than three months prior to the community interview. Note that the index hospitalization occurred within three months of the interview.

### Readmission

Date of readmission since the index discharge date was determined from the linked Medicare inpatient claims files.

### Covariates

Information about predisposing, enabling, and need characteristics was obtained during the community survey and from linked Medicare claims data. Predisposing risks for readmission included age, gender, race (white vs. others), living arrangement (alone or not alone), and marital status (married vs. other). A proxy respondent indicated if the respondent was unable to respond to the interview due to illness or physical or cognitive disability. Prior illness status was defined as the number of previous hospital admissions within one year prior to the interview. This information was obtained from the inpatient claims files.

Need characteristics included diagnoses, disability level, and cognitive status. Presence of arthritis, diabetes, heart disease, emphysema, and cancer were determined from self-reports provided during the community survey. Participants were classified as having cognitive impairment if they had dementia or a score on a mental status test indicating presence of cognitive impairment (Pfeiffer, 1975; Tombaugh & McIntyre, 1992). Missing cognitive status was assigned to those who did not have dementia or a mental status score. Level of ADL disability was categorized as 1–2 and 3–5 ADL disabilities.

Unmet need for either a new or an existing ADL disability was the enabling characteristic examined in this study. Participants were classified as having zero versus one or more unmet needs.

### Statistical Analyses

Bivariate Cox proportional hazards models were computed to assess the association between predisposing, enabling, and need characteristics and time until the first readmission (Allison, 1995). Right censoring occurred if the participant died, was admitted to a skilled nursing facility (after the community interview, but before a subsequent hospital admission), or at the end of the study interval if not readmitted priorly. Sampling weights reflecting each participant's probability of inclusion in the sample were included in the models to obtain design consistent parameter estimates. Standard errors were computed using the Taylor series linearization approach to adjust for the complex sampling design (Cox & Oakes, 1984; Grambsch & Therneau, 1994).

A multivariable Cox proportional hazards model was used to determine the association between unmet ADL need and readmission after

controlling for postdischarge subject characteristics that predispose and create need for readmission. Models were simplified using backwards variable selection. A secondary analysis was computed using a multivariable Cox model to assess the risk of unmet need for a new ADL disability compared with unmet need for an existing ADL disability.

Model diagnostics were performed using Martingale residuals to detect nonlinearity and Schoenfeld residuals to test the proportional odds assumption (Fox, 2002; Therneau & Grambsch, 2000). To assess whether the results varied across time, a main effect for assessment occasion (1994, 1999, and 2004) and an interaction between unmet need and assessment occasion were included in the final models. Analyses were performed using the SAS 9.2 survey procedures and R 2.14.1 using the survey, survival, and ggplot2 packages.

## Results

Table 1 reveals that the majority of participants were female (65%), white (85%), and lived with others (63%). Proxy respondents (e.g., family members) completed thirty percent of the interviews. Prevalence of diabetes (31%), cancer (15%), heart disease (60%), stroke (14%), and cognitive impairment (23%) were similar to those reported in other studies of disabled adults (Stineman et al., 2011).

Bivariate results (Table 2) show that participants most likely to be readmitted were of minority racial status (HR: 1.59, 95% CI: 1.08–2.35), and had a proxy (HR: 1.60, 95% CI: 1.19–2.25), diabetes (HR: 1.69, 95% CI: 1.27–2.25), more than one hospital admission prior to the index admission (HR: 1.51, 95% CI: 1.37–1.68), and 3–5 ADL disabilities (HR: 1.72, 95% CI: 1.31–2.27). Those who reported unmet need for ADL help were more likely to be readmitted in the year following the index hospitalization (HR: 1.66, 95% CI: 1.25–2.20). The bivariate analyses also reveal that those with unmet need, either for a new or an existing ADL disability was associated with increased risk for readmission (HR: 2.37; 95% CI: 1.37–4.11 and HR: 1.61; 95% CI: 1.21–2.14, respectively).

Table 3 reports adjusted risks for readmission. Higher age and having diabetes, more than one previous hospital admission, more than two ADL disabilities, and unmet need for an ADL disability were associated with an increased risk of readmission (HR: 1.37; 95% CI: 1.03, 1.82). The effects of assessment occasion and the interaction between assessment occasion and unmet need were

Table 1. Sample Characteristics

	N	Percent	
		Unweighted	Weighted
Sex			
Male	182	34.87	35
Female	340	65.13	65
Race			
White	456	87.36	84.9
Other	66	12.64	15.1
Living arrangement			
Alone	201	38.54	36.97
Not alone	320	61.42	63.03
Proxy			
No	363	69.54	70.29
Yes	159	30.46	29.71
Arthritis			
No	136	26.15	27.34
Yes	386	73.85	72.66
Diabetes			
No	380	72.94	69.39
Yes	141	27.06	30.61
Cancer			
No	438	84.39	84.82
Yes	81	15.61	15.18
Heart disease			
No	214	41.31	40.28
Yes	304	58.69	59.72
Stroke			
No	446	86.1	85.73
Yes	72	13.9	14.27
Emphysema			
No	440	84.78	83.88
Yes	79	15.22	16.12
Cognitively impaired			
No	253	48.47	48.11
Yes	119	22.8	22.57
Missing	150	28.74	29.32
Number of ADL disabilities			
1–2	226	43.29	42.81
3–5	296	54.61	53.19
Unmet ADL need			
No	380	72.8	70.83
For existing disability	109	20.8	21.62
For new disability	33	6.32	7.55
Age		M = 78.14 SD = 7.54	
Number of previous hospital admissions		M = 1.84 SD = 1.23	

not significant, indicating that the effect of unmet need on hospital readmission did not change significantly over time. Figure 2 illustrates the time to readmission for those with and without unmet ADL need.

Secondary analyses showed that the hazard ratio for risk of readmission for those who reported unmet need for existing disability was 1.22 (95%



Table 2. Unadjusted Risks for Readmission

	Weighted readmission (%)	<i>p</i> value	Hazard ratio (95% CI)
Gender			
Female	53.52	—	—
Male	56.04	.34	1.15 (.86, 1.53)
Race			
White	55.96	—	—
Other	68.05	.02	1.59 (1.08, 2.35)
Living arrangement			
Alone	51.86	—	—
Not alone	61.19	.08	1.28 (.97, 1.68)
Proxy			
No	52.9	—	—
Yes	69.34	.002	1.60 (1.19, 2.14)
Arthritis			
No	65.06	—	—
Yes	55.1	.1	.77 (.57, 1.05)
Diabetes			
No	52.4	—	—
Yes	69.7	<.001	1.69 (1.27, 2.25)
Cancer			
No	56.4	—	—
Yes	63.38	.83	.96 (.68, 1.34)
Heart disease			
No	52.21	—	—
Yes	61.54	.08	1.28 (.97, 1.68)
Stroke			
No	56.1	—	—
Yes	67.79	.15	1.27 (.92, 1.76)
Emphysema			
No	56.69	—	—
Yes	63.94	.6	1.10 (.77, 1.58)
Cognitively impaired			
No	53.79	—	—
Yes	63.62	.06	1.37 (.99, 1.91)
Missing	59.86	.3	1.19 (.85, 1.67)
Number of ADL disabilities			
1–2	46.68	—	—
3–5	66.1	<.001	1.72 (1.31, 2.27)
Unmet ADL need			
No	51.61	—	—
Yes	72.78	<.001	1.66 (1.25, 2.20)
Unmet ADL need			
No	51.61	—	—
For existing disability	71.61	.001	1.61 (1.21, 2.14)
For new disability	76.13	.002	2.37 (1.37, 4.11)
Age		.72	1.00 (.99, 1.02)
Number of previous hospital admissions		<.001	1.51 (1.37, 1.68)

CI: .90–1.65) and those who reported unmet need for new disability was 2.02 (95% CI: 1.24–3.30) compared with no unmet need (Table 4). The effect of unmet need did not change over time as demonstrated by the nonsignificant effect of assessment

Table 3. Adjusted Risks for Readmission Including Presence versus Absence of Unmet ADL Need

	Hazard ratio (95% CI)
Age in years	1.02 (1.00, 1.04)
Diabetes	
No	—
Yes	1.53 (1.16, 2.02)
Number of previous hospital admissions	1.51 (1.37, 1.67)
Number of ADL disabilities	
1–2	—
3–5	1.41 (1.05, 1.89)
Unmet ADL need	
No	—
Yes	1.37 (1.03, 1.82)

occasion and the nonsignificant interaction between assessment occasion and unmet need. The hazard ratio for unmet need for new disability compared with existing need for an ADL disability was 1.66 (95% CI: 1.01–2.73, see Figure 3).

## Discussion

One in four hospitalized Medicare patients return home with unmet need for new or existing ADL disabilities. Unmet ADL need increases risk for readmission, especially among patients who report unmet needs for recently acquired ADL disabilities. It is well documented that hospitalization is associated with the declines in ADL functioning. These declines persist after hospitalization despite the effectiveness of interventions to reduce hospital-associated functional decline (Counsell et al., 2000; Landefeld, Palmer, Kresevic, Fortinsky, & Kowal, 1995). This study provides evidence that ADL needs should be thoroughly assessed and addressed after the patients return home from a hospital episode.

To our knowledge, only two studies considered whether unmet need for functional disabilities increases risk for readmission. A study conducted in Italy demonstrated that living alone and lack of regular emotional or material support is associated with readmission. The study did not explicate whether lack of emotional support versus support for physical disabilities contributed to readmission rates (Di Iorio et al., 1998). A study of Medicare patients revealed that persons who experienced two hospitalizations within 60 days had reported unmet needs for one or more ADL or IADL disabilities prior to the first hospitalization (Arbaje et al., 2008). The authors acknowledge a limitation of that study was that it was not possible to determine whether unmet functional needs changed

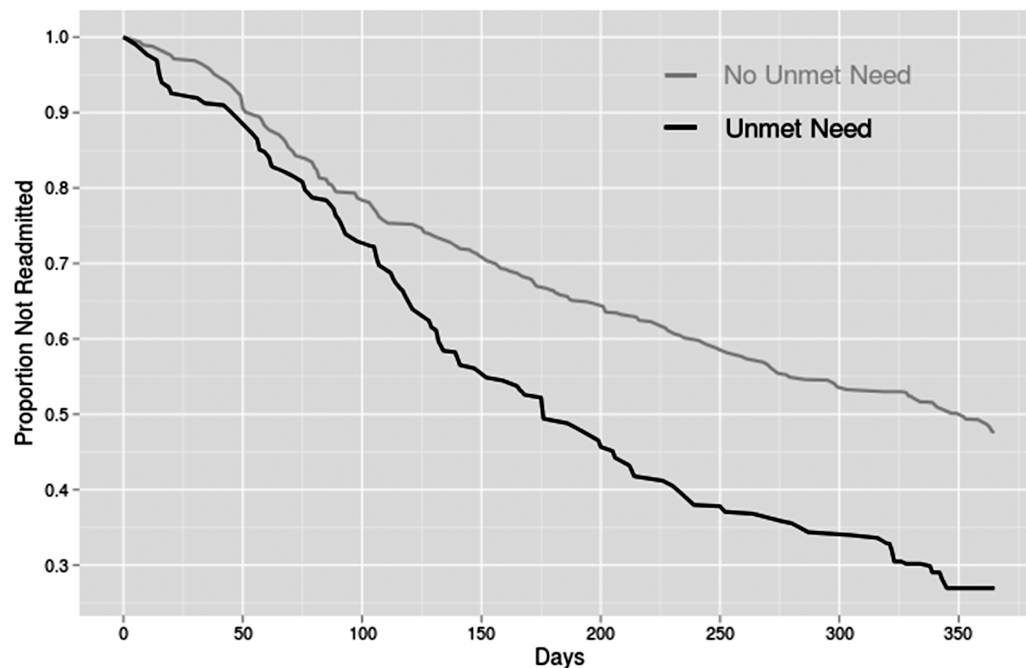


Figure 2. Kaplan-Meier curves representing hospital readmission risk associated with unmet activities of daily living (ADL) need.

Table 4. Adjusted Risks for Readmission Including Unmet ADL Need for New and Existing Disabilities

	Hazard ratio (95% CI)
Age in Years	1.02 (1.00, 1.04)
Diabetes	
No	—
Yes	1.53 (1.38, 1.69)
Number of previous hospital admissions	1.55 (1.18, 2.04)
Number of ADL disabilities	
1–2	—
3–5	1.39 (1.03, 1.88)
Unmet ADL need	
No	—
For existing disability	1.22 (.90, 1.65)
For new disability	2.02 (1.24, 3.30)

during the year of monitoring for readmission. In contrast, our study design provided the opportunity to demonstrate that participants who return to the community with unmet need for an ADL disability developed since the index hospitalization are more vulnerable for readmission than those who return home with unmet need for an ADL disability acquired prior to the index hospitalization.

The transition from hospital to home is problematic for many patients (Murtaugh & Litke, 2002), especially when that transition involves coping with functional disabilities for which patients feel they do not have adequate help. Formal home care services provide assistance to patients with poor functional status who are vulnerable to readmission

(Bowles et al., 2002; Jencks et al., 2009), but only 4% of the patients are discharged with home care (Wier et al., 2010). Absence of home care increases the risk for hospitalization (Xu et al., 2010) and readmission (Bowles et al., 2002). Collectively, this evidence suggests that patients' functional needs should be carefully evaluated after discharge. A recent review reveals that most postdischarge or transitional care interventions focus on medical management, but few address patients' functional needs after discharge (Naylor, Aiken, Kurtzman, Olds, & Hirschman, 2011).

### Limitations

The findings must be considered in the context of the limitations of conducting research with existing data. First, we were not able to determine whether participants experienced a constant or periodic state of unmet ADL need. Nonetheless, results revealed that a single "snapshot" assessment of unmet need after discharge is prognostic of readmission. Second, we cannot specify the reason the individual reported unmet need. The most common reasons for reporting unmet need are that 1) the help does not occur when needed, 2) the amount of help is insufficient, and 3) the person helping with the task is not able to do what is needed (e.g., help with transferring or bathing) (LaPlante et al., 2004). Third, we cannot verify that new unmet need developed as a consequence of the illness or injury that precipitated the index hospitalization.

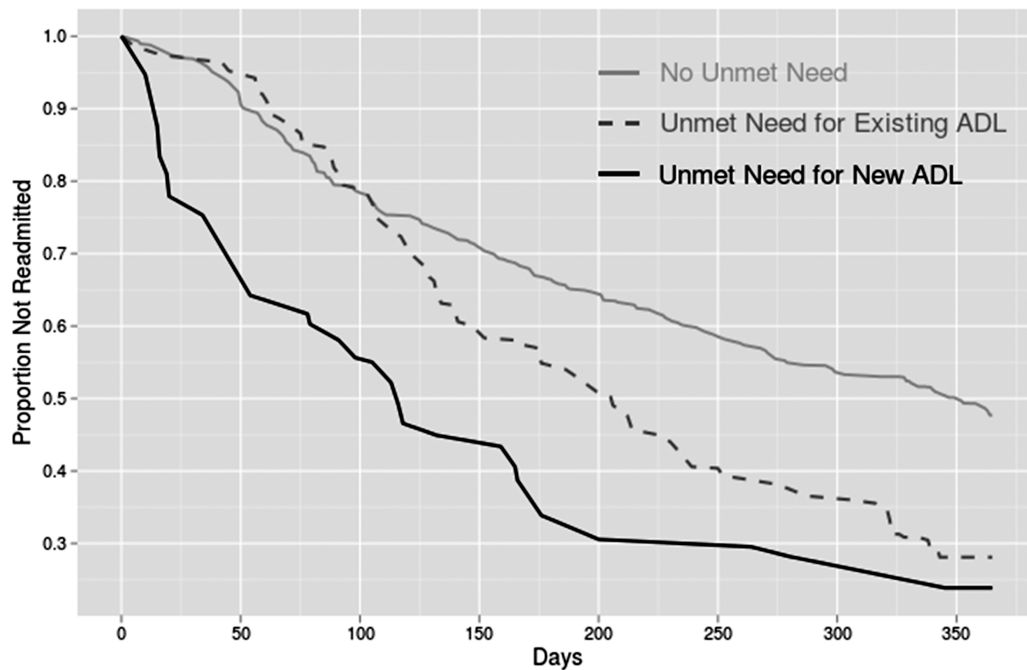


Figure 3. Kaplan-Meier curves representing hospital readmission risk for unmet need for existing and new activities of daily living (ADL) disabilities.

However, it is likely that most ADL disability that began within this interval is related to the reason for the index hospitalization, because nearly half of incident ADL disability occurs in the context of hospitalization (Covinsky et al., 2000; Mehta et al., 2011). Fourth, we cannot describe the mechanism by which unmet need led to readmission. Unmet need is associated with self-reports of inadequate nutrition, skin breakdown, falls, and significantly reduced mobility in the home (LaPlante et al., 2004). However, billing records are not designed to describe causal pathways for admission. Fifth, data are not available to determine whether patients had unmet need in other aspects of self-care that are commonly included in surgical or medical discharge plans. For example, a study conducted in Japan revealed that unmet need for medication administration increases risk for hospitalization (Kuzuya et al., 2008). Despite these limitations, the results provide evidence that asking patients whether they have sufficient help at home for their self-care needs may be effective in identifying a modifiable risk for readmission.

## Conclusion

Comprehensive discharge planning and transitional care interventions can reduce readmission rates (Naylor et al., 2011; Phillips et al., 2004). The results of this study provide evidence that

eligibility for transitional care should include consideration of whether a patient has sufficient ADL help after returning home from a hospitalization.

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