

# Who Becomes a High Utilizer? A Case-Control Study of Older Adults in the USA

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## INTRODUCTION

Frequently hospitalized patients represent a high-cost population at risk of poor outcomes. These high-utilizers represent only 1.6% of admitted patients, but they account for 8% of admissions and 7% of direct costs.<sup>1,2</sup> While prior studies have identified risk factors for 30-day readmissions,<sup>3</sup> little is known about risk factors associated with patients who accrue multiple admissions over a longer period of time. Prior studies using cross-sectional analyses have also neglected to identify upstream risk factors for becoming a high-utilizer.<sup>3,4</sup> Proactively identifying patients years before entering a cycle of frequent hospitalizations may allow for early intervention to prevent hospitalizations and improve outcomes. We sought to identify distinguishing comorbid conditions, functional limitations, and social risk factors that differentiate patients, who had 5 or more hospitalizations over a 2-year period, years before they became high-utilizers.

## METHODS

We identified cases from the Health and Retirement Study (HRS) who reported having 5 or more hospitalizations over the past 2 years in a biannual survey between 2002 and 2014. We used the first survey on which high-utilizers reported 5 or more hospitalizations over 2 years as the index survey ( $T_0$ ) to identify cases. Each high-utilizer was matched to a control, who never reported being hospitalized 5 or more times over 2 years, based on age, gender, and survey year using data from the index survey ( $T_0$ ).

We then compared variables about chronic conditions associated with 4- and 10-year prognosis,<sup>5</sup> functional status, and social factors from the survey immediately preceding the index survey ( $T_{-1}$ ) using bivariate chi-squared tests and conditional logistic regression. To compare the prevalence of risk factors over time, we used generalized linear mixed models using data from the index survey ( $T_0$ ) and the two surveys preceding the index survey ( $T_{-1}$  and  $T_{-2}$ ), which provided three timepoints for comparison of change in prevalence. The institutional review board at the University of California, San Francisco, approved the use of data from HRS for this study.

## RESULTS

Of the 18,602 participants age 65 and older, 984 (5.3%) reported being admitted to the hospital 5 or more times within 2 years. Of those, 886 (90.0%) had data from the prior two surveys and could be matched with controls on age, gender, and survey year, giving a sample of 1772 participants. In the first year of high utilization, high-utilizers reported a mean of 7.2 hospitalizations over 2 years (median 6, interquartile range (IQR) 5–8, range 5–75), while controls reported a mean of 0.6 hospitalizations over 2 years (median 0, IQR 0–1) ( $p < 0.001$ ).

Comparing high-utilizers to controls using data from the survey immediately preceding the index survey ( $T_{-1}$ ), cases who became high-utilizers, had a higher prevalence of all comorbidities other than abnormal body mass index (BMI) and a higher prevalence of all examined markers of impaired function (Table 1). Cases also had higher prevalence of being not married or widowed and having an informal caregiver (Table 1).

A subset of factors had significantly different rates of change in prevalence over time between high-utilizers and controls. Factors with significantly different rates of change in prevalence included heart disease, BMI, impairments in activities of daily living (ADLs), impairments in instrumental activities of daily living (IADLs), falls, ability to drive, and difficulty climbing one flight of stairs (Fig. 1). None of the social factors or other medical conditions had significant differences in rate of change in prevalence.

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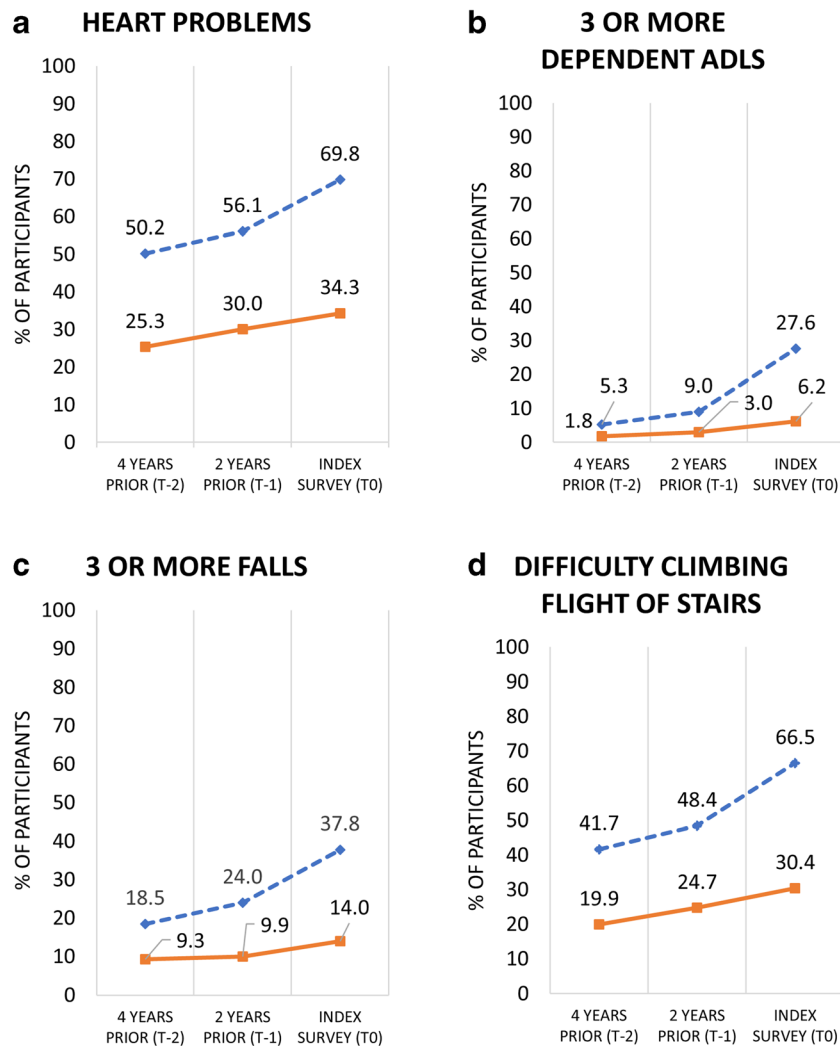
Table 1 Risk Factors of Cases and Controls 2 Years Prior to High-Utilizer Cohort Becoming Frequently Hospitalized ( $T_{-1}$ )

Characteristic	Cases (N=886) No. (%)	Controls (N=886) No. (%)	Unadjusted OR	P value
<b>Demographics</b>				
Age	Mean 74.9 SD (7.9)	Mean 74.9 SD (8.0)	1	
Gender				
Female	515 (58.1)	515 (58.1)	1	
Ethnicity				
White	674 (76.1)	681 (76.8)	1	
African American	132 (14.9)	123 (13.9)	1.1 (0.8–1.4)	0.54
Latino	62 (7.0)	68 (7.7)	0.9 (0.6–1.3)	0.67
Other	18 (2.0)	14 (1.6)	1.3 (0.6–2.6)	0.47
<b>Comorbidities</b>				
Number of hospitalizations	2.2 (8.3)	0.5 (0.9)	1.9 (1.7–2.1)	<0.001
Heart problems	496 (56.1)	265 (30.0)	2.8 (2.3–3.5)	<0.001
Lung disease	209 (23.7)	74 (8.4)	3.2 (2.4–4.2)	<0.001
Cancer	198 (22.5)	136 (15.4)	1.6 (1.3–2.1)	<0.001
Diabetes	326 (36.9)	201 (22.7)	2 (1.6–2.5)	<0.001
BMI				
Normal (18.5–24.9)	263 (30.1)	292 (33.3)	1	
Underweight (<18.5)	23 (2.6)	22 (2.5)	1.1 (0.6–2.0)	0.71
Overweight/obese ( $\geq 25$ )	588 (67.3)	564 (64.2)	1.2 (0.9–1.4)	0.18
<b>Functional status</b>				
ADL dependent				
0 dependent	676 (77.4)	801 (91.0)	1	
1–2 dependent	119 (13.6)	53 (6.0)	2.9 (2.0–4.3)	<0.001
$\geq 3$ dependent	79 (9.0)	26 (3.0)	3.4 (2.1–5.3)	<0.001
IADL dependent				
0 dependent	469 (52.9)	631 (71.2)	1	
1–2 dependent	277 (31.3)	189 (21.3)	2.2 (1.7–2.8)	<0.001
$\geq 3$ dependent	140 (15.8)	66 (7.5)	3.2 (2.3–4.5)	<0.001
Self-rated health compared with last year				
Better/about the same	457 (51.7)	636 (69.8)	1	
Worse	427 (48.3)	250 (28.2)	2.4 (1.9–2.9)	<0.001
Visual impairment	322 (36.4)	213 (24.1)	1.8 (1.5–2.3)	<0.001
Hearing impairment	301 (34.1)	228 (25.7)	1.5 (1.2–1.9)	<0.001
Falls				
None	407 (50.1)	558 (68.5)	1	
1–2	116 (14.3)	108 (13.3)	1.5 (1.1–2.1)	0.009
2–3	94 (11.6)	68 (8.3)	1.9 (1.3–2.7)	0.001
$\geq 3$	195 (24.0)	81 (9.9)	3.3 (2.4–4.5)	<0.001
Driving status				
No/never drove	273 (33.9)	167 (20.5)	1	
Yes	531 (66.0)	647 (79.5)	0.4 (0.3–0.6)	<0.001
Difficulty climbing one flight of stairs	427 (48.4)	219 (24.7)	2.8 (2.3–3.5)	<0.001
<b>Social factors</b>				
Alcohol use				
$\leq 7$	763 (86.2)	714 (81.0)	1	
7–14	49 (5.5)	72 (8.2)	0.6 (0.4–0.9)	0.02
$> 14$	73 (8.3)	96 (10.9)	0.7 (0.5–1.0)	0.04
Informal caregiver	172 (19.4)	66 (7.5)	3.1 (2.3–4.3)	<0.001
Living children in contact				
$\geq 2$	742 (85.2)	732 (84.0)	1	
0–1	129 (14.9)	139 (16.0)	0.9 (0.7–1.2)	0.38
Living alone	274 (30.9)	242 (27.3)	1.2 (1.0–1.5)	0.08
Financial assistance from children	63 (7.5)	52 (6.2)	1.0 (0.9–1.1)	0.37
Marital status				
Married	449 (50.7)	540 (61.0)	1	
Not married/widowed	436 (49.3)	346 (39.1)	1.7 (1.3–2.1)	<0.001

## DISCUSSION

Our findings demonstrate that high-utilizers have a higher prevalence of comorbidities and higher rates of functional impairment compared with their age- and gender-matched peers years before they become high-utilizers. In addition, impairments of functional status more consistently showed greater increases in prevalence as cases moved closer to becoming high-utilizers. Together, these findings highlight the need to focus on preventive strategies that monitor, maintain, and improve function in addition to disease-specific models

that may miss critical changes in function that are associated with frequent hospitalization. This study also adds to the literature by investigating a unique population who accrue multiple hospitalizations outside of 30-day readmissions and by investigating risk factors years upstream from high utilization. Future studies may further delineate the relationship between functional decline and the timing and duration of hospitalizations by linking HRS and Medicare data, which may reduce confounding factors present in this study.



**Figure 1** Change in prevalence of risk factors associated with frequent hospitalization over time. Comparison of the prevalence of comorbid conditions and functional limitations between participants who became frequently hospitalized at the time of the index survey (dashed horizontal line) and participants who were never frequently hospitalized (solid line). The comparisons of slopes are based on an overall line of best fit using mixed methods linear modeling. **a** Self-reported comorbid heart problems ( $p = 0.006$ ). **b** Self-reported dependency for 3 or more activities of daily living ( $p < 0.001$ ). **c** Self-reported 3 or more falls over the past 2 years ( $p < 0.001$ ). **d** Self-reported difficulty climbing stairs ( $p < 0.001$ ).

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#### Compliance with Ethical Standards:

The institutional review board at the University of California, San Francisco, approved the use of data from HRS for this study.

**Conflict of Interest:** The authors declare that they do not have a conflict of interest.

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