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In-hospital Mobility Variations across Primary Diagnoses among Older Adults

Vincenzo Valiani, MD^{a,b}, Shiyao Gao, MPH^a, Zhiguo Chen, PHHP-BIO^{a,b,c}, Sunil Swami, MBBS, MPH, PhD^a, Christopher A. Harle, PhD^d, Gigi Lipori, MT, MBA^e, Sandrine Sourdet, MD^f, Samuel Wu, PhD^c, Susan G. Nayfield, MD, MSc^a, Carlo Sabbá, MD^b, Marco Pahor, MD^a, and Todd M. Manini, PhD.^a

^aDepartment of Aging & Geriatric Research, University of Florida, Gainesville, FL

^bClinica Medica Cesare Frugoni, Dipartimento Interdisciplinare di Medicina, University of Bari Aldo Moro, Bari, Italy

^cDepartment of Biostatistics, University of Florida, Gainesville, FL

^dHealth Services Research, Management & Policy, University of Florida, Gainesville, FL

^eUF Health, University of Florida, Gainesville, FL

^fDepartment of Geriatric Medicine, Toulouse University Hospital, Gérontopôle, Toulouse, France

Abstract

Objectives—To examine the relationship between primary diagnoses and mobility impairment and recovery among hospitalized older adults.

Design—Prospective cohort study.

Setting—UF Health Shands Hospital, an 852-bed level I trauma center located in Gainesville, Florida.

Participants—18,551 older adults (≥ 65 years) with 29,148 hospitalizations between 1/2009 and 4/2014.

Measurements—Incident and discharge mobility impairment and recovery were assessed using the Braden activity subscale score that was recorded by the nursing staff at every shift change—approximately three times per day. Primary diagnosis ICD-9 codes were used as predictors and re-categorized by using the Agency for Health Care Research and Quality Clinical Classification Software.

Results—Out of the 15,498 hospital records where the patient was initially observed to “walk frequently”, 3,186 (20.6%) developed incident mobility impairment (chair-fast or bedfast). Primary diagnoses with a surgical or invasive procedure were the most prevalent (77.2 %) among

Corresponding Authors: Vincenzo Valiani, MD, Department of Aging & Geriatric Research, 2004 Mowry Road, Gainesville FL, 32611, Phone: 352-273-9390, Fax: 352-273-9920, v.valiani@ufl.edu or vincio86@gmail.com. Todd Manini, PhD, Department of Aging & Geriatric Research, 2004 Mowry Road, Gainesville FL, 32611, Phone: 352-275-8670, Fax: 352-273-9920, tmanini@ufl.edu.

CONFLICT OF INTEREST

All authors declare NO conflict of interest.

the hospital observations with incident mobility impairment; otherwise primary diagnoses without surgery were much more associated with discharge mobility impairment (59%). The highest incidence of mobility impairment occurred in patients with heart valve disorders and aortic and peripheral/visceral artery aneurysms (6.24 and 6.05 events per 30 person-days, respectively); septicemia showed the highest incidence rate for mobility limitation at discharge (0.94 events per 30 person-days). Mobility impairment was observed in 13,650 (46.8% of total) records at admission and 5,930 (43.44%) were observed to recover to a state of walking occasionally or frequently. Osteoarthritis and cancer of gastrointestinal organs/peritoneum had the highest incidence rate for mobility recovery (7.68 and 5.63 events per 30 person-days respectively).

Conclusions—Approximately 1 out of 5 patients who were mobile at admission became significantly impaired during hospitalization. However, about half (43.4%) of patients observed to have mobility impairment at admission recovered during hospitalization. Conditions most associated with mobility impairment and recovery are varied, but older patients hospitalized for septicemia and cardiovascular diseases with surgery (heart valve disorders and aortic/peripheral/visceral artery aneurysms) appear to be at most risk for incident mobility impairment that did not recover at discharge.

Keywords

hospitalization; disability; mobility; aging; comorbidity

INTRODUCTION

Hospitalization of older adults is strongly associated with increased nursing home placement and functional decline, even in patients with relatively moderate to high functional status at admission^{1–2}. In that regard, low mobility (walking and transferring) and bed rest during hospitalization are common, regardless whether the patient is able to walk independently or not³. An estimated 23–33% of hospitalized older adults experience decreased mobility defined as being limited to a bed or a chair or infrequent ambulation. Only 65% of patients were observed to walk at least once a day outside their room during hospitalization⁴. Despite the strong association between poor mobility and post hospitalization adverse outcomes⁵, the factors associated with mobility limitation in the hospital setting have received little attention.

A complex set of symptoms (weakness or pain, fear of falling, lack of motivation and need for assistance), medical conditions, diagnostic and therapeutic procedures, and the hospital environment have been identified by the patients as perceived barriers that limit in-hospital mobility⁶. To our knowledge, only one study demonstrated that illness severity is associated with hospital mobility⁷. As such, acute illness and subsequent hospitalization is likely to trigger a pre-existing frailty status⁸ increasing the risk for functional decline, new institutionalization and death⁵ among older adults. However, the research has stopped short in evaluating the association of mobility impairment with specific medical conditions that cause hospitalization (e.g. primary diagnosis). It has also neglected to examine mobility recovery rates in older patients who are hospitalized with significant impairment. This is partly due to the need for large sample sizes while simultaneously charting mobility changes during hospitalization.

It is becoming clear that in-hospital mobility is an important modifiable element for post hospitalization functional outcomes⁶. A recent study by Hastings and coworkers⁹ showed that a supervised walking program for hospitalized older adults was feasible and safe and demonstrated promising results in improving functional post-discharge outcomes. Understanding the medical illnesses most associated with mobility impairment or recovery during hospitalization will help to identify and target the older adults at risk of mobility limitation or those who will recover faster from their baseline impairment. Therefore, the primary objective of this study is to understand the primary diagnoses that are associated with incident mobility impairment and recovery in older hospitalized patients.

METHODS

Design and Setting

Data were collected in a retrospective manner, but the design followed a prospective cohort study where hospitalized patients were evaluated at baseline and assessed throughout their stay for mobility impairment and recovery. Data were collected in older adults (65+ years old) who were hospitalized at University of Florida Health Shands Hospital, an 852-bed level I trauma center located in Gainesville, Florida. This work was supported by the National Institutes of Health and National Center for Advancing Translational Sciences (NIH/NCATS) Clinical and Translational Science Award to the University of Florida (UL1 TR000064) and by the University of Florida's, Claude D. Pepper Center (P30AG028740-R6, Data and Statistical Science Core).

Data Sources

Patient data from electronic medical records were warehoused using an Integrated Data Repository (IDR) between January 1st 2009 and April 20th 2014. The IDR aggregates clinical and administrative system data, which can subsequently be used for research. The data were compiled in a de-identified longitudinal dataset that included: demographics, hospital admission and discharge International Classification of Diseases Ninth Revision (ICD-9) diagnoses and procedures codes and Braden activity, mobility and nutrition subscale scores obtained at admission, during hospitalization and at discharge. The University of Florida Gainesville Health Science Center Institutional Review Board reviewed and approved the study protocol as exempt from human subjects' research.

Patients

The initial study population was composed of 18,624 older adults, 65+ years of age. Many patients had multiple hospitalizations and thus there were a total of 29,341 hospital observations. One hundred and sixty one observations did not contain Braden scores, 31 observations did not have primary diagnoses and one record did not have primary procedures and were removed from analysis. The total analytic sample was 29,148 hospital observations over a total of 18,551 patients.

Outcome Measures

The outcomes were incident and discharge mobility impairment and recovery during hospitalization. The Braden "activity" subscale was used to assess the outcomes. The Braden

scale is commonly performed to predict pressure sores using six subscales (sensory perception, moisture, activity, mobility, nutrition and friction and shear), and each subscale has a score between 1 and 4, with the exception of the friction and shear subscale, which ranges from 1 to 3¹⁰. It's well demonstrated that lower scores of the Braden scale are associated with higher risk of pressure ulcers and lower mobility levels¹¹. Diminished levels of mobility influence the duration and intensity of pressure experienced by patients and can contribute to pressure ulceration¹². This is why the Braden activity subscale can be used also to assess the mobility level of the patient in a clinical setting. In particular, the Braden activity subscale has demonstrated a strong correlation with the Braden scale at admission and at discharge in assessing pressure ulcer risk and consequently the mobility status of the patient¹³ and has excellent inter-reliability among hospital staff with an inter-class correlation coefficient of 0.96¹⁴. The Braden activity subscale measures the mobility (walking and transferring) level of the hospitalized patient with a score between 1 and 4 where: 1 = "the patient is confined to bed"; 2 = "ability to walk severely limited or non-existent; the patient cannot bear his own weight and or must be assisted into chair or wheelchair"; 3 = "the patient walks occasionally during the day, but for very short distances, with or without assistance; he spends majority of each shift in bed or chair"; 4 = "the patient walks outside the room at least twice a day and inside the room at least once every 2 hours during waking hours".

Shands Hospital nursing staff administered the Braden activity subscale at each shift change during a hospital stay (approximately 3 times per day) from admission to discharge. There were a total of 520,037 assessments recorded. Braden activity subscale scores were averaged over each hospital day. Incident mobility impairment was defined as first transition from "being able to walk occasionally or twice a day outside or at least once every two hours during waking hours" to a "severely limited or nonexistent ability to walk or confined to bed" (a daily average Braden activity subscale score transition from 3 at admission to daily average of < 3 during the hospitalization). Discharge mobility impairment was defined as an average Braden activity subscale score of < 3 ("severely limited or nonexistent ability to walk or confined to bed") on the day of discharge among patient hospital observations with incident mobility impairment during hospitalization.

Incident mobility recovery was evaluated in those patient hospital observations that were "severely limited or nonexistent ability to walk or confined to bed" at admission. Incident mobility recovery was defined as the first transition to "ability to walk occasionally or twice a day outside or at least once every two hours during waking hours" (a daily average Braden activity subscale score transition from < 3 at admission to daily average of 3 during the hospitalization). Discharge mobility recovery was defined as an average Braden activity subscale score of 3 ("being able to walk occasionally or twice a day outside or at least once every two hours during waking hours") on the day of discharge among patient hospital observations with incident mobility recovery.

Predictors

The major predictors were patients' primary diagnoses during the hospital stay. The ICD-9 primary diagnoses codes were re-categorized using the Agency for Health Care Research

and Quality Clinical Classification Software (CCS)¹⁵. Eighty-two single CCS diagnoses categories were considered. Only those categories with ≥ 50 admissions were included in the analysis. Covariates included: demographic characteristics (admission age, sex and race). Primary CCS diagnoses were divided in surgical and non-surgical diagnoses through the ICD-9 primary procedures codes. The ICD-9 primary procedures codes were re-categorized using the Agency for Health Care Research and Quality Clinical Classification Software (CCS)¹⁵. The primary diagnoses that had a surgical or invasive primary procedure during hospitalization were defined as “primary diagnoses with surgery”; those who had not a surgical or invasive primary procedure were defined as “primary diagnoses without surgery”.

Data Analysis

Patient baseline characteristics are reported as counts, means or medians. Differences in patient characteristics in binary and continuously measured characteristics were estimated using generalized estimating equation (GEE) methods. These methods were useful in order to account for the fact that each patient might have multiple hospitalizations. The exchangeable covariance was applied to estimate errors for clustered patient records. For this analysis, hospitalization records without the occurrence of mobility impairment or mobility recovery were censored at the time of discharge. The primary analysis calculated adjusted incidence rates (per 30 person-days) of mobility impairment and mobility recovery for each primary CCS diagnosis category adjusting for sex, race and age at admission. GEE negative binomial models were used to estimate incidence rates and 95% confidence intervals (CLs) for each CCS predictor. The analyses were conducted in R 3.1.1¹⁶. All statistical analyses were 2-tailed, and alpha level of 0.05 was considered statistically significant.

RESULTS

Table 1 describes the baseline characteristics of patient hospital observations. There were 15,498 (53%) patient hospital observations with normal mobility at admission and 228,587 Braden activity subscale assessments - a median number of 12 assessments per observation. There were 13,650 (47%) hospital observations admitted with impaired mobility and 291,450 Braden activity subscale assessments— a median number of 15 assessments per observation. Compared with patients' observations admitted with normal mobility, those with impaired mobility at admission were older (75.93 ± 7.90 vs 73.63 ± 6.96), spent more days in the hospital (median of 5 days vs 3 days) and had a higher Charlson comorbidity index (2.82 ± 2.39 vs 2.50 ± 2.42). Patients' observations with impaired mobility at admission had a significantly higher prevalence of myocardial infarction, congestive heart failure, peripheral vascular disease, cerebrovascular disease, dementia and diabetes. However, cancer was significantly more prevalent among patients admitted with normal mobility compared to those admitted with impaired mobility. Finally, patients' observations with impaired mobility at admission had a significantly higher prevalence of surgical or invasive procedures during hospitalization compared to those admitted with normal mobility (62.6% vs 55.9%).

Twenty percent (20.6%; 3,186 out of 15,498 observations) patient hospital observations with normal mobility at admission had incident mobility impairment over a median follow-up of

3 days (IQR, 2 to 5). Approximately 43% (5,930 out of the 13,650 observations) recovered from their mobility impairment at admission over a median follow-up of 4 days (IQR, 3 to 7).

Primary diagnoses predictors of in-hospital mobility impairment

Among 3,186 patient hospital observations which experienced incident mobility impairment during hospitalization, 2,458 (77.2%) had a primary diagnosis which required surgery and only 728 (22.8%) had a primary diagnosis without surgery. Discharge mobility impairment occurred in 38% of those with a primary diagnosis which required surgery and in 59% of the patient hospital observations with a primary diagnosis without surgery. Table 2 describes the adjusted incidence rate of incident mobility impairment by the first five primary diagnoses with and without surgery where there were at least 50 admissions. Among primary diagnoses which required surgery during hospitalization, patients with heart valve disorders were most likely to become impaired during their hospital stay [69.23%, 6.24 (95% CI: 5.37–7.24) events per 30 person-days]. Among primary diagnoses without surgery, patients with intracranial injury were more likely to develop incident mobility impairment [1.89 (95% CI: 1.26–2.84) events per 30 person-days]. Figure 1 shows the top five primary diagnoses with and without surgery by discharge mobility impairment where there were at least 50 admissions. Patients with peripheral and visceral atherosclerosis showed the highest rate of discharge mobility impairment [1.88 (95% CI: 1.15–3.07) events per 30 person-days] among primary diagnoses which required surgery during hospitalization; otherwise patients with septicemia had the highest rate for discharge mobility impairment [0.94 (95% CI: 0.57–1.55) events per 30 person-days] among primary diagnoses without surgery.

Primary diagnoses predictors of in-hospital mobility recovery

Among 5,930 patient hospital observations which experienced mobility recovery during hospitalization, 4,159 (70.13%) had a primary diagnosis which required surgery during hospitalization and only 1,771 (29.87%) had a primary diagnosis without surgery. Discharge mobility recovery occurred in 88% of those with a primary diagnosis with surgery and in 90% of patient hospital observations with a primary diagnosis without surgery. Table 2 describes the adjusted incidence rate of incident mobility recovery by the first five primary diagnoses with and without surgery where there were at least 50 admissions. Figure 2 shows the top five primary diagnoses with and without surgery by discharge mobility recovery where there were at least 50 admissions. Among primary diagnoses which required surgery during hospitalization individuals with osteoarthritis had the highest incidence of mobility recovery and discharge mobility recovery [7.68 (95% CI: 6.93–8.51) and 7.37 (95% CI: 6.62–8.20) events per 30 person-days respectively]. Among primary diagnoses without surgery, patients with hypertension with complications or secondary hypertension were more likely to develop incident mobility recovery [3.87 (95% CI: 2.88–5.20) events per 30 person-days]; otherwise those with aortic, peripheral and visceral artery aneurysms had the highest rate for discharge mobility recovery [3.41 (95% CI: 2.61–4.47) events per 30 person-days].

DISCUSSION

The purpose of this study was to evaluate the relationship between primary diagnoses and mobility impairment and recovery during hospitalization among older adults. Patients admitted with impaired mobility were older, spent more days in the hospital and had a higher number of comorbidities than those admitted with normal mobility. The large number of patient observations and thorough evaluation of in-hospital mobility made it possible to conduct the analysis. To the author's knowledge, this is one of the few large-scale evaluations of the connection between primary diagnoses and mobility changes during hospitalization. While there are many evaluations of functional characteristics, personal and subjective barriers during and after hospitalization^{5, 6, 17}, these studies have not fully considered primary diagnoses as predictors of mobility impairment or recovery. In particular, Fisher and coworkers⁸ showed that diagnostic category and illness severity, in a relative small sample of patients, were significantly associated with lower mobility during hospitalization. However, because of a small sample, they stopped short by characterizing only six general diagnostic categories (cardio-pulmonary, infectious, orthopedic/musculoskeletal, gastrointestinal, neurologic and other).

Among patients admitted with normal mobility, incident mobility impairment occurred more among those who underwent surgical or invasive procedures during their hospital stay. In particular cardiovascular diseases with surgical or invasive procedures on heart or vessels showed the highest incidence rate of mobility impairment during hospitalization and at discharge. Otherwise, discharge mobility impairment was more common among patients who did not receive surgical procedures with 59% of these patients being discharged with mobility limitations. In particular septicemia and urinary tract infections yielded the highest rate of in hospital discharge mobility impairment among patients who were not subjected to surgery.

Among patients admitted with impaired mobility, incident mobility recovery occurred more among those who underwent surgical or invasive procedures during their hospital stay with almost 90% of all patients showing a mobility recovery at discharge. In particular, patients with a primary diagnosis of osteoarthritis and cancer of other gastrointestinal organs or peritoneum were the most likely to recover from their mobility impairment. Otherwise patients with hypertension with complications and secondary hypertension and aortic, peripheral and visceral aneurysms had the highest incidence rate of recovery among those who did not receive surgery.

Mobility impairment

Surgical diagnoses: cardiovascular diseases—Obviously older adults who were subjected to surgical or invasive procedures during hospitalization showed a higher rate of incident mobility impairment compared to those who were not. In particular primary diagnoses with a cardiovascular origin (heart valve disorders, aortic, peripheral and visceral artery aneurysms, and peripheral and visceral atherosclerosis) appeared in the top three conditions with highest incidence of mobility impairment during hospitalization and at discharge. Among patients admitted with normal mobility, heart valve disorders were associated with the highest incidence of mobility impairment. Approximately 70.2% of the

patient hospital observations showed heart valve surgical interventions with another 10% receiving cardiac catheterization or coronary arteriography. Surgical procedures and invasive diagnostic techniques are obviously associated with restrictions in mobility, which may further aggravate pre-hospital frailty symptoms often seen in an older patient¹⁸. In accordance to this finding, a recent study showed that over one-third of cardiac surgery patients experienced early postoperative mobility issues¹⁹. Evaluating the procedures administered for the three top diagnoses, most of them were invasive surgical procedures on heart valves, vessels or aortic resection, replacement or anastomosis. These findings suggest that older patients admitted with cardiovascular diseases that undergo surgical procedures on heart or vessels, have a high likelihood of developing mobility impairment during hospitalization and at discharge that might contribute to related adverse consequences in terms of disuse muscle atrophy, reduced metabolism, bed sores, and falls. Therefore it may be worthwhile targeting physical therapy to patients admitted with a cardiovascular diagnosis as they have the greatest risk of poor mobility status during hospitalization and at discharge.

Non-surgical diagnoses: septicemia—Surprisingly patients who did not undergo surgical procedures showed a significant higher rate of discharge mobility impairment compared to those who had surgery. In particular 59% of those who developed mobility limitations during the hospital stay were discharged with mobility impairment. Septicemia had the highest rate of discharge mobility impairment which is likely related to the serious consequences of sepsis (severe sepsis and septic shock) during the hospital stay. Indeed, older adults with sepsis often present with nonspecific symptoms and are at risk for under-recognition and under-treatment, with greater likelihood of rapid progression to severe sepsis and septic shock²⁰. Moreover research has showed that sepsis induces cognitive declines that could transfer to mobility impairments in an already susceptible population²¹. Generally the process of recovery from sepsis is very long and this study shows that older adults with sepsis who develop mobility limitation during hospitalization are more likely to be discharged with mobility impairment. As such sepsis is an ideal target for medical staff in order to intervene on patients' mobility to prevent worse post-hospitalization functional outcomes.

Mobility recovery

Surgical diagnoses: osteoarthritis and cancer—Patients with osteoarthritis had the highest incident rate of mobility recovery during hospitalization and at discharge among those who underwent surgical or invasive procedures. Many of these patients received knee arthroplasty (57.5%) or total or partial hip replacement (30.2%). These patients were likely to receive physical therapy following their surgery, which might have contributed to their accelerated recovery compared to other conditions. Additionally, reduced arthritic pain could have promoted more activity²². Patients with specific cancers (gastrointestinal organs and peritoneum, other and unspecified benign neoplasms and pancreas) were also likely to recover from their mobility impairment at admission. Surgical interventions were common in these patients, who might have relieved pain and neurological symptoms helping them regain their normal mobility.

Non-surgical diagnoses: hypertension with complications—A primary diagnosis of hypertension with complications or secondary hypertension resulted in highest mobility recovery not associated with a surgical or invasive intervention. Treatment for this condition is readily available and recovery would be expected.

Limitations

This study has limitations. First, the analysis is based on data derived from ICD-9 codes and CCS diagnosis categories which tend to generalize multiple specific diagnoses in one single group and could reflect incomplete coding. While we had a large number of patient observations during the hospital stay, our measure of mobility impairment is not objectively ascertained as compared to others who have used activity monitors²³. With that said, the Braden activity sub score has demonstrated good validity and reliability for mobility changes¹⁴ and a strong correlation with the Braden scale which is a validated indirect measure of the mobility status of the patient¹³. Moreover, the mobility status of the patient prior to admission was unknown. Finally, the surgical procedures were not well specified and the date in which the procedure was performed was not available to temporarily evaluate the effect of these procedures. Despite these limitations, this study is an important first step in identifying the primary diagnoses associated with mobility changes during hospitalization.

CONCLUSION

Approximately 1 out of 5 patient hospitalizations that initially had normal mobility at admission became impaired in the hospital. However about half of patient hospital observations recovered from initial mobility impairment at admission. Primary diagnoses with surgical or invasive procedures on heart or vessels and sepsis were associated with the highest incidence rate of mobility limitation during hospitalization and at discharge. Mobility recovery was more common in patients undergoing surgical procedures that are often pre-planned and associated with post-surgical physical therapy. These results are geared to help target in hospital mobility interventions that are expected to reduce post-hospitalization disability in older adults. For example, older patients with cardiovascular primary diagnosis who undergo surgery or those with sepsis could be targeted for a specific mobility assessment and individualized mobility promotion program.

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Top 5 Primary Diagnoses with Surgery

Top 5 Primary Diagnoses without Surgery

Figure 1. Discharge Mobility Impairment and Primary Diagnoses

Top 5 diagnosis categories with adjusted incidence rates of discharge mobility impairment. Adjusted incidence rate for sex, race and admission age per 30 person-day and 95% confidence interval. Peripheral and visceral athero = peripheral and visceral atherosclerosis; Aor; peri & viscer arter aneur = aortic, peripheral and visceral artery aneurysms; Diabetes mellitus with complic = Diabetes mellitus with complications;

Top 5 Primary Diagnoses with Surgery

Top 5 Primary Diagnoses without Surgery

Figure 2. Discharge Mobility Recovery and Primary Diagnoses

Top 5 diagnosis categories with adjusted incidence rates of discharge mobility recovery. Adjusted incidence rate for sex, race and admission age per 30 person-day and 95% confidence interval. Gastrointestinal cancer = cancer of other gastrointestinal organs and peritoneum; Other unspecif benign neoplasm = Other and unspecified benign neoplasm; Aor; peri & viscer arter aneur = aortic, peripheral and visceral artery aneurysms; Hypertension with complication = Hypertension with complications and secondary hypertension; Complications surgery; med car = Complications of surgical procedures or medical care.

Table 1

Selected baseline characteristics of the study in-hospital observations.

Characteristics	Number of patient observations (N=29148)	Normal mobility at admission (N=15498)	Impaired mobility at admission (N=13650)	P-value
Age at admission	74.71 ± 7.50	73.63 ± 6.96	75.93 ± 7.90	<0.001
Diagnosis count	14.25 ± 7.21	12.74 ± 6.59	15.97 ± 7.50	<0.001
Length of stay, Median (IQR)	4 (6)	3 (2, 6)	5 (3, 9)	<0.001
One or more Hosp. acquired conditions	78 (0.27%)	32 (0.21%)	46 (0.34%)	0.063
Charlson Index	2.65 ± 2.41	2.50 ± 2.42	2.82 ± 2.39	<0.001
MI	3,165 (10.86%)	1,577 (10.18%)	1,588 (11.63%)	<0.001
CHF	6,537 (22.43%)	3,057 (19.73%)	3,480 (25.49%)	0.033
PVD	3,796 (13.02%)	1,637 (10.56%)	2,159 (15.82%)	<0.001
CEVD	4,150 (14.24%)	1,329 (8.58%)	2,821 (20.67%)	<0.001
Dementia	1,150 (3.95%)	279 (1.80%)	871 (6.38%)	<0.001
Rheumatic disease	977 (3.35%)	509 (3.28%)	468 (3.43%)	0.699
Peptic ulcer	485 (1.66%)	245 (1.58%)	240 (1.76%)	0.213
Liver disease	466 (1.60%)	249 (1.61%)	217 (1.59%)	0.452
Diabetes	8,188 (28.09%)	4,102 (26.47%)	4,086 (29.93%)	<0.001
Renal disease	6,282 (21.55%)	3,211 (20.72%)	3,071 (22.50%)	0.131
Cancer	4,837 (16.59%)	3,090 (19.94%)	1,747 (12.80%)	<0.001
Surgery during hospitalization	17,206 (59.0%)	8,667 (55.9%)	8,539 (62.6%)	<0.001
Event		Impairment 3,186 (20.6%)	Recovery 5,930 (43.4%)	
Time to event		3 (3)	4 (4)	

Values represent, N (%) for categorical variables or mean ± standard deviation for continuous variables unless otherwise stated.

IQR= interquartile range; MI = myocardial infarction; CHF = chronic heart failure; PVD = peripheral vascular disease; CEVD = cerebral vascular disease.

Table 2

Ranking of the top five CCS primary diagnosis categories with incident mobility impairment and recovery.

Ranking	Incident mobility impairment 3186 (21%)		Incident mobility recovery 5930 (43%)	
	Primary diagnoses with surgery	Primary diagnoses without surgery	Primary diagnoses with surgery	Primary diagnoses without surgery
	2458 (77.2%)	728 (22.8%)	4159 (70.1%)	1771 (29.9%)
	Primary Diagnosis	Primary Diagnosis	Primary Diagnosis	Primary Diagnosis
1	Heart valve disorders	Intracranial injury	Osteoarthr	Hypertens with comp
2	Aor/Per/Vis art aneury	Septicemia	Cancer GI; peritoneum	Aor/Per/Vis art aneury
3	Per/Vis atherosclero	Other circul disease	Oth/Unsp benign neopl	Syncope
4	Septicemia	Delirium, dementia	Cancer of pancreas	Cardiac dysrhythmia
5	Other and ill-defined cerebrovascular disease	Epilepsy & convulsions	Biliary tract disease	Pneumonia
	IR (95% CI)	IR (95% CI)	IR (95% CI)	IR (95% CI)
	6.24 (5.37–7.24)	1.89 (1.26–2.84)	7.68 (6.93–8.51)	3.87 (2.88–5.20)
	6.05 (5.10–7.18)	1.76 (1.24–2.50)	5.63 (4.78–6.63)	3.81 (2.97–4.89)
	3.78 (2.76–5.17)	1.60 (0.99–2.60)	4.91 (4.11–5.86)	3.74 (2.75–5.11)
	3.42 (2.57–4.56)	1.49 (0.90–2.45)	4.71 (3.79–5.85)	3.15 (2.55–4.08)
	3.32 (1.87–5.91)	1.34 (0.67–2.70)	4.58 (3.37–6.22)	2.90 (2.31–3.64)

Values represent, N (%) for categorical variables and adjusted incidence rate (IR) per 30 person per day with 95% confidence interval

Osteoarthr = Osteoarthritis; Hypertens with comp = Hypertension with complications and secondary hypertension; Aor/Per/Vis art aneury = Aortic, peripheral and visceral artery aneurysms; Per/Vis atherosclero = Peripheral and visceral atherosclerosis; Other circul disease = Other circulatory disease; Oth/Unsp benign neopl = Other and unspecified benign neoplasm.