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Original Study

The Course of Geriatric Syndromes in Acutely Hospitalized Older Adults: The Hospital-ADL Study

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A B S T R A C T

Objectives: To establish the prevalence and course of geriatric syndromes from hospital admission up to 3 months postdischarge and to determine the probability to retain geriatric syndromes over the period from discharge until 3 months postdischarge, once they are present at admission.
Design: Prospective multicenter cohort study conducted between October 2015 and June 2017.
Setting and participants: Acutely hospitalized patients aged 70 years and older recruited from internal, cardiology, and geriatric wards of 6 Dutch hospitals.
Measures: Cognitive impairment, depressive symptoms, apathy, pain, malnutrition, incontinence, dizziness, fatigue, mobility impairment, functional impairment, fall risk, and fear of falling were assessed at admission, discharge, and 1, 2, and 3 months postdischarge. Generalized estimating equations analysis were performed to analyze the course of syndromes and to determine the probability to retain syndromes.
Results: A total of 401 participants [mean age (standard deviation) 79.7 (6.7)] were included. At admission, a median of 5 geriatric syndromes were present. Most prevalent were fatigue (77.2%), functional impairment (62.3%), apathy (57.5%), mobility impairment (54.6%), and fear of falling (40.6%). At 3 months postdischarge, an average of 3 syndromes were present, of which mobility impairment (52.7%), fatigue (48.1%), and functional impairment (42.5%) were most prevalent. Tracking analysis showed that geriatric syndromes that were present at admission were likely to be retained. The following 6 geriatric syndromes were most likely to stay present postdischarge: mobility impairment, incontinence, cognitive impairment, depressive symptoms, functional impairment, and fear of falling.
Implications: Acutely hospitalized older adults exhibit a broad spectrum of highly prevalent geriatric syndromes. Moreover, patients are likely to retain symptoms that are present at admission postdischarge. Our study underscores the need to address a wide range of syndromes at admission, the importance of communication on syndromes to the next care provider, and the need for adequate follow-up care and syndrome management postdischarge.

RvS and LAR contributed equally to this work.

The Hospital-ADL study group consists of the following members: Ingeborg Kuper (Slotervaart Hospital, Amsterdam), Annemarieke de Jonghe and Maike Leguit-Elberse (Tergooi hospital, Blaricum), Ad Kamper (Isala Zwolle), Nynke Posthuma (BovenIJ Hospital, Amsterdam), and Nienke Brendel and Johan Wold (Meander Medical Center, Amersfoort).

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The authors declare no conflicts of interest.

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Among acutely hospitalized older patients, the acute medical condition is often accompanied by geriatric syndromes such as pain, unintentional weight loss, incontinence, depressive symptoms, and cognitive impairment.[1,2] Although there are no formal criteria to define geriatric syndromes, these are generally described as multifactorial, nonspecific disease presentations that have many shared risk factors and are seen across multiple disease categories.[3–5] In addition to risk factors such as high age and the severity of the index diagnosis, geriatric syndromes are important risk factors for adverse post-hospitalization outcomes, including functional decline,[1,6] hospital (re-)admission and institutionalization,[7,8] and mortality.[1]

During hospitalization, pre-existing geriatric syndromes may deteriorate or new syndromes may develop,[9–11] and it is conceivable that geriatric syndromes remain prevalent postdischarge. The first months postdischarge have been marked as a crucial time, during which patients are at elevated risk to develop new acute conditions.[12,13] Therefore, it seems important to assess not only how geriatric syndromes develop during but also after hospitalization. Qualitative research indeed provides indications that symptoms indicative of geriatric syndromes, for example, fatigue, apathy, and fear of falling, are common in the first weeks post-acute hospitalization.[14] However, little quantitative research has been conducted to assess to what extent syndromes remain present, or how likely it is that patients recover during the postdischarge period. Thus far, a single study on care transitions from hospital to skilled nursing facilities, determined that geriatric syndromes remained highly prevalent at different time points, with patients also developing new syndromes during their nursing home stay.[15]

Another limitation of the current literature is that studies have traditionally focused on the presence of a limited set of commonly acknowledged syndromes, such as cognitive impairment, malnutrition, incontinence, and fall risk.[1,7,9–11,15] The definition of geriatric syndromes, as presented above, would allow for a much broader spectrum that, for example, also includes fatigue and apathy.[3,4] However, data on the prevalence and course of such a more complete spectrum of geriatric syndromes are practically absent. This makes it more difficult for care providers to establish if a particular geriatric syndrome reflects a mere transient deterioration, for example, related to the index diagnosis, or a condition that without intervention is less likely to recover and thus reflects a persistent vulnerability.

A more complete view of the course and prevalence of various geriatric syndromes may aid care professionals in providing adequate geriatric syndrome assessment at time of admission and, moreover, adequate follow-up care during the critical months postdischarge. Therefore, the present study aimed (1) to establish the prevalence and course of geriatric syndromes from hospital admission up to 3 months postdischarge in acutely hospitalized patients aged 70 and older and (2) to determine the probability to retain geriatric syndromes over the period from discharge until 3 months postdischarge, once they are present at admission.

Methods

Study Design and Setting

The Hospital-Associated Disability and impact on daily Life (Hospital-ADL) study is a multicenter observational prospective cohort study, which was conducted between October 2015 and June 2017.[16] Participants were recruited from Internal Medicine, Cardiology, or Geriatric wards at 6 Dutch hospitals. The study was approved by the Institutional Review board of the Academic Medical Center (AMC) in The Netherlands (Protocol ID: AMC2015_150) and performed according to the Dutch Medical Research Involving Human Subjects Act and principles of the Declaration of Helsinki (1964). Local approval was provided by all participating hospitals.

Study Population

Consecutive patients aged 70 and older, acutely admitted for at least 48 hours to one of the participating wards, were contacted for participation. The following inclusion criteria were applied: (1) approval of the attending medical doctor; (2) adequate Dutch language proficiency to complete questionnaires; and (3) Mini-Mental State Examination (MMSE)[17] score $\geq$15. Although delirium is a common geriatric syndrome,[3] we were not able to include delirious patients either because an MMSE could not be performed or because patients scored below the inclusion threshold of 15. Patients were also excluded if they (1) had a life expectancy of less than 3 months, as assessed by the attending physician, and (2) were disabled in all basic activities of daily living (using the 6-item Katz Index[18]).

Data Collection

Two researchers (R.S. and L.R.) visited the participating wards on Mondays, Wednesdays, and Fridays, and contacted eligible patients within 48 hours after admission. After informed consent was obtained, patients were enrolled in the study. In order to reduce observer variability, the researchers were trained to administer the standardized study protocol. Demographics were assessed at admission. During 5 assessments, including within 48 hours after admission, discharge, and 1 (home visit), 2 (by telephone), and 3 months postdischarge (home visit), a comprehensive geriatric assessment (CGA) that focused on 3 domains (psychological, somatic, and functional)[16] was performed.

This CGA evaluated 12 health problems that are commonly seen in older persons and which are covered by the generally used definition of geriatric syndromes, namely, multifactorial nonspecific disease presentations, highly prevalent in the older population.[3,4] In the psychological domain, cognitive impairment and depressive symptoms were assessed, which are commonly described as geriatric syndromes.[3,4] Additionally, although less commonly acknowledged as a geriatric syndrome, it was decided to include apathy in addition to depressive symptoms. Although symptoms of apathy are often subsumed under depression, apathy and depression are considered as distinguishable entities that may require different treatment strategies.[19] Besides, in qualitative research apathy has been found to be highly present among older patients during the postdischarge period.[14]

In the somatic domain, acknowledged geriatric syndromes such as pain, malnutrition, and incontinence were assessed.[3,4] Dizziness was included, because it is often the result of a multifactorial interplay between medical and functional aspects in older individuals,[20–22] and is associated with other geriatric syndromes such as functional decline.[23] Although not conventionally defined as a geriatric syndrome, it was decided to also report fatigue. Fatigue is an important feature of frailty[3,24] and was found to be prominently reported postdischarge among older patients.[14]

In the functional domain, functional and mobility impairments and participants' fall risk was assessed. With regard to fall risk, participants were asked whether they had a fall in the past 6 months before hospitalization, and whether they fell during their hospital stay or in the first, second, or third month postdischarge. Fear of falling was also determined because falls are often accompanied by fear of falling.[25]

The presence of geriatric syndromes was measured at all 5 different time points with 2 exceptions: First, malnutrition was not measured at discharge because the duration of acute care was considered too short to make a change in nutritional status. In addition, the measurement of malnutrition, using the SNAQ,[26] involves retrospective questions on the previous months, which exceeds the period of hospital admission. Second, cognitive impairment could not be measured at 2 months postdischarge, because at that time point a

telephone interview follow-up was performed. Note, with regard to functional and mobility impairment, participants were also asked to retrospectively indicate if they were impaired 2 weeks prehospitalization.

Statistical Analysis

Descriptive statistics were used to summarize patient demographic and medical characteristics. To evaluate the prevalence and remission rates of geriatric syndromes, all syndromes were dichotomized. Table 1 provides an overview of assessment instruments per domain as well as relevant cut-off values used to dichotomize syndromes. To analyze the course of syndromes from admission until 3 months postdischarge, logistic generalized estimating equation analyses were performed. Generalized estimating equation takes into account the correlation between the repeated observations within the patient and provides more robust estimates when the outcome is dichotomous.[30] The obtained odds ratios (ORs) represent the odds for finding a similar prevalence rate for a certain syndrome at discharge and 1, 2, or 3 months postdischarge as compared to the prevalence rate at admission, and indicates whether prevalence rates significantly differ. To determine how likely patients are to retain geriatric syndromes over the period from discharge until 3 months postdischarge, logistic generalized estimating equation analysis was used to perform tracking analysis, as described by Twisk et al.[31,32] The ORs obtained from these tracking analyses represent stability coefficients, that is, the ORs for patients with a certain geriatric syndrome at baseline to retain that syndrome over the total course from discharge until 3 months postdischarge and at the 4 different time points, including discharge and 1, 2, and 3 months postdischarge. Statistical analyses were performed using SPSS Statistics (version 24.0).

Results

Participant Characteristics

Between October 2015 and February 2017, a total of 1024 consecutive patients were available for participation, of whom 505 did not meet the inclusion criteria, were too ill to participate, or could not be contacted within 48 hours after admission, mostly because they were not present at the ward during time of inclusion, for example, because of medical examination. Of the 519 remaining patients, 401 (39.2%) were enrolled in the study (Figure 1). Table 2 provides an overview of participant characteristics. Overall, participants had a mean age (standard deviation) of 79.7 (6.7), and 51.4% were male. Median duration of hospital stay was 5.8 days, and most frequent admission diagnoses were cardiac, infection, and respiratory related (respectively, 30.4%, 18.7%, and 14.5%).

Prevalence and Course of Geriatric Syndromes

The median (interquartile range) number of geriatric syndromes present at hospital admission, discharge, and 1, 2, and 3 months postdischarge was 5 (3-6), 4 (2-6), 4 (2-5), 3 (1-5), and 3 (1-5), respectively. Figure 2A displays the prevalence course of geriatric syndromes in the psychological domain. At admission, 20% of participants were cognitively impaired. A total of 23% had depressive symptoms at admission; 58% of participants were apathetic. As shown in Figure 2B, fatigue was most frequently present in the somatic domain: 77% were fatigued at admission. Between 37% and 40% of patients experienced pain, malnutrition, or incontinence at admission. Figure 2C, the functional domain, shows that half of the participants were impaired in mobility 2 weeks prehospitalization. Functional impairment increased from 45% at baseline up to 62% at admission. A total of 40% of participants were afraid to fall at admission. During the 6 months before hospitalization, 39% of participants had a fall; in the first month postdischarge, this was 14.6%.

Most prevalence rates were significantly lower at 3 months postdischarge as compared to admission, with the exception of the following 5 geriatric syndromes: depressive symptoms, pain, incontinence, mobility impairment, and fear of falling. Supplement Table 1 presents the prevalence rates of geriatric syndromes, stratified by gender, at admission, discharge, and 1, 2, and 3 months postdischarge. The above results remained essentially unaltered when the above analyses (which included missing data) were repeated using only complete cases.

Retention of Geriatric Syndromes From Admission Until Postdischarge

Table 3 shows the tracking odds ratios for all geriatric syndromes, representing the odds that patients with a certain geriatric syndrome at baseline will retain that syndrome at discharge and 1, 2, and 3 months postdischarge, and over the overall course of discharge until 3 months postdischarge. For example, if a patient had depressive symptoms at admission, then this patient had an odds ratio (OR) [confidence interval (CI)] of 15.49 (7.70-31.14) to still have depressive

Table 1
Measurement Instruments Used to Assess Geriatric Syndromes

Geriatric Syndrome or Condition	Measurement Instrument	Range of Scores	Cut-off Point
Psychological Domain			
Cognitive functioning	Mini-Mental State Examination[17]	0-30	≤23: cognitive impairment
Depressive symptoms	Geriatric Depression Scale (GDS)[27]	0-15	≥6: depressive symptoms
Apathy	GDS[19]	0-3	≥2: apathy
Somatic domain			
Pain	Numeric Rating Scale for pain[28]	0-10	≥4: pain
Malnutrition	Short Nutritional Assessment Questionnaire (SNAQ)[26]	0-7	2: moderately malnourished ≥3: severely malnourished
Incontinence	Presence of incontinence	Yes/no	Yes
Dizziness	Do you suffer from dizziness at this moment?	Yes/no	Yes
Fatigue	Numeric rating scale for fatigue[29]	0-10	≥4: fatigued
Functional domain			
Functional impairment	Katz ADL index score[18]	0-6	≥1
Mobility impairment	Use of a walking aid	Yes/no	Yes
Fall risk	Falls in past half year before hospitalization, falls at hospital, and falls in first, second, and third month postdischarge	Yes/no	Yes
Fear of falling	Numeric rating scale for fear of falling	0-10	≥4: fear of falling

ADL, activities of daily living.

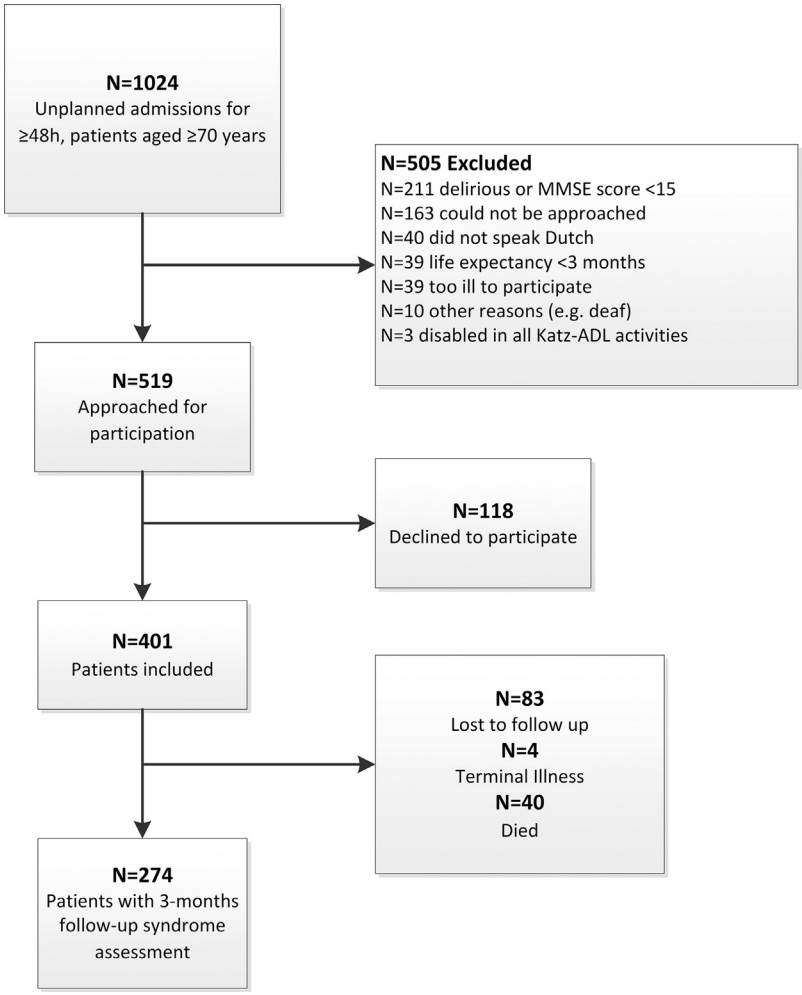

Fig. 1. Diagram of participant inclusion.

symptoms at 1 month postdischarge, and an overall OR (CI) of 20.27 (12.41-33.10) to retain depressive symptoms over the total course until 3 months postdischarge. If a patient was fatigued at admission, a patient has an overall OR (CI) of 5.06 (3.46-7.41) to retain fatigue over the total course, and an OR (CI) of 3.20 (1.75-5.81) to be fatigued at 3 months postdischarge.

When a syndrome was present at admission, the following 6 geriatric syndromes were most likely to stay present in the post-discharge period: mobility impairment, incontinence, cognitive impairment, depressive symptoms, functional impairment, and fear of falling. Compared to these syndromes, participants were less likely to retain fatigue, apathy, malnutrition, pain, and fall risk over the post-discharge period. Sensitivity analysis were performed for these tracking analyses and comparable results were found using only complete cases.

Discussion

This multicenter prospective cohort study showed a broad range of geriatric syndromes to be highly prevalent among acutely hospitalized older patients. At admission, the median number of geriatric syndromes per patient was 5, among which fatigue, functional impairment, apathy, mobility impairment, and fear of falling showed the highest prevalence. Although this number decreased over the post-discharge course, prevalence rates of geriatric syndromes remained high posthospitalization. At 1 month postdischarge, on average 4 syndromes were present; at 3 months postdischarge, 3 syndromes were still present. The data further showed that when a certain syndrome is present at hospital admission, patients are likely to retain that syndrome over the period from discharge until 3 months post-discharge. This was particularly the case for mobility impairment, incontinence, cognitive impairment, depressive symptoms, functional impairment, and fear of falling.

To our knowledge, our study is one of the first to assess prevalence rates of a broad spectrum of geriatric syndromes over the hospital and postdischarge course. Therefore, comparing the present results with those of earlier studies is difficult, because of differences in the evaluated syndromes and a lack of postdischarge assessment in previous research.[1,7,9–11] At hospital admission, the prevalence rates for pain, mobility and functional impairment, and malnutrition were higher in a previous cohort study,[1] probably because of the inclusion of severely cognitive impaired and delirious, that is, more frail, patients. In a similar patient population,[9] at admission and discharge, more or less comparable prevalence rates were found for incontinence, activities of daily living impairment, and fall risk. Their considerably higher prevalence rates of cognitive impairment are most likely due to performance of the Cognitive Performance Scale (CPS), which has a lower specificity compared to the MMSE[34] used in our study. The prevalence rates of cognitive impairment, pain, and incontinence at admission are in accordance with a recent cohort study in acutely hospitalized

Table 2
Baseline Characteristics of the Study Population (N = 401)

Patient Characteristics	
Age in years, mean (SD)	79.7 (6.7)
Male, n (%)	206 (51.4)
Living arrangements before admission, n (%)	
Independent	337 (84.0)
Nursing home	9 (2.2)
Senior residence/assisted living	55 (13.7)
Marital status, n (%)	
Married or living together	209 (52.1)
Single or divorced	64 (16.0)
Widow/widower	128 (31.9)
Born in the Netherlands, n (%)	359 (89.5)
Education, n (%)	
Primary school	101 (25.2)
Elementary technical/domestic science school	89 (22.2)
Secondary vocational education	120 (29.9)
Higher-level high school/third-level education	91 (22.7)
Charlson Comorbidity Index,* mean (SD)	2.14 (1.95)
Polypharmacy,† n (%)	260 (64.8)
Hearing impairment, n (%)	52 (13.0)
Vision impairment, n (%)	41 (10.2)
Hospitalization in past 6 mo, n (%)	133 (33.2)
Primary admission diagnosis, n (%)	
Infection	58 (14.5)
Gastrointestinal	45 (11.2)
Cardiac	122 (30.4)
Respiratory	75 (18.7)
Cancer (including hematology)	13 (3.2)
Electrolyte disturbance	11 (2.7)
Renal	15 (3.7)
Other	62 (15.5)
Length of hospital stay, days, median (IQR)	5.8 (3.9-8.9)
Discharge destination, n (%)	
Home	317 (79.1)
Nursing home	6 (1.5)
Rehabilitation center	20 (5.0)
Assisted living	6 (1.5)
Other (eg, other hospital)	17 (4.2)
Unknown	35 (8.7)

IQR, interquartile range; SD, standard deviation.
*Range of 0-31, with a higher score indicating more or more severe comorbidity.[33]
†Use of 5 or more different medications.

patients discharged to skilled nursing facilities,[15] and the higher prevalence rates of depressive symptoms might be a consequence of the use of the Hoyl GDS-5 scale, which has a much lower specificity compared to the GDS-15.[35]

We found that prevalence rates of apathy, fatigue, and fear of falling were among the highest at hospital admission. Although decreasing over the postdischarge course, prevalence rates remained high postdischarge, which is consistent with previous qualitative results.[14] Taking into account findings of earlier studies that fatigue, fear of falling,[36] and apathy[37] are often present in older community dwellers, it is perhaps not surprising that these syndromes were highly prevalent in our study population. Yet, these conditions are not commonly acknowledged geriatric syndromes and have not been addressed in previous studies on geriatric syndromes in hospitalized patients.[1,7,9–11,15] Although it can be argued that apathy and fatigue are features of depression and frailty, respectively, they seem to represent common conditions in an older patient population. In addition, each has a significant impact on daily functioning and quality of life postdischarge, but may benefit from different intervention strategies.[19,38,39]

Our results imply that when a syndrome is present at admission, patients are likely to retain those geriatric syndromes postdischarge. Hence, prevalence rates remain high postdischarge; that is, spontaneous recovery is less probable than might be assumed, which underscores the need for adequate communication on the presence of geriatric syndromes and tailored follow-up care after hospitalization. Although CGA has proven to be effective in the in-hospital setting,[40] CGA has shown limited effects on postdischarge outcomes, for example, functional status and readmission.[41] These mixed findings are probably due to a lack of postdischarge follow-up on recommendations provided in the CGA treatment plan and discontinuation of interventions that are initiated during hospitalization. At present, patients are often still discharged with limited coordination and communication between hospital and the home care settings (eg, the general practitioner).[42–45] Accordingly, reporting of geriatric syndromes in discharge summaries is infrequent,[1] which also holds true for when a patient is discharged to a skilled nursing facility.[11] However, when a general practitioner receives a comprehensive patient handover, including information on geriatric syndromes, this will potentially allow for a more tailored selection of interventions and follow-up care. More essential even may be the initiation of organized transitional care for this vulnerable patient population, including nurse care coordination to ensure a safe transition from hospital to the primary care setting.[46,47] Our findings indicated that geriatric syndrome assessment and management, both in the hospital setting and the vulnerable period postdischarge, might be important elements of these transitional care interventions.

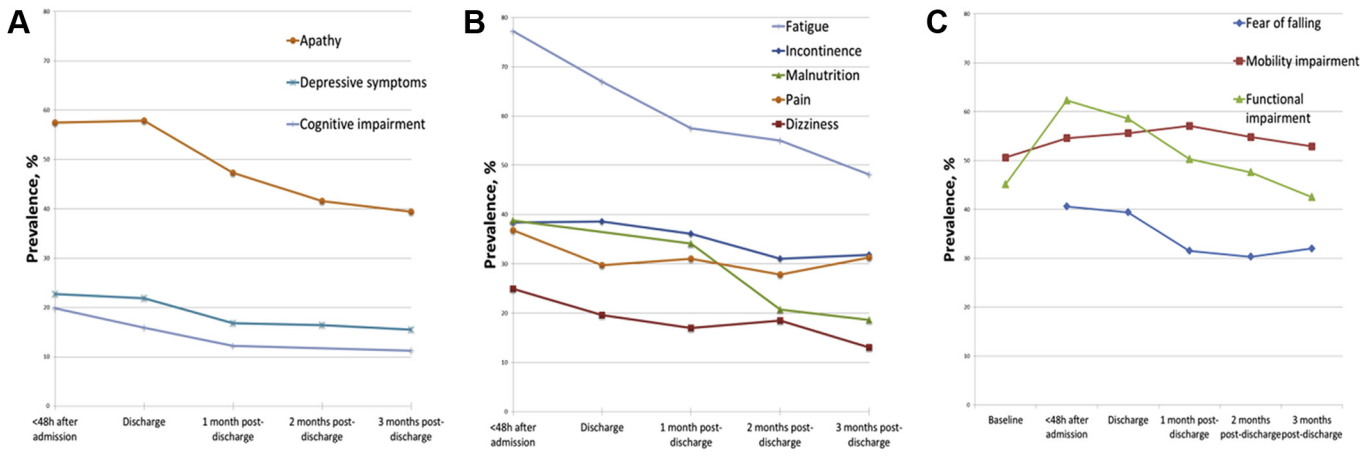

Fig. 2. Prevalence rates of geriatric syndromes in the psychological (A), somatic (B), and functional (C) domains.

Table 3
Stability Coefficients at Different Time Points of Geriatric Syndromes*

Geriatric Syndrome	Overall Stability Coefficient (OR, 95% CI)†	Stability Coefficients at Different Time Points (OR, 95% CI)‡
Psychological domain		
Cognitive impairment	30.23 (17.15-53.30)	Discharge: 86.70 (34.06-220.71) P_1: 15.81 (6.84-36.51) P_3: 15.17 (5.83-39.52)
Depressive symptoms	20.27 (12.41-33.10)	Discharge: 32.02 (16.35-62.68) P_1: 15.49 (7.70-31.14) P_2: 10.79 (5.32-21.88) P_3: 22.40 (10.57-47.49)
Apathy	4.69 (3.46-6.36)	Discharge: 18.00 (10.44-31.03) P_1: 2.61 (1.63-4.18) P_2: 2.69 (1.63-4.43) P_3: 3.31 (1.98-5.53)
Somatic domain		
Pain	4.19 (2.98-5.88)	Discharge: 8.71 (5.24-14.47) P_1: 3.18 (1.94-5.23) P_2: 2.85 (1.67-4.86) P_3: 2.98 (1.76-5.06)
Malnutrition	4.63 (3.12-6.88)	P_1: 5.28 (3.16-8.84) P_2: 3.56 (1.98-6.39) P_3: 6.34 (3.33-12.10)
Incontinence	31.10 (19.75-49.00)	Discharge: 68.96 (34.94-136.11) P_1: 17.07 (9.59-30.36) P_2: 28.48 (14.81-54.77) P_3: 25.73 (13.40-49.41)
Dizziness	7.72 (5.17-11.53)	Discharge: 22.00 (11.50-42.07) P_1: 4.92 (2.65-9.16) P_2: 5.55 (2.99-10.31) P_3: 3.87 (2.26-14.32)
Fatigue	5.06 (3.46-7.41)	Discharge: 9.34 (5.31-16.41) P_1: 5.20 (2.88-9.39) P_2: 3.56 (2.01-6.30) P_3: 3.20 (1.75-5.81)
Functional domain		
Functional impairment	17.58 (11.41-27.10)	Discharge: 49.61 (26.01-94.64) P_1: 11.05 (6.40-19.09) P_2: 10.87 (6.20-19.06) P_3: 15.0.7 (8.15-27.86)
Mobility impairment	69.70 (40.83-118.99)	Discharge: 166.59 (75.02-369.93) P_1: 55.12 (27.49-110.52) P_2: 44.07 (22.41-86.66) P_3: 51.55 (24.94-106.99)
Fear of falling	12.04 (8.25-17.56)	Discharge: 25.80 (14.72-45.24) P_1: 9.43 (5.44-16.34) P_2: 6.96 (4.03-12.03) P_3: 9.20 (5.19-16.30)
Fall risk	4.38 (2.74-7.00)	P_1: 3.51 (1.82-6.77) P_2: 4.30 (1.97-9.38) P_3: 7.00 (2.78-17.65)

P_1, 1 month postdischarge; P_2, 2 months postdischarge; P_3, 3 months postdischarge.
*Representing odds ratios for patients with a certain geriatric syndrome at baseline to retain that syndrome over the total course from discharge until 3 months postdischarge and at the 4 different time points, including discharge and 1, 2, and 3 months postdischarge.
†Estimated with generalized estimating equation analysis using all available data and 5 time points.
‡Estimated with GEE analysis using all available data and the 4 different time points.

Limitations

The present study is subject to limitations. First, we did not have information on geriatric syndromes prior to hospitalization. It is not possible therefore to determine if the geriatric syndromes observed were already present in the premorbid period or newly developed. Second, it is possible, and indeed consistent with the definition of "geriatric syndromes," that multiple syndromes may reflect single disease process or comorbidity. For example, dehydration may lead to dizziness and falling, which, in turn, might underlie fear of falling. Third, MMSE scores used to assess cognitive impairment at admission should be cautiously interpreted, as the acute illness and deteriorating effects of hospitalization might have transiently altered MMSE results. Fourth, we did not include delirious and cognitive impaired patients, nor patients who were too ill to participate. In such patients geriatric syndromes might have been even more pronounced[48] and thus the current study may provide an underestimation of the actual prevalence of the various syndromes. Last, nearly one-third of participants were lost to follow-up or died within 3 months postdischarge. In our analyses, we included cases with missing data and, although similar results were obtained in sensitivity analysis using only complete cases, it is conceivable that subjects who were lost to follow-up may have gained new syndromes in the postdischarge period. This may also have led to an underestimation of the actual prevalence rates. Notwithstanding, the present study provided valuable novel information on the prevalence and course of geriatric syndromes applicable to most acutely hospitalized patients, covering the period between hospital admission until 3 months postdischarge.

Conclusion

Geriatric syndromes are highly prevalent among acutely hospitalized older patients. At admission, a median of 5 syndromes was present, of which fatigue, functional impairment, apathy, mobility impairment, and fear of falling are most frequently observed. Prevalence rates of geriatric syndromes remain high in the first 3 months postdischarge, and when a certain syndrome is present at admission, patients are likely to retain that syndrome over the postdischarge course. The notable wide range of prevalent syndromes, both during and posthospitalization, underscores the need to address a wide range of geriatric syndromes at hospital admission, the importance of communication on syndromes to the next care provider, and the need for adequate follow-up care and syndrome management postdischarge.

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Supplementary Table S1
Prevalence of Geriatric Syndromes at Admission, Discharge, and 1, 2, and 3 Months Postdischarge, Overall and Separately for Men and Women

Geriatric Syndrome	Time Point	Prevalence Rates, Overall,* % (n)	OR (95% CI) and *P* Value for Finding Similar Prevalence Rates as Compared to Prevalence Rate at Admission	Prevalence Rates for Men, % (n)	OR (95% CI) and *P* Value for Finding Similar Prevalence Rates as Compared to Prevalence Rate at Admission for Men	Prevalence Rates for Women, % (n)	OR (95% CI) and *P* Value for Finding Similar Prevalence Rates as Compared to Prevalence Rate at Admission for Women
Psychological Domain							
Cognitive impairment	Admission	19.8 (75)		18.2 (35)		21.4 (40)	
	Discharge	15.9 (52)	0.78 (0.64-0.96); .02	14.1 (23)	0.77 (0.59-1.00); .05	17.7 (29)	0.80 (0.59-1.08); .14
	P_1	12.2 (34)	0.63 (0.47-0.85); .003	11.3 (17)	0.65 (0.43-0.99); .04	13.4 (17)	0.61 (0.40-0.94); .03
	P_2	—	—	—	—	—	—
	P_3	11.3 (26)	0.58 (0.41-0.81); .002	10.8 (14)	0.63 (0.40-0.98); .04	11.9 (12)	0.52 (0.31-0.89); .02
Depressive symptoms	Admission	22.7 (90)		19.3 (39)		26.2 (51)	
	Discharge	21.9 (76)	0.97 (0.79-1.20); .80	19.2 (34)	1.04 (0.77-1.42); .78	24.7 (42)	0.92 (0.70-1.22); .56
	P_1	16.8 (50)	0.85 (0.66-1.08); .18	16.7 (26)	1.03 (0.74-1.42); .87	16.9 (24)	0.70 (0.48-1.02); .06
	P_2	16.4 (44)	0.81 (0.61-1.07); .13	14.6 (21)	0.84 (0.55-1.25); .39	18.4 (23)	0.79 (0.54-1.15); .21
	P_3	15.5 (41)	0.80 (0.63-1.03); .08	17.5 (25)	0.99 (0.74-1.34); .99	13.2 (16)	0.63 (0.43-0.94); .02
Apathy	Admission	57.5 (229)		50.7 (103)		64.6 (126)	
	Discharge	57.9 (201)	1.03 (0.85-1.24); .76	55.4 (98)	1.20 (0.91-1.58); .19	60.6 (103)	0.87 (0.67-1.12); .28
	P_1	47.3 (141)	0.71 (0.54-.93); .01	48.1 (75)	0.95 (0.64-1.39); .78	46.5 (66)	0.51 (0.35-0.75); <.001
	P_2	41.6 (112)	0.58 (0.44-0.76); <.001	40.3 (58)	0.68 (0.47-0.98); .04	43.2 (54)	0.49 (0.32-0.74); .001
	P_3	39.4 (104)	0.54 (0.41-0.70); <.001	40.6 (58)	0.69 (0.48-0.98); .04	38.0 (46)	0.41 (0.27-0.62); <.001
Somatic domain							
Pain	Admission	36.8 (147)		33.5 (69)		40.2 (78)	
	Discharge	29.7 (108)	0.73 (0.59-0.92); .01	22.0 (40)	0.57 (0.41-0.80); .001	37.4 (68)	0.89 (0.65-1.21); .46
	P_1	31.0 (95)	0.81 (0.62-1.07); .13	25.2 (40)	0.72 (0.49-1.04); .08	37.4 (55)	0.91 (0.61-1.36); .65
	P_2	27.8 (76)	0.70 (0.52-0.93); .02	23.1 (34)	0.62 (0.42-0.93); .02	33.3 (42)	0.77 (0.50-1.18); .23
	P_3	31.3 (83)	0.82 (0.62-1.09); .174	24.6 (35)	0.70 (0.47-1.02); .07	39.0 (48)	0.96 (0.62-1.48); .85
Malnutrition	Admission	38.8 (155)		39.3 (81)		38.1 (74)	
	Discharge	—	—	—	—	—	—
	P_1	34.1 (104)	0.88 (0.69-1.13); .33	36.9 (59)	0.98 (0.69-1.39); .92	31.0 (45)	0.78 (0.55-1.10); .16
	P_2	20.7 (59)	0.45 (0.33-0.60); <.001	24.0 (36)	0.51 (0.34-0.77); .001	17.0 (23)	0.38 (0.24-0.58); <.001
	P_3	18.6 (50)	0.41 (0.30-0.54); <.001	18.9 (27)	0.40 (0.26-0.61); <.001	18.3 (23)	0.41 (0.28-0.60); <.001
Incontinence	Admission	38.4 (154)		20.4 (42)		57.4 (112)	
	Discharge	38.6 (139)	1.03 (0.90-1.19); .65	25.7 (47)	1.33 (1.05-1.69); .02	52.0 (92)	0.86 (0.70-1.05); .14
	P_1	36.1 (112)	0.92 (0.75-1.12); .40	23.0 (37)	1.13 (0.77-1.65); .54	50.3 (75)	0.78 (0.59-1.02); .07
	P_2	31.0 (90)	0.81 (0.67-.97); .02	19.0 (29)	0.95 (0.68-1.32); .76	44.5 (61)	0.69 (0.52-0.90); .007
	P_3	31.9 (87)	0.85 (0.70-1.03); .09	17.4 (25)	0.88 (0.61-1.26); .48	48.1 (62)	0.80 (0.60-1.06); .12
Dizziness	Admission	24.9 (100)		18.9 (39)		31.3 (61)	
	Discharge	19.6 (71)	0.72 (0.58-0.91); .01	17.6 (32)	0.91 (0.66-1.28); .60	21.5 (39)	0.60 (0.43-0.82); .001
	P_1	17.0 (52)	0.65 (047-0.88); .01	17.5 (28)	1.00 (0.66-1.48); .98	16.4 (24)	0.43 (0.27-0.70); .001
	P_2	18.5 (53)	0.74 (0.54-1.00); .05	17.2 (26)	0.99 (0.66-1.49); .97	20.0 (27)	0.57 (0.36-0.89); .01
	P_3	13.0 (35)	0.48 (0.34-0.69); <.001	12.6 (18)	0.73 (0.44-1.22); .23	13.4 (17)	0.33 (0.20-0.56); <.001
Fatigue	Admission	77.2 (308)		70.7 (145)		84.0 (163)	
	Discharge	67.0 (242)	0.60 (0.47-0.76); <.001	58.9 (106)	0.60 (0.44-0.82); .001	75.1 (136)	0.56 (0.37-0.84); .005
	P_1	57.5 (176)	0.40 (0.30-0.52); <.001	54.1 (86)	0.52 (0.37-0.74); <.001	61.2 (90)	0.27 (0.18-0.42); <.001
	P_2	55.0 (149)	0.39 (0.29-0.52); <.001	49.7 (72)	0.46 (0.30-0.69); <.001	61.1 (77)	0.30 (0.20-0.47); <.001
	P_3	48.1 (127)	0.29 (0.22-0.40); <.001	43.7 (62)	0.36 (0.24-0.54); <.001	53.3 (65)	0.22 (0.14-0.34); <.001
Functional domain							
Functional impairment	Baseline	45.1 (181)		28.6 (59)		62.6 (122)	
	Admission	62.3 (249)		50.7 (104)		74.4 (145)	
	Discharge	58.6 (211)	0.88 (0.75-1.02); .09	50.8 (93)	1.00 (0.81-1.22); .99	66.7 (118)	0.73 (0.57-0.94); .02
	P_1	50.3 (156)	0.65 (0.52-0.80); <.001	40.4 (65)	0.68 (0.50-0.92); .01	61.1 (91)	0.58 (0.41-0.80); .001
	P_2	47.6 (138)	0.61 (0.49-0.76); <.001	35.9 (55)	0.59 (0.43-0.82); .001	60.6 (83)	0.60 (0.43-0.84); .003
	P_3	42.5 (116)	0.52 (0.42-0.64); <.001	31.3 (45)	0.50 (0.36-0.70); <.001	55.0 (71)	0.50 (0.36-0.67); <.001

Mobility impairment	Baseline	50.6 (203)		40.8 (84)		61.0 (119)	
	Admission	54.6 (219)		47.1 (97)		62.6 (122)	
	Discharge	55.6 (200)	1.05 (0.94-1.17); .43	47.0 (86)	1.01 (0.87-1.16); .92	64.4 (114)	1.09 (0.91-1.31); .36
	P_1	57.1 (177)	1.20 (1.02-1.39); .02	48.4 (78)	1.14 (0.92-1.42); .23	66.4 (99)	1.26 (1.01-1.58); .04
	P_2	54.8 (159)	1.09 (0.92-1.28); .32	47.1 (72)	1.12 (0.88-1.44); .35	63.5 (87)	1.04 (0.84-1.29); .70
	P_3	52.7 (144)	1.13 (0.96-1.32); .15	45.1 (65)	1.09 (0.85-1.39); .51	61.2 (79)	1.18 (0.95-1.46); .13
Fall risk	Fall in previous 6 months	38.7 (155)	—	37.9 (78)	—	39.5 (77)	—
	Fall during hospital stay	5.0 (16)	—	3.7 (6)	—	6.4 (10)	—
	P_1	14.6 (45)	—	10.0 (16)	—	19.5 (29)	—
	P_2	12.1 (35)	—	13.2 (20)	—	10.9 (15)	—
	P_3	11.1 (30)	—	11.2 (16)	—	10.9 (14)	—
Fear of falling	Admission	40.6 (163)		29.1 (60)		52.8 (103)	
	Discharge	39.4 (143)	0.95 (0.80-1.12); .54	29.3 (53)	1.03 (0.77-1.39); .84	49.5 (90)	0.87 (0.70-1.07); .18
	P_1	31.5 (96)	0.72 (0.57-0.90); .004	23.9 (38)	0.84 (0.58-1.20); .34	39.7 (58)	0.61 (0.44-0.83); .002
	P_2	30.3 (83)	0.76 (0.60-.097); .03	25.0 (37)	0.90 (0.62-1.31); .59	36.5 (46)	0.65 (0.46-0.90); .01
	P_3	32.0 (85)	0.81 (0.64-1.03); .08	25.9 (37)	0.95 (0.68-1.33); .76	39.0 (48)	0.70 (0.49-0.99); .05

CI, confidence interval; OR, odds ratio; P_1, 1 month postdischarge; P_2, 2 months postdischarge; P_3, 3 months postdischarge.
ORs represent the odds for finding a similar prevalence rate at discharge, 1, 2 or 3 months postdischarge as compared to prevalence rates at admission.
*■■■.