Published in final edited form as:

J Am Geriatr Soc. 2016 October ; 64(10): 2027–2034. doi:10.1111/jgs.14320.

Stability of Geriatric Syndromes in Hospitalized Medicare Patients Discharged to Skilled Nursing Facilities

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Abstract

Objectives—The purpose of this study was to assess multiple geriatric syndromes in a sample of older hospitalized patients discharged to skilled nursing facilities and, subsequently, to home to determine the prevalence and stability of each geriatric syndrome at the point of these care transitions.

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Conflicts of Interest: None of the authors have significant conflicts of interest to report related to this project or the results reported within this manuscript.

The editor in chief has reviewed the conflict of interest checklist provided by the authors and has determined that the authors have no financial or any other kind of personal conflicts with this paper.

Dr. Sandra Simmons has served as a professional consultant for Nestle, which is a company that makes nutritional supplement products, but no portion of this study was funded or otherwise supported by Nestle. Dr. John Schnelle has provided expert testimony on staffing levels in long term care but none related to this project or any of the facilities that participated in this project.

Author Contributions: Each co-author contributed significantly to the manuscript.

Dr. Sandra F. Simmons served as a Co-Investigator on the CMS-funded study so she contributed to multiple aspects of this study from concept and design, oversight of data collection and analyses and preparation of this manuscript.

Drs. Bell and Vasilevskis also both served as Co-Investigators on the CMS-funded study. They both contributed to the interpretation of the analyses and the preparation of the manuscript.

Avantika Saraf served as the project data manager and analyst. She conducted all of the statistical analyses for this paper and created all of the Results Tables and Figures with the assistance of Emily Long, Research Assistant, who entered, cleaned and organized all data.

Chris Coelho served as a Research Assistant on this project. He collected, entered and cleaned all of the data related to the geriatric syndromes and assisted in data summaries, interpretation and manuscript preparation (Methods section).

Mary Lou Jacobsen served as the Project Coordinator. She was responsible for scheduling and overseeing all data collection. She assisted in data interpretation and manuscript preparation (Methods section).

Dr. John F. Schnelle served as the Principal Investigator of the CMS-funded study. So, he had a significant role on every aspect of this project.

Design—Descriptive, prospective study.

Setting—One large university-affiliated hospital and four area SNFs.

Participants—Fifty-eight hospitalized Medicare beneficiaries discharged to SNF.

Measurements—Research personnel conducted standardized assessments of the following geriatric syndromes at hospital discharge and two weeks following SNF discharge to home: cognitive impairment, depression, incontinence, unintentional weight loss, loss of appetite, pain, pressure ulcers, history of falls, mobility impairment and polypharmacy.

Results—The average number of geriatric syndromes per patient was 4.4 ($\pm$ 1.2) at hospital discharge and 3.8 ($\pm$ 1.5) following SNF discharge. There was low to moderate stability for most syndromes. On average, participants had 2.9 syndromes that persisted across both care settings, 1.4 syndromes that resolved, and 0.7 new syndromes that developed between hospital and SNF discharge.

Conclusion—Geriatric syndromes were prevalent at the point of each care transition but also reflected significant within-individual variability. These findings suggest that multiple geriatric syndromes present during a hospital stay are not transient nor are most syndromes resolved prior to SNF discharge. These results underscore the importance of conducting standardized screening assessments at the point of each care transition and effectively communicating this information to the next provider to support the management of geriatric conditions.

Keywords

post-acute care; care transitions; polypharmacy

INTRODUCTION

Geriatric syndromes represent clinical conditions common in older adults that share underlying causative factors and involve multiple organ systems.¹ Examples of geriatric syndromes include incontinence, cognitive impairment, delirium, falls, pressure ulcers, pain, unintentional weight loss, anorexia, mobility impairment and depression.^{2–4} Geriatric syndromes are independently associated with a risk for adverse outcomes such as functional decline,^{4–6} the acquisition of additional syndromes, hospital admissions⁷ and mortality,⁴ even when controlling for traditional measures of illness severity and age.

Geriatric syndromes are particularly prevalent among hospitalized older patients and are often exacerbated by the acute care episode.^{1,4,5,8} We recently showed in a study of Medicare beneficiaries that 55% of these patients experienced three or more syndromes at the point of hospital discharge to a Skilled Nursing Facility (SNF).⁸ A separate prospective cohort study of 577 hospitalized older patients showed that two-thirds experienced between one and five syndromes prior to hospitalization, upon hospital admission and at hospital discharge. This study also documented that multiple syndromes reflected either a worsening of a premorbid condition or new onset during the hospitalization event.⁵

It is plausible to hypothesize that the number of geriatric syndromes experienced by SNF patients at hospital discharge may be contributing to poor post-discharge outcomes

following hospitalization.^{2,4,7} There are sparse data, however, about the stability of geriatric syndromes among hospitalized older adults during care transitions; and, even if recognized, hospital providers may be uncertain if geriatric syndromes represent a temporary event related to the acute illness likely to resolve or a new condition that warrants treatment.

A recent study examined depressive symptoms among hospitalized older adults upon hospital admission, hospital discharge and six-months after discharge.⁹ Results showed significant changes over time with an initial increase in depressive symptoms during hospitalization followed by a decline six months after hospital discharge. However, depressive symptoms after hospital discharge still remained higher than symptoms upon hospital admission.⁹ Understanding the extent to which other geriatric syndromes improve, stabilize or worsen during a patient's subsequent SNF stay and transition home may help explain patient outcomes after hospitalization. In addition, different syndromes may be more or less responsive to hospital or SNF-based interventions based on their stability during these care transitions.

To our knowledge, there have been no studies to determine the stability of multiple geriatric syndromes during the care transitions from the hospital to SNF to home. The purpose of this study was to assess multiple geriatric syndromes in a sample of older hospitalized patients discharged to SNF at hospital discharge and within two weeks of SNF discharge to determine the prevalence and stability of each geriatric syndrome at the point of these care transitions.

METHODS

Participants & Setting

All Medicare patients discharged from one large university-affiliated hospital to four area SNFs, which had the highest SNF placement rates from this hospital, were prospectively included in this project from October 1, 2014 through June 26, 2015. Patients discharged from the hospital to hospice (end-of-life) care were excluded from this project as were patients who had a discharge location from SNF other than home. Although most Medicare patients are older adults (> 65), there was not an exclusionary criterion based on age. There also was not an exclusionary criterion based on cognitive status, although patients who were unable (e.g., due to severe cognitive impairment or delirium) or unwilling (e.g., refusal) to respond to the interview questions at each time point were excluded from the analyses.

The data related to the stability of geriatric syndromes were collected as part of a larger project funded by the Centers for Medicare and Medicaid Services (CMS) as a quality improvement project to reduce hospital readmissions among Medicare beneficiaries discharged to 23 area SNFs.⁸ The larger CMS-funded project utilized trained clinical research personnel to conduct a standardized medical record review in conjunction with standardized interview-based assessments related to multiple geriatric syndromes. The university-affiliated Institutional Review Board provided approval for this project and waived the requirement for written, informed consent. Instead, eligible patients were provided a standardized description of the project by trained clinical research personnel (at the time of their referral to one of the participating SNFs) and had the right to refuse the

interview. If a patient completed the interview during their hospital stay, they were asked for permission to be contacted for interview again following SNF discharge. The sample for this sub-study was defined as participants who discharged from the four area SNFs to home and had complete assessments at both hospital discharge and within two weeks of SNF discharge (Fig 1).

Patient Characteristics and Geriatric Syndrome Assessments

Trained clinical research personnel reviewed participants' medical records upon hospital admission and discharge for demographic information (e.g., age, sex, race), admission diagnosis, length of hospital stay, reason for SNF referral and discharge service. In addition, all scheduled and prescribed as needed [PRN] medications were abstracted from the medical record based on discharge orders and the most recent Medication Administration Record in each care setting (i.e., hospital and SNF) to determine the total number of prescribed medications at each time point. Although 'polypharmacy' is not always considered a geriatric syndrome, per se, it has been shown to be a strong risk factor for multiple geriatric syndromes.¹⁰ Thus, changes in the total number of prescribed medications were monitored from hospital to SNF discharge as part of this study. The presence of polypharmacy was defined as five or more medications^{11–13}, and the presence of hyper-polypharmacy was defined as ten or more medications.^{14–16}

Trained clinical research personnel also completed standardized, patient interview-based screening assessments related to the following geriatric syndromes: cognitive impairment, depression, urinary and/or fecal incontinence, unintentional weight loss, loss of appetite (i.e., anorexia), pain, and history of falls within the last three months. Assessments were completed in person prior to hospital discharge and via telephone following SNF discharge. Nurse documentation in the medical record was used to augment fall history self-reported by the patient and assess pressure ulcer status (stage 1 – 4) in each care setting. Physical therapy documentation was used to assess mobility impairment (categories: 1. completely independent with or without an assistive device [e.g., cane or walker]; 2. verbal instructions only; 3. physical assistance [one or two-person assist]; and, 4. unable to walk [completely physically dependent/non-weight bearing]). Mobility impairment was considered present for patients who required verbal and/or physical assistance or who were unable to walk (Physical Therapy categories 2–4).

Cognitive impairment was assessed using the Brief Interview for Mental Status (BIMS), which is a short, performance-based screening tool for cognitive impairment. The BIMS total score ranges from 0 to 15 (0–7: severe impairment; 8–12: moderate impairment; 13–15: cognitively intact) and has been validated against other commonly used assessment tools.^{17,18} A patient with a BIMS total score of 12 or less was categorized as having cognitive impairment. Prior studies have demonstrated that older adults with mild to moderate cognitive impairment remain capable of reliably responding to structured interview questions about some aspects of their health and functioning, so patients with lower BIMS scores were not excluded from analyses if they provided complete interview data related to the geriatric syndromes at both time points.^{19–21} Depressive symptoms were assessed with the Geriatric Depression Scale – 5 item scale, which is a screening tool for

probable depression and has been shown to be reliable and valid in community-dwelling, acute care and long-term care patients.^{22,23} The GDS 5-item tool provides a total score between 0 (no symptoms) and 5 (all 5 symptoms endorsed), with a score of two or higher indicative of probable depression.^{22,23}

In addition, patients were asked about their current pain using the following structured questions: “Please rate your current pain on a scale from 0 to 10 with 0 being no pain and 10 being the worst pain you can imagine”. Individuals with a numeric response ≥ 5 were classified as having moderate to severe pain. A numeric pain score of ≥ 5 was considered clinically significant pain for several reasons. First, federal regulations that guide pain assessments in the SNF care setting define an episode of moderate to severe pain as 5 or greater using the same 0–10 scale.²⁴ In addition, multiple studies have similarly defined ‘significant pain’ as a numeric rating of 5 or higher^{25–28}, and one study showed that pain at this level interferes with functional status.²⁶

Patients also were asked about the presence of bladder or bowel incontinence (i.e., “Do you have any urine or bowel accidents?”; “If ‘yes’, which?” Bladder, bowel, or both), unintentional weight loss (i.e., “Have you lost weight without trying within the last month prior to being admitted to the hospital?”; “Have you lost weight during this hospital stay/since being in the SNF?”) and any recent loss of appetite (i.e., “Have you noticed a change in your appetite since being admitted to the hospital/since being in the SNF?” – response options included: no change, yes – appetite decrease, yes – appetite increase) via standardized interview questions.⁸

History of falls (hospital assessment: within the last three months; post SNF discharge assessment: since hospital discharge) was assessed based on patient interview (i.e., “Have you fallen within the last three months [hospital assessment] / during your SNF stay and/or at home [post SNF discharge assessment]?”). Patient self-report related to falls during their SNF stay was compared to SNF medical record documentation for verification. A fall was considered present if indicated in either data source (SNF medical record or patient interview). In addition, because the reference timeframe for ‘history of falls’ remained three months at both assessment points, participants who endorsed a fall history at hospital discharge were, again, coded as having a fall history at SNF discharge along with participants who reported a new fall event (since hospital discharge).

Data Analyses

Descriptive statistics were used to summarize participants’ demographic and medical characteristics (Table 1) and the overall prevalence rates of each geriatric syndrome (Table 2). The median and interquartile ranges are also reported for variables with non-normal distributions (e.g., length of hospital and SNF stay). Participant characteristics (i.e., age, sex, ethnicity, hospital length of stay and discharge service) were compared between the sub-sample of participants with complete data (N=58) and those lost from the study (total loss N = 131) using independent samples t-tests for continuous measures and chi-square analyses for categorical measures. A McNemar or Wilcoxon statistic was used to compare the overall prevalence of each geriatric syndrome between hospital discharge and post SNF discharge (N=58). The within-individual stability of each geriatric syndrome (present or absent) across

the two time points (hospital and SNF discharge) was compared using a Kappa statistic, which adjusts for chance agreement when examining a binary outcome. A Kappa value of .70 or higher is reflective of strong agreement; although lower Kappa values can still be statistically significant.

RESULTS

Participants and Setting

The four SNFs were located in the middle Tennessee area and had an average total capacity of 165 beds and average total staffing (licensed nurses + nurse aides) of 4.96 hours per resident per day (hprd). Both bed capacity and total staffing levels in these four SNFs were higher than the average for SNFs throughout the state (TN state average = 114 beds and 3.97 total hprd) based on publicly-reported data during the project period (<http://www.medicare.gov/nursinghomecompare>). The overall Medicare star ratings ranged from three to five stars across the four sites. Three of the sites were for-profit and only one was part of a chain. The one not-for-profit facility was part of a continuing care retirement community. Each of the four sites employed Geriatric Nurse Practitioners, and two of the sites also had a Board-certified Geriatrician who served as the Medical Director.

Figure 1 illustrates the derivation of the final sample of 58 participants who had complete geriatric syndrome assessment data at both hospital discharge and follow-up after SNF discharge. A total of 189 patients were discharged to one of the four area SNFs during the data collection time period. Geriatric syndrome assessments were completed prior to hospital discharge for 144 (76%) patients. As shown in Figure 1, reasons for incomplete in-hospital assessments included patient inability to respond to interview questions (N=22), refusal (N=7) and insufficient time prior to discharge (N=16). Follow-up assessments after SNF discharge were targeted toward patients who discharged home, which included assisted-living, from SNF. Thus, 34 patients were excluded from follow-up assessments due to a SNF discharge location other than home (Fig 1). Of the remaining 110 patients, an additional 42 who went home from SNF were otherwise lost due to inability to contact, refusal or death (Fig 1). The remaining 58 patients who had geriatric syndrome assessment data at both time points and who discharged home from SNF comprised the sample for this sub-study.

Table 1 shows the characteristics of the 58 participants, who had an average age of 77 (± 8.3) years and who were predominately female (72%) and White (84%). Their average length of stay in the hospital was 6.9 (± 3.6) days (median = 6.0, interquartile range = 5), and their average length of stay in the SNF was 26.5 (± 13.2) days (median = 25.0, interquartile range = 16). Hospital assessments were conducted by research personnel, on average, 1.3 (± 1.8) days prior to hospital discharge. Follow-up assessments were conducted by research personnel, on average, 39 (± 17.3) days following hospital discharge and 12 (± 12.4) days following SNF discharge. Thus, there was approximately one month between hospital discharge and SNF follow-up assessments. The majority of participants (93%) were referred to SNF for therapy services (Table 1). This sub-sample of patients was mostly discharged from the following hospital service teams: orthopedic surgery, general medicine, and geriatrics.

Participants lost from this study for any reason (Fig 1. Total N=131) had a longer length of hospital stay (8.98 ± 6.0 days, $t = 2.96$, $P = .004$) relative to the study sample shown in Table 1 (N=58). In addition, a lower proportion of those lost from this study was female (55.7%, chi-square = 4.70, $df = 1$, $P = .030$), and a lower proportion was discharged from the orthopedic surgery service (12.2%, chi-square = 9.65, $df = 1$, $P = .002$). There were no other characteristics shown in Table 1 that differed significantly between study participants and those lost from the study (N = 58 versus 131, respectively).

Prevalence of Geriatric Syndromes

Table 2 shows the overall prevalence of each geriatric syndrome at hospital discharge (column 2) and post SNF discharge (column 3), which was approximately one month later. The frequency of incomplete data for select assessments is denoted in Table 2 footnotes, with the most missing data due to incomplete physical therapy documentation in each location. Prevalence rates for the group of 58 patients were comparable at each time point for most syndromes with the exception of mobility impairment, which had a significantly lower prevalence post SNF discharge (100% to 59%, $P < .001$).

The remaining geriatric syndromes shown in Table 2 had comparable prevalence rates at both hospital discharge and post SNF discharge, with the following syndromes occurring most frequently: depression (38% and 34%), loss of appetite (48% and 36%), unintentional weight loss (41% and 40%), moderate to severe pain (31% and 33%) and history of falls (35% and 36%). In addition, both polypharmacy (100%) and hyper-polypharmacy (85% and 88%) had high prevalence rates in this patient sample. Specifically, participants were prescribed an average of $14.21 (\pm 4.38)$ medications at hospital discharge and $14.78 (\pm 4.72)$ medications at SNF discharge. On average, $4.97 (\pm 3.09)$ medications per patient were added, $4.36 (\pm 2.38)$ medications were stopped, and $1.21 (\pm 1.08)$ medications had dose changes during the SNF stay. The fall prevalence rate was similar primarily because the reference timeframe remained three months at both assessment points; thus, the majority of participants who had a history of falls (within the past three months) at hospital discharge were the same participants with a history of falls approximately one month later at SNF discharge. The average number of geriatric syndromes per patient (of possible 10 to include polypharmacy but exclude hyper-polypharmacy) was $4.5 (\pm 1.3)$ at hospital discharge and $3.8 (\pm 1.5)$ following SNF discharge ($t = 3.17$, $P = .002$). Thus, on average, approximately one syndrome was resolved per patient between hospital and SNF discharge.

Stability of Geriatric Syndromes

Table 2 (columns 5–8) and Figure 2 show the within-individual stability of each geriatric syndrome from hospital discharge to post SNF discharge. Table 2 shows the proportion with each syndrome at both time points (syndrome persistent), only at hospital discharge (syndrome lost), or only post SNF discharge (syndrome gained). For example, 13 patients (23%) endorsed symptoms of probable depression (GDS-5 > 2) at both hospital and post SNF discharge; whereas, 8 patients (14%) only endorsed symptoms at hospital discharge and 6 patients (11%) only endorsed symptoms post SNF discharge (Kappa = .47, $P < .001$). Thus, although the overall prevalence of depressive symptoms was comparable at hospital and post SNF discharge, there was instability in this syndrome among 14 of the 27 patients

(52%) who endorsed symptoms. Figure two graphically displays these stability data to also include the proportion of patients for whom the syndrome was absent at both time points.

As shown in both Table 2 and Figure 2, there was low to moderate stability for most of the syndromes, with loss of appetite and hyper-polypharmacy yielding the highest Kappa values (.55 and .57, respectively; both $P < .001$). History of falls also had high stability (Kappa = .96) predominately due to most cases (20/21) having a fall within the same three-month assessment timeframe, with only one participant experiencing a new fall after hospital discharge. The syndromes that showed the most instability (non-significant Kappa values) were incontinence, pressure ulcers and mobility impairment. In each case, the condition was resolved (Table 2 and Figure 2. Syndrome Lost) or newly developed (Table 2 and Figure 2. Syndrome Gained) for a substantial proportion of patients following hospital discharge. On average, participants had 2.9 geriatric syndromes that persisted across both care settings, 1.4 syndromes that resolved, and 0.7 new syndromes that developed between hospital and SNF discharge.

DISCUSSION

The purpose of this study was to examine the prevalence and stability of geriatric syndromes from the time of hospital discharge to shortly following SNF discharge for a sample of older patients discharged to SNF and, subsequently, to home. Results showed that geriatric syndromes were common during these care transitions, with participants experiencing an average of three to four syndromes at each time point. While prevalence rates were comparable for most syndromes, there remained significant within-individual variability. On average, participants experienced the persistence of approximately three syndromes, the resolution of one syndrome, and the addition of one new syndrome. These findings suggest that multiple geriatric syndromes present during a hospital stay are not transient, which highlights the importance of conducting standardized screening assessments at the point of care transitions. Furthermore, geriatric syndrome assessment information should be effectively communicated to out-patient providers (e.g., primary care, home health) to support the management of geriatric conditions.

The need to address geriatric syndromes during care transitions has been recently noted in the context of acquired “post-hospital syndrome”, which reflects a period of heightened vulnerability following hospital discharge.²⁹ Post-hospital syndrome consists of conditions such as sleep disturbance, pain, depression, cognitive impairment, delirium, mobility impairment and nutritional issues (i.e., geriatric syndromes). Because these conditions are typically not related to the acute hospitalization event, they are not addressed during or following the hospital stay and, thus, may increase the patient’s risk for other adverse outcomes (e.g., hospital readmissions, falls, poor medication compliance, functional decline).²⁹

Mobility impairment showed the most improvement from hospital to SNF discharge, which is not surprising given the rehabilitation focus of SNF and the delivery of physical/occupational therapy services to most study participants. However, while there also were improvements in other syndromes in the SNF care setting (e.g., incontinence, pressure

ulcers), new syndromes developed across all conditions other than mobility impairment. These findings suggest that hospital providers should not assume that SNF care will result in consistent improvements in geriatric syndromes beyond mobility impairment nor should providers expect the number of syndromes experienced by a patient to necessarily decline by the time they are discharged home from SNF.

It is notable that all study participants met criteria for polypharmacy^{11–13}, and most also met criteria for hyper-polypharmacy^{14–16} at both hospital and SNF discharge. The high prevalence of polypharmacy is of major concern and may contribute to multiple harmful outcomes among older hospitalized patients such as decreased medication adherence,³⁰ increased adverse drug events,^{30–32} and increased health care utilization and costs.^{33–36} Polypharmacy has additionally been found to be associated with the development of the following geriatric syndromes: long-term cognitive impairment,³⁷ delirium,³⁸ falls,^{14,39} urinary incontinence,^{40,41} and unintentional weight loss.^{42,43} Thus, polypharmacy may contribute to the worsening of syndromes and/or the development of new syndromes. The persistence of multiple geriatric syndromes at the point of SNF discharge home also could potentially interfere with the patient's ability to maintain their independence and quality of life.

This study had several notable limitations. First, the small sample represented only one hospital and four area SNFs, and the study sample represented a higher proportion of orthopedic discharge service patients relative to those lost from the study. Secondly, although the screening questions for some syndromes addressed the one-month (i.e., unintentional weight loss) to three-month (i.e., history of falls) timeframe prior to hospital admission, the design of this study did not allow for pre-hospital admission assessments. This study also did not include follow-up assessments at a later time point (e.g., 3–6 months after SNF discharge) during which time it is possible that the prevalence and/or stability of each geriatric syndrome may have changed further. It is also important to note that there may have been clinically meaningful changes in severity that were not detected by the brief, screening tools used in this study. Finally, there are geriatric syndromes (e.g., delirium, sleep) that were not assessed as part of this study. Despite these limitations, this study revealed important findings related to both the prevalence and stability of multiple geriatric syndromes among hospitalized, older patients discharged to SNF and, subsequently home, that health care providers need to be aware of to effectively treat this vulnerable patient population.

Acknowledgments

This research was supported by the Department of Health and Human Services, Centers for Medicare & Medicaid Services grant #1C1CMS331006 awarded to Principal Investigator, Dr. John F. Schnelle, PhD. Dr. Vasilevskis was supported by the National Institute on Aging of the National Institutes of Health award #K23AG040157, the Veterans Affairs Clinical Research Center of Excellence, and the Geriatric Research, Education and Clinical Center (GRECC). Dr. Bell was supported by K12HD043483-11 from NIH/NICHD and by the Eisenstein Women's Heart Fund. The contents of this publication are solely the responsibility of the authors and do not necessarily represent the official views of the U.S. Department of Health and Human Services or any of its agencies, the National Institutes of Health or the Department of Veterans' Affairs.

Sponsor's Role: There was no role of the sponsor in any aspect of this study beyond funding. See acknowledgements section.

REFERENCES

1. McRae PJ, Peel NM, Walker PJ, et al. Geriatric syndromes in individuals admitted to vascular and urology surgical units. *J Am Geriatr Soc.* 2014; 62:1105–1109. [PubMed: 24801947]
2. Anpalahan M, Gibson SJ. Geriatric syndromes as predictors of adverse outcomes of hospitalization. *Int Med J.* 2008; 38:16–23.
3. Lee PG, Cigolle C, Blaum C. The co-occurrence of chronic diseases and geriatric syndromes: The health and retirement study. *J Am Geriatr Soc.* 2009; 57:511–516. [PubMed: 19187416]
4. Buurman BM, Hoogerduijn JG, de Haan RJ, et al. Geriatric conditions in acutely hospitalized older patients: Prevalence and one-year survival and functional decline. *PloS One.* 2011; 6:e26951. [PubMed: 22110598]
5. Lakhan P, Jones M, Wilson A, et al. A prospective cohort study of geriatric syndromes among older medical patients admitted to acute care hospitals. *J Am Geriatr Soc.* 2007; 59:2001–2008. Cigolle CT, Langa KM, Kabeto MU, et al. Geriatric conditions and disability: The Health and Retirement Study. *Ann Int Med.* 2007; 147:156–164. [PubMed: 17679703]
6. Wang HH, Sheu JT, Shyu YI, et al. Geriatric conditions as predictors of increased number of hospital admissions and hospital bed days over one year: Findings of a nationwide cohort of older adults from Taiwan. *Arch Gerontol Geriatr.* 2014; 59:169–174. [PubMed: 24588875]
7. Bell S, Vasilevskis E, Saraf A, et al. Geriatric syndromes in hospitalized older adults discharged to skilled nursing facilities. *J Am Geriatr Soc.* in press.
8. Chen CM, Huang GH, Chen CC. Older patients' depressive symptoms 6 months after prolonged hospitalization: Course and interrelationships with major associated factors. *Arch Gerontol Geriatr.* 2014; 58:339–343. [PubMed: 24472139]
9. Flood KL, Rohlfing A, Le CV, et al. Geriatric syndromes in elderly patients admitted to an inpatient cardiology ward. *J Hosp Med.* 2007; 2:394–400. [PubMed: 18081154]
10. Cao YJ, Mager DE, Simonsick EM, et al. Physical and cognitive performance and burden of anticholinergics, sedatives, and ACE inhibitors in older women. *Clin Pharm Ther.* 2008; 83:422–429.
11. Hein C, Forgues A, Piau A, et al. Impact of polypharmacy on occurrence of delirium in elderly emergency patients. *J Am Med Dir Assoc.* 2014; 15:850, e11–e15.
12. Landi F, Dell'Aquila G, Collamati A, et al. Anticholinergic drug use and negative outcomes among the frail elderly population living in a nursing home. *J Am Med Dir Assoc.* 2014; 15:825–829. [PubMed: 25282629]
13. Best O, Gnjjidic D, Hilmer SN, et al. Investigating polypharmacy and drug burden index in hospitalised older people. *Int Med J.* 2013; 43:912–918.
14. Fraser LA, Liu K, Naylor KL, et al. Falls and fractures with atypical antipsychotic medication use: A population-based cohort study. *JAMA Int Med.* 2015; 175:450–452.
15. Lu WH, Wen YW, Chen LK, et al. Effect of polypharmacy, potentially inappropriate medications and anticholinergic burden on clinical outcomes: A retrospective cohort study. *Canadian Med Assoc J.* 2015; 187:E130–E137.
16. Chodosh J, Edelen MO, Buchanan JL, et al. Nursing home assessment of cognitive impairment: Development and testing of a brief instrument of mental status. *J Am Geriatr Soc.* 2008; 56:2069–2075. [PubMed: 19016941]
17. Saliba D, Buchanan J, Edelen MO, et al. MDS 3.0: Brief interview for mental status. *J Am Med Dir Assoc.* 2012; 13:611–617. [PubMed: 22796362]
18. Chibnall JT, Tait RC. Pain assessment in cognitively impaired and unimpaired older adults: A comparison of four scales. *Pain.* 2001; 92:173–186. [PubMed: 11323138]
19. Chu L, Schnelle JF, Cadogan MP, et al. Using the minimum data set to select nursing home residents for interview about pain. *J Am Geriatr Soc.* 2004; 52:2057–2061. [PubMed: 15571542]
20. Cadogan MP, Schnelle JF, Al-Sammarai NR, et al. A standardized quality assessment system to evaluate pain detection and management in the nursing home. *J Am Med Dir Assoc.* 2006; 7:S11–S19. [PubMed: 16500269]

21. Hoyl MT, Alessi CA, Harker JO, et al. Development and testing of a five-item version of the Geriatric Depression Scale. *J Am Geriatr Soc.* 1999; 47:873–878. [PubMed: 10404935]
22. Rinaldi P, Mecocci P, Benedetti C, et al. Validation of the five-item geriatric depression scale in elderly subjects in three different settings. *J Am Geriatr Soc.* 2003; 51:694–698. [PubMed: 12752847]
23. Research Triangle Institute (RTI) International. (U.S.). MDS 3.0 Quality Measures: User's Manual. Research Triangle Park, NC: Research Triangle Institute International; 2012.
24. Jensen MP, Smith DG, Ehde DM, et al. Pain site and the effects of amputation pain: Further clarification of the meaning of mild, moderate, and severe pain. *Pain.* 2001; 91:317–322. [PubMed: 11275389]
25. Jones KR, Vojir CP, Hutt E, et al. Determining mild, moderate, and severe pain equivalency across pain-intensity tools in nursing home residents. *J Rehab Res Dev.* 2007; 44:305.
26. Mendoza TR, Chen C, Brugger A, et al. Lessons learned from a multiple-dose post-operative analgesic trial. *Pain.* 2004; 109:103–109. [PubMed: 15082131]
27. Serlin RC, Mendoza TR, Nakamura Y, et al. When is cancer pain mild, moderate or severe? Grading pain severity by its interference with function. *Pain.* 1995; 61:277–284. [PubMed: 7659438]
28. Krumholz HM. Post-hospital syndrome – An acquired, transient condition of generalized risk. *New Engl J Med.* 2013; 368:100–102. [PubMed: 23301730]
29. Col N, Fanale JE, Kronholm P. The role of medication noncompliance and adverse drug reactions in hospitalizations of the elderly. *Arch Int Med.* 1990; 150:841–845. [PubMed: 2327844]
30. Steinman MA, Lund BC, Miao Y, et al. Geriatric conditions, medication use, and risk of adverse drug events in a predominantly male, older veteran population. *J Am Geriatr Soc.* 2011; 59:615–621. [PubMed: 21410446]
31. Onder G, Petrovic M, Tangiisuran B, et al. Development and validation of a score to assess risk of adverse drug reactions among in-hospital patients 65 years or older: The GerontoNet ADR risk score. *Arch Int Med.* 2010; 170:1142–1148. [PubMed: 20625022]
32. Flaherty JH, Perry HM 3rd, Lynchard GS, et al. Polypharmacy and hospitalization among older home care patients. *J Geront Biol Sci Med Sci.* 2000; 55:M554–M559.
33. Morandi A, Bellelli G, Vasilevskis EE, et al. Predictors of rehospitalization among elderly patients admitted to a rehabilitation hospital: The role of polypharmacy, functional status, and length of stay. *J Am Med Dir Assoc.* 2013; 14:761–767. [PubMed: 23664484]
34. Gnjdic D, Hilmer SN, Hartikainen S, et al. Impact of high risk drug use on hospitalization and mortality in older people with and without Alzheimer's disease: A national population cohort study. *PLoS One.* 2014; 9:e83224. [PubMed: 24454696]
35. Sganga F, Landi F, Ruggiero C, et al. Polypharmacy and health outcomes among older adults discharged from hospital: Results from the CRIME study. *Geriatr Gerontol Int.* 2015; 15:141–146. [PubMed: 24467719]
36. Oyarzun-Gonzalez XA, Taylor KC, Myers SR, et al. Cognitive decline and polypharmacy in an elderly population. *J Am Geriatr Soc.* 2015; 63:397–399. [PubMed: 25688619]
37. Hein C, Forgues A, Piau A, et al. Impact of polypharmacy on occurrence of delirium in elderly emergency patients. *J Am Med Dir Assoc.* 2014; 15:850, e11–e15.
39. Bennett A, Gnjdic D, Gillett M, et al. Prevalence and impact of fall-risk-increasing drugs, polypharmacy, and drug-drug interactions in robust versus frail hospitalised falls patients: A prospective cohort study. *Drugs Aging.* 2014; 31:225–232. [PubMed: 24452921]
40. Kashyap M, Tu le M, Tannenbaum C. Prevalence of commonly prescribed medications potentially contributing to urinary symptoms in a cohort of older patients seeking care for incontinence. *BMC Geriatr.* 2013; 13:57. [PubMed: 23758756]
41. Gormley EA, Griffiths DJ, McCracken PN, et al. Polypharmacy and its effect on urinary incontinence in a geriatric population. *Br J Urol.* 1993; 71:265–269. [PubMed: 8097424]
42. Jyrkka J, Enlund H, Lavikainen P, et al. Association of polypharmacy with nutritional status, functional ability and cognitive capacity over a three-year period in an elderly population. *Pharmacoepidemiol Drug Saf.* 2011; 20:514–522. [PubMed: 21308855]

43. Heuberger RA, Caudell K. Polypharmacy and nutritional status in older adults: A cross-sectional study. *Drugs Aging*. 2011; 28:315–323. [PubMed: 21428466]

Figure 1.
Consort Diagram of Sample Derivation

Figure 2.
Stability of Geriatric Syndromes from Hospital Discharge to Post-SNF Discharge

Table 1**Participant Characteristics (N=58)**

Descriptive Characteristic	Percent (n) or Mean ($\pm$Standard Deviation)
Age (years)	76.9 ($\pm$ 8.3)
Percent Female	72.4 (42)
Percent White	86.2 (50)
Hospital Length of Stay (days)	6.86 ($\pm$ 3.6)
Skilled Nursing Facility (SNF) Length of Stay (days)	26.5 ($\pm$ 13.2)
Number of days between in-hospital assessments and hospital discharge	1.3 ($\pm$ 1.8)
Number of days between hospital discharge and post SNF follow-up	38.8 ($\pm$ 17.3)
Number of days between SNF discharge and post SNF follow-up	12.3 ($\pm$ 12.4)
Reason for SNF Referral	
Percent Physical Therapy / Occupational Therapy	93.1 (54)
Percent Intravenous Antibiotics	5.2 (3)
Wound Care	1.7 (1)
Discharge services (Three Most Frequent)	
Percent Orthopedic Surgery	31.0 (18)
Percent General Medicine	12.0 (7)
Percent Geriatric Medicine	17.2 (10)

Table 2
Prevalence and Stability of Geriatric Syndromes from Hospital Discharge to Post-SNF Discharge

Geriatric Syndrome	Hospital Discharge Percentage (n/D)	SNF Discharge Percentage (n/D)	P Value	Syndrome Lost Syndrome present at Hospital Discharge but absent Post SNF Discharge Percentage (n/D)	Syndrome Persistent Syndrome present at both Hospital and Post SNF Discharge Percentage (n/D)	Syndrome Gained Syndrome absent at Hospital Discharge but present Post SNF Discharge Percentage (n/D)	Kappa Value
Cognitive Impairment	15.8% (9/57)	12.3% (7/57)	0.727	8.8% (5/57)	7.0% (4/57)	5.3% (3/57)	0.420**
Depressive Symptoms	37.5% (21/56)	33.9% (19/56)	0.791	14.3% (8/56)	23.2% (13/56)	10.7% (6/56)	0.465**
Incontinence (Bladder/ Bowel or Both)	34.5% (20/58)	20.7% (12/58)	0.115	24.1% (14/58)	10.4% (6/58)	10.4% (6/58)	0.157
Loss of Appetite	48.3% (28/58)	36.2% (21/58)	0.092	17.2% (10/58)	31.0% (18/58)	5.2% (3/58)	0.547***
Unintentional Weight Loss	41.4% (24/58)	39.7% (23/58)	1.000	17.2% (10/58)	24.1% (14/58)	15.5% (9/58)	0.321*
Pain	31.0% (18/58)	32.8% (19/58)	1.000	13.8% (8/58)	17.2% (10/58)	15.5% (9/58)	0.326*
Pressure Ulcers	10.4% (6/58)	10.4% (6/58)	1.000	6.9% (4/58)	3.5% (2/58)	6.9% (4/48)	0.256
Falls	34.5% (20/58)	36.2% (21/58)	1.000	0.0% (0/58)	34.5% (20/58)	1.7% (1/58)	0.962***
Mobility Impairment ^a	100% (51/51)	58.8% (30/51)	<0.001	41.2% (21/51)	58.8% (30/51)	0.0% (0/51)	0.000
Hyper polypharmacy (> 10 medications)	84.5% (49/58)	87.9% (51/58)	0.687	3.5% (2/58)	81.0% (47/58)	6.9% (4/58)	0.566***
Polypharmacy (> 5 medications)	100% (58/58)	100% (58/58)	1.000	0.0% (0/58)	100% (58/58)	0.0% (0/58)	--
Average Syndromes per patient, Mean (±SD) ^b	4.5 (±1.3)	3.8 (±1.5)	<0.001	1.4 (1.0)	3.0 (1.3)	0.7 (±0.8)	n/a

Data for each syndrome represents those with valid data at both time points; n/d = numerator/denominator.

Missing Data: Cognitive Impairment: Hospital=1 | Depressive Symptoms: Hospital=2 | Mobility Impairment: Hospital=2; Post SNF=5

^aMobility Impairment includes the need for any type of assistance (verbal instruction or physical help) or total dependence/inability to walk.

^b Average Syndromes per patient calculated based on the presence of 10 syndromes, excluding hyperpolypharmacy.

p value < 0.001; --- Kappa could not be computed due to a prevalence of 100% for both time points.

p value > 0.01

**

p value < 0.05

*

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