Published in final edited form as:
*J Hosp Med*. 2010 February ; 5(2): 69–75. doi:10.1002/jhm.589.

# Impact and Recognition of Cognitive Impairment among Hospitalized Elders

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## INTRODUCTION

In 2001, approximately 12.6 million individuals aged 65 and older were discharged from American hospitals with an average length of stay of 5.8 days1 and up to 66% of them suffered from cognitive impairment (CI)2–20. CI in hospitalized older adults includes a variety of disorders ranging from mild cognitive deficit, delirium, to full-blown dementia. Dementia is a syndrome of decline in memory plus at least one other cognitive domain, such as language, visuo-spatial, or executive function sufficient to interfere with social or occupational functioning in an alert person21. Delirium is a disturbance of consciousness with reduced ability to focus, sustain, or shift attention that occurs over a short period of time and tends to fluctuate over the course of the day22. Mild cognitive impairment without dementia is defined as the presence of a cognitive deficit in the absence of delirium that does not affect functional performance23.

Hospitalized older adults with CI are vulnerable to hospital complications including delirium, physical restraints, urinary catheters, and tethers2,3,24–35. The management of their medical or surgical illnesses requires avoiding certain medications with anticholinergic activities that might worsen cognition36. Furthermore, CI may delay diagnostic and therapeutic procedures, demand more time for informed-consent related issues, and result in difficulty in adherence to medical recommendations37,38. The special needs of hospitalized older adults with delirium and dementia has been shown to increase demands on nursing staff, risk of post-discharge institutionalization, length of stay and health care costs3–10,27,39–48. We wanted to look specifically at CI because it often goes undetected49–51 and can have a great impact on the hospital course of elders.

Screening for CI among hospitalized older adults has been considered to have potential benefit in hospital care of older adults52. Screening may lead to early detection by uncovering subtle symptoms not yet apparent to families or other caregivers who know the patient well but do not notice small declines or changes in day-to-day functioning. Early recognition of CI may lead to early treatment and subsequently may delay progression of cognitive decline improve health outcomes. Screening may enhance physician's prescribing

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practices and reduce exposure to harmful medications among these vulnerable patients. Finally, delirium is an important prognostic indicator and screening patients could provide invaluable information towards the overall clinical picture. Despite all of this, the current literature does not provide sufficient information to support the use of routine screening on admission[2–20,41,52–54]. Most of the published studies were conducted among elders who stayed in the hospital for more than 48 hours, missing data on the crucial first 48 hours of the hospital course[2–20,41,52–54]. These studies did not evaluate the impact of unrecognized CI on the hospital course and the majority of these studies were not conducted in the urban and lower socioeconomic status populations of elders that are the most vulnerable for bad health outcomes[2–20,41,52–54]. Finally, few studies evaluated the impact of delirium superimposed on cognitive impairment on the hospital course and mortality of elders[2–20,41,52–54].

With these details in mind we wanted to explore the impact of cognitive impairment recognition among patients aged 65 and older admitted to the medical services of an urban, public hospital in Indianapolis to determine the prevalence and the impact of recognized and unrecognized CI on the hospital course of these elders. Furthermore, we examined the role of delirium superimposed on these hospitalized elders with CI.

## METHODS

The study was approved by the Indiana University Purdue University at Indianapolis Institutional Review Board (IRB).

### Study setting and population

The study was conducted on the inpatient general medicine service of Wishard Memorial Hospital (WMH). WMH is a 450-bed, university-affiliated, urban, public hospital that is staffed by Indiana University School of Medicine faculty and housestaff. It serves a population of approximately 750,000 in Marion County.

### Inclusion and exclusion criteria

Patients were enrolled in the study based on the following criteria: 1) at least 65 years of age; 2) hospitalized on a medical ward; 3) able to speak English; and 4) have CI at the time of hospital admission (see below). Patients were excluded if they had previously enrolled in the study, were enrolled in another clinical study at the time of admission, or were aphasic or unresponsive at the time of screening.

### Cognitive screening

Cognitive impairment was determined by the Short Portable Mental Status Questionnaire (SPMSQ)[55,56], chosen for its accuracy[56] and the fact that it is entirely verbal in administration. In most cases, patients were followed and reassessed daily. Patients having two or more errors, indicating a score of 8 or less on the SPMSQ after adjusting for race and education were considered to have cognitive impairment. The SPMSQ is a brief 10-item screening test with a sensitivity of 86% and specificity 99.0% for dementia among medical inpatients[56]. At the time of cognitive screening, delirium was assessed by using the Confusion Assessment Method (CAM)[22]. This was also done daily in most cases. The CAM[22] is a structured instrument that evaluates the ten symptoms of delirium specified in the DSM-III-R: acute onset, fluctuating course, inattention, disorganized thinking, altered level of consciousness, disorientation, memory impairment, perceptual disturbances, psychomotor agitation or retardation, and sleep/wake disturbance. The CAM score is determined by examining the patient, investigating the chart and interviewing the nurse and/or a family member for (a) acute and fluctuating changes in mental status, (b) inattention, (c)

disorganized or incoherent thinking, and (d) altered level of consciousness. A CAM score is considered to be positive if the patient displays both (a) and (b) with at least one of (c) or (d). The CAM diagnosis of delirium was validated against the clinical judgment of a psychiatrist and found to have a sensitivity of 97% and a specificity of 92%22. A research assistant (RA) was trained for a period of nine months by a physician as a rater to interview the patient and administer both the SPMSQ and the CAM at the time of admission and then every weekday. When feasible, the RA administered both the SPMSQ and the CAM within the first few hours of hospitalization, and then followed up with our patients each day. More than 75% of our initial cognitive screening occurred in the first 48 hours of hospital admission, and was repeated on a daily basis. In addition to cognitive assessment, the RA reported the presence or absence of Foley catheterization, physical restraints, and tethers during the cognitive assessment. Agreement was obtained from the general internal medicine group practice physicians both to participate in the study and to request screening for CI as part of the recognized admission standard of care among their hospitalized patients aged 65 and older. The study coordinator was notified of all admissions for patients aged 65 or older by the hospital intranet email and paging system. Admission notifications were sent by page and email on an hourly basis from Monday through Friday, 8:00 a.m. through 5:00 p.m. Those admissions occurring between the hours of 5:00 p.m. and 8:00 a.m. were sent during the next normal batch notification. Pages and emails for admissions occurring on Saturday and Sunday were sent on Monday morning at 8:00 a.m.

## Regenstrief Medical Record System at WMH

The computerized Regenstrief Medical Record System (RMRS) is the primary instrument for processing data and monitoring patient and physician activity for Wishard Health System57,58. The RMRS is a modular system, composed of Registration and Scheduling, Laboratory, and Pharmacy database modules. The Registration and Scheduling module is used to make all outpatient appointments for the office practices associated with Wishard Health System. The Laboratory module handles all data for all inpatient and outpatient laboratories. This module also produces all lab reports and data used for billing. In addition to laboratory data, this module stores coded results and full text interpretations of all imaging studies and special procedures. The Pharmacy module contains information on medication orders captured by the Computerized Physician Order Enter (CPOE). The Database module stores all the above data by date in a fully coded form. Thus, these data are readily retrievable for individual patients by health care providers using on-line terminals. Data for large numbers of patients are retrievable using a locally developed English-like language called CARE. Patients can be identified either by a certain restriction list (e.g., the list of subjects in a study) or by clinical criteria. The RMRS also maintains a number of other databases including diagnoses, vital signs, results of laboratory tests and diagnostic tests, full-text discharge summaries, preventive health maneuvers, and detailed information on all inpatient and outpatient charges. It contains death certificate information from the Indiana State Board of Health for all registered patients who die in, or outside of Indiana. Therefore, the RMRS collects and monitors a broad array of physician and patient activity, practice patterns, utilization, diagnostic test finding, and offer a wonderful array of outcome measures.

## Other Data collections

Patient demographics such as age, gender, race, and education level were determined by the RMRS and by information obtained during the time of cognitive screening. Length of hospital stay and 30-day post hospitalization mortality were obtained from the RMRS. Comorbidity level was measured by reviewing the RMRS and determining each patient's Charlson comorbidity index total score59,60. This score was determined using ICD-9 codes gathered from one year prior to admission until the patient was discharged from the hospital.

Anticholinergic medications were determined by using the Anticholinergic Cognitive Burden Scale61, an expert-based practical index. The scale was developed based on a review of all published studies from 1996 to 2007 that measured the anticholinergic activities of a drug and its association with cognitive function in older adults. The list of drugs reviewed was presented to an expert interdisciplinary panel that included geriatricians, geriatric pharmacists, geriatric psychiatrists, general physicians, geriatric nurses, and aging brain researchers. The panel categorized each medication into a possible or definite anticholinergic category based on the severity of its cognitive anticholinergic effects61. A patient who received at least one order of a possible or definite anticholinergic during their hospitalization was considered to be an anticholinergic user. Prior recognition of CI was determined by searching the RMRS for any ICD-9 code (see appendix) indicative of dementia, Alzheimer disease, or delirium reported at hospital admission, discharge, or during a one year period prior to hospitalization for every patient enrolled in the study. Those patients with documented ICD-9 codes were felt recognized as having some form of cognitive impairment. Those who had a positive screen but no prior documentation according to ICD-9 coding, were said to have unrecognized CI.

**Analysis—**Descriptive statistics were calculated, including percentages for binary categorical variables, means and standard deviations for continuous variables. Comparisons between groups were based upon Fisher's Exact Tests for binary categorical variables and t-tests for continuous variables. When controlling for covariates such as age, gender, race, Charlson comorbidity index, and SPMSQ at screening, group comparisons were made by using logistic regression for binary categorical variables and multiple regression for continuous variables. Since the distributions of length of stay and Charlson comorbidity index were skewed, all statistical tests comparing them across groups were actually performed on their log-transformed values.

## RESULTS

### The Prevalence and recognition of CI

Table 1 describes the demographic characteristic of our study population, which is a reflection of the public and urban nature of our target hospital. Our study assessed the cognitive status of 997 older adults usually (> 75% of the time) within 48 hours of their admission to the medical ward of this urban hospital between July of 2006 and March 2008 (see table 1) and found that 43% of these elders had evidence of CI as determined by a SPMSQ score of 8 points or less. However, 61% of the 424 cognitively impaired elders were not documented or recognized by the electronic medical record system to have cognitive deficit.

### The impact of unrecognized CI on the hospital course

As expected, hospitalized elders with documented CI were older (mean age of 79.1 vs. 76.1 with $p < 0.001$) and had worse cognitive function upon screening than those with unrecognized CI (mean SPMSQ 3.4 points vs. 6.3 with $p < 0.001$). Furthermore, CI recognition was influenced by the elders' race and comorbidity (see table 2); a higher percentage of elders with documented CI were African American (69% vs. 54% with $p = 0.003$) and had less comorbidity (mean Charlson index of 1.9 vs. 2.3 with $p = 0.03$). After adjusting for age, gender, race, comorbidity, and cognitive function at screening, our study found no differences between elders with previously recognized CI and those with unrecognized CI in regard to the length of hospital stay (6.7 days vs. 7.5 days with $p = 0.59$), 30-day post hospital mortality (4.8% vs. 6.6% with $p > 0.2$), home discharge (32% vs. 45% with $p > 0.7$), hospital readmission (19.2% vs.18.8 % with $p > 0.6$), delirium incidence (27% vs. 21% with $p > 0.9$), and physical restraints (1.8% vs. 1.5% with $p > 0.4$). We also found

that elders with undocumented CI were not more likely to receive definite anticholinergics (33.2% vs. 32.7% with $p > 0.9$).

### The impact of delirium on the hospital course of elders with CI

Among the 424 hospitalized elders with CI, 163 (38%) had delirium at least once during their hospital course and 24% had delirium on the day of hospital discharge. In comparison to elders who had CI but not delirium during their hospitalization (see table 3), those with at least one day of delirium had a higher 30-day post hospitalization mortality risk (8.6% vs. 4.2% with $p = 0.09$), stayed in the hospital 3.3 additional days (9.2 days vs. 5.9 days with $p < 0.001$), were less likely to be discharged home (25% vs. 49% with $p < 0.001$), were more likely to receive a Foley catheterization (52% vs. 23% with $p < 0.001$), more likely to be physically restrained (4% vs. 0% with $p < 0.01$), and more likely to receive tethers during their care (89% vs. 69% with $p < 0.001$). There was no statistically significant difference between the two groups in terms of 30-day hospital readmission rates or in their use of definite anticholinergics (see table 3).

## DISCUSSION

Our study found that in an urban, public hospital, acute or pre-existing cognitive impairment affects more than a third of hospitalized elders admitted to general medical services. Unfortunately, our hospital system does not currently recognize the majority of these vulnerable patients. Our study also found that delirium affects more than one third of hospitalized elders with CI during their hospital course. Delirium complicates hospital care by prolonging length of stay and decreasing the probability of surviving and getting discharged home. It leads to high use of Foley catheterization, physical restraints and tethers.

The high prevalence of CI with and without delirium in our cohort is within the rates reported previously in the literature. It is estimated that the prevalence of CI in hospitalized older adults ranges from 14% to 66%, depending on the method used to measure cognition, the definition of CI, and the type of hospital ward (surgical, medical, geriatric units)[2–20]. One particular study that used a similar cognitive assessment method reported higher prevalence rates for both CI and delirium[11]. The study randomly evaluated a sample of 201 patients aged 65 and over who were hospitalized for a medical illness and found that 56% of the cohort suffered from CI and among those with CI, 47% had delirium[11]. The difference between this finding and our study is most likely due to our sampling technique; more than 75% of our cognitive screening occurred in the first 48 hours of hospital admission whereas the Australian study, in similar enrollment criteria to all of the published studies in this area, excluded patients who were discharged within 48 hours of admission. We believe, however, that by including the first 48 hours of admission in our design, our study provides a more generalizable reflection of the actual acute care experience.

The impact of delirium on the course of hospital care found in our study supports some of the findings from previous studies conducted in the past two decades[5,6,11]. Despite two decades of clinical research, delirium continues to increase mortality, hospital stays and post hospital institutionalization.

We were surprised to find that patients suffering from delirium continue to receive at least one definite anticholinergic medication. Such medications are considered inappropriate among patients with any form of cognitive impairment[36,62]. Although the impact of anticholinergic medications on hospitalized outcomes is less well described, their use has been suspected to negatively impact long-term outcomes of cognitive impairment[61,63]. Our study found no difference in the use of anticholinergic medications between those with CI

who experienced delirium and those who did not; however the total burden of anticholinergic medication was not assessed in a quantitative manner. It is still unknown if certain anticholinergic medications or a cumulative effect of anticholinergic medications may impact cognitive or health-related outcomes in a vulnerable older population with CI.

Although our study reported for the first time in a systematic way the rate of undocumented CI among hospitalized elders found to have CI on admission, we found no impact of such under-recognition on the length of hospital stay, mortality, discharge location, and delirium occurrence. Although the use of anticholinergic medications is not recommended for patients with any form of CI, our results indicate that a significant number of patients with cognitive impairment continue to receive inappropriate medications. CI recognition in the elderly was not shown to have a statistically significant affect on length of stay, cost or mortality.

Our study has some limitations. First of all, we did not determine the underlying types of CI such as Alzheimer disease, vascular dementia, mild cognitive impairment or reversible etiology other than delirium. Such a categorization requires post hospital assessment, which was not included in our study design. Second, our delirium incidence rate and delirium impact on hospital outcomes might be very conservative and may underestimate its true prevalence and correlation due to our data collection methods. Despite the fluctuating nature of delirium, our study was not designed to assess the presence of delirium every shift and tried to assess cognitive function on a daily basis throughout the patient's hospitalization. Therefore, the severity and duration of delirium could not be accurately assessed. Our reported rates of use of Foley catheterization, physical restraints, and tethers are also very conservative and we could not determine the appropriateness of these procedures. Our study was conducted in one public hospital in an urban city with a higher percentage of African Americans. Thus, our sample is not a true representative sample. However, studies with significant representation of minority groups are not common in the research literature, especially in cognitive impairment research; we hope to fulfill some of the gaps in the literature regarding the most vulnerable older American population. Finally, we were limited in our use of ICD-9 coding to determine if patients had previously been recognized by other providers as having cognitive impairment. ICD-9 coding, while useful, is not perfect in identifying all if a patient's medical problems. Use of coding to determine whether a patient had been recognized as impaired also does not allow us to determine when the diagnosis was made.

In conclusion, our study evaluated cognitive impairment in hospitalized elders and found that in our cohort of 997 patients, 43% were cognitively impaired on admission. Of those with CI, 61% were not documented or recognized as impaired. We found no statistically significant difference between those with documented CI and those with undocumented CI in terms of length of stay, mortality, home discharge, readmission rates, incidence of delirium or potential to receive anticholinergics or restraints. Among those with CI, 38% had delirium. Those with delirium experienced increased length of stay, decreased discharge to home, and increased use of Foley catheters and restraints.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Acknowledgments

The study was supported by Paul A. Beeson Career Development Award in Aging (K23 AG 26770-01) from the National Institute on Aging, the Hartford Foundation, The Atlantic Philanthropy, and the American Federation of Aging Research.

## References


1. Graves EJ, Gillum BS. National hospital discharge survey: annual summary, 1994. Vital Health Stat. 1997; 13:i–v. 1–50.
2. Inouye SK. The dilemma of delirium: clinical and research controversies regarding diagnosis and evaluation of delirium in hospitalized elderly medical patients. Am J Med. 1994; 97:278–88. [PubMed: 8092177]
3. Erkinjuntti T, Autio L, Wikstrom J. Dementia in medical wards. J Clin Epidemiol. 1988; 41:123–6. [PubMed: 3335878]
4. Lyketsos CG, Steinberg M, Tschanz JT, Norton MC, Steffens DC, Breitner JC. Mental and behavioral disturbances in dementia: findings from the Cache County Study on Memory in Aging. Am J Psychiatry. 2000; 157:708–14. [PubMed: 10784462]
5. Lyketsos CG, Sheppard JM, Steele CD, et al. Randomized, placebo-controlled, double-blind clinical trial of sertraline in the treatment of depression complicating Alzheimer's disease: initial results from the Depression in Alzheimer's Disease study. Am J Psychiatry. 2000; 157:1686–9. [PubMed: 11007727]
6. Lyketsos CG, Sheppard JM, Rabins PV. Dementia in elderly persons in a general hospital. Am J Psychiatry. 2000; 157:704–7. [PubMed: 10784461]
7. Fulop G, Strain JJ, Fahs MC, Schmeidler J, Snyder S. A prospective study of the impact of psychiatric comorbidity on length of hospital stays of elderly medical-surgical inpatients. Psychosomatics. 1998; 39:273–80. [PubMed: 9664774]
8. Saravay SM, Lavin M. Psychiatric comorbidity and length of stay in the general hospital. A critical review of outcome studies. Psychosomatics. 1994; 35:233–52. [PubMed: 8036253]
9. Erkinjuntti T, Wikstrom J, Palo J, Autio L. Dementia among medical inpatients. Evaluation of 2000 consecutive admissions. Arch Intern Med. 1986; 146:1923–6. [PubMed: 3767536]
10. Wancata J, Windhaber J, Krautgartner M, Alexandrowicz R. The consequences of non-cognitive symptoms of dementia in medical hospital departments. Int J Psychiatry Med. 2003; 33:257–71. [PubMed: 15089007]
11. Harwood DM, Hope T, Jacoby R. Cognitive impairment in medical inpatients. I: Screening for dementia--is history better than mental state? Age Ageing. 1997; 26:31–5. [PubMed: 9143435]
12. Gustafson Y, Berggren D, Brannstrom B, et al. Acute confusional states in elderly patients treated for femoral neck fracture. J Am Geriatr Soc. 1988; 36:525–30. [PubMed: 2897391]
13. Seymour DG, Vaz FG. A prospective study of elderly general surgical patients: II. Postoperative complications. Age Ageing. 1989; 18:316–26. [PubMed: 2603840]
14. Linka E, Bartko G, Agardi T, Kemeny K. Dementia and depression in elderly medical inpatients. Int Psychogeriatr. 2000; 12:67–75. [PubMed: 10798454]
15. Bickel H, Cooper B, Wancata J. Psychiatric disorders in elderly general hospital patients: incidence and long-term prognosis. Nervenarzt. 1993; 64:53–61. [PubMed: 8437648]
16. Kolbeinsson H, Jonsson A. Delirium and dementia in acute medical admissions of elderly patients in Iceland. Acta Psychiatr Scand. 1993; 87:123–7. [PubMed: 8447239]
17. Lazaro L, de Pablo J, Nieto E, Vieta E, Vilalta J, Cirera E. Psychiatric morbidity in elderly patients admitted to a general hospital. A day-prevalence study. Med Clin (Barc). 1991; 97:206–10. [PubMed: 1943277]
18. Bowler C, Boyle A, Branford M, Cooper SA, Harper R, Lindesay J. Detection of psychiatric disorders in elderly medical inpatients. Age Ageing. 1994; 23:307–11. [PubMed: 7976778]
19. Johnston M, Wakeling A, Graham N, Stokes F. Cognitive impairment, emotional disorder and length of stay of elderly patients in a district general hospital. Br J Med Psychol. 1987; 60 (Pt 2): 133–9. [PubMed: 3620390]
20. Tolson D, Smith M, Knight P. An investigation of the components of best nursing practice in the care of acutely ill hospitalized older patients with coincidental dementia: a multi-method design. J Adv Nurs. 1999; 30:1127–36. [PubMed: 10564412]
21. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. 4. Washington, DC: American Psychiatric Association; 1994.

22. Inouye SK, van Dyck CH, Alessi CA, Balkin S, Siegal AP, Horwitz RI. Clarifying confusion: the confusion assessment method. A new method for detection of delirium. Ann Intern Med. 1990; 113:941–8. [PubMed: 2240918]
23. Unverzagt FW, Gao S, Baiyewu O, et al. Prevalence of cognitive impairment: data from the Indianapolis Study of Health and Aging. Neurology. 2001; 57:1655–62. [PubMed: 11706107]
24. Inouye SK, Schlesinger MJ, Lydon TJ. Delirium: a symptom of how hospital care is failing older persons and a window to improve quality of hospital care. Am J Med. 1999; 106:565–73. [PubMed: 10335730]
25. Inouye SK, Bogardus ST Jr, Charpentier PA, et al. A multicomponent intervention to prevent delirium in hospitalized older patients. N Engl J Med. 1999; 340:669–76. [PubMed: 10053175]
26. Frels C, Williams P, Narayanan S, Gariballa SE. Iatrogenic causes of falls in hospitalised elderly patients: a case-control study. Postgrad Med J. 2002; 78:487–9. [PubMed: 12185225]
27. Francis J, Martin D, Kapoor WN. A prospective study of delirium in hospitalized elderly. Jama. 1990; 263:1097–101. [PubMed: 2299782]
28. O'Keeffe S, Lavan J. The prognostic significance of delirium in older hospital patients. J Am Geriatr Soc. 1997; 45:174–8. [PubMed: 9033515]
29. Cole MG, Primeau FJ. Prognosis of delirium in elderly hospital patients. Cmaj. 1993; 149:41–6. [PubMed: 8319153]
30. Ramsay R, Wright P, Katz A, Bielawska C, Katona C. The detection of psychiatric morbidity and its effects on outcome in acute elderly medical admissions. Int J Ger Psych. 1991; 6:861–866.
31. Gillick MR, Serrell NA, Gillick LS. Adverse consequences of hospitalization in the elderly. Soc Sci Med. 1982; 16:1033–8. [PubMed: 6955965]
32. Brennan TA, Leape LL, Laird NM, et al. Incidence of adverse events and negligence in hospitalized patients. Results of the Harvard Medical Practice Study I. N Engl J Med. 1991; 324:370–6. [PubMed: 1987460]
33. Foreman MD, Wakefield B, Culp K, Milisen K. Delirium in elderly patients: an overview of the state of the science. J Gerontol Nurs. 2001; 27:12–20. [PubMed: 11915152]
34. Inouye SK, Viscoli CM, Horwitz RI, Hurst LD, Tinetti ME. A predictive model for delirium in hospitalized elderly medical patients based on admission characteristics. Ann Intern Med. 1993; 119:474–81. [PubMed: 8357112]
35. Inouye SK, Charpentier PA. Precipitating factors for delirium in hospitalized elderly persons. Predictive model and interrelationship with baseline vulnerability. Jama. 1996; 275:852–7. [PubMed: 8596223]
36. Fick DM, Cooper JW, Wade WE, Waller JL, Maclean JR, Beers MH. Updating the Beers criteria for potentially inappropriate medication use in older adults: results of a US consensus panel of experts. Arch Intern Med. 2003; 163:2716–24. [PubMed: 14662625]
37. Marcantonio ER, Goldman L, Mangione CM, et al. A clinical prediction rule for delirium after elective noncardiac surgery. Jama. 1994; 271:134–9. [PubMed: 8264068]
38. Marcantonio ER, Juarez G, Goldman L, et al. The relationship of postoperative delirium with psychoactive medications. Jama. 1994; 272:1518–22. [PubMed: 7966844]
39. Saravay SM, Kaplowitz M, Kurek J, et al. How do delirium and dementia increase length of stay of elderly general medical inpatients? Psychosomatics. 2004; 45:235–42. [PubMed: 15123850]
40. Bynum JP, Rabins PV, Weller W, Niefeld M, Anderson GF, Wu AW. The relationship between a dementia diagnosis, chronic illness, medicare expenditures, and hospital use. J Am Geriatr Soc. 2004; 52:187–94. [PubMed: 14728626]
41. Schor JD, Levkoff SE, Lipsitz LA, et al. Risk factors for delirium in hospitalized elderly. Jama. 1992; 267:827–31. [PubMed: 1732655]
42. Saravay SM, Steinberg MD, Weinschel B, Pollack S, Alovis N. Psychological comorbidity and length of stay in the general hospital. Am J Psychiatry. 1991; 148:324–9. [PubMed: 1992834]
43. Levkoff SE, Evans DA, Liptzin B, et al. Delirium. The occurrence and persistence of symptoms among elderly hospitalized patients. Arch Intern Med. 1992; 152:334–40. [PubMed: 1739363]
44. Mayou R, Hawton K, Feldman E. What happens to medical patients with psychiatric disorder? J Psychosom Res. 1988; 32:541–9. [PubMed: 3236278]

45. Pautas E, Verny M, Holstein J, Bouchon JP, Saint-Jean O. Dementia syndromes and length of stay of elderly patients in internal medicine. Ann Med Interne (Paris). 1997; 148:424–6.
46. Tran B, Zureik M, Davido A, et al. Hospital discharge planning and length of hospital stay in elderly patients admitted through the emergency department. Rev Epidemiol Sante Publique. 1995; 43:337–47. [PubMed: 7667540]
47. Torian L, Davidson E, Fulop G, Sell L, Fillit H. The effect of dementia on acute care in a geriatric medical unit. Int Psychogeriatr. 1992; 4:231–9. [PubMed: 1477311]
48. Fields SD, MacKenzie CR, Charlson ME, Sax FL. Cognitive impairment. Can it predict the course of hospitalized patients? J Am Geriatr Soc. 1986; 34:579–85. [PubMed: 3088089]
49. Boustani M, Peterson B, Hanson L, Harris R, Lohr KN. US Preventive Services Task Force. Screening for dementia in primary care: a summary of the evidence for the U.S. Preventive Services Task Force. Ann Intern Med. 2003 Jun 3; 138(11):927–37. [PubMed: 12779304]
50. Ardern M, Mayou R, Feldman EKH. Cognitive impairment in the elderly medically ill: how often is it missed. Int J Ger Psych. 1993; 8:929–937.
51. Lindesay J. Recognition of cognitive impairment in elderly medical in-patients. J R Soc Med. 1995; 88:183–4. [PubMed: 7745560]
52. Chow TW, MacLean CH. Quality indicators for dementia in vulnerable community-dwelling and hospitalized elders. Ann Intern Med. 2001; 135:668–76. [PubMed: 11601949]
53. Marcantonio ER, Flacker JM, Wright RJ, Resnick NM. Reducing delirium after hip fracture: a randomized trial. J Am Geriatr Soc. 2001; 49:516–22. [PubMed: 11380742]
54. Webster R, Holroyd S. Prevalence of psychotic symptoms in delirium. Psychosomatics. 2000; 41:519–22. [PubMed: 11110116]
55. Pfeiffer E. A short portable mental status questionnaire for the assessment of organic brain deficit in elderly patients. J Am Geriatr Soc. 1975; 23:433–41. [PubMed: 1159263]
56. Erkinjuntti T, Sulkava R, Wikstrom J, Autio L. Short Portable Mental Status Questionnaire as a screening test for dementia and delirium among the elderly. J Am Geriatr Soc. 1987; 35:412–6. [PubMed: 3571790]
57. McDonald CJ, Overhage JM, Tierney WM, et al. The Regenstrief Medical Record System: a quarter century experience. Int J Med Inform. 1999; 54:225–53. [PubMed: 10405881]
58. Cohen CA, Gold DP, Shulman KI, Wortley JT, McDonald G, Wargon M. Factors determining the decision to institutionalize dementing individuals: a prospective study. Gerontologist. 1993; 33:714–20. [PubMed: 8314097]
59. Charlson ME, Sax FL, MacKenzie CR, Fields SD, Braham RL, Douglas RG Jr. Resuscitation: how do we decide? A prospective study of physicians' preferences and the clinical course of hospitalized patients. Jama. 1986; 255:1316–22. [PubMed: 3944949]
60. Charlson ME, Sax FL, MacKenzie CR, Fields SD, Braham RL, Douglas RG Jr. Assessing illness severity: does clinical judgment work? J Chronic Dis. 1986; 39:439–52. [PubMed: 3086355]
61. Boustani M, Campbell N, Munger S, Maidment I, Fox C. Impact of anticholinergics on the aging brain: a review and practical application. Aging Health. June; 2008 4(3):311–320.
62. Boustani, M.; Buttar, A. Delirium in Hospitalized Older Adults. In: Ham, R.; Sloane, P.; Warshaw, G., editors. Primary Care Geriatrics, A Case-Based Approach. 5. Vol. Chapter 15. 2007. p. 210-218.
63. Boustani M, Hall KS, Lane KA, Aljadhey H, Gao S, Unverzagt F, Murray MD, Ogunniyi A, Hendrie H. The association between cognition and histamine-2 receptor antagonists in African Americans. J Am Geriatr Soc. 2007 Aug; 55(8):1248–53. [PubMed: 17661965]

## Table 1

Demographics of elders screened for cognitive impairment during medical admission to an urban hospital in Indianapolis.

| Variable | N | %/Mean (SD) |
|---|---|---|
| Age | 997 | 74.8 (7.5) |
| % Age ≥ 85 | 997 | 12.6% |
| % Female | 997 | 67.8% |
| % African American | 997 | 59.4% |
| Education | 910 | 10.3 (2.8) |
| % Education < 12 Years | 910 | 59.1% |
| % Screened within 48 Hours of Admission | 997 | 73.2% |
| Mean SPMSQ score at screening | 997 | 7.7 (2.8) |
| % Cognitive impairment based on the SPMSQ score ≤ 8 | 997 | 42.5% |

## Table 2

Comparison between patients with documented and those with undocumented:

| | CI Documented | CI Undocumented | p-value | p-value* |
|---|---|---|---|---|
| N | 165 (39%) | 259 (61%) | N/A | |
| Mean Age (SD) | 79.1 (7.9) | 76.1 (8.0) | <0.001 | |
| % Female | 68.5% | 64.5% | 0.40 | |
| % African American | 68.5% | 53.7% | <0.01 | |
| Mean SPMSQ at Screen (SD) | 3.4 (2.7) | 6.3 (2.1) | <0.001 | |
| Mean Charslon Comorbidity Index (SD) | 1.9 (1.9) | 2.3 (2.1) | 0.03 | |
| Mean Length of Hospital Stay (SD) | 6.7 (5.1) | 7.5 (7.1) | 0.49 | 0.59 |
| % Survived at 30 day post discharge | 95.2% | 93.4% | 0.53 | 0.25 |
| % Discharged Home | 31.5% | 45.2% | =0.01 | 0.74 |
| % Readmission within 30 days after Discharge Home | 19.2% | 18.8% | 0.99 | 0.66 |
| % Incidence Delirium | 26.7% | 20.6% | 0.52 | 0.99 |
| % Observed with Foley Catheter | 43.6% | 27.4% | <0.001 | 0.61 |
| % Observed with Physical Restraint | 1.8% | 1.5% | 0.99 | 0.31 |
| % Observed with Tethers | 81.8% | 73.8% | 0.06 | 0.58 |
| % with at least one Ach | 83.6% | 90.7% | 0.03 | 0.22 |
| - % Possible Ach | 81.2% | 88.4% | 0.05 | 0.31 |
| - % Definite Ach | 32.7% | 33.2% | 0.99 | 0.64 |

* p-value after adjusting for age, gender, race, Charslon comorbidity index, and SPMSQ at screen.

Ach: Anticholinergics

## Table 3

Demographic and hospital course of cognitively impaired elders with and without delirium

| | Delirium* + | Delirium − | p-value |
|---|---|---|---|
| N | 163 (38%) | 261 (62%) | N/A |
| Mean Age (SD) | 78.4 (8.5) | 76.5 (7.8) | 0.02 |
| % Female | 60.1% | 69.7% | 0.05 |
| % African American | 64.4% | 56.3% | 0.10 |
| Mean Charslon Comorbidity Index (SD) | 1.8 (1.9) | 2.3 (2.1) | 0.01 |
| Mean Length of Hospital Stay (SD) | 9.2 (7.9) | 5.9 (4.9) | <0.001 |
| % Survived at 30-day post discharge | 91.4% | 95.8% | 0.09 |
| % Discharged Home | 24.5% | 49.4% | <0.001 |
| % Readmission within 30 days after Discharge Home | 22.5% | 17.8% | 0.50 |
| % Observed with Foley Catheter | 51.5% | 22.6% | <0.001 |
| % Observed with Physical Restraint | 4.3% | 0.0% | <0.01 |
| % Observed with Tethers | 89.0% | 69.4% | <0.001 |
| % with at least one Anticholinergic | 83.4% | 90.8% | 0.03 |
| - % Possible Anticholinergic | 80.4% | 88.9% | 0.02 |
| - % Definite Anticholinergic | 36.8% | 30.7% | 0.20 |

*Subjects with at least one hospital day with delirium.