Associations Among Fluid Intake, Cognitive Function, and Length of Stay in Psychogeriatric Inpatients

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Abstract

**Purpose:** To examine interactions, associations, and differences among cognition, fluid intake, and demographic variables that may affect length of stay (LOS) for psychogeriatric inpatients aged 65 years or older.

**Design and Methods:** Descriptive, comparative, correlational secondary analysis of data from a primary study of 202 inpatients.

**Findings:** Older adults with and without cognitive impairment had different fluid intake over time \((P=.03; F=3.50)\) but had no difference in LOS in relation to cognitive functioning \((P=.23)\); additional factors may predict LOS.

**Practice Implications:** Care providers for elderly inpatients must monitor fluid intake for patients with and without cognitive impairment throughout hospitalization.

Keywords: cognition; dehydration; geriatric; length of stay; Mini-Mental State Examination
Abbreviations

AHRQ, Agency for Healthcare Research and Quality
ECT, electroconvulsive therapy
LOS, length of stay
MMSE, Mini-Mental State Examination
Inadequate fluid intake can lead to dehydration, which can be serious and medically costly (Kayser-Jones, Schell, Porter, Barbaccia, & Shaw, 1999; Wakefield, Mentes, Holman, & Culp, 2009). Each year, as many as 1 million older adults are admitted to hospitals with inadequate fluid intake as their presenting clinical factor (Abdallah, Remington, Houde, Zhan, & Melillo, 2009). Older adults with inadequate fluid intake are at risk for increased mortality, up to seven times that of older adults with adequate fluid intake (Abdallah, Remington, Houde, Zhan, & Melillo, 2009). In addition, the dehydration and malnutrition that subsequently develop may lead to increased morbidity and result in iatrogenic adverse outcomes, such as functional decline, cognitive decline, falls, and pressure ulcers (Inouye, Bogardus, Baker, Leo-Summers, & Cooney, 2000; Wakefield, Mentes, Holman, & Culp, 2009).

Multiple factors play a role in fluid intake and development of dehydration. Age-related physiologic changes and the presence of multiple medical comorbidities affect the elderly person’s ability to take in recommended amounts of fluids (Kenney & Chiu, 2001; Robinson & Rosher, 2002). Fluid and electrolyte imbalances, fatigue, pain, opioid use, and depression can impair the older person’s cognitive ability and increase the risk for dehydration (American Association of Neuroscience Nurses [AANN], 2007;  

1 Typically, the “Introduction” section contains a brief overview of a few paragraphs with a few reference citations, and the bulk of the literature review is presented in the “Discussion” section. Please review a few papers from your target journal and see if it might be necessary to revise your paper to conform to that standard.2

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Cognitive impairment, including dementia, impairs the ability of elderly persons to meet self-care needs that include maintaining adequate levels of fluid intake (Lin, Watson, & Wu, 2010). Social and environmental factors in the long-term care setting, such as inadequate staffing and physical inaccessibility of fluids to residents, also lead to low fluid intake (Kayser-Jones, Schell, Porter, Barbaccia, & Shaw, 1999).

The negative consequences of dehydration may lengthen length of stay (LOS) in hospitalized persons and thereby increase health care costs (Mentes, 2006; Mentes & Culp, 2003). Despite its preventability, dehydration remains a widespread reason for hospitalization of elderly persons, who are at greatest risk for it (Agency for Healthcare Research and Quality [AHRQ], 2012; Kim, 2007). These unnecessary hospitalizations are considered indicators of the poor quality of health care outside the hospital setting, and they cost an astounding $1.6 billion in real costs and $4.97 billion in hospital charges annually for the elderly (AHRQ, 2012; Kim, 2007). Hospitalization for dehydration has therefore been included as a Prevention Quality Indicator by the Agency for Healthcare Research and Quality in the US Department of Health and Human Services (AHRQ, 2012). In the current health care environment, there is constant pressure from multiple sources to decrease hospital LOS to better contain costs (Compton, Craw, & Rudisch, 2006).

Although the magnitude of the medical consequences and the economic burden of dehydration are not quantifiable, much less is known about how fluid intake and the level of cognition alone or in combination influence the LOS of hospitalized psychogeriatric patients. Since this geriatric population has psychiatric conditions that are unique in their acuity and severity, the associations among fluid intake, cognitive functioning, and LOS should be examined to identify any modifiable factors that may improve outcomes. We therefore sought to examine the interactions, associations, and differences among fluid intake, cognition, and specific demographic variables and their
impact on inpatient LOS of psychogeriatric patients. Our specific aims were 1) to examine differences in fluid intake at different time points for groups of patients with normal or impaired cognition; 2) to compare LOS for patients with normal cognition compared to that of patients with impaired cognition; and 3) to determine whether other factors (eg, age, sex, or electroconvulsive therapy [ECT]) were predictive of LOS.

**Methods**

The primary study was a descriptive, retrospective medical records review to investigate the hydration status of psychogeriatric inpatients and to explore possible factors causing dehydration (Forsyth et al., 2008). Deidentified data from the primary study were used for this secondary study, for which access was granted to the password-protected database containing specific data necessary to conduct the present study. Patients selected from the data set of the primary study consisted of persons 65 years of age or older who were hospitalized in the psychogeriatric unit (N=202). Ages ranged from 65 to 96 years with a mean (SD) of 77.2 (7.3). Mini-Mental State Examination (MMSE) scores ranged from 0 to 30, with a mean of 23.32 (6.88). LOS ranged from 1 to 31 days, with a mean of 10.3 (6.7). Data from the primary study used for our current analysis included fluid intake (mL) at 3 time points during hospitalization (admission, midpoint, and discharge), MMSE score, LOS in days, and age in years.

This study was compliant with the Health Insurance Portability and Accountability Act and was approved by the institutional review board with a waiver of informed consent because it was deemed minimal risk.

**Data Analysis**

Because of the small sample size, we used a nonparametric Wilcoxon’s Signed-rank test to compare LOS between persons with (MMSE <24) and without (MMSE ≥24) cognitive impairment, with statistical significance set at $P<.05$ using 2-sided tests, as standard assumptions were not met for a $t$ test. To examine the difference
between fluid intake within 24 hours of admission, at midpoint of the hospitalization, and within 24 hours of discharge in older adults with and without cognitive impairment, we used a repeated measures analysis of variance in SAS (version 9) (SAS Institute Inc). Further specific questions to address group differences in persons with or without cognitive impairment were asked relating to fluid intake at admission, at the midpoint of hospitalization, and within 24 hours of discharge using the repeated measures analysis. Multiple linear regression was used to determine which factors were predictive of LOS. Factors included admission fluid intake, midpoint fluid intake, discharge fluid intake, global cognitive function as measured by the MMSE, age, sex, and ECT. These factors were analyzed independently of each other.

**Results**

Subjects involved in this secondary analysis consisted of 202 patients aged 65 years or older who were hospitalized in the psychogeriatric unit. Detailed demographic and clinical information of this sample have been published previously (Forsyth et al., 2008).

**Comparison of LOS and Cognitive Status**

Patients without cognitive impairment (n=57 [28.2%]) had a mean LOS of 9.5 (6.6) days. Those with cognitive impairment (n=98 [48.5%]) had a mean LOS of 10.9 (7.0). The Wilcoxon’s Signed-rank test showed no significant association between LOS and global cognitive functioning ($P=.23$).

**Cognitive Status in Relation to Fluid Intake at Points of Hospitalization**

A repeated measures of variance analysis was done to compare the fluid intake levels with the LOS points at admission, at midpoint, and at discharge for the two groups (with and without cognitive impairment) (see Figure). The fluid intake level of patients changed throughout the LOS from admission to midpoint and from midpoint to discharge; these changes differed between the two groups (Table 1; $P=.03$). For both
groups, fluid intake increased from admission to midpoint (Table 2). However, the decreased change in fluid intake for those with cognitive impairment was not as drastic as that for the noncognitively impaired group.\[Q^2\]

**Factors Predicting LOS**

Multiple linear regression showed that none of the factors examined were predictive of LOS (Table 3).

**Discussion**

Our objective was to examine the interactions, associations, and differences among cognition, fluid intake, and specific demographic variables for geriatric psychiatric patients that may affect inpatient LOS in those aged 65 years or older. Our study is unique for its investigation of cognitive impairment and fluid intake in hospitalized psychogeriatric patients.

The first aim of our study was to compare LOS in older adults with cognitive impairment to that in older adults without cognitive impairment, and our data revealed no difference between these two groups. This finding contrasts with what has been reported previously in the medical literature. Cognitive impairment at baseline and decline in cognitive function during hospitalization are both established predictors of increased LOS in medical and psychiatric inpatients (Binder & Robins, 1990; Inouye, Bogardus, Baker, Leo-Summers, & Cooney, 2000; Johnston, Wakeling, Graham, & Stokes, 1987; Kato, Galynker, Miner, & Rosenblum, 1995). Although our data are limited by the small sample size and the use of only one cognitive measure, this finding requires further

2 You deleted the Figure citation here. If you wish to retain the figure, please cite it where most appropriate. If you wish to delete the figure, please delete the legend. Yes – keep figure.
exploration because cognitive status alone may not have as much influence as other factors on LOS in psychogeriatric inpatients.

Our second aim was to examine differences in fluid intake at admission, at midpoint, and at discharge between patients with and without cognitive impairment. Our data revealed a surprising finding—that the fluid intake of patients without cognitive impairment decreased over time during hospitalization compared to that in patients with cognitive impairment. This finding is exclusive to this study, whereas previous research has shown that patients with cognitive impairment, such as dementia, tend to have difficulty maintaining adequate levels of fluid intake (Lin, Watson, & Wu, 2010). Perhaps, in the inpatient setting, more attention is paid to cognitively impaired patients and more effort is made to ensure hydration. Gaspar (1999) found that patients in a nursing home setting with higher dependency regarding functioning had higher fluid intake than those with higher functioning, likely because the staff provided more fluids. This may mean that health care providers should ensure that patients who are cognitively intact are also receiving adequate attention regarding their hydration status. Furthermore, studies are needed to determine the ideal point in the hospitalization when persons with or without cognitive impairment would require or would best benefit from further nursing interventions regarding fluid intake.

The third aim was to investigate whether there was a predictive relationship between LOS and MMSE, admission fluid intake, midpoint fluid intake, discharge fluid intake, age, sex, or ECT. We determined that none of the aforementioned factors were predictive. Studies have identified age as a predictor for increases in LOS (Chung et al., 2010; Jimenez, Lam, Marot, & Delgado, 2004; Snowden et al., 2004). However, King, Jones, and Brand (2006) reported that age was not statistically significant to LOS, which is also true of the data presented here ($P=.70$). Sex was also predictive of LOS in studies done by Chung et al. (2010) and Compton, Craw, and Rudisch (2006). Previous research
has also shown that increased LOS occurs among patients who receive ECT (Blank et al., 2005; Jimenez, Lam, Marot, & Delgado, 2004). Our findings are not consistent with the literature. Further research should be conducted to determine whether there are predictors of LOS that are unique to hospitalized psychogeriatric patients. Although this study did not show a statistically significant association between LOS and ECT, this finding may be attributed to the large standard error and the small sample. These data are possibly related in that LOS increased 0.56 day for patients who had undergone ECT. Further research is needed to explore this interesting relationship.

**Limitations**

Our study is a secondary analysis of the primary study data set from a retrospective review, and it therefore has similar limitations (ie, a single treatment setting, missing data, and chart review of electronic medical record documentation) (Forsyth et al., 2008). Our analysis also was not designed for in-depth examination of other factors that influence LOS.

**Implications for Practice**

The overall purpose of this study was to examine the influence of fluid intake and cognition on inpatient LOS in older adults. Although we did not find that these factors influence LOS, we did find lower fluid intake during hospitalization in patients without cognitive impairment compared to that in those with cognitive impairment. Our findings indicate that hydration status should be monitored and that equivalent interventions should be put in place for all patients regardless of the extent of their cognitive functioning. Our results provide new insights on psychogeriatric inpatients, who are typically underrepresented in research studies. In addition, although much research has been done on fluid intake, cognition, and LOS as individual concepts, little or no research has been done to address this combination. This area of study is important for today’s health care team because of the need to ensure adequate hydration in the
elderly (Mentes, 2006; Mentes & Culp, 2003; Wakefield, Mentes, Holman, & Culp, 2009) and the increased need for cost containment by reducing LOS (Compton, Craw, & Rudisch, 2006). Further research is needed on factors that might predict LOS in this population.

**Funding Source:** None.

**Conflict of Interest:** None.
References


Table 1

Repeated Measures ANOVA of Psychogeriatric Patients

<table>
<thead>
<tr>
<th>Variable</th>
<th>Num df</th>
<th>Den df</th>
<th>F Value</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMSE</td>
<td>1</td>
<td>147</td>
<td>0.15</td>
<td>.70</td>
</tr>
<tr>
<td>LOS</td>
<td>2</td>
<td>147</td>
<td>21.59</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>MMSE×LOS</td>
<td>2</td>
<td>147</td>
<td>3.50</td>
<td>.03</td>
</tr>
</tbody>
</table>

N=202; Abbreviations: ANOVA, analysis of variance; Den df, denominator degrees of freedom; LOS, length of stay; MMSE, Mini-Mental State Examination; Num df, numerator degrees of freedom.

\(^a\) Alpha level: \(P=.05\).

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Please expand Table 1 title to be more explanatory of contents (indicate number of patients and which population they represent). Title revised. The N is with the explanation below the table.

Footnote wording correct as added in Table 1 and also in Table 3? Yes.
Table 2

*Mean Fluid Intake of Psychogeriatric Inpatients*[^Q^] (*N*=202) *During Hospitalization*

<table>
<thead>
<tr>
<th>Cognitive Status</th>
<th>Mean Fluid Intake, mL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Admission (SD)</td>
</tr>
<tr>
<td>No cognitive impairment</td>
<td>962.22 (62.94)</td>
</tr>
<tr>
<td>Cognitive impairment</td>
<td>943.29 (80.36)</td>
</tr>
</tbody>
</table>

[^Q^]: Addition correct? = YES
Table 3

Factors Predicting Length of Stay in Psychogeriatric Inpatients

<table>
<thead>
<tr>
<th>Factors</th>
<th>LOS, days</th>
<th>SE</th>
<th>P Value[Q7]a</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMSE (&lt;24)</td>
<td>–0.679</td>
<td>0.654</td>
<td>.30</td>
</tr>
<tr>
<td>Admission fluid intake</td>
<td>–0.001</td>
<td>0.001</td>
<td>.33</td>
</tr>
<tr>
<td>Midpoint fluid intake</td>
<td>0.000</td>
<td>0.001</td>
<td>.63</td>
</tr>
<tr>
<td>Discharge fluid intake</td>
<td>0.000</td>
<td>0.000</td>
<td>.51</td>
</tr>
<tr>
<td>Age, y</td>
<td>0.033</td>
<td>0.086</td>
<td>.70</td>
</tr>
<tr>
<td>Female sex</td>
<td>0.343</td>
<td>0.624</td>
<td>.58</td>
</tr>
<tr>
<td>ECT</td>
<td>0.558</td>
<td>1.126</td>
<td>.62</td>
</tr>
</tbody>
</table>

Abbreviations: ECT, electroconvulsive therapy; LOS, length of stay; MMSE, Mini-Mental State Examination; SE, standard error.

a Alpha level: \( P \leq .05 \).

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6 Addition to Table 3 title correct? = YES

7 \( P \) values OK as rounded to 2 decimal places, per AMA style? = YES, although this journal require APA, not AMA style.
Legend

Figure. Levels of fluid intake in psychogeriatric inpatients with or without cognitive impairment at hospital admission, at midpoint of hospitalization, and at discharge. Over time there was a statistically significant difference[Q^8] (shown by ANOVA) (P=.03) between level of cognition and fluid intake.

^8 Or “by” or “with”? That is, what does text from here to end of legend mean?= see added wording.