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Hydration and Acute Confusion in Long-Term Care Residents[1]

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Although it is generally appropriate for a healthy adult to consume 2000 to 2500 ml per day, the literature does not address evaluating any standard. The objective here was to develop a weight-based hydration management intervention and evaluate the impact of this on the incidence of acute confusion (AC) using an N = 98. The intervention consisted of a fluid intake goal based on 100 ml per kg for the first 10 kg, 50ml/kg for the next 10 kg, and 15 ml for the remaining body weight. The treatment group received instruction and assistance on the fluid goal and the control group received routine care. Measurements included serum electrolytes, bioimpedance analysis, urinalysis, Mini-Mental State Exam, and the NEECHAM. There was no difference in the incidence of AC between treatment and controls, but those individuals with ≥ 90% compliance demonstrated higher ECF volumes and also lower urine leukocyte counts.

Keywords: *confusion; hydration; elderly; fluid balance; urinary tract infection*

Inadequate fluid intake is related to a number of poor outcomes, such as pressure sores, leg ulcers, psychological stress, and acute confusion (Christensson, Unosson, & Ek, 1999) in frail, elderly people. This problem is important in long-term care (LTC) settings, in which hydration status may not always be detected in older adults as serum chemistries are not immediately available (Gross et al., 1992). Acute confusion (AC) is especially difficult to detect in LTC because of the high incidence of dementia found in these settings (Kane & Atherly, 2000). Recognition of AC is also complicated in elderly people because of several other conditions, including depression (Teresi, Abrams, Holmes, Ramirez, & Eimicke, 2001), that may be confused with AC.

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ELDERS AND FLUID INTAKE

Making sure elderly people in LTC consume adequate fluids is particularly challenging when no clear standard exists (Chidester & Spangler, 1997). Although it is generally considered appropriate for a healthy adult to consume 2000-2500 ml of fluids per day, the literature does not address evaluating any standard or relating any recommended fluid intake level to a nursing outcome. From a physiological perspective, dehydration is a serious risk factor for elders because other antagonistic changes occur with aging: total body water (TBW) decreases, kidneys are less able to excrete metabolites, and the sensation of thirst decreases (Bennett, 2000). Because these changes deplete the ability of a frail, elderly person to establish homeostasis when fluid volume changes, clinical researchers should focus on testing hydration standards for clinical effectiveness.

The link between AC and hydration status has been established previously in some of our work (Mentes, Culp, Maas, & Rantz, 1999). It is unclear, however, what mechanism in the pathogenesis of AC increases risk or how much fluid each day should be consumed to reduce this risk. Community-based older adults generally consume adequate volumes of fluids on a daily basis, but in LTC, many elderly residents do not consume enough liquids (Kenney & Chiu, 2001). Indeed, many elderly residents in LTC receive less than the 2000-2500 ml fluid intake regardless of cognitive status, level of dependency, or type of nursing unit (Armstrong-Esther, Browne, Armstrong-Esther, & Sander, 1996).

There are very few studies on dehydration and/or AC in the LTC population. Chidester and Spangler (1997) examined fluid intake in LTC residents for 3 consecutive days, with three standards used to define adequate fluid intake. The first standard consisted of 30 ml per kg of body weight and the second standard was based on 1 ml per kcal consumed. The third standard was the most accurate in calculating water intake; it was based on 100 ml per kg for the first 10 kg, 50 ml per kg for the next 10 kg, and 15 ml for the remaining kg. Most nursing home participants in the Chidester study had little difficulty meeting the fluid intake requirement of the first two standards, but 90% of residents had inadequate fluid intake according to the third standard based on body weight.

There are other approaches to calculating a recommended fluid intake for elderly people. For example, in one study of fluid intake in nursing home residents, the researchers used a fluid standard based on 1,600mL per m^2 body surface area (BSA) (Gaspar, 1999). In the report, Gaspar stated that only 8 of 99 participants met or exceeded this standard. Gaspar found that

only 76% of the fluid goal was attained by the average resident in LTC, and half of the participants had less than 1,500 ml of fluid intake per day.

PURPOSE

The purpose of this study was to evaluate a weight-based hydration management intervention with the goal of decreasing the incidence of AC. The following two hypotheses were proposed:

Hypothesis 1: Residents who are placed on a hydration management program (treatment group) will demonstrate more indicators of adequate hydration (e.g., lighter colored urine, lower urine specific gravity, normal TBW estimates) compared to a control group receiving routine care.

Hypothesis 2: Residents who are placed on a hydration management program (treatment group) will experience a reduced incidence of AC compared to a control group receiving routine care.

DESIGN

This was a quasi-experimental cohort study with a follow-up period of 4 weeks. Treatment group participants received assistance with meeting an individually derived fluid intake goal based on body weight and control participants received routine care.

SAMPLE

Participants were recruited from seven LTC facilities in eastern Iowa. The sample size was $N = 98$. Six of the facilities had fewer than 120 beds; the seventh was a 500-bed Veteran Affairs (VA) facility. Baseline serum sodium, blood urea nitrogen (BUN), and creatinine levels were not routinely available and were drawn to establish eligibility for the study. Residents were excluded if any of the following conditions were present:

1. Current AC at baseline.
2. Terminal illness by diagnosis/care documentation.
3. Uncontrolled diabetes as manifested by medication records or chart documentation showing use of sliding-scale insulin coverage in the past 72 hours.
4. Residents with nasogastric or gastrostomy tubes.
5. Severe renal failure (serum creatinine > 3.5 mg per dl).

6. Severe congestive heart failure as assessed by participant's primary care provider.
7. Current urinary tract infection.
8. Serum sodium > 135 mEq per L.

Signed consent forms were obtained from the family member responsible for the resident's health care if a health care power of attorney existed; the participant signed the consent form if he/she was able to make the decision independently (determined by reviewing the Medicare Minimum Data Set [MDS], Resident Assessment Instrument [RAI], where item 4 in Section B documents the cognitive ability of the individual to make his or her daily decisions). In addition, the physician or primary care provider was contacted to obtain consent to increase fluid intake.

Treatment and control groups were determined randomly by facility rather than on an individual (participant) basis due to the community impact of the hydration intervention in the LTC facility. This is difficult to describe here, but the reader is encouraged to recall that this study was conducted in an LTC center and not a hospital. In essence, the intervention could not be double blinded, and it could not be randomly assigned to some residents and not others on the same unit as these elders live together and are familiar with each other's care regimens. Not all nursing units within a facility were used, and it was not possible to do random selection of the unit. The nursing director in the facility made recommendations as to what unit would be used in the study but was not informed of either treatment or control assignment at the time of the unit selection.

Method

Acute confusion assessments. AC assessments were done using the Mini-Mental Status Examination (MMSE) (Folstein, Folstein, & McHugh, 1975) and NEECHAM (Neelon, Champagne, McConnell, Carlson, & Funk, 1992). These instruments were administered at baseline and weekly but could be triggered at any time point if an acute mental status change was clinically detected. The NEECHAM and the MMSE are rather high in terms of response burden, so these were not administered daily; the RN research assistant at the time of an acute change in mental status administered both instruments when an acute mental status change was noted. The acute mental status trigger included any behavioral change, altered attention, lethargy and/or agitation, any change from baseline behavior, or a request by the LTC staff RN.

Note that all assessments were completed by the research team, either by the investigators directly or by the RN research assistant who was specifically trained in the psychometric properties of the instruments; facility staff were not responsible for conducting assessments.

Reliability is well established for the MMSE; the consistency of scores ranges from 0.83 to 0.99 among groups of psychiatric, neurologic, and mixed-diagnosis patients where acute change in mental status needs to be documented (Crum, Anthony, Bassett, & Folstein, 1993). The NEECHAM was selected because it was a nurse-developed instrument specifically designed for AC. Most of the other instruments available were based on the medical model of delirium or were not easily implemented in the LTC setting (Rapp et al., 2000). The NEECHAM (range 8-30) allows for rapid bedside documentation of normal information processing and detects early cues of delirium. The NEECHAM includes physiological data, including heart rate, oxygen saturation, respiratory rate, blood pressure, and incontinence status. Construct validity for the NEECHAM was established using a correlation with the Barthel Index (r = .70) indicating a link between acute confusional states and actual physical performance in accomplishing activities of daily living (Neelon, Champagne, Carlson, & Funk, 1996). The interrater reliability with the NEECHAM was 91% (κ = .65). A score lower than 25 constituted an AC event.

Weight-based hydration intervention. An individual fluid intake goal was calculated according to body weight: 100 ml per kg for the first 10 kg of weight, 50 ml per kg for the next 10 kg of weight, and 15 ml per kg for the remaining kg of weight (Chidester & Spangler, 1997). Of the oral fluid intake goal, 75% was delivered with meals and the remaining 25% was delivered during nonmeal times (i.e., medication times and planned nourishment times). Fluids at medication time were standardized to 180mL (6 oz.) per administration. Caffeinated and alcoholic beverages with a diuretic effect were not counted toward the fluid goal.

Nursing staff caregivers in the treatment facilities were instructed on the weight-based hydration intervention. The RN research assistant calculated the fluid goal and measured fluid intake randomly to ensure compliance with the protocol. No coercive approaches were used to increase fluid intake, but treatment group caregivers were instructed to offer more fluids and to provide 180 ml of water with medications. Treatment group facilities also received assistance from the research team, in which we purchased various beverages for participants based on their own likes and dislikes, convened structured social activities in the facility in which consuming fluids was

encouraged, and also provided participants with a so-called sip-and-go cup, when nursing staff filled their beverage container at scheduled intervals during the day. Control group nursing staff caregivers were not instructed on the intervention.

Staff caregiver education. Both the treatment and control facility nursing staffs received training on the signs and symptoms of AC. This included viewing a video segment of an individual with AC and an individual with dementia. This served as a basis for comparing the types of confusion in LTC and allowed the investigative team to clearly delineate the differences between AC and dementia with all facility staff caregivers. These in-service programs were about 30 minutes to 45 minutes in length and were offered several times on at least two nursing shifts and on weekends prior to initiating the protocols. The treatment facility staff also received additional instruction on the rationale for the weight-based hydration intervention and details of how the intervention was to be implemented. Staff nurses in the LTC facility were asked to note any behavioral or mental status changes and to document them on a flow sheet every 8 hours. These sheets were reviewed by the RN research assistant and alerted the investigative team to any need for increased vigilance in monitoring a particular participant when AC was suspected.

Urinalysis. Using a urine color chart, urine color was assessed weekly. The chart was tested in elderly patients by the authors (Wakefield et al., 2002). The urine color chart is a low-cost, practical tool for monitoring hydration status in locations in which lab services are not immediately available. Validity for the urine color scheme was established using urine specific gravity ($r = .80$, $p < .001$) and urine osmolality ($r = .82$, $p < .001$). The scale ranges from 1 (*pale straw*) to 8 (*greenish brown*) and was correlated with hematocrit, BUN, and serum creatinine (Armstrong et al., 1994).

Urine specific gravity (SG) was measured with a photometric urine analyzer (Nagel & Seiler, 1995). The photometric analysis procedure was also used to detect the presence of leukocytes in the urine. Leukocyte esterase, present in granulocytic leukocytes, catalyzes and reacts with the reagent to produce a purple color that is detected by the reader. This procedure has been used in clinical research as a screening method for urinary tract infection (Keski-Nisula et al., 1995).

Bioelectrical impedance analysis. Bioelectrical impedance analysis (BIA) was used to estimate total body water (TBW) estimates, specifically the volume in liters and the percentage body weight. The technique calculates

extracellular fluid (ECF) and intracellular fluid (ICF). BIA is a noninvasive technique: electrodes are applied to the hands and feet, and estimates of fluid composition in terms of TBW, ICF, and ECF (Bracco et al., 2000) are obtained by passing a small electrical current between the electrodes. Reliability of BIA has been demonstrated clinically. Body mass calculations from the BIA technique are slightly higher than the Quetelet Index (QI) based on the formula QI = (weight in kilograms)/(height in meters)^2 that is traditionally used in many nursing studies using anthropometric measures. Validity for the BIA estimate of TBW was compared with the mathematically calculated method using the Watson equation ($r = .65$, $p < .05$) and found adequate (Mandolfo, Farina, & Imbasciati, 1995). BIA measurements were taken at least 4 hours after diuretic therapies for both the treatment and control groups.

DATA ANALYSIS

Urine SG readings are read with the photometric analyzer in increments of .005; for this reason, nonparametric techniques were used in analyzing these values. The Kruskal-Wallis is an alternative to the one-way analysis of variance and is similar to the Mann-Whitney test, except there are more groups. In this study, the analysis consisted of comparing mean SG across the 4 weeks of follow-up to detect differences from week to week. A Fisher's exact test was used when evaluating the association between the intervention and the frequency count for AC. This was done because a chi-square analysis cannot be performed on a table with two columns and two rows when the expected value in a cell is small, generally defined as a cell size less than six. The Fisher's exact test is less likely to find true differences and, statistically, the test is considered conservative at best.

BIA was conducted using RJL Systems Cyprus software version 1.2. This software estimates human body composition and fluid compartments (TBW, ICF, and ECF) and statistically calculates these estimates by calculating levels in volume (liters). The underlying assumption is that BIA readings are obtained from hand to foot and use stature height as length, therefore taller people have longer arms and legs, and shorter people have shorter arms and legs. Any analysis method that did not statistically adjust for this difference would decrease the accuracy of the predicted result. In any case, the Cyprus software computed the fluid estimates, and the values were imported into SPSS version 8.0, where all descriptive and inferential analyses were completed.

TABLE 1: Comparison of Treatment and Control Groups at Baseline

Description	*Group*	M	SD
Age (years)	Treatment	84.49	9.25
	Control	83.78	8.14
Mini-Mental State Exam (total score)	Treatment	23.48	5.27
	Control	23.27	4.78
NEECHAM (total score)	Treatment	27.78	2.56
	Control	28.09	1.99
24-hour intake (ml)	Treatment	1769	572.92
	Control	1683	561.42
Serum sodium (mEq/L)	Treatment	138.54	3.46
	Control	141.23	3.89
BUN creatine ratio[a]	Treatment	21.70	8.84
	Control	17.89	6.45

a. $p = .02$, $t = 2.14$.

FINDINGS

As previously described, a total of 98 participants were admitted to the study, with 53 in the treatment group (women = 29, 54.7%; men = 24, 45.3%) and 45 in the control group (women = 24, 53.3%; men = 21, 46.7%). It was not possible to have equal size treatment and control groups because individuals were not randomly assigned as explained previously. Age and baseline cognitive measures including MMSE and NEECHAM scores are displayed in Table 1. There were no statistically significant differences between the treatment and control groups on the cognitive measures. The treatment and control groups were significantly different at baseline on the BUN to creatinine ratio ($p = .02$), with the treatment group demonstrating higher readings ($\bar{x} = 21.70$, $sd = 9.84$ vs. $\bar{x} = 17.89$, $sd = 6.45$). Mean baseline weight was slightly lower for the treatment group ($\bar{x} = 65.45$ kg, $sd = 14.35$) than the control group ($\bar{x} = 72.57$ kg, $sd = 14.28$). The mean fluid goal at baseline for the treatment group was calculated at 1892 ml, with a range from 1400 ml to 2420 ml.

Urinalysis. There were significant differences in urine SG across all 4 weeks of follow-up using the Kruskal-Wallis procedure ($p < .05$). The most prominent difference was observed between weeks 1 and 2, with the treatment group demonstrating lower values ($\bar{x} = 1.0154$, $sd = 4.593E\text{-}03$) than those of the control group ($\bar{x} = 1.0193$, $sd = 4.788E\text{-}03$) at week 2. This difference was most likely attributed to the effect of the hydration intervention.

During weeks 3 and 4, urine SG readings were similar between the two groups. Urine color ratings also changed in the treatment group over the observation period. Because a lower value indicates a lighter color, the impact of the hydration intervention in the treatment group is shown by significant differences between the two groups in weeks 1 through 3 ($p \leq .01$). In week 4, the urine color ratings remained lower in the treatment group but were not significantly different from those of the control group.

At week 4, there was no statistically significant difference in fluid intake between the treatment and control groups, based on the random sample of fluid intake measures taken during the follow-up period: 27 (50.9%) of participants in the treatment group had 90% or greater compliance with the fluid goal and 23 (51.1%) in the control group consumed fluids consistent with the hydration management guideline. In essence, both the treatment and control groups were consuming approximately the same volume of fluids.

For the purpose of this analysis, the investigative team retrospectively calculated a fluid intake goal for control group participants to compare fluid intake based on the weight-based standard, even though a formal calculation of a goal for the control group was not established during the protocol. Irrespective of treatment or control group assignment, 48 of the 98 participants consumed less than 90% of their individually weight-derived fluid goal and 50 consumed equal to or greater than 90% of this weight-based fluid intake standard. As this was done retrospectively in the analysis, there was no bias introduced related to this stratification.

BIA measures. BIA was stratified across voluntary fluid intake behaviors based on the 90% fluid goal compliance. The results are displayed in Table 2. There was a significant difference in ECF levels, with those who consumed 90% or more of the fluid goal demonstrating higher ECF volume ($\bar{x} = 18.9$ L, $sd = 3.8$) compared to those with less than 90% fluid goal compliance ($\bar{x} = 16.8$ L, $sd = 3.1$), which was statistically significant ($p = .002$). There were no statistical differences in total body water (TBW) and ICF levels, but the volume (in liters) for each fluid compartment suggested better hydration in the ≥ 90% group.

Acute confusion. There were 6 cases of AC during the 4-week period, 3 in the treatment group and 3 in the control group. When stratified by 90% compliance with the weight-based fluid goal irrespective of their control and treatment group assignments, 4 cases were found in the < 90% compliance with the fluid goal and 2 cases in the ≥ 90% compliance. There was no significant difference in the incidence with the 90% compliance stratification using

TABLE 2: Bioelectrical Impedance Analysis Measurement Taken at Week 4 Based on 90% Compliance With Hydration Intake Goal Irrespective of Treatment and Control Group Assignment

Description	*% of Fluid Goal Consumed*	N	M	SD
Total body weight liters	< 90	48	34.2	6.4
	≥ 90	50	38.3	8.9
Intracellular fluid liters	< 90	48	17.5	4.3
	≥ 90	50	19.5	5.9
Extracellular fluid liters[a]	< 90	48	16.8	3.1
	≥ 90	50	18.9	3.8

a. $p = .002$, $t = -3.13$, $df = 96$.

the Fisher's exact test. AC cases were clinically different from non-AC participants. The mean heart rate was higher and more variable in AC participants ($\bar{x} = 78.33$, $sd = 24.77$) compared to those without confusion ($\bar{x} = 74.53$, $sd = 10.66$). Oxygen saturation percent was also slightly lower among participants with AC ($\bar{x} = 92.29$, $sd = 5.25$) compared with those who were not classified as confused ($\bar{x} = 94.72$, $sd = 3.49$).

Incidental findings. In the analysis, we tried to identify other therapeutic benefits of the weight-based hydration management intervention by looking at leukocyte counts. Using the same stratification procedure described above, lower leukocyte counts were obtained over the period of follow-up in the > 90% compliance group. This was remarkable, given that the rates were nearly identical at baseline in the two groups ($\bar{x} = 148.3$ in the ≤ 90% group versus $\bar{x} = 144.8$ in the ≥ 90% group).

DISCUSSION

The treatment and control groups were different at baseline on the BUN to creatinine ratio. This is not, in general, a desired starting point for experimental studies. In this case, however, this imbalance in the groups actually biased the analysis toward the null hypothesis and was clearly outside the control of the investigators. Also, many of the inferential conclusions were not based on the treatment versus control group paradigm but actual fluid intake levels based on compliance with the weight-based standard

calculated retrospectively. In essence, any difference between treatment and control groups at baseline did not impact the analysis.

The first hypothesis was partially supported by the results of this study. Although the treatment group did demonstrate lower urine color ratings and lower urine SG readings, this was not maintained throughout the follow-up period due to reduced compliance with the intervention. We do recommend monitoring urine color as this can become part of the care routine and is a noninvasive procedure that is easily interpreted in the absence of serum chemistries. There is one qualification: Some elders may not concentrate urine very well. Despite this disclaimer, the clinical value of this simple technique outweighs these disadvantages for all but the few who have moderate to severe renal insufficiency as we have documented previously (Wakefield et al., 2002).

Medications may also influence the color of urine, and nursing staff personnel need to be alert to this possibility.

Compliance with the hydration management intervention waned after 4 weeks, and the nursing staff in both the treatment and control groups was also less likely to report acute changes in mental status after this length of time. We conducted part of the analysis reported here using a criterion of a 90% compliance with a weight-based fluid goal. For control participants, this was done after the fact due to decreased interest on the part of treatment participants to continue drinking fluids at the recommended levels. This constituted a threat to internal validity (i.e., the degree to which a study establishes the cause-and-effect relationship) between the treatment and the observed outcome (Slack & Draugalis, 2001). The flaw in the design is that fluid intake cannot be rationed or dosed like a pharmaceutical clinical trial (Goodwin, Pritchard, & Spiegel, 1999) even though we did try to encourage both participants and staff by offering training. Of course, researchers cannot restrict the fluid intake of a control participant nor coerce treatment participants to consume more fluids in human participants.

To remedy the situation, we examined voluntary fluid intake. The BIA estimates fluid compartments (i.e., TBW, ICF, and ECF) in this study were based on the 90% compliance stratification. ECF in volume was different between the two groups, with those who consumed < 90% of the bodyweight standard having lower volume readings. The urine leukocyte readings were best analyzed using this same stratification. Results of this analysis indicate that the weight-based standard for calculating fluid goals does have some therapeutic benefit in persons who may be at risk for dehydration.

Another therapeutic value of the weight-based fluid goal was the lower mean leukocyte count (Leu μ/L) in participants who were 90% compliant

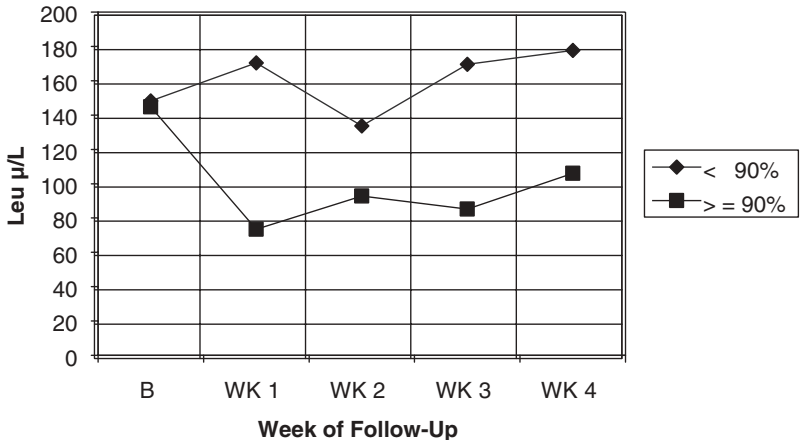

Figure 1: Mean leukocyte counts (Le µ/L) urine by percentage compliance with the weight-based fluid goal irrespective of group assignment.
B = baseline, Wk = week.

with the standard (see Figure 1). Because urinary tract infection (UTI) has previously been identified as an antecedent for AC, it is a possible explanation for the lower incidence of AC found here in the > 90% group. Increasing fluid intake may also improve renal perfusion and decreases bladder stasis, thus decreasing infection rates. This may have also increased the frequency of micturition and the care burden for nursing home staff. Given the higher number of lower skilled auxiliary staff in the nursing home industry and the relatively low registered-nurse-to-client ratios in many facilities, the increased frequency of urination may be a serious barrier in implementing any hydration management protocol in long-term care.

In essence, the second hypothesis related to the incidence of AC was not supported. There were a higher number of AC cases in the < 90% fluid intake group however, and the data suggest that in a larger study with more resources to control extraneous variables a true difference may exist. There were limitations here related to the degree of surveillance that could be provided by our research team, and thus we relied heavily on the nursing staffs in each facility to alert us to acute changes in cognition. We found it difficult to get some staff members to simply report a change in mental status to the research nurse so that an AC assessment could be completed. We compensated for this by increasing our own surveillance, but without some cues from the facility care providers, this proved difficult. One possibility may be a perceived lack of understanding about what AC means clinically and how

it is differentiated from other types of cognitive impairment conditions. Often, staff nurses in LTC found it difficult to distinguish between dementia and AC even though an educational intervention was provided.

Many residents in LTC have dementia. In our earlier MDS study, 52.5% of participants with AC were diagnosed with dementia (Mentes et al., 1999). AC events are more difficult to identify in this population. The nursing staff in many of these facilities may not have recognized the clinical importance of an acute change in mental status to our protocols, despite remedial in-service training. We believe it is important to teach LTC staff nurses about the salient differences between dementia and AC and when to seek clinical assistance when an acute mental status change is present. This training is critical, and we have implemented it in several facilities in Iowa (Rapp et al., 1998). Although our educational interventions aided staff in recognizing AC episodes, the limited staff time available from other tasks did somewhat impede our progress in effectively delivering the intervention.

Limitations. Although the methods chosen here to detect AC are clinically useful, the lack of statistical significance in decreasing the incidence of AC during the 4-week follow-up period in the hydration treatment group suggests a need for more vigilance in implementing the intervention and monitoring for acute cognitive changes. As mentioned, the threats to internal validity became apparent to the investigative team as a result of our data quality monitoring, but we felt the study did need to progress and that it would be possible to retrospectively analyze fluid intake in the control group.

Fluid intake prescriptions need to be monitored carefully in participants with renal and cardiovascular disease as these individuals are often on therapeutic regimens that make them prone to hydration problems. Our BIAs may not have estimated the sudden changes in body fluid compartments accurately on participants who were taking diuretic therapy even though every attempt was made to take readings at least 4 hours after these doses.

Because of the multifactorial nature of AC, a weight-based hydration approach alone may not have the statistical power to impact on the pathogenesis of AC (Foreman, Wakefield, Culp, & Milisen, 2001). A multicomponent model using a variety of interventions has shown some success in reducing the incidence of AC (Inouye et al., 1999; Rizzo et al., 2001). Inouye et al. (1999) used an intervention strategy that consisted of standardized protocols for the management of six risk factors for AC: cognitive impairment, sleep deprivation, immobility, visual impairment, hearing impairment, and dehydration. This strategy included staff education, frequent orientation of the participant, proper placement of hearing and visual aids,

environmental modifications, and adequate hydration. These approaches resulted in significant reductions in the number and duration of episodes of AC in hospitalized older patients.

Compliance with a hydration protocol was initially pursued with great zeal when caregivers and residents of long-term care facilities first learned of it, but this enthusiasm waned during the course of lengthy follow-up periods. This complicated our question related to the minimum length of time required for a physiological benefit. This research is very difficult to implement ethically, and it is unclear if experimental or clinical trials can ever be conducted that evaluate hydration interventions in humans. Future work will need to focus on refining hydration standards in elders that articulate renal and congestive heart failure comorbidities.

The notion that a hydration intervention improves the health of individuals is biologically plausible. A link between hydration and cognitive functioning was not confirmed here, but a therapeutic benefit was suggested with the hydration management protocols described here. A weight-based standard for hydration in elders may not be the only approach for a calculating fluid goal; other techniques should be evaluated, and an evidenced-based standard for the long-term-care elder should be clearly communicated to agencies responsible for quality indicators in this population. It is critical. The nursing home industry does not have immediate access to lab facilities for serum electrolyte measures to diagnose dehydration. We should be beyond recognizing poor hydration and focusing on preventing the problem in the first place. A clear consensus among geronotological researchers and clinicians on this very important issue would greatly improve elder care. We do not mean to discount clinical judgment in ensuring adequate fluid intake, but the relatively sparse literature in this area should greatly alarm organizations that allocate resources for research in aging.

This study does document a reduced leukocyte count in urine for participants who consume fluids consistent with the weight-based standard and an improvement in fluid compartment volume. This is an important finding and lends credibility to the concern of gerontological nurses that residents in LTC get adequate hydration. Knowing what an adequate level for daily fluid intake is for frail, elderly residents of long-term-care facilities is critical, and other researchers are encouraged to avoid the pitfalls described here in designing studies that are based on treatment and control groups.

NOTE

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