Published in final edited form as:

J Am Geriatr Soc. 2020 October ; 68(10): 2329–2335. doi:10.1111/jgs.16695.

Hospital Elder Life Program in Long Term Care (HELP-LTC): A Cluster Randomized Controlled Trial

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Abstract

Background/Objective: The Hospital Elder Life Program (HELP) has been shown to prevent delirium in hospitalized older adults. The objective of this study was to test the efficacy of HELP adapted to long-term care (HELP-LTC).

Design: Cluster randomized controlled trial

Setting: 514-bed academic urban nursing home

Participants: 219 long-term nursing home residents who developed an acute illness or change in condition were randomly assigned to HELP-LTC (n=105) or usual care (n=114) by unit.

Intervention: HELP-LTC is a multi-component intervention targeting delirium risk factors, including cognitive impairment, immobility, dehydration, and malnutrition. Two certified nursing assistants (CNAs) delivered HELP-LTC components twice daily 7 days/week. In addition, recommendations were given to primary providers to reduce medications associated with delirium.

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Author contributions: Study concept and design (Boockvar, Teresi, Inouye), acquisition of subjects and/or data (Boockvar, Judon), analysis and interpretation of data (Boockvar, Teresi, Eimicke), and preparation of manuscript (all). All authors gave final approval of the version to be published. Drs. Boockvar and Teresi had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Presented in part at the 2019 American Geriatrics Society Annual Scientific Meeting.

Conflict of interest: The authors have no financial interests to disclose.

Measurements: Delirium (primary outcome) and delirium severity were ascertained each weekday by a research assistant blinded to group assignment, using the Confusion Assessment Method (CAM) and CAM severity score (CAM-S), respectively. Cognitive function was determined using the Cognitive Performance Scale (CPS). Hospitalization was ascertained by chart review.

Results: Participants were 81.7 years old on average and 65.3% female. At baseline, usual care group participants had better cognitive function than intervention group participants (CPS 1.33 vs. 2.25; $p=0.004$). Delirium symptoms declined over the course of the episode (mean CAM-S 3.63 at start vs. 3.27 at end). Overall, 33.8% of the total sample experienced incident delirium. After adjusting for baseline cognitive function, there were no significant differences in delirium or delirium severity between intervention and usual care groups. Hospitalization was not significantly different between groups.

Conclusion: An intervention targeting delirium risk in long-term nursing home residents did not prevent delirium or reduce delirium symptoms. Baseline differences in cognitive function between groups, greater-than-expected improvements in both groups, quality-enhancing practices such as consistent assignment delivered to both groups, and adaptations of the intervention may have biased results towards null.

Keywords

nursing homes; delirium; intervention; randomized controlled trial

INTRODUCTION

Nursing home residents are at risk for delirium because of the widespread presence of delirium risk factors such as cognitive impairment, immobility, and sensory impairment¹. Acute conditions that can precipitate delirium are common in nursing home residents, occurring 2-4 times per resident per year², and at least three-quarters of these are managed in the nursing home setting (e.g., uncomplicated urinary tract infection)³. Despite this, there is limited evidence on interventions to prevent or treat delirium in the nursing home^{4,5}. The Hospital Elder Life Program (HELP) has been shown to prevent delirium in hospitalized older adults by providing delirium-risk-reducing components via specially-trained Elder Life specialists and volunteers to vulnerable individuals⁶. In addition, HELP remains effective when tailored to individual organizations or settings, with adaptations to enrollment criteria, screening and assessment tools, and intervention protocols⁷. In a previous study, we demonstrated the feasibility, fidelity, and acceptability of a HELP program adapted to long-term care (HELP-LTC), with delirium-risk-reducing components delivered to acutely-ill long-term nursing home residents via mobile Certified Nursing Assistants (CNAs)⁸.

The objective of this study was to test the efficacy of HELP-LTC for acutely-ill long-term nursing home residents in a single-site cluster randomized controlled trial, building on our feasibility study. In this study, as in the previous study⁸, CNAs delivered delirium-risk reducing components twice daily to long-term nursing home residents beginning at the onset of an acute illness, during treatment for the acute illness (e.g., 7 days of antibiotics), and for 1 week post-treatment. We designed our approach to test the hypothesis that HELP-LTC

would reduce delirium incidence (primary outcome), and reduce delirium severity and hospitalization (secondary outcomes) during the acute illness and at 30 days after the end of the acute illness episode.

METHODS

Setting and participants

The study setting was a 514-bed academic urban nursing home. Residents were included who: 1) resided on a long-term care unit; 2) had expected survival of at least 2 months and no plan for discharge, and 3) developed an acute illness or change in condition, according to published criteria⁹. We focused on long-term care residents for delirium-prevention because: 1) a substantial fraction of postacute residents who are admitted to nursing homes are still acutely ill and some still have delirium that developed in the hospital; 2) a prior trial of a multicomponent delirium abatement program in postacute care was ineffective¹⁰; 3) we intended to ascertain delirium outcomes over a follow-up period (e.g., 30 days) that often exceeds the duration of postacute stays; 4) we were concerned that HELP-LTC components (especially mobility interventions) would be redundant with physical and occupational therapy during post-acute care, which would dilute the effect of HELP; and 5) we had prior success piloting HELP in long-term care⁸.

Each weekday residents who in the prior 24-48 hours were suspected to have onset of acute illness or change in condition were identified by: 1) daily pharmacy query that provided names of residents newly prescribed antibiotic(s), intravenous fluids, or intravenous medication(s), indicating treatment for an acute change in condition, 2) referral from unit-based staff of residents with suspected or actual acute change in condition, and 3) daily census report identifying residents who returned to the nursing home from the hospital after an acute hospital stay. Residents were excluded who: 1) were receiving hospice care, 2) were nonverbal or unable to follow simple commands, 3) were not determined to have a change in condition after further screening, or 4) declined participation. We received human subjects committee approval from The New Jewish Home to implement program activities with assent rather than written consent, because HELP-LTC protocols consist of care components that are elements of standard care, are minimal risk, and are optimally implemented within 1-2 days of acute illness onset, a time period insufficient for a full written consent process. Since the study facility has its own full-time in-house medical staff, and since it makes available to its front-line staff an early illness recognition tool ("STOP AND WATCH"^{11,12}), the time for communication and recognition of acute change between nursing and medical staff was consistent with current best practice¹¹.

Group assignment

Each of 12 long-term care units was randomly assigned to HELP-LTC or usual care prior to patient enrollment. Residents were assigned to HELP-LTC or usual care based on unit, with each unit representing a separate cluster. We selected unit-based assignment in order to reduce the potential for contamination (e.g., diffusion of features of the intervention into usual care by unit staff) and to enable blinding of outcome ascertainment and of unit staff. Consistent staffing on each unit was a top goal at the facility at the time of the study, and

according to a senior nurse executive it occurred at least 80% of the time, estimated based on the number of part-time staff.

Intervention

HELP-LTC has been described in detail previously⁸. In brief, it is a multi-component intervention adapted from HELP that is designed to ameliorate delirium risk factors highly prevalent in nursing home residents^{1,6,13–15}, and it focuses on cognitive impairment, immobility, dehydration, and malnutrition. It is delivered to residents as close as possible to the onset of acute illness or change in condition, since the risk of delirium is highest in the first 3 days after acute illness onset¹⁶. Instead of trained volunteers, who are commonly used in hospital-based programs, HELP-LTC was adapted to be delivered by CNAs, who can be drawn from an available front-line nursing home workforce pool.

For this clinical trial, 2 CNAs who were credentialed and experienced in delivering hands-on care in the nursing home setting were trained to deliver HELP-LTC. These CNAs were part of the study team and did not have a current NH staff role. These CNAs delivered HELP-LTC components to the intervention group twice daily every day, 7 days per week beginning at the onset of an acute illness episode, during treatment for the acute illness (e.g., 1-2 weeks of antibiotics), and for 1 week post-treatment, for a maximum of 3 weeks. At each visit, the CNAs provided care components directly to residents guided by structured protocols and a visit form⁸. A typical visit lasted 30 minutes and began with a greeting and orientation to person, time and place, followed by provision of water, a cognitive exercise (i.e., reminiscence, music, and/or game), physical exercise (i.e., walking, standing, and upper extremity movements), and a snack and second cup of water—matching the structure of hospital-based HELP programs.

Nursing home unit staff was not asked to provide HELP-LTC components. However, the HELP-LTC CNAs communicated with the nursing home unit staff to tailor activities, ensure safety (e.g., swallowing and mobility safety), and avoid overlap with unit staff's activities; and they rounded on patients with a clinician expert weekly. The maximum HELP-LTC daily census was 12 residents, and was typically 5-7 residents during the study, for a total of 10-14 visits daily during an 8-hour shift. In a subset of patients, a clinician expert reviewed patient medication lists and provided recommendations to primary care providers regarding discontinuing or reducing medications associated with delirium, using the American Geriatrics Society-Beers guidelines¹⁷.

For residents in the usual care group, CNAs entered the resident's room once daily, and, if the resident was awake, greeted the resident. The approximate time spent in this greeting was 3 minutes or less. No other intervention was provided.

Measures

The primary outcome was incident delirium, using the Confusion Assessment Method, long-form (CAM)¹⁸. A single research assistant (RA) received formal training over 4 weeks in delirium assessment and other measurements, and was observed at least monthly by a clinical expert for quality control. The following cognitive tests were used for scoring the CAM: for attention, digit span and backwards recitation of days of week and months of

year; for temporal orientation and short-term memory, the Brief Interview of Mental Status (BIMS)¹⁹; for spatial orientation, direct questioning of facility name, floor, city, and state. The RA administered the CAM each weekday beginning at the onset of an acute illness, during treatment for the acute illness, and for 1 week post-treatment, and once 30 days later. Delirium severity was ascertained each weekday using the CAM severity score (CAM-S), which is a summative count of delirium features²⁰. The RA was strictly blinded to group assignment and remained unaware of intervention design or group assignment after study end.

We collected data at baseline on resident demographic and clinical characteristics, characteristics of the acute illness, delirium risk factors, and prior hospital use. As measures of illness severity, we used the Inpatient Physiologic Failure Score (IPFS)²¹, and whether the patient received intravenous therapy or antibiotics during treatment for the acute condition. We ascertained markers of dehydration (intravenous fluids, blood urea nitrogen (BUN): creatinine ratio > 20) and of under-nutrition (new nutritional supplement prescribed, weight loss > 3 lbs, albumin < 3.5) during the acute condition.

Physical function was determined using the nursing home Activities of Daily Living (ADL) scale²². Cognitive performance was determined using the Cognitive Performance Scale (CPS)²³ (range 0-6; higher score = worse cognitive function) and the Brief Interview of Mental Status (BIMS) (range 0-15; higher score = better cognitive function)¹⁹. Physical and cognitive function were ascertained via interview with an informant who was a unit staff person who knew the resident well at study enrollment, 1 week after illness end, and at 30 days after illness end. Hospitalization up to 30 days after illness end was ascertained by chart review.

Analyses

Baseline characteristics of residents and their acute illnesses were summarized using descriptive statistics. Intervention and usual care groups were compared using bivariate statistics. Because units rather than residents were randomized, there is the potential for imbalance at baseline; thus *p* values were presented for group comparisons, calculated using IBM SPSS Complex Samples (Armonk, NY). Intervention adherence was defined as frequency that a CNA recorded that an indicated intervention activity was delivered, with a pre-stated goal of completion of 75% of indicated interventions. Within each group, the change in delirium severity from baseline to follow-up time points was calculated. Because the usual care group had significantly better cognitive function at baseline, delirium outcomes comparisons were adjusted for baseline cognitive function, using the CPS.

All analyses were intent-to-treat. Multivariable models were estimated to compare between-group incidence of delirium and average daily delirium severity accounting for baseline difference in cognition and repeated measures over time. Delirium incidence (delirium coded as one) was analyzed using SAS (Cary, NC) PROC GLIMMIX, assuming a logit link and a binomial distribution and adjusting for clustering within unit. Delirium severity was analyzed using a repeated measures mixed model adjusting for clustering within unit using SAS PROC MIXED. Analyses were performed examining the trajectory (slope) between the groups, compared using the data wave (baseline, average daily, one-month) as a proxy for

administration. Contrast estimates were performed to compare the treatment groups at each end-point (between group differences) and also to compare baseline to one-month follow-up and baseline to average daily within each group. All analyses accounted for within-cluster associations, using robust standard errors. A compound symmetry covariance structure was assumed. The intraclass-correlation coefficient representing within-unit correlation of the delirium severity measure was 0.038, which is low, indicating a small clustering effect.

RESULTS

Sample characteristics:

There were 219 participants included in the study: 114 in the intervention group and 105 in the usual care group (Figure). The mean age was 81.7 years (standard error corrected for clustering (SE): 1.1); 65.3% were female. Participants were 33.3% non-Hispanic White, 35.2% non-Hispanic Black, and 29.7% Hispanic. Table 1 compares baseline characteristics between groups, excluding cognitive function. The usual care group had significantly higher frequency of heart failure than the intervention group (34.3% vs 23.7%; $p=0.011$) but had a similar number of chronic conditions (2.8 vs 2.9; $p=0.809$). The most common acute diagnoses in both groups were urinary infection (17.8%), skin infection (8.7%), and respiratory infection (7.8%). There were no significant differences in IPFS or other measures of illness severity between groups. The average episode length was 9.8 days (SE .56).

Intervention dose:

For intervention group subjects, HELP-LTC CNAs delivered 17.6 (SE 1.1) daily visits per illness episode with average visit duration of 29.8 (SE 0.58) minutes. Among visits in which each component was indicated, greeting and orientation was completed in 99%; a cognitive activity was completed in 95%, most often reminiscence, music, and reading activities; a physical activity was completed in 90%, most often walking, chair stands, and range of motion exercises; fluid administration was provided in 92%; and snack was provided in 65%. The total component completion rate was 89.4%. The most common cause of not receiving a component was resident refusal, followed by resident being off the floor or unavailable.

Medications:

For intervention group subjects, a clinician expert completed medication reviews on 54 of the 114 HELP-LTC patients (47%) and made recommendations to reduce or stop 22 drugs among 17 patients. The most common drugs were histamine receptor 2 blockers (45%) (e.g., famotidine), drugs for Parkinson's disease (27%) (e.g., levodopa), benzodiazepines (18%) (e.g., lorazepam), and anticholinergics (9%) (e.g., benztropine). Six patients had a medication reduced or discontinued as a result of a recommendation.

Intervention effects:

Table 2 presents cognitive function data, stratified by treatment group. The usual care group had better cognitive function than the intervention group at baseline, with significantly lower CPS scores (1.33 vs. 2.25; $p=0.004$) and significantly higher BIMS scores (9.70 vs. 7.95; $p=0.031$). Overall, 33.8% of the sample experienced incident delirium during the acute

illness episode. In both groups, delirium symptoms improved over the course of the episode. Overall, the mean CAM-S score at the beginning of the acute illness episode was 3.63, and declined to 3.27 at the end of follow-up (result not shown). There was an associated improvement in cognitive function over the course of the acute illness, with mean BIMS for the total sample increasing from 8.8 at baseline to 9.9 at the end of the acute illness ($p < .001$) and the mean CPS decreasing from 1.8 to 1.6 (not significant; Table 2).

Table 2 shows results for delirium outcomes. After adjustment for baseline difference in cognitive function, there were no significant differences in delirium or delirium severity between intervention and usual care groups. 31% of the usual care group and 36% of the intervention group experienced incident delirium during the acute illness episode (adjusted $p = .101$). At follow-up one month later, 4% of the usual care and 11% of the intervention group had delirium (result not shown). The mean CAM-S score at the end of the acute illness episode was 2.8 in the usual care group and 3.6 in the intervention group (adjusted $p = .154$). There were no significant differences in markers of dehydration and under-nutrition between groups (Table 3), and rates of hospitalization were not significantly different between groups, with 18.1% experiencing hospital transfer in the usual care group and 15.8% in the intervention group ($p = .524$). Overall, 6.5% of the sample died and there was not a significant difference in deaths between the groups (7.69% in usual care and 5.36% in Intervention).

DISCUSSION

This study found that a multi-component intervention targeting delirium risk factors (e.g., cognition, immobility, hydration, and under-nutrition) in acutely-ill long-term nursing home residents (HELP-LTC) did not prevent delirium or reduce delirium symptoms in the intervention group compared with usual care. We had hypothesized that adapting the Hospital Elder Life Program (HELP), which reduces delirium in hospitalized older adults⁶, to the long-term care setting would be effective in reducing delirium and improving other outcomes of acute illness in this population (e.g., reduced hospitalization). However, this was not the case, despite our previous promising pilot study in which we demonstrated the excellent feasibility, fidelity, and uptake of this approach⁸.

This is the first study designed to determine the effect of a multi-component intervention on delirium prevention in long-term nursing home residents. Strengths of the study were the cluster-randomized prospective design, the blinded assessment of outcomes, and the intensity of the intervention. Innovations of the study were that participants were enrolled at the onset of acute illness, which is a period of marked increase in delirium risk, and that HELP-LTC was delivered by trained CNAs who had experience as unit staff in the long-term care setting. Nursing home CNAs were credentialed to provide hands-on mobility activity and oral fluid and feeding in disabled older adults. This study advances our knowledge about non-pharmacological approaches to delirium-prevention in long-term care settings, where few studies have been done²⁴. Our negative results may be helpful to inform and improve the study design and approach for future delirium-prevention efforts for disabled older adults in nursing home and other settings.

There are several possible reasons that HELP-LTC did not demonstrate its intended effect. First, the cluster-randomized design resulted in significant baseline differences in the comparison groups, with significantly more cognitive impairment at baseline in the intervention group. While cognitive impairment was controlled for in the analyses, it is well-known to be the strongest predictor of development of delirium¹ and it is possible that these baseline differences may have biased our results towards the null.

Second, our intervention was adapted from the HELP model, and several of the adaptations might have lowered the potency of the overall intervention. The HELP interventions are typically applied three times a day (twice during the day and once in the evening), and we applied just the daytime interventions, omitting the evening interventions and sleep protocol for staffing reasons. Although HELP-LTC CNAs discussed each patient with the unit-based nursing staff and rounded with the lead clinician weekly, we did not have a formal interdisciplinary team for integration with nursing or formal interdisciplinary rounds. Addressing medications, which is typically done with all HELP patients, only occurred in half in the present study. Moreover, in the long-term care setting, medications associated with delirium are often prescribed for chronic disease control (e.g., Parkinson's disease) and providers may be more reluctant to change these medications. In contrast, the target medications in the hospital often are for temporary symptoms such as insomnia.

Third, we found that study participants showed substantial improvement in cognition and reduction in delirium severity over time in both intervention and usual care groups, which may have limited our ability to detect an intervention effect. Our study enrolled residents at the onset of acute illness, resulting in a sample of participants likely to experience resolution of illness-associated cognitive change over time. This improvement finding is in contrast to a study that ascertained prevalent delirium in a cross section of long-term care residents in which residents showed less frequent improvement patterns and more frequent worsening patterns²⁵.

Fourth, it is possible that long-term nursing home residents, because of underlying cognitive and physical function impairment, are resistant to HELP-LTC components. For example, a nursing home resident permanently non-ambulatory (e.g., from a prior stroke) that is only able to do passive exercise may not have been amenable to the mobility component of HELP-LTC; similarly, an individual with permanent cognitive impairment from Alzheimer's disease may not be amenable to orientation and reminiscence activities.

Fifth, it is possible that the intervention group may have experienced substitution of care rather than enhancement of care if unit-based staff reduced their attention to intervention residents, since unit staff could see when residents were receiving extra attention from HELP-LTC CNAs. It is also possible that the usual care group may have received some features of HELP-LTC, especially hydration and nutrition, as part of usual care since they are elements of standard care for nursing home residents. The lack of difference in markers of dehydration and under-nutrition among intervention and usual care groups support either of these scenarios.

Finally, the study took place at a single site that was an academic-affiliated nursing home with high quality ratings, and it had a relatively small sample size (219). It is possible that this facility was unrepresentative of other facilities; e.g., that it already provided usual or standard care that was comparable in some ways to the intervention, or that quality-enhancing co-interventions such as consistent assignment or early illness identification diluted the difference between intervention and control groups. Conversely, even in an academic nursing home with in-house medical staff and an early recognition tool, illness recognition could still have been delayed, which could have diminished the effectiveness of the intervention.

The lack of efficacy signal from this study may indicate that replicating the study “as is” in other facilities or adding participants without changing the study design and/or intervention approach would not change the null result. However, it cannot be ruled out that facilities with fewer resources or lower quality ratings could benefit from the program. Future studies of delirium-prevention in long-term care should be encouraged. For example, it may be impactful to deliver HELP to a group of nursing home residents other than at the time of acute illness, conduct more intensive medication review and reduction, hold formal interdisciplinary rounds, or increase collaboration with nursing staff to enhance the delivery and potency of the interventions. Training nursing home staff in HELP methods could also be beneficial.

About 2% to 5% of older adults worldwide live in nursing homes²⁶, and delirium is common in this setting, occurring during 18-33% of acute conditions¹⁶. Nursing homes share features with hospitals that likely increase risk of delirium, including sensory over-stimulation, tendency of providers to over-medicate, and use of devices that restrict movement. In addition, nursing home residents exhibit multiple delirium risk factors, including high frequencies of acute illness, sensory impairment, physical function impairment, and cognitive impairment. Future approaches to preventing delirium in this setting would suggest identifying alternative modifiable factors, with a focus on environmental factors and medications. In this regard, a study of an automated intervention designed to reduce polypharmacy in the nursing home setting probably reduced delirium²⁷. Thus, delirium is a potentially important outcome for the growing field of research on deprescribing in the nursing home and other settings²⁸. In addition, this study’s findings underscore the need for research to improve the ascertainment of delirium co-occurring with dementia, a clinical scenario common in all settings that care for older adults. Finally, examining this intervention in the postacute setting, where patients may be at higher risk for delirium, will be important in future research.

ACKNOWLEDGMENTS

This study was supported by grants from the National Institute on Aging (R21AG049289 and R24AG054259). Partial support for analysis was provided by the Mount Sinai Pepper Older Americans Independence Center (National Institute on Aging 1P30AG028741). Dr. Boockvar holds the Anna A. Greenwall Chair. Dr. Inouye holds the Milton and Shirley F. Levy Family Chair.

Sponsor’s Role: The sponsor had no role in the design, methods, subject recruitment, data collection, analysis, or preparation of paper.

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Figure.
CONSORT Diagram

Table 1.

Participant characteristics at baseline by treatment group. T-tests or chi-square tests results are reported with standard errors (SE) adjusted for clustering within unit.

Variable		Total (n=219)		Usual Care (n=105)		Intervention (n=114)		p-value
Age (years) (mean (SE))		81.7	(1.1)	80.6	(1.3)	82.7	(1.5)	0.349
Female gender (% (SE))		65.3	(5.4)	67.6	(2.7)	63.2	(10.0)	0.667
Race (% (SE))	White, non-Hispanic	33.3	(4.6)	39.1	(7.9)	28.1	(4.6)	0.239
	Black, non-Hispanic	35.2	(2.8)	37.1	(4.5)	33.3	(2.7)	0.482
	Hispanic	29.7	(3.6)	23.2	(3.9)	35.1	(5.0)	0.099
	Other	1.8	(0.8)	0	(0)	3.5	(1.2)	0.042
Chronic Condition Count (mean (SE))		2.8	(0.1)	2.8	(0.1)	2.9	(0.1)	0.809
Individual chronic conditions:								
Heart failure (% (SE))		28.8	(2.5)	34.3	(2.6)	23.7	(2.3)	0.011
Chronic lung disease (% (SE))		30.6	(2.6)	31.4	(4.6)	29.8	(2.6)	0.766
Diabetes (% (SE))		36.5	(4.0)	30.5	(6.3)	42.1	(4.3)	0.170
Cerebrovascular accident (% (SE))		14.6	(1.5)	13.3	(1.1)	15.8	(2.5)	0.360
Alzheimer's disease (% (SE))		10.5	(1.8)	12.4	(3.2)	8.8	(1.8)	0.312
Non-Alzheimer's dementia (% (SE))		52.5	(5.6)	47.6	(7.5)	57.0	(7.4)	0.395
Physical function (ADL score) (mean (SE))		15.2	(0.7)	14.2	(0.7)	16.1	(1.1)	0.162
Sensory function:	Impaired vision (% (SE))	11.9	(1.7)	14.3	(2.5)	9.7	(1.7)	0.141
	Impaired hearing (% (SE))	17.8	(2.6)	17.1	(4.0)	18.4	(3.3)	0.810
Do not resuscitate (% (SE))		55.7	(4.4)	61.9	(8.6)	50.0	(3.1)	0.234
Hospitalized in the past 12 months (% (SE))		60.7	(5.4)	67.6	(8.3)	54.4	(4.4)	0.204
Characteristics of acute illness:								
Illness severity score (IPFS) (mean (SE))		1.3	(0.1)	1.4	(0.1)	1.3	(0.2)	0.544
Treated with antibiotics (% (SE))		52.5	(4.5)	53.3	(7.4)	51.8	(5.4)	0.866
Treated with intravenous fluids (% (SE))		11.0	(2.0)	13.3	(3.9)	8.8	(1.6)	0.248

ADL = Activities of Daily Living, with higher score = worse function; IPFS = Inpatient Physiologic Failure Score, with higher score = higher severity

Table 2:

Delirium outcomes and cognitive measures by treatment group. P-values are reported for t-test or chi-square test comparison between intervention and control, with standard errors adjusted for clustering within unit, and delirium outcomes also adjusted for baseline difference in cognitive function, using the Cognitive Performance Scale.

Measure	Total (n=219)		Usual Care (n=105)		Intervention (n=114)		p-value
Brief Interview of Mental Status (mean (SE)): higher score = better cognitive function							
At baseline	8.8	(0.4)	9.7	(0.4)	8.0	(0.5)	0.031
At episode end	9.9	(0.5)	10.8	(0.6)	9.1	(0.5)	0.040
At 1 month	9.7	(0.5)	10.5	(0.6)	9.1	(0.6)	0.113
Cognitive Performance Scale (mean (SE)): higher score = worse cognitive function							
At baseline	1.8	(0.2)	1.3	(0.1)	2.3	(0.2)	0.004
At episode end	1.6	(0.2)	1.3	(0.2)	1.9	(0.2)	0.059
At 1 month	1.8	(0.2)	1.5	(0.1)	2.1	(0.2)	0.037
Delirium							
Incidence (CAM) (%) -- baseline to episode end	33.8		31.4		36.0		0.101
Severity (CAM-S) (mean (SE)) -- at episode end	3.2	(0.2)	2.8	(0.2)	3.6	(0.2)	0.154

CAM = Confusion Assessment Method; CAM-S = Confusion Assessment Method-Severity (higher score = worse severity); SE = Standard Error

Table 3:

Dehydration and under-nutrition indicators by treatment group. P-values are reported for chi-square test comparisons between intervention and control, with standard errors adjusted for clustering within unit.

	Total (n=219)		Usual Care (n=105)		Intervention (n=114)		p-value
	%	SE	%	SE	%	SE	
Dehydration indicators							
Intravenous fluids prescribed	5.5	(2.0)	5.7	(2.5)	5.3	(3.0)	0.912
BUN : creatinine ratio > 20	9.1	(2.0)	8.6	(3.1)	9.7	(2.6)	0.798
Under-nutrition indicators							
New nutrition supplement prescribed	4.1	(1.0)	2.9	(1.3)	5.3	(1.2)	0.238
Weight loss 3 pounds	34.3	(3.4)	35.2	(4.6)	33.3	(4.9)	0.782
Albumin < 3.5	6.4	(1.6)	4.8	(2.5)	7.9	(1.4)	0.367

SE = standard error; BUN = blood urea nitrogen