

Effectiveness of the In-Hospital Information Technology System-Based Delirium Management Intervention Program in Medically Hospitalized Patients with Dementia: A Retrospective Case–Control Study

Sin-Chen Wang^{1,*}, Wen-Fu Wang^{2,*}, Ming-Che Chang^{3,*}, Yu-Chun Tung^{4,*}, Kai-Ming Jhang²

¹College of Medicine, Taipei Medical University, Changhua, Taiwan; ²Neurological Institute, Changhua Christian Hospital, Changhua, Taiwan; ³Department of Nuclear Medicine, Changhua Christian Hospital, Changhua, Taiwan; ⁴Department of Pharmacy, Taichung Veterans General Hospital, Taichung, Taiwan

*These authors contributed equally to this work

Correspondence: Kai-Ming Jhang, Neurological Institute, Changhua Christian Hospital, No. 135 Nanxiao St., Changhua City 500, Changhua, Taiwan, Tel +886 4 7238595 ext. 3521, Email kmjhang@gmail.com

Purpose: This study aimed to study the effectiveness of an information technology (IT) system-based delirium management intervention program for prevention and earlier detection of delirium in medically hospitalized patients with dementia.

Patients and Methods: This was a retrospective case–control study. The study population consisted of patients aged 50–100 years who were diagnosed with dementia and hospitalized in the general wards of neurology, psychiatry, or geriatrics. The intervention group included 101 patients receiving a delirium management protocol comprising IT-supported delirium detection, multicomponent prevention, and treatment protocols. A total of 101 controls matched for age, gender, and severity of dementia in the intervention group were selected.

Results: The intervention group showed a significantly lower delirium incidence (34% versus 18%, $p=0.010$) and earlier detection of delirium after hospitalization (3.2 versus 2.2 days, $p=0.035$). Factors associated with the presence of delirium in hospitalized patients with dementia were receiving delirium management protocol (OR=0.37, 95% CI=0.16–0.83, $p=0.019$) and restraints during hospitalization (OR=14.4, 95% CI=5.81–39.1, $p<0.001$).

Conclusion: The in-hospital IT system-based delirium management intervention program is associated with reduced delirium incidence and earlier delirium detection after hospitalization. Appropriate delirium management and avoiding unnecessary restraints are important for hospitalized patients with dementia.

Plain Language Summary: This study demonstrated the effectiveness of an information technology (IT) system-based delirium management intervention program to prevent delirium in medically hospitalized patients with dementia. The in-hospital IT system-based delirium management intervention program significantly reduces delirium incidence and can detect delirium significantly earlier after hospitalization. Appropriate delirium management and avoiding unnecessary restraints are important for hospitalized patients with dementia.

Keywords: delirium prevention and management, information technology, dementia, case management, hospitalization

Introduction

Dementia is a degenerative disease that affects mental, motor, and verbal aspects of humans.¹ The prevalence of dementia has rapidly increased. By 2020, more than 50 million people were diagnosed with dementia worldwide. This number is

expected to double every 20 years. By 2030, the global population with dementia is projected to reach 82 million and 152 million in 2050.² Meanwhile, delirium is a disease that affects attention and cognition. It is characterized by acute onset and fluctuating symptoms. Delirium has multiple causes. Its occurrence is often accompanied by underlying predisposing and precipitating factors.³ Notably, dementia and delirium have an interconnected relationship. Dementia increases the risk of developing delirium; similarly, delirium increases the risk of dementia.⁴

Acute hospitalization increases the risk of delirium in frail older adults with cognitive impairment.⁵ For instance, patients with Alzheimer's disease have a 56% chance of developing delirium during hospitalization. Moreover, patients who experienced delirium had a rate of cognitive decline in the year following hospitalization that was twice as fast as that of patients who did not experience delirium.⁶ Some scholars have proposed the "system integration failure" hypothesis of delirium. Specifically, delirium is triggered by various precipitants, including cognitive dysfunction and neurological disorders. These precipitants lead to delirium substrates, such as neuronal aging, neuroinflammation, and oxidative stress, which in turn cause neurotransmitter dysregulation and network dysconnectivity. Ultimately, system integration failure results in acute brain failure, which subsequently leads to persistent or chronic delirium.⁷

Delirium prevention during acute hospitalization is an important issue. Early in 1999, a study used a prospective matching strategy and demonstrated the effectiveness of a multicomponent intervention for preventing delirium in hospitalized older adults. The intervention method comprised standardized protocols for managing six risk factors for delirium: cognitive impairment, sleep deprivation, immobility, visual impairment, hearing impairment, and dehydration. The incidence of delirium, number of days with delirium, and total number of delirium episodes were significantly lower in the intervention group.⁸ A meta-analysis concluded that evidence-based non-pharmacological interventions include cognition or orientation, early mobility, hearing, sleep-wake cycle preservation, vision, and hydration. Among the 11 studies that measured delirium incidences, the risk of delirium was significantly reduced by 44% and 63% in randomized and non-randomized trials, respectively.⁹

To our knowledge, few studies have focused on delirium prevention specifically in patients with dementia. A retrospective study reported that the relative risk of delirium associated with anticholinergic use was 2.3 in hospitalized patients with dementia. Anticholinergic use is a modifiable risk factor for delirium prevention and beneficial for the management of hospitalized patients with dementia.¹⁰ A meta-analysis noted the lack of inpatient rehabilitation specifically designed for delirium prevention in patients with cognitive impairment. However, such a model could potentially represent an innovative approach to delirium prevention in these patients in the future.¹¹

Owing to the relative scarce research on delirium prevention in people living with dementia, Changhua Christian Hospital (CCH) created a delirium management intervention model. This model includes an information system to help ward nurse practitioners (NPs) or residents performing delirium assessments, prevention, and treatment for hospitalized patients with dementia. In previous studies, IT tools applied to dementia were mainly focused on alleviating behavioral and psychological symptoms of dementia (BPSD) and providing cognitive training,^{12,13} however, their use in delirium has been limited. Known examples include IT systems for delirium risk prediction. This study aimed at testing the effectiveness of the in-hospital information technology (IT) system-based delirium management intervention program designed by the CCH.

Materials and Methods

Design and Participants

This study was conducted at CCH's Dementia Center, a medical center in Changhua, Taiwan, from March 2019 to December 2023. Patients aged 50–100 years who were diagnosed with dementia and hospitalized in the general wards of neurology, psychiatry, or geriatrics were enrolled. Patients who were not to be referred to clinical psychologists for diagnosis of dementia before hospitalization were excluded.

This case–control study used retrospective chart reviews and electronic medical records obtained from hospitals. The aim was to elucidate the effectiveness of a case manager-based dementia collaborative care model on delirium incidence and duration during acute hospitalization.

This study was approved by the CCH's Institutional Review Board (CCH IRB 240205), which waived the requirement for informed consent because the data used were derived from electronic charts.

Intervention Method

CCH's collaborative multidisciplinary dementia care team has been operational since October 2015, comprising clinical physicians, dietitians, nursing case managers, occupational therapists, pharmacists, physical therapists, psychologists, and social workers.^{1,14} After obtaining consent, the dementia patient-caregiver dyad was introduced to the case manager-centered collaborative care team by physicians (neurologists, psychiatrists, and geriatrists) who had made the diagnosis of dementia at the out-patient department (OPD). Patients and caregivers received an initial comprehensive assessment, monthly phone contact, and follow-up face-to-face evaluations every six months to find the unmet care needs of patients and their caregivers, and transferring to suitable resources.^{15,16} Patients were excluded from the care model if they refused contact with case managers, had no OPD follow-up for more than six months, or lived in a nursing home.

To further extend our service to patients with dementia requiring acute hospitalization, the care team introduced an in-hospital multidisciplinary consultation and delirium management protocol since August 2020. If patients with dementia who agreed to join the OPD care team provided their approval, case managers would receive automatic messages and consult with dietitians, physical/occupational therapists, pharmacists, and social workers to renew the needs of the patient and caregiver. Delirium evaluation using the Confusion Assessment Method (CAM) was also introduced in our inpatient system.¹⁷ During day shifts, the systems automatically remind neurology and psychiatry ward NPs or residents to make the assessment. If no delirium was identified during the assessment, a delirium prevention protocol was initiated; if delirium was detected, a delirium treatment protocol was introduced. The significance of this IT system lies in its ability to provide real-time assessment of patients' conditions. Accordingly, when delirium symptoms first emerge, standardized alerts are generated, enabling the timely initiation of appropriate management.

The CCH delirium prevention protocol includes six categories: re-orientation, avoiding sleeping deprivation, promoting activities, avoiding dehydration, adjusting medications, and correcting sensory loss.⁸ The re-orientation protocol includes setting up clocks and calendars in wards to remind patients of time. To avoid sleep deprivation, sleep-enhancement strategies include keeping quiet after 9:00 P.M. in the wards and reducing care behavior from 9:00 P.M. to 6:00 A.M. To promote activities, a physical therapist is consulted to arrange off-bed activities thrice a day. The daily fluid volume is adjusted according to the blood urea nitrogen/creatinine ratio to avoid dehydration. The clinical pharmacist performs prescription evaluations for each patient and provides suggestions for medication adjustment. To correct sensory loss, patients are recommended to keep using their previous hearing or visual aids.

The delirium treatment protocol includes alleviating possible causes and pharmacological treatment. When delirium is detected by CAM, the system will help NPs/resident to find possible aggravated factors associated with delirium through "PRIMSE" method.¹⁸ "P" means "Pain", reminding care staffs to assess pain and undertake adequate pain control. "R" is for "Restrain" and "Retention". Restraints should be employed only if the patient meets the principles of restraint. Checking for urinary retention is important in patients with delirium. "I" indicates "Infection", "Impaction", and "Oral Intake." Care staff must identify the potential sources of infection and fecal impaction and initiate early oral feeding, if possible. "S" means "Sign", "Sleep disturbance", "Sensory change", and "Social isolation." If focal neurological signs develop, brain images should be immediately arranged. The care staff also need to manage sleep disturbance or sensory loss in patients. Social isolation reminds care staff to engage with familiar things or family members to be with the patient. "M" is for "Medication adjustment" and "Metabolic." NPs/residents should adjust medications for patients with a high delirium tendency and check metabolic and electrolyte balance. "E" is for "Environment", which means adjusting the environment according to hypo- or hyperactive delirium phenotype.

Intervention Group

In total, 101 patients were included in the intervention group. These were patients who signed the consent form to join the CCH collaborative multidisciplinary dementia care model between August 2020 and December 2023. During the dementia case management period, patients experienced acute hospitalization in the neurology, psychiatry, or geriatrics wards, and received an in-hospital multidisciplinary consultation and delirium management protocol.

Control Group

The control group comprised patients admitted to the same wards between March 2019 and December 2023 who did not participate in the care model during hospitalization. A total of 1201 hospital admissions were identified. Among them, 101 controls were selected by 1:1 matching with the intervention group based on age, gender, and severity of dementia (global clinical dementia rating (CDR) scores). In the control group, patients still received the same prevention and treatment measures as those in the intervention group; however, the control group did not receive daily IT system reminders prompting NPs/Residents to assess for delirium, nor did they receive IT system reminders regarding management strategies.

Measurements

Measurement of Delirium

In the intervention group, delirium was defined as a “positive assessment of delirium by CAM”, which was a standardized assessment method used in all included wards. A positive assessment means having acute onset and fluctuating inattention and either disorganized thinking or altered consciousness. In the control group, delirium was defined as “delirium recorded in the inpatient progress notes.” The first days with delirium after hospitalization and persistent duration of delirium were also analyzed.

Measurement of Variables Related to the Occurrence of Delirium

Data on patient age, gender, main admission diagnosis, global CDR, dependence level, hearing and visual status, comorbidities, admission into intensive care units (ICU), and restraint and Foley insertion were collected.

The global CDR was classified into four levels, 0.5, 1, 2, and 3, indicating the severity of dementia.¹⁹ Dependence level was classified into three categories: able to live independently, dependent on instrumental activities of daily living (IADL), and dependent on basic activities of daily living (ADL). Comorbidity indicates the number of comorbidities listed at discharge, including 14 comorbidities, including hypertension (HTN), diabetes (DM), dyslipidemia, chronic kidney disease (CKD), atrial fibrillation or other arrhythmia, cardiovascular disease or heart failure, benign prostate hypertrophy or other urological disorder, cerebrovascular disease (CVA), chronic hepatitis/cirrhosis/chronic liver disease, chronic obstructive pulmonary disease (COPD)/asthma, cancer, chronic anemia, osteoarthritis, and chronic gastrointestinal disease.

Statistical Analysis

R software (R Foundation for Statistical Computing) was used to generate and analyze all study data. The dependent variable was the presence of delirium, while the independent variables were factors related to the occurrence of delirium mentioned in the previous paragraph. Differences between categorical data were calculated using the chi-square or Fisher's exact tests. Numerical data were analyzed using Student's *t*-test or Wilcoxon rank-sum test. A multivariate logistic regression model was used to test for the factors associated with the presence of delirium. Statistical significance was determined when the *p*-value was less than 0.05.

Results

This study enrolled 101 patients with dementia who participated in a collaborative care model and delirium prevention protocol during admission. The control group comprised 101 patients matched for age, gender, and severity of dementia (global CDR). [Table 1](#) presents the basic participant characteristics. The control and intervention groups did not significantly differ regarding age, gender, global CDR, dependence level, hearing status, comorbidity, ICU admission, restraint, and Foley insertion.

Incidence of Delirium

[Table 2](#) shows the incidence of delirium between the control and intervention groups. Compared with the control group, the intervention group shows significantly lower incidence of delirium (34% versus 18%, *p*=0.010), with significantly

Table 1 Basic Characteristics of Intervention and Control Groups

Characteristic	Control (N=101) ^f	Intervention (N=101) ^g	p value ^b
Age	80.8 (8.9)	81.4 (8.3)	0.6
Gender			0.5
Female	70/101 (69%)	65/101 (64%)	
Male	31/101 (31%)	36/101 (36%)	
Main admission diagnosis			0.002
CVA	13/101 (13%)	28/101 (28%)	
Management of neurodegenerative disorder	8/101 (7.9%)	14/101 (14%)	
Infection	51/101 (50%)	36/101 (36%)	
Seizure	7/101 (6.9%)	7/101 (6.9%)	
Electrolytes/endocrine imbalance	2/101 (2.0%)	8/101 (7.9%)	
Other	20/101 (20%)	8/101 (7.9%)	
Global CDR			0.8
0.5	23/101 (23%)	27/101 (27%)	
1	29/101 (29%)	27/101 (27%)	
2	26/101 (26%)	28/101 (28%)	
3	23/101 (23%)	19/101 (19%)	
Dependence			0.2
Able to live independently	8/101 (7.9%)	5/101 (5.0%)	
Dependent on IADL	36/101 (36%)	49/101 (49%)	
Dependent on basic ADL	57/101 (56%)	47/101 (47%)	
Hearing			0.9
Normal	68/101 (67%)	67/101 (66%)	
Abnormal	33/101 (33%)	34/101 (34%)	
Visuality			0.006
Normal	60/101 (59%)	78/101 (77%)	
Abnormal	41/101 (41%)	23/101 (23%)	
Comorbidity	2.4 (1.5)	2.4 (1.4)	0.7
ICU			0.5
No	95/101 (94%)	97/101 (96%)	
Yes	6/101 (5.9%)	4/101 (4.0%)	
Restraint			0.9
No	81/101 (80%)	82/101 (81%)	
Yes	20/101 (20%)	19/101 (19%)	
Foley			0.9
No	66/101 (65%)	65/101 (64%)	
Yes	35/101 (35%)	36/101 (36%)	

Notes: ^a Mean (SD); n/N (%). ^bWilcoxon rank sum test; Pearson's Chi-squared test.

Abbreviations: CVA, cerebrovascular accident; CDR, clinical dementia rating; ADL, activity of daily living; IADL, instrumental ADL; ICU, intensive care unit.

earlier detection of delirium after hospitalization (3.2 versus 2.2 days, $p=0.035$), and although nonsignificant, fewer delirium persistent days (3.4 versus 2.2 days, $p=0.15$).

Factors Associated with Delirium

Table 3 shows the logistic regression model used to predict the factors associated with delirium. The intervention group shows significantly lower risk of delirium compared with the control group (OR=0.37, 95% CI=0.16–0.83, $p=0.019$).

Table 2 Incidence of Delirium Between Intervention and Control Groups

Characteristic	Control (N=101) ^a	Intervention (N=101) ^a	p value ^b
Delirium			0.010
No	67/101 (66%)	83/101 (82%)	
Yes	34/101 (34%)	18/101 (18%)	
Days with first recoding of delirium after hospitalization	3.2 (2.2)	2.2 (1.9)	0.035
Delirium persistent days	3.4 (3.0)	2.2 (1.9)	0.15

Notes: ^an/N (%); Mean (SD) ^bPearson's Chi-squared test; Wilcoxon rank sum test.

Table 3 Logistic Regression Model to Predict Factors Associated with Delirium

Characteristic	OR ^a	95% CI ^a	p value
Group			
Control	–	–	
Intervention	0.37	0.16, 0.83	0.019
Main admission diagnosis			
CVA	–	–	
Management of neurodegenerative disorder	1.86	0.42, 8.20	0.4
Infection	1.14	0.38, 3.65	0.8
Seizure	2.04	0.39, 10.2	0.4
Electrolytes/endocrine imbalance	0.26	0.01, 2.30	0.3
Other	1.32	0.34, 5.13	0.7
Dependence			
Able to live independently	–	–	
Dependent on IADL	2.23	0.35, 25.0	0.4
Dependent on basic ADL	3.92	0.64, 44.7	0.2
Hearing			
Normal	–	–	
Abnormal	0.62	0.25, 1.48	0.3
Visuality			
Normal	–	–	
Abnormal	0.87	0.36, 2.09	0.8
Comorbidity	1.01	0.77, 1.32	>0.9
ICU			
No	–	–	
Yes	2.55	0.40, 15.0	0.3
Restraint			
No	–	–	
Yes	14.4	5.81, 39.1	<0.001
Foley			
No	–	–	
Yes	0.85	0.36, 1.94	0.7

Notes: ^aOR = odds ratio, CI = confidence interval.

Abbreviations: CVA, cerebrovascular accident; ADL, activity of daily living; IADL, instrumental ADL; ICU, intensive care unit.

Further, restraint during hospitalization poses a significantly higher risk to the development of delirium (OR=14.4, 95% CI=5.81–39.1, $p<0.001$).

Discussion

This study found that an in-hospital IT system-based delirium management intervention program significantly reduced the incidence of delirium. Our findings indicated that post-hospitalization delirium detection was significantly earlier in the intervention group. Regarding the factors associated with delirium, the intervention group showed significant lower risk of delirium. Meanwhile, restraint during hospitalization contributed to higher risk of delirium. These positive patient outcomes may be closely associated with the IT system's real-time and standardized alert function.

Next, we discuss some reasons for making our intervention methods a successful model. First, in-hospital multi-disciplinary consultations had certain benefits. Once the dementia patient from the OPD agreed to join the care team, a case manager was assigned to find the care needs and connect with the entire team. When the patient was admitted, the team's dieticians established a proper nutrition plan, physical/occupational therapists cared for the patient's motor functions, pharmacists checked appropriate medicines, and social workers provided consultations for the patient.

Second, the multicomponent intervention worked. We drew lessons from previous studies in that these daily care aspects of patients are also important.⁸ For example, setting up clocks and calendars in wards helped the patients with re-orientation. Keeping quiet after 9:00 P.M. prevented patients from experiencing sleep deprivation. In addition, performing off-bed activities thrice a day promoted the patient's activities. Such non-pharmacological methods played a crucial role in the intervention model. Finally, the IT system was the highlight of our intervention method. Upon detecting delirium by CAM, the IT system would help NPs/resident to identify possible causes of delirium through "PRIMSE" method.¹⁸ This system contributed to a more in-depth and detailed intervention.

A meta-analysis that discussed non-pharmacological interventions for preventing delirium in hospitalized non-ICU patients included 22 randomized control trials (RCT) with 5,718 adult participants. The results indicated that compared to usual care, multicomponent non-pharmacological interventions can reduce delirium incidence by 43% in hospitalized adults; however, mortality was not significantly affected. Furthermore, these interventions may reduce the length of hospital stay and duration of delirium. However, their impact on delirium severity remains uncertain. Additionally, we explored interventions that reduce delirium incidence. We found that reorientation (including the use of familiar objects), cognitive stimulation, and sleep hygiene significantly reduce the risk of incidence of delirium. Conversely, attention to nutrition and hydration, oxygenation, medication review, mood assessment, and bowel and bladder care did not significantly reduce the risk of incidence of delirium.²⁰ Our delirium prevention protocol also has an orientation protocol that includes the placement of familiar objects and a calendar at the bedside. Additionally, when caregivers visit, they remind the patients of the date, location, and reason for hospitalization, which also serves as a form of cognitive stimulation. Furthermore, our non-pharmacological sleep protocol, which includes maintaining quiet conditions in the ward after 9:00 PM, is part of our sleep hygiene practices. As mentioned above, the results of our work aligns with a meta-analysis which discussed the effectiveness of multicomponent interventions (involving at least two simple interventions) in preventing delirium in hospitalized elderly patients. It is found that multicomponent interventions effectively reduced the incidence, duration, and severity of delirium.²¹ Similarly, we specifically focused on multi-component interventions for delirium prevention in hospitalized elderly patients with dementia. Our results also demonstrated that multicomponent interventions significantly reduced the incidence and duration of delirium, although not significantly.

A systematic review and meta-analysis examined the effectiveness of non-pharmacological interventions delivered through information and communication technologies (ICTs) for behavioral and psychological symptoms of dementia (BPSD). The ICT-based interventions encompassed: (1) activity engagement interventions delivered using digital health that provided music therapy and reminiscence therapy, (2) exercise-based interventions, (3) social engagement interventions involving social robots, and (4) telehealth-based care aid interventions that offered coaching or counseling programs. The findings indicated that ICT-enabled non-pharmacological strategies produced a large effect in alleviating depressive symptoms among older adults with dementia and demonstrated a moderate effect in reducing overall BPSD as well as agitation.¹² Another systematic review and meta-analysis discussed the effects of technology-assisted

interventions for individuals with dementia. In this study, technology-assisted interventions included modalities such as interactive video games (eg, Wii), exergaming, virtual reality, and robotic technologies. The findings demonstrated that, compared to usual care, technology-assisted interventions were associated with significant enhancements in cognitive function and reductions in depressive symptoms.¹³

Studies exploring delirium prevention using IT systems focus on several aspects. A retrospective cohort study proposed a new method for assessing delirium: the Electroencephalographic (EEG) CAM Severity Score (E-CAM-S). E-CAM-S is based on a learning-to-rank machine-learning model that utilizes forehead EEG signals. The study found that the E-CAM-S has a similar strength of association with the length of stay in the hospital and in-hospital mortality compared to the traditional interview-based CAM-S. This is an example of using an information system to measure the severity of delirium and assess its clinical outcomes.²² A RCT utilized a web-based application, Web_DeliPREVENT_4LCF, to predict the participants' risk of delirium. This machine learning application predicts delirium risk based on patient data and employs a built-in Short CAM (S-CAM) for delirium assessment. If a participant is identified as being in the delirium-risk or delirium-positive groups, non-pharmacological and multicomponent delirium prevention interventions are provided. The results showed that the intervention group had a 0.30 times lower incidence of delirium and 0.08 times lower one-month hospitalization mortality rate than the control group, both with significant outcomes. Thus, the web-based application can assist in delirium prevention.²³

A systematic review and meta-analysis discussed the risk factors for delirium in older patients who were hospitalized. The results showed that the risk factors for delirium included frailty, physical restraint, prior falls, severe illness, cognitive impairment, and older age. Notably, years of education have been identified as a protective factor against delirium.²⁴ Another systematic review and meta-analysis investigated the risk factors of delirium in acutely hospitalized older patients. The results revealed that dementia, illness severity, visual impairment, urinary catheterization, and length of hospital stay were significantly associated with delirium.²⁵ Here, we found that restraint was significantly associated with delirium, consistent with the findings of the above studies. A review article discussed the impact of physical restraints on patients in the ICU. Subsequent delirium was reported as the most frequent adverse event. Specifically, the physical restraint increased the risk of delirium among 2,093 patients from 25 ICUs.²⁶ Thus, physical restraint should be carefully applied in hospitalized patients with dementia.

The strength of this study lies in its IT system-based intervention and the specific targeting of patients with dementia. Only a few studies have utilized IT systems to aid delirium prevention. Few studies specifically focus on delirium prevention in individuals with dementia. However, this study has some limitations. First, this was a non-randomized study. A selection bias may have been present in the intervention and control groups. Although we made efforts to align their characteristics in matching the case and control groups, the main admission diagnoses and visibility categories had significant differences. To overcome the influence of these possible confounders, they were adjusted in the logistic regression model. Second, the study was conducted at a single hospital. Further, the population size of the recruited subjects was small. This result may not be generalizable to other populations.

Conclusions

In conclusion, the implementation of an in-hospital IT system-based delirium management intervention program was associated with a reduced delirium incidence. Delirium detection after hospitalization occurred significantly earlier. Additionally, among the risk factors for delirium, the intervention group showed a significant risk reduction. Meanwhile, the use of restraints during hospitalization significantly increased the risk of delirium. Furthermore, conducting randomized controlled studies to further evaluate the efficacy of this intervention remains highly important.

Data Sharing Statement

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Ethics Approval and Consent to Participate

This study was approved by the Institutional Review Board of Changhua Christian Hospital (CCH IRB 240205). All experiments were compliant with the Declaration of Helsinki. As all data required in this study were extracted from the electronic charts after deleting personalized information, informed consent was waived by the Institutional Review Board of Changhua Christian Hospital.

Funding

This research received no specific grant from any funding agency.

Disclosure

Sin-Chen Wang, Wen-Fu Wang, Ming-Che Chang, and Yu-Chun Tung are co-first authors for this study. The authors report no conflicts of interest in this work.

References

- Chen YJ, Wang WF, Chang MC, et al. The effectiveness of the case manager-centered collaborative care model with computer-assisted assessment on quality indicators for the care of dementia. *Dement Geriatr Cognit Disord*. 2024;53(1):29–36. doi:10.1159/000536646
- Guerchet M, Prince M, Prina M. Numbers of people with dementia around the world. *Alzheimer's Disease International*. 2020. Available from: <https://www.alzint.org/u/numbers-people-with-dementia-2017.pdf>. Accessed October 9, 2025.
- Keenan CR, Jain S. Delirium. *Med Clin North Am*. 2022;106(3):459–469. doi:10.1016/j.mcna.2021.12.003
- Fong TG, Inouye SK. The inter-relationship between delirium and dementia: the importance of delirium prevention. *Nat Rev Neurol*. 2022;18(10):579–596. doi:10.1038/s41582-022-00698-7
- Weldingh NM, Mellingsæter MR, Hegna BW, et al. Impact of a dementia-friendly program on detection and management of patients with cognitive impairment and delirium in acute-care hospital units: a controlled clinical trial design. *BMC Geriatr*. 2022;22(1):266. doi:10.1186/s12877-022-02949-0
- Weiner MF. Impact of delirium on the course of Alzheimer disease. *Arch Neurol*. 2012;69(12):1639–1640. doi:10.1001/archneurol.2012.2703
- Maldonado JR. Delirium pathophysiology: an updated hypothesis of the etiology of acute brain failure. *Int J Geriatr Psychiatry*. 2018;33(11):1428–1457. doi:10.1002/gps.4823
- Inouye SK, Bogardus ST, Charpentier PA, et al. A multicomponent intervention to prevent delirium in hospitalized older patients. *N Engl J Med*. 1999;340(9):669–676. doi:10.1056/NEJM199903043400901
- Hshieh TT, Yue J, Oh E, et al. Effectiveness of multicomponent nonpharmacological delirium interventions: a meta-analysis. *JAMA Intern Med*. 2015;175(4):512–520. doi:10.1001/jamainternmed.2014.7779
- Hale EW, Macchi ZA, Pressman PS. Delirium following anticholinergic use in hospitalized patients with dementia. *Neurohospitalist*. 2023;13(2):153–155. doi:10.1177/19418744221135914
- Hauer K, Dutzi I, Werner C, et al. Delirium prevention in early rehabilitation during acute hospitalization and implementation of programs specifically tailored to older patients with cognitive impairment: a scoping review with meta-analysis. *J Alzheimers Dis*. 2024;97(1):3–29. doi:10.3233/JAD-230644
- Cho E, Shin J, Seok JW, et al. The effectiveness of non-pharmacological interventions using information and communication technologies for behavioral and psychological symptoms of dementia: a systematic review and meta-analysis. *Int J Nurs Stud*. 2023;138:104392. doi:10.1016/j.ijnurstu.2022.104392
- Saragih ID, Wei CW, Batubara SO, et al. Effects of technology-assisted interventions for people with dementia: a systematic review and meta-analysis. *J Nurs Scholarsh*. 2023;55(1):291–303. doi:10.1111/jnu.12808
- Hung YH, Wang WF, Chang MC, et al. Case management-based collaborative care model associated with improvement in neuropsychiatric outcomes in community-dwelling people living with dementia. *BMC Geriatr*. 2023;23(1):339. doi:10.1186/s12877-023-04024-8
- Wang WF, Su YY, Jhang KM, et al. Patterns of home- and community-based services in older adults with dementia: an analysis of the long-term care system in Taiwan. *BMC Geriatr*. 2021;21(1):290. doi:10.1186/s12877-021-02231-9
- Jhang KM, Chang MC, Lo TY, et al. Using the a priori algorithm to classify the care needs of patients with different types of dementia. *Patient Prefer Adherence*. 2019;13:1899–1912. doi:10.2147/PPA.S223816
- Inouye SK, van Dyck CH, Alessi CA, et al. Clarifying confusion: the confusion assessment method. A new method for detection of delirium. *Ann Intern Med*. 1990;113(12):941–948. doi:10.7326/0003-4819-113-12-941
- Confusion Assessment Method (CAM) with PRISME. Available from: <https://www.interiorhealth.ca/sites/default/files/PDFS/cam-prisme.pdf>. Accessed October 9, 2025.
- Morris JC. The clinical dementia rating (CDR): current version and scoring rules. *Neurology*. 1993;43(11):2412–2414. doi:10.1212/WNL.43.11.2412-a
- Burton JK, Craig LE, Yong SQ, et al. Non-pharmacological interventions for preventing delirium in hospitalised non-ICU patients. *Cochrane Database Syst Rev*. 2021;7(7):Cd013307. doi:10.1002/14651858.CD013307.pub2
- León-Salas B, Trujillo-Martín MM, Martínez Del Castillo LP, et al. Multicomponent interventions for the prevention of delirium in hospitalized older people: a meta-analysis. *J Am Geriatr Soc*. 2020;68(12):2947–2954. doi:10.1111/jgs.16768
- van Sleuwen M, Sun H, Eckhardt C, et al. Physiological assessment of delirium severity: the electroencephalographic confusion assessment method severity score (E-CAM-S). *Crit Care Med*. 2022;50(1):e11–e19. doi:10.1097/CCM.0000000000005224

23. Park M, Moon KJ. Web-based delirium prevention application for long-term care facilities. *J Am Med Dir Assoc.* 2023;24(4):559–563.e2. doi:10.1016/j.jamda.2022.12.023
24. Wu CR, Chang KM, Tranyor V, et al. Global incidence and prevalence of delirium and its risk factors in medically hospitalized older patients: a systematic review and meta-analysis. *Int J Nurs Stud.* 2024;162:104959. doi:10.1016/j.ijnurstu.2024.104959
25. Ahmed S, Leurent B, Sampson EL. Risk factors for incident delirium among older people in acute hospital medical units: a systematic review and meta-analysis. *Age Ageing.* 2014;43(3):326–333. doi:10.1093/ageing/afu022
26. Berger S, Grzonka P, Amacher SA, et al. Adverse events related to physical restraint use in intensive care units: a review of the literature. *J Intensive Med.* 2024;4(3):318–325. doi:10.1016/j.jointm.2023.11.005

Journal of Multidisciplinary Healthcare

Publish your work in this journal

The Journal of Multidisciplinary Healthcare is an international, peer-reviewed open-access journal that aims to represent and publish research in healthcare areas delivered by practitioners of different disciplines. This includes studies and reviews conducted by multidisciplinary teams as well as research which evaluates the results or conduct of such teams or healthcare processes in general. The journal covers a very wide range of areas and welcomes submissions from practitioners at all levels, from all over the world. The manuscript management system is completely online and includes a very quick and fair peer-review system. Visit <http://www.dovepress.com/testimonials.php> to read real quotes from published authors.

Submit your manuscript here: <https://www.dovepress.com/journal-of-multidisciplinary-healthcare-journal>

Dovepress

Taylor & Francis Group