




RESEARCH ARTICLE

Consolidated framework for advancing implementation science for the implementation process and adherence assessment of a non-pharmacological delirium prevention program

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Abstract

Objective: To evaluate the contribution of applying the theoretical framework of implementation science for adherence to non-pharmacological interventions to prevent delirium.

Methods: A quasi-experimental prospective design was conducted from March 2017 to October 2018 in a teaching hospital. Participants included 149 healthcare staff and 72 elderly inpatients. A non-pharmacological delirium prevention program was designed, applied and evaluated in accordance with the consolidated framework for advancing implementation research (CFIR). The primary outcome was the global adherence rate to 12 predefined indicators, comparing measurements at baseline (O1), after training (O2) and at a 6-month follow-up (O3) assessed by an external reviewer. Staff knowledge and beliefs about delirium were assessed using a validated tool, and delirium incidence was evaluated using the confusion assessment method.

Results: Overall adherence increased from 58.2% (O1) to 77.9% (O2) and 75.6% (O3) (O2 vs. O1: $p < 0.001$ and O3 vs. O1: $p < 0.001$). Staff perceptions regarding implementation of non-pharmacological interventions increased from 74.8% to 81.9% ($p = 0.004$). Delirium incidence was non-significantly reduced from 20% (O1) to 16% (O3) ($p = 0.99$).

Conclusions: Implementation of a delirium prevention program using a CFIR model was useful in improving adherence to activities included in this program, as well as improving the knowledge and beliefs regarding delirium by healthcare workers. The impact of this implementation strategy on the incidence of delirium should be evaluated in a larger scale multicenter trial.

KEYWORDS

adherence, CFIR, delirium, implementation, non-pharmacological intervention, prevention

1 | INTRODUCTION

Delirium is a common complication among the hospitalized elderly, with reported incidences reaching 82% for those in critical care units.^{1,2} Delirium awareness is growing worldwide due to its association with several short-, medium- and long-term negative outcomes, including morbidity, mortality, cognitive and functional impairment.³⁻⁶

Although there are currently no treatments for delirium, there is high-quality evidence showing that multiple non-pharmacological interventions to prevent delirium (nPPD) are effective, decreasing its incidence by 30%–40%.⁷⁻⁹ Because of the evidence for their efficacy, many clinical guidelines and scientific societies promote routine use of these interventions in clinical practice.^{10,11} However, despite evidence for the efficacy of these prevention tools going back more than 15 years, their global implementation remains insufficient.¹²⁻¹⁴ nPPD consist of a complex transdisciplinary intervention, requiring efficient inter-professional teamwork among physicians, nurses, physiotherapists, occupational therapists, patients and relatives that are difficult to implement in daily clinical activities.¹⁵⁻¹⁸ Furthermore, although studies on nPPD report interventions and training activities for clinical staff, many of them do not provide a detailed description of the strategies used to implement these programs into clinical practice, adherence to specific single domains that compose the programs or the effects of education and training activities among the healthcare team or the patients and relatives. It has been reported that levels of adherence achieved for the different actions that compose the multidimensional programs to prevent delirium are a key determinant of their impact,¹⁹ so in depth analysis of these specific data is critical to improve the application, replicability and sustainability of the preventive program over time.

Developed over the last years, implementation science (IS) is an area of knowledge that examines strategies, mechanisms and factors that determine implementation of processes, actions, and/or evidence.^{20,21} Several theoretical and conceptual frameworks guiding the implementation process have been reported, and over the last few years, more comprehensive reference frameworks have been generated that gather together these different theories (meta-theories).²²⁻²⁶ Although benefits of the systematic use of IS have been reported in different scenarios, the application of such theoretical constructs for the design and implementation of delirium prevention programs is sparse.^{17,27} For this reason, we designed the present study aiming to assess adherence to the application of nPPD measures, following implementation of a program designed, applied and evaluated in accordance with constructs and components of the consolidated framework for advancing implementation research (CFIR).

2 | METHODS

2.1 | Design

Prospective quasi-experimental (before and after), in two clinical departments (internal medicine rooms and medical intermediate care

Key points

Question

- Can improved adherence of clinical staff to non-pharmacological interventions to prevent delirium (nPPD) be attained using a consolidated framework for advancing implementation research (CFIR)?

Findings

- This study observed increased global adherence to nPPD measures from 58.2% at baseline measurement, to 77.9% after education, and 75.6% 6 months after training. Moreover, knowledge and attitudes of healthcare workers regarding delirium were improved

Conclusions

- Use the CFIR theoretical framework is effective in increasing adherence to a series of activities of a delirium prevention program and could be a tool to improve implementation of these programs globally

unit) of a University Hospital. The present study is part of the FONDEF UCHID16AM0080 project (clinical trials registration NCT03573843). Report of this implementation study was performed according to the StaRI Statement for Reporting Implementation Studies.²⁸

2.2 | Study population

(A) Healthcare staff: actions were undertaken with the healthcare staff of the abovementioned units, including medical, nursing, physical therapist and nurse assistant. (B) Patients: patients 65 years or older admitted to the abovementioned units with medical pathologies. Patients with a history of dementia, users of psychoactive medication, non-Spanish speakers and patients presenting with delirium upon initial assessment were excluded.

2.3 | Context implementation

A high complexity university hospital with a liver and cardiac transplant centre with an emphasis on teaching and research served as the site for this study. The participating clinical units have informed and motivated chiefs who are open to implementing nPPD and have sufficient infrastructure. The material resources were obtained from a health research fund. The clinical hospital has an electronic medical record system and computer support for this project. Fifteen beds of the intermediate care unit and 26 beds of

Internal Medicine unit were included, with 62 and 33 healthcare staff, including nurses, nurse assistants and physicians, respectively. Both units care for older adults admitted for acute pathology without need of invasive mechanical ventilation. In the intermediate care unit, patients can receive non-invasive ventilation, high flow nasal cannula and low doses of vasopressors. The average stay is 5 days for the intermediate care unit and 4 days for internal medicine. One of the units (intermediate care unit) has experience with delirium prevention programs, but activities of capacitation have not been done for at least for 5 years. Local regulations and accreditation process do not have indicators about delirium prevention.

2.4 | Intervention

A literature review regarding progress in IS was performed, addressing both the general and specific aspects of such disciplines applied previously in delirium prevention.^{17,18,22,23,25} Furthermore, we examined studies that explored barriers regarding the implementation of good practices for delirium prevention and management.^{29–31} According to the analysed data, the research team decided to apply the CFIR. The latter is a pragmatic meta-theoretical framework that attempts to consolidate the more than 30 theories that have been developed in this discipline and that recommends some practical guidelines for its use.^{22,23} It has a standardized structure with 5 domains and 39 constructs, the capacity for applying the model in different stages of the implementation process (before, during and after), and the availability of recommendations on the widest use of the theoretical framework comprised the strengths that justified our choice. To develop the implementation strategies, actions were performed considering all 39 constructs of CFIR. Around 15 implementation strategies were applied, for example, meeting with heads of units and opinion leaders to define local nPPD protocols, training with clinical teams, defining local leaders, feedback with local leaders, assessment using an instrument of knowledge and beliefs, delivery of study materials, creation of a brochure about delirium, creation of nursing medical care for delirium prevention, installation of clock and calendar in all rooms, among others (see Table 1 for more details). Some of the most featured actions are detailed below.

2.5 | I.D. Intervention characteristics—Adaptability

After conducting training and feedback activities with the healthcare teams, the proposed elements to be incorporated into the non-pharmacological delirium prevention program that originally emerged from the literature review and the experience of our research team³² were increased from six to eight intervention areas.

2.6 | III.C and III.E Inner setting—Networks and communications, culture and readiness for implementation/leadership engagement

One of the most important components to produce changes in behaviour within an organization is to ensure that webs of networks are established and that communication is frequent and of quality, including both formal and informal channels. In this study, several actions to address this component were conducted, including systematical spread in regular clinical meetings of the participating units of different aspects related to the non-pharmacological delirium prevention protocol, graphic materials displayed on unit walls to show information about delirium prevention and inclusion of an annually scheduled meeting on World Delirium Day on March 11. A WhatsApp group was also created among local leaders to maintain fluid communication to solve frequent daily problems, and a request was made to include delirium concepts in the practical training plan in internal medicine and nursing. To promote a participatory approach, activities and roles were defined for the various members of the healthcare team in each area. Additionally, local leaders were designated according to their interest and motivation to lead implementation of the protocol in their unit with the aim of incorporating the proposed activities into daily healthcare routine. Based on her own interest to lead a delirium prevention program, one nurse was established as a local leader, who had daily contact with the rest of the healthcare staff. Their functions were to check compliance of non-pharmacological interventions, maintain motivation in the healthcare staff, hold monthly meetings with other local leaders and inform the external change agent about difficulties in implementation. The final elements to be incorporated to the delirium prevention program, as well as activities defined per role, are shown in Table 2, together with the supervision and support actions performed by local leaders and external change agents and facilitators.

2.7 | IV.A. Characteristics of individuals. Knowledge and beliefs about the intervention

Based on CFIR recommendations, the team leader considered exploration of staff knowledge and beliefs regarding delirium an important aspect. To accomplish this, a recently published tool was translated, adapted and subsequently applied to healthcare staff of the participating units before and after the intervention.³³

2.8 | V.D. Process. Reflecting and evaluating. Assessment of adherence

Of the eight domains that were incorporated into the intervention, four of them were selected based on their presence in the existing guidelines for delirium prevention and the ease of monitoring their

TABLE 1 Strategies and implementation actions in accordance to the CFIR model

Topic/Description	Strategies for implementation	Results of implementation
I. Intervention characteristics		
A. Intervention source	Search for international and national literature	There are experiences of implementing nPPD nationally and internationally but not with use of the CFIR model
B. Evidence strength and quality	Search for international and national literature	Good level of evidence of the impact of prevention of non-pharmacological delirium with multicomponent intervention
C. Relative advantage	Application of knowledge and beliefs instrument	Clinicians agree that patients with delirium complicate providing medical attention The advantage of decreasing delirium is to improve patient care
D. Adaptability	Meeting with heads of units and opinion leaders to define nPPD local protocol Training with clinical teams Definition of local leaders Feedback with local leaders	Highly adaptable to the local reality Hospital has prior experience in the prevention of delirium It agreed to improve the local nPPD protocol, increasing from six to eight domains (orientation, environment management, early mobilization, correction of sensory impairment, sleep protocol, hydration correct, family participation and drug reduction) Definition of roles considering opinions
E. Triability	Study corresponds to a pilot study	An implementation program is designed and implemented according to the CFIR model on a small scale (two hospitalization units)
F. Complexity	Evaluated with an instrument of knowledge and beliefs Worked on in clinical team training Feedback with local leaders. Improvement of facilities	Nurses and nurse assistants do not perceive high difficulty in the measures but a slight increase in the workload in the short term. However, the load should diminish in the long term if the delirium decreases
G. Design quality and packaging	Training and feedback with opinion leaders and local leaders (heads of units) Delivery of study material Creation of a brochure about delirium Creation of nursing medical care Installation of clock and calendar in all rooms Meeting with physical therapist	Coordination with opinion and local leaders to incorporate protocol into the work routine so as not to increase the burden Definition of roles considering opinions Support of intervention team in the installation of environmental management material (calendars, clocks) Activities to be performed by physical therapy in early-mobilization protocol are defined
H. Cost	Research project funds	Financing allows provision of human resource (support agents for external change) and material for implementation plan The physical conditions for implementation are available
II. Outer setting		
A. Patient need and resources	Meetings and feedback with local leaders and opinion leaders (heads of units) Assessed with an instrument of knowledge and beliefs. Creation of a brochure about delirium	Program considers the needs of patients (improvement of environment and hospital care) Organization receptive to changes Barriers and facilitators are gathered with an instrument Information brochure is given to family members (see Table 2)
B. Cosmopolitanism	No specific strategy	There is no formal network of communication with other institutions, but there is an exchange of experiences in annual conferences
C. Peer pressure	No specific strategy	On the national setting level, it does not exist
D. External policy and incentives	Research project funds for state health	State encouragement of research in older adults allows development of the project. There is no institutional incentive policy

TABLE 1 (Continued)

Topic/Description	Strategies for implementation	Results of implementation
III. Inner setting		
A. Structural characteristics	Assessed in part with an instrument of knowledge and beliefs	University hospital, with emphasis on teaching and research, receptive to the implementation of protocols that improve clinical practice. The healthcare staff is young and is receptive to changes and have interest in delirium training
B. Networks & communications	Assessed in team training Assessed in meetings with opinion leaders and locals Use of clinical meetings (which are formal instances of communication) to systematically deliver information about delirium prevention program Use of social networks	Good communication between staff of the same hierarchy. Communication is less fluent between different levels The non-pharmacological prevention protocol was systematically extended through regular clinical meetings. Social networks (WhatsApp) helped maintain fluid communication about the delirium protocol and promoted the inclusion of delirium knowledge in the practical training plan for internal medicine and nursing residents, improving formal communication among staff
C. Culture	Team training Meetings with opinion leaders and locals Application of knowledge and beliefs instrument	The opinions and method of organization of the units is gathered Definitions of roles considering opinions
D. Implementation climate	Favourable climate, interest and receptive institution.	
1. Tension for change	Assessed with an instrument, trainings and meetings with leaders.	Clinicians refer that high prevalence of perceived delirium alters the quality of care provided to the patient; therefore, a change should be made, implementing stable prevention protocols.
2. Compatibility	Team training Meetings with opinion leaders and locals Creation of nursing medical care Assessment of adherence	We shall try to adjust specific nPPD activities to their usual practice to facilitate their implementation Definition of roles considering opinions
3. Relative priority	Assessed with instrument, training and meetings with leaders	After implementation, subjective aspects, such as interest and importance in implementing the protocol, were evaluated, as well as objective adherence to 12 selected indicators, 3 indicators for each of the four domains (environmental management, early mobilization, sensorial impairment and drug reduction) evaluated by external personnel improve
4. Organizational incentives and rewards	No specific strategy	The definition of opinion leaders and local leaders provided an incentive to incorporate the measures
5. Goals and feedback	Training for clinical teams Meetings with leaders	During training, the objectives are clearly stated and feedback is gathered.
6. Learning climate	Meetings with leaders	They reported a positive climate
E. Readiness for implementation	Tangible commitment of the organization to implement the intervention	
1. Leadership engagement	Meetings with heads of units Local leaders were defined, according to their own interest and motivation to lead the implementation of the protocol in their unit Specific functions were defined by local leaders	Teaching and research hospital that promotes leadership action Support for change and leadership of heads of units and local leaders One nurse was established as a local leader per duty, who has daily contact with the rest of the healthcare staff
2. Available resources	Research project funds	Financing allows to provision of human resource (agents of external change) and material for implementation plan The physical conditions for implementation are available

(Continues)

TABLE 1 (Continued)

Topic/Description	Strategies for implementation	Results of implementation
3. Access to knowledge and information	Training and feedback with local leaders and opinion leaders (heads of units) Delivery of study material Creation of a brochure about delirium Creation of nursing medical care Installation of clock and calendar in all rooms	Project information and non-pharmacological prevention measures are easily accessed in the electronic clinical record
IV. Characteristics of individuals		
A. Knowledge and beliefs about the intervention	Application of knowledge and beliefs instrument	Knowledge and perceptions are evaluated before and after training and implementation of measures
B. Self-efficacy	Assessed in team training	Good perception of abilities after training
C. Individual stage of change	Assessed with instrument Reassessment of adherence (assessed with adherence to the 12 indicators)	Young staff, with little experience, but with an interest in training Adherence to the evaluated indicators improved (objective evaluation), reflecting a change not only in knowledge and beliefs, but also in behaviour that was maintained at follow-up
D. Individual identification with organization	No specific strategy	No specific action will be taken
E. Other personal attributes	Assessed with instrument	Young staff, with little experience, but with an interest in training
V. Process		
A. Planning	Planning according to CFIR model	Execution of actions as planned
B. Engaging	Motivating and engaging through different strategies	
1. Opinion leaders	Meetings with opinion leaders	The opinion leaders are incorporated before, during and after implementation
2. Formally appointed internal implementation leaders	Meetings with local leaders	Local leaders are defined based on their motivation for the topic
3. Champions	Support by local nPPD expert	Hospital expert collaborates in delivering nPPD recommendations
4. External change agents	Project staff act as support staff Generate support material for implementation	External support agent conducts training, feedback meetings and responds to contingent problems
C. Executing	Face-to-face support, feedback	The implementation is conducted according to the established plan
D. Reflecting & evaluating	Feedback after training Reassessment of adherence	Formal instances to reflect on the implemented measures Assessment of adherence to measures at different times is defined

Abbreviations: CFIR, consolidated framework for advancing implementation science; nPPD, nonpharmacological interventions to prevent delirium.

activities by a trained external evaluator. The selected domains were environmental management, early-mobilization protocol, correction of sensorial deficit and drug reduction.

2.9 | Outcomes

Assessments were planned as follows: one baseline measurement (O1), one measurement after the training process (O2) and one

follow-up measurement (6 months after training: O3), aiming at evidencing short- and medium-term adherence to the four domains of the nPPD.

The primary outcome assessed was the rate of adherence to application of nPPD measures, comparing measurements in O2 and O3, to the baseline measurement (O1). For that, a global adherence rate was constructed by summing the 12 indicators, comprising three items for each of the four domains (environmental management, early mobilization, sensorial impairment and drug reduction).

TABLE 2 Domains and team actions of nPPD

	N	NA	PT	PH	IL	EChA
1	Orientation					
	√	√	-	-	Check	Included in nursing medical care
2	Environment management					
	-	√	-	-	Check	Installation of calendars and clocks.
	-	√	-	-	Check	Included in nursing medical care
	√	√	-	-	Check	Included in nursing medical care
	√	-	-	-	-	Information in brochure
	-	√	-	-	-	Training to clinical teams
3	Early mobilization					
	-	-	-	√	Check	Training to physicians
	-	-	√	-	-	Training to physiotherapists
4	Correction of sensorial impairment					
	√	√	-	-	Check	Included in nursing medical care
5	Sleep protocols					
	√	√	-	√	-	Included in nursing medical care
	√	-	√	√	Check	Training to clinical teams
	√	√	-	√	-	Training to clinical teams
6	Hydration correct					
	√	√	-	√	Check	Training to clinical teams
7	Family participation					
	-	-	-	√	-	Training to clinical teams
	√	-	-	-	Check	Information in brochure
8	Drug reduction					
	-	-	-	√	Check	Training to physicians
	-	-	-	√	Check	Training to physicians

Note: The sign √ means the direct participation for different professional and non-professional roles for each domain (1-8) and activities of our non-pharmacological delirium prevention program (NPPD). Abbreviations: EChA, external change agents; IL, internal leaders; N, nursing; NA, nurse assistant; nPPD, non-pharmacological interventions to prevent delirium; PH, physicians; PT, physical therapist.

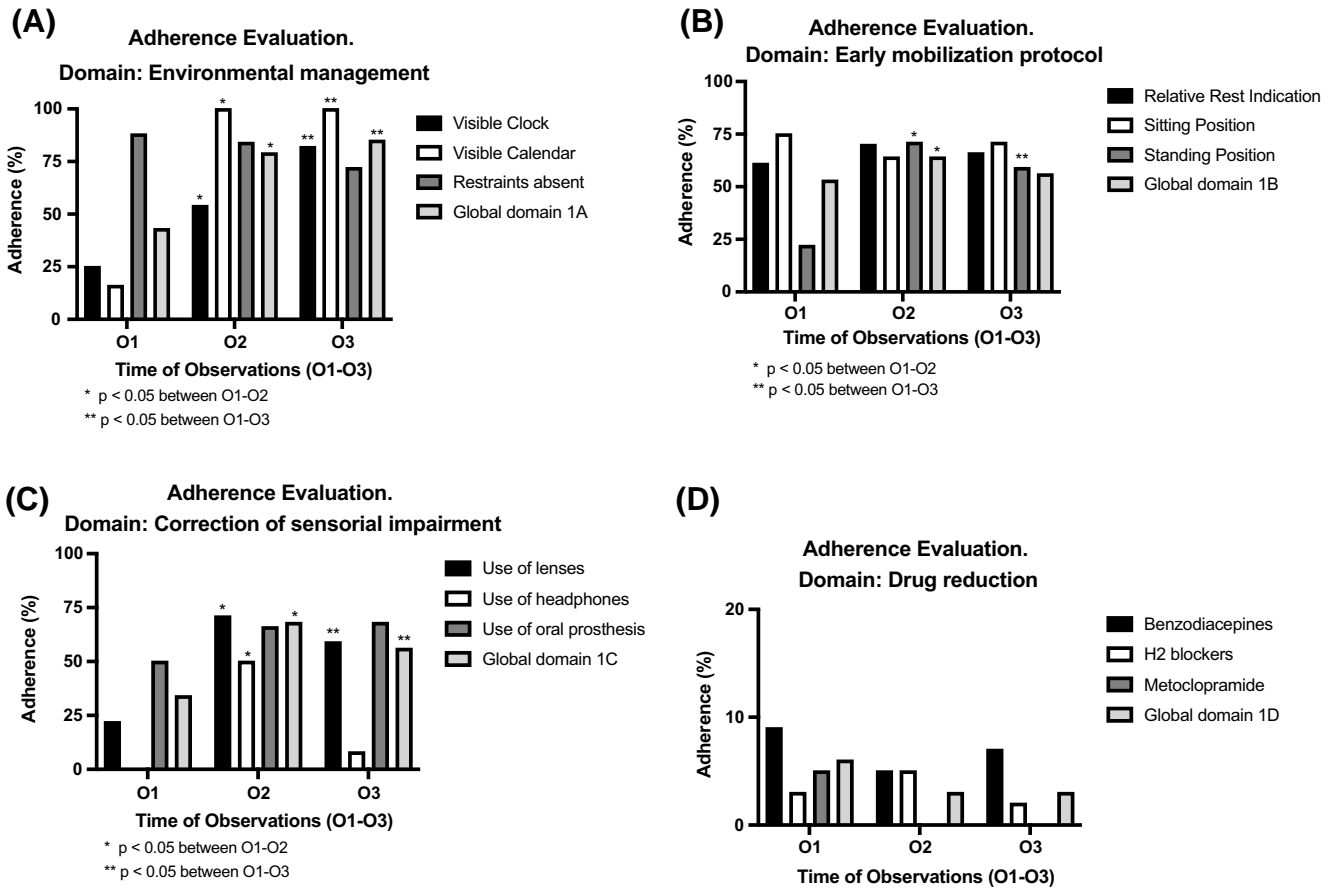


FIGURE 1 Adherence evaluation to nonpharmacological interventions to prevent delirium

Adherence rate per domain was reported and for each of the 12 individual indicators.

Additionally, staff knowledge and beliefs regarding delirium were compared before (O1) and after (O2) implementation with a tool that included 15 questions about staff characteristics, knowledge assessment with true or false statements and assessment of beliefs and practices regarding delirium. Moreover, a section was added to this evaluation on the perception of the nPPD program implementation by the healthcare staff, both for each domain, as well as through a global cumulative score.

Finally, as a secondary outcome, delirium incidence before and after the implementation process was assessed using the confusion assessment method (CAM)³⁴ administered by a trained occupational therapist twice a day during the first 5 days of hospitalization, including weekends. CAM diagnostic criteria was fulfilled by the presence of (1) either acute change or fluctuation obtained from a family member or nurse aware of the patient's baseline mental status, (2) inattention assessed by month of the year backwards or digit-span backwards (4 digits), plus either (3) disorganized thinking, defined as unclear or illogical flow of ideas during patient assessment or a wrong answer to questions, such as place/time orientation or relevant personal data, including age or birth date or (4) an altered level of consciousness defined as a Sedation Agitation Scale difference of 4.

2.10 | Ethics

The present study was approved by the Research Ethics Committee of the Hospital Clínico Universidad de Chile, and all participants provided written-informed consent.

2.11 | Sample size

Based on historical data, we estimated a basal adherence of 60% to the four defined domains. Considering a 20% relative increase in adherence as clinically significant and using a power of 80% and a bilateral alpha of 0.05, the sample size for observations required 260 assessments for each one of the evaluations (O1, O2 and O3).

2.12 | Statistical analysis

Mean (SD) and proportions (%) are used as required for descriptive statistics. Comparison between assessments at O2 and O3, as compared to O1, was performed using Chi-squared test with a significance level of $p < 0.05$. GraphPad Prism 8 software was used for

TABLE 3 Demographic characteristics and hospital outcomes in older patients studied at different times for evaluation of adherence to delirium prevention measures

Time of evaluation	O1	O2	O3	Total
Number of patients	25	23	24	72
Gender female, <i>n</i> (%)	10 (40)	11 (48)	12 (50)	22 (46)
Age (years old), mean (standard deviation)	76 ± 8	75 ± 7	77 ± 10	76 ± 8
Unit intermediate care, <i>n</i> (%)	8 (32)	11 (48)	7 (29)	26 (36)
Hospital stay, median (p25–75)	28 (14–56)	22 (13–41)	12 (7–20)	20 (9–36)
Hospital mortality, <i>n</i> (%)	2 (8)	3 (13)	2 (8)	7 (10)

statistical analysis. Subgroup analyses were conducted for the data collected by different healthcare staff (medical, nursing and nurse assistant teams).

3 | RESULTS

Implementation of the CFIR-based delirium prevention program produced an increase in global adherence to nPPD measures from 58.2% (428/735) at the O1 measurement to 77.9% (561/720) in O2 and 75.6% (492/651) in O3 (O2 vs. O1: RR 0.66; 95% CI 0.59 to 0.72; $p < 0.0001$ and O3 vs. O1: RR 0.71; 95% CI 0.64 to 0.77; $p < 0.0001$).

This change was dependent on increases in two of the four domains, environmental management and correction of sensorial impairment. Our adherence to an early-mobilization protocol and drug reduction did not change significantly after the intervention. The percentage of adherence to the nPPD program domains and indicators at O1, O2 and O3 assessments are shown in Figure 1.

Delirium incidence was assessed by CAM in 72 older adults across three points (25, 23 and 24, respectively), not including those who did not meet inclusion criteria. The patient sample that was evaluated was generated from the sample size of required adherence evaluations. Patient demographic characteristics at O1, O2 and O3 are shown in Table 3. The CFIR-based implemented program produced a decreased trend in delirium incidence during periods O1, O2 and O3, from 20%, to 18% to 16%, respectively (O3 vs. O1: RR 0.9, 95% CI 0.52 to 1.97; $p = 0.99$).

During CFIR-based program implementation, 82 healthcare staff were assessed and trained (86% of the total sample) (age 34 + 10 years, 74% female; 65% had less than 5 years' work experience). Their demographic characteristics and interest in delirium, including information separated by profession in both assessments, are shown in the supplemental material (Table S1). There were no differences among demographic characteristics between evaluations. After program implementation (O2) (n : 67 assessments, 71% of healthcare team), the proportion of staff with a self-perception of having been trained increased from 13% to 74% ($p < 0.01$).

At baseline (O1), there were significant differences in knowledge concerning delirium among the healthcare team members assessed by the mean score of staff knowledge and a perceptions tool (Table S2), with higher scores for physicians (13.8 + 0.8) than nurses

(11.7 + 2.1) and nurse assistants (10.1 + 2.1) (comparisons: physicians vs. nurses $p = 0.04$; nurses vs. nurse assistant $p = 0.003$). Implementation of the CFIR-based delirium prevention program produced an increase in the mean score of staff knowledge and the perceptions tool, from 11.1 + 2.4 at baseline to 12 ± 2 in assessment O2 ($p = 0.014$). The most significant advances regarding knowledge were related to recognizing poor nutrition, impaired vision and hearing impairment as factors predisposing to delirium. Details of each answer separated by the different professions of the healthcare staff, as well as changes between assessments O1 and O2, are documented in supplemental material (Table S2).

Implementation of the CFIR-based delirium prevention program was associated with an improvement in delirium related beliefs and practices in the three dimensions evaluated: 'importance of delirium prevention', 'delirium screening is part of my role' and 'avoid use of benzodiazepines (lorazepam, clonazepam) as a strategy of prevention'. On this point, there were also differences depending on healthcare profession that are shown in supplemental material (Table S3).

After implementation of the CFIR-based delirium prevention program, staff perception regarding global perception of implementation of measures (either totally or partially) increased from 74.8% (476/636) to 81.9% (422/515) ($p = 0.004$). The perception of implementation of the measures was significant for the environmental management domain (Figure 2).

4 | DISCUSSION

To our knowledge, this is the first study showing the complete implementation process of a program of non-pharmacological measures for the prevention of delirium based on the CFIR theoretical framework of the science of implementation and its association with a significant increase in adherence to those preventive interventions, including a time-sustained effect reaching 6 months of follow-up.

Recently, the PADIS 2018 guidelines, in the setting of critical care patients, recommend the use of IS to implement these clinical guidelines for analgesia, sedation, delirium and mobilization in critical care patients; however, application of these measures in this scenario is still pending.³⁵ Available evidence for the use of IS in the prevention of delirium is based on the use of several elements and theoretical frameworks but not in the comprehensive use of them.

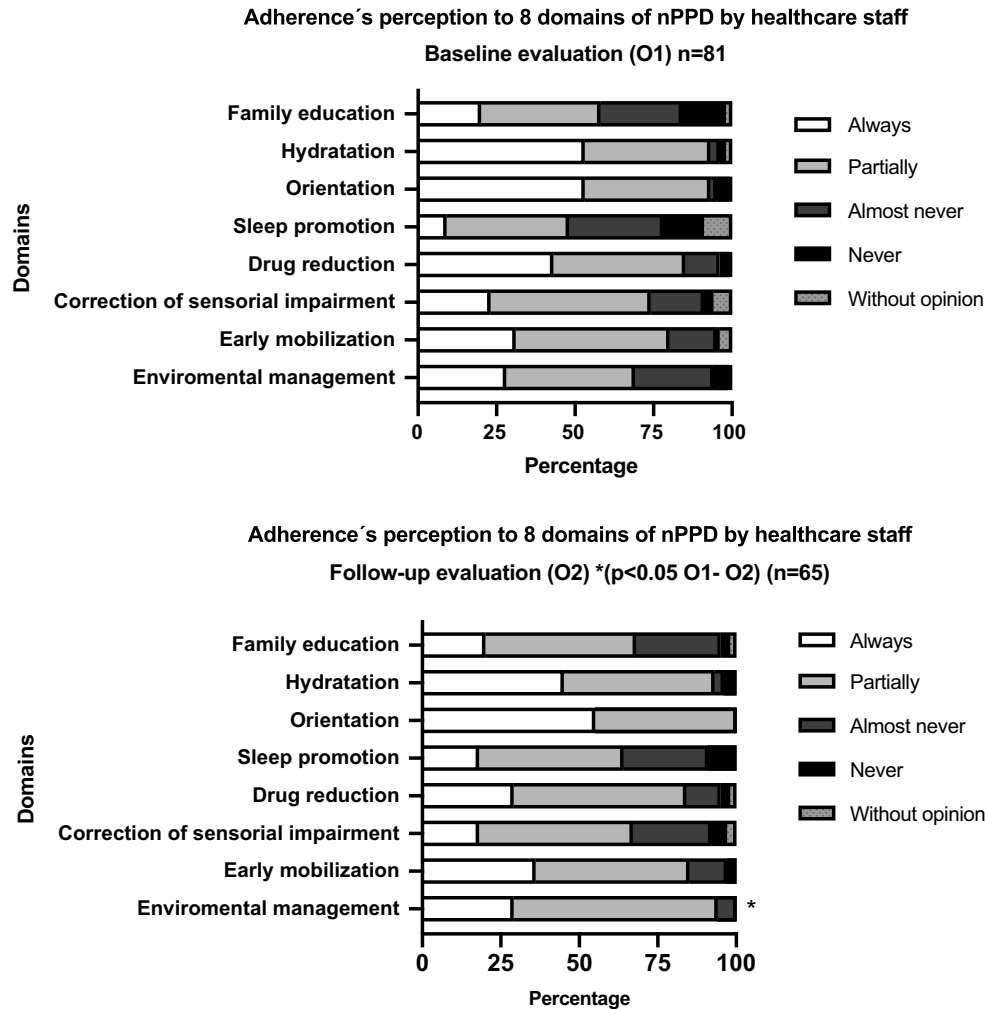


FIGURE 2 Adherence's perception to eight domains of nonpharmacological interventions to prevent delirium by healthcare staff

This is how Mudge A, et al. used the iPARISH framework for a protocol of prevention of geriatric syndromes in the hospitalized elderly or the COGCHAMPS initiative that performs a series of interventions to deal with hospitalized patients with cognitive deficits.^{36,37} The use of the CFIR framework enables a relatively detailed understanding of the strengths and weaknesses of the implementation of a non-pharmacological delirium prevention program aiming at improving its reach to older hospitalized persons.

The significant improvement documented in global adherence to nPPD measures was dependent on only two of the four assessed domains, environmental management and correction of sensorial deficits. Global adherence to the domain 'early mobilization' did not change; however, the indicator 'Standing position' increased significantly between O2 and O3 compared to O1. This indicator might be the most critical compliance indicator for assessing the implementation of 'early mobilization' practices compared to the other evaluated indicators, 'indication of relative rest' and 'sitting position'. Similarly, no significant change was observed for the domain 'drug control'; however, this might be due to the low use of triggering medications at the baseline assessment.

The assessment of baseline knowledge about delirium showed significant differences between healthcare professionals (physicians, nurses and nurse assistant), with lower scores for nurse assistants, comparable with data of nurses reported by Sinvani et al.³³ That difference must be considered to optimize the educative actions associated during the implementation process because several actions related to the care of older hospitalized persons are part of the activities performed by this assistant staff. Therefore, actions should focus on their training and motivation. For example, the perception of a higher delirium prevalence (50%) than that detected in the study (20%) might be due to confusion between delirium and dementia, a common situation among staff with poor training that it is important to address during educational activities. The implementation of nPPD produced a significant improvement in knowledge among the healthcare team, more relevant among nurse assistants (Table S3), showing that the whole team is suited for these educational activities.

Regarding staff beliefs and practices on delirium, the implemented program increased perception of the importance of delirium prevention and recognition as part of duties for all healthcare staff.

Both elements are essential for implementation of a delirium program since they are deeply related to the interest to adopt changes. To modify behaviours in healthcare personnel, a 'change in knowledge' is not enough. To improve clinical processes and generate significant learning leading to a 'better doing' in daily practice, it is necessary to invoke changes in the beliefs and attitudes of health personnel, which are sustainable over time, such as those described.

The findings of perception of adherence by staff are interesting. In the baseline evaluation (O1), 74% perceived global or partial adherence, in contrast with the 58.2% that we effectively measured. This difference between professionals' perceptions and reality has already been reported and has multiple potential causes.³⁸ In addition, in the domain analysis, environmental management was increased in accordance with the observed adherence findings.

Our study documents the feasibility of applying the CFIR theoretical framework in delirium prevention in developing countries. Most of the evidence and studies performed with the theoretical frameworks of the science of implementation come from developed countries, raising doubts about how this program will run in countries with fewer human resources and more vulnerable patients. Documenting the feasibility of using this tool in this context is of great value for a wide variety of populations.

Although the small sample of older adults evaluated in our study does not allow for us to determine the effect of the implementation program on the reduction of delirium, the observed incidence is consistent with reported data for these units by other studies. Álvarez et al. 2017³² studying the role of nPPD in non-ventilated older adults, reported an incidence of 20% in the control group, and in a second study designed to determine the role of a software to improve implementation of nPPD, the incidence of delirium in the control group was 15.6%.³⁹ Both results are very concordant with the incidence results reported in our study. At the international level, a review article by Inouye 2014 reports incidences in general medical units and geriatric units between 11% and 29%, with a population similar to that of our study.² Our study has some weaknesses, including being conducted at a single university centre, having both a low number of patients and of evaluated staff. Furthermore, the characteristics of the healthcare team, both demographic, as well as composition and others, are unique to our reality and might not necessarily extrapolate to other countries and/or healthcare systems. Nevertheless, we believe this design has several strengths that contribute to the knowledge related to implementation of delirium prevention strategies. First, the lack of a delirium prevention protocol in the hospital where the study was performed allowed use of the CFIR theoretical framework from the very beginning of the process. Second, report of the use of CFIR was intensive and exhaustive, in accordance with the existing recommendations, to enable replication of this report in different sanitary settings in real life, which often differ from the settings of delirium prevention clinical trials. Third, long-term measurement of adherence was included to determine whether the implementation process would be lost or would decrease over its application after the intensive training process.

5 | CONCLUSIONS

Implementation of a non-pharmacological delirium prevention program using the CFIR framework documents a significant increase in adherence to delirium prevention measures. We recommend replication of this implementation strategy in further larger scale studies for delirium prevention.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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