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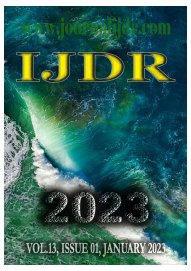

REVIEW ARTICLE **OPEN ACCESS**

ENVIRONMENT AND DELIRIUM IN HOSPITALIZED ELDERLY: INTEGRATIVE LITERATURE REVIEW

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ABSTRACT

***Objective*:** to identify studies in the national and international literature on the relationship between *delirium* and environment (ambience) in hospitalized aged people. ***Method*:** an integrative review in which the *MEDLINE/PubMed, EMBASE, CINAHL, Scopus, Web of Science and Virtual Health Library Portal* (*Portal da Biblioteca Virtual em Saúde*) databases were searched in September 2022. ***Results*:** the search resulted in 1,199 articles, of which 291 were excluded due to duplicity and 908 after reading their titles and abstracts, which resulted in 10 articles that comprised the analysis *corpus* of the review. Lower occurrence of *delirium* was associated with hospitalization in Geriatric Nursing wards (OR: 0.90, 95% CI: 0.024-0.331, p<0.001) and with implementation of a home-based hospital during rehabilitation (OR: 0.17, 95% CI: 0 .03-0.65, p=0.0564); there was an association between *delirium* and night time medical evaluations (OR: 2.22, 95% CI: 1.17-4.22, p=0.015), time spent in the emergency sector greater than 10 hours (OR: 2.23 95% CI: 1.13-4.41, p=0.04), and room transfers per patient/day (OR: 9.69 95% CI: 6.20-15.16, p<0.0001). ***Conclusion*:** changes in the environment are precipitating factors for *delirium*. The environment is a potentially modifiable risk factor for *delirium* reduction in hospitalized aged people.

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INTRODUCTION

The term ambience permeates several knowledge areas, such as architecture and urbanism, health, social assistance, worker's health and gerontology. In health, ambience was advocated by the Ministry of Health's National Humanization Policy (*Politica Nacional de Humanização*, PNH) and "it refers to the treatment given to the physical space, understood as a social, professional and interpersonal relationship space that should provide welcoming, resolute and humanitarian care" (Brazil, 2010). The term ambience comes from the French "*ambiance"* and can be translated as environment (Bestetti, 2014). The PNH considers "ambience" based on three axes: the space that aims at comfort: the space as a tool that eases the work process: and ambience as a space for encounters between subjects. Comfortability values privacy, comfort and the elements that make up the environment (noise level, color, ventilation, lighting, temperature and furniture), in addition to organization of the space in order to guarantee accessibility. In turn, the space as a tool for improving work processes refers to performing activities with optimization of resources, humanization and welcoming, so that the environment is suitable for everyone who uses it.

Ambience as a meeting space allows producing subjectivities in the arrangement of the environment and in its use that exert impacts on people's subjective well-being by providing the encounter and, through this, a possibility for reflection and action capacity (Brazil, 2010). The hospital environment is the health facility for hospitalization and treatment of patients; however, this definition can be considered a paradox since, on certain occasions, hospitalization can further destabilize pathophysiological and psychological conditions, being capable of generating other adverse events. The hospital sometimes transits as a space that will provide symptom relief, health recovery, access to diagnosisand ideal treatment, and others as an environment that can also generate anxiety and anguish (Bezerra *et al*., 2021).

Hospitalization of aged people requires greater attention from the professionals responsible for managing the physical, social and professional spaces, as well as those related to interpersonal relationships. It is indispensable to provide the necessary means for a welcoming, resolute and human environment, as the aged population is the one that most uses hospital services when compared to other age groups. Disorientation in time and space and environmental stimuli, under different conditions, can make an aged person

susceptible to adverse events such as the occurrence of *delirium*. One third of hospitalized aged people are affected by *delirium* (Marcantonio, 2017). It is an acute disorder related to attention, awareness and cognition that leads to increased mortality, institutionalization and cognitive decline (Witlox *et al.*, 2010). In addition, it brings about consequences for the health system as a whole due to its social, medical and economic implications (Oh *et al*., 2017). Although the causes of *delirium* are related to acute diseases, exogenous intoxication, exposure to toxins and abstinence from substances, among other etiologies (American Psychiatric Association, 2013), some researchers have shown that non-pharmacological interventions such as sleep hygiene, time orientation stimuli and space and sensory stimuli can prevent it (Hshieh *et al*., 2015). Such data may indicate that environmental factors play an important role in the development of *delirium*. In their results, some studies point to precipitating environmental factors for the occurrence of *delirium*, namely: bed transfer (OR: 9.69; CI 95%: 6.20-15.16, p<0.0001) (Goldberg *et al.*, 2015); time spent in the emergency sector (OR: 2.23; CI 95%: 1.13-4.41) (Bo *et al*., 2009); presence of louder sound levels for 12h-18h (OR: 1.15; CI 95%: 1.036-1.292, p =0.011) in adults admitted to Intensive Care Units (ICUs) (Sangari *et al*., 2021); and daylight intensity in hospital beds with and without windows (Iwamoto *et al*., 2018). As well as provision of ward-type beds and/or single rooms in the ICU, where *delirium* was reduced in 0.4 days (95% CI: 0.1-0.7, p=0.005) (Zaal *et al*., 2013). Identifying the relationship between ambience and the occurrence of *delirium* in hospitalized aged people is relevant, given the significant percentages of *delirium* found in this age group, which proves to be one of the most complex management problems in the hospital context. Given the above, this study aimed at identifying studies in the national and international literature on the relationship between *delirium* and ambience in hospitalized aged people.

METHODS

This is an integrative literature review and, for that purpose, the due methodological stages were taken to identify the research question, establish criteria for inclusion and exclusion of studies, characterization and extraction of information from the studies, evaluation of the results, and presentation and interpretation of the results (Mendes *et al*., 2008). The following research question was elaborated, for the first stage: Which is the relationship between *delirium* and environment in hospitalized aged people? The PECO strategy (P – Population or Patient; E – Exposure; C – Comparison; O – Outcomes) (Aromataris *et al*., 2020) was used, where P (Aged people), E (Ambience), C (Hospitalization) and O (*Delirium*). For the search strategies, the *Medical Subject Headings* (MeSH) terms from *PubMed* (used for the *PubMed* and *Web of Science* databases), *EMBASE* and *Scopus* were employed in English and, in Portuguese, they were used in the *Biblioteca Virtual em Saúde* (BVS) Portal (DeCS) (Chart 1).

In the second stage, the inclusion criteria of the studies were established, namely: having people aged ≥ 60 years old as target population; being published in any language (without limit regarding publication date), including the topics of *delirium* and ambience, having been conducted in a hospital, and/or including a comparison of the hospital to other environments. The exclusion criteria were as follows: case reports, letters to the editor, abstracts in conference proceedings, dissertations, reviews, theses and monographies. The search was carried out independently in September 2022 by two researchers and resulted in a total of 1,199 articles. To reduce the possibility of search error and evaluation of the eligibility or not of the studies, a third researcher was consulted. All 1,199 articles were introduced in a bibliographic manager to remove duplicates, resulting in 908 studies that were approved for reading their titles and abstracts respecting the inclusion and exclusion criteria, which resulted in 25 studies for full reading. 10 studies were selected for review and analysis, upon fully reading the articles. The *Preferred Reporting Items for Systematic Reviews and Meta-analyses* (PRISMA) flowchart (Page *et al*., 2020) was usedto illustrate selection of the articles that comprised the integrative review *corpus* (Figure 1). In the third stage, the articles were read in full in order to characterize them and extract the data to a *Microsoft Excel*® spreadsheet, which was structured with the following data: author(s) and year of publication; publication journal; country where the study was conducted, environment of the study, instrument used to assess *delirium*, sample, study design, primary objective and level of evidence (Chart 2). In the fourth stage, a critical reading of the articles was carried out in order to synthesize all the available information and classify the level of evidence (Peters *et al*., 2015) (Chart 3). In the fifth stage, the results were analyzed and interpreted based on the research question of this integrative review. In order to end the sixth stage, a synthesis of the knowledge from the articles analyzed and emerging considerations was carried out. Chart 4 shows the characteristics of the unit and/or ambience interventions and their results in hospitalized aged people.

RESULTS

In this integrative review, the 10 selected publications proved to be regular in relation to numbers in each year of publication, with a slight predominance of 2016 (n=2; 20%), followed by 2001, 2006, 2009, 2010, 2013, 2015, 2017 and 2018 (n=1; 10%). In relation to the journals, there was higher prevalence of *BMCGeriatrics*(n=2; 20%) followed by *J Am Geriatr Soc*, *Age and Aging*, *Am J Geriatr Psychiatry*, *J Gerontol A Bio Sci Med Sci.*, *The Journal of Thoracic and Cardiovascular Surgery*, *Geriatric Emergency Medicine*, *Front. Aging Neurosci* and *Int Psychogeriatr*, all with the same number (n=1; 10%). The samples in the studies ranged from 104 to 1010 patients and the age groups were diverse and comprised age > 60 (n=1; 10%), > 65 (n=3; 30%), > 70 (n=2; 20%), ≥ 70 (n=1; 10%), >75 (n=1; 10%), and ≥ 75 (n=1; 10%). Only one of them compared younger and longer-lived older adults aged < 65 and > 65 years old (n=1; 10%). Among the countries in which the studies were conducted, Canada (n=3; 30%), Australia and Italy (n=2; 20%) stood out, followed by the United States of America, Norway and England (n=1; 10%). The main loci of the studies were hospitals (n=4; 40%) and ICUs (n=2; 20%), followed by geriatric and general wards; geriatric ward; *delirium* room and home-based hospital, with (n=1; 10%) each. Of the instruments used to assess *delirium*, the *Confusion Assessment Method* (CAM) (n=3; 30%), and the *Confusion Assessment Method for the Intensive Care Unit* (CAM-ICU) (n=2; 20%) stood out, followed by CAM and DRS; CAM/*Delirium Index*; 4AT; DSM-5, *Delirium Motor Subtype Scale* and not reported (n=1; 10%). The level of evidence for the studies varied from 1c to 3e. Regarding the methodological designs, there was predominance of retrospective cohort studies (n=3; 30%), randomized clinical trials (n=2; 20%) and prospective observational studies (n=2; 20%), followed by prospective cohort studies (n=1; 10%), retrospective observational studies (n=1; 10%) and case-control studies (n=1; 10%).

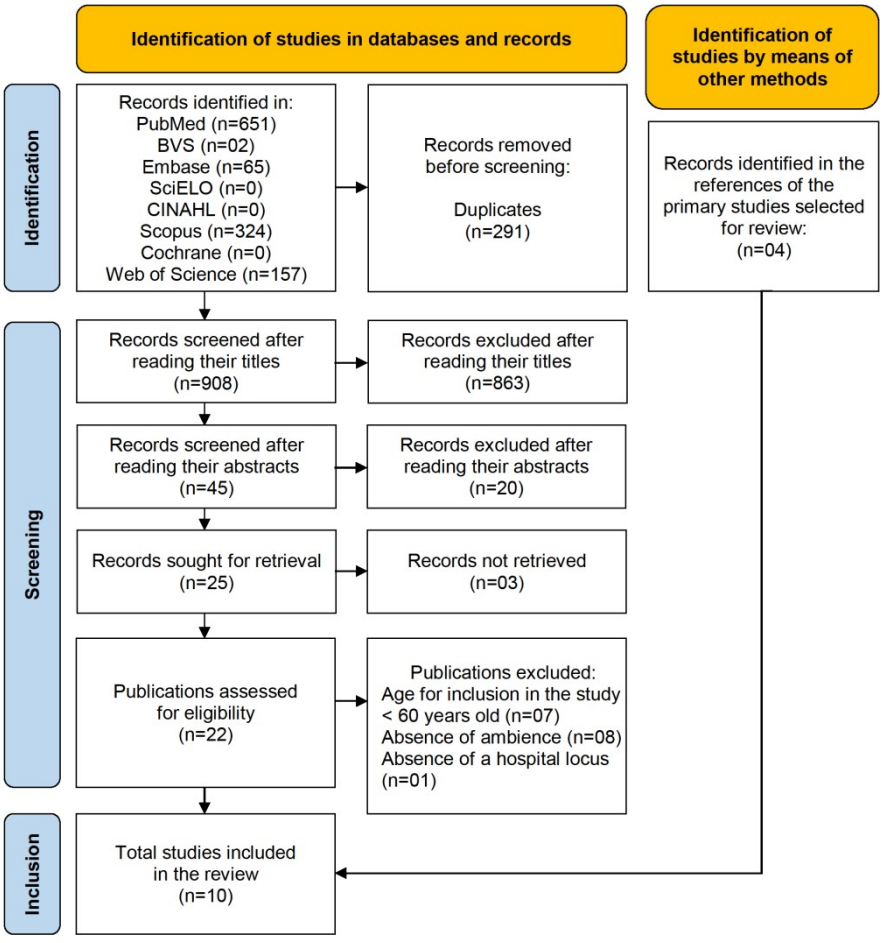
DISCUSSION

The Ministry of Health's National Humanization Policy recognizes and values individuality and elements of the environment such as color, noise level, ventilation, lighting, temperature and furniture for inclusion of most of the studies in this review (Caplan *et al*., 2006; Flaherty *et al*., 2010; Arenson *et al*., 2013; Giraud *et al*., 2016; Evensen *et al*., 2018). One study implemented a control environment (home-based hospital) and randomized 104 patients for geriatric rehabilitation in the home-based hospital and at a tertiary-level hospital in Sydney (Australia) with the objective of comparing the occurrence of *delirium* and other clinical outcomes. It was observed that thehome-based hospital group had a lower chance of developing *delirium* during rehabilitation (OR: 0.17; 95% CI: 0.03-0.65), shorter rehabilitation (15.97 vs. 23.09 days; p=0.0164) and shorter hospitalization time (20.31 vs. 40.09, p≤0.0001). The home-based hospital group was more satisfied (p=0.0057).

Chart 1. Distribution of the search strategies in specific databases, Curitiba, PR, 2022

Database	Search strategy
MEDLINE	#1 "*Architecture*"[Mesh] OR #2 "*Environment*"[Mesh] OR *Environments* OR *Impacts, Environmental* OR *Environmental Impacts* OR *Impact, Environmental* OR *Environmental Impact* OR #3 "*Hospital Design and Construction*"[Mesh] OR *Hospital Construction and Design* OR *Hospital Designs* OR *Hospital Design* OR *Design, Hospital* OR *Designs, Hospital* OR *Hospital Renovations* OR *Hospital Renovation* OR *Renovation, Hospital* OR *Renovations, Hospital* OR *Hospital Construction* OR *Construction, Hospital* AND #4 "*Delirium*"[Mesh] OR *Subacute Delirium* OR *Delirium, Subacute* OR *Deliriums, Subacute* OR *Subacute Deliriums* OR *Delirium of Mixed Origin* OR *Mixed Origin Delirium* OR *Mixed Origin Deliriums AND* #5 "*Risk Factors*"[Mesh] OR *Factor, Risk* OR *Risk Factor* OR *Social Risk Factors* OR *Factor, Social Risk* OR *Factors, Social Risk* OR *Risk Factor, Social* OR *Risk Factors, Social* OR *Social Risk Factor* OR *Health Correlates* OR *Correlates, Health* OR *Population at Risk* OR *Populations at Risk* OR *Risk Scores* OR *Risk Score* OR *Score, Risk* OR *Risk Factor Scores* OR *Risk Factor Score* OR *Score, Risk Factor* AND #6 "*Aged*"[Mesh] OR *Elderly*.
BVS	(MH:"Arquitetura" OR (Arquiteto) OR (Arquitetos) OR (Arquitetura como Assunto) OR (*Architecture*) OR (*Arquitectura*) OR MH:J01.086$ OR MH:SP4.122.403.559$ OR MH:SP8.946.702.667.537$ OR MH:"Meio Ambiente" OR (Environment) OR (Ambiente) OR (Ambiente) OR (Ambientes) OR (Avaliação de Impacto Ambiental) OR (Estudo de Impacto Ambiental) OR (Impacto Ambiental) OR (Impacto Ecológico) OR (Impactos Ambientais) OR (Medição de Impacto Ambiental) OR MH:G16.500.275$ OR MH:N06.230$ OR MH:SP4.102.072.573$ OR MH:SP8.473.654.377$ OR MH:"Arquitetura Hospitalar" OR (*Hospital Design and Construction*) OR (*Arquitectura y Construcción de Hospitales*) OR (*Design* e Construção de Hospitais) OR (Projeto e Construção de Hospitais) OR (Reforma Hospitalar) OR (Reformas Hospitalares) OR MH:J01.086.339.250$ OR MH:N02.278.200.403$ OR MH:VS3.001.001.001.002$AND MH:"Delírio" OR (Delirium) OR (Delirio) OR (Delírio) OR (*Delirium*) OR MH:C10.597.606.337.500$ OR MH:C23.888.592.604.339.500$ OR MH:F01.700.250.500$ OR MH:F03.615.350$;AND #5 MH:"Fatores de Risco" OR (*Risk Factors*) OR (*Factores de Riesgo*) OR (Correlatos de Saúde) OR (Fator de Risco) OR (Fatores de Risco Não Biológicos) OR (Fatores de Riscos Não Biológicos) OR (Pontuações de Fatores de Risco) OR (Pontuações de Risco) OR (Pontuações do Fator de Risco) OR (Pontuações dos Fatores de Risco) OR (População em Risco) OR (Populações em Risco) OR MH:E05.318.740.600.800.725$ OR MH:N05.715.350.200.700$ OR MH:N05.715.360.750.625.700.700$ OR MH:N06.850.490.625.750$ OR MH:N06.850.520.830.600.800.725$ OR MH:SP4.102.072.092.693.334.920$ OR MH:SP5.001.037.068$ OR MH:SP8.473.327.167$ AND MH:"Idoso" OR (*Aged*) OR (*Anciano*) OR (Idosos) OR (Pessoa Idosa) OR (Pessoa de Idade) OR (Pessoas Idosas) OR (Pessoas de Idade) OR (População Idosa) OR MH:M01.060.116.100$)
EMBASE	(*aged*:ti,ab,kw AND *delirium*:ti,ab,kw AND *environment*:ti,ab,kw)
Scopus	(TITLE-ABS-KEY (**aged**) AND TITLE-ABS-KEY (**delirium**) AND TITLE-ABS-KEY (**environment**)
Web of Science	(*aged* (All fields) AND *delirium* (All fields) AND *environment* (All fields))

Source: The authors (2022).



Source: The authors (2022).

Figure 1. *PRISMA* flowchart corresponding to selection of the studies, Curitiba, PR, 2022

Chart 2. Characteristics of the studies that comprised the integrative review, Curitiba, PR, 2022

Authors' data	Journal	Origin of the study	Environment	Assessment of *delirium*	Sample	Age (years old)	Study design	Primary objective	Level of Evidence
Mccusker *et al*. (2001)	J Am Geriatr Soc	Canada	Hospital	*CAM/ *Delirium* Index	444	> 65	Observational and prospective study	To assess the relationship between the environmental risk factors and severity of *delirium*.	3e
Caplan *et al*. (2006)	Age and Aging	Australia	Home-based hospital	*CAM	104	> 60	Randomized clinical trial	To compare the occurrence of *delirium*, hospitalization time, cost, †FIM, ‡MMSE, rehabilitation, §GDS and satisfaction with the home-based hospital and with the hospital.	1c
Bo *et al*. (2009)	Am J Geriatr Psychiatry	Italy	Geriatric ward and General ward	*CAM and ‖DRS	252	≥ 70	Observational and prospective study	To assess the association of *delirium* in aged people hospitalized in geriatric and general wards.	3e
Flaherty *et al*. (2010)	J Gerontol A Bio Sci Med Sci.	United States of America	*Delirium* room	*CAM	148	> 65	Observational and retrospective study	To describe a care management model, *Delirium* room.	3e
Arenson *et al*. (2013)	The Journal of Thoracic and Cardiovascular Surgery	Canada	¶ICU	**CAM-ICU	1010	< 65 and > 65	Retrospective cohort study	To examine the effect of the physical modification of the ¶ICU on ††POD.	3c
Goldberg *et al*. (2015)	BMC Geriatrics	Canada	Hospital	*CAM	994	> 70	Case-control study	To assess the association between *delirium* and room transfers in aged patients.	3d
Bo *et al*. (2016)	Geriatric Emergency Medicine	Italy	Hospital	‡‡AMT-4	330	> 75	Retrospective cohort study	To assess the relationship between time in the Emergency sector before admission to the ward and *delirium*.	3c
Giraud *et al*. (2016)	Front. Aging Neurosci.	England	¶ICU	**CAM-ICU	223	> 70	Randomized clinical trial	To assess the mirror intervention in the ¶ICU and the impact on ††POD reduction and on the postoperative outcomes.	1c
Ranasingh *et al*. (2017)	Int Psychogeriatr	Australia	Hospital	-	600	> 65	Retrospective cohort study	To compare the number of ward changes between §§OPERA and general medicine patients during hospitalization; to explore the reasons for bed changes and the relationship between transfer and negative outcomes.	3c
Evensen *et al*. (2018)	BMC Geriatrics	Norway	Geriatric ward	‖‖DSM-5, *Delirium Motor Subtype Scale*	254	≥ 75	Prospective cohort study	To investigate the association of ward transfers, arrival at the emergency room at night, time spent in the emergency sector and night time specialist visits, night time radiological procedures with *delirium* and its motor subtypes in patients hospitalized in a geriatric ward.	3c

Note: *CAM = Confusion Assessment Method; †FIM = Functional Independence Measure; ‡MMSE = Mini-Mental State Examination; §GDS = Geriatric Depression Scale; ‖DRS = Delirium Rating Scale, ¶ICU = Intensive Care Unit; **CAM-ICU = Confusion Assessment Method for the Intensive Care Unit; ††POD = Postoperative *Delirium*; ‡‡ 4-ATM = Abbreviated Mental Test; §§OPERA = Older Person Evaluation Review and Assessment; ‖‖DSM-5 = Diagnostic and Statistical Manual of Mental Disorders,5th edition.

Chart 3. Classification of the level of evidence of the studies, Curitiba, PR, 2022

Level of Evidence	Study designs
1	Experimental research designs:
1.a	Systematic review of randomized controlled trials;
1.b	Systematic review of randomized and controlled trials and other study designs;
1.c	Randomized controlled trial;
1.d	Randomized controlled pseudotrials.
2	Quasi-experimental designs:
2.a	Systematic review of quasi-experimental studies;
2.b	Systematic review of quasi-experiments and other study designs with lower levels of evidence;
2.c	Prospectively controlled studies of quasi-experiments;
2.d	Pre- and post-test or retrospective, historical and controlled group studies.
3	Observational - Analytical outcomes:
3.a	Systematic review of comparable cohort studies;
3.b	Systematic review of comparable cohorts and other study designs with lower levels of evidence;
3.c	Cohort study with control group;
3.d	Case-control study;
3.e	Observational studies with no control group.
4	Observational - Descriptive studies:
4.a	Systematic review of descriptive studies;
4.b	Cross-sectional study;
4.c	Case series;
4.d	Case study.
5	Experts' opinions - Laboratory bench research studies
5.a	Systematic review of experts' opinions;
5.b	Consensus among experts;
5.c	Laboratory research study/Experts' opinion.

Source: Peters *et al*. (2015)

Chart 4. Characteristics of the unit and/or ambience interventions and their results in hospitalized aged people. Curitiba, PR, 2022

Authors' data	Characteristics of the unit/intervention	Result
Mccusker *et al*. (2001)	To evaluate the effect of isolation due to multidrug-resistant germs and other environmental factors such as room type, room changes, sensory stimulation levels, hospital unit, presence of personal objects and presence of family members on *delirium*.	The variables related to the increase in the *delirium* severity scores were as follows: intensive care, 12.3 (*SD = 5.7); number of room changes, 8.2 (*SD = 4.9); long-term care unit, 8.7 (*SD = 2.3); absence of a clock, 8.1 (*SD = 4.4); absence of glasses, 7.5 (*SD = 4.5); presence of family members, 7.2 (*SD = 4.9); and presence of chemical, 7.5 (*SD = 4.8) and physical, 8.9 (*SD = 4.6) restraints.
Caplan *et al*. (2006)	The patients were randomized to the in-hospital and home-based services, with home-based rehabilitation provided by a multidisciplinary team similar to the in-hospital one specialized in Ortogeriatrics.	The home-based group had a lower chance of *delirium* during rehabilitation (†OR: 0.17; ‡95% CI: 0.03-0.65), shorter rehabilitation (15.97 vs. 23.09 days; p=0.0164) and shorter hospitalization time (20.31 vs. 40.09 days, $p \leq 0.0001$). The home-based group was more satisfied (p=0.0057).
Bo *et al*. (2009)	Principles of the Gerontology ward: effective communication, avoiding bed rest, encouraging early mobilization and ambulation, non-pharmacological approaches to sleep and anxiety, maintaining nutritional status and hydration, controlling pain and reducing polypharmacy. There were no limitations regarding time for visits.	*Delirium* was found in 6.6% in the Gerontology ward (AGW) and in 15.2% in the General ward. Hospitalization in the AGW was associated with less *delirium* (OR: 0.90; 95% CI: 0.024-0.331, p<0.001). The increase in the incidence of *delirium* was associated with greater cognitive impairment (p<0.001) and to recent stressful events (p<0.001).
Flaherty *et al*. (2010)	Implementation of a management model, *Delirium* room. The *Delirium* room is closer to the Nursing station; the Nursing team observes and manages the patient 24 hours a day, preserving the patient's privacy. Physical restraints are not used. Emphasis on a non-pharmacological approach.	The prevalence and incidence of *delirium* were 16.2% and 16.1%, respectively. For §ADLs, there was an improvement in patients with *delirium* (from 4.1 ± 4.6 at admission to 6.1 ± 3.9 at discharge) and deterioration in those without *delirium* (from 7.4 ± 4.7 at admission to 6.9 ± 4.5 at discharge) (p<0.001). There was no difference in length of stay between the patients with and without *delirium* (6.4 ± 3.1 and 5.9 ± 3.6 days, p=0.46) and deaths (4.5% and 1.9%, p=0.58).
Arenson *et al*. (2013)	Physical modification of the ‖ICU. ‖ICU 1 was characterized by the absence of physical barriers between the beds, exposure to the “traffic” noise and absence of windows. ‖ICU 2 was less exposed to the “‘traffic” noise and offered private rooms with physical barriers, windows to the outside, and visual access to a clock.	The overall prevalence of ¶POD was 14.7%: 6.2% in patients aged less than 65 years old and 21.4% in those over the age of 65. No significant difference was found in the prevalence of ¶POD between both ‖ICU environments. Diverse evidence suggests that the ‖ICU environment can exert a heterogeneous effect on *delirium* both among older and younger patients.

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Goldberg *et al*. (2015)	The number of room transfers was evaluated in the first hospitalization week of the patients with *delirium* and of those in the group without *delirium*.	The mean hospitalization times were 11.6 days in the patients with *delirium* and 7.8 days in those without *delirium*, $p<0.001$. The number of room transfers in the *delirium* group was 2.21 (1.28) when compared to 1.68 (0.93) in those without *delirium*, $p<0.0001$. The logistic regression model evidenced that room transfers per patient/day were associated with *delirium* (†OR: 9.69; ‡95% CI: 6.20-15.16, $p<0.0001$).
Bo *et al*. (2016)	To assess the Emergency Department (**ER) space and the association between time in the **ER before admission to the ward and *delirium.*	*Delirium* was associated with time spent in the emergency sector greater than 10 hours (†OR: 2.23 ‡95% CI: 1.13-4.41), with moderate to severe cognitive impairment (†OR: 5.47 ‡95% CI: 2.76-10.85) and with advanced age (†OR: 1.07 ‡ 95% CI: 1.01-1.13).
Giraud *et al*. (2016)	The mirror intervention in postoperative care in the ‖ICU consisted in using and training on two types of mirrors to support mental state, attention, physical mobilization, feedback and multisensorial integration. One mirror was for personal use to see the face and another, standard of 160 × 50 cm, to provide visual feedback in support of proprioception.	The intervention was not associated with a reduction in *delirium* in the ‖ICU (17% Mirrors vs. 16% Habitual Care) or duration [Mirrors: 1 (1– 3) vs. Habitual Care: 2 (1–8)]. The intervention exerted no significant impact on other secondary outcomes.
Ranasinghe *et al*. (2017)	To randomize the care measures from a team coordinated by a geriatrician who reviewed the initial assessment of older adults (††OPERA), and the other under the care of general practitioners. The number of bed transfers was evaluated and the patients that underwent at least three transfers were compared.	The ††OPERA group patients were more likely to have cognitive impairment ($p=0.005$), be moderate to severely frail ($p=0.016$), and present *delirium* at admission ($p=0.03$), when compared to those in the general clinical practice. *Delirium* occurred in 33 (49.4%) patients from the ††OPERA group and in 5 (22.7%) from the general clinical practice who underwent at least three bed transfers ($p=0.03$).
Evensen *et al*. (2018)	The patients were evaluated in the Emergency sector and the radiological procedures were performed before proceeding to the ward. The time of arrival at the emergency room was recorded, as well as the time in the unit, the time to perform imaging tests and night time medical visits. The nurses recorded the ward transfers (yes/no).	There was a significant association between night time investigations and *delirium* (†OR: 2.22; ‡95% CI: 1.17-4.22, $p=0.015$). There were no associations between any other exposure variables (time in the emergency sector, transfers between wards, arrival at the unit during the night and *delirium*. No exposure variable was associated to the motor subtypes of *delirium*.

Note: *SD = Standard Deviation; †OR = Odds Ratio; ‡CI = Confidence Interval; §ADLs = Activities of Daily Living; ‖ICU = Intensive Care Unit; ¶POD = Postoperative *Delirium*; **ER = Emergency Room; ††OPERA = Older Person Evaluation Review and Assessment.

One of the possible strategies, considering reduction of *delirium* in the hospital environment, would be to develop programs that render the wards' environment more similar to the home and less rigid and invasive in the everyday routines (Caplan *et al*., 2006). The *delirium* room, consideredby theauthors as a new care management model, consists of a room with beds within an Acute Care unit for aged people, which offers 24-hour Nursing care, focusing on non-pharmacological approaches and completely free from physical restrictions. In a sample of 148 patients with 16.2% (24/148) prevalence of *delirium* at admission and, during monitoring in the room, a value of 16.1% (20/124) was observed. There was no difference in length of stay between patients in the *delirium* room (6.4 ± 3.1) and in the ward (5.9 ± 3.6 days), $p=0.46$. Mortality was 4.5% and 1.9% in the patients with and without *delirium*, respectively, $p=0.58$. There was an improvement in functionality of the patients in the *delirium* room that might equalize the outcomes in those without *delirium*, which might justify the non-association of *delirium* with increased length of stay and death (Flaherty *et al*., 2010).

A retrospective cohort study conducted in Winnipeg (Canada) with 1,010 patients aged < 65 and ≥ 65 years old after cardiac surgery in two different Intensive Care Units (ICUs) aimed at evaluating the effect of a physical modification of the ICU environment on postoperative *delirium* (POD). ICU 1 was characterized by the absence of physical barriers between the beds, exposure to high “traffic” noise and absence of windows, whereas ICU 2 had less exposure to noise, and offered private rooms with physical barriers, external wall-to-wall windows and access to a visible clock. There was no significant difference in POD between both ICUs (16.1% vs. 13.5%, $p=0.25$). The overall prevalence of POD was 14.7%: 6.2% in the patients aged < 65 and 21.4% in those over 65 years old. The length of ICU stay in people under 65 years old who had *delirium* was longer in ICU 1 than in ICU 2 (5.4% vs. 1.7%, $p=0.006$) (Arenson *et al*., 2013). The change in the ICU environment did not exert any effect on the prevalence of *delirium*; however, this does not exclude the interaction with other factors in a more complex way, as it presented positive results such as shorter length of stay in ICU 2 for the patients under 65 years old. Reduction of *delirium* in this environment should involve a more comprehensive approach. A study conducted with 223 aged individuals (> 70 years old) at the *Papworth Hospital*, Cambridge (England), evaluated the use of mirrors in reducing POD and improving postoperative outcomes in cardiac surgeries. Two types of mirrors were proposed for the intervention, a personal mirror to see the face and a larger one (standard mobile of 160 × 50 cm) to perform physical/occupational therapy and provide visual feedback to support proprioception. The intervention with mirrors was not associated with the reduction in *delirium*, which was 17% in the intervention group and 16% in habitual care, $p=0.705$; nor in the duration of *delirium*, with 1 day (1–3) in the intervention group vs. 2 days (1–8) in habitual care, $p=0.401$. Using the intervention favored recall of factual (not delusional) items 12 weeks after surgery, $p=0.003$. The intervention exerted no significant impact on other secondary outcomes (Giraud *et al*., 2026). Using mirrors can increase the patients' interaction with the team, and this care can help them in orientation, with the possibility of being one of the strategies in the multimodal approach to *delirium*.

A prospective cohort study conducted in the Emergency Department of a hospital in Turin (Italy) with 330 older adults aged ≥ 75 years old aimed at evaluating the association between the time spent in the Emergency Department (ER) before admission to the ward and development of *delirium*. It was observed that *delirium* was associated with time spent in the emergency sector greater than 10 hours (OR: 2.23; 95% CI: 1.13-4.41), with moderate to severe cognitive impairment (OR: 5.47 95% CI: 2.76-10.85) and with advanced age (OR: 1.07 95% CI: 1.01-1.13) (Bo *et al*., 2016). The relationship of hospital bed transfers with the care modality in the ward and *delirium* was evaluated in a retrospective cohort study conducted in Brisbane (Australia) that randomly paired two groups with 300 aged individuals. One group (OPERA) was maintained under the care of a multidisciplinary team coordinated by a geriatrician who reviewed the initial assessment of the older adults, and the other was under the care of general practitioners.

The number of bed transfers was evaluated and the patients that underwent at least three transfers were compared. It was observed that the OPERA group patients were more likely to have pre-morbid cognitive impairment (p=0.005), be moderate to severely frail (p=0.016) and present *delirium* at admission (p=0.03), when compared to general medicine patients. *Delirium* occurred in 33 (49.4%) OPERA patients and in 5 (22.7%) general medicine patients who underwent at least three transfers (p=0.03) (Ranasinghe *et al*., 2017).Despite the significant association between *delirium* and other negative outcomes to bed transfers, this association cannot be attributed to this, as the OPERA group presented a higher degree of cognitive impairment, dependence and frailty when compared to the general medicine group.

A potentially modifiable environmental factor is room transfers, which can be secondary to allocation of the patients to beds outside the destination unit, the need for movement due to prophylactic precaution and the presence of multidrug-resistant germs. A study conducted at the inpatient service of the *St. Michael Hospital* in Toronto (Canada) aimed at evaluating the association between *delirium* and room transfers. It was observed that, of the 994 patients included, 126 (12.7%) presented *delirium* in the first hospitalization week, and were compared to the control group: 868 (86.3%). There was a significant difference in the mean hospitalization time, that is, 11.6 days in the patients with *delirium* and 7.8 days in those without *delirium*, p<0.001. The number of transfers in the *delirium* group subjects was 2.21 (1.28), when compared to 1.68 (0.93) in those without *delirium*, p<0.0001. The multivariable logistic regression model showed that room transfers per patient/day were associated with higher incidence of *delirium* (OR: 9.69 95% CI: 6.20-15.16, p<0.0001) (Goldberg *et al*., 2015). Although causality cannot be inferred, room transfer is a potentially modifiable risk factor to reduce the incidence of *delirium* in hospitalized aged patients. Some studies, already presented, identified associations between environmental factors, such as room transfers and time spent in the Emergency Department (ER), and *delirium*, although none of them investigated the influence of environmental factors on the motor subtypes of *delirium*. A prospective cohort study was conducted in the geriatric ward of the *St. Olav's University Hospital* from Trondheim (Norway) with 254 patients aged ≥ 75 years old aimed at evaluating the association of *delirium* and its motor subtypes with ward transfers, arrival at the emergency room during the night, time spent in the emergency sector, and performing night time medical evaluations and radiological procedures. There was a significant association between night time medical assessmentsand *delirium* (OR: 2.22 95% CI: 1.17-4.22, p=0.015). There were no associations between any other exposure variables (time spent in the emergency sector, transfers between wards, arrival at the unit during the night) and *delirium* (Evensen *et al*., 2018).

The associations of room transfer and time spent in the ER with *delirium* are plausible, as both can be perceived as stressful events, contributing to its development (Maclullich *et al*., 2008). The relationship between environmental risk factors in hospitals and severity of *delirium* was the object of a prospective observational clinical study conducted at a general hospital in Montreal (Canada). A total of 444 older adults aged > 65 years old were observed: 326 (73.42%) with *delirium* and 118 (26.58%) without *delirium*. The *delirium* severity scores ranged from 0 (absence of symptoms) to 21 (maximum severity) (McCusker *et al*., 1998). The variables related to increased *delirium* severity scores were as follows: intensive care, 12.3 (SD = 5.7); long-term care unit, 8.7 (SD = 2.3); number of room changes, 8.2 (SD = 4.9), absence of a clock, 8.1 (SD = 4.4): absence of glasses, 7.5 (SD = 4.5); presence of a family member, 7.2 (SD = 4.9); and presence of chemical, 7.5 (SD = 4.8) and physical, 8.9 (SD = 4.6) restraints (McCusker *et al*., 2001). A prospective observational study was conducted at geriatric and general wards in Turin (Italy) with 252 older adults aged ≥ 70 years old. The research aimed at evaluating the association of *delirium* in aged patients hospitalized in the geriatric ward when compared to the general ward. The geriatric ward included qualified medical and nursing staff, who excelled in effective communication, avoiding bed rest, encouraging early mobilization and ambulation, performing non-pharmacological approaches for sleep and anxiety, maintaining nutritional status and hydration, controlling pain, reducing polypharmacy, and not limiting time for visitors. *Delirium* was observed in 6.6% in the geriatric ward, and in 15.2% in the general ward. There was a significant association between geriatric ward and less *delirium*(OR: 0.90; 95% CI: 0.024-0.331, p<0.001). The patients with *delirium* presented worse functional status in ADLs and IADLs (p<0.001), greater cognitive impairment (p<0.001) and longer hospitalization times (12.3 ± 3.4 vs. 6.3 ± 2.0 days, p<0.001) (Bo *et al*., 2009). The strengths of this integrative literature review lie in its comprehensive search strategy, in the methodological evaluation and in the process to extract the standardized data. The heterogeneous and specific populations of the studies, the different loci and ways to evaluate ambience, the sample sizes (not always representative of the population), and the use of various methods to assess *delirium* are considered limitations. Hospitalization in a geriatric ward and implementation of a "home-based hospital" are protective factors against *delirium,* whereas performance of night time clinical evaluations, more than three room transfers and prolonged time spent in the emergency sectorcan be precipitating factors. Changes in the ambience are precipitating factors for *delirium*. The environment is a potentially modifiable risk factor to reduce the incidence of *delirium* in hospitalized aged patients. Studies on the relationship between ambience/environment and *delirium* in hospitalized aged people are still incipient, which highlights the need for surveys that identify the specificities in the ambience/environment that are related to the occurrence of *delirium* in hospitalized aged individuals.

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