Incidence of delirium following hospitalization of elderly people with fractures: risk factors and mortality

Incidência de *delirium* após internação de idosos com fraturas: fatores de risco e mortalidade

Incidencia de *delirium* tras hospitalización de ancianos con fracturas: factores de riesgo y mortalidad

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ABSTRACT

Objective: To identify the incidence, risk factors for delirium, and its association with death in the elderly hospitalized with fractures. **Method:** Prospective cohort, with a one-year follow-up of elderly people with clinical or radiological diagnosis of fracture, from an emergency and trauma hospital in the state of Goiás. The outcome delirium was defined by the medical description in the medical record. The predictor variables were demographic, health conditions, and hospitalization complications. A hierarchical multiple analysis was performed using robust Poisson regression, with Relative Risk as a measure of effect. **Results:** A total of 376 elderly patients were included. The incidence of delirium was 12.8% (n = 48). Risk factors were male gender, age ≥80 years, dementia, heart disease, osteoporosis, chronic obstructive pulmonary disease, high-energy traumas, pneumonia, urinary tract infection, and surgery. The risk of death in the sample was 1.97 times higher (HR: 1.97 95% CI 1.19–3.25) in elderly people with delirium. **Conclusion:** Delirium had an intermediate incidence (12.8%); the risk of death in this group was about 2 times higher in one year after hospital admission. Demographic factors, past history of diseases, surgery, and complications have increased the risk and require monitoring during hospitalization of elderly people with fractures.

DESCRIPTORS

Aged; Fractures, Bone; Hospitalization; Delirium; Mortality; Geriatric Nursing.

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INTRODUCTION

Delirium is an acute disorder of attention, awareness, and cognition, which occurs with reduced ability to concentrate or sustain attention, memory deficit, disorientation, and language disorders. This disorder tends to develop in a short period of time and can be classified, according to its clinical manifestations, into hypoactive, hyperactive and mixed[1].

Its incidence ranges from 9 to 50%[2–4] in the elderly with different clinical conditions. Different factors contribute to the occurrence of delirium: more advanced age groups[5–6], surgical procedures[2,7–8], urinary retention and intestinal constipation[6,9], immobility[6,10], pain[10], dehydration[9–10], use of polypharmacy[10], dementia[3,11], reduced caloric and protein intake[6], and infections[9–10].

Although delirium occurs in different settings, the hospital environment is the most common. Its occurrence increases the length of hospital stay[3,7], the likelihood of readmissions[12], worsens functionality[4], increases deaths[2,11,13–14] and hospital costs[15].

Fractures from low-energy trauma are very prevalent in the elderly and have become an important public health problem because, in addition to expenses, they are related to reduced mobility, worse quality of life, and the occurrence of complications that are difficult to manage in several care settings. Delirium is a frequent complication in the elderly hospitalized with fractures[7,11–12] that, individually, correlates with worse outcomes, including death.

Some studies have shown that hospitalizations due to femur and/or hip[3,7] fractures are among the main causes of hospitalization leading to delirium. However, few studies have analyzed the predictive factors for delirium in the elderly hospitalized with fractures[3,16].

Taking the projections of an increase in the proportion of elderly people into account, as well as the fact that fractures are conditions bringing important demands, such as delirium, for the elderly health and for health services, the comprehension of factors precipitating delirium in the hospital environment may help in the proposition of measures to reduce the risk of this complication and consequently improve these patients' clinical outcome.

Therefore, the objective of this study was to identify the incidence of delirium, its risk factors, and its association with death in the elderly hospitalized with fractures.

METHOD

Design of Study

This is a prospective longitudinal study, with elderly people hospitalized due to fractures over a six-month period. The follow-up of the elderly included in the study was one year, starting on the date of admission.

Population

The population consisted of elderly (age ≥ 60 years) admitted to a reference hospital for urgency and trauma in the city of Goiânia (State of Goiás, Central Brazil)

due to any type of fracture, over a period of six months (September 1, 2016 to February 28, 2017).

The aforementioned hospital is large, with 407 hospital beds, a reference for the treatment of highly complex clinical and traumatic emergencies. It is a teaching hospital that receives medical and multiprofessional residency in various specialties every year.

Selection Criteria

During the study period, 1541 elderly people with different medical diagnoses were hospitalized. Of these, all the elderly who had a clinical or radiological diagnosis of fracture described in the medical record, according to the International Statistical Classification of Diseases and Related Health Problems (ICD-10): S02, S12, S22, S32, S42, S52, S62 , S72, S82, S92, T02, T08, T10 and T12 were included. Elderly people who remained in the institution for less than 72 hours were excluded, due to the lack of most variables investigated in this study. Thus, the population of this study was 376 elderly people who had any type of fracture, corresponding to 24.4% of all hospitalizations taking place in a six-month period.

Data Collection

Data were collected in electronic and paper medical records and in the mortality information system (SIM) of the Municipal Health Department of the Municipality of Goiânia. The local Medical Archive Service provided a list of people aged 60 or older hospitalized during the study period. From this list, elderly people diagnosed with a fracture in any location were screened, through the medical description in medical records, with clinical signs, confirmed by X-ray and/or tomography report. For data collection, a structured instrument was used, elaborated based on the literature, previously tested in a pilot study with information on demographic, health and clinical conditions, hospitalization data, mechanisms of trauma and complications during hospitalization. The pilot study data did not integrate the analysis of this research. Death data were collected through SIM using the elderly's and the mother's names.

Data Analysis and Treatment

The dependent variable in this study was delirium, defined by the medical entry in the medical records from the time of admission until discharge or death. The incomplete diagnostic hypotheses for delirium were not classified for analysis. Signs of delirium (drowsiness, agitation, and confusion) were collected, but were not included in the outcome.

Independent Variables

Concerning the independent variables, the risk factors analyzed were grouped into: (i) sociodemographic: sex and age group; (ii) health condition: self-reported comorbidities (dementia, heart disease, diabetes, hypertension, osteoporosis, chronic obstructive pulmonary disease),

Charlson Index (0-2 and ≥3)[17]; polypharmacy, defined by the concomitant use of five or more drugs[18], medical history of vertigo, previous fractures; (iii) trauma-related factors: fractured bone and trauma mechanism (low-energy trauma that corresponds to falling from standing height, or a high-energy trauma equivalent to falling from heights, motor vehicle collision, collision with motorcyclist, cyclist, and running over of pedestrians); (iv) complications (pneumonia and urinary tract infection) and surgery during hospitalization (yes or no).

For this analysis of the association between delirium and death, the variable delirium was considered exposure, and the variable death from any cause during the follow-up period of the elderly was considered as an outcome.

The collected data were analyzed using the Software for Statistics and data Science (STATA), version 12.0. In the univariate analysis, the magnitude of the association was estimated by the Relative Risk (RR) and its respective confidence intervals (95% CI). The variables with $p \leq 0.20$ in the univariate analysis were included in a multiple regression model, with a distal-proximal hierarchical approach,[19] a model that assumes that the variables of the proximal level have a greater relationship with outcome occurrence than those of the intermediate and distal block. Thus, following a distal-proximal direction, demographic characteristics (first level or distal) were used to aggregate the variables related to previous health conditions (second level or intermediate) and the variables that occurred during hospitalization (third level or proximal). Following the inclusion of a new block, the variables of the block already tested were maintained, that is, the later blocks did not influence the previous ones. Variables presenting p value ≤ 0.05, as well as when there were changes in the adjusted PR greater than 10%, were maintained in the model of their respective level. The relationship between delirium and death was presented by the Kaplan Meier curve and the effect of the association was estimated by the Hazard Ratio (HR).

ETHICAL ASPECTS

The study was approved by the Ethics Committee of the Hospital de Urgência de Goiânia, opinion 2.874.973/2018. As these are secondary data, the application of the Free and Informed Consent Form was not necessary; therefore, the term of commitment was requested for the use of data for collection in medical records.

RESULTS

During the study period, 1541 medical records of the elderly were evaluated and 376 were included, which met the eligibility criteria. Of this total, 54.3% were women, 66.5% were between 60 and 79 years old with a mean age of 74.7 years (±9.37), 24.3% used 5 or more medications, 21.3% were underweight, 26.0% had 4 or more diseases (Table 1).

The incidence of delirium was 12.8% (n = 48). As for the type, 20.8% were classified as hypoactive, 37.5% hyperactive, 18.7% mixed, and 23.0% were not

Table 1 – Univariate analysis between sociodemographic and health conditions and the occurrence of delirium in elderly people admitted with fractures – Goiânia, GO, Brazil, 2017.

Variables	Total n (%)	Incidence of delirium N (%)	RR (95% CI)	p ≤ 0.05
Sex				
Female	204 (54.3)	29 (14.2)	1.00	0.362
Male	172 (45.7)	19 (11.1)	0.79 (0.45–1.33)	
Age group (years)				
60–79	250 (66.5)	10 (4.0)	1.00	
≥80	126 (33.5)	38 (30.1)	7.53 (3.88–14.64)	≤0.001
History of diseases				
Dementia	39 (10.4)	17 (45.5)	4.20 (2.57–6.85)	≤0.001
Heart disease	73 (19.4)	20 (27.4)	2.59 (1.55–4.32)	≤0.001
Diabetes	81 (21.5)	8 (9.8)	0.63 (0.30–1.30)	0.214
Hypertension	216 (57.4)	33 (15.2)	1.23 (0.69–2.17)	0.472
Osteoporosis	63 (16.8)	27 (42.8)	5.61 (3.40–9.26)	≤0.001
COPD	39 (10.4)	14 (35.9)	3.15 (1.86–5.34)	≤0.001
Charlson index				
0–2	338 (89.9)	35 (10.3)	1.00	
≥3	38 (10.1)	13 (34.2)	3.30 (1.92–5.67)	≤0.001
Polypharmacy				
0–4	302 (80.3)	30 (9.9)	1.00	
≥5	74 (19.7)	18 (24.3)	2.44 (1.44–4.14)	0.001
Previous fractures				
No	316 (84.0)	27 (8.5)	1.00	
Yes	60 (16.0)	21 (35.0)	4.09 (2.48–6.75)	≤0.001

informed by the attending physician. Signs of delirium (hypoactivity/drowsiness, confusion and/or psychomotor agitation) were described in 27.7% (n = 104) of the elderly.

In Table 1, the univariate analysis showed an increased risk of delirium for the variables: age group ≥80 years, dementia, heart disease, osteoporosis, and chronic obstructive pulmonary disease (COPD), Charlson index ≥3, polypharmacy, and previous fractures.

Regarding the variables related to hospitalization, there was a greater risk of delirium in the elderly who suffered low-energy trauma, fracture of the femur, had complications such as pneumonia and urinary tract infection (Table 2).

In the final hierarchical multiple analysis model, the following remained associated with delirium: male patients,

Table 2 – Univariate analysis of sociodemographic and health conditions and the occurrence of delirium in elderly people admitted with fractures – Goiânia, GO, Brazil, 2017.

Variables	Total n (%)	Incidence of delirium n (%)	RR (95% CI)	p < 0.05
Mechanism of trauma¥				
LET*	247 (66.3)	47 (19.0)	23.97 (3.33–172.21)	0.002
HET*	126 (33.7)	1 (1.0)	1.00	
Fractured bone				
Femur	200 (53.2)	41 (20.5)	5.15 (2.37–11.20)	≤0.001
Tibia	42 (11.2)	2 (4.7)	0.34 (0.08–1.37)	0.132
Humerus	25 (6.6)	4 (16.0)	1.27 (0.49–3.27)	0.611
Radius	27 (7.2)	3 (11.1)	0.86 (0.28–2.59)	0.789
Face bones	24 (6.4)	3 (12.5)	0.97 (0.32–2.92)	0.968
Vertebrae	30 (8.0)	1 (3.3)	0.24 (0.34–1.72)	0.107
Complications during hospitalization				
Pneumonia	60 (15.9)	26 (43.3)	6.22 (3.78–10.22)	≤0.001
UTI	42 (11.2)	18 (42.9)	4.77 (2.92–7.78)	≤0.001
Surgery during hospitalization				
Yes	265 (70.5)	32 (66.6)	0.83 (0.47–1.46)	0.534
No	111 (29.5)	16 (33.4)	1.00	

* LET: Low-energy trauma; * HET: High-energy trauma; UTI: urinary tract infection; ¥: missing data for 3 participants.

80 years of age or older, dementia, heart disease, osteoporosis, COPD, pneumonia, and surgery (Table 3).

Of the total of 376 hospitalized elderly, 86 (22.9%) died of any cause, and of these, 21 had delirium during hospitalization (24.7%). The occurrence of delirium increased the risk of death by 1.97 (HR: 1.97 95% CI 1.19–3.25, p = 0.008) (Figure 1).

DISCUSSION

The incidence of delirium found in this study (12.8%) can be considered as intermediate compared to previous studies[2–3,11,20]. There is evidence of variation in the incidence of delirium from 9%[20] to 17%[11] in emergency services, 28%[2] to 34%[3] in patients with fractures, increasing to about 50% in patients with previous health conditions present at admission, such as dementia[3]. In this study, this intermediate incidence can be attributed to the underdiagnosis of delirium, since 28% had clinical criteria for diagnosis. Despite being a widely discussed subject in the literature, in clinical practice the diagnosis and management of delirium are still incipient[21]. As it is a common complication in elderly people with fractures, it is important to recognize the risk factors for its occurrence.

The relationship between advanced age (≥80 years) and delirium corroborates previous studies[5,22]. During the aging process, the elderly have difficulties in maintaining their homeostasis, which leads to a gradual decrease in the physiological reserve and consequent accumulated decline in several physiological systems, leading to the occurrence of delirium[22]. Still in relation to demographic aspects, elderly men had a higher risk of delirium compared to women. This datum may be related to a higher incidence of traffic accidents by men and, consequently, a higher number of admissions to the study site. This finding shall be further explored, as previous studies have shown a higher proportion among women[3–4,16].

As for comorbidities, elderly people with a previous history of dementia, heart disease, COPD, and osteoporosis had an increased risk of delirium. Previous studies show that dementia is one of the most important risk factors for delirium[3–4,6,9,16]. One study analyzed the risk factors for the occurrence of delirium in patients admitted for hip fractures and the incidence observed was 35% in the group with dementia and 21% in those with no previous dementia[3]. In dementia, there is cortical and subcortical structures impairment and deregulation in the release of neurotransmitters acting on individuals' homeostasis, leading to functional cognitive decline, which may justify this overlap of delirium with dementia[9,22].

Elderly people with COPD also had a higher risk of delirium in this study. A study demonstrated that elderly people hospitalized with COPD more frequently have: recurrent infections, low respiratory infections, hydroelectrolytic disorders, associated cardiac diseases, ventilatory support, longer ICU stays[23]. The combination of these factors can contribute to complications, one of them being delirium[23].

No studies evaluating the relationship between heart disease and delirium in elderly people with fractures were found. However, previous studies with hospitalized elderly people[24–25] show that, among cardiac patients, there is a lower ejection fraction, arrhythmias, and decreased peripheral perfusion[24], which could explain more frequently confusion disorders. In addition, they show greater hemodynamic instability during the perioperative period, increasing complications and length of hospital stay[24–25].

History of osteoporosis has also been associated with delirium. One study observed an association between the reduction of Bone Mineral Density and osteoporosis with cognitive impairment[26]. The hypothesis the authors raised for this association was hormonal changes and an increase in inflammatory markers that are known to alter cognitive function[26].

During hospitalization, risk factors for delirium were surgery and complications such as pneumonia and urinary tract infection.

Table 3 – Multiple regression analysis in hierarchical blocks for the occurrence of delirium in patients admitted to the study – Goiânia, GO, Brazil, 2017.

Variables	Distal block		Intermediate block		Proximal block	
	RR[1] (95% CI[2])	p[3]	RR (95% CI)	p	RR (95% CI)	p
Sex						
Female	1.00		1.00		1.00	
Male	1.25 (0.75–2.08)	0.378	2.18 (1.36–3.52)	≤0.001	2.25 (1.41–3.57)	≤0.001
Age (years)						
60–79	1.00		1.00		1.00	
≥80	7.98 (4.07–15.65)	≤0.001	4.03 (2.22–7.30)	≤0.001	2.33 (1.22–4.45)	0.010
Charlson index						
0–2			1.00		1.00	
≥3			0.97 (0.55–1.70)	0.937	1.04 (0.61–1.77)	0.862
Dementia			2.81 (1.76–4.48)	≤0.001	2.72 (1.51–4.89)	≤0.001
Heart disease			1.80 (1.21–2.69)	0.004	1.75 (1.13–2.71)	0.011
Osteoporosis			3.58 (2.14–6.00)	≤0.001	2.47 (1.37–4.44)	0.002
COPD[4]			2.34 (1.49–3.68)	≤0.001	1.79 (1.07–2.98)	0.024
Polypharmacy			1.58 (1.05–2.39)	0.026	1.27 (0.84–1.92)	0.253
Mechanism of trauma						
HET[5]					1.00	
LET[6]					5.65 (0.75–42.48)	0.092
Femur fracture					1.05 (0.48–2.30)	0.893
Pneumonia					2.75 (1.48–5.11)	0.002
UTI[7]					1.74 (1.11–2.73)	0.016
Surgery					2.01 (1.06–3.83)	0.032

[1] Relative risk; [2] Confidence interval; [3] p value; [4] DPOC: Chronic obstructive pulmonary disease; [5] HET: High-energy trauma; [6] LET: Low-energy trauma; [7] UTI: Urinary tract infection.
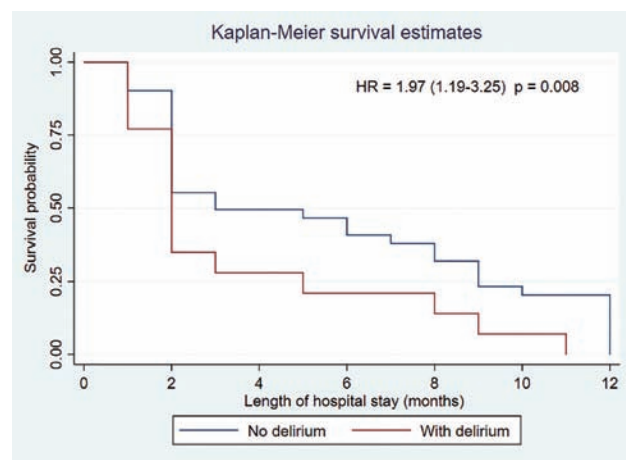

Figure 1 – Association between delirium during hospitalization and death from any cause in elderly people with fractures – Goiânia, GO, Brazil, 2017.

Elderly hospitalized with fractures often require a surgical approach; however, their clinical conditions are not always satisfactory as they are under surgical stress. The postoperative period has been associated with delirium and a complicated course of hospitalization[2–4,8]. Investigation among the postoperative risk factors of orthopedic surgery and delirium demonstrated an association with events that occurred during the intraoperative period, such as: blood loss and laboratory changes, mainly of inflammatory markers such as C-reactive protein (CRP)[8]. There is also evidence that elderly people with an ASA classification >3 are at increased risk for delirium[10,14,27]. Other studies[26,28] have related delirium in the postoperative period to a higher incidence of pain, immobilization, urinary retention, and bed rest in an intensive care unit.

During the hospitalization period, the elderly who developed pneumonia and UTI had a higher risk of delirium, data that corroborate previous studies[3,9–10,13]. Pneumonia and UTI are frequent complications during elderly hospitalization due to different causes[3,9–10,13]. Hospitalizations due to fractures are generally prolonged[3,7], contributing to decreased functionality and mobility, leading to respiratory and urinary complications, for instance. However, in this study, these complications diagnosis was not always concluded before the occurrence of delirium, which suggests that there is an association between these infections and delirium during hospitalization, but without the possibility of inferring causality.

Delirium increased the risk of death in this elderly population hospitalized due to fractures. The relationship between delirium and death in the elderly with different clinical conditions, including fractures, has been discussed in the literature[4,16,29]. Studies show that the death rate is high in the elderly with fractures, with a high proportion in those with delirium[4,16]. A study observed that in one year the death rate in patients with fractures was 19%, increasing to 39% in those with delirium[16]. It was found in a study that patients hospitalized with delirium were three times more likely to die when compared to those who did not have delirium[27]. Despite the high rate, it is not clear in the literature whether delirium is directly related to the outcome death or whether it can be an indicator of severity of comorbidities and of health conditions and complications[3–4,9,29–30]. Together, these factors can increase the occurrence of deaths.

As limitations of this study, we can mention the collection of data in medical records, which hindered the application of standardized instruments for detecting delirium. In addition, the lack of information in medical records stands out, which made it impossible to investigate variables such as disabilities. To overcome these limitations, some precautions, such as standardizing the formulary, collecting the medical diagnosis, conducting a pilot test, were taken to ensure the reliability of the data collected.

CONCLUSION

The findings of this study demonstrated a 12.8% incidence of delirium in elderly people with fractures. Demographic factors, previous history of diseases, surgery and the occurrence of complications during hospitalization were risk factors for delirium during hospitalization. The occurrence of delirium increased the risk of death by 1.97 times and was, during hospitalization, a predictor for death from any cause among the elderly after one year of follow-up of hospital admission.

Together, the findings signal the need for health conditions assessment and monitoring of complications such as pneumonia and UTI for the early identification of delirium and its consequent management.

The multiprofessional team, having diverse knowledge in specific areas and daily monitoring these patients' progression, shall work in the identification of these risk factors for the prevention of delirium and intervene so that they are controlled or minimized in the face of targeted assistance.

Moreover, considering that the incidence of delirium after fractures decreases when using multidimensional assessment of the elderly, it is recommended that geriatric assessment protocols be implemented in large hospitals such as this one for clinical assessment and monitoring of hospitalized elderly with fractures.

RESUMO

Objetivo: Identificar a incidência, os fatores de risco para o *delirium* e sua associação com óbito em idosos hospitalizados com fraturas. **Método:** Coorte prospectiva, com seguimento de um ano de idosos com diagnóstico clínico ou radiológico de fratura, de um hospital de urgência e trauma de Goiás. O desfecho *delirium* foi definido pela descrição médica no prontuário. As variáveis preditoras foram demográficas, condições de saúde e complicações da internação. Realizou-se análise múltipla hierarquizada utilizando-se regressão de Poisson robusta, com Risco Relativo como medida de efeito. **Resultados:** Foram incluídos 376 idosos. A incidência de *delirium* foi 12,8% (n = 48). Os fatores de risco foram: sexo masculino, idade ≥80 anos, demência, cardiopatia, osteoporose, doença pulmonar obstrutiva crônica, acidentes de alta energia, pneumonia, infecção do trato urinário e cirurgia. O risco de óbito na amostra foi 1,97 vezes maior (HR: 1,97 IC 95% 1,19–3,25) em idosos com delírio. **Conclusão:** O *delirium* teve uma incidência intermediária (12,8%); o risco de óbito nesse grupo foi cerca de 2 vezes maior em um ano após a admissão hospitalar. Fatores demográficos, história pregressa de doenças, realização de cirurgia e ocorrência de complicações aumentaram o risco e precisam ser monitorados durante a internação de idosos com fraturas.

DESCRITORES

Idoso; Fraturas Ósseas; Hospitalização; Delírio; Mortalidade; Enfermagem Geriátrica.

RESUMEN

Objetivo: Identificar la incidencia, los factores de riesgo para el *delirium* y su asociación con el óbito en ancianos hospitalizados con fracturas. **Método:** Cohorte prospectiva, con acompañamiento de un año con ancianos con diagnóstico clínico o radiológico de fractura, de un hospital de urgencias y trauma en Goiás, Brasil. El resultado *delirium* fue definido por la descripción médica en el registro médico. Las variables predictoras fueron demográficas, condiciones de salud y complicaciones de la hospitalización. Se realizó el análisis de regresión múltiple jerárquica utilizando la regresión de Poisson con varianza robusta, con Riesgo Relativo como medida de efecto. **Resultados:** Fueron incluidos 376 ancianos. La incidencia de *delirium* fue 12,8% (n = 48). Los factores de riesgo fueron: sexo masculino, edad ≥ 80 años, demencia, cardiopatía, osteoporosis, EPOC, traumas de alta energía, neumonía, infección urinaria y cirugía. El riesgo de óbito en la muestra fue 1,97 veces mayor (HR: 1,97 IC 95% 1,19–3,25) en ancianos con *delirium*. **Conclusión:** El *delirium* tuvo una incidencia intermediaria (12,8%); el riesgo de óbito en ese grupo fue aproximadamente 2 veces mayor en un año después de la admisión hospitalaria. Factores demográficos, historia anterior de enfermedades, realización de cirugía y la ocurrencia de complicaciones aumentaron el riesgo y necesitan ser monitoreados durante la hospitalización de ancianos con fracturas.

DESCRIPTORES

Anciano; Fracturas Óseas; Hospitalización; Delirio; Mortalidad; Enfermería Geriátrica.

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