

ORIGINAL ARTICLE

Geriatric care-related outcomes in patients 75 years and older admitted to a pulmonary disease center and predictors for hospital-related complications

Daniela Josefina Cataneo-Piña  | Celia Gabriela Hernández-Favela | Lidia Aurora Mondragón-Posadas | Citlalic Torres Nuñez

Geriatrics Department, Instituto Nacional de Enfermedades Respiratorias Ismael Cosío Villegas, Mexico City, Mexico

Correspondence

Daniela Josefina Cataneo-Piña, Geriatrics Department, Instituto Nacional de Enfermedades Respiratorias Ismael Cosío Villegas, Calz. de Tlalpan 4502, Belisario Domínguez Sección XVI, Mexico City 14080, Mexico.

Email: cataneodaniela@gmail.com

Abstract

Objective: The primary aim of this study was to evaluate the influence of targeted interventions, administered through comprehensive geriatric assessments on the incidence of hospitalization-related complications among older adults diagnosed with pulmonary diseases.

Methods: A retrospective analysis of medical records encompassed individuals aged 75 years and older who were admitted to a lung center during the period spanning from March to June 2023. These admissions occurred in a context where standardized geriatric management protocols were systematically implemented. This study's scope extended to assessing the prevalence of hospital-related complications, encompassing delirium and pressure ulcers. A rigorous multivariate logistic regression analysis was conducted to discern and characterize associated factors.

Results: The integration of comprehensive geriatric assessment yielded a substantial reduction in in-hospital complications among the cohort of 118 patients (mean age: 82.1 ± 5.6 years, 44.5% women). The incidence of delirium decreased from 53.3% to 21.8% [odds ratio (OR): 0.246, 95% confidence interval (CI): 0.134–0.450, $p < 0.001$], whereas the presence of pressure ulcers decreased from 43.9% to 25% (OR: 0.395, 95% CI: 0.217–0.715, $p < 0.001$). The multivariate analysis uncovered independent associations between delirium and variables including community-acquired pneumonia (OR: 4.417, 95% CI: 1.574–12.395, $p = 0.005$), severe disability (OR: 2.981, 95% CI: 1.140–7.798, $p = 0.026$), and hearing loss (OR: 3.219, 95% CI: 1.260–8.170, $p = 0.014$). Prolonged hospital stays emerged as the sole factor significantly associated with pressure ulcers (OR: 1.071, 95% CI: 1.033–1.109). Furthermore, an intricate bidirectional relationship was evident between delirium and pressure ulcers (OR: 7.158, 95% CI: 2.962–17.300, $p < 0.01$).

Conclusion: In conjunction with its consequent interventions, geriatric evaluation assumes a pivotal role in ameliorating adverse outcomes stemming from hospitalization among older adults afflicted with pulmonary ailments. This role gains particular

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saliency among subpopulations characterized by heightened susceptibility, such as individuals coping with hearing loss and severe disability.

KEYWORDS

delirium, geriatric assessment, hospital-related complications

1 | INTRODUCTION

Respiratory diseases constitute a significant source of morbidity and mortality among the older adult population.¹ In the year 2021, chronic lower respiratory diseases emerged as the fifth leading cause of mortality within this demographic, trailing behind cardiovascular diseases, malignant neoplasms, and coronavirus disease 2019 (COVID-19).²

Lung disorders predominantly afflict older adults, with lower respiratory tract infections manifesting as the most prevalent conditions in this age group. These infections contribute to a substantial 42% escalation in per-patient health care costs in high-income countries, particularly among individuals aged 75 years and older.³ Additionally, lung cancer ranks as the second most frequently diagnosed neoplasm in men and the third in women aged 65 years and beyond.⁴ Furthermore, infectious diseases, notably, serve as common catalysts for prolonged hospitalization, and frequently precipitating complications, such as pleural effusion, hemoptysis, or infection.⁵

Of particular note, the older population encounters significant health care costs during hospitalization, primarily due to complications like pressure ulcers and delirium.⁶ Both complications have been associated with an elongated length of stay and heightened mortality rates.^{7,8} The heightened prevalence of delirium and pressure ulcers has been linked to specific mediators, including invasive medical devices, disruptions in the sleep-wake cycle, dehydration, and malnutrition.⁹ It is noteworthy that the presence of one of these factors augments the risk of developing one or more of the other complications.¹⁰

Fortunately, targeted interventions following a comprehensive geriatric assessment (GA) have shown promise in preventing these debilitating complications.¹¹ The GA is meticulously designed and currently implemented to identify specific needs related to various geriatric syndromes and subsequently propose interventions that address physiological, psychological, and social factors.

Within our institution, in a dedicated Pulmonary Disease Center, a pivotal shift has been initiated. In the preceding year, geriatric care was introduced into the realm of hospitalization. Since the inception of 2023, every patient aged 75 years and older has undergone a comprehensive GA, complemented by daily evaluations of in-hospital complications. Furthermore, attending physicians receive expert guidance on management adjustments based on the clinical findings derived from the GA.

2 | AIM

2.1 | Primary

The primary aim of this study is to ascertain whether the integration of targeted interventions through comprehensive GA influences the frequency of hospitalization-related complications.

2.2 | Secondary

Secondary objectives encompass the analysis of determinants associated with the occurrence of these complications during the hospitalization period. This analysis comprehensively explores geriatric syndromes, comorbid conditions, and admission diagnoses.

3 | METHODOLOGY

3.1 | Design and setting

A retrospective study reviewing physical and electronic medical records and nursing charts of patients aged 75 years and older admitted to the Pulmonary Disease Center from March to June 2023.

3.2 | Geriatric assessment

Starting from March 2023, upon admission to the hospital, all individuals aged 75 years and older underwent a comprehensive GA within the initial 24 hours. The GA was performed by a team conformed by two general physicians and a geriatrician, who instructed the rest of the team on the standardized way to perform the GA and the complications to be aware of. This GA meticulously assessed the presence of diverse geriatric syndromes, using validated scales. The Katz Index was used to evaluate functionality concerning basic activities of daily living,¹¹ whereas the Lawton & Brody Index¹² was used for instrumental activities. Screening for sarcopenia was accomplished through the strength, ambulation, resistance, climbing stairs, and falls (SARC-F) questionnaire,¹³ and frailty was assessed using the fatigue, resistance, aerobic capacity, illnesses, and loss of weight (FRAIL) questionnaire.¹⁴ Sensory deficits were evaluated by direct inquiries concerning limitations in vision or communication due to hearing loss, with the assistance of visual, hearing, or

ambulatory aids. Cognitive impairment was addressed through the Global Deterioration Scale.¹⁵ Responses to these inquiries were corroborated through interviews with the primary caregiver.

3.3 | Hospital-associated complications

The geriatric team conducted daily reviews of patients to identify complications arising during hospitalization, encompassing pressure ulcers (via physical examination), dehydration, gastrointestinal bleeding, adverse drug reactions, constipation, and delirium.

Recommendations were proffered to the attending physician to manage and prevent identified complications. Interventions were made on case-by-case scenario, focusing on those troublesome domains identified through GA. A list of the most frequent interventions done by the geriatric team are shown in Table 1. The electronic

medical record meticulously documented the initial and subsequent assessments and the corresponding interventions recommended to the attending physician. Ongoing follow-up care was administered throughout the patient's hospital stay until discharge.

The presence of delirium was discerned using the 3-Minute Diagnostic Confusion Assessment Method (3D-CAM). The 3D-CAM scale, validated in Spanish,¹⁶ was utilized to identify delirium, boasting a sensitivity of 94% and specificity of 89%.¹⁷ This tool identified four core attributes of delirium: acute onset or fluctuating course (A), inattention (B), disorganized thinking (C), and altered level of consciousness (D).¹⁸ Patients were deemed to have delirium if they exhibited the first two attributes (A + B) and any two of the third (C) or fourth (D).

The information derived from GA, such as the results of the used scales and the suggested interventions made to the attending physicians were registered on the electronic medical record, where all

TABLE 1 Geriatric interventions following geriatric assessment

Valued domain	Recommendation
<i>Sensory</i>	
Visual impairment	<ul style="list-style-type: none"> • Encourage the use of glasses
Hearing impairment	<ul style="list-style-type: none"> • Encourage the use of hearing aids • Placing signs that indicate the need for a proper voice tone and volume
<i>Gastrointestinal</i>	
Malnutrition	<ul style="list-style-type: none"> • Oral assessment, encourage the use of dentures, xerostomia or infections • Diet consistency adequation according to patient needs • Dietary consult, and addition of dietary supplements when needed
Constipation	<ul style="list-style-type: none"> • Encourage fluid intake, and addition of laxatives according to the patient's condition
Swallowing problems	<ul style="list-style-type: none"> • Perform a formal swallowing test by the otorhinolaryngology team and provision of the right diet consistency
<i>Neuropsychiatric</i>	
Cognitive impairment	<ul style="list-style-type: none"> • Aware health care team of cognitive impairment and increased delirium risk • Promote non-pharmacological anti-delirium measures • Validate appropriate needs and dosages of medication, such as antidepressants, antipsychotics, and sedatives • Avoid medications with anticholinergic side effects
History of previous delirium symptoms	<ul style="list-style-type: none"> • Disseminate awareness among the health care team regarding the increased risk of delirium, facilitating timely prevention and intervention efforts • Advocate for the adoption of non-pharmacological strategies aimed at averting delirium <ul style="list-style-type: none"> • Ensure well-lit patient rooms with adequate daylight exposure during daytime hours • Minimize the collection of samples and administration of nocturnal medications, whenever possible • Avoid taking samples or applying night medications • Foster patient orientation, provide wall clocks and calendars • Avoid the use of physical restraints • Maintain adequate fluid and electrolyte balance, bowel movements, patient mobility, and potential sources of nosocomial infections • Implement cognitive stimulation • Contemplate the utilization of low-dose antipsychotic medications in cases characterized by hyperactive delirium • Assess and treat delirium causes such as pain, infection, electrolyte imbalance, constipation, and dehydration
History of depressive or anxiety disorder	<ul style="list-style-type: none"> • Psychological intervention and support
<i>Functionality, frailty, and sarcopenia</i>	
Frailty and sarcopenia	<ul style="list-style-type: none"> • Initiate physical rehabilitation • Adequate nutritional support • Comorbidities management • Avoid bed resting as possible
Functional disability	<ul style="list-style-type: none"> • Encourage patient self-care and provide assistance as needed

the health teams involved in patient care could notice patient risk of complications and the interventions to prevent these.

3.4 | Data collection

Data collection followed a retrospective approach, extracting pertinent information from electronic medical records, which were subsequently entered into a database. The dataset included demographic variables, comorbidities, reasons for admission, results derived from geriatric assessment scales, geriatric interventions, and complications observed throughout the hospitalization period.

3.5 | Statistical analysis

The sample comprised consecutively recruited patients aged 75 years and older admitted to the hospital. The parametric distribution of variables was assessed using the Kolmogorov–Smirnov statistic. Findings were presented as frequencies and percentages for categorical variables, mean and standard deviation for continuous variables exhibiting normal distribution, and median and interquartile range for continuous variables displaying nonparametric distribution.

To scrutinize variations in the prevalence of in-hospital complications over time, the prevalence of these complications was compared in accordance with the months of follow-up. Pearson's chi-squared test was used to compare the frequency of complication occurrences over the 4 months of interest. Furthermore, a multivariate logistic regression analysis was executed, incorporating factors that exhibited significant associations with complications in the univariate analysis while controlling for demographic variables.

4 | RESULTS

Between March and June 2023, GAs were conducted on a cohort of 118 hospitalized patients, of which 53 (44.5%) were women, with a mean age of 82.1 years ($SD \pm 5.6$). Subsequent to the inception of the standardized geriatric approach, a discernible reduction in the incidence of in-hospital complications was observed. Specifically, there was a decrease in the prevalence of delirium from 53.3% in March to 21.8% in June [odds ratio (OR): 0.246, 95% confidence interval (CI): 0.134–0.450, $p < 0.001$], as well as a decrease in the occurrence of pressure ulcers from 43.9% in March to 25% in June (OR: 0.395, 95% CI: 0.217–0.715, $p < 0.001$; [Figure 1](#)). Concurrently, a reduction in hospitalization duration was also noted, with a decline from 23.7 (± 27.2) days in March to 13.56 (± 36.9) days in June ($p = 0.090$; [Figure 2](#)).

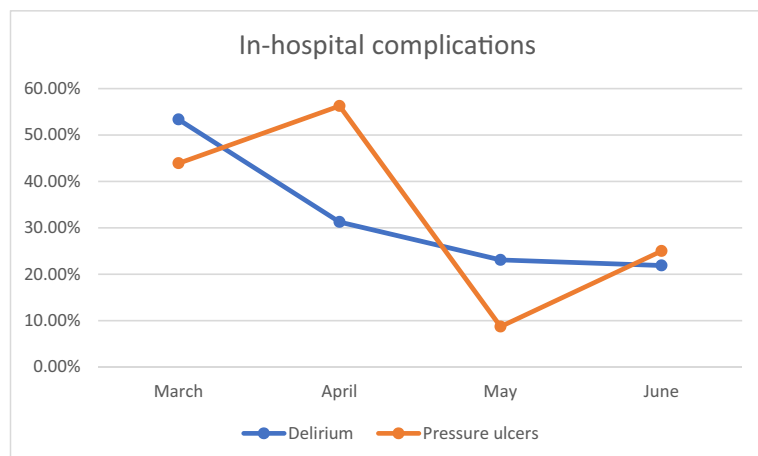


FIGURE 1 Percentage of hospital-related complications incidence by month in older adults admitted to a pulmonary diseases center.

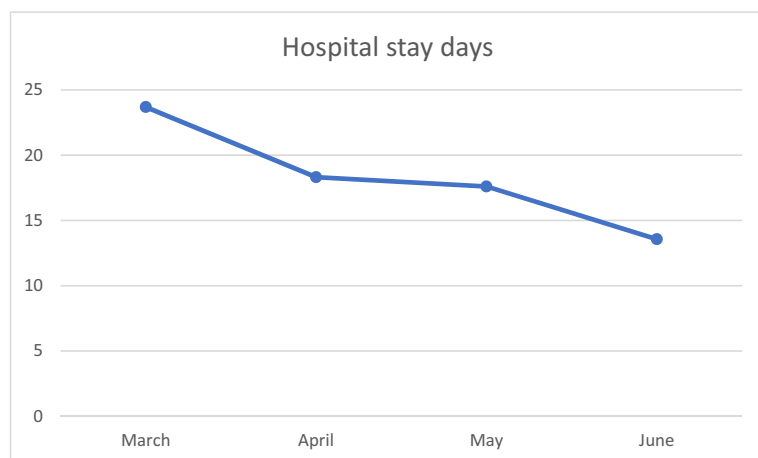


FIGURE 2 Mean of hospital stay days by month in older adults admitted to a respiratory diseases hospital.

The primary admission diagnoses were predominantly community-acquired pneumonia ($n=26$, 21.85%), followed by pleural effusion ($n=23$, 19.3%), and COVID-19 pneumonia ($n=22$, 18.5%). In univariate analysis, community-acquired pneumonia was associated with delirium, whereas pleural effusion was linked to pressure ulcers (Table 2).

The most prevalent geriatric syndromes identified included cognitive impairment, categorized based on the Global Deterioration Scale (>1), which was present in 74 (62.7%) patients, followed by sarcopenia ($n=65$, 54.6%), and hearing impairment ($n=63$, 52.9%). Geriatric syndromes significantly associated with delirium encompassed hearing impairment and severe disability, as categorized

by a Katz Index score of 2 or fewer points (Table 3). Reduced grip strength exhibited a notable association with delirium, with values measuring 15.2 (± 9.9) kg in patients without delirium, in contrast to 11.2 (± 8.8) kg in patients with delirium (OR: 0.960, 95% CI: 0.910–0.991, $p=0.047$).

After multivariate analysis, which accounted for age and sex, in addition to variables exhibiting significant associations in the univariate analysis, it was determined that community-acquired pneumonia (OR: 4.417, 95% CI: 1.574–12.395, $p=0.005$), severe disability (OR: 2.981, 95% CI: 1.140–7.798, $p=0.026$), and hearing loss (OR: 3.219, 95% CI: 1.260–8.170, $p=0.014$) independently correlated with the presence of delirium during hospitalization (Table 4). Notably, the

TABLE 2 Sex and admission diagnosis and its association with hospital-related complications in univariate analyses

	Total		Delirium			Pressure ulcers		
	$n=118$	%	$n=42$	%	p value	$n=37$	%	p value
Female sex	53	44.54	15	28.3	0.154	15	30	0.540
COVID-19	22	18.5	8	19.05	0.907	11	29.7	0.064
Community-acquired pneumoniae	26	21.85	17	40.48	<0.001	11	29.7	0.137
Pleural effusion	23	19.33	5	11.9	0.130	3	8.11	0.053
Hemoptysis	2	1.68	0	0	0.292	0	0	0.316
COPD exacerbation	8	6.72	1	2.38	0.162	2	5.41	0.616
Lung mass	20	16.81	6	14.3	0.587	3	8.11	0.079
ILD exacerbation	14	11.76	3	7.14	0.248	5	13.51	0.658
Heart failure	4	3.36	2	4.76	0.531	2	5.41	0.209

Note: Bold indicates significant p values (<0.05).

Abbreviations: COPD=chronic obstructive pulmonary disease; COVID-19=coronavirus disease 2019; ILD=interstitial lung disease.

TABLE 3 Geriatric syndromes and their association hospital-related complications in univariate analyses

	Total		Delirium			Pressure ulcers		
	$n=118$	%	$n=42$	%	p value	$n=37$	%	p value
Severe disability (Katz Index <3)	30	25.21	16	38.1	0.017	11	29.7	0.329
Hearing impairment	63	52.94	31	73.8	<0.001	20	54.1	0.385
Visual impairment	33	28.45	9	22.5	0.303	7	19.4	0.144
Frailty (FRAIL 3–5)	43	36.13	16	38.1	0.742	17	45.9	0.195
Sarcopenia (SARC-F >3)	65	54.62	25	59.2	0.428	20	54.1	0.943
Cognitive impairment (GDS >1)	74	62.71	30	71.4	0.145	22	61.1	0.874

Note: Bold indicates significant p values (<0.05).

Abbreviations: FRAIL=fatigue, resistance, aerobic capacity, illnesses, and loss of weight; GDS=Geriatric Depression Scale; SARC-F=strength, ambulation, resistance, climbing stairs, and falls.

TABLE 4 Delirium-associated factors in a multivariate regression model

	OR	95% CI	p value
Sex	0.853	0.351–2.071	0.726
Age, y	1.017	0.937–1.104	0.676
Community acquired pneumonia	4.418	1.574–12.395	0.005
Severe disability (Katz Index <3)	2.981	1.140–7.798	0.026
Hearing loss	3.219	1.286–8.169	0.014

Note: Bold indicates significant p values (<0.05).

Abbreviations: CI=confidence interval; OR=odds ratio.

sole factor associated with pressure ulcers in the multivariate analysis was prolonged hospital stay (OR: 1.071, 95% CI: 1.033–1.109). A bidirectional relationship was also observed between the presence of delirium and pressure ulcers (OR: 7.158, 95% CI: 2.962–17.300, $p < 0.001$).

5 | DISCUSSION

In the current investigation, a discernible reduction in the prevalence of delirium and pressure ulcers and a decrease in the duration of hospitalization was observed after the implementation of standardized geriatric medical assessments. Additionally, it was determined that patients exhibiting severe disability hearing loss and those admitted with a diagnosis of community-acquired pneumonia constituted groups at heightened risk for delirium. Furthermore, patients diagnosed with delirium were identified as having an elevated susceptibility to developing pressure ulcers associated with prolonged hospital stays.

The provision of geriatric interventions for hospitalized patients is multifaceted. It can be delivered through diverse modalities, one of which includes specialized hospital care units, commonly referred to as Acute Care for the Elderly (ACE) units¹⁹ and Geriatric Evaluation and Management Units (GEMU).²⁰ These units use coordinated multidisciplinary teams to conduct comprehensive GAs to identify and address medical, physical, psychological, and social issues. Research has shown that such units contribute to a reduction in functional decline at the time of discharge.²¹

An alternate model involves the engagement of geriatric teams specializing in evaluating hospitalized patients, often called Geriatric Consultation Teams, as utilized in the present study. In this model, a multidisciplinary team rigorously evaluates each case, deliberates on alternative courses of action, and formulates treatment plans tailored to the specific needs of hospitalized older adults.²² These services represent a critical component of comprehensive geriatric care and an essential organizational principle within the context of hospital care for this demographic. A systematic review conducted by Deschodt et al²³ reported that implementing these teams has yielded improvements in functional status, reduced re-admission rates, and decreased mortality.

Among older adults, the most frequent complications associated with hospitalization encompass urinary tract infections, pressure ulcers, delirium, and hospital-acquired pneumonia. These complications contribute significantly to the incremental costs of prolonged hospital stays in this population, doubling the estimated cost per episode.²⁴ A meta-analysis by Song et al.²⁵ underscored that pressure ulcers were associated with a 1.78-fold elevated risk of mortality attributed to the inflammatory response in affected patients and underlying metabolic and circulatory alterations.

Conversely, delirium represents a geriatric syndrome linked to many adverse outcomes, including pronounced cognitive decline, institutionalization, and heightened mortality rates.²⁶ This syndrome stems from multiple factors and disproportionately affects individuals

possessing certain risk factors, such as sensory deficits. In our study, we ascertained that those patients with hearing impairment faced a more than threefold increased risk of presenting with delirium compared to those with intact hearing, substantiating findings from the systematic review by Oliveira et al,²⁷ where hearing impairment augmented the risk of delirium by 2.57 times among older adults in emergency department settings. Given this body of evidence, several authors and organizations recommend evaluating and managing hearing impairment as a preventive measure against delirium.^{28,29} Utilizing cost-effective hearing assistance in various settings, including emergency departments, has yielded favorable outcomes, including reduced re-admission rates and enhanced adherence to medical recommendations.³⁰ Consequently, interventions aimed at ameliorating sensory impairments during hospitalization should be seriously considered to mitigate the incidence of delirium.

Another significant factor associated with delirium is severe disability, recognized as one of the terminal phases within the continuum of frailty trajectories and linked to heightened mortality risk.³¹ Delirium and frailty, especially in advanced stages marked by functional disability, exhibit a mutually independent relationship, as demonstrated by the results of a meta-analysis by Perisco et al, which reported that patients afflicted with frailty faced a 2.2-fold heightened risk of developing delirium.³² These conditions are multifactorial in etiology, sharing common underlying factors, such as age-related inflammation, vascular alterations, nutritional deficiencies, and multimorbidity.³³ Delirium prevention assumes paramount importance, as pharmacological interventions are often associated with significant adverse effects,³⁴ whereas nonpharmacological interventions are frequently rendered ineffective once the complication has manifested.³⁵

6 | CONCLUSION

In this observational study, we observed a progressive decline in the prevalence of hospitalization-related complications following the introduction of a specialized geriatric consultation team for patients aged 75 years and older, who were admitted to a respiratory hospital.

Notably, patients admitted with a primary diagnosis of community-acquired pneumonia and those presenting with specific geriatric syndromes, such as hearing impairment and limitations in basic activities of daily living, exhibited an augmented susceptibility to these complications, particularly delirium.

Furthermore, the risk of developing pressure ulcers in this patient cohort incrementally escalated by 7% on each consecutive day of hospitalization. The inter-relationship between delirium and pressure ulcers was bidirectional, resulting in prolonged hospital stays and heightened economic burdens.

AUTHOR CONTRIBUTIONS

All the authors have actively participated in the search of literature search, writing, and revision of this manuscript and approval of the final version.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

ETHICS STATEMENT

This protocol has been approved by the Institutional Ethical Research and Investigation Committees (C54-23) upon the retrospective nature of the study and the low risk derived from the research. All procedures were performed following the Helsinki Declaration.

ORCID

Daniela Josefina Cataneo-Piña  <https://orcid.org/0000-0002-8524-1174>

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