

## Clinical-epidemiological characteristics of patients diagnosed with severe community-acquired pneumonia

### Características clínico-epidemiológicas de pacientes con diagnóstico de neumonía grave adquirida en la comunidad

### Características clínico-epidemiológicas de pacientes com diagnóstico de pneumonia comunitária grave

Luis Fong Pantoja<sup>1\*</sup> , Niger Guzmán Pérez<sup>11</sup> , Elizabeth Bárbara Dieguez Matamoros<sup>11</sup> 

<sup>1</sup>Hospital GJanral Docente “Orlando Pantoja Tamayo”. Santiago de Cuba, Cuba.

<sup>11</sup>Hospital Militar “Dr. Joaquín Castillo Duany”. Santiago de Cuba, Cuba.

\* Corresponding author: [luisfong87@nauta.cu](mailto:luisfong87@nauta.cu)

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## ABSTRACT

**Introduction:** community-acquired pneumonia is considered a priority health problem internationally. **Objective:** to characterize patients diagnosed with severe community-acquired pneumonia treated in the ICU and UCIE of the Hospital GJanral Docente Orlando Pantoja Tamayo, Granma, Cuba, according to clinical and epidemiological aspects. **Method:** an observational, descriptive and cross-sectional study was carried out on 107 patients with severe community-acquired pneumonia, between January 2021 and December 2023. The corresponding summary measures were applied for each type of clinical and epidemiological variable, in the comparison between the variables according to sex, the Chi-square test for homogeneity and the Mann-Whitney U test were used as appropriate. The Chi-square test of independence was used to explore the association between variables. For

each statistical test, a confidence level  $\alpha=0.05$  was applied. **Results:** sepsis was present in 47.2% of patients and mortality reached 43.0% of the studied sample. The median for age was 65.0 years (IQR=23.0). A significant statistical association was found between the variables: multiple organ dysfunction, sepsis, positive vasoactive-inotropic drugs, multilobar infiltrate, slow capillary refill and thermal gradient with the status at discharge. **Conclusions:** severe community-acquired pneumonia occurs at an advanced age, with the presence of sepsis and a high mortality rate; Furthermore, multiple organ dysfunction, sepsis, positive vasoactive-inotropic drugs, multilobar infiltrate, slow capillary refill, and thermal gradient are associated with mortality.

**Keywords:** pneumonia; mortality; respiratory failure; epidemiology



**RESUMEN**

**Introducción:** la neumonía adquirida en la comunidad es considerada un problema de salud prioritario a nivel internacional. **Objetivo:** caracterizar a los pacientes con diagnóstico de neumonía grave adquirida en la comunidad atendidos en la UCI y UCIE del Hospital GJanral Docente Orlando Pantoja Tamayo, Granma, Cuba, según aspectos clínicos y epidemiológicos. **Método:** se realizó un estudio observacional, descriptivo y transversal en 107 pacientes con neumonía grave adquirida en la comunidad, entre Janro 2021 a diciembre de 2023. Se aplicaron las medidas resúmJans correspondientes para cada tipo de variable clínica y epidemiológica, en la comparación entre las variables según sexo se utilizó la prueba de Ji Cuadrado de homogJanidad y la prueba U de Mann-Whitney según correspondiera. En la exploración de asociación entre variables se empleó la prueba de Jicuatrado de independencia. Para cada prueba estadística se aplicó un nivel de confianza  $\alpha=0,05$ . **Resultados:** la sepsis estuvo presente en el 47,2 % de los pacientes y la mortalidad alcanzó al 43,0 % de la muestra estudiada. La mediana para la edad fue de 65,0 años (RIC=23,0). Se encontró asociación estadística significativa entre las variables: disfunción múltiple de órganos, sepsis, drogas vasoactivas-inotrópicas positivas, infiltrado multilobar, lJan capilar lento y gradiente térmico con el estado al egreso. **Conclusiones:** la neumonía grave adquirida en la comunidad se presenta a una edad avanzada, con presencia de sepsis y alta tasa de mortalidad; además, la disfunción múltiple de órganos, la sepsis, las drogas vasoactivas-inotrópicas positivas, el infiltrado multilobar, el lJan capilar lento y el gradiente térmico están asociados a la mortalidad.

**Palabras clave:** neumonía; mortalidad; insuficiencia respiratoria; epidemiología

**RESUMO**

**Introdução:** a pneumonia adquirida na comunidade é considerada um problema de saúde prioritário internacionalmente. **Objetivo:** caracterizar os pacientes com diagnóstico de pneumonia comunitária grave atendidos na UTI e UCIE do Hospital GJanral Docente Orlando Pantoja Tamayo, Granma, Cuba, segundo aspectos clínicos e epidemiológicos. **Método:** estudo observacional, descritivo e transversal, realizado em 107 pacientes com pneumonia grave adquirida na comunidade, entre janeiro de 2021 e dezembro de 2023. Foram aplicadas as medidas resumo correspondentes para cada tipo de variável clínica e epidemiológica, na comparação entre as variáveis segundo sexo, foram utilizados o teste Qui-quadrado para homogJanidade e o teste U de Mann-Whitney, conforme apropriado. O teste Qui-quadrado de independência foi utilizado para explorar a associação entre as variáveis. Para cada teste estatístico foi aplicado um nível de confiança  $\alpha=0,05$ . **Resultados:** a sepse esteve presente em 47,2% dos pacientes e a mortalidade atingiu 43,0% da amostra estudada. A mediana para idade foi de 65,0 anos (IIQ=23,0). Foi encontrada associação estatística significativa entre as variáveis: disfunção de múltiplos órgãos, sepse, drogas vasoativas-inotrópicas positivas, infiltrado multilobar, enchimento capilar lento e gradiente térmico com o estado na alta. **Conclusões:** a pneumonia grave adquirida na comunidade ocorre em idade avançada, com presença de sepse e alta mortalidade; Além disso, disfunção de múltiplos órgãos, sepse, drogas inotrópicas vasoativas positivas, infiltrado multilobar, enchimento capilar lento e gradiente térmico estão associados à mortalidade.

**Palavras-chave:** pneumonia; mortalidade; insuficiência respiratória; epidemiologia

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## INTRODUCTION

Community-acquired pneumonia (CAP) is among the leading causes of sepsis, morbidity, mortality and disability, and is therefore considered a priority health problem at international level. It is the second leading cause of hospital admissions and the first cause of death due to infections. The incidence is variable and depends on socioeconomic and environmental conditions, access to health services, age and sex. It is also reported that it can affect up to 14 cases per 1,000 inhabitants.<sup>(1)</sup>

In the USA, more than 4 million patients are diagnosed with CAP and, of these, up to one million require hospitalization, resulting in high health care costs and ranking as the sixth leading cause of death. In 2017 in Argentina, the incidence of the disease was 384.2 cases per 100,000 population, and admissions due to CAP reached 34.0% of diagnosed patients.<sup>(2,3)</sup>

In 2021, pneumonia together with influenza was the third leading cause of mortality in Cuba, with 229.0 deaths per 100,000 inhabitants, and an increase of approximately four times compared to the previous year. The same behavior was reported in the province of Santiago de Cuba with 190.4 deaths per 100,000 inhabitants and an increase of approximately three times the previous value.<sup>(4)</sup>

The greatest burden of mortality in patients diagnosed with CAP occurs in hospitals, so much so that only an estimated mortality of less than 1.0% is found in patients who are treated on an outpatient basis. Between 20.0 to 25.0 % of patients diagnosed with CAP require admission and the in-hospital mortality rate is between 4.0 to 23.0 % of patients. It is higher in patients admitted to intensive care units (ICU).<sup>(1,5)</sup>

One to nine patients diagnosed with CAP will require admission to the ICU for the development of severe respiratory failure, sepsis and septic shock. Mortality in this group of patients is close to 50.0% of admitted cases. The last 15 years have witnessed a progressive increase in the incidence of severe CAP, accompanied by a very discrete decrease in mortality in these patients.<sup>(6)</sup>

Conceptually, CAP is defined as the presence of symptoms and signs of lower respiratory infection, given by: fever ( $>38$  °C), cough, expectoration, chest pain, dyspnea and signs of alveolar space occupation. The diagnosis is confirmed by the presence of a new pulmonary infiltrate through a chest X-ray. In addition, it takes into account that the symptoms and signs present in the patient began in the community without the history of hospital admission in the previous 15 days and up to 48 hours after the patient's hospitalization.<sup>(7)</sup>



In 2007 the Infectious Disease Society of America/American Thoracic Society established criteria for the diagnosis of severe CAP, divided into minor criteria: respiratory rate equal to or greater than 30 breaths/minute, arterial partial pressure of oxygen/inspiratory oxygen fraction ratio equal to or less than 250 mmHg, multilobar infiltrates by chest X-ray, confusion/disorientation, uremia equal to or greater than 3.3 mmol/l (20 mg/dl), leukocytes less than 4 000 cells/ml, thrombocytes less than 100 000/ml, hypothermia (<36 °C), arterial hypotension requiring intensive fluid resuscitation. Major criteria may include: septic shock and need for mechanical ventilation. Severe CAP is considered severe if the patient meets one major criterion or three or more minor criteria.<sup>(7)</sup> This definition was taken into account for the development of the present investigation.

During the study, no other research was found in the municipality of Contramaestre, Santiago de Cuba, Cuba province, referred to this subject; for this reason, it was decided to carry out this research, which aims to characterize patients with a diagnosis of severe community-acquired pneumonia according to clinical and epidemiological aspects.

## METHOD

An observational, descriptive and cross-sectional study was carried out in the population of patients diagnosed with severe CAP treated in the ICU and emergent intensive care unit (EICU) of the GJanral Teaching Hospital Orlando Pantoja Tamayo, Contramaestre municipality, Santiago de Cuba province, Cuba; in the period from January 2021 to December 2023.

The population was defined by the 107 patients with a diagnosis of severe CAP, who met the following criteria: patients over 18 years of age, attended in the ICU and the EICU, treated with invasive ventilation (IV), complete data in the clinical history, were not pregnant or puerperal patients, or patients with COVID-19. The sample consisted of all patients with complete data.

The variables used to achieve the research objective were: sex, hypostatic position, personal pathologic antecedents (PPA), multiple organ dysfunction (MOD), sepsis, vasoactive-inotropic-positive drugs, slow capillary refill (>3 s), thermal gradient, multilobar infiltrate, status at discharge (deceased, alive), age, body mass index (BMI), duration of IV, time from symptom onset to onset of IV, heart rate (HR), respiratory frequency (RF), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial blood pressure (MAP) and body temperature.

The primary data were obtained from the physical examination and the clinical histories of the patients at the time of admission to the ICU and EICU. The variables evaluated were obtained and measured by the authors.



For qualitative variables, the absolute frequency and percentage were used as summary measures; for quantitative variables, the median and interquartile range (IQR) was used. In the comparison of the variables between both sexes, the Chi-square test of homogeneity (qualitative variables) and the Mann-Whitney U test (quantitative variables) were used. The Chi-square test of independence was used to explore the association between discharge status (dependent variable) and the independent variables (hypostatic position, PPA, MOD, sepsis, positive vasoactive-inotropes drugs, slow capillary refill, thermal gradient, multilobar infiltrate).

For each statistical test of Chi-square of homogeneity, Chi-square of independence and Mann-Whitney U test, a confidence interval of 95.0 % and significance level  $\alpha=0.05$  was used. SPSS v.26.0 was used for statistical processing, and the results were presented in tables.

The research was performed with previous authorization of the Scientific Council and the center's Management. This research was in accordance with the Declaration of Helsinki of the World Medical Association.

## RESULTS

Table 1 shows that male patients predominated for 52.3 %, PPA were present in 83.2 % of the sample studied, followed by the presence of sepsis and deceased patients for 47.2 % and 43.0 %, respectively. In addition, significant statistical differences were found in the proportion of cases between both sexes for the variables presence of multilobar infiltrate and deceased patients, in both cases with predominance of the male sex.

**Table 1** Patients with severe community-acquired pneumonia according to presence of qualitative variables and sex.

Variables	Sex		Total (n=107) n (%)	Chi-square
	Female (n=51) n (%)	Masculine (n=56) n (%)		
Hypostatic	18 (35,3)	18 (32,1)	36 (33,6)	p=0,730
PPA	43 (84,3)	46 (82,1)	89 (83,2)	p=0,764
DMO	15 (29,4)	26 (46,4)	41 (38,3)	p=0,075
Sepsis	24 (47,1)	27 (48,2)	51 (47,7)	p=0,905
Positive vasoactive-inotropes drugs	16 (31,4)	23 (41,1)	39 (36,4)	p=0,298
Slow capillary refill	18 (35,3)	24 (42,9)	42 (39,3)	p=0,424
Thermal gradient	15 (29,4)	17 (30,4)	32 (29,9)	p=0,915
Multilobar infiltrate	13 (25,5)	31 (55,4)	44 (41,1)	p=0,002
Deceased	15 (29,4)	31 (55,4)	46 (43,0)	p=0,007

Note: PPA: personal pathologic antecedents, MOD: multiple organ dysfunction.

On analyzing the quantitative variables (Table 2), the median for age was 65.0 years (RIC=23.0), while the median duration of invasive ventilation was 3.0 days (RIC=2.0). Significant statistical differences were found between the medians of both sexes for the following variables: time from the beginning of symptoms to onset of IV and respiratory frequency.



**Table 2** Patients with severe community-acquired pneumonia according to presence of quantitative variables and sex

Variables	Sex		Total (n=107) Median (RIC)	UMW
	Female (n=51) Median (RIC)	Masculine (n=56) Median (RIC)		
Age (years)	73,0 (37,0)	61,5 (20,0)	65,0 (23,0)	p=0,351
BMI (kg/m <sup>2</sup> )	24,8 (8,3)	23,5 (4,2)	23,7 (5,5)	p=0,801
Duration of IV (days)	4,0 (2,0)	3,0 (3,0)	3,0 (2,0)	p=0,448
Time from onset of symptoms to onset of IV (days)	5,0 (5,0)	7,0 (3,0)	6,0 (4,0)	p=0,014
HF(lat/min)	106,0 (29)	101,5 (30,0)	103,0 (29,0)	p=0,530
R (resp/min)	28,0 (8,0)	26,5 (8,0)	28,0 (8,0)	p=0,041
SBP (mmHg)	110,0 (28,0)	114,0 (43,5)	110,0 (32,0)	p=0,132
TAD (mmHg)	64,0 (20,0)	70,0 (23,0)	70,0 (20,0)	p=0,311
MAP (mmHg)	76,6 (23,3)	87,3 (26,5)	82,0 (24,6)	p=0,165
Temperature (°C)	36,2 (0,4)	36,4 (0,6)	36,4 (0,6)	p=0,513

**Note:** BMI: body mass index, IV: invasive ventilation, HF: heart frequency, RF: respiratory frequency, SBP: systolic blood pressure, TAD: diastolic blood pressure, MAP: mean arterial blood pressure, UMW: Mann-Whitney U test.

When exploring the association between variables (Table 3), a significant statistical association was found between BMD/status at discharge and sepsis/status at discharge, with a higher incidence of patients in the group with absence of the condition and status at discharge alive.

**Table 3** Association between hypostatic position, personal pathological history, multiple organ dysfunction and sepsis with status at discharge.

Variables		Status upon leaving		Total(107) n (%)	Chi-square
		Deceased (n=46) n (%)	Vivo (n=61) n (%)		
		Hypostatic position	Yes	15 (32,6)	21 (34,4)
	No	31 (67,4)	40 (65,6)	71 (66,4)	
PPA	Yes	37 (80,4)	52 (85,2)	89 (83,2)	p=0,510
	No	9 (19,6)	9 (14,8)	18 (16,8)	
MOD	Yes	32 (69,6)	9 (14,8)	41 (38,3)	p<0,001
	No	14 (30,4)	52 (85,2)	66 (61,7)	
Sepsis	Yes	35 (76,1)	16 (26,2)	51 (47,7)	p<0,001
	No	11 (23,9)	45 (73,8)	56 (52,3)	

**Note:** PPP: personal pathologic antecedents, MOD: multiple organ dysfunction.

Table 4 shows that there was a significant statistical association between the following variables: positive vasoactive-inotropes drugs/status at discharge, multilobar infiltrate/status at discharge, slow capillary refill/status at discharge, thermal gradient/status at discharge. With a higher incidence of patients in the group with absence of the condition and state at discharge alive.



**Table 4** Association between the variables vasoactive-anisotropic drug-positive, multilobar infiltrate, slow capillary refill and thermal gradient with the state at discharge.

Variables		Status upon leaving		Total(107) n (%)	Chi-square
		Deceased (n=46)	Vivo (n=61)		
		n (%)	n (%)		
Positive vasoactive-inotropic drugs	Yes	28 (60,9)	11 (18,0)	39 (36,4)	p<0,001
	No	18 (39,1)	50 (82,0)	68 (63,6)	
Multilobar infiltrate	Yes	35 (76,1)	9 (14,8)	44 (41,1)	p<0,001
	No	11 (23,9)	52 (85,2)	63 (58,9)	
Slow capillary filling	Yes	30 (65,2)	12 (19,7)	42 (39,3)	p<0,001
	No	16 (34,8)	49 (80,3)	65 (60,7)	
Thermal gradient	Yes	24 (52,2)	8 (13,1)	32 (29,9)	p<0,001
	No	22 (47,8)	53 (86,9)	75 (70,1)	

## DISCUSSION

On reviewing the foreign and national literature, it was found that Montiel, et al.<sup>(5)</sup> found a higher incidence of female sex for 54.8% of patients, comorbidities were present in 92.3% of the sample and reported a mortality that reached 29.8% of patients. In turn, García, et al.<sup>(2)</sup> emphasize the greater presence of the male sex in the research, in addition to the fact that PPPs were present in 75.4% of the sample studied.

Ramírez<sup>(8)</sup> in his research highlights a clear predominance of the male sex with 80.0 % of the sample studied, the personal history of diseases was present in more than 65.0 % of the patients and reported a mortality of 35.0 % of the cases admitted for CAP. On the other hand, Saldías, et al.<sup>(9)</sup> described a predominance of male sex with 50.3 % and the presence of comorbidities in 82.3 % of the sample; the authors themselves noted the presence of a multifocal infiltrate pattern in the chest X-ray in more than 48.0 % of patients with CAP of bacterial and viral etiology.

Kim, et al.<sup>(10)</sup> found that the male sex was present in 61.7% of the sample studied with bacteremia, septic shock had an incidence of 27.4% of the patients and mortality was 40.6%. In addition, Sellarès, et al.<sup>(11)</sup> emphasize that male sex predominated with 63.5 % of patients, bilateral pulmonary consolidation was found in 12.6 %, septic shock in 10.3 % and mortality during hospitalization reached 8.0 %; likewise, Hyun, et al.<sup>(12)</sup> describe that 5.2 % of patients with CAP developed bacteremia.

When comparing the results, it was found that there were no coincidences with the research of Montiel, et al.<sup>(5)</sup> with respect to the predominant sex, which did not have the same behavior as the rest of the research<sup>(2,8-11)</sup> previously cited, where the male sex maintained similar behavior to the present research.





Regarding the differences found in the proportion of patients diagnosed with CAP in both sexes, Corica, et al.<sup>(13)</sup> describe that this difference is due to the protective role of estrogen in female health against respiratory infectious diseases, a protective role that is lost as age advances in the female sex. In the opinion of the authors of the present investigation, the difference in the proportion between both sexes in CAP is due to more than a biological cause, and the social, economic and spiritual aspects underlying this problem should be explored in greater depth.

On the other hand, the mortality reported by authors Montiel,<sup>(5)</sup> Ramirez,<sup>(8)</sup> and Sellarès<sup>(11)</sup> was lower than that of the present study; only coincidence was found with the study by Kim, et al.<sup>(10)</sup> The presence of high mortality in patients with severe CAP in the present study is related to a high incidence of sepsis and MOD in patients. The rest of the described findings present similar behaviors.

At the same time, Montiel, et al.<sup>(5)</sup> describe a mean age of 57.5 years (SD=22.8) and a predominance of the age group over 65 years with 41.1 % of the patients. In addition to the above, Garcia, et al.<sup>(2)</sup> in their study emphasize that the age group with the highest proportion of patients was 70 years or older, Ramirez<sup>(8)</sup> highlights that the highest incidence of patients was in the age group over 60 years and Saldías, et al.<sup>(9)</sup> describe a mean age of 70.2 years (SD=18.5).

Kim, et al.<sup>(10)</sup> found a median for age and BMI of 73.0 years (RIC=17.8) and 21.3 kg/m<sup>2</sup> (RIC=5.3), respectively; they also describe that the median for MAP was 66.7 mmHg (RIC=21.0), for HR was 113.0 beats per minute (RIC=32.0) and for RF was 24.0 breaths per minute (RIC=8.0). Carmo, et al.<sup>(14)</sup> described a median HR of 91.0 beats per minute (RIC=32.0), FR of 22.0 breaths per minute and body temperature of 36.2 °C (RIC=1.2). Corona, et al.<sup>(3)</sup> highlight that 52.2 % of the patients had a nutritional assessment of overweight according to BMI and Hyun, et al.<sup>(12)</sup> a mean of 22.4 kg/m<sup>2</sup> (SD=4.0) for BMI.

The findings described in the previously mentioned investigations <sup>(2,3,5,8-10,12,14)</sup> coincide with those reported in the present investigation.

Regarding variables related to mortality in patients with CAP, Montiel, et al.<sup>(5)</sup> found no significant statistical association between the presence of comorbidities and mortality. However, Garcia, et al.<sup>(2)</sup> described the quick Sequential Organ Failure Assessment (qSOFA) greater than 2 points as a prognostic factor for mortality in the patient with severe CAP with an odds ratio (OR)=3.08 (CI 95.0 %: 1.07 - 8.85, p=0.033); which in turn is used in the recognition of patients with sepsis at the time of hospital admission.

Similarly, Corona, et al.<sup>(3)</sup> in their investigation of factors related to mortality in patients with CAP, found that the presence of previous bed rest presented an OR=3.2 (CI 95.0 %: 2.1 - 4.8), the presence of chronic disease with an OR=2.0 (CI 95.0 %: 1.1 - 3.6). In addition, Kim, et al.<sup>(10)</sup> found that a risk factor for death in patients with severe CAP was sepsis, with an OR=2.22 (CI 95.0 %: 1.54 - 3.03).





In turn, García, et al.<sup>(2)</sup> found a significant statistical association between the presence of bilateral multilobar infiltrate with mortality in severe CAP, while Corona, et al.<sup>(3)</sup> found that bilateral multilobar infiltrate was a prognostic factor for mortality in these patients (OR=1.6; CI 95.0 %: 1.08 - 2.50). And Carmo, et al.<sup>(14)</sup> in their investigation of derivation and validation of a new severity scale for ICU admission of CAP patients, found that the need for vasopressor use had an (adjusted)OR=4.28 (95.0 % CI: 1.48 - 12.32) for the probability of death.

The studies<sup>(2,5,10,14)</sup> cited were in agreement with the present study, with the exception of the study by Corona, et al.<sup>(3)</sup> which recognizes the association of previous bed rest with mortality, which was not verified in the present study.

## CONCLUSIONS

Severe community-acquired pneumonia appears at an advanced age, with the presence of sepsis and a high mortality rate; in addition sepsis, MOD, vasoactive-in oestrogen-positive drug use, multilobar infiltrates, slow capillary refill, and thermal gradient are associated with mortality.

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**Conflicts of interest:**

The authors declare that there are no conflicts of interest.

**Author contributions:**

Luis Fong Pantoja: conceptualization, data curation, formal analysis, research, methodology, project management, resources, supervision, validation, visualization, writing-preparing the original draft, writing-revising and editing.

Niger Guzmán Pérez: conceptualization, data curation, formal analysis, research, methodology, resources, supervision, validation, visualization, writing-preparation of the original draft, writing-revision and editing.

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[Base de datos sobre características clínico-epidemiológicas de pacientes con diagnóstico de neumonía grave adquirida en la comunidad](#)

