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Original Article

Factors associated with confirmation determinants for COVID-19 notification

Fatores associados aos determinantes para a confirmação da notificação pela COVID-19

Factores asociados a determinantes para confirmación de notificación por COVID-19

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Abstract

Objective: To analyze the factors associated with the confirmation determinants of notified Coronavirus Disease-2019 (COVID-19) cases. **Method**: A cross-sectional study using two accompanying data for notifications in the state of Pernambuco, Brazil, between February and August 2020. Descriptive statistics and binary logistic regression were performed with odds ratios as the association measure. **Results**: A total of 38,178 cases were reported, of which 59.9% were confirmed. Factors associated with confirmation determinants included: male (OR: 1.08; 95% CI=1.02-1.14), older adults (OR 1.15; 95% CI=1.09-1.22) and race/white (OR:1.10; CI95%=1.03-1.17). Change in smell/taste isolated or associated with symptomatology (OR 2.41; 95% CI=2.13-2.72) and unreported deaths (OR: 2.74; 95% CI=2.57-2.92) have more chance of confirmation for COVID-19. **Conclusion**: The confirmation determinants for the notified cases demonstrate the importance of clinical symptoms such as loss of smell and taste, as well as evolution to death as an outcome.
Descriptors: COVID-19; Disease Notification; Hospitalization; Coronavirus; Signs and Symptoms

Resumo

Objetivo: analisar os fatores associados aos determinantes para a confirmação dos casos notificados pela *Corona virus Disease*-2019 (COVID-19). **Método:** estudo transversal com a utilização dos dados de acompanhamento das notificações no estado de Pernambuco, entre fevereiro e agosto de 2020. Realizou-se estatística descritiva e regressão logística binária com

razões de chance como medida de associação. **Resultados:** foram notificados 38.178 casos, sendo 59,9% confirmados. Fatores associados aos determinantes da confirmação: homens (OR:1,08; IC95%=1,02-1,14), idosos (OR 1,15; IC95%=1,09-1,22) e raça/cor branca (OR:1,10; IC95%=1,03-1,17). Alteração de olfato/paladar isolado ou associado na sintomatologia (OR 2,41; IC95%=2,13-2,72) e os óbitos no desfecho (OR:2,74; IC95%=2,57-2,92) tiveram mais chance de terem a confirmação para a COVID-19. **Conclusão:** os determinantes para a confirmação dos casos notificados demonstraram a importância de sintomas clínicos como a perda de olfato e paladar, assim como evolução para óbito como desfecho.
Descritores: COVID-19; Notificação de Doenças; Hospitalização; Coronavirus; Sinais e Sintomas

Resumen

Objetivo: Analizar los factores asociados a los determinantes para la confirmación de casos notificados por Coronavirus Disease-2019 (COVID-19). **Método**: Estudio transversal con datos del seguimiento de notificaciones en el estado de Pernambuco, Brasil, entre febrero y agosto de 2020. Se realizó estadística descriptiva y regresión logística binaria con razones de probabilidad como medida de asociación. **Resultados**: Se notificaron 38.178 casos, de los cuales se confirmó el 59,9%. Factores asociados a determinantes de confirmación: hombres (OR: 1,08; IC95%=1,02-1,14), adultos mayores (OR 1,15; IC95%=1,09-1,22) y raza blanca/color (OR:1,10; IC95%=1,03-1.17). La alteración aislada o asociada del olfato/gusto en los síntomas (OR 2,41; IC95%=2,13-2,72) y las muertes no declaradas (OR: 2,74; IC95%=2,57-2,92) tenían más probabilidades de confirmación por COVID-19. **Conclusión**: Los determinantes para la confirmación de los casos notificados demostraron la importancia de los síntomas clínicos como la pérdida del olfato y del gusto, así como la evolución a la muerte como resultado.
Descriptores: COVID-19; Notificación de Enfermedades; Hospitalización; Coronavirus; Signos y Síntomas

Introduction

Coronavírus Disease-2019 (COVID-19) is a disease caused by a new coronavirus identified as SARS-CoV-2, first recognized in Wuhan at the end of 2019, and presented a wide spectrum of severity and evolution.[1] With the rapid spread on all continents and generating a significant number of deaths and burdens on health systems, the World Health Organization (WHO) declared a Public Health Emergency of international concern regarding the global outbreak of the new coronavirus.[2]

It is a disease with high transmissibility, clinical severity and high mortality,[3] and therefore has triggered the commitment and collaboration between scientists around the world in a coordinated effort which has not only accelerated understanding of the pathophysiology of COVID-19 and its clinical manifestations, but has also contributed to the better prognosis of hospitalized patients.[4]

The most common clinical symptoms are fever, cough, fatigue and dyspnea, while the least reported symptoms are sputum production, headache, hemoptysis and diarrhea.[5] The literature points out some groups which are at greater risk for illness and severity, such as older adults and those with comorbidities.[6] Diabetes, followed by hypertension and obesity, are identified as predisposing factors for infection and case severity, and are related to the increase in need for hospitalization in the Intensive Care Unit (ICU).[7]

COVID-19 caused more than 600 thousand deaths in two years of the pandemic in Brazil, with an average mortality rate of 320.3 per 100 thousand inhabitants and a fatality rate of 2.1% recorded in June 2022. In addition, some factors can influence lethality, such as knowledge about the disease, installed capacity at the hospital level, and carrying out diagnoses, in addition to monitoring cases which are still in progress.[3]

Early diagnosis of cases of the disease is relevant for implementing immediate care which can improve the prognosis.[9] In addition, the notification of confirmed cases of COVID-19 is important to identify the profile of cases and trace the disease evolution.[10] Therefore, the objective of this study is to analyze the factors associated with the confirmation determinants of reported COVID-19 cases.

Method

A cross-sectional epidemiological study was conducted using the databases related to monitoring notifications of COVID-19 in the state of Pernambuco, made available by the Planning and Management Department in conjunction with the State Health Department and the State Agency for Information Technology of Pernambuco.[11]

The monitoring panel provided provides two types of information, one aggregated and one individualized, called syntactic base and general base, respectively. Files with a .csv extension are provided for download in both possibilities, as well as online monitoring of cases. The present study analyzed the general basis which deals with individual cases reported regardless of outcome (confirmed, discarded, clinical improvement, or death) downloaded in December 2020.

The population comprised all cases reported by COVID-19 in the state of Pernambuco until the analyzed period. All records of cases that were reported between

February and August 2020 were included in the sample. Notifications that showed absence or inconsistency in the information record were excluded, leaving 38,178 records in the sample.

The dependent variable was case conclusion: confirmed or discarded. The independent variables were: gender, race/color, age group, symptoms, presence of comorbidities, related comorbidity, need for hospitalization, and case evolution.

The database was initially constructed by downloading files followed by the transfer to statistical software and analysis. The variables were also dichotomized aiming at a better analysis of the associated factors. Binary variables were created to characterize them considering the diversity of symptom and comorbidity associations related to the cases. Categorization involved the presence of a particular symptom or comorbidity alone or associated with other symptoms or comorbidities.

Descriptive statistics were used through frequency distribution. Associated factors were evaluated using binary logistic regression, with an analysis of effects being performed using odds ratios (Odds Ratio - OR), which enabled calculating the occurrence probability of events in the analyzed outcome. The inclusion of variables in the multivariate model was performed using the stepwise method, adopting $p<0.20$ as an inclusion criterion, thus obtaining an adjusted multivariate model. A significance level of 5% and a confidence level of 95% were adopted. The Stata 14.0 software program was used for statistical analysis and Microsoft Office Excel 2013 to build the database and tables.

Considering the use of aggregated and public domain data, the project followed the ethical precepts established in the Resolution of the National Health Council No. 510/2016, which establishes in its article 1 that there is no need for evaluation by the CEP/CONEP system. Therefore, evaluation by the Research Ethics Committee was not necessary.

Results

A total of 38,178 cases were reported in the analyzed period, with 59.9% being confirmed. Most were non-older adults (55.8%), female (50.1%) and self-declared non-white (77.5%); 30.8% had some comorbidity. Isolated or associated diabetes was present

in 45.8% of the presented comorbidities, along with isolated or associated heart diseases in 65.9%, isolated or associated respiratory diseases in 13.8%, presence of obesity in 9.8%, and patients had multiple comorbidities in 40.9% of the cases (Table 1).

Table 1 - Clinical and sociodemographic profile of reported cases of COVID-19. Pernambuco, February - August, 2020 (n=38,178).

	n	%
Case conclusion		
Discarded	15,314	40.1
Confirmed	22,864	59.9
Age group		
Non-older adult	21,317	55.8
Older adult	16,861	44.2
Gender		
Female	19,133	50.1
Male	19,045	49.9
Race/skin color[†]		
Non-white	17,970	77.5
White	5,204	22.5
Presence of comorbidity		
No	26,433	69.2
Yes	11,745	30.8
Isolated or associated Diabetes[§]		
No	6,371	54.2
Yes	5,374	45.8
Isolated or associated heart disease[§]		
No	4,007	34.1
Yes	7,738	65.9
Isolated or associated respiratory disease[§]		
No	10,125	86.2
Yes	1,620	13.8
Isolated or associated obesity[§]		
No	10,594	90.2
Yes	1,151	9.8
Multiple comorbidities[§]		
No	6,940	59.1
Yes	4,805	40.9

[†]O (n) refers to cases which only contained race/color information.

[§]O (n) refers to cases which only presented a certain isolated or associated comorbidity.

Regarding the symptoms presented by the patients, it was observed that 85.5% were isolated or associated respiratory symptoms, 62.1% had isolated or associated fever and 51.0% had fever associated with respiratory symptoms. Other symptoms reported, but less frequently, were gastrointestinal tract (GI) symptoms (6.2%), rash

(0.2%), headache (11.9%), smell/taste changes (6.7%). %) and fever associated with altered smell/taste (4.7%). In 78% of the cases hospitalization was necessary and regarding the evolution of the case in the notification, 71.9% of the cases were recovered or hospitalized and 28.1% died (Table 2).

Table 2 - Symptomatic profile and evolution of reported cases of COVID-19. Pernambuco, February - August, 2020 (n=38,178).

	n	%
GIT symptoms (alone or associated))		
No	35,799	93.8
Yes	2,379	6.2
Rashes (isolated or associated)		
No	38,100	99.8
Yes	78	0.2
Headache (isolated or associated)		
No	33,646	88.1
Yes	4,532	11.9
Change in smell or taste (isolated or associated)		
No	35,613	93.3
Yes	2,565	6.7
Respiratory symptoms (isolated or associated)		
No	5,528	14.5
Yes	32,650	85.5
Fever (isolated or associated)		
No	14,471	37.9
Yes	23,707	62.1
Fever associated with respiratory symptoms		
No	18,710	49.0
Yes	19,468	51.0
Fever associated with change in smell/taste		
No	36,393	95.3
Yes	1,785	4.7
Evolution of reported cases		
Recovered or hospitalized	27,464	71.9
Death	10,714	28.1
Hospitalization		
No	8,077	22.0
Yes	28,695	78.0

GIT - Gastrointestinal tract

When analyzing the determining confirmation factors for the reported cases, it was observed that men (OR 1.08; p-value=0.006), older adults (OR 1.15; p-value<0.001) and white race/color (OR 1.10; p-value=0.005) were more likely to have a confirmed

case. People who presented isolated or associated smell/taste changes were twice as likely to be confirmed for COVID-19 (OR 2.41; p-value<0.001) when compared to other symptoms. Notified death cases were twice as likely to be confirmed (OR 2.74; p-value<0.001) (Table 3).

Table 3 – Confirmation determinants of reported COVID-19 cases. Pernambuco, February - August, 2020 (n=38,178).

	Odds Ratio	p-value	95%CI	
Gender				
Male	1.08	0.006	1.02	1.14
Female	1.00			
Race/color				
White	1.1	0.005	1.03	1.17
Non-white	1.00			
Age group				
Older adult	1.15	<0.001	1.09	1.22
Non-older adult	1.00			
Isolated or associated change in smell/taste				
Yes	2.41	<0.001	2.13	2.72
No	1.00			
Presence of comorbidity				
Yes	1.04	0.210	0.98	1.1
No	1.00			
Case evolution in the notification				
Death	2.74	<0.001	2.57	2.92
Recovered or hospitalized	1.00			

Discussion

From the results, it was possible to observe that the profile of patients during the analyzed period was predominantly non-older adult and self-declared non-white, with a slight prevalence of females, and most of the reported cases had the result confirmed.

The age group of the patients analyzed is in agreement with the profile found in research on the subject.[12] In a study carried out in Beijing on the characteristics of COVID-19 infection, there was variation according to the severity of the cases, as most of the mild cases were young adults, while older adults aged 60 years or older predominated in severe cases.[12] Cases among adults with a mean age of 40.1 years prevailed in Brusque, Santa Catarina,[13] while the predominant age group in Fortaleza, Ceará, was 36 to 60 years.[14]

There is no consensus in the studied literature regarding gender, with the prevalence of a given gender varying according to the country and region of analysis. There was a prevalence of females in the total number of cases of COVID-19 infection in the city of Almeria in Spain.[15] Males in the city of Peshawar in Pakistan had a higher frequency in the total of cases, corresponding to 70.25% infected.[16] Studies analyzed in Brazil showed a predominance of both females[14,17] and males.[13]

A smaller proportion of patients had comorbidities, with diabetes, heart disease, respiratory diseases, obesity and multiple comorbidities standing out among those reported. This profile is similar to that found in the national[14] and international literature,[18] in which the prevalence of comorbidities such as diabetes, hypertension and obesity was also evidenced.

The correlation of comorbidities with the disease severity showed that preexisting chronic diseases, especially hypertension and diabetes, were strongly related to the increase in the severity of cases and the need for ICU admission.[19] In addition to these, cardiovascular and respiratory diseases system may also potentiate the risk of severity in patients.[20]

The main symptoms presented by the patients (whether isolated or associated) were fever, respiratory symptoms and fever associated with respiratory symptoms. To a lesser extent, other symptoms such as those of the gastrointestinal tract, rash, headache, change in smell/taste and fever associated with a change in smell/taste were also evidenced.

The symptoms found in the analyzed studies show the predominance of symptoms such as fever, cough, fatigue and dyspnea in most cases.[7,16,20] Other symptoms such as headache and gastrointestinal symptoms were also observed in Wuhan, China, but with a lower frequency.[5]

Hospitalization was necessary in most patients, and recovery or hospitalization predominated regarding the case evolution, while a smaller proportion progressed to death. Hospitalization occurs after clinical worsening of patients who develop a severe acute respiratory syndrome and require hospitalization for respiratory support in clinical beds or specialized care such as in the ICU.[21]

Confirmed cases associated with risk factors increase the severity of the disease, considerably increasing the number of hospitalizations and the need to structure health services to meet the demand.[19] When there is an imbalance between demand and supply of hospital beds and assisted ventilation equipment, the healthcare system situation becomes critical and may result in an increase in mortality in places where service provision is not prepared.[22]

Regarding the confirmation determinants, it was observed that men, older adults and white people were more likely to have a confirmed case for COVID-19. These characteristics were also evidenced in a national study on the clinical and epidemiological profile, showing a higher prevalence in all the individuals studied.[13] The male population is also commonly identified as having a high frequency of SARS-CoV-2 infections.[16]

In addition, patients who presented changes in smell/taste isolated or associated with other symptoms and reported cases of death were twice as likely to have the case confirmed. A cross-sectional study on smell/taste changes in Milan, Italy, demonstrated that these symptoms are frequent in patients with SARS-CoV-2 infection and may precede the onset of clinical disease developed.[23] A meta-analysis study showed that olfactory disorder symptoms were strong predictors for the positivity of COVID-19 cases when compared to other symptoms, indicating its prevalence in 62% of confirmed cases.[24]

The literature also documents that anosmia is more common in patients with COVID-19 than in patients suffering from other respiratory infections or controls,[25] and olfactory and gustatory dysfunctions may be associated with milder cases of the disease and a lower mortality rate.[26]

Thus, it is essential to know the determining factors for confirming cases, considering the potential that early diagnosis and treatment have in reducing the risk of transmission and worsening of cases.[27] In this sense, they help prevent and control the disease, further reducing the burden on hospitals.[27]

It is noteworthy that the virus has been undergoing mutations since the first cases of SARS-CoV-2 infection until the present moment, which lead to the emergence of new variants around the world, and which present a different behavior in relation to

clinical manifestations, are more transmissible and intensify the severity of cases.[28] Moreover, some variants caused a change in the profile of infection, such as aggravation in the younger age group, severity of symptoms and longer hospital stays.[29]

In addition, the introduction of immunization against COVID-19 through vaccination has improved mortality rates and aggravated cases, especially in the highest risk population such as older adults with comorbidities, with a positive impact on the number of hospitalizations and deaths of patients.[30] In this context, maintaining preventive measures and expanding vaccination to minimize the circulation of the virus, preventing infections and consequently reducing the possibilities of evolution of SARS-CoV-2 is imperative to control the pandemic.[28]

The limitation of this study refers to the use of a secondary source and collection carried out in the initial period of the pandemic, which may present underreporting, inconsistencies and incompleteness due to inadequate filling out of the notification forms and inputting into the Information System by the Secretariats of the analyzed state. Other limitations were related to the large number of reported symptom combinations.

The study made it possible to analyze and discuss the factors associated with confirmation determinants for reported cases of COVID-19 in the state of Pernambuco. The results enabled recognizing the clinical, demographic and symptomatological profile of the notified patients during the analyzed period, in addition to the clinical outcomes after diagnosis confirmation.

Conclusion

The confirmation determinants for reported cases of COVID-19 in the state of Pernambuco evidenced in the present study especially demonstrated the importance of some clinical symptoms such as loss of smell and taste, as well as evolution to death as an outcome during the initial period of the pandemic between February to August 2020. Other characteristics such as gender, race/color and age group were also decisive for confirming cases.

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