Prognosis of hospitalized smoking patients for COVID-19: Integrative review

RESUMO | Objetivo: analisar as evidências científicas sobre o prognóstico de pacientes tabagistas que foram hospitalizados por COVID-19. Método: revisão integrativa baseada na estratégia PICO, realizada com 21 artigos indexados nas bases de dados Pubmed, Web of Science, Lilacs e SCOPUS, em maio de 2021. Resultados: foram identificados 798 estudos, e destes 21 compuseram a amostra. Os principais prognósticos identificados foram: risco aumentado de hospitalização, risco de gravidade da COVID-19 aumentado, maiores ocorrências de hospitalização e longa permanência em Unidade de Terapia Intensiva, maiores chances de uso de ventilação contínua e maiores índices de mortalidade. Conclusões: evidenciou-se relação do tabagismo com maiores índices de hospitalização, agravamento da doença, maiores chances de admissão em Unidades de Terapia Intensiva, necessidade de ventilação mecânica e elevados índices de mortalidade. Ainda, fomenta a produção de estudos que visem estudar características desfavoráveis na evolução da COVID-19.
Descritores: COVID-19; Enfermagem; Hospitalização; Prognóstico; Tabagismo.

ABSTRACT | Objective: to analyze the scientific evidence on the prognosis of smokers who were hospitalized for COVID-19. Method: integrative review based on the PICO strategy, carried out with 21 articles indexed in Pubmed, Web of Science, Lilacs and SCOPUS databases, in May 2021. Results: 798 studies were identified, and of these 21 made up the sample. The main prognoses identified were: increased risk of hospitalization, increased risk of COVID-19 severity, greater occurrences of hospitalization and long stay in the Intensive Care Unit, greater chances of using continuous ventilation and higher mortality rates. Conclusion: there was evidence of a relationship between smoking and higher rates of hospitalization, worsening of the disease, higher chances of admission to Intensive Care Units, need for mechanical ventilation and high mortality rates. It also encourages the production of studies aimed at studying unfavorable characteristics in the evolution of COVID-19.
Keywords: COVID-19; Nursing; Hospitalization; Prognosis; smoking.

RESUMEN | Objetivo: analizar la evidencia científica sobre el pronóstico de fumadores hospitalizados por COVID-19. Método: revisión integradora basada en la estrategia PICO, realizada con 21 artículos indexados en las bases de datos Pubmed, Web of Science, Lilacs y SCOPUS, en mayo de 2021. Resultados: se identificaron 798 estudios, de los cuales 21 conformaron la muestra. Los principales pronósticos identificados fueron: mayor riesgo de hospitalización, mayor riesgo de severidad de la COVID-19, mayores ocurrencias de hospitalización y larga estancia en la Unidad de Cuidados Intensivos, mayores posibilidades de uso de ventilación continua y mayores tasas de mortalidad. Conclusiones: el tabaquismo se asoció con mayores tasas de hospitalización, empeoramiento de la enfermedad, mayores posibilidades de ingreso a Unidades de Cuidados Intensivos, necesidad de ventilación mecánica y altas tasas de mortalidad. También incentiva la producción de estudios que tengan como objetivo estudiar características desfavorables en la evolución del COVID-19.
Palabras claves: COVID-19; Enfermería; Hospitalización; Pronóstico; de fumar.

Natan David Pereira
Specialist Nurse - State University of Maringá - UEM
ORCID: 0000-0002-7116-0533

Eduardo Rocha Covre
Master - State University of Maringá - UEM
ORCID: 0000-0001-7338-121X

Francielle Renata Danielli Martins Marques
Master - State University of Maringá - UEM
ORCID: 0000-0002-8578-9615

Grazieli Adrieli Rodrigues Pires
Master - State University of Maringá - UEM
ORCID: 0000-0002-9673-9218

Ligia Carreira
Professor at the State University of Maringá - UEM
ORCID: 0000-0003-3891-4222

Marcelle Paiano
Professor at the State University of Maringá - UEM
ORCID: 0000-0002-7597-784X

Luiz Augusto Facchini
Professor at the Federal University of Pelotas - UFPEL
ORCID: 0000-0002-5746-5170

Maria Aparecida Salci
Professor at the State University of Maringá - UEM
ORCID: 0000-0002-6386-1962

Recebido em: 13/02/2022
Aprovado em: 28/03/2022

INTRODUCTION

Beginning in December 2019, in Wuhan, Hubei Province, China, coronavirus disease (COVID-19) is characterized as an infectious disease caused by SARS-CoV-2. With a sudden onset, rapid spread and high rates of morbidity and mortality, the disease quickly spread to the rest of the world, becoming a pandemic and overloading the world's health systems. [1] By July 4th, 2021, more than 182.3 million confirmed cases of SARS-CoV-2 infection had been repor-

ted to the World Health Organization (WHO), with more than 3.9 million of these having died. [2]

COVID-19 can evolve in different ways and has the following severity classification: 1) Asymptomatic cases: absence of clinical signs; 2) Mild cases: mild signs or mild respiratory tract infection; 3) Moderate cases: presence of pneumonia associated with the coronavirus and, in most cases, need for non-invasive ventilatory support; 4) Severe cases: compromised breathing pattern, requiring hospitalization in Intensive Care Units (ICU) and invasive mechanical ventilation; 5) Critical cases: people who need immunomodulatory therapy, have multiple organ failure or suffer from a cytokine storm. [3]

Among the risk factors responsible for more serious outcomes of COVID-19, advanced age, heart problems, decompensated high blood pressure, diabetes mellitus, impaired immunity, chronic kidney disease, high-risk pregnancy, severe obesity, liver problems or coagulopathies, smoking, chronic lung disease, and moderate or severe asthma. All these conditions are greatly aggravated in people who use tobacco, due to the impairments that the consumption of the product causes. [4-5]

Smoking is considered a Chronic Non-Communicable Disease (NCD) and a global public health problem, characterized by dependence on nicotine present in tobacco products. It is estimated that, annually, it is responsible for approximately eight million preventable early deaths in the world, of which about seven million are caused by direct consumption of tobacco and 1.2 million by passive exposure to the product. [6-7]

Tobacco consumption is harmful to human health, as it is a substance recognized as a risk factor for several cardiovascular diseases, neoplasms, CNCDs and communicable diseases, such as tuberculosis, influenza and cold sores. Additionally, continuous exposure to nicotine causes a decrease in lung functions, a reduction in the body's defense mechanisms and a considerable increase in the incidence of respiratory infections. [6,8-9]

Among the ways to consume tobacco, smoking is the most common. This practice increases the risk of infection by SARS-CoV-2, considering the physical and immunological susceptibility caused to the organism, as well as the risk of contagion when handling cigarettes with contaminated hands and taking them to the oral mucosa or facial region, facilitating the entry of the virus into the body. [10-11]

Some studies correlate the development of the severe form of COVID-19 with the development of pneumonia and evolution to death, mostly in smokers, allowing the association of tobacco with worse prognosis of the disease. [12-15]

In this way, the development of studies involving the theme for the production of scientific evidence on the influence and association of smoking with the prognoses of people who developed COVID-19 becomes relevant. Thus, this study aimed to analyze the available scientific evidence on the prognosis of smokers who were hospitalized for COVID-19.

METHOD

This is an Integrative Review (IR) of the literature, structured according to the Preferred Reporting Items for Systematic Review and Meta-Analyses (Prisma) flowchart. According to this tool, a checklist with 27 items and a flowchart composed of four steps must be followed, in order to assist in the reporting and production of reviews and meta-analyses. [16]

To carry out this review, the literature search took place on May 10, 2021, by two different and independent reviewers, and was structured in six steps: 1) identification of the problem and elaboration of the guiding question; 2) establishment of inclusion and exclusion criteria for content; 3) definition of the databases used and research resources; 4) definition of the contents used in the construction of the project; 5) selection, evaluation of contents and interpretation of results; 6) review production. [17]

The research question was designed according to the PICo strategy [18], considering the acronyms P: Patient – Smokers; I: Phenomenon of interest – Prognosis; Co: Context – Hospitalization for COVID-19. In view of this, the following guiding question was obtained: What is the prognosis of smokers who were hospitalized for COVID-19?

The search for scientific evidence took place through virtual access to the following databases: US International Library of Medicine (Pubmed), Web of Science, Latin American and Caribbean Literature on Health Sciences (LILACS) and Scopus.

The following inclusion criteria were established: studies relating smoking to hospitalization for COVID-19; original studies; published in full and from January 1st, 2020 to May 10th, 2021; in English, Portuguese and Spanish. Literature reviews/reflections, editorials, abstracts of proceedings, dissertations, theses and reports were excluded. Repeated contents were considered only once.

The search strategy was structured with controlled and uncontrolled descriptors, according to the configurations required in each database. The descriptors used are indexed in the Health Sciences Descriptors (DECS), namely: COVID-19, smoking, hospitalization and prognosis. All the descriptors mentioned were used, as well as alternative terms, according to the return of results in each database, interconnected with the Boolean connectors AND and OR simultaneously.

The search in the databases was manual and initially resulted in 5,971

studies and five records obtained from other sources. First, the filters of free availability in full and publication date were applied, excluding 5,046 records. The titles of 925 articles were read to identify those that addressed the proposed theme as an inclusion criterion, resulting in 79 studies. In the next step, 50 records were eliminated because they did not meet the inclusion criteria. Subsequently, the records were inserted into the Mendeley reference manager in order to identify possible duplications in the selection of contents. [19] As a result, eight duplicate publications were excluded, and the publication identified in the first searched database was maintained, resulting in a final sample composed of 21 studies included in this review (Figure 1).

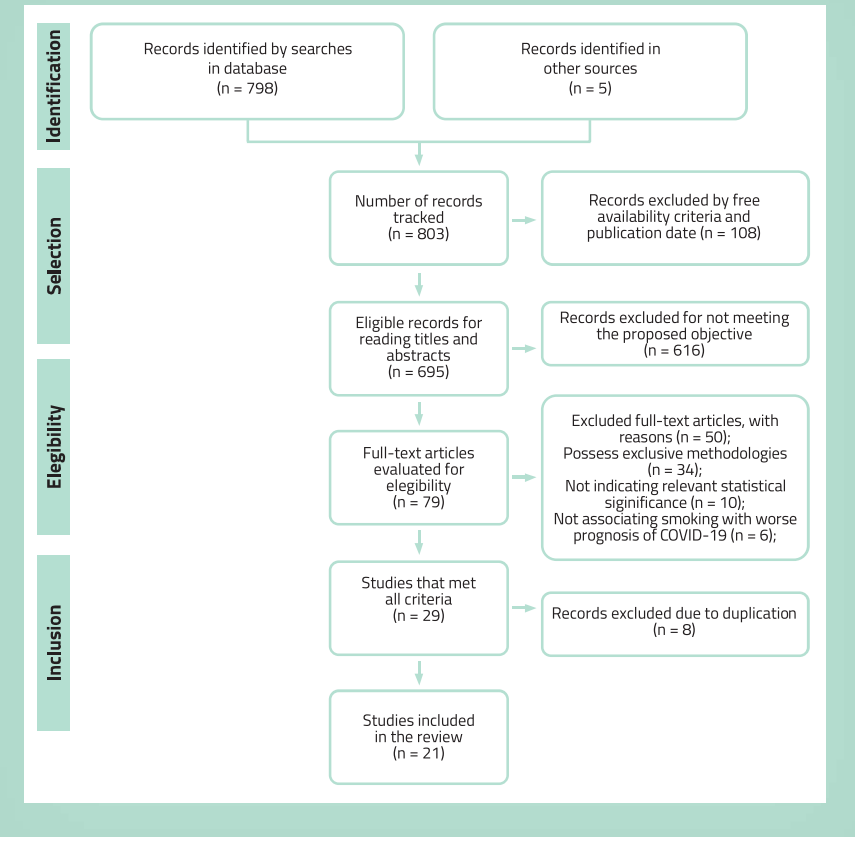
To facilitate the identification and visualization of the main information of each study that consolidated the final sample, the following characterization information from the manuscripts was extracted: name of authors, year of publication, place of research, language of the article, level of evidence, objective and type of study and its main results. The selected studies were identified by abbreviated prefixes, being article 1 (A1), article 2 (A2), and so on.

The level of evidence of the studies selected to compose this review followed the protocol proposed by the Agency for Healthcare Research and Quality (AHRQ), which covers six levels: (I) evidence resulting from meta-analysis and systematic review; (II) evidence obtained from randomized clinical trials; (III) evidence obtained in clinical trials without randomization; (IV) evidence from cohort and case-control studies; (V) evidence from a systematic review of descriptive and qualitative studies; (VI) evidence based on a descriptive or qualitative study. [20]

The ATLAS.ti® software was used for the graphic visualization of information from the selected studies. This instrument enabled the construction of the word cloud, based on the main results of the studies selected to compose this review. The use of this software confers greater reliability to the results, since it avoids possible biases of the authors. [21]

As it is an integrative literature review, there was no need to submit the project to the Ethics Committee, but the study was carried out keeping the same ethical precepts required of authors.

Figure 1. Identification and selection of articles included in the integrative review, according to the PRISMA flowchart. Maringá, PR, 2021.



Source: survey data, 2021.

RESULTS

All studies selected for this review were published in electronic journals with free access. As for the methodological design of the articles, 16 are retrospective cohorts; three in descriptive studies; a cross-sectional study and a clinical trial. Regarding the country in which the studies were carried out, the sample consisted of ten studies carried out in China, seven in the United States of America (USA), two in Brazil, one in Spain and one worldwide. According to the level of evidence of the selected articles, 16 were classified as level IV; four, level VI; and a level II (Table 2).

Still, there were several objectives and methodological approaches of the studies selected to compose this review, as well as the sample. The main results of each of the studies are presented in a summarized way, as shown in Table 2.

DISCUSSION

Given the current pandemic sce-

nario of COVID-19, investigations that analyze factors associated with the development of the disease, its aggravating factors and prognoses are extremely important. This integrative review aimed to analyze the scientific evidence available in the literature on the prognosis of smokers who were hospitalized for COVID-19. And, scientific evidence suggests that smoking is closely associated with worse prognosis for COVID-19, raising the need for hospitalization, prolonged hospitalization, ICU admission, occurrence of sequelae after the disease and death. [43]

Behavioral factors in people who smoke were considered risk predictors of contamination by SARS-CoV-2. Considering the different forms of tobacco consumption and the habit of smoking being the most common, scientists say that this practice can be a means of transmission of the virus because the person takes the contaminated hand to the mouth repeatedly, increasing exposure to the risk of contamination. [44]

The smoke produced by tobacco consumption was considered responsible for the increase in the binding sites of the proteins present in the viral envelopes, the angiotensin-converting enzyme (ACE2), providing a fusion of the viral envelopes with the membranes of the host cell. [45]

Several individuals infected with SARS-CoV-2 remained asymptomatic in the initial stage of the disease. However, after a while, they started to present symptoms in an insidious way. Among individuals who presented this condition, 15.7% reported being users or having used tobacco at some point in their lives, according to a study carried out in Hunan, China, with 70 individuals who tested positive for the coronavirus between January and February 2020. [27]

It is evident that tobacco causes a decrease in lung functions, which can cause pneumonia, aggravating the health condition of patients who contract

Table 2. Main characteristics of the selected articles, according to number, objective, methodological approach and main results found.

Author/Year/ Country	Study Title	Study Purpose
Altschul et al.[22] 2020, EUA.	Predictors of mortality for patients with COVID-19 and large vessel occlusion.	To assess the mortality risk of patients with ELVO and COVID-19.
Lohia et al.[23] 2020, EUA.	Preexisting respiratory diseases and clinical outcomes in COVID-19: a multihospital cohort study on predominantly African American population	To investigate correlation between smoking and clinical outcomes in patients with COVID-19.
Zhou et al.[24] 2020, China.	Exploiting an early warning Nomogram for predicting the risk of ICU admission in patients with COVID-19: a multi-center study in China.	Identify and predict ICU admission of patients with COVID-19
Liu et al.[25] 2020, China.	Analysis of factors associated with disease outcomes in hospitalized patients with 2019 novel coronavirus disease.	Investigate factors that lead to pneumonia progression in COVID-19 patients.
Guan et al.[26] 2020, China.	Comorbidity and its impact on 1590 patients with COVID-19 in China: a nationwide analysis.	Assess the risk of serious adverse outcomes in patients with COVID-19.
Tao et al.[27] 2020, China.	Determination of risk factors for predicting the onset of symptoms in asymptomatic COVID-19 infected patients.	To investigate risk factors of symptom onset and clinical features in asymptomatic COVID-19 infected.
Zhou et al.[28] 2020, China.	Prognosis models for severe and critical COVID-19 based on the Charlson and Elixhauser comorbidity indices.	Establish prognostic scoring models in severe and critical cases of COVID-19.
Graziani et al.[29] 2020, Espanha.	Characteristics and Prognosis of COVID-19 in Patients with COPD.	Explore the impact of COVID-19 on a large population-based sample of COPD patients.
Benzano et al.[30] 2020, Brasil.	Clinical vulnerability for severity and mortality by COVID-19 among users of alcohol and other substances.	Investigate the prevalence of risk factors for the severity of COVID-19.
Yu et al.[31] 2020, China.	Association Between Clinical Manifestations and Prognosis in Patients with COVID-19.	Determine risk factors among individuals with COVID-19.
Peng et al.[32] 2020, China.	Smoking Is Correlated With the Prognosis of Coronavirus Disease 2019 (COVID-19) Patients: An Observational Study.	Explore the role of smoking in COVID-19.

SARS-CoV-2. In a study conducted in China with 95 people infected with the virus, smoking was identified as an independent risk factor associated with exacerbation of the disease after treatment for Severe Acute Respiratory Syndrome (SARS). Among those diagnosed, 21.1% reported a history of smoking and had severe pneumonia.[31]

A study carried out in Japan showed that smokers are more susceptible to early, diverse and unstable colonization of respiratory pathogens when compared to non-smokers and are more likely to develop respiratory pathological conditions.[46]

Justifying these findings, the observation of computed tomography (CT) images of the chest revealed spots called "ground glass strips", responsible for the increase in the attenuation coefficient of the lungs, in addition to hypervascularization of the pulmonary pleura, bilateral pulmonary opacity and alveolar consolidation.[47-48]

Tobacco, in addition to all the aforementioned pulmonary impairments, is associated with a higher risk of hospitalization among those contaminated by SARS-CoV-2. Due to the clinical signs of the disease, individuals find themselves in the need to seek health care. A retrospective cohort conducted in Florida (USA) showed that smokers had a higher risk of hospitalization, with 28.8% reporting being tobacco users, while 29.8% were former smokers.[34]

Corroborating this evidence, a study conducted in Atlanta (USA) also showed that tobacco users were 2.3 times more likely to be hospitalized when compared to non-smokers. Additionally, smoking associated with another risk factor such as obesity, hypertension or diabetes, the chances of hospitalization due to COVID-19 become even greater.[40]

People who had a history of or used tobacco had significantly higher hospitalization rates than non-smokers and had more severe outcomes. A study conducted in the USA found that, among 10,216 patients who required hospitalization and assistance in health institutions due to COVID-19, 21.2% were former smokers and 7.3% current smokers.[36]

A retrospective cohort of 941,280 people showed that a history of smoking increased the risk of developing the severe form of COVID-19 twice as much

Zhao et al.[33] 2020, EUA.	Prediction model and risk scores of ICU admission and mortality in COVID-19.	Predict ICU admission and mortality in patients with COVID-19.
Jehi et al.[34] 2020, EUA.	Development and validation of a model for individualized prediction of hospitalization risk in 4,536 patients with COVID-19.	To characterize hospitalized patients with COVID-19.
Wang et al.[35] 2020, China.	Critically Ill Patients with Coronavirus Disease 2019 in a Designated ICU: Clinical Features and Predictors for Mortality.	Investigate prognostic factors of critically ill patients with COVID-19.
Neira et al.[36] 2021 EUA	Smoking and risk of COVID-19 hospitalization.	To assess the risk of hospitalization in patients by smoking status.
Li et al.[37] 2021, Mundial.	Modifiable lifestyle factors and severe COVID-19 risk: a Mendelian randomisation study.	Investigate causality between BMI, smoking, physical activity and alcohol consumption to severe COVID-19.
Adrish et al.[38] 2020, EUA.	Association of smoking status with outcomes in hospitalized patients with COVID-19.	To analyze patients' smoking habits in the evolution of hospitalized patients with COVID-19 disease.
Soares et al.[39] 2020, Brasil.	Factors for Hospitalization and Mortality due to COVID-19 in Espírito Santo State, Brazil.	To analyze the relationships of clinical factors, comorbidities and demographic characteristics with hospitalization and death from COVID-19.
Killerby et al.[40] 2020, EUA.	Characteristics Associated with Hospitalization Among Patients with COVID-19.	To compare characteristics of hospitalized and non-hospitalized patients for COVID-19.
Wang et al.[41] 2020, China.	Epidemiological and clinical features of 125 Hospitalized Patients with COVID-19 in Fuyang, Anhui, China.	Investigate the epidemiological and clinical characteristics of COVID-19 cases.
Li et al.[42] 2021, China.	Tobacco smoking confers risk for severe COVID-19 unexplainable by pulmonary imaging.	Test the hypothesis that increased smoking or the risk of COVID-19 is severe.

Source: survey data, 2021.

(OR= 1.84) and the need for hospitalization due to illness (OR= 2.15). [37]

Some factors are pointed out as predictors of ICU admission, such as smoking history and previously diagnosed diseases. Another retrospective cohort analyzed 1,871 adults in 2020 and found that preexisting respiratory diseases (aOR: 1.34; 95% CI: 1.07-1.68) and smoking history (aOR: 1.25; 95% CI: 1.01-1.55) were statistically significant in predicting ICU admission. [23]

Other studies also point out that, in addition to current exposure or smoking history, older age, changes in respiratory rate, changes in blood pressure, chronic kidney disease, changes in lymphocytes, lactic dehydrogenase, procalcitonin and decreased oxygen saturation were also present in cases of ICU admissions. [24,26,33]

Tobacco users are more likely to be referred to the ICU and are more likely to have long periods of hospitalization in this sector. A study evaluated the length of hospital stay of 51 patients diagnosed with COVID-19, revealing that the average length of stay was 22.82 ± 12.32 days, however, 37.3% required a length of stay longer than 24 days. The multivariate analysis of these cases showed that advanced age (OR 1.064, 95% CI 1.011-1.121) and tobacco exposure (OR 3.696, 95% CI 0.856-15.955) were directly related to longer ICU stay. [28]

The person who smokes presents changes in the immune system, resulting in hyperinflammation and high rates of cytokines, which leads to slower recoveries and, consequently, longer hospitalizations. [49]

Considering the production of antibodies, the study identified that smokers, upon administration of a dose of the Pfizer/BioNTech vaccine for COVID-19, had reduced antibody production when compared to other individuals. In this way, it is possible to associate the use of tobacco with less effective immune responses, favoring the contamination and evolution of diseases, as well as hindering the recovery of the organism after contamination. [50]

A study carried out with 78 patients diagnosed with COVID-19 in hospitals in China allowed some observations. Divided between the progression group and the improvement group, participants in the progression group were mostly smokers or ex-smokers.

> “It is estimated that, annually, it is responsible for approximately eight million preventable early deaths in the world, of which about seven million are caused by direct consumption of tobacco and 1.2 million by passive exposure to the product.”

Furthermore, those in the progression group were more likely to need high-level respiratory support than those in the improvement group (x^2= 16.01, P= 0.001); smoking history (OR: 14.285; 95% CI: 1.577–25.000) and respiratory failure (OR: 8.772, 95% CI: 1.942–40,000) were statistically related to worse disease progression. [25]

Several studies point to a relationship between smoking and more severe cases of COVID-19 among hospitalized patients, represented by a high percentage of smokers who have worse progressions or do not survive the disease when compared to non-smokers. [22,30,32,39]

A study conducted with 941,280 individuals showed that exposure to tobacco twice increases the risk of developing severe COVID-19. Although this study does not associate smoking with COVID-19 mortality, the same points out that cumulative exposure to tobacco can culminate in comorbidities, such as lung cancer and heart disease, which are diagnosed in most deaths caused by COVID-19. [37,42]

A survey found that among 125 hospitalized patients diagnosed with COVID-19, 12.5% reported being current or past tobacco users. Among these, the 25 who presented evolution to severe and critical clinical conditions were active users of tobacco and/or derivatives of this product. [41]

In Brazil, a study carried out in Espírito Santo with 10,713 individuals evaluated the risk factors associated with the development of severe forms of COVID-19 and identified a higher prevalence of poor prognosis and deaths in obese people with a report of current or previous exposure to smoking (36.8%). Also, among those who were hospitalized, 50.6% of smokers did not survive the disease and died. [39] Tobacco is, therefore, one of the factors most commonly related to critical cases of the disease. [38]

Mortality rates among those infected with COVID-19 are high, however, these indicators are more exacerbated when there are other associated factors, such as smoking history, previous diseases and hemodynamic changes. Among 179 patients admitted with stroke, those who had pulmonary symptoms present had a mortality rate of 71.4%. Also, those who reported a history of smoking expressed an increased risk of mortality when compared to the others (p=0.003). [22]

Smoking is also pointed out as

responsible for increasing mortality rates in people with previous chronic respiratory diseases. The observation of clinical data from 793 individuals with Chronic Obstructive Pulmonary Disease (COPD) contaminated by SARS-CoV-2 identified indicators of worse disease outcomes, such as ICU admission, need for mechanical ventilation and death, especially if associated with factors such as smoking; and, with an increased risk of death by 42% to 72% when compared to those without COPD. [29]

A survey aimed to identify prognostic factors of 59 critically ill patients hospitalized in ICUs, and pointed out that 51 of them had previously diagnosed underlying diseases and 41 died despite receiving health care. Compared to survivors, those who died had a smoking history and hemodynamic changes. [35]

CONCLUSION

The use of the integrative review allowed us to identify scientific evidence on the prognosis of tobacco users who were hospitalized for COVID-19. Smoking is responsible for the development of pneumonia in individuals affected by SARS-CoV-2, aggravation of cases and development of severe and critical forms of the disease, increase in ICU admission rates, need for mechanical ventilation and increase in mortality rates.

Among the limitations of this study is the scarcity of primary articles that address the prognosis of smokers who were hospitalized due to COVID-19. Still, the high level of pathogenicity of this disease and the implementation of differentiated therapy in several places must be considered, preventing the standardization and homogeneity of information.

The importance of producing studies aimed at elucidating the impairments caused by tobacco use in the face of the diagnosis of COVID-19 is noted. Furthermore, studies like this one serve to encourage research that seeks to investigate which factors may be related to worse prognosis of patients affected by SARS-CoV-2, allowing public health managers, physicians, nursing professionals and other members of multidisciplinary teams to provide science-based health care as a way of ensuring the quality and resolution of actions.

Referências

1.Baloch S, Baloch MA, Zheng T, Pei X. The Coronavirus Disease 2019 (COVID-19) Pandemic. Tohoku J Exp Med. 2020;250(4):271-278. https://doi.org/10.1620/tjem.250.271.

2.World Health Organization (WHO). WHO Coronavirus (COVID-19) Dashboard [Internet]. 2020 [acesso em 01 Jul. 2021]. Disponível em: https://covid19.who.int/.

3.Gülsen A. Simple classification of COVID-19 patients. J Lung Pulm Respir Res. 2020[acesso em 02 Jul. 2021];7(3):62-63. Disponível em: https://medcraveonline.com/JLPRR/JLPRR-07-00230.pdf.

4.Wu C, Chen X, Cai Y, Xia J, Zhou X, Xu S et al. Risk Factors Associated with Acute Respiratory Distress Syndrome and Death in Patients With Coronavirus Disease 2019 Pneumonia in Wuhan, China. JAMA Intern Med. 2020;180(7):934-943. https://doi.org/10.1001/jamainternmed.2020.0994.

5.Sardu C, Gambardella J, Morelli MB, Wang X, Marfella R, Santulli G. Hypertension, Thrombosis, Kidney Failure, and Diabetes: Is COVID-19 an Endothelial Disease? A Comprehensive Evaluation of Clinical and Basic Evidence. J Clin Med. 2020;9(5):1417. https://doi.org/10.3390/jcm9051417.

6.Drope J, Hamill S, Islami F, Liber A, Nargis N, Stoklosa M. The Tobacco Atlas [Internet]. Atlanta: American Cancer Society and Vital Strategies. 2018 [acesso em 01 Jun. 2021]. Disponível em: https://files.tobaccoatlas.org/wp-content/uploads/2018/03/TobaccoAtlas_6thEdition_LoRes.pdf.

7.World Health Organization (WHO). Tobacco [Internet]. 2021 [acesso em 30 Jul. 2021]. Disponível em: https://www.who.int/news-room/fact-sheets/detail/Tobacco.

8.Pinto M, Bardach A, Palacios A, Biz A, Alcaraz A, Rodriguez B et al. Burden of smoking in Brazil and potential benefit of increasing taxes on cigarettes for the economy and for reducing morbidity and mortality. Cad Saude Publica. 2019;35(8):e00129118. https://doi.org/10.1590/0102-311x00129118.

9.Centers for Disease Control and Prevention (CDC). Health Effects of Cigarette Smoking [Internet]. 2021 [acesso em 03 Jun. 2021]. Disponível em: https://www.cdc.gov/tobacco/data_statistics/fact_sheets/health_effects/effects_cig_smoking/.

10.Berlin I, Thomas D, Le Faou AL, Cornuz J. COVID-19 and Smoking. Nicotine Tob Res. 2020;22(9):1650-1652. https://doi.org/10.1093/ntr/ntaa059.

11.Qi D, Yan X, Tang X, Peng J, Yu Q, Feng L et al. Epidemiological and clinical features of 2019-nCoV acute respiratory disease cases in Chongqing municipality, China: a retrospective, descriptive, multiple-center study. MedRxiv. 2020. https://doi.org/10.1101/2020.03.01.20029397.

12.Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet. 2020;395(10229):1054-1062. https://doi.org/10.1016/S0140-6736(20)30566-3.

13.Guan WJ, Ni ZY, Hu Y, Liang WH, Ou CQ, He JX, et al. Clinical characteristics of coronavirus disease 2019 in China. N Engl J Med. 2020;382:1708-20. https://doi.org/10.1056/NEJMoa2002032.

14.Verdavas CI, Nikitara K. COVID-19 and smoking: a systemic review of the evidence. Tob. Induc. Dis. 2020;18. https://doi.org/10.18332/tid/119324.

15.Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. JAMA. 2020;323(11):1061-69. https://doi.org/10.1001/jama.2020.1585.

16.Galvão TF, Pansani TSA, Harrad D. Principais itens para relatar Revisões sistemáticas e Meta-análises: A recomendação PRISMA. Epidemiol. Serv. Saúde. 2015;24(2). https://doi.org/10.5123/S1679-49742015000200017.

17.Mendes KDS, Silveira RCCP, Galvão CM. Integrative literature review: a research method to incorporate evidence in health care and nursing. Texto Contexto Enferm. 2008;17(4):758-64. https://doi.org/10.1590/S0104-07072008000400018.

18.Santos CMC, Pimenta CAM, Nobre MRC. The PICO strategy for the research question construction and evidence search. Rev. Latino-Am Enfermagem. 2007;15(3). https://doi.org/10.1590/S0104-11692007000300023.

19.Moraes TCC. Mendeley – Manual do Usuário [Internet]. Piracicaba (BR): USP; 2018 [acesso em 05 Jun. 2021]. 88 p. Disponível em: https://www.esalq.usp.br/biblioteca/pdf/Mendeley-manual-do-usuario-2018-v.1.pdf

20.González-García R. Scientific evidence in surgery for the treatment of temporomandibular joint internal derangement. Stomatological Dis. Sci. 2019;3:5. http://dx.doi.org/10.20517/2573-0002.2018.26.

21.Klüber TE. ATLAS.ti como instrumento de análise em pesquisa qualitativa de abordagem fenomenológica. ETD - Educ. Temat. Digit. 2014;16(1):1-4. https://doi.org/10.20396/etd.v16i1.1326.

22.Altschul DJ, Esenwa C, Haranhalli N, Unda SR, Ramos RLG, Dardick J, et al. Predictors of mortality for patients with COVID-19 and large vessel occlusion. Interv Neuroradiol. 2020;26(5):623-28. https://doi.org/10.1177/1591019920954603.

23.Lohia P, Sreeram K, Nguyen P, Choudhary A, Khicher S, Yarandi H, et al. Pre-existing respiratory diseases and clinical outcomes in COVID-19: a multihospital cohort study on predominantly African American population. Respir Res. 2021;22(1):37. https://doi.org/10.1186/s12931-021-01647-6.

24.Zhou Y, He Y, Yang H, Yu H, Wang T, Chen Z, et al. Exploiting an early warning Nomogram for predicting the risk of ICU admission in patients with COVID-19: a multi-center study in China. Scand J Trauma Resusc Emerg Med. 2020;28(26). https://doi.org/10.1186/s13049-020-00795-w.

25.Liu W, Tao ZW, Wang L, Yuan ML, Liu K, Zhou L, et al. Analysis of factors associated with disease outcomes in hospitalized patients with 2019 novel coronavirus disease. Chin Med J (Engl). 2020;133(9):1032-38. https://doi.org/10.1097/cm9.0000000000000775.

26.Guan WJ, Liang WH, Zhao Y, Liang HR, Chen ZS, Li YM, et al. Comorbidity and its impact on 1590 patients with COVID-19 in China: a nationwide analysis. Eur Respir J. 2020;14(55):2000547. https://doi.org/10.1183/13993003.00547-2020.

27.Tao PY, Leng L, Liu K, Zhou RH, Hu YC, Wu SJ, et al. Determination of risk factors for predicting the onset of symptoms in asymptomatic COVID-19 infected patients. Int J Med Sci. 2020;17(4):2187-93. https://doi.org/10.7150/ijms.47576.

28.Zhou W, Qin X, Hu X, Lu Y, Pan J. Prognosis models for severe and critical COVID-19 based on the Charlson and Elixhauser comorbidity indices. Int J Med Sci. 2020;17(15):2257-63. https://doi.org/10.7150/ijms.50007.

29.Graziani D, Soriano JB, Rio-Bermudez CD, Morena D, Diaz T, Castillo M, et al. Characteristics and Prognosis of COVID-19 in Patients with COPD. J Clin Med. 2020;9(10):3259. https://doi.org/10.3390/jcm9103259.

30.Benzano D, Ornell F, Schuch JB, Pechansky F, Sordi AO, Von Diemen L, et al. Clinical vulnerability for severity and mortality by COVID-19 among users of alcohol and other substances. Psychiatry Res. 2021;300:e113915. https://doi.org/10.1016/j.psychres.2021.113915.

31.Yu T, Cai S, Zheng Z, Cai X, Liu Y, Yin S, et al. Association Between Clinical Manifestations and Prognosis in Patients with COVID-19. Clin Ther. 2020;42(6):964-72. https://doi.org/10.1016/j.clinthera.2020.04.009.

32.Peng F, Lei S, Zhang Q, Zhong Y, Wu S. Smoking Is Correlated with the Prognosis of Coronavirus Disease 2019 (COVID-19) Patients: An Observational Study. Front Physiol. 2021;12:634842. https://doi.org/10.3389/fphys.2021.634842.

33.Zhao Z, Chen A, Hou W, Graham JM, Li H, Richman PS, et al. Prediction model and risk scores of ICU admission and mortality in COVID-19. PLoS One. 2020;15(7):e0236618. https://doi.org/10.1371/journal.pone.0236618.

34.Jehi L, Ji X, Milinovich A, Erzurum S, Merlino A, Gordon S, et al. Development and validation of a model for individualized prediction of hospitalization risk in 4,536 patients with COVID-19. PLoS One. 2020;15(8):e0237419. https://doi.org/10.1371/journal.pone.0237419.

35.Wang ZH, Shu C, Ran X, Xie CH, Zhang L. Critically Ill Patients with Coronavirus Disease 2019 in a Designated ICU: Clinical Features and Predictors for Mortality. Risk Manag Healthc Policy. 2020;13:833-45. https://doi.org/10.2147/rmhp.s263095.

36.Neira DP, Watts A, Seashore J, Polychronopoulou E, Kuo YF, Sharma G. Smoking and risk of COVID-19 hospitalization. Respir Med. 2021;182:106414. https://doi.org/10.1016/j.rmed.2021.106414.

37.Li S, Hua X. Modifiable lifestyle factors and severe COVID-19 risk: a Mendelian randomisation study. BMC Med Genomics. 2021;14(1):38. https://doi.org/10.1186/s12920-021-00887-1.

38.Adrish M, Chilimuri S, Mantri N, Sun H, Zahid M, Gongati S, et al. Association of smoking status with outcomes in hospitalized patients with COVID-19. BMJ Open Respir Res. 2020;7(1):e000716. https://doi.org/10.1136/bmjresp-2020-000716.

39.Soares RCM, Mattos LR, Raposo LM. Risk Factors for Hospitalization and Mortality due to COVID-19 in Espírito Santo State, Brazil. Am J Trop Med Hyg. 2020;103(3):1184-90. https://doi.org/10.4269/ajtmh.20-0483.

40.Killerby ME, Link-Gelles R, Haight SC, Schrodt CA, England L, Gomes DJ, et al. Characteristics Associated with Hospitalization Among Patients with COVID-19. MMWR Morb Mortal Wkly Rep. 2020;69(25):790-94. https://doi.org/10.15585/mmwr.mm6925e1.

41.Wang R, Pan M, Zhang X, Han M, Fan X, Zhao F, et al. Epidemiological and clinical features of 125 Hospitalized Patients with COVID-19 in Fuyang, Anhui, China. Int J Infect Dis. 2020;95:421-28. https://doi.org/10.1016/j.ijid.2020.03.070.

42.Li J, Long X, Zhang Q, Fang X, Li N, Fedorova B, et al. Tobacco smoking confers risk for severe COVID-19 unexplainable by pulmonary imaging. J Intern Med. 2021;289(4):574-83. https://doi.org/10.1111/joim.13190.

43.□enkal N, Meral R, Medetalibeyoglu A, Konyaoglu H, Kose M, Tukek T. Association between chronic ACE inhibitor exposure and decreased odds of severe disease in patients with COVID-19. Anatol J Cardiol. 2020;24(1):21-29. https://doi.org/10.14744/anatoljcardiol.2020.57431.

44.Perski O, Herbe□ A, Sahab L, Brown J. Influence of the SARS-CoV-2 Outbreak on the Uptake of a Popular Smoking Cessation App in UK Smokers: Interrupted Time Series Analysis. JMIR Mhealth Uhealth. 2020;8(6):e19494. https://doi.org/10.2196/19494.

45.Sharif-Askari NS, Sharif-Askari FS, Alabed M, Temsah MH, Heialy SA, Hamid Q, et al. Airways Expression of SARS-CoV-2 Receptor, ACE2, and TMPRSS2 Is Lower in Children Than Adults and Increases with Smoking and COPD. Mol Ther Methods Clin Dev. 2020;18:1-6. https://doi.org/10.1016/j.omtm.2020.05.013.

46.Hanioka T, Morita M, Yamamoto T, Inagaki K, Wang PL, Ito H, et al. Smoking and periodontal microorganisms. Jpn Dent Sci Rev. 2019;55(1):88-94. https://doi.org/10.1016/j.jdsr.2019.03.002.

47.Zheng Y, Xiong C, Liu Y, Qian X, Tang Y, Liu L, et al. Epidemiological and clinical characteristics analysis of COVID-19 in the surrounding areas of Wuhan, Hubei Province in 2020. Pharmacol Res. 2020;125:104821. DOI: https://doi.org/10.1016/j.phrs.2020.104821.

48.Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020;395(10223):497-06. https://doi.org/10.1016/s0140-6736(20)30183-5.

49.Chakladar J, Shende N, Li WT, Rajasekaran M, Chang EY, Ongkeko WM. Smoking-Mediated Upregulation of the Androgen Pathway Leads to Increased SARS-CoV-2 Susceptibility. Int J Mol Sci. 2020;21(10):3627. https://doi.org/10.3390/ijms21103627.

50.Watanabe M, Balena A, Tuccinardi D, Tozzi R, Risi R, Masi D, et al. Central obesity, smoking habit, and hypertension are associated with lower antibody titres in response to COVID-19 mRNA vaccine. Diabetes Metab Res Rev. 2021;e3465. https://doi.org/10.1002/dmrr.3465.