KEY WORDS: chronic obstructive pulmonary disease (COPD) – asthma - depressive disorder - cross-sectional studies

INTRODUCTION

Respiratory diseases such as asthma (AS) and chronic obstructive pulmonary disease (COPD) are non-communicable chronic diseases representing a public health problem. These diseases are responsible for 3.9 million deaths annually, and it is estimated that by 2030 it will be among the four leading causes of death (Kuzmar et al. 2018, World Health Organization 2020). In Colombia, the prevalence of COPD and SA is around 10% (Caballero et al. 2008, Kuzmar et al. 2018). Besides, they are considered high-cost diseases for the health system and the patient due to the loss of productivity (Caballero et al. 2008, Pérez-Machón & Álvarez-García 2017).

More common among COPD than AS patients, dyspnea limits physical activity, emotional and social state (Jonsdottir 1998, Nicoll 2003). Among these factors, a vicious circle is established that limits social and professional functioning and daily situations, with a progressive deterioration in the quality of life, with the need for oxygen and in-hospital services, which leads to patients’ social isolation (World Health Organization 2020). This situation affects mood and contributes to developing psychological symptoms and meets the criteria for diagnosing major depressive disorder (Galić et al. 2019, López et al. 2007, Šimić & Vukojević 2019).

During the current epidemic of Acute Syndrome Coronavirus 2 (SAR-CoV-2) disease, patients with AS or COPD are in a situation of special medical care. This situation can increase morbidity and mortality between 90% and 96% in patients with SAR-CoV-2 (Burke 2020, Lopez et al. 2001, Valdes 2020, Yang et al. 2020, Zhou et al. 2020, Wan et al. 2020). Measures to prevent the spread of SARSAR-CoV-2 and the negative psychosocial consequences of confinement represent a significant stressor for the population (Bornstein 2020).

From the perspective of the diathesis-stress model, the conjugation of the above individual risk factors and stressful or adverse events could be associated with greater vulnerability in patients with COPD and AS during the SAR-CoV-2 epidemic, consequently predisposing or exacerbating symptoms of major depression compared to the general population (Vasquez et al. 2010, Wang 2020). Among mental disorders, major depressive disorder is the most prevalent in patients with AS and COPD (Pérez-Manchón 2017).

At regular times, the prevalence of major depressive disorder can vary between 2% and 26.5% depending on the severity of AS and COPD (Coronel-Pazos & Fuentes-Ortiz 2018, Marshall 2015, Moussas 2008, Strine 2008). Among the risk factors associated with major depressive disorder in patients with AS or COPD are the proximal social determinants such as age, gender, marital status, and educational level. For example, in a study conducted on 18,856 participants from 38 states of the United States, as well as Puerto Rico, the U.S. Virgin Islands, and the District of Columbia, Tara et al. (2008) found that adults with AS between 18 and 24 years old, women, incomplete secondary education, separated and unemployed have a higher risk of depression.
In patients with AS and COPD, it can coexist with various medical diseases. Medical comorbidity increases the risk of major depressive disorder. Besides, a history of a depressive episode is related to depression risk among the general population amidst the SAR-CoV-2 epidemic (Sherman et al. 2020). Similarly, diagnosing lung disease may be associated with major depressive disorder, particularly in patients with COPD (Coronel-Pazos & Fuentes-Ortiz 2018).

Patients with AS and COPD could present a higher risk of functional deterioration due to diseases’ comorbidity and the psychosocial consequences of the SAR-CoV-2 epidemic (Lopez et al. 2001). The above could exacerbate pre-existing mental health problems (Garcia 2013). However, today, the frequency of depression during the SAR-CoV-19 epidemic confinement in patients with AS and COPD is unknown. This study provides information for the evaluation and clinical treatment of patients with AS and COPD (De Miguel-Díez et al. 2010). The treatment of major depressive disorder favours therapeutic adherence and the prevention of relapses in patients with AS or COPD (Garcia et al. 2013).

The present study’s objective was to know the variables associated with the risk of major depression during confinement due to SAR-CoV-2 in patients with AS and COPD in the Colombian Caribbean.

SUBJECTS AND METHODS

Research design and ethical considerations

A cross-sectional observational study was designed. The project was approved by an institutional research ethics committee (Act 002 of March 26th, 2020). The patients participated voluntarily after signing informed consent online. Anonymity and confidential handling of information was guaranteed, consistent with the Helsinki Declaration (World Medical Association 2018).

Sample and selection criteria

Three hundred seventeen adult patients with asthma or COPD followed in a specialized clinic in Santa Marta, Colombia, were invited to participate. This sample was calculated for an expected prevalence of 25% risk of a major depressive episode (± 5), with a 95% confidence level, to which it added 10% for eventual losses (Hernández 2006). Besides, this sample size allowed simultaneous adjustment for up to seven variables, at the rate of ten positive cases of risk of a major depressive episode for each variable included in a logistic regression model (Katz 2006).

Variables

Demographic information was consolidated: age, gender, education, marital status, employment, jobs (health care worker or not), medical comorbidity (diabetes, hypertension or other), history of depressive disorder, and current risk of a major depressive episode.

The risk of a major depressive episode was quantified with the Personal Health Questionnaire (PHQ-9). The PHQ-9 is an instrument that consists of nine items that explore the presence of depressive symptoms during the last month (Kroenke et al. 2001). These symptoms correspond to the criteria included for major depressive disorder in the Diagnostic and Statistical Manual of the American Psychiatric Association fourth revised edition (Kocalevent et al. 2013) and remain unchanged in the fifth version (American Psychiatric Association 2013). This instrument was previously adapted for the Colombian population (Cassiani-Miranda et al. 2017). In Colombian primary care patients, the PHQ-9, for the cut-off point of seven used in the present study, showed a sensitivity of 0.90, a sensitivity of 0.82, a positive predictive value of 0.58, and a negative predictive value of 0.97 (Cassiani-Miranda et al. 2020).

Procedure

The patients were contacted by telephone. The study’s objectives and explained, keeping the answers anonymous and the confidential handling of the information. It was specified that the electronic questionnaire did not allow knowing the IP address or the telephone number used to respond to the research questionnaire. The patients who agreed to participate were sent to the phone to the email that provided the respective link. A second message or email was sent a week later to remind them to complete the questionnaire or to ignore it if they had already filled it out.

Analysis of data

The traditional descriptive analysis was done for qualitative and quantitative variables. The major depressive episode’s risk was the dependent variable and the remaining variables as independent variables. Crude odds ratios with 95% confidence intervals (95%CI) were established, and those variables that showed probability values less than 20% were considered for a final adjustment. The process was carried out in several steps, and the variables were included in ascending order according to the probability value, as suggested in Greenland’s recommendations (1989). The Hosmer-Lemeshow goodness of fit of the final model was calculated to accept the same (Hosmer-Lemeshow et al. 1991). The analysis was completed in the SPSS version 23 program (IBM Corp. 2018).

RESULTS

Of the 317 phone numbers selected, ten did not exist, 15 did not answer, 292 patients received the questionnaire, 277 patients (94.9%) accepted to participate, and 15 patients (5.1%) disagreed. The ages were observed between 18 and 96 years (M=60.4, SD=17.6). Eighty-five (30.7%) participants scored for the risk of a major depressive episode. Table 1 presents more information that is descriptive.
In the present study, a prevalence of risk of depressive episodes greater than 30.7% was observed during the last month. It was associated with a history of major depressive disorder and medical comorbidity in patients with AS and COPD during confinement due to SAR-CoV-2 in the Colombian Caribbean.

The prevalence of the risk of depression in the last month was 30.7%. This prevalence of risk of major depressive episode, quantified with Patient Health Questionnaire-9 (PHQ-9), is very close to that observed in Colombia, before SAR-CoV-2 lockdown, among college students (27.3%) (Cassiani et al. 2017) and primary care patients (27.2%) (Cassiani et al. 2020). The prevalence of risk of depression in AS and COPD patients with before the pandemic is unknown. Moreover, there is a lack of Colombian studies in the general population, AS and COPD patients who report the PHQ-9 risk of depression during SAR-CoV-2 lockdown that compare the present study’s frequency.

A higher prevalence of risk of depression was expected in this group of patients because, from the perspective of vulnerability, the stress diathesis model predicts that patients who meet a series of risk factors related to the conjugation of various acute stressors, where the number and severity of the stressful event are related to the onset and development of a depressive episode (Hammen 2005). Concern for the medical condition itself and the risk of contagion contributes to the severe and critical evolution of cases, with higher mortality in patients over 60 years of age and with chronic non-communicable diseases, constitutes a significant acute factor for patients with AS and COPD (Valdés 2020, Yang et al. 2020). Other low-intensity stressors accompany the previous, but long-lasting, lifestyle changes derived from compulsory confinement, misinformation, and economic difficulties (Caballero-Dominguez & Campo Arias 2020, Reinecke 2017, Taylor 2008, Šimić & Vukojević 2019). Possibly, other factors not analyzed explain a similar prevalence. For example, cultural factors such as familism, very common in the Colombian Caribbean, play a protective role given the attention and care that is usually given to adults with a chronic disease, that is, the epidemic did not imply an additional stressor for these patients (Shum et al. 2014, Thomas et al. 2017).

In the present study, variables such as age, gender, marital status, and educational level are independent of the current major depression in patients with AS and COPD during SAR-CoV-2. These findings differ from what was found in a study conducted at regular times in Colombia, before SAR-CoV-2 lockdown, among college students (27.3%) (Cassiani et al. 2017) and primary care patients (27.2%) (Cassiani et al. 2020). The prevalence of risk of depression in AS and COPD patients with before the pandemic is unknown. Moreover, there is a lack of Colombian studies in the general population, AS and COPD patients who report the PHQ-9 risk of depression during SAR-CoV-2 lockdown that compare the present study’s frequency.

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In the present study, variables such as age, gender, marital status, and educational level are independent of the current major depression in patients with AS and COPD during SAR-CoV-2. These findings differ from what was found in a study conducted at regular times in 18,856 adults with asthma aged 65 or over were less likely to present current depression compared to those aged 18 to 24 years (OR=12.4, 95% CI 10.0-15.2), incomplete secondary education (OR=38.2, 95% CI 33.2-43.4), being married (OR=29.5, 95% CI 26.6-32.6), female gender (OR=14.9, 95% CI 20.1-23.7), and being un-

### Table 1. Description of the sample

<table>
<thead>
<tr>
<th>Variable / Category</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 65 years</td>
<td>150</td>
<td>54.2</td>
</tr>
<tr>
<td>Older than 65 years</td>
<td>127</td>
<td>45.8</td>
</tr>
<tr>
<td>Gender</td>
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<td></td>
</tr>
<tr>
<td>Female</td>
<td>180</td>
<td>64.0</td>
</tr>
<tr>
<td>Male</td>
<td>97</td>
<td>36.0</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school or less</td>
<td>156</td>
<td>55.1</td>
</tr>
<tr>
<td>College or more</td>
<td>121</td>
<td>44.9</td>
</tr>
<tr>
<td>Stable couple</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (Free union or married)</td>
<td>158</td>
<td>57.0</td>
</tr>
<tr>
<td>No (Single, separated or widowed)</td>
<td>119</td>
<td>43.0</td>
</tr>
<tr>
<td>Unemployed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>202</td>
<td>72.9</td>
</tr>
<tr>
<td>No</td>
<td>75</td>
<td>27.1</td>
</tr>
<tr>
<td>Colombian socioeconomic status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low (I, II or III)</td>
<td>193</td>
<td>69.7</td>
</tr>
<tr>
<td>High (IV, V or VI)</td>
<td>84</td>
<td>30.3</td>
</tr>
<tr>
<td>Health worker</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>19</td>
<td>6.9</td>
</tr>
<tr>
<td>No</td>
<td>258</td>
<td>93.1</td>
</tr>
<tr>
<td>Medical comorbidity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>140</td>
<td>50.5</td>
</tr>
<tr>
<td>No</td>
<td>137</td>
<td>49.5</td>
</tr>
<tr>
<td>Major depressive history</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>16</td>
<td>5.8</td>
</tr>
<tr>
<td>No</td>
<td>261</td>
<td>94.2</td>
</tr>
</tbody>
</table>

One variable (history of a major depressive disorder) was statistically associated with a major depressive episode's risk. However, medical comorbidity, gender, and health employed were considered for a final adjustment due to these variables showing associations with a p-value of 0.30. Table 2 shows all crude odds ratios. Finally, depression risk was related to the history of major depressive disorder (OR=4.39, 95% CI 1.53-12.67), and medical comorbidity (OR=1.69, 95% CI 1.00-2.86), Hosmer-Lemeshow test, $\chi^2=0.36$, df=1, p=0.55.

### Table 2. Crude associations for depression risk

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age younger than 65 years</td>
<td>1.23</td>
<td>0.73-2.05</td>
</tr>
<tr>
<td>Female gender</td>
<td>1.44</td>
<td>0.83-2.50</td>
</tr>
<tr>
<td>Education high school or less</td>
<td>1.16</td>
<td>0.69-1.94</td>
</tr>
<tr>
<td>Without a stable couple</td>
<td>1.03</td>
<td>0.72-0.73</td>
</tr>
<tr>
<td>Unemployed</td>
<td>1.09</td>
<td>0.61-1.95</td>
</tr>
<tr>
<td>Low socioeconomic status</td>
<td>1.16</td>
<td>0.63-2.03</td>
</tr>
<tr>
<td>Health employed</td>
<td>1.71</td>
<td>0.66-4.42</td>
</tr>
<tr>
<td>Medical comorbidity</td>
<td>1.66</td>
<td>1.00-2.79</td>
</tr>
<tr>
<td>History of major depressive disorder</td>
<td>4.13</td>
<td>1.45-11.78</td>
</tr>
<tr>
<td>Asthma diagnosis</td>
<td>1.23</td>
<td>0.74-2.05</td>
</tr>
</tbody>
</table>
employed (OR=37.8, 95% CI 31.4-44.7) was associated with a major depressive episode (Tara et al. 2008). These differences may be mediated by the variability of populations studied and differences in the countries and the context in which the studies were carried out (Grimes & Schulz 2002).

The present study showed that a history of depressive disorder in patients with AS and COPD was associated with the risk of a major depressive episode during the last month. These results are consistent with what was observed by Vieira et al. (2017) in regular times; in 18,856 patients with AS in the United States, they found an association between depressive symptoms in the last month with a diagnosis of depression throughout life (OR=63.0, 95% CI 59.4-66.4). Besides, Sherman et al. (2020) found in a sample of 599, using online survey during a period during which SAR-CoV-2 infection rates in Arkansas, United States, increased significantly that a positive PHQ-9 screening was associated with a prior history of mental health difficulties (OR=4.4, 95% CI 2.6-7.4). Patients with a history of depressive disorder are more susceptible to experiencing more chronic stressors; therefore, greater vulnerability to relapse and experiencing new major depression (Monroe et al. 2007). From this perspective, previous depressive episodes predispose greater accessibility to negative schemas and erroneous, harmful, and dysfunctional information processing (Kendler et al. 2001).

In the current study, medical comorbidity in patients with AS and COPD was associated with last-month major depression. Few studies indicate the relationship between these medical conditions in patients with AS and COPD; However, in Nicaragua, in 200 chronically ill patients, non-communicable comorbidities were associated with depression (Amaya-Silva & Elvir-Mendoza 2010). Despite the difference in medical conditions in these studies, some authors point out that comorbidities in patients with AS and COPD are factors that predict more significant stress for the patient and family; therefore, dependence on oxygen and worse hospitalization compromise significant in autonomy and functioning in the different areas, which increases the risk of major depression (De Miguel-Díez et al. 2010, Sayeed et al. 2020, World Health Organization 2020). This study responds to current mental health needs in periods of confinement. Furthermore, in respiratory diseases such as AS and COPD of chronic course, with remissions and exacerbations, it is necessary to fully understand the risk factors associated with the prognosis during SAR-CoV-2 confinement (Jonsdottir 1998, Nicoll 2003).

SAR-CoV-2 is not a pandemic; it is a syndemic that results from a complex interaction of predisposing individual, social and cultural causes, processes and situations. In chronically ill patients, this set of negative factors becomes more important because they significantly increase susceptibility to psychological suffering, illness, or death (Horton 2020).

Empirical epidemiological references for predictive risk factors favour the design of prevention programs and the clinical management of diseases based on evidence (Carlsson et al. 2017). It is essential to have comprehensive, multi-professional endpoints and treatment in a multimorbidity context associated with AS and COPD (Pandarakalam 2018). Medical treatments combined with psychotherapy and psychoeducation have shown improvement in the control of symptoms and the quality of life of patients (Pérez-Manchón & Álvarez-García 2017). Likewise, multidimensional and transdisciplinary techniques for dealing with the crisis derived from the threat caused by SAR-CoV-2 in patients with chronic diseases can have positive effects (Rehman & Lela 2020).

In the present study, the risk of major depression was estimated using the PHQ-9, which allowed identifying possible cases. A major depressive episode diagnosis requires confirmation by a clinical interview, which was not carried out in the present study. However, in the Colombian population, the PHQ-9 has shown good clinimetric performance, a sensitivity of 0.90, and a specificity of 0.82, which guarantees the measurement’s validity (Cassiani et al. 2020). These findings must be interpreted with caution because no control group allows validating and contrasting the results during confinement for SAR-CoV-2. Future research is recommended to have larger samples and includes other disorders, such as anxiety, stress, coping, and groups with different severity levels (Garcia et al. 2013). Furthermore, the cross-sectional design does not allow the direction of causality to be identified (Grimes & Schulz 2002, Sica 2006).

CONCLUSIONS
It is concluded that depression risk is associated with a depressive disorder history and medical comorbidity among AS and COPD patients during SARS-CoV-2 confinement in the Colombian Caribbean. Future research is recommended to carry out the study with a larger number of participants. It includes variables related to cognitive processes, attitudes related to the control of symptoms, relapses, perception of disease, and its difference with other chronic diseases during and post-pandemic.

**Contribution of individual authors:**

* Carmen Cecilia Caballero-Domínguez contributed to the study conception and design and data interpretation and revised the intellectual content critically and approved the final version.
* John Carlos Pedrozo-Pupo contributed to the study conception and design and data interpretation and approved the final version.
* Adalberto Campo-Arias contributed to the study conception and design and data interpretation and statistical analysis revised the intellectual content and approved the final version.
Acknowledgments:
The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflict of interest: None to declare.

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