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Coronavirus disease 2019—related anxiety is associated with uncontrolled asthma in adults

There is evidence that the coronavirus disease 2019 (COVID-19) pandemic, its mitigation strategies, and resulting life changes are associated with detrimental effects on physical and mental health. Adults in the United States were times more likely to meet the criteria for moderate or serious mental distress in April 2020 than in 2018 (70.4% vs 22.0%). Although there is evidence linking stress with asthma exacerbation, studies addressing the impact of the COVID-19 pandemic on anxiety among adults with asthma are limited. We evaluated the associations of COVID-19—related anxiety with asthma control in adults.

An online, cross-sectional study was conducted with US adults (≥ 18 years old) with a current self-reported physician diagnosis of asthma. Study invitations were shared online (eg, social media, email contacts in the networks of the researchers, ResearchMatch), and participants opted in for an incentive drawing.

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measured using a 5-point Likert scale to capture participants' responses to 8 questions on participants' experiences in the previous 2 weeks. These questions were developed in the Coronavirus Health and Impact Survey Initiative, which was launched early in the pandemic. Responses were summed for a score ranging from 8 to 40 with higher values indicating higher anxiety. Anxiety scores were first dichotomized at the median (22) as high (above median) or low (at or below median) and then categorized into quartiles (8-17, 18-22, 23-26, and 27-40) to evaluate the dose-response association of anxiety with uncontrolled asthma. Participants also completed the asthma control test (ACT) and answered questions about health care utilization and the level of life changes during the pandemic. The study was approved by the University of Kansas Medical Center's institutional review board.

As of December 19, 2020, 909 surveys were received, of which 873 had complete data on the main variables. The χ² statistics were used to evaluate associations of anxiety (high vs low) with participant characteristics. Binary logistic regression models evaluated associations of anxiety level as a dichotomous variable or as an ordinal variable (quartiles) with uncontrolled asthma (ACT score ≤ 19). Multiple logistic regression analysis was performed to adjust for potential confounding variables identified a priori, including age, education, sex, race or ethnicity, residential area, home ownership, and having confirmed/suspected COVID-19. Statistical analysis was performed in SAS 9.4 (SAS Institute, Cary, North Carolina), and a P value less than .05 indicated statistical significance.

Participants were mostly of female sex (83%), White (80%), urban (60%), with at least a college degree (69%), and mean age of 45 plus or minus 15 years. Among the participants, 13% and 15% self-quarantined with and without COVID-19 symptoms, respectively; 14% lost their job; 21% had reduced ability to earn money; 25% had confirmed or suspected COVID-19; and 2% were hospitalized owing to COVID-19. Almost 57% had a self-reported asthma episode or attack since the pandemic, 29% contacted their health care provider for urgent care in response to irritants, allergens, and infections. Others revealed that chronic negative stress induces inflammatory changes that reduce glucocorticoid receptor responsiveness. Both of these mechanisms can lead to difficult-to-treat, uncontrolled asthma. Our study has the typical limitations of the cross-sectional design, including the inability to rule out whether poor asthma control leads to increased

![Figure 1. Percentage with uncontrolled asthma by anxiety levels (quartiles). P values for overall differences and for a dose-response association were less than .001.](image-url)
Anxiety (ie, reverse causation), selection bias, and relying on self-report of asthma. Furthermore, the anxiety scale used was developed during the emerging COVID-19 crisis to provide researchers with consistent measurement tools. Therefore, our findings should be interpreted with caution as reliability, validity, and cut points of the instrument have not yet been established. In addition, we could not assess whether COVID-19–related anxiety was additive to existing chronic anxiety or whether anxiety and asthma symptoms were confused. Moreover, although we were able to achieve geographic diversity in our sample, well-educated White women were overrepresented.

The COVID-19 pandemic has disproportionately affected people with chronic diseases, including asthma; these impacts were both physically and psychologically. Although asthma-related emergency department visits and hospitalizations seemed to be lower during COVID-19, we must consider the avoidant healthcare behaviors people developed during the COVID-19 pandemic. Our findings underscore the need for health care providers to assess for the ongoing psychological impact of the pandemic and refer to mental health specialists. Equally important are efforts among policymakers to improve access to mental health services for all, especially during a pandemic.

The major outcome of the PROPAM study was the reduction of asthma exacerbations. Participant children were included in this analysis based on documented allergy, including house dust mite (HDM) allergy. Children attended primary-care–pediatric clinics and were considered allergic if symptoms occurred after exposure to the sensitizing allergen. Allergy was defined as presence of allergen-specific immunoglobulin (Ig)E, documented by skin-prick test (a wheal 3 mm or larger than the negative control was considered positive; the extracts were manufactured by Lofarma, Milan, Italy) or by serum assessment (ImmunoCap; Thermo Fisher, Milan, Italy) according to validated criteria.

The probiotic mixture supplementation lasted 4 months. The probiotic mixture was produced and manufactured by Lofarma, Milan, Italy) or by serum assessment (ImmunoCap; Thermo Fisher, Milan, Italy) according to validated criteria. The probiotic mixture supplementation lasted 4 months.

Table 1 reports the main findings. Allergic children were included in this analysis based on documented allergy, including house dust mite (HDM) allergy. Children attended primary-care–pediatric clinics and were considered allergic if symptoms occurred after exposure to the sensitizing allergen. Allergy was defined as presence of allergen-specific immunoglobulin (Ig)E, documented by skin-prick test (a wheal 3 mm or larger than the negative control was considered positive; the extracts were manufactured by Lofarma, Milan, Italy) or by serum assessment (ImmunoCap; Thermo Fisher, Milan, Italy) according to validated criteria. The probiotic mixture supplementation lasted 4 months.

The Ethics Committee of Napoli 3 Sud NHS approved the study procedure on April 12, 2017 (N. 45/21/04/2017), and the study was registered on ClinicalTrials.gov (NCT04289441). Eleven Italian primary-care pediatricians, resident in the Campania region of southern Italy, identified the participants for the study.

A multivariate logistic regression model was applied to identify all factors significantly associated with the occurrence of asthma exacerbation. Results were expressed as odds ratio with 95% confidence intervals.

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