Original Article

General Stress Among Young Adults with Asthma During the COVID-19 Pandemic

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What is already known about this topic? The coronavirus disease 2019 pandemic has profoundly affected the lives of the global population. Little is known on how the pandemic has affected anxiety and stress in young adults, and the influence of asthma and allergic rhinitis.

What does this article add to our knowledge? Young adults with asthma expressed more coronavirus disease 2019—related concern about their own health, reported more contact with online health care, and more perceived stress than did participants without asthma, especially females and young adults with uncontrolled asthma.

How does this study impact current management guidelines? Health caregivers should be aware of the increased levels of stress and health concerns related to the pandemic and offer appropriate support to young individuals with asthma.

BACKGROUND: The coronavirus disease 2019 (COVID-19) pandemic has profoundly affected the lives of the global population.

OBJECTIVE: To explore anxiety and stress in relation to COVID-19 among young adults, and the potential influence of asthma and allergic rhinitis.

METHODS: This cross-sectional study included 1644 participants from the population-based birth cohort BAMSE (Swedish abbreviation for Children, Allergy, Milieu, Stockholm, Epidemiology), participating in a follow-up at age 24 years and a COVID-19 follow-up conducted in August-November 2020 (mean age, 25.3 years). Anxiety and concern related to COVID-19 were analyzed as general anxiety, concern of own health and health of family members, and contact with online health care providers due to concern about COVID-19. Stress was measured with the perceived stress scale.

RESULTS: Around half the participants reported increased anxiety due to COVID-19, and this was more common among females (57.0%, compared with 42.6% in males; $P < .001$). Young adults with asthma reported more concern about their own health (adjusted odds ratio, 1.50; 95% CI, 1.12-2.02) and perceived stress (adjusted regression coefficient [adjusted β], 1.49; 95% CI, 0.52-2.45) compared with peers without asthma, and this was more pronounced among females and those with uncontrolled asthma. Symptoms of allergic rhinitis were not associated with increased concern or anxiety in relation to COVID-19.

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CONCLUSIONS: Young adults with asthma experience more COVID-19—related health concerns, compared with those without asthma, especially females and participants with uncontrolled asthma This needs to be considered in the care of young people with asthma.   © 2021 The Authors. Published by Elsevier Inc. on behalf of the American Academy of Allergy, Asthma & Immunology. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/). (J Allergy Clin Immunol Pract 2022;10:108-15)

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INTRODUCTION

Early adulthood is for most individuals an active period of life, when intensive social interaction with friends, starting a new family, the beginning of a working career, and many founding events for the rest of life may take place. The coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has profoundly affected the lives of a large part of the global population since it was declared a pandemic by the World Health Organization in March 2020.[1] The measures taken to reduce the spread such as quarantines, travel bans, and restrictions on public gatherings have caused a major impact socially and economically on people in addition to the threat of the disease in itself.[2] In Sweden, in contrast to many other countries, no lockdown has been imposed, although several restrictions (such as closed universities and schools for adolescents, prohibition of larger gatherings, and recommendations against visiting people older than 70 years) have been implemented.[3] Still, among young people, often having a large part of their social lives outside the family, these restrictions may have had a major impact on psychological well-being.

Asthma, the most common respiratory condition among young adults,[4] was early suspected to be a risk factor for severe COVID-19,[5] especially when uncontrolled or undertreated. This was based on the experience that asthma exacerbations and loss of asthma control are commonly triggered by respiratory viral infections and tends to be worse in uncontrolled asthma.[6] Also, allergic rhinitis was early linked to COVID-19 infection and a worse outcome of the disease.[7] However, in most studies performed later, asthma or allergic rhinitis has not been linked to an increased risk of becoming diagnosed with COVID-19[8] or developing a more severe COVID-19.[9-12]

There have been several studies observing an increase in anxiety and worse mental health since the onset of the pandemic,[13,14] and female sex has been found to be a risk factor for COVID-19—related anxiety.[13] One Swedish study of mental health symptoms in adults during the beginning of the pandemic found physical risk factors, including respiratory conditions, to have a significant correlation to anxiety and insomnia.[15] In contrast, a study conducted among university students, also in Sweden, found no increase in levels of stress, anxiety, or depression compared with before the onset of the pandemic.[16] However, specific data on increased anxiety and perceived stress in young adults with asthma and allergic disease related to the COVID-19 pandemic are missing. It is important to investigate COVID-19—related anxiety in individuals with asthma, because anxiety has previously been shown to be related to asthma both in childhood and later[17,18] and clinical worsening among middle-aged individuals with severe asthma.[19] Uncontrolled asthma has in turn been found to associate with worse quality of life.[20] Allergic rhinitis and atopic diseases have also been reported to associate with increased anxiety[17,21]; however, so far no association between allergic rhinitis and increased levels of anxiety has been established in relation to COVID-19.[22]

The aim of the present study was to describe the prevalence of COVID-19—related anxiety and stress among young adults from a population-based Swedish birth cohort approximately 6 months into the COVID-19 pandemic, and to explore the potential influence of asthma and symptoms of allergic rhinitis.

METHODS

Study population and study design

The study population includes participants from the population-based prospective birth cohort BAMSE (Swedish abbreviation for Children, Allergy, Milieu, Stockholm, Epidemiology), previously described in detail.[23] The BAMSE cohort originally includes 4089 participants, born between 1994 and 1996 and recruited at age 2 to 3 months in the northwestern and central parts of Stockholm, Sweden. The participants have been subsequently followed with repeated questionnaires and clinical examinations, with the primary aim to study risk factors and consequences of allergic diseases. The response rate has remained high throughout the years, with 75% (n = 3064 for the questionnaire, n = 2270 for the clinical investigation) of the original cohort participating in the latest follow-up in 2016-2019 at age 22 to 24 years (referred to as the 24-year follow-up).[24]

In August 2020, a new follow-up of the BAMSE cohort was initiated, focusing on long-term effects of COVID-19 (referred to as the COVID-19 follow-up). All 2270 participants who completed the clinical investigation at the 24-year follow-up study were invited to the study. Starting August 11, 2020, an invitation letter was sent by e-mail with information about the study and a link to a web questionnaire. The questionnaire was open to answer for 3 months (until November 10, 2020) and covered questions related to the COVID-19 pandemic, including mental health, stress, lifestyle factors, and symptoms related to asthma and allergic disease. Of the 2270 invited participants, 1644 (72% of invited) answered the questionnaire and were included in the current study population. The study was approved by the Swedish Ethical Review Authority (approval no. 2020-02922). Participants provided written informed consent when answering the questionnaire.

Definition of asthma and symptoms of rhinitis

Asthma was defined as having a doctor's diagnosis of asthma (ever) in combination with symptoms of wheeze in the last 12 months and/or any asthma medication use in the last 12 months.[25]

Uncontrolled asthma was defined on the basis of a modified version of the Global Initiative for Asthma definition[26] as at least 1 of the following: 12 or more episodes of breathing difficulties in the last 12 months, activity limitation due to respiratory symptoms in the last 4 weeks, night-time awakening due to respiratory symptoms in the

TABLE I. Description of the study population in relation to anxiety due to COVID-19* (n = 1644)

Characteristic	All (n = 1644)†	No increased anxiety (n = 800) †	Increased anxiety (n = 844) †	P value‡
Age (y), mean ± SD	25.3 ±0.79	25.2 ±0.78	25.3 ±0.79	.13
				P value§
Male sex	648 (39.4)	372 (46.5)	276 (32.7)	<.001
Month of answering the questionnaire				.58
August 2020	1374 (83.6)	668 (83.5)	706 (83.7)	
September 2020	163 (9.9)	85 (10.6)	78 (9.2)	
October 2020	95 (5.8)	41 (5.1)	54 (6.4)	
November 2020	12 (0.7)	6 (0.8)	6 (0.7)	
Occupation				.002
- Working	845 (51.5)	446 (55.9)	399 (47.3)	
- Studying	620 (37.8)	279 (35.0)	341 (40.5)	
- Other	176 (10.7)	73 (9.2)	103 (12.2)	
Current smoking				.10
No/ex-smoker	1399 (85.3)	686 (86.0)	713 (84.6)	
Occasional smoking	181 (11.0)	77 (9.7)	104 (12.3)	
Daily smoking	61 (3.7)	35 (4.4)	26 (3.1)	
Reduced social contacts during the COVID-19 pandemic‖				<.001
No	221 (13.4)	169 (21.1)	52 (6.2)	
Yes	1423 (86.6)	631 (78.9)	792 (93.8)	
BMI status at 24 y				.83
Underweight	88 (5.4)	47 (5.9)	41 (4.9)	
Normal weight	1206 (73.4)	585 (73.1)	621 (73.6)	
Overweight	279 (17.0)	134 (16.8)	145 (17.2)	
Obese	71 (4.3)	34 (4.3)	37 (4.4)	

BMI, Body mass index.

Values are n (%) unless otherwise indicated.

*Increased anxiety due to COVID-19 was defined as answering "Yes" to the question "Have you felt increased anxiety due to COVID-19?"

†Numbers may not add up to total due to internal missing.

‡P value obtained by t test.

§P value obtained by χ^2 test.

‖From February 2020 to the date of answering the questionnaire.

TABLE II. Descriptive results on anxiety and concern due to COVID-19, and PSS-10 score in relation to sex (n = 1644)

Outcome	All (n = 1644)		Females (n = 996)		Males (n = 648)		
	n/N	%	n/N	%	n/N	%	P value*
Increased anxiety due to COVID-19	844/1644	51.3	568/996	57.0	276 /648	42.6	<.001
Increased concern for family or close relative's health due to COVID-19	1379/1643	83.9	871/995	87.5	508/648	78.4	<.001
Increased concern about own health due to COVID-19	500/1642	30.5	349/995	35.1	151/647	23.3	<.001
Contact with online health care due to concerns for COVID-19	175/1644	10.6	114/996	11.5	61/648	9.4	.19
	N	**Mean ± SD**	**N**	**Mean ± SD**	**N**	**Mean ± SD**	**P value†**
PSS-10 score	1626	14.9 ± 7.2	985	16.1 ± 7.1	641	13.1 ± 7.0	<.001

*P value obtained by χ^2 test.
†P value obtained by t test.

last 4 weeks, and regular use of short-acting beta agonists in the last 4 weeks.

Symptoms of allergic rhinitis were defined as having symptoms, from the eyes or nose after exposure to pollen or furred animals without simultaneous common cold or flu in the last 12 months.

Assessment of anxiety and stress

Anxiety and concern related to COVID-19 were analyzed as general anxiety, concern about the health of own family or close relatives, concern for own health, and contact with online health care providers due to concern about COVID-19. The following questions were used to define these outcomes:

Have you felt increased anxiety due to COVID-19?

Have you felt increased concern about the health of your family/close relatives due to COVID-19?

Have you felt increased concern about your own health due to COVID-19?

Have you been in contact with online health care providers due to concerns about COVID-19?

Stress was defined on the basis of perceived stress scale (PSS-10) consisting of 10 questions on how the participants have perceived and handled stress and stressful situations in the last month.[27] Each question has 5 answer categories from "never" to "very often," which are given 0 to 4 points depending on the answers (scores are reversed for 4 questions with positive statements), in total 0 to 40 points. Complete data on the questions included in the PSS-10 were provided by 1626 of the 1644 participants.

Assessment of covariates

Information on current occupation, current smoking, and reduction in social activities during the COVID-19 pandemic was collected in the COVID-19 follow-up questionnaire, whereas body mass index was calculated on the basis of measured weight and height at the 24-year examination. Occupation was categorized as student, worker, and other (including "parental leave or unpaid leave," "unemployed," "furloughed due to the current pandemic," or "other"). Current smoking was defined as daily or occasional smoking. Body mass index status was categorized into underweight (<18.5 kg/m^2), normal weight (18.5-24.9 kg/m^2), overweight (25-29.9 kg/m^2), or obesity (≥30 kg/m^2) using normal weight as the reference group.

Statistical analyses

Descriptive data are presented as number (n) and percent (%) for categorical variables (background factors, covariates, asthma, asthma control, allergic rhinitis, and anxiety/concern) and as mean and SD for the PSS score. Differences in background factors between the groups reporting no increased versus increased anxiety due to the COVID-19

pandemic were assessed with χ^2 tests. Differences between sex with regard to anxiety, concern, and perceived stress were tested using the χ^2 test for categorical variables and the t test for the PSS score.

Logistic regression analyses were performed to investigate the associations between the exposures (asthma, asthma control, symptoms of allergic rhinitis) and anxiety/concern in relation to COVID-19, in crude models and in models adjusted for sex, current occupation, current smoking, and body mass index status at the 24-year follow-up. For differences in mean PSS scores, linear regression analyses were performed with the same covariates.

All analyzes were performed using the statistical software Stata (Stata Corp, College Station, Texas), version 16.0. P values less than .05 were considered statistically significant.

RESULTS

Description of the study population

The study population (n = 1644) consisted of 996 females (60.6%) and 648 males (39.4%). Most of the participants (83.6%) answered the COVID-19 questionnaire in August 2020, at a mean age of 25.3 ± 0.79 years. Around half the participants (51.3%) reported increased anxiety due to COVID-19. Table I presents a description of the study population in relation to reported anxiety due to COVID-19. Among participants who reported increased anxiety, a lower proportion was working (47.3% compared with 55.9% among those with no increased anxiety; P = .002). The prevalence of smoking was 3.7% for daily smoking and 11.0% for occasional smoking, with no significant difference in relation to anxiety. At 24 years, overweight and obesity were present in 17.0% and 4.3% of the participants, respectively, also with no difference in relation to anxiety. Most participants reported that they had reduced their social contacts during the pandemic, and this was more common among participant with increased anxiety (93.8% compared with 78.9% among those with no increased anxiety; P < .001).

Descriptive results on exposures and outcomes

A large proportion of the participants (83.9%) reported increased concern about the health of family members and/or close relatives due to COVID-19, whereas 30.5% reported increased concern about their own health due to COVID-19 (Table II). These aspects of anxiety/concern were more common among females, compared with males (all P < .05, Table II). Around 1 in 10 (10.6%) reported that they had been in contact with an online health care provider due to worry against COVID-19, with no significant difference with regard to sex.

PSS-10 scores ranged from 0 to 36 points, with a mean of 14.9 ± 7.2 points and a median of 14 points. Females had higher

TABLE III. Anxiety and concern due to COVID-19, and PSS-10 score, in relation to asthma and symptoms of allergic rhinitis (n = 1644)

Subgroup	Increased anxiety due to COVID-19					
	n/N	%	OR crude	95% CI	OR adjusted*	95% CI
No asthma	716/1413	50.7	1.00 (reference)		1.00 (reference)	
Asthma	128/231	55.4	1.21	0.91 to 1.60	1.16	0.87 to 1.55
No symptoms of allergic rhinitis	476/926	51.4	1.00 (reference)		1.00 (reference)	
Symptoms of allergic rhinitis	367/716	51.3	0.99	0.82 to 1.21	0.98	0.80 to 1.20

Subgroup	Increased concern for family or close relative's health due to COVID-19					
	n/N	%	OR crude	95% CI	OR adjusted*	95% CI
No asthma	1182/1413	83.7	1.00 (reference)		1.00 (reference)	
Asthma	197/230	85.7	1.17	0.79 to 1.73	1.16	0.77 to 1.73
No symptoms of allergic rhinitis	775/926	83.7	1.00 (reference)	—	1.00 (reference)	—
Symptoms of allergic rhinitis	603/715	84.3	1.05	0.80 to 1.37	1.05	0.80 to 1.38

Subgroup	Increased concern about own health due to COVID-19					
	n/N	%	OR crude	95% CI	OR adjusted*	95% CI
No asthma	409/1411	29.0	1.00 (reference)	—	1.00 (reference)	—
Asthma	91/231	39.4	**1.59**	**1.19 to 2.12**	**1.50**	**1.12 to 2.02**
No symptoms of allergic rhinitis	279/926	30.1	1.00 (reference)	—	1.00 (reference)	—
Symptoms of allergic rhinitis	221/714	31.0	1.04	0.84 to 1.28	1.01	0.81 to 1.25

Subgroup	Contact with online health care due to concerns for COVID-19					
	n/N	%	OR crude	95% CI	OR adjusted*	95% CI
No asthma	141/1413	10.0	1.00 (reference)	—	1.00 (reference)	—
Asthma	34/231	14.7	**1.56**	**1.04 to 2.33**	**1.52**	**1.01 to 2.28**
No symptoms of allergic rhinitis	91/926	9.8	1.00 (reference)	—	1.00 (reference)	—
Symptoms of allergic rhinitis	84/716	11.7	1.22	0.89 to 1.67	1.18	0.86 to 1.62

Subgroup	PSS-10 score					
	N	Mean ± SD	β crude	95% CI	β adjusted*	95% CI
No asthma	1396	14.6 ± 7.2	0.00 (reference)	—	0.00 (reference)	—
Asthma	230	16.4 ± 7.1	**1.79**	**0.79 to 2.79**	**1.49**	**0.52 to 2.45**
No symptoms of allergic rhinitis	914	14.6 ± 7.1	0.00 (reference)	—	0.00 (reference)	—
Symptoms of allergic rhinitis	710	15.3 ± 7.2	**0.73**	**0.02 to 1.43**	0.65	−0.02 to 1.33

BMI, Body mass index.

Bold values represent statistically significant associations.

*Adjusted for sex, current occupation, current smoking, and BMI status at 24 y.

mean PSS-10 scores compared with males (14.9 points vs 13.1 points; $P < .001$; Table II).

The prevalence of asthma according to definition was 14.1% (15.3% in females and 12.2% in males; $P = .08$), and the prevalence of symptoms of allergic rhinitis was 43.6% (44.8% in females and 41.7% in males; $P = .22$). Among the participants with asthma at the COVID-19 follow-up (n = 231), 29.4% had uncontrolled asthma, 31.6% in females and 25.3% in males ($P = .32$).

Perceived stress and anxiety/concern due to COVID-19 in relation to asthma and allergic rhinitis

Compared with participants without asthma, participants with asthma reported more concern about own health due to COVID-19 (39.4% vs 29.0%; $P = .001$) and more contact with online health care due to concerns for COVID-19 (14.7% vs 10.0%; $P = .03$), whereas there was no difference in increased anxiety (in general) or in increased concern about the health of family or close relatives (Table III). These associations were confirmed in the adjusted regression models (adjusted odds ratio [OR] for increased concern about own health: 1.50, 95% CI, 1.12-2.02, and adjusted OR for contact with online health care: 1.52, 95% CI, 1.01-2.28). Asthma was also associated with a

higher PSS-10 score (16.4 compared with 14.6; adjusted β, 1.49; 95% CI, 0.52-2.45). Symptoms of allergic rhinitis were not associated with increased anxiety/concern, but a slightly higher PSS-10 score (15.3 compared with 14.6; $P = .04$), significant in the unadjusted model only (Table III).

Because females reported more anxiety and concern than males, Figure 1 shows the prevalence of increased anxiety/concern in relation to COVID-19 by sex and asthma status. This result showed that the increased concern about own health among participants with asthma was statistically significant among females (44.7% among females with asthma compared with 33.3% among females without asthma; $P = .007$), but not males (29.1% among males with asthma compared with 22.5% among males without asthma; $P = .20$). In addition, the association between asthma and contact with online health care was present only among females, whereas no association was observed among males (Figure 1).

Perceived stress and anxiety/concern due to COVID-19 in relation to asthma control

Among the 231 participants with asthma, uncontrolled asthma was associated with increased concern about own health
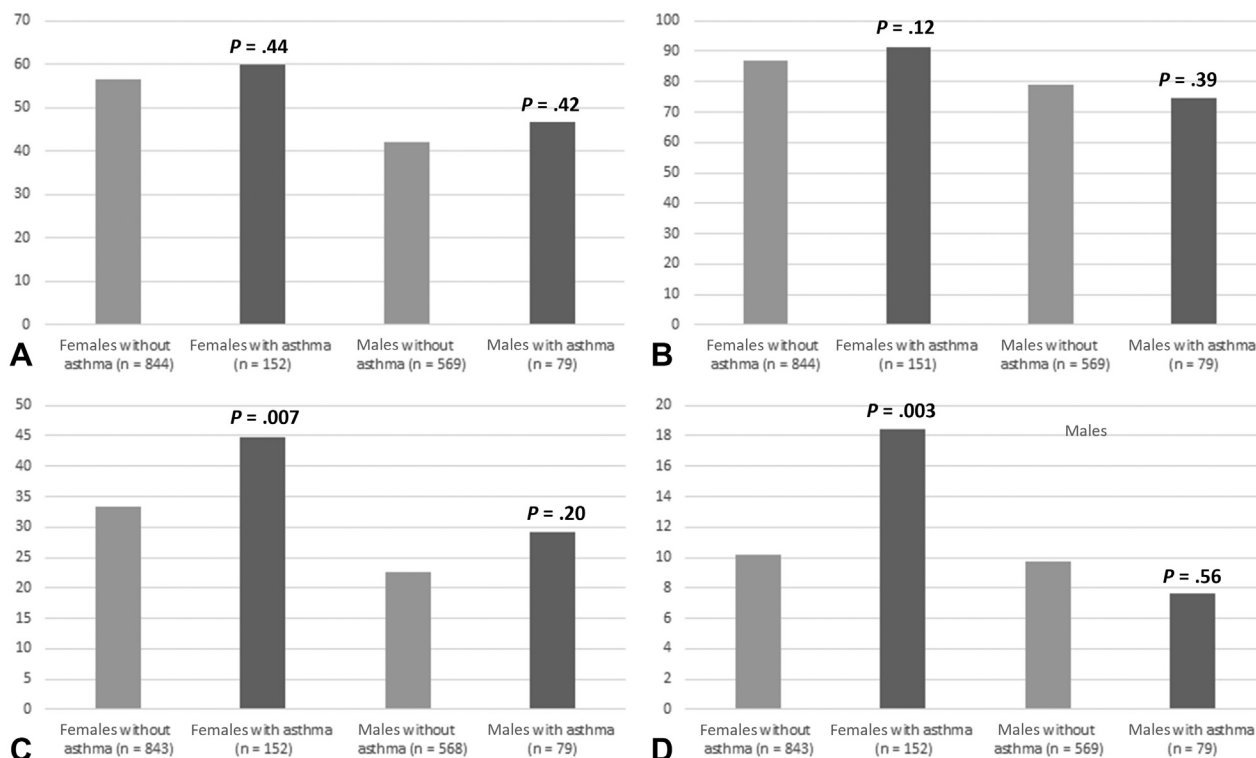
FIGURE 1. Prevalence of (**A**) increased anxiety due to COVID-19, (**B**) increased concern for family or close relative's health due to COVID-19, (**C**) increased concern about own health due to COVID-19, and (**D**) contact with online health care due to concerns for COVID-19, by sex and asthma status at the COVID-19 follow-up. P values represent comparisons between asthma and no asthma in each sex, obtained by χ^2 tests.

(OR, 1.86; 95% CI, 1.05-3.30) and higher PSS-10 score (β, 2.35; 95% CI, 0.36-4.35) in the unadjusted models (Table IV). These associations were somewhat attenuated and no longer significant in the adjusted models (adjusted OR, 1.76, 95% CI, 0.98-3.18, and adjusted β, 1.83, 95% CI, −0.11 to 3.77, respectively). Uncontrolled asthma was associated with lower concern for family or close relative's health due to COVID-19 in both models (adjusted OR, 0.31; 95% CI, 0.14-0.71). There were no significant associations between asthma control and increased anxiety due to COVID-19 (in general) or with contact with online health care due to concerns for COVID-19.

DISCUSSION

In the present study, based on data from a population-based cohort, the main aim was to investigate COVID-19—related anxiety and stress in young adults and the potential influence of asthma and symptoms of allergic rhinitis. Around half the participating young adults reported increased anxiety, and this was more common among females, compared with males. Participants with asthma expressed more COVID-19—related concern about their own health, reported more contact with online health care, and perceived more stress than did participants without asthma; this was more pronounced among females with asthma and in participants with uncontrolled asthma. Participants with symptoms of allergic rhinitis did not report more anxiety or concerns related to COVID-19 compared with participants without symptoms of allergic rhinitis, although they

had a somewhat higher level of perceived stress assessed with the PSS-10 questionnaire.

Individuals with respiratory diseases have been identified as a risk group for COVID-19, even if data regarding asthma have pointed toward a low or absent risk increase both to become infected and to become severely ill in COVID-19.[7,8,10,28,29] Still, our data suggest asthma to be associated with more health-related concerns due to COVID-19 also among young, in general healthy, individuals. This confirms that previous findings on an association between anxiety and asthma in children[18] and adults[17] are highly relevant also for concerns due to COVID-19.

The COVID-19 pandemic has been shown to increase anxiety in the general population in Sweden and elsewhere.[15,30-32] Also, younger age, not targeted as a risk factor, has been reported to correlate with poorer mental health related to the COVID-19 pandemic.[15] Female sex has been identified as a risk for more COVID-19—related anxiety symptoms,[13] despite male sex being associated with a higher risk for COVID-19—related death.[28] In the present study, females were also more anxious in relation to COVID-19 in general and about both their own and close relatives' health compared with males, and even more so among females with asthma. In contrast, obesity, an established risk factor for severe COVID-19,[33] was not found to be more common in the group with increased anxiety. The group with increased anxiety had however, to a higher extent, reduced its social contacts, compared with those who reported no increased anxiety. In line with previous studies,[22] we did however not find

TABLE IV. Anxiety and concern due to COVID-19, and PSS-10 score, in relation to asthma control among participants with asthma (n = 231)

	Increased anxiety due to COVID-19					
Asthma control status	n/N	%	OR crude	95% CI	OR adjusted*	95% CI
Controlled asthma	91/163	55.8	1.00 (reference)	—	1.00 (reference)	—
Uncontrolled asthma	37/68	54.4	0.94	0.53 to 1.67	0.90	0.50 to 1.60
	Increased concern for family or close relative's health due to COVID-19					
Asthma control status	n/N	%	OR crude	95% CI	OR adjusted*	95% CI
Controlled asthma	145/162	89.5	1.00 (reference)	—	1.00 (reference)	—
Uncontrolled asthma	52/68	76.5	**0.38**	**0.18 to 0.81**	**0.31**	**0.14 to 0.71**
	Increased concern about own health due to COVID-19					
Asthma control status	n/N	%	OR crude	95% CI	OR adjusted*	95% CI
Controlled asthma	57/163	35.0	1.00 (reference)	—	1.00 (reference)	—
Uncontrolled asthma	34/68	50.0	**1.86**	**1.05 to 3.30**	1.76	0.98 to 3.18
	Contact with online health care due to concerns for COVID-19					
Asthma control status	n/N	%	OR crude	95% CI	OR adjusted*	95% CI
Controlled asthma	23/163	14.1	1.00 (reference)	—	1.00 (reference)	—
Uncontrolled asthma	11/68	16.2	1.17	0.54 to 2.57	1.04	0.46 to 2.35
	PSS-10 score					
Asthma control status	N	Mean ± SD	β crude	95% CI	β adjusted*	95% CI
Controlled asthma	162	15.7 ± 7.3	0.00 (reference)	—	0.00 (reference)	—
Uncontrolled asthma	68	18.1 ± 6.2	**2.35**	**0.36 to 4.35**	1.83	−0.11 to 3.77

Bold values represent statistically significant associations.

increased anxiety due to COVID-19 in participants with symptoms of allergic rhinitis.

In the beginning of the pandemic, asthma was hypothesized to be an important risk factor for severe disease and death, which may have impacted on health-related anxiety in individuals with asthma.[5] However, it may be possible that anxiety has lessened in subsequent months of the pandemic because more recent studies indicated that asthma does not increase the risk of severe COVID-19. Another factor possibly increasing the anxiety among patients with asthma is the lower access to regular health care during the pandemic. A qualitative British study investigating fears and anxiety related to COVID-19 among individuals with chronic respiratory conditions (including asthma) among adults revealed fears not only for being at a higher risk but also for not being prioritized by the health care due to the preexisting condition.[34] In line with these results, we found that participants with uncontrolled asthma experienced more concern about their own health in relation to COVID-19. However, they expressed less concerns about their family or close relatives' health in relation to COVID-19 than did participants with controlled asthma. This finding was somewhat unexpected, and possibly reflects that uncontrolled asthma is a highly stressful condition, leaving less room for focus on other concerns.

The strengths of the present study include the well-characterized study population of young adults from a population-based cohort with information collected recently before and around 6 months after the onset of the COVID-19 pandemic. The population-based design contributes with information on asthma of different severity, in contrast to data from a clinic. The included population is relatively large and has a high response rate.

There are however limitations with our study. Because of the population-based design, the group with asthma contains a limited number of individuals, especially when divided in

controlled and uncontrolled asthma. Furthermore, the data on health care contacts due to the pandemic are self-reported, however with a low risk of recall bias with questions covering a relatively short period of time (6 months). We had no information on anxiety-related disorders from before the onset of the pandemic and were not able to adjust for prepandemic levels of stress and anxiety potentially higher in individuals with asthma or allergic disease.[17,18,21,35] However, our study did specifically measure anxiety and concerns related to COVID-19, not general anxiety or health concerns. The higher level of perceived stress found in both participants with asthma and allergic rhinitis was in contrast not asked in relation to COVID-19 and could possibly reflect the generally higher stress level associated with these conditions.[36,37]

CONCLUSIONS

Our results found young people at risk for increased anxiety and perceived stress associated with COVID-19. Looking specifically at the group with asthma, COVID-19–related concerns about their own health were further increased and especially if asthma was uncontrolled. This emphasizes the need of awareness in caregivers regarding the risk of increased anxiety in vulnerable individuals not necessarily at higher risk.

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