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Differences in the Prevalence of Allergy and Asthma before During and after the COVID-19 Pandemic (Article Reviews)

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Abstract **Original Research Article**

The increasing prevalence of allergies and asthma has become a significant global socioeconomic burden. The COVID-19 pandemic has dramatically changed the health and lifestyles of children and adolescents, but its impact on allergies and asthma remains unclear due to limited studies. This article aims to explore the differences in the prevalence of allergies and asthma among children and adolescents before during and after the COVID-19 pandemic, using data from various regions. COVID-19 increases the risk of new-onset asthma, and vaccination may reduce this risk by preventing COVID-19, particularly in older individuals. Further research is needed to explain these finding. Data were core databases and supplemented by browsing health information journals and citation searching. Asthma It is the most common chronic respiratory disorder in children, is a heterogeneous disease characterized by chronic airway inflammation and hyperresponsiveness that causing repeated cough, wheezing, chest tightness and shortness of breath, with prevalence approximately 14% of children worldwide, a prevalence much higher than that among adults (7.7%) [1] The purpose of this study is to investigate the incidence of asthma in children before and after the COVID-19 pandemic and explore potential contributing factors. Asthma diagnosis rates, demographic factors, and environmental exposures were compared. The study included Children and adolescents Adolencents with a documented diagnosis of asthma (ICD-10 code J45) were included. Exclusion criteria included pre-existing chronic respiratory conditions other than asthma.

Keywords: Asthma, Children, COVID-19, Post epidemic Allergy, Adolescence epidemic.

INTRODUCTION

Allergy and asthma are two common childhood conditions that are familiar to many. Asthm exacerbation is the most frequent reason for hospitalization for asthma, and it can be life-threatening in children. When left untreated, such exacerbations increase the risk of chronic obstructive pulmonary disease in adulthood [2]. asthma not only affects the well-being of individual children but also imposes a substantial burden on society [3]. The repercussions span a spectrum from heightened mortality and morbidity to disruptions in education, manifesting as lost school days for children and productivity setbacks due to parental workdays lost [3-5]. It can be a cause of parental and family stress if not treated appropriately can lead to chronic obstructive pulmonary disease in adulthood [2]. The incidence of childhood asthma has been linked to various environmental and genetic factors, suggesting an interaction between genes and environmental conditions such as exposure to pollutants, lifestyle changes and reduced microbial diversity. These factors are thought to have contributed to the increase in asthma cases seen from the late 20th century into the early 21st century [6].

Globally, the incidence of asthma varies significantly by age group and over time, with the higher rates observed in very young children (0–4 years) and generally decreasing with age. However, the incidence has shown a slight increase over time in the 0–9-year-old age group. Interestingly, the most recent birth cohorts have exhibited higher asthma incidence rates, although mortality from asthma has generally decreased over the same periods, particularly in older age groups [7]. Respiratory infections, particularly viral infections, may trigger allergic reactions and exacerbate allergic diseases such as asthma and allergic rhinitis [8, 9].

series of studies have demonstrated that the morbidity from Coronavirus Disease 2019 (COVID- 19) is lower in children compared to adults [1–3]. Risk factors for severe disease include older age, male sex,

chronic respiratory diseases, diabetes, coronary artery disease, obesity, and ethnicity (black, Asian, and mixed) [4–6]. Chronic respiratory diseases are among these high- risk pre- existing conditions, and asthma represents the majority of such patients.

It is well known that since the end of 2019, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has caused a global pandemic. The measures implemented to control COVID-19 have greatly changed people's daily habits and routines [10], including online classes or home-based working, keeping social distance, wearing a mask, have slowed the spread of not only just COVID-19, but other infectious diseases. Literature reported a significant decline in hospital admissions in the United States with the onset of the COVID-19 pandemic [11]. Asthma hospital visits and hospitalizations also decreased in many countries during the COVID-19 pandemic [11-15].

However, few large-scale studies have investigated the prevalence of allergic diseases and asthma among children and adolescents during the COVID-19 pandemic.

Therefore, we conducted this study using a review of articles to compare the prevalence of asthma in children and adolescents before and during the COVID-19 pandemic.

METHODE

This study was conducted using a systematic literature review. Scientific articles were collected from various online databases (e.g., PubMed, Google Scholar, etc.) that examined the prevalence of asthma in children and adolescents before and during the COVID-19 pandemic. The selection of studies was based on predefined inclusion and exclusion criteria.

RESULT

Study 1: In U.S. children and adolescents aged 0–17, the prevalence of allergies and asthma showed changes between 2018 and 2021 Respiratory allergies: 2018: 14.0% (95% CI, 13.1%-15.0%) 2021: 18.8% (95% CI, 17.8%-19.9%) Food allergies: 2018: 6.5% (95% CI, 5.8%-7.1%) 2021: 5.8% (95% CI, 5.2%-6.4%) Skin allergies: 2018: 12.6% (95% CI, 11.6%-13.5%) 2021: 10.7% (95% CI, 9.9%-11.5%).

Asthma: 2018-2019: 11.1% (95% CI, 10.5%-11.7%) 2020-2021: 9.8% (95% CI, 9.2%-10.4%)

The data showed statistically significant differences in the prevalence of respiratory allergies, skin allergies, and asthma before and during the COVID-19 pandemic. These differences remained even after adjusting for demographic and socioeconomic variables

Study 2: The study analyzed in Korean Study. 840,488 adolescents aged 12–18, with an average age of 15.08 years, and found changes in the prevalence of allergic conditions over time. Key findings include:

Prevalence Trends: Overall allergic morbidity increased from 23.19% (2009–2011) to 25.09% (2018–2019), but significantly decreased after the outbreak (βdiff −0.095, OR 0.799). Asthma prevalence decreased gradually from 2.23% (2009–2011) to 1.99% (2018–2019), with a sharp decline after the outbreak (βdiff −0.137, OR 0.495). Allergic rhinitis prevalence increased from 17.79% (2009–2011) to 20.45% (2018–2019), but also decreased after the outbreak (βdiff −0.119, OR 0.795). Atopic dermatitis showed a slight increase from 6.74% (2009–2011) to 6.82% (2018–2019), but decreased after the outbreak (βdiff −0.030, OR 0.927).

Impact of the Pandemic: The decrease in the prevalence of asthma, allergic rhinitis, and atopic dermatitis could be linked to the COVID-19 pandemic. Strict public health measures like social distancing, mask mandates, and lockdowns acted as physical barriers, reducing exposure to allergens. Studies from other countries like Brazil, India, and Singapore also showed a reduction in asthma cases due to similar measures.

Study 3. This study examined the relationship between COVID-19, vaccination, and new-onset asthma.

Study 3. 1: 1.6% of the COVID-19 cohort developed new-onset asthma, compared to 0.7% in the matched control group. The incidence rates were 31.28 vs. 14.55 per 1,000 person-years (P < .001). The COVID-19 cohort had a significantly higher risk of developing asthma (aHR 2.14; 95% CI 1.88–2.45). Study3. 2: The vaccinated cohort had a lower risk of new-onset asthma than the matched controls (aHR 0.82; 95% CI 0.76–0.89).

Study3. 3: Among individuals without a COVID-19 diagnosis, vaccination was not significantly associated with a reduced asthma risk (aHR 0.95; 95% CI 0.87–1.04). Subgroup Analysis: Fully vaccinated individuals had a lower risk of new-onset asthma. Older individuals and those with diabetes mellitus had a higher risk compared to their counterparts. COVID-19 was associated with an increased risk of new-onset asthma, which may be preventable through vaccination.

DISCUSSION

Based on a USA Study, they found that the prevalence of respiratory allergies increased and the prevalence of both skin allergies and asthma decreased among US children and adolescents during the COVID-19 pandemic compared with the pre-COVID-19 pandemic. The differences persisted after adjusting for demographic and socioeconomic variables.

It was supposed that the increased prevalence of respiratory allergies among children and adolescents during the COVID-19 pandemic may be attributed to several potential factors. The changes in lifestyle and behavior during the pandemic, including reduced outdoor activities and increased time spent indoors, were potentially one of the most important aspects [19, 20]. It may have led to greater exposure to indoor allergens and reduced exposure to beneficial outdoor environments. Qing [21] found that children and youth groups exhibited an increasing positive rate for most common allergens, especially *et al.*, indoor inhalant allergens, during the COVID-19 epidemic compared to before the pandemic in China. Furthermore, the rapid and potent immune response against SARS-CoV-2 infection is the first line of defense against the invasion of the virus. However, excessive natural immune inflammation and impaired adaptive immune response may cause damage to both local and systemic tissues [22]. The COVID-19 virus may activate and disrupt the regulation of the immune system [23], and may lead to an enhanced response to allergens in the body. This may make children and adolescents more sensitive to respiratory allergens and increase the risk of allergic reactions and symptoms. There are also other reasons that may contribute to the increased prevalence of respiratory allergies among children and adolescents. Scientific research indicated that the COVID-19 pandemic had a negative impact on the mental health of children and adolescents [23]. High levels of stress and anxiety can potentially have adverse effects on the immune system [25], thereby potentially increasing the risk of allergic reactions. Additionally, the implementation of infection prevention measures, such as the utilization of face masks and adherence to social distancing, might have unintentionally affected the normal progression of immune tolerance, potentially resulting in an elevated risk of developing allergic sensitization.

The decreased prevalence of asthma among children and adolescents in the United States during the COVID-19 pandemic was observed in the study. A lot of attention has been paid to the reasons for the decline in the prevalence of asthma. The reduction in exposure to common environmental triggers of asthma among children and adolescents may have contributed to it. It was the result of the implementation of public health measures to control COVID-19 and other infectious diseases [17, 18]. These measures effectively limited the exposure of children and adolescents to outdoor allergens, air pollution, and irritants, which may trigger or exacerbate asthma [26–28]. What's more, the reduction in the prevalence of asthma attacks may have been strongly influenced by the ongoing decrease in respiratory virus levels during the COVID-19 pandemic [29]. Viral respiratory tract infections are commonly associated with induced asthma exacerbations [30]. And the incidence of respiratory viral diseases and the detection of viruses declined significantly during the pandemic [29, 34]. Therefore, the incidence of asthma may be reduced as a result. In addition, reductions in vigorous physical activity during the COVID-19 pandemic may also have had an effect on the reduced prevalence of asthma [26]. It was reported that vigorous physical activity was positively associated with symptoms of asthma in adolescents [31]. During the epidemic, there was a decrease in physical activity among adolescents [32, 33], leading to a corresponding reduction in vigorous exercise, thus resulting in a decrease in the prevalence of asthma. What's more, with fewer doctor visits during the COVID-19 pandemic, there were fewer instances of making a doctor's diagnosis, also influencing the results.

This study has several notable strengths. Firstly, the study was a large-scale study to compare the differences in the prevalence of allergic diseases and asthma among US children and adolescents during the COVID-19 pandemic and preceding the pandemic. Moreover, it utilizes extensive nationwide population-based data.

In study used data from the Korea Youth Risk Behavior Web-based Survey (KYRBS) from 2009 to 2021, which is an online survey monitoring health-related behaviors among adolescents. The study focused on adolescents aged 12-18 and included those diagnosed with allergic diseases (asthma, allergic rhinitis, and atopic dermatitis) within the past 12 months. The study was approved by the institutional review boards of Sejong University and the Korea Disease Control and Prevention Agency.

Prevalence Trends: **Overall Allergic Morbidity**: Increased from 23.19% (2009-2011) to 25.09% (2018-2019), then decreased after the COVID-19 outbreak. **Asthma**: Decreased from 2.23% (2009-2011) to 1.99% (2018-2019), with a rapid decline after the outbreak. **Allergic Rhinitis**: Increased from 17.79% (2009-2011) to 20.45% (2018-2019), then decreased after the outbreak. **Atopic Dermatitis**: Slightly increased from 6.74% (2009-2011) to 6.82% (2018-2019), followed by a decrease after the outbreak.

Factors Analyzed: Age, sex, BMI, residence area, smoking status, alcohol consumption, parents' educational level, economic level, and school performance were considered. Female and overweight or obese adolescents were more vulnerable to allergic diseases.

Impact of COVID-19: The decrease in allergic diseases during the pandemic is attributed to public health measures like social distancing, mask mandates, lockdowns, and school closures, which reduced exposure to allergens. This trend is consistent with studies from Brazil, India, and Singapore, which also showed a reduction in asthma admissions during the pandem. In

study 3 the largest comprehensive evaluation of the risk of new-onset asthma in adults after COVID-19 infection using a nationwide dataset. It found that subjects with COVID-19 had an asthma incidence rate of 31.28 per 1,000 person-years, which is 2.1 times higher than those without COVID-19. The risk was particularly high in older subjects. COVID-19 vaccination was effective in reducing the incidence of new-onset asthma by lowering the risk of developing COVID-19.

Previous studies focused on the severity of COVID-19 in subjects with asthma, indicating that well-controlled asthma did not increase the risk of severe COVID-19 unless it was uncontrolled or treated with oral corticosteroids. An American case-control study reported increased healthcare utilization for asthma in the post-COVID-19 cohort with a risk ratio of 1.95 compared to the non-COVID-19 cohort. Another study showed asthma-like diagnoses were prevalent among children hospitalized with COVID-19. A retrospective study also indicated a higher risk of new-onset asthma in subjects with recent COVID-19 compared to age- and sex-matched controls.

The exact pathophysiology of asthma associated with viral infection is not fully understood, but previous studies suggest the airway epithelium and immune mediators play a role. The risk of new-onset asthma was especially higher in older subjects due to age-related immune system changes.

CONCLUSION

The prevalence of respiratory allergies increased, while the prevalence of both skin allergies and asthma decreased among children and adolescents during the COVID-19 pandemic compared to the pre-pandemic period. Further research is needed to explore the relationship between allergic diseases and the pandemic, with a particular focus on the impact of lifestyle changes resulting from COVID-19 prevention measures. COVID-19 has been associated with an increased risk of new-onset asthma, whereas vaccination may help mitigate this risk by preventing COVID-19, particularly in older individuals. Further studies are necessary to better understand these findings. The COVID-19 pandemic had a significant impact on the prevalence of allergic diseases and asthma, with varying effects depending on the type of allergy. Public health measures played a crucial role in these changes, and further research is required to fully assess the long-term implications. Clinicians should consider evaluating patients with persistent respiratory symptoms post-COVID-19 for asthma and recognize the potential benefits of COVID-19 vaccination in reducing the risk of new-onset asthma, especially in older populations. These studies have certain limitations, including their main focus on the Korean and USA population.

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