Addressing Air Quality Mitigation as a Key Factor in Asthma Management and Prevention

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Asthma Air Quality Mitigation as a Key Factor in Asthma Management and Prevention

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Dr. Wittler

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Executive Summary

Introduction

A Doctoral Nursing Project (DNP) addressing asthma mitigation was implemented at a sub-urban child care center in Illinois in the Summer of 2023. Asthma is the most prevalent chronic condition in childhood and was selected as a topic for a project due to the increased incidence and prevalence of asthma in this Illinois region (Centers for Disease Control and Prevention (CDC), 2022). In this geographic area, the demographics consist of a majority of African American, low socioeconomic status persons—which has also been identified in the literature as the demographic most predisposed to developing asthma. Therefore, a project was developed to mitigate the development and management of asthma for children attending a daycare center in Illinois.

Literature Review

A thorough literature review was conducted to better understand the factors that influence the development and management of asthma, as well as determine what factors are driving the socioeconomic and racial disparity in the prevalence of asthma. The literature consistently identified that exposure to poor air quality increased the risk of developing asthma, some studies even indicated that children living in areas with poor outdoor air quality have twice the prevalence of asthma (Brumberg et al., 2021; Kharti et al., 2021; Nardone et al., 2018). Additionally, those diagnosed with asthma living in areas with poor air quality are more likely to have asthma exacerbations, ER visits, and hospitalizations (Khatri et al., 2021; Lee et al, 2020; Pan et al., 2020). Major contributors to poor ambient air quality include pollutants from motor vehicle traffic and industrial waste. The literature steadily indicated that preschool-age children
and younger are the most sensitive to poor ambient air quality and pollutants (Khatri et al., 2021; Lee et al., 2019).

The literature also noted that African American children are more likely to attend school and live in communities with poor air quality readings with higher amounts of pollutants than non-African American children (Correa-Agudelo et al., 2022; Nardone et al., 2018). Additionally, schools with a majority population consisting of African American children are more likely to be within two-tenths of a mile from a major roadway (Nardone et al., 2018). This is significant, as schools and daycares close to major highways have elevated readings of motor vehicle pollutants in their classrooms (Gasper et al., 2018). Geographic location of communities also played a role in ambient air pollution readings, with urban communities having higher readings than rural areas (Bronco et al., 2020; Querdibitty et al., 2023). However, racial and socioeconomic factors drive community disparities in air quality readings more so than geographic differences (Querdibitty et al., 2023). Rural communities with majority African American populations were nine times more likely to be exposed to poor air quality than rural communities composed of non-African Americans (Querdibitty et al., 2023).

There is little guidance available in the literature to guide daycares and preschools for mitigating poor ambient air exposure, but many organizations such as the Centers for Disease Control and Prevention (CDC), American Lung Association (ALA), and American Academy of Pediatrics (AAP) have published guidance for school-aged children. These organizations point to the Environmental Protection Agency (EPA) as the authority on air quality monitoring and mitigation. The EPA has partnered with AirNow to make resources available to communities and schools to monitor air quality and increase awareness of daily air quality readings through an air quality flag program. Additionally, the EPA recommends that schools use air filters with a
Minimum Efficiency Reporting Value (MERV) rating of 8, but they neglect to list any guidance for the frequency of changing or ensuring compliance (Martenies & Batterman, 2018). Upon the literature search, it was found that most states do not require site assessments before establishing a daycare location (Querdibitty et al., 2023). Illinois’ state specific guidance for daycare licensure does not require a complete site history to be obtained and does not offer any requirements or recommendations regarding zoning of physical location (Illinois Department of Children and Family Services, 2020).

Methods

This project was implemented at a mid-size child care facility that primarily serves African American and Hispanic children from ages 6 weeks to 5 years of age of families with low income. The purpose of this project was to increase staff awareness regarding the role that air quality has on developing and managing asthma. It was crucial to educate staff on the risk that environmental exposures have in the development of asthma as well as explain to staff why children at this specific child care center are considered a high-risk population. After staff education, an air flag program published by the EPA and AirNow was implemented at the child care center location.

A project site assessment was completed before implementation to determine the current mitigation techniques already in place. The center had an established quarterly pest control plan in place, a tobacco-free campus, and an hourly cleaning checklist and schedule for each classroom. The site also had air filters that were changed quarterly by maintenance within the building. After completing an assessment, a time was set for project implementation. A pre-survey of nine questions on a 5-point Likert scale and one yes/no question was administered to the staff before staff received asthma and air quality education.
Staff members were provided asthma and air quality flag program education in person at their monthly training meeting. This meeting was conducted with staff the day before the flag program was initiated and staff were able to ask questions regarding asthma or the flag program. The child care center coordinator notified parents about the flag program's implementation and provided parents with EPA resources via email. The day of the meeting an air quality widget was installed on the home screen of the coordinator’s computer, along with a daily spreadsheet where the flag color of the day was tracked. Air quality flags from the EPA website were printed and laminated and left with the coordinator to post at the front of the center. The coordinator was also provided with a document from the EPA that provided guidance on actions to take depending on the air quality color. Over the next six weeks, each weekday morning the coordinator checked air quality with the widget, hung the flag color for the day, and recorded the flag color on the spreadsheet. This flag was displayed for the teachers, parents, and children to see. After project implementation, the coordinator emailed the staff with a link to the post-survey. The post-survey included the same questions as the pre-survey with one additional question asking if they attended the educational event before implementation.

The students established a timeline to implement the project at the beginning of June 2023. The site assessment was conducted by the students with their stakeholder on February 16th. This project was submitted to the Southern Illinois University Edwardsville’s IRB committee and on May 8th, the project was determined by the committee as not human research and did not need IRB approval to proceed. Staff education was provided on June 26th, and therefore the intervention could not be implemented until late June. The pre-survey was emailed to staff by the center coordinator on June 21th, remaining pre-surveys were taken on the 26th before the start of the presentation. The project was implemented from June 27th to August 4th. The DNP students
returned to the project site on August 3\textsuperscript{rd}, to collect the air quality tracking sheet and collect the post-surveys in person. Unfortunately, no surveys were able to be completed at this time as few staff were available due to summer break. The post-surveys were emailed to the staff by the center coordinator on August 9\textsuperscript{th}, 2023.

\textbf{Evaluation}

As mentioned, a pre-survey and post-survey were administered to staff to determine the significance of this project. 12 pre-surveys were completed, and 8 post-surveys were completed. There were nine questions on a 5-point Likert scale and one yes/no question. Before the implementation of this project, 50\% of respondents strongly agreed that exposure to poor air quality can make a young child more likely to develop asthma. After implementation, 75\% of respondents strongly agreed with this statement—indicating an increased understanding of the role that air quality plays in developing asthma. Pre-surveys indicated that 58\% of respondents strongly agreed that they felt there were steps they could take to prevent asthma attacks in children. After the implementation of the project, 88\% of respondents indicated they strongly agreed there were steps they could take to prevent an asthma attack. Another noticeable change in responses showed that post-implementation, 75\% of respondents strongly agreed that control of symptoms of an asthmatic child is dependent on their environment. Before implementation, only 41\% of respondents strongly agreed with this.

One of the limitations in this project was the difference in sample sizes between pre and post-surveys, as well as the small sample size. A Mann-Whitney U test was selected to determine the significance of the results due to previously noted limitations (McClenaghan, 2022). It was determined that there were no statistically significant changes indicated from the pre-survey and post-survey. However, staff left several positive comments in the comments section of the post-
survey and felt that this project was very informative. An additional limitation to this study was the lack of a validated tool that was adapted from several validated tools.

**Impact**

The immediate impact of this project was increased staff awareness of air quality monitoring and readings, as well as its role in asthma management and prevention. Additionally, the literature review has highlighted the difference between genetic predisposition compared to the influence of social factors such as the environment in which people live when determining risk factors for developing conditions such as asthma. The DNP students were able to disseminate this information as well as their intervention outcomes to the EPA on October 31, 2023. This was presented virtually to over 150 EPA employees during the EPA’s Environmental Justice Week.

This project has also identified a need for further interventions. During the staff educational session, staff were engaged and asked many questions after the presentation. Staff asked DNP students to return for more education, especially education for parents so they can also identify symptoms of asthma as well as home triggers. Additionally, this project identified that air filter compliance and changing schedule could be further assessed to ensure it meets EPA recommendations. Both interventions have been identified as possible future student projects, which has been supported by the project site stakeholders.

On a small scale and on a personal level, this project has changed how the graduate students for this project approach patient encounters. It has instilled a passion for considering social determinants of health when establishing a plan of care for patients, as well as a sense of advocacy for creating systematic changes to benefit patients on a community health level. Systematic changes that would improve this disparity in asthma diagnosis and management
could include zoning laws for daycares and schools, policy development at the school level for air quality compliance interventions and requiring site assessments before establishing daycare sites. This project has also revealed a need for further research regarding infants-preschoolers with asthma or asthma symptoms as a lack of research has led to a lack in guidance in daycare settings for asthma mitigation.

Conclusion

Asthma diagnosis was noted to have a higher prevalence in an Illinois county with primarily African American individuals with low socioeconomic status which is a consistent finding for this demographic throughout the literature. The literature, however, establishes that this population is more likely to live and attend schools in communities with poor air quality, which is the most prevalent risk factor for developing asthma. Efforts to mitigate this risk factor in a child care center were established through the implementation of the EPA’s air quality flag program. Results from the implementation of the project indicated increased staff awareness that increased exposure to poor air quality results in increased risk of developing asthma. Additionally, following implementation, more staff identified that the environment plays a role in asthma exacerbations and more staff members indicated there were steps they could take to prevent asthma attacks. These results, although not statistically significant, were anecdotally significant through the positive feedback elicited from staff member comments. Future interventions for parent education and further investigation of the daycare’s air filters could help improve environmental triggers. Ultimately, there continues to be a need for systematic changes regarding zoning and policies to fully mitigate the socioeconomic and racial disparity in the development of asthma.