Spatial Analysis Of Housing Problems And Asthma Control Among Children With Asthma In An Urban Environment

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BACKGROUND

- Striking socioeconomic health disparities persist in pediatric asthma in urban settings.
- 16% of Black children have asthma compared to 3.3% of non-Hispanic, White children in D.C.
- The D.C. Pediatric Asthma Registry shows the highest pediatric asthma-related ED visits occurs in Southeast D.C., where poverty and unemployment rate are highest.
- IMPACT DC (IDC) is an asthma program in Washington, D.C. dedicated to evaluation and treatment of children with recent ER visits, hospitalizations and/or uncontrolled asthma.

OBJECTIVES

- To understand how deprivation of basic needs correlates asthma morbidity.
- To explore how deprivation of basic needs may contribute to health disparities in pediatric asthma.

METHODS

- A social needs questionnaire was developed and distributed in IMPACT DC clinic.
- 7 categories of social needs were assessed: household asthma triggers, asthma concerns at school, employment, public benefits, food insecurity, housing assistance and general assistance.
- Participants >4 years old completed the Asthma Control (ACT).
- Data was collected at initial in-person clinic visits at IMPACT DC February 2022 – June 2022.
- Analysis limited to participants living in Washington, DC.
- Participants addresses were geocoded onto a map of 46 Neighborhood Clusters defined by the D.C. Government Office of Planning.

RESULTS

- Of the 186 participants, average age was 7.6 years, 83% were Black, and 36% had moderate-severe persistent asthma.
- 54% reported >1 social need.
- Of those with at least 1 social need, 45% identified household triggers and 49% identified housing assistance.
- Housing assistance requests included finding housing (61%), paying utilities (51%), and foreclosure counseling (8%).
- Participants reporting household asthma triggers and/or housing assistance were concentrated within 5 neighborhood clusters in Washington, D.C., all located in Wards 7 and 8.
- ACT scores were on average 2.3 lower in participants who reported household asthma triggers compared to those who did not (p<0.02).

CONCLUSION

- Identification of social needs associated with housing may provide additional insight when trying to identify children with poorly controlled asthma.
- These findings have the potential to impact policy change to elevate housing standards in Washington, D.C. and close the gap in health disparities of pediatric asthma.

Future Considerations

- Next steps involve exploring the distribution of each social need by ward and by neighborhood. In order to identify how to allocate resource centers.
- It will be important to characterize the neighborhoods with high needs, in order to better understand the drivers behind these social determinants of health.

Acknowledgements

- Thank you to the IMPACT DC Clinic for administering the screeners during clinic.

Figure 1: Social needs survey.

Figure 2: Kernel density map of participants who reported a need for assistance with household asthma triggers.

Figure 3: Kernel density map of participants who reported a need for assistance with housing issues.
Automated Wheeze Detection in Children Using Data-Efficient Deep Learning Models

**BACKGROUND**

- 1:12 or 6 million children with asthma
- 1.7 million ED visits
- 12.8 million missed school days

- Initiation of "yellow zone" management on the asthma action plan (AAP) currently relies on subjective measures of acute asthma severity, often delaying initiation of rescue therapy.
- Combining the current AAP with an objective mobile app that scores acute asthma severity (automated detection and assessment of wheeze severity + respiratory rate + pulse oximetry + measure of dyspnea) could provide parents with decision support and allow for more timely initiation of rescue therapy, ultimately decreasing ED utilization.
- A key requirement for developing an objective mobile application for home management of acute asthma is automated wheeze detection.

**OBJECTIVE**

To develop an automatic deep learning-based algorithm to assist parents/clinicians in assessing the severity of asthma in children.

**RESULTS**

**Automatic wheeze detection with an accuracy of 84%**

**METHODS**

**Data Collection**

Enrolled children with asthma (2-18yrs), between 7/22-4/23, from the Emergency Department.

- Trained research assistants to collect lungs sound and voice recordings using the StethAid Lungs platform.
- Each lung sound recording was 15 seconds in duration.
- Recordings originated from 11 separate locations.
- Lung sound labels (ground truth) were provided by physicians at the bedside using their acoustic stethoscope and asynchronously by study physicians SP, DP, and JS.

**Deep learning workflow**

- Feature extraction
- Pre processing
- Model deployment in clinics/home

**DISCUSSION**

Potential applications of StethAid for Lungs:
- In Hospitals/Clinics: Minimizing ED visits for asthma.
- Tracking the efficacy of treatments: Extend care access to communities in underserved areas.
- Improving confidence in diagnoses: At Home. Identifying symptoms early reducing severity of exacerbations.
- Lowering costs and improving medical outcomes: Doing Work:
  1. Deep learning for dyspnea detection
  2. Respiratory rate calculation
  3. Asthma score calculation

**CONCLUSIONS**

- StethAid Lungs could assist parents in managing their child’s asthma at home.
- StethAid Lungs could be used in quickly identifying high risk patients and prevent asthma attacks.
- StethAid Lungs could aid in reducing ED visits and school absenteeism.

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