Automated Wheeze Detection in Children Using Data-Efficient Deep Learning Models

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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 detection 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 lung 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

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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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