

The Long-Term Effect of a Quality Improvement Intervention in the Management of Bronchiolitis

Quality improvement interventions have been shown to improve adherence with bronchiolitis treatment guidelines; however, the long-term effect of these interventions is unclear. We show that while such an intervention led to a long-lasting change, this was attenuated with time. Repeated interventions are required to maintain guideline adherence.

Keywords: *Emergency department, Management, Radiography.*

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Bronchiolitis has a broad differential diagnosis but alternate diagnoses can be distinguished by history and physical examination alone [1]. Guidelines therefore state that clinicians should not routinely order chest X-rays for the diagnosis of bronchiolitis as findings have no effect on patient management or outcomes [2]. We previously conducted a successful quality improvement (QI) intervention to decrease the use of chest X-ray in bronchiolitis at two medical centers, also showing a reduction in hospitalization and use of unnecessary medication [3]. However, as the long-term effects of QI are unclear, and prior studies were mostly limited to one season [4,5], we conducted the current study to assess the long-term outcomes.

This was a retrospective cohort study at the Hadassah EinKerem and Mount Scopus Medical Centers in Jerusalem, Israel. In November, 2015 the pediatric and emergency department (ED) staff participated in formal educational sessions led by pediatric pulmonologists that focused on the guidelines, emphasizing those sections on chest X-ray. Guideline cards were positioned throughout the ED physician stations, with routine follow-up during the 2015-16 bronchiolitis season [3]. The study was approved by the institutional review board.

The current study compared patients with bronchiolitis seen in the ED during three time periods. The historical group (prior to the intervention) the early group (seen during the year of the intervention) and the late group (comprised of patients seen the following two bronchiolitis seasons). A total of 1,115 cases were included in the final analysis: 207 in the historical group, 298 in the early group and a sample of 610 in the late group. The groups were similar in terms of gender, vaccination status, background diseases and family history of asthma. Patients were younger in the early and late groups, with mean (SD) age of 5.7 (4.9) and 6.2 (5.4) month, respectively, compared with the historical group, 7.9 (5.4) month ($P<0.0001$). Symptoms and physical examination findings were similar throughout the three periods.

The rate of chest X-ray use decreased from 58.3% in the historical group to 36.6% ($P<0.001$) in the early group but increased to 44.6% ($P<0.001$) in the late group. There were no significant differences between the two seasons included in the late group, or the two centers. On multivariate analysis, only belonging to the historical group predicted getting a chest X-ray (OR=1.6, 95%CI 1.1-2.3; $P<0.013$). The proportion of abnormal

chest X-rays increased from 28.4% in the historical group to 48.1% in the early group and slightly decreased to 31.5% in the late group ($P<0.001$).

Analysis of secondary outcomes showed a decrease in the hospitalization rate from 76.8% to 69.8% ($P=0.05$) in the early group and 57.7% in the late group ($P<0.001$). The length of stay was unchanged. The readmission rate was 2.9% and 2.7% in the historical and early groups, respectively ($P=0.89$), but 8.4% in the late group ($P=0.008$). However, this was not correlated with chest X-ray use ($P=0.34$). Use of supplemental oxygen in the ED increased over the study period. There was a downtrend in the use of antibiotics, bronchodilators, and hypertonic saline with no change in corticosteroids. Fewer laboratory tests were performed; 71.7% in the historical group to 64.1% in the late group ($P=0.047$).

Nose swab samples were drawn from 55.8% of the historical group, 47% of the early group, and 40.7% of the late group. Respiratory syncytial virus (RSV) decreased from 80.2% to 59.7% ($P<0.001$) and adenovirus from 21.6% to 10.9% ($P=0.007$); human metapneumovirus (hMPV) increased from 6.9% to 14.1% ($P=0.047$). Having had a chest X-ray correlated with positive findings on the nose swab ($P<0.001$), but not specific pathogens.

We have shown that a focused intervention may lead to a persistent effect; however, this is attenuated with time. While chest X-ray rate remained lower than it was before the intervention (44.6% vs. 58.3%), it increased by 22% compared with the year of the intervention. Few studies have investigated the long-term effects of QI in bronchiolitis. Perlstein, et al. [6] showed partial adherence over three years in their study, while Tejedor-Sojo, et al. [7] utilized periodic feedbacks to sustain momentum, and showed improvement with time.

The most plausible reason for the increase in the rate of chest X-ray in our study is the time lapse from the intervention. However, our findings were suggestive of a more severe bronchiolitis season during the study period, with an increase in ED visits, an increase in hMPV that may cause a worse illness [8,9] and a decrease in RSV. Furthermore, oxygen supplementation rates increased as did re-admission rates. One may argue that the increase in re-admissions reflects an undesired effect of the QI intervention. However, there was no statistical association between the decrease in chest X-ray and the increase in re-admissions.

To conclude, we have shown that a QI intervention led to long-lasting change in management practices; however, the improvement attenuated with time. We therefore recommend conducting repeat interventions at the beginning of each bronchiolitis season to maintain adherence.

Ethics approval: Hadassah-Hebrew University institutional review board; 008-16-HMO, dated April 14, 2016.

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REFERENCES

1. Teshome G, Gattu R, Brown R. Acute Bronchiolitis. *Pediatr Clin North Am.* 2013;60:1019-34.

2. Ralston SL, Lieberthal AS, Meissner HC, et al. Clinical Practice Guideline: The Diagnosis, Management, and Prevention of Bronchiolitis. *Pediatrics.* 2014;134:e1474-e1502.
3. Reiter J, Breuer A, Breuer O, et al. A quality improvement intervention to reduce emergency department radiography for bronchiolitis. *Respir Med.* 2018;137:1-5.
4. Tyler A, Krack P, Bakel LA, et al. Interventions to reduce over-utilized tests and treatments in bronchiolitis. *Pediatrics.* 2018;141:e20170485.
5. Ralston SL, Garber MD, Rice-Conboy E, et al. A multicenter collaborative to reduce unnecessary care in inpatient bronchiolitis. *Pediatrics.* 2016;137: e20150851.
6. Perlstein PH, Kotagal UR, Schoettker PJ, et al. Sustaining the implementation of an evidence-based guideline for bronchiolitis. *Arch Pediatr Adolesc Med.* 2000;154:1001.
7. Tejedor-Sojo J, Chan KN, Bailey M, et al. Improving bronchiolitis care in outpatient settings across a health care system. *Pediatr Emerg Care.* 2019;35:791-8.
8. Akhras N, Weinberg JB, Newton D. Human metapneumovirus and respiratory syncytial virus: subtle differences but comparable severity. *Infect Dis Rep.* 2010;2:e12.
9. Jroundi I, Mahraoui C, Benmessaoud R, et al. A comparison of human metapneumovirus and respiratory syncytial virus WHO-defined severe pneumonia in Moroccan children. *Epidemiol Infect.* 2016;144:516-26.

Vitamin A Supplementation in Children in Guédiawaye Health District, Senegal

To assess the coverage rate of routine vitamin A supplementation, a descriptive study was carried out in the Guédiawaye Health District. The coverage rate for vitamin A supplementation was 48.6%. Age over 24 months, uneducated father, maternal age over 25, and lack of disease-related knowledge were factors associated with delayed vitamin A supplementation.

Keywords: Coverage, Health program, Under-5 children.

Vitamin A deficiency remains a public health problem in developing countries, particularly in Africa and the Indian subcontinent. It affects young children, often associated with protein-energy malnutrition, and pregnant women [1]. Vitamin A supplementation is recommended in infants and children aged 6-59 months as a public health intervention to reduce child morbidity and mortality [2]. In accordance with this guideline, Senegal adopted vitamin A supplementation as a strategy during routine immunization activities and mass campaigns, since 2013. The objective of this study was to determine the coverage rate for vitamin A supplementation among children 6-59 months of age in the Guédiawaye Health District.

This community-based descriptive study was conducted from 1 June to 30 November, 2018 in the Guédiawaye district. The surveys relating to the characteristics of the child, the family and knowledge about vitamin A supplementation concerned the households drawn at the level

of each stratum, using a systematic two-stage cluster random sampling. The first stage consisted in selecting neighborhoods within the geographical area of the district, and the second stage in selecting households within the drawn neighborhoods. In each selected household, all children aged 6-59 months were included in the survey. Data collection was carried out by two trained investigators. Each investigator was accompanied by a *bajenou ngox*, a neighborhood godmother, to facilitate the interview. The parameters studied were: the individual characteristics of the child (age, sex, position within sibling, spacing interval between births), household characteristics, and knowledge about vitamin A supplementation. A written informed consent was obtained from the individual parent prior to the survey.

The median age of fathers was 38 and that of mothers 28 years. The average household size was 7 people. Out of 366 children aged 6-59 months surveyed, 188 (51.4%) had not received vitamin A. The coverage rate was higher for children over 23 months of age (65.6%). Before 12 months, coverage rate was 36.8% and between 12 and 23 months 64.6%. The characteristics of the households surveyed are summarized in **Table I**. Age over 24 months [OR (95% CI) 3.41 (1.87-6.19); $P<0.001$], father's lack of education [OR (95% CI) 1.49 (0.91-2.44); $P=0.11$], maternal age over 25 year [OR (95% CI) 1.74 (1.01-3.02); $P=0.04$], and lack of knowledge of means of protection against diseases [OR (95% CI) 1.43 (0.83-2.44); $P=0.19$] were factors associated with delayed vitamin A supplementation.

Improving the vitamin A status of under-5 children increases their chance of survival by reducing mortality by 25% from childhood illnesses such as malaria, diarrhea, acute