Published in final edited form as:

Clin Pediatr (Phila). 2017 October ; 56(11): 1048–1053. doi:10.1177/0009922817698801.

Screen time engagement is increased in children with asthma

Alexandra P. Rota¹, Leonard B. Bacharier, MD¹, Katy Jaffee, MS², Cynthia M Visness, PhD², James E. Gern, MD³, Meyer Kattan, MD⁴, George T. O'Connor, MD⁵, Robert A. Wood, MD⁶, Peter J. Gergen, MD⁷, and Gordon R. Bloomberg, MD¹

Department of Pediatrics, Division of Allergy, Immunology & Pulmonary Medicine, Washington University in St. Louis School of Medicine, Saint Louis, MO

¹Washington University School of Medicine, St. Louis, MO, USA

²Rho Federal Systems Division, Inc., Chapel Hill, NC, USA

³University of Wisconsin School of Medicine and Public Health, Madison, WI, USA

⁴Columbia University College of Physicians and Surgeons, New York, NY, USA

⁵Boston University School of Medicine, Boston, MA, USA

⁶Johns Hopkins University School of Medicine, Baltimore, MD, USA

⁷National Institute of Allergy and Infectious Diseases, Bethesda, MD, USA

Abstract

Background—Lifestyle behaviors are an important component in the evaluation of childhood asthma. One aspect of lifestyle behaviors is the number of hours engaged with electronic screens. Questioning the extent of these sedentary behaviors may help in the assessment of current symptom control.

Objective—Study objectives are to 1) determine the number of hours engaged with electronic screens during “out of school time” among a cohort of inner city children 8–9 years of age, and 2) determine if children with a diagnosis of asthma spend more time engaged with media screens than other children of comparable age and social-economic status.

Methods—Parents of children at the St Louis site of the Urban Environment and Childhood Asthma (URECA) cohort were surveyed by questionnaire to assess their child’s engagement in screen time. URECA clinical data for a prior asthma diagnosis by age 8 were analyzed using a non-parametric Wilcoxon and Spearman correlation in relation to screen time. Socioeconomic status, allergen exposure, and environmental barriers were controlled.

Results—131 surveys were completed out of 142 URECA participants. We found that children with asthma, as compared to children without asthma, engage in significantly more hours of screen time (35 vs. 26 hours/week, $p = 0.004$).

Conclusion—We investigated the degree of sedentary behavior, as designated by hours engaged with media screen time, among an urban group of children with asthma compared with healthy children of similar race/ethnicity and environment. Children with asthma used significantly more

media screen time. This information adds life-style behavior to clinical data as an additional dimension in the assessment of asthma in children.

INTRODUCTION

Asthma is a chronic disease that is heterogeneous in nature and expressed with variable symptoms and airflow limitations. It is characterized clinically by inflammation of the airways and recurrent episodes of wheezing, coughing, and breathlessness. The prevalence of asthma has increased among children over the past decade, making it the most common chronic childhood illness, affecting more than 6.8 million children in the United States and posing a significant public health problem [1, 2]. Of these children, those who grow up in lower socioeconomic status and urban environments have a higher prevalence of asthma and suboptimal asthma control compared to the overall U.S. rate [1–5].

Among the possible factors related to the expression of suboptimal control of childhood asthma is the consideration of lifestyle behaviors that lead to sedentary behavior. Previous studies have identified the influence of physical activity as a critical component to healthy childhood development in this population [6–8]. Among studies of activity, it is also clear that better asthma control is associated with an increase in aerobic exercise [9–11]. One index of sedentary behavior is time spent while engaged in television and mobile devices.

Similar to the recent dramatic increase in asthma, there has also been a dramatic increase in media use over the past decade [13], making it particularly important to study screen time engagement in this population. Studies of urban children with asthma reported that they were less active than their peers, but these data did not include the amount of time spent engaged with screens outside of school [12]. Furthermore, this investigation was conducted over 10 years ago and did not include the recent increase in media use. In adults and adolescents, a lower level of physical inactivity, characterized by television watching, is inversely associated with asthma symptoms [14, 15]. Identifying the relationship between screen time and asthma in this vulnerable population may help develop ways to better assess, control and prevent asthma symptoms in urban youth. To date, this association with screen time has not been recently studied in school-aged urban children.

Our study investigates whether children with a diagnosis of asthma engage in more screen time, as an index of sedentary behavior, than children without asthma.

METHODS

Subjects

Using the Urban Environment and Childhood Asthma (URECA) cohort, a longitudinal birth cohort of children living in four U.S. cities (Saint Louis, Boston, New York, and Baltimore) created to study the antecedents of asthma among urban children, we collected data to study the relationship between asthma and screen time at the St Louis site [3, 16].¹ Our cohort consists of 142 participants 8–9 years of age. In the URECA study, standardized

¹The URECA study focuses on participants living in disadvantaged neighborhoods where 20% of the population lives below the federal poverty line and is at a higher risk of developing wheezing and allergen sensitivity [3]. At the time of birth, the URECA study

questionnaires are administered at annual visits and quarterly phone calls to collect data related to study outcomes, and also continue to engage the family in the study and provide informational updates. For this sub-study, informed consent was given over the telephone during a quarterly call or in writing at a yearly visit.

Questionnaire

Our study used a questionnaire, the Activity and Inactivity Form, with 10 specific questions (Figure S1), addressing the participants' degree of average weekly screen time engagement while outside of school, as defined by television, computer, tablet, or other forms of videogame use, on both weekdays and weekends. This survey used questions from the CDC's validated 2015 Youth Risk Behavior Survey [17]. Using URECA standardized questions, we also evaluated the perceived socioeconomic and environmental obstacles to physical activity in urban school-aged children, risk factors that may influence screen time, and the parental perceptions of symptoms during play that are related to hours spent with screens. All participants were surveyed either over the phone or during a scheduled clinic visit. We administered the questionnaire between September 2014 and January 2015, when all of these children were enrolled in school.

Determinants of Screen Time

"Screen time," as a measure of inactivity, was determined by combining all of the weekdays and weekend screen time use. Similar to a national study conducted by the Kaiser Family Foundation, we determined screen time and media use in children as TV, computer, and video game use [13]. For our study, we included Friday as a weekday.

Definition of Asthma

As defined by URECA investigators, "asthma" at age 7 is classified as having any of the following definitions: (1) self-reported physician-diagnosed asthma between the ages of 4–8 years and the presence of asthma symptoms in the past 12 months, (2) a bronchodilator reversibility of $\geq 10\%$ or PC20 ≥ 4 (methacholine) during pulmonary function tests and the presence of asthma symptoms in the past 12 months, (3) presence of two or more wheezing episodes in the past 12 months, OR two or more asthma related doctor's visit in the past 12 months, OR the use of a controller medication in the past 6 months. An additional three cases of incident asthma between ages 7 and 8 were included based on reports of wheezing during the year. In this study, asthma was defined at age 8.

Clinical Data

In addition to the Activity and Inactivity Form data (Figure S1), we used data from participants' most recent URECA annual clinic visit for this study; this visit was 0 to 9 months prior to the study. For each annual clinic visit, lung function is assessed by spirometry pre- and post- bronchodilator in accordance with ATS criteria and impulse

participants had to meet 3 criteria, 1) have a biological mother or father reporting a history of asthma, hay fever, or eczema, 2) reside in the inner-city, defined for this study as specific contiguous neighborhoods where at least 20% of the population has income below the federal poverty line, as defined by the 2000 consensus, and 3) were delivered at an affiliated hospital at 34 weeks gestation or later [3, 16].

oscillometry (IOS). Methacholine challenge was performed at age 7. Allergen sensitization was assessed at age 7. For URECA analyses, allergic sensitization is defined as the presence of either: 1) one or more positive allergy skin tests, or 2) one or more positive tests for allergy-specific IgE using ImmunoCap. Seasonal and perennial allergies were tested for indoor and outdoor allergens.²

Statistical Analysis

We designed this study to achieve 90% power ($\alpha=0.05$, two-sided) to test for an association between asthma and media use. To determine if increased media use is associated with an asthma diagnosis we used a non-parametric Wilcoxon test to compare total weekly screen time by categorical variables, such as each specific symptom, gender and season. A Spearman correlation was completed between total screen time and continuous variables such as total number of symptoms and BMI. We fitted several generalized linear models with Poisson distribution for multivariate model predicting total weekly activity. The asthma features used in the models were: wheezing during a cold, wheezing due to cold air exposure, wheezing during exercise, wheezing during the fall or winter seasons, wheezing diagnosed by a doctor, allergen sensitivity, current household smokers, BMI, and sex.

The Institutional Review Board at Washington University in St Louis approved this study and participants provided consent.

RESULTS

Subjects

As of December 2015, 142 children were currently active participants in the St Louis site cohort of the URECA study. One hundred and thirty-one completed questionnaires, representing a response rate of 92%. Eleven participants were not enrolled because they were unable to be contacted during the data collection period. Children at this stage of the study were seen at their 8th and 9th birthdays, and were of primarily African American (91%) or mixed descent (9%). Forty-seven percent ($n=62$) of participants are male. Of the 131 subjects, 36% ($n=47$) had asthma as defined by the URECA criteria (Table 1) [16].

Comparison of Screen Time for Asthmatics and Control

Children with asthma spent significantly more time engaged in “out of school screen time” than children without asthma (35 hours/ week (SD = 15.27) versus 26 hours/ week (SD = 16.34) ($p = 0.004$, Table 2 and Figure 1). Out of 47 children with asthma, 51% ($n=24$) engaged in 35+ hours of screen time per week and out of 84 children without asthma, 32% ($n=27$) engaged in 35+ hours of screen time per week ($p=0.004$). There were no asthma-

²Children undergo skin prick testing at age 7 years (Multi-Test II, Lincoln Diagnostics, Decatur, IL) for the following 14 indoor and outdoor allergens (Greer Laboratories): *Alternaria tenuis*, American and German cockroach mix, *Aspergillus* mix, cat hair, *Dermatophagoides farinae*, *Dermatophagoides pteronyssinus*, dog epithelia, German cockroach, mouse epithelia, *Penicillium notatum*, ragweed mix, rat epithelia, Timothy grass, and tree pollen (white oak). To determine total and allergen-specific IgE and allergen-specific IgG antibody, these values are measured annually by fluoroenzyme immunoassay (UniCAP, Pharmacia & Upjohn, Diagnostics, Uppsala, Sweden). The panel of specific IgE antibodies varies by blood sample: egg white, milk, and peanut for children's samples; birch or oak, ragweed, and Timothy grass for maternal samples; and *Dermatophagoides farinae*, *Dermatophagoides pteronyssinus*, dog epithelium, cat dander/ epithelium, German cockroach, mouse urine protein, and *Alternaria alternata* measured for all samples. Due to lack of complete outdoor allergen sensitivity data, we were unable to check for this.

related difference in the number of days a child goes to PE classes ($p = 0.8$), the number of sports teams a child played in school ($p = 0.9$), or the number of days being active defined as 60 minutes/day ($p = 0.3$) (Table 2). This indicates that the reported activity level during “in-school time” and reported sports among children with asthma is comparable to their non-asthmatic controls.

Barriers to Physical Activity for Asthmatics and Control

In response to the question “What do you think are the biggest obstacles in getting enough exercise for your child?” there was no asthma-related difference for any of the environmental and socioeconomic barriers analyzed separately, together, and as “multiple barriers” versus “no multiple barriers” ($p = 1.0$, data not shown). Parents of children with asthma selected “Not enough organized sports/activities in the community” (23% of respondents) most frequently, and at the same rate as parents of non-asthmatics (Table 3). Additionally, asthma status was not related to the number of hours of sleep ($p = 0.17$) (Table 2).

Risk Factors Influencing Screen Time Among a Subset of Children with Asthma

We analyzed several risk factors that could potentially influence screen time engagement among children with asthma, and did not find significant differences related to asthma. At the time of the study, the risk factors we tested for were: severity of asthma symptoms ($p = 0.1$), seasonal wheezing ($p = 0.8$), exercise induced wheezing ($p = 0.4$), wheezing in cold air ($p = 0.4$), illness induced wheezing ($p = 0.096$), allergen sensitivity (dog, cat, mouse, roach, mold, and dust mites) ($p = 0.7$), health care utilization, current household smoking ($p = 1.0$), and BMI ($p = 0.3$). Boys engaged in somewhat more screen time (33.4 hours vs. 30.5 hours) but the difference was not statistically different, ($p = 0.1$). We looked at health care utilization (oral steroids use, emergency department visits, and urgent care visits) as an index of asthma severity, and found that none of the children with asthma used these resources due to asthma exacerbation during our data collection period.

Parental Perceptions of Asthma

We also assessed parental perceptions of symptoms during physical activity. When the parents of children with asthma were surveyed, 72% reported that their child experiences wheezing or feeling out of breath when exercising or playing outside (Table 4). Yet, only 26% of parents of children with asthma responded that asthma prevents their children from exercising or playing outside (Table 4). There was a non-significant trend ($p = 0.07$) for an association between wheezing or feeling out of breath during exercising or playing outside and screen time. As reported by parents, asthma preventing exercising or playing outside was not associated with screen time engagement ($p = 1.0$).

DISCUSSION

Our findings demonstrate that children with asthma spend significantly more time engaged in screen time than their age-, gender-, socioeconomically-, and racially-similar non-asthmatic peers, even after controlling for the presence of barriers to other choices for outside activities.

From the factors we considered, only the presence of a diagnosis of asthma was strongly related to greater screen time engagement. There was a non-significant trend for gender and symptoms with exercise. Non-significant factors include the allergen sensitivity, health care utilization, albuterol use, wheezing, and BMI. Despite parental awareness of exercise related symptoms, they do not seem to be aware that symptoms during exercise might contribute to excessive use of electronic devices. This is supported by the fact that only 26% of parents of children with asthma indicated that asthma was a barrier to physical activity, yet there is a non-significant trend that associates exercise symptoms to screen time. It is also important to note that there was no statistical difference between the numbers of hours that asthmatic children and non-asthmatic children spent sleeping. Thus, asthmatic children have the same nighttime opportunities to engage in screen media.

Parents of both asthmatic and non-asthmatic children expressed at similar rates the opinion that that not having enough organized sports and activities in the community, concern regarding safety issues, nor the economic cost of physical activity were obstacles to exercise. Prior studies conducted nationally and in comparable neighborhoods also identified these barriers, but not with respect to asthma [8, 19–21]. Based on our results, we can conclude that the need for more affordable and accessible exercise [19, 22] and neighborhood safety [8] may not be the main reason children with asthma are spending more time indoors engaged with screen time, but rather could be impacting all children.

The results have important implications in that they point out that children with asthma are spending more time than children without asthma in front of television, computers, and video games, which decreases time for physical activity. Organizations, including the Centers for Disease Control and Prevention, recognize activity and exercise as an important part of childhood and a way to prevent chronic illness, such as asthma [18]. If children with asthma are spending more time engaged with screens, this limits the amount of exercise, a critical component to reducing asthma symptoms [9, 10]. In this study it is unclear if recommendations for exercising more will improve asthma. Future studies include examining this by realizing that children with asthma are more sedentary. From this study, we learned that screen time information supplements the clinical assessment of asthma in urban children and adds another dimension to the assessment of asthma in this population. This information can be used to encourage more active behavior. Because screen time is an index of sedentary behavior, it may help to distinguish children with mild asthma from otherwise healthy children.

Limitations

This study has limitations that deserve mention. The results of this survey may be affected by recall bias as it highlights the subjective reports of parents and might not be representative of the exact time their child spends inactive. The cross-sectional nature of this study means we cannot determine the direction of association between asthma and screen time. Most of the children with asthma in this birth cohort study had mild asthma, and relationships could differ in asthma or greater severity. Additionally, it is important to note that we studied urban children and suburban children may have different findings. Strengths

of the study included the prospective study design, detailed evaluation of asthma and use of validated questionnaire [8].

CONCLUSION

On average, children with asthma spend more time engaged in screen time for significantly more hours than children of the same age without asthma within the same study cohort even after controlling for the presence of barriers to other choices for outside activities. Furthermore, parents of children with asthma acknowledge that their children experience symptoms with exercise, but do not seem to be aware that exercise related symptoms might contribute to excessive use of electronic devices. These results emphasize that asthma is significantly related to children engaging in increased screen time.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

ACKNOWLEDGEMENTS

I want to thank the St Louis Urban Environment and Childhood Asthma study staff (Elizabeth Tesson, Kim Ray, Renee Sharp, and Angie Frei) for their help and support with this study project. I am also grateful for the aid of William Shannon, PhD, and Elena Deych, MS, (Division of General Medical Science, Department of Medicine, Washington University School of Medicine in St. Louis) for their help with statistical analysis.

This project has been funded in whole or in part with Federal funds from the National Institute of Allergy and Infectious Diseases, National Institutes of Health, under Contract numbers NO1-AI-25496, NO1-AI-25482, HHSN272200900052C, HHSN272201000052I, 1UM1AI114271-01 and UM2AI117870. Additional support was provided by the National Center for Research Resources, National Institutes of Health, under grant 5UL1RR024992-02.

References

1. Bloom B, Jones L, and Freeman G, Summary health statistics for U.S. children: National Health Interview Survey, 2012. Vital and Health Statistics, 2013 10(258).
2. Mannino DM, et al., Surveillance for asthma--United States, 1980--1999. MMWR Surveill Summ, 2002 51(1): p. 1-13.
3. Lynch SV, et al., Effects of early-life exposure to allergens and bacteria on recurrent wheeze and atopy in urban children. J Allergy Clin Immunol, 2014 134(3): p. 593-601.e12. [PubMed: 24908147]
4. Kim H, et al., Health care utilization by children with asthma. Prev Chronic Dis, 2009 6(1): p. A12. [PubMed: 19080018]
5. Asthma's Impact on the Nation: Fact Sheet. 2009 [cited 2015 February 7]; Available from: http://www.cdc.gov/asthma/impacts_nation/.
6. Long MW, et al., School-day and overall physical activity among youth. Am J Prev Med, 2013 45(2): p. 150-7. [PubMed: 23867021]
7. Lafleur M, et al., Increasing Physical Activity in Under-Resourced Communities Through School-Based, Joint-Use Agreements, Los Angeles County, 2010-2012. Preventing Chronic Disease, 2013 10: p. E89. [PubMed: 23721790]
8. Kottyan G, et al., Assessment of active play, inactivity and perceived barriers in an inner city neighborhood. J Community Health, 2014 39(3): p. 538-44. [PubMed: 24306236]
9. Fitch KD, Blitvich JD, and Morton AR, The effect of running training on exercise-induced asthma. Ann Allergy, 1986 57(2): p. 90-4. [PubMed: 3740562]

10. Matsumoto I, et al., Effects of swimming training on aerobic capacity and exercise induced bronchoconstriction in children with bronchial asthma. *Thorax*, 1999 54(3): p. 196–201. [PubMed: 10325893]
11. Nystad W, Stigum H, and Carlsen KH, Increased level of bronchial responsiveness in inactive children with asthma. *Respir Med*, 2001 95(10): p. 806–10. [PubMed: 11601746]
12. Lang DM, et al., Physical activity in urban school-aged children with asthma. *Pediatrics*, 2004 113(4): p. e341–6. [PubMed: 15060265]
13. Rideout, Generation M2: Media in the lives of 8- to 18- Year-Olds. Kaiser Family Foundation Study, 2010.
14. Vogelberg C, et al., Leisure time activity and new onset of wheezing during adolescence. *Eur Respir J*, 2007 30(4): p. 672–6. [PubMed: 17596269]
15. Jakes RW, et al., Physical inactivity is associated with lower forced expiratory volume in 1 second : European Prospective Investigation into Cancer-Norfolk Prospective Population Study. *Am J Epidemiol*, 2002 156(2): p. 139–47. [PubMed: 12117705]
16. Gern JE, et al., The Urban Environment and Childhood Asthma (URECA) birth cohort study: design, methods, and study population. *BMC Pulm Med*, 2009 9: p. 17. [PubMed: 19426496]
17. Centers for Disease Control and Prevention. 2015 Youth Risk Behavior Survey. [cited 2015; Available from: www.cdc.gov/yrbs].
18. USDoHaH S, Physical activity guidelines for Americans: Be active, healthy, and happy!, D.o.H.a.H. Services, Editor. 2008: Washington, DC.
19. Krans EE and Chang JC, A will without a way: barriers and facilitators to exercise during pregnancy of low-income, African American women. *Women Health*, 2011 51(8): p. 777–94. [PubMed: 22185291]
20. Hills AP, Dengel DR, and Lubans DR, Supporting public health priorities: recommendations for physical education and physical activity promotion in schools. *Prog Cardiovasc Dis*, 2015 57(4): p. 368–74. [PubMed: 25269062]
21. Mitchell MS, et al., ‘Will walk for groceries’: Acceptability of financial health incentives among Canadian cardiac rehabilitation patients. *Psychol Health*, 2014 29(9): p. 1032–43. [PubMed: 24731024]
22. Lounsbury MA, et al., Facilitators and barriers to adopting evidence-based physical education in elementary schools. *J Phys Act Health*, 2011 8 Suppl 1: p. S17–25. [PubMed: 21350258]
23. Farley TA, et al., Safe play spaces to promote physical activity in inner-city children: results from a pilot study of an environmental intervention. *Am J Public Health*, 2007 97(9): p. 1625–31. [PubMed: 17666701]
24. Davis MM, et al., Recommendations for prevention of childhood obesity. *Pediatrics*, 2007 120 Suppl 4: p. S229–53. [PubMed: 18055653]
25. Barlow SE, Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics*, 2007 120 Suppl 4: p. S164–92. [PubMed: 18055651]

Figure 1: Total screen time engagement on weekends and weekdays

When dividing total screen engagement between weekends and weekdays, asthmatics still spend more time than their control engaged in screen time, even when they have the opportunity to spend more time engaged in physical activity over the weekend.

Table 1:

Demographics

Overall (n = 131)	
Ages	8–9 years old
Child's gender: Male	47%
Child's race/ethnicity (African American)	91%
Income < \$15,000	84%
Mother completed high school	61%
Asthmatics	36%
Sensitized to at least 1 allergen (Asthmatic, Non-asthmatic)	62%, 43%*

Children with asthma were more likely to be sensitized to allergens (62% vs. 43%, $p=0.046$).

Table 2:

Screen time in asthmatics and control

	Asthma			
	Yes (n=47)		No (n=84)	
	Median	IQR	Median	IQR
Total week screen time *	35.00	17 (27, 44)	26.00	19 (19.5, 38.5)
Number of days/ week active (defined as 60 minutes/ day)	7.00	2 (5, 7)	7.00	2 (5, 7)
Number of days/ week child goes to PE class	2.00	1 (2, 3)	2.00	1 (2, 3)
Number of sports teams a child plays on	0.00	0 (0, 0)	0.00	(0, 0)
Hours spent sleeping	9.8	(8.8–10.0)	10.0	(9.0–10.7)

*
p < 0.01

Table 3:

Obstacles other than asthma

	Asthma (n=47)	No Asthma (n=84)
Not enough organized sports/activities in the community	23%	23%
Not enough money for sports equipment, bicycles, etc.	21%	21%
Neighborhood not safe enough for kids to play outside	17%	25%
Kids would rather watch TV or play video games	17%	21%
No place to play outside	17%	12%
Not enough physical education in school	4%	7%

Table 4:

Asthma symptoms and physical activity

	Yes	No
Asthma symptoms during physical activity	72.34%	29.79%
	(100% of participants who answered “Yes” were inactive)	(84.6% of subjects who answered “No” were inactive)
Asthma as a barrier to physical activity	25.53%	74.47%
	(n=100% of subjects who answered “Yes” were inactive)	(94.3% of subjects who answered “No” were inactive)