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Implementing a novel electronic health record approach to track child sugar-sweetened beverage consumption

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ABSTRACT

Sugar-sweetened beverage (SSB) consumption is a risk factor for childhood obesity. Including this measure in electronic health records (EHR) could enhance clinical care and facilitate research on this topic. We implemented a single-item, EHR screening question for SSB and 100% fruit juice at 8 pediatric practices affiliated with a North Carolina academic medical center. From March–December 2017, we evaluated SSB screening of children 6 months–17 years of age. In a sub-sample of screened patients, we also conducted a telephone-based validation survey, comparing EHR-based responses to a lengthier beverage questionnaire, using Spearman rank coefficients and Kappa statistic. 22,626 children (91% of all seen) were screened for SSB intake. The screened population was diverse – 35% non-Hispanic White, 26% African-American, and 30% Hispanic. Consistent with national estimates, reported intake was typically higher than recommended: 41% (n = 9220) reported consuming SSB or fruit juice > 1×/day in the past month, and consumption was higher among race/ethnic minorities. Of 201 validation survey respondents, direct correlation between their beverage survey and EHR screener responses was moderate, with a Spearman's rank correlation coefficient of 0.41 ($p < 0.001$) and Kappa statistic of 0.42 (95% CI 0.24–0.60). EHR-based screening for SSBs and fruit juice was successfully implemented, generating a large volume of SSB consumption data in a diverse patient population. Inclusion of patient-reported dietary measures in the EHR is feasible and could be useful for clinical care and research. Planned modifications may improve the correlation of such a screener with lengthier dietary instruments.

1. Background/introduction

Sugar-sweetened beverage (SSB) consumption is a modifiable risk factor for childhood obesity, (de Ruyter et al., 2012; Ebbeling et al., 2012; Malik et al., 2013; Dong et al., 2015; Hu, 2013; Trumbo and Rivers, 2014; Millar et al., 2014; Pan et al., 2014) and has been linked to adverse health outcomes such as cardiometabolic disease, in both children and adults.(Ambrosini et al., 2013; Loh et al., 2017; Van Rompay et al., 2015; Kosova et al., 2013; Malik et al., 2014; Stelmach-Mardas and Walkowiak, 2016; Campos et al., 2015; Berentzen et al., 2015) Even overconsumption of 100% fruit juice in children is not benign – it is associated with subsequent greater SSB intake and adiposity.(Shefferly et al., 2015; Sonneville et al., 2015) Consumption of SSBs in the United States has declined in recent years; however, intake still exceeds recommended levels.(Kit et al., 2013; Ford et al., 2016; Briefel et al., 2015; Barlow and Expert, 2007) Furthermore, overconsumption and early initiation of SSBs are especially common among lower-income and racial/ethnic minority children.(Richmond et al., 2013; Dodd et al., 2013; Han and Powell, 2013; Taveras et al., 2013)

Clinical guidelines set strict limits on children's daily intake of sweet drinks: only small amounts of 100% fruit juice, with general avoidance of all SSBs.(Heyman and Abrams, 2017; Vos et al., 2017) Guidelines also universally recommend that medical providers ask about and counsel on SSB intake as part of a comprehensive approach to pediatric obesity prevention and treatment.(Davis et al., 2007; Krebs et al., 2007; Spear et al., 2007) Unfortunately, this information is not easily gathered in systematic ways that can be tracked over time. Providers may not consistently adhere to SSB screening guidelines due to lack of prompts to screen. Even practices that do routinely screen for SSB consumption often rely on paper questionnaires or free text in progress notes to document patient responses, rendering SSB data unusable for population management, easy historical reference on an individual

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patient, or research purposes. There exists an increasing emphasis on electronic health record (EHR) capture of social and behavioral determinants of health.(Adler and Stead, 2015) Yet, the handling of dietary behavior information differs from other elements of the patient chart, such as weight, allergies, or medications, all of which can be easily searched or filtered in the EHR.

To increase the routine and standardized screening of children for SSB intake, and enable health systems to track such intake in their patient populations, we created and implemented a single-item, point-of-care SSB and fruit juice screening question to be administered using the EHR. The aims of this study were two-fold: (1) To understand the feasibility of implementing an EHR-based SSB screener in busy clinical practices, using measures of screening rates over time, and examining encounter and patient-level predictors of whether or not screening took place, and (2) To test the validity of self-reported SSB consumption data recorded in the EHR using our screener. To accomplish the second aim, we surveyed a subsample of the EHR-screened population, using a lengthier beverage questionnaire that included items from the 2013–2014 National Health and Nutrition Examination Survey (NHANES) and compared these responses to their EHR-documented SSB consumption.

2. Methods

2.1. Setting

We worked with the informatics team at Wake Forest Baptist Medical Center in North Carolina, to implement an EHR-based SSB screening question in 8 affiliated primary care pediatric (n = 7) or family medicine (n = 1) practices. Practices ranged in size from 2 to 5 physicians, and served a diverse group of patients in both rural and urban locations. All practices used the same, enterprise-wide EHR platform (Epic®), for documentation and clinical care. The institutional IRB approved the project.

2.2. Patient population

Patients 6 months through 17 years of age were eligible to be screened for SSB intake at any in-person clinic visit beginning March 20, 2017. Data for this analysis spans the 56,211 clinical encounters that occurred through December 20, 2017.

2.3. Intervention

We created a screening question intended to estimate a child's recent frequency of consumption, similar to beverage items in the 2013–14 NHANES dietary screener. However, to enhance screening rates in a busy clinical setting, we combined all SSB types and fruit juice (FJ) into a single item. We also chose to include flavored/sweetened milks as an SSB example.(Afeiche et al., 2018) A time frame of "the past month" was specified because clinical staff administered the screening question during all encounter types. In the case of urgent/sick visits, the days immediately prior would not reflect typical dietary behavior.

The final screener read, "*In the past month, how often did (child's name) drink a sugar-sweetened beverage or 100% fruit juice? Sugar-sweetened beverages include things like fruit-flavored drinks, juice from concentrate, punch, Kool Aid, soda, sports drinks, sweet tea or flavored milks.*" Respondents selected one of the following categorical response options: "*Never*", "*Once per week or less*", "*Several per week but not every day*", "*1 per day*", "*2 per day*", "*3 per day*", "*4 or more per day*" or "*Refused*".

Medical assistants and nursing staff were prompted to conduct SSB screening while "rooming" patients. Upon electronically entering vital signs for an eligible patient, the SSB question automatically appeared on their computer monitor, formatted as a yellow "Best Practice Alert" (BPA) box. Response choices appeared as click boxes within the BPA. Staff were instructed read the question aloud to parents or caregivers for children ≤12 years of age, and to the patient directly for 13–17 year-olds. For Spanish-speaking patients/families, a Spanish-language paper version of the question was provided (Supplement).

If a screening response indicated more SSB/FJ consumption than recommended for a patient's age, an educational paragraph automatically inserted in the after-visit-summary (AVS) document provided following the clinic encounter (Supplement). For infants under 12 months of age, the AVS paragraph on sugary drinks appeared if *any* SSB/FJ intake was reported. For children 1 year and older, the paragraph was included only if frequency exceeded 1 per day. The paragraph differed based on the age group of the child and appeared in English or Spanish depending on the language preference recorded in the EHR.

Because SSB/FJ intake may change over time, the screening BPA repeated at 90-day intervals for each child to capture longitudinal information. Capturing change over time is important because SSB consumption becomes more frequent as children age, (Han and Powell, 2013) and because individual-level trends over time may help to identify patients in need of a more dedicated intervention to reduce consumption. The 90-day minimum for repeat screening was chosen to prevent excessive screening burden among children who visit the pediatrician frequently for acute or chronic illness.

2.4. Staff training, monitoring and incentives

Prior to activating the SSB screener in the EHR, our research team conducted on-site trainings for clinical office staff. The trainings included education about the health importance of SSBs and details regarding screening implementation. We reviewed a suggested workflow for the screener, instructing staff to read the exact wording of the question as provided in the BPA, and to read answer choices aloud to respondents. Physicians were welcomed, but not required, to attend these trainings.

Research staff followed up with brief weekly visits at each practice for the first month of SSB screening, and monthly thereafter. At monthly visits, we provided practice managers with a personalized report detailing their site's screening performance. To avoid penalizing lower volume clinics, we measured site performance using the percent of eligible encounters in compliance with screening. On a quarterly basis, all staff members at locations where screening compliance averaged ≥70% (project benchmark for implementation) received $10 gift cards.

2.5. EHR data extraction

We extracted EHR data weekly on all pediatric encounters at participating practices. Data elements included patient demographics (age, sex, race/ethnicity, language), encounter information (type, location, date), and responses to SSB screening.

2.6. Validation survey

We conducted a telephone validation survey on a stratified random sample of 201 patients (n = 50 infants, n = 101 1–12 year olds, n = 50 13–17 year olds) who underwent EHR-based screening. The survey served 2 main purposes: (de Ruyter et al., 2012) to collect a timely, validated measure of child SSB consumption against which our EHR-based measure could be compared, and (Ebbeling et al., 2012) to assess patient and parental impressions of the EHR-based SSB screening at the recent pediatric visit.

We conducted telephone surveys in English or Spanish within one week of the clinical encounter. For children ≤12 years, only the caregiver present at the recent visit responded to the survey; teenagers responded to questions along with their parent/caregiver. We obtained verbal consent from parents/caregivers, with assent from teens. The survey lasted approximately 10 min and included questions about recall