Beyond BMI:
Investigating the Feasibility of Using NUTRISTEP® and Electronic Medical Records as a Surveillance System for Healthy Weights Including Risk and Protective Factors in Children

Final Report: Phase 1 and Phase 2
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Overview

The LDCP *Beyond BMI: Investigating the Feasibility of Using NUTRISTEP® and Electronic Medical Records as a Surveillance System for Healthy Weights Including Risk and Protective Factors in Children* aimed to address the current data gap that exists in childhood healthy weights surveillance at the local health unit level. This report provides details our first year (2014-15) of research, which was divided into two phases. In phase one, the Beyond BMI research team partnered with the Better Outcomes & Registry Network (BORN) Ontario, to acquire children's health and weight data from Electronic Medical Records (EMRs) in primary care settings to analyze data quality. To create a more comprehensive childhood healthy weights surveillance system, the research team identified the need for additional risk and protective factor information, to accompany height and weight data. As a result, the research team focused phase two of the project on conducting a situational assessment regarding the use of the NutriSTEP® screening tool for risk and protective factors for obesity in primary care settings in Ontario.

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EXECUTIVE SUMMARY

Background

Roughly one-third of Canadian children and adolescents aged 5 to 17 years are overweight or obese (31.5%). The health consequences of excess weight in childhood include increased risk of type 2 diabetes, hypertension and poor emotional health. The significance of childhood obesity on long-term population health rivals that of smoking in potential impact. Despite this, local public health units do not have region-specific estimates for child healthy weights, and the risk and protective factors for obesity.

An ecological approach to obesity prevention emphasizes that there are risk and protective factors that play a role in a child's healthy weight, including family factors (e.g., meal patterns, parental over-concern about their own or their child's weight), peer influences (e.g., weight-based teasing and stigmatization), environmental factors in the school and community, societal factors (e.g., media influences), and public policy.

It is well understood that the pathway to overweight and obesity is complex. Evidence points to social and built environments as possible contributors to the epidemic. Socioeconomic measures have been developed and are important for population health assessment in order to effectively research risk trajectories within an ecological context. Assessing childhood obesity on an ecological level enables the design of interventions that will align with the development of supportive environment policy changes.

The Ontario Public Health Standards (OPHS) Child Health Requirement specifies that local public health units are required to conduct surveillance and monitoring of trends over time on the topic areas of healthy weights, healthy eating and physical activity. And, as of June 2014, local public health units are mandated to assess the implementation status of NutriSTEP® as per the Accountability Agreement Indicator Protocol.

Limitations of the Existing Obesity Surveillance Systems

Current systems in Canada (and Ontario) for monitoring child, adolescent or adult obesity prevalence are not ideal for several reasons:

1. Population level height and weight measurements, and associated overweight and obesity assessment, are rarely captured for children under age 6 years in Canada. Current national surveillance excludes children under 3 years of age and has very limited data on children 3 to 4 years of age.
2. Obesity estimates are not consistently reliable at the local public health unit level for children due to small sample size (e.g., about 1,000 in the catchment of

Kingston, Frontenac and Lennox & Addington (KFL&A) Public Health per cycle of the CCHS).

3. Obesity data from the CCHS are based on self-reported height and weight. National prevalence estimates derived from self-reported rather than measured heights and weights are shown to provide inaccurate measurement estimates.
4. The cross-sectional design of the CCHS and CHMS limits the ability to monitor important longitudinal effects.

EMRs, NutriSTEP®, and BORN as Components of Healthy Weights Surveillance

Our LDCP Child Healthy Weights team envisioned an Ontario-wide, longitudinal, healthy weight surveillance system that can be collected systematically with an integrated measure of risk and protective factors for child healthy weights, including the social determinants of health, to provide estimates at a local health unit level. Given the lack of critical data for younger children as described above, our LDCP group identified existing sources of height and weight data, as well as existing tools to collect risk and protective factor data related to child obesity risk, for children under the age of 5 years.

To date, no data source exists to meet the OPHS requirement. Recent seminal documents, such as the Public Health Ontario (PHO) report, *Measuring the Health of Infants, Children and Youth for Public Health in Ontario*, as well as the Healthy Kids Panel report, *No Time to Wait: the Healthy Kids Strategy*, highlighted and recommended addressing major OPHS indicator gaps related to childhood healthy weights. Both documents list breastfeeding, growth and development, and healthy weights as major indicator gaps.

Both documents recommend accessing data sources from non-public health partners (e.g., EMRs), linking multiple data sources to improve the utility of the data (e.g., height and weight data linked with NutriSTEP® data), and building on new data sources or registries (e.g., BORN). Therefore, local public health units must develop a system to gain access to local data on children's height, weight, and risk and protective factors for overweight and obesity, and other weight-related problems. Public health units must develop efficient ways to collect data that capitalizes on systems and sources that are already in place, but are not yet used for public health purposes. Beyond BMI will assist local public health to meet the OPHS and Accountability Agreement Indicator requirements.

Scope of Project

This project aimed to identify the feasibility of establishing a provincial model linking risk and protective factors for child healthy weights to measured child health data in primary care practitioner's EMRs. It also aimed to determine a process to store and extract these

data from a provincial database – BORN Ontario – that could be accessed by all public health units for child healthy weights surveillance and monitoring. Specific outcomes included:

- A sample healthy weight data quality assessment;
- A strong working relationship with BORN supporting the use of healthy weight data from EMRs;
- Key knowledge regarding how NutriSTEP® screening and follow up are done in primary care;
- Recommendations to inform the next stage of the project (2-year LDCP funding proposal) regarding the electronic collection of NutriSTEP® in primary care settings and linking these data with EMRs.

Research Goal

The goal of this research project was to explore the feasibility of using existing electronic medical records (EMR) and the NutriSTEP® tool to extract comprehensive healthy weight data for children ages 0-5 years to improve local public health unit surveillance. Two distinct phases were undertaken in efforts to achieve this research goal – Phase 1 and Phase 2

Phase 1 Objectives

1. To develop a process and test the feasibility of acquiring the EMR data from BORN Ontario;
2. To examine the data quality for the height, weight, nutrition and socio-demographic variables currently collected through EMRs from BORN Ontario;
3. To estimate the prevalence of optimal growth, and the differences in marginalization, among Ontario children, and;

Phase 2 Objectives

4. To examine how primary care sites use NutriSTEP®, interpret results and provide feedback to parents;
5. To understand barriers and facilitators to NutriSTEP® screening use by primary care providers;
6. To determine receptivity of primary care sites to collect NutriSTEP® electronically and have it linked to EMR data.

Phase 1 Summary: Data Quality Assessment of Child Healthy Weights from Electronic Medical Records

Introduction

The absence of a local data source for measured height and weight, and the risk and protective factors for overweight and obesity, in children less than three years of age is a critical gap for public health units in Ontario.

Purpose

The purposes of this study were to develop a process for and test the feasibility of acquiring the 18-month well-baby visit (WBV) data from the electronic medical records (EMR) from BORN Ontario, to examine the data quality for the height, weight, nutrition and socio-demographic variables currently collected through the EMRs from BORN Ontario, and to estimate the prevalence of optimal growth, and the differences in marginalization, among Ontario children at their 18 month WBV.

Methods

Following BORN Ontario's data request process, an application to access health data for research purposes was completed and submitted electronically. The development of the analysis plan and data acquisition was an iterative process between the research team and BORN staff members. Three separate de-identified data files were transferred from BORN Ontario using a secure File Transfer Protocol site.

Results

A total of 2,126 records for the 18-month WBVs were extracted for the period September 2013 to June 2014, of which 779 records were from children aged 17 to 22 months. Item response rates were as follows: 75% for weight and height, 82% to 95% for the nutrition variables, and 85% for the Ontario Marginalization Index. Fourteen percent of the records of children aged 17 to 22 months were classified as being at risk of overweight; 8% were overweight or obese.

Discussion

Initial results demonstrated that the 18-month WBV data from BORN Ontario are accessible and of good quality, and highlight the importance of health information standards. The results from this study are therefore of benefit to multiple stakeholders: EMR vendors, primary care practitioners, BORN Ontario and public health professionals. Public health could play a role in increasing awareness of the prevalence of overweight and obesity in this early childhood population, advocating for the use and transmission of clinical data within the EMRs to better facilitate care and management, and the monitoring of healthy weights, increasing awareness of the importance of health

information standards for system interoperability, and participating and promoting further research.

Conclusion

The 18-month WBV data from BORN Ontario has the potential to fill an identified data gap in public health. An ongoing mechanism to support the interaction between the multiple stakeholders is needed. The purpose of this mechanism would be to enhance the quality of the data and usability of the EMR as a data source for improving care and management, and for monitoring children's height and weight, and the risk and protective factors for overweight and obesity. The centralized data collection through BORN Ontario is a key asset for the successful development and implementation of an EMR-based surveillance system for healthy childhood weights.

Phase 2 Summary: Beyond BMI - Risk and Protective Factors for Child Healthy Weights Assessed Using NutriSTEP® in Primary Health Care

Introduction

The NutriSTEP® screening tool is being used in some primary care settings to identify nutritional risk among children. However, little is known about exactly how the screening tool is being used in these settings. The potential for incorporating nutritional status data into electronic medical records (EMRs) is also not well understood. If nutritional status data were available in EMRs, this would have implications for combining height and weight data available in EMRs with risk and protective factors to provide a more comprehensive picture of childhood healthy weights: a picture that goes *beyond BMI*.

Purpose

The three main purposes of the research were:

- To examine how primary care sites use NutriSTEP®, interpret results and provide feedback to parents.
- To understand barriers and facilitators to NutriSTEP® screening use by primary care providers.
- To determine receptivity of primary care sites to collect NutriSTEP® electronically and have it linked to EMR data.

Methods

Based on a framework by Durlak and DuPre on the implementation of prevention or promotion innovations, this project studied the implementation of NutriSTEP® as an innovation in primary care practices through 10 semi-structured interviews with primary care practices in which NutriSTEP® was in use. The sample was drawn from a variety of

practice settings: Family Health Teams (FHT), Community Health Centres (CHC), Aboriginal Health Access Centres (AHAC), pediatrician practices.

Results

Objective 1: To examine how primary care sites use NutriSTEP®, interpret results and provide feedback to parents

There was variety in the ways practices implemented the NutriSTEP® screening. The most common way was to incorporate the screening into the 18-month well-baby visit.

Following from the framework developed by Durlak and DuPre, provider characteristics that were relevant to the implementation of NutriSTEP® were identified: interest in pediatrics, awareness of NutriSTEP®, a perceived need for nutrition information, and a sense that NutriSTEP® had valuable benefits, such as being a validated and reliable tool, providing an opportunity to start a conversation and adapt programs to meet patient needs, and being worth the time necessary to incorporate the screening. Provider comfort with nutrition topics was helpful in supporting the use of NutriSTEP®.

Characteristics of NutriSTEP® as a tool that supported its use were also identified: practices found it easy to use, with an accessible literacy level. Many practices relied on local public health to provide the hard copies of the screens.

Objective 2: To understand barriers and facilitators to NutriSTEP® screening use by primary care providers

Having a compatible organizational strategy was important for several practices in the decision to use NutriSTEP®. In several cases, the decision was made and implemented by a committee or work group, which also developed the processes by which the screening would happen.

The incorporation of NutriSTEP® into a specific visit was an effective practice, largely because it built on an appointment already being made for other reasons. The challenge of attaching NutriSTEP® to an existing visit was the time pressure involved, although most found in practice that the time involved was not a problem. A system for referrals to a dietitian was important as a support for the screening. Many practices had developed ways to add NutriSTEP® scores and related information to their EMR, although none felt that they had a completely satisfactory system for doing so.

Administrative staff played an important role in many practices by handing out the screens to the appropriate clients. Dietitians played a crucial role in successful implementation of NutriSTEP®, often as the providers who introduced NutriSTEP® to their practices, but also in roles as screen administrator, referral resource, trainer and NutriSTEP® “champion”, within their own practices and sometime with other practices

as well. Having NutriSTEP® and nutrition resources available for providers and for parents were important supports for the screening, and public health units often played a supportive role by identifying and sharing helpful resources.

Objective 3: To determine receptivity of primary care sites to collect NutriSTEP® electronically and have it linked to EMR data

Primary care practices were uniformly in support of the idea of a version of NutriSTEP® that was electronic, that could be completed on a tablet in the clinic setting, and for which the data would be linked automatically with their EMR. There was also support for the idea of NutriSTEP® data being gathered and pooled cross practices, to provide provincial estimates of children's nutritional health status. Interviewees felt that in order to take NutriSTEP® screening to scale across the province, provincial-level direction, probably including incentives and supports, would be needed.

Discussion and Implications

This project set out to understand the current uses of NutriSTEP® in primary care practices in Ontario. The screening is being used effectively in the practices that participated in the research, with certain enabling factors being identified. In particular, the incorporation of NutriSTEP® into the well-baby or well-child visit was a common practice. Practices had made efforts, in various creative ways, to bring NutriSTEP® into their EMRs, but all were interested in a system that would bring NutriSTEP® screening results automatically into the EMR.

With the potential to have NutriSTEP® integrated into EMRs comes the potential for evaluation and surveillance uses of the data, both at the level of the practice and at the provincial level. Interviewees were supportive of the idea of provincial-level data pooled across practices. They recognized that provincial direction would be needed to achieve a scaled-up version of what they had been doing individually and in different ways.

Conclusions

This research has contributed to an understanding of some enabling factors toward a collaborative healthy weights screening program that could be used for improving child health care and management, and for local population health assessment and surveillance purposes. The exploration of the significant potential of integration of NutriSTEP® into EMRs is a clear next step from this study, to build understanding in practical terms of the feasibility of the main components of an EMR-based surveillance system for childhood healthy weights. A mechanism is needed to support interactions between public health and primary care practitioners, along with partners such as BORN Ontario and EMR vendors.

Next Steps

We have ascertained that it is feasible and acceptable to use NutriSTEP® in primary care practices and that there is receptivity to explore its integration into EMRs. Heights and weight from the 18-month WBVs with the BORN Ontario information system are of high quality. The next phase of our work is to test the implementation of an electronic version of NutriSTEP® more broadly in primary care settings and assess what processes and structures need to be in place for these data to be successfully integrated into BORN Ontario for extraction for surveillance purposes.

PHASE 1: DATA QUALITY ASSESSMENT OF CHILD HEALTHY WEIGHTS FROM ELECTRONIC MEDICAL RECORDS

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INTRODUCTION

One-third (32%) of Canadian children and adolescents aged five to 17 years are overweight or obese(1). The health consequences of excess weight in childhood are numerous and include psychological issues, bone and joint deformation, sleep apnea, and an increased risk of diabetes, hypertension and cardiovascular disease(2). In addition, there is considerable evidence supporting a link between overweight and obesity during childhood, particularly in early childhood, and an increased risk for adult obesity(2,3).

Nationally and provincially, there are a few surveys that measure overweight and obesity in children and youth(4). These existing data sources have limitations in terms of providing ongoing data at the local level, particularly for children younger than three years of age, and many rely on self-reported measures of height and weight (2).

Within the Ontario Public Health Standards, the Child Health Standard specifies that Boards of Health are required to "conduct epidemiological analysis of surveillance data, including monitoring of trends over time, emerging trends, and priority populations" on the topic areas of healthy weights, healthy eating and physical activity(5). The absence of a local data source for measured height and weight, and the risk and protective factors for overweight and obesity, in children less than three years of age is a critical gap.

The need for public health to develop a system for local healthy weights surveillance was identified in Public Health Ontario's (PHO) report, *Measuring the Health of Infants, Children and Youth for Public Health in Ontario*, and the Healthy Kids Panel report, *No Time to Wait: The Healthy Kids Strategy*(4,6).

The Healthy Kids Panel report recommended the development of a healthy weights surveillance system for childhood that builds on existing registries such as the Better Outcomes Registry and Network (BORN) Ontario. BORN Ontario is an organization funded by the Ontario Ministry of Health and Long-Term Care and administered by the Children's Hospital of Eastern Ontario. BORN Ontario achieved full registry status in 2011 (Appendix I). The BORN Information System (BIS) enables the centralized collection of data on every birth in Ontario. Data are sourced from a variety of organizations such as hospitals and laboratories, midwifery groups and more recently, primary care providers, and are collected through a variety of mechanisms. The increased use of electronic medical records (EMRs) for clinical patient notes in primary care practices, from 39% in 2010 to 62% in 2013 has enabled BORN Ontario to partner with registered EMR vendors across Ontario to augment the BIS holdings with information collected during routine well-baby visits (WBV) in paediatric and primary care settings(7,8).

The Healthy Kids Panel report also recommended leveraging routine WBVs to enhance surveillance. A commonly used system in primary care practices for WBVs is the Rourke Baby Record (RBR©)(9,10). Since 2009, the RBR© recommended using the World Health Organization's (WHO) Child Growth Standards based on the 2006 WHO Multicentre Growth Reference Study(11). This recommendation has been reinforced by the 2010 collaborative statement by the Dietitians of Canada, Canadian Paediatric Society, College of Family Physicians of Canada and Community Health Nurses of Canada(12). The RBR© has standard forms (Guides I to V) for charting the WBVs and the completion of each form of the RBR© captures a direct measurement of a child's height/length and weight, as well as nutritional and developmental information (Appendix II). In 2009, a new fee code was added to the Schedule of Benefits for Physician Services for services insured under the Ontario Health Insurance Plan as an incentive for physicians to conduct an enhanced 18-month WBV. This enhanced visit with the health care provider offers a longer visit and includes the use of the RBR, along with other developmental screens(13).

Building on the existing partnership between BORN Ontario and Ontario Public Health Units (PHUs), the goal of this research study was to explore the use of the 18-month WBV data from the EMRs of primary care settings for childhood healthy weight surveillance.

PURPOSE

The three main purposes of this study were:

- To develop a process and test the feasibility of acquiring the 18-month WBV EMR data from BORN Ontario,
- To examine the data quality for the height, weight, nutrition and socio-demographic variables currently collected through EMRs from BORN Ontario, and
- To estimate the prevalence of optimal growth, and the differences in marginalization, among Ontario children at their 18-month WBV.

METHODS

Process for Acquiring EMR data from BORN Ontario

The development of the analysis plan and data acquisition was an iterative process between the research team and BORN staff members (i.e., privacy manager, health informatics manager and data analysts). Following BORN Ontario's data request process, an application to access health data for research purposes was completed and

submitted electronically. Ethics approval for this study was received from Durham Region Health Department.

Data Analysis Plan

The analysis plan included an assessment of the coverage of the 18-month WBV data, validation of the data for completeness and acceptable ranges, and an estimation of the prevalence of overweight and obesity, stratified by the 2006 Ontario Marginalization Index (ON-Marg) quintiles for the four ON-Marg dimensions of residential instability, material deprivation, dependency and ethic concentration(14). Validation of postal codes, and matching to PHUs and ON-Marg quintiles were performed by BORN Ontario.

Data Analysis

Coding for the validation criteria and the growth classifications were performed by BORN using Statistical Analysis Software (SAS) 9.4. Frequencies and cross tabulations were performed using standard spreadsheet software.

Data Receipt

In line with BORN Ontario's responsibility to protect personal health information as a prescribed registry under the Personal Health Information Protection Act 2004, data were de-identified or anonymized to ensure confidentiality (Appendix 1). Record level data was approved for release. The research team agreed to BORN Ontario's secure retention and use guidelines, and policies.

Three separate de-identified data files were transferred from BORN Ontario using a secure File Transfer Protocol site.

Data file 1 included record level data by age in months and sex, and three separate tables of age in months by sex aggregated by PHU. The PHU was determined using the postal code of the child's residence from the EMR.

Data file 2 included record-level information on item response (missing = yes/no) and validity (valid = yes/no) for the following variables: date of birth, gestational age, birth weight, sex, height and weight by anonymized family health teams (FHTs) and PHUs. The height variable for children two years of age and younger was assumed to a recumbent length measurement as recommended in the reporting guidelines of the RBR©. Item response only (missing = yes/no) was included for the four variables from the 18-month WBV nutrition module: breastfeeding, homogenized milk, avoid sweetened juices/liquids and no bottles by anonymized FHTs and PHUs. Separate tables included the percentage of valid postal codes based on the 2013 Ontario Postal Code Conversion (PCCF) file and the percentage of valid postal codes that matched to dissemination areas in the 2006 ON-Marg file(14,15).

Data file 3 included record-level data on the child's growth classification (underweight, risk of overweight, and overweight or obese = yes/no/missing) based on the 2007 WHO Simplified Field Tables and the 2006 ON-Marg quintiles (1 = least marginalized; 5 = most marginalized; 99 = missing) by age in months, sex, anonymized FHTs and PHUs(11,15).

Data Coverage

Data coverage was assessed using the Ontario Registered Person Database (RPDB) and the WBV billings from the Medical Services Database(16,17). The number of two year olds from the RPDB was used as a proxy for 18-month olds. Age and sex coverage from data file 1 was calculated as the percentage of Ontario's estimated 18-month old population in 2013 and the percentage of WBVs billed between January to November 2012.

Data Validation – Completeness and Acceptable Ranges

Data completeness was analyzed by determining the percentages of missing data for each variable: date of birth, gestational age, birth weight, sex, height, weight, FHTs, PHUs, and the four variables from the nutrition module. Acceptable ranges for the height and weight variables were established by the research team, and were based on the upper and lower limits from the 2007 WHO Simplified Field Tables(11). Records with heights between 45.0 centimetres (cm) and 110.0cm were considered as valid. Valid weights were categorized by sex: males weighing between 2.1 kilogram (kg) to 21.5kg and females weighing between 2.1kg to 22.0kg were considered valid.

Prevalence Estimates of Optimal Growth

Prevalence of overweight and obesity were calculated using the WHO Child Growth Standards(11). Children were classified as at risk of overweight if the weight-for-length was >85th percentile but <= 97th percentile. The weight-for-length cut-off criteria for overweight or obese children was >97th percentile. Children were classified as underweight if the weight-for-age was <3rd percentile. The denominator included records with either missing height or weight. Optimal growth classification was determined by subtraction. For the analysis by the ON-Marg quintiles for the four ON-Marg dimensions of residential instability, material deprivation, dependency and ethic concentration, the risk of being overweight and overweight or obese were combined, and missing values were included in the denominator

RESULTS

Capture

BORN has partnered with two EMR vendors capturing data from 11 FHTs.

A total of 2,126 WBVs were extracted from the BIS between September 2013 and June 2014. The ages ranged from birth to 88 months which excludes six records with a recorded age between 275 and 898 months. The age variable was missing in 3% (56/2,126) of the records. Fifty-three percent (53% or 1,126/2,126) of the records were males and 47% were female. Sex was unknown in only one record.

Five percent (5% or 99/2,126) did not have a valid postal code based on the 2013 Ontario PCCF. In subsequent coding, an additional 8% (172/2,216) of the postal codes were not matched to dissemination areas in the 2006 ON-Marg file. In total, 13% (271/2,216) of the postal codes did not match to a DA in the 2006 ON-Marg file.

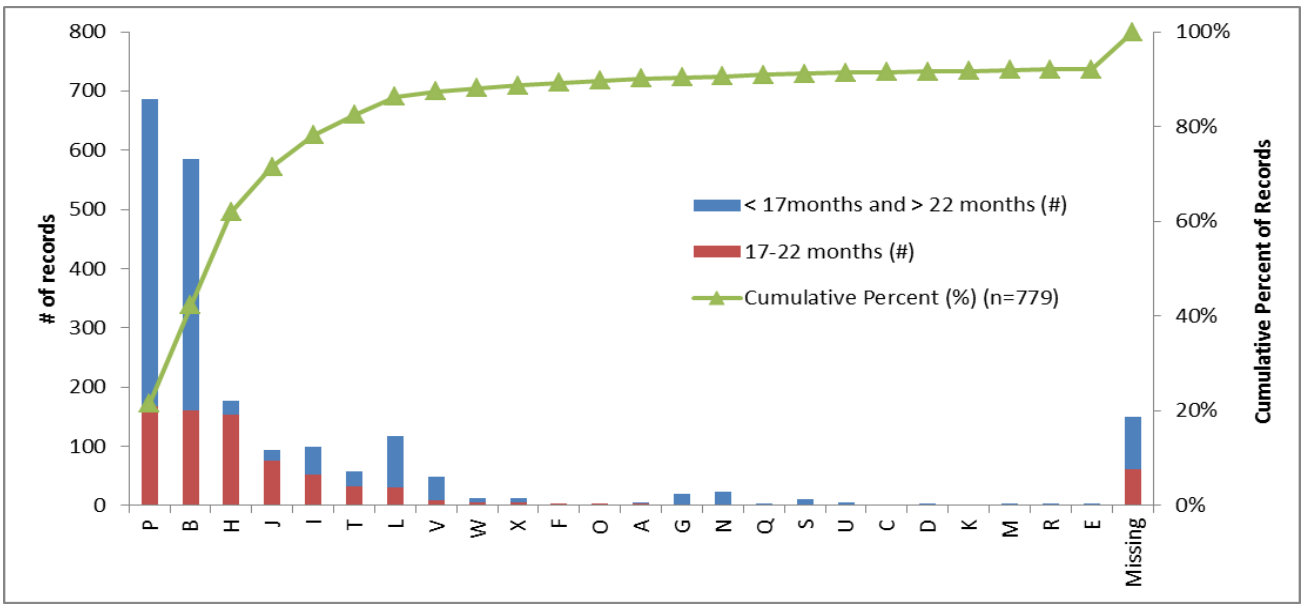
Twenty-four of 36 PHUs had at least one record. Four PHU (PHU P, B, H and L) had more than 100 records per PHU accounting for 74% (1,567/2,126) of the capture. Seven percent (7% or 150/2,126) of the records were missing the PHU identifier (Figure 1).

A subset of records with an age range of 17 to 22 months was used to better reflect an appropriate age for an 18-month WBV. Applying this criterion, 779 or 37% of the total records from data file 1 were used for all subsequent analyses. Within the subset of records aged 17 to 22 months, over three-quarters were aged 18 or 19 months (78% or 606/779). Fifty-two percent (52% or 404/779) were males and 48% were females.

A valid postal code was missing in 4% (33/779) of the records. Fifteen percent (15% or 118/779) of the records were missing data on the ON-Marg quintiles.

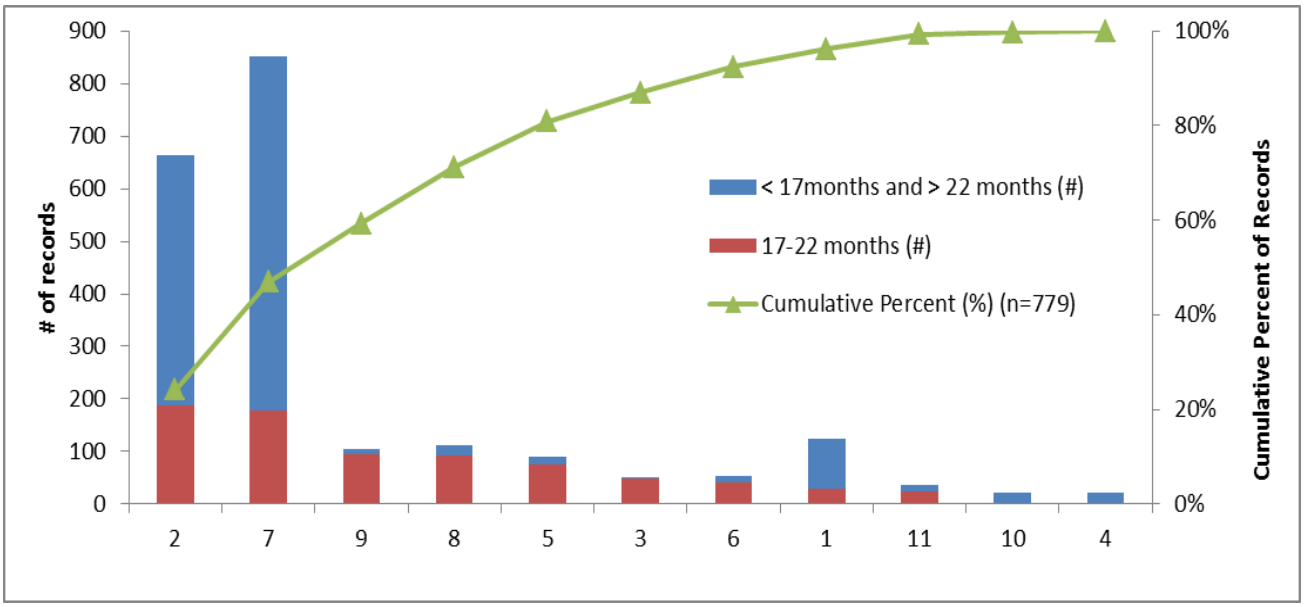
Twenty-three of 36 PHUs had at least one 18-month WBV record. Four PHUs (PHU P, B, H and J) accounted for over 70% (557/779) of the records. Eight percent (8% or 62/779) of the records were missing the PHU identifier (Figure 1). Almost half (47%) of the records were from two of the 11 FHTs (Figure 2).

Figure 1: Capture of the BORN data by de-identified PHU



Source: Better Outcomes Registry & Network (BORN) Ontario. Unpublished data, BORN Information System. Accessed: 26 Jun 2014.

Figure 2: Capture of the BORN data by anonymous FHT



Source: Better Outcomes Registry & Network (BORN) Ontario. Unpublished data, BORN Information System. Accessed: 26 Jun 2014.

Data Coverage

The subset of 779 records represented less than 1% (0.51%) of the estimated 18-months olds in Ontario and 1% (1.2%) of the OHIP billed WBVs in Ontario.

Data Validation – Completeness and Acceptable Ranges

Item response for date of birth and sex was 100%, and 96% (746/779) for postal codes.

Only four records contained gestational age. This prompted BORN to include a gestational age variable from their hospital holdings and using this data source, 96% (748/779) of the records were linked to a gestational age from the birth record.

Item response was 29% (226/779) for birth weight. Linking to the birth weight variable from the hospital holdings, item response increased to 97% (755/779).

Eighty-one percent (81% or 632/779) of the records had a listed height and 82% (639/779) had a listed weight. This declined to 75% for both height (588/779) and weight (583/779) when the criteria for acceptable ranges were applied. Twenty-seven percent (27% or 214/779) of the records did not have one of the required data elements, height or weight, for the subsequent growth classification calculations.

Valid reporting of height was not consistent across PHUs. For the 4 PHUs (P, B, H and J) with the largest number of records, the percent of records with valid height ranged from 53% in PHU P to 97% in PHU H (Appendix III). For the two FHTs with the largest number of records, the percent of records with valid height was 61% in FHT 2 and 48% in FHT 7 (Appendix IV).

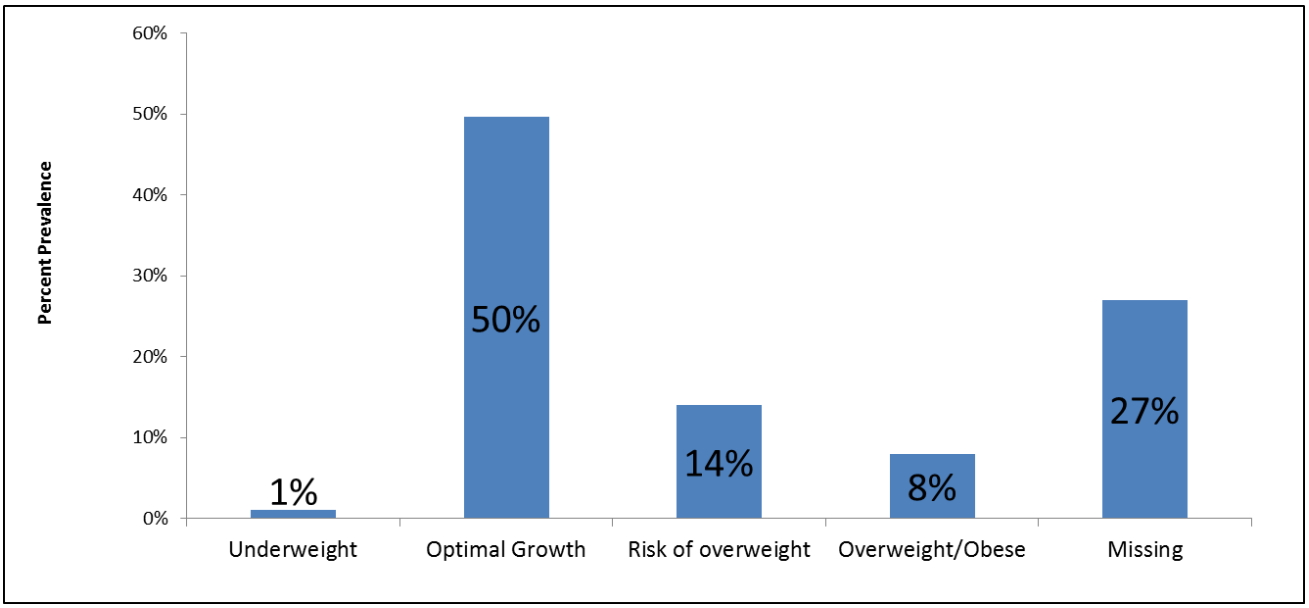
Similarly, reporting of weight was not consistent across PHUs or FHT. For the 4 PHUs (P, B, H and J) with the largest number of records, the percent of records with valid weights ranged from 53% in PHU P to 95% in PHU H (Appendix V). For the two FHTs with the largest number of records, the percent of records with valid weight was 65% in FHT 2 and 49% in FHT 7 (Appendix VI).

The item response rate for the four variables of the nutrition module was 82% for breastfeeding, 95% for homogenized milk, 92% for avoid sweetened juices/liquids, and 93% for no bottles. These percentages could not be interpreted as prevalence estimates. For the four PHUs (P, B, H and J) with the largest number of records, item response for the breastfeeding variable ranged from a low of 69% in PHU H to 96% in PHU B. The ranges of item response for the homogenized milk, avoid sweetened juices/liquids, and no bottle variables were 94-96%, 90-96% and 90-96%, respectively (Appendix VII). For FHTs 2 and 7, item response was 96% and 94%, respectively for all four of the variables in the nutrition module (Appendix VIII).

Prevalence of Overweight and Obesity

One-half (50%) of the children were classified as optimal growth; 1% were underweight; 14% were at risk of being overweight; 8% were either overweight or obese; 27% were missing (Figure 3).

Figure 3: Growth classifications for children aged 17-22 months (n=779)



Source: Better Outcomes Registry & Network (BORN) Ontario. Unpublished data, BORN Information System. Accessed: 26 Jun 2014.

Growth classifications by PHU and by FHT are found in Appendices IX and X. For the 4 PHUs (P, B, H and J) with the largest number of records, estimates of optimal growth ranged from 36% in PHU P to 64% in PHU H. For FHTs 2 and 7, estimates of optimal growth were 43% and 31%, respectively.

The risk of overweight and overweight or obese were combined (n=170) for the analysis stratified by the ON-Marg quintiles for each of the four ON-Marg dimensions of residential instability, material deprivation, dependency and ethnic concentration. Missing values were included in the denominator (15% or 25/170).

The risk of overweight and overweight or obese combined (n=170) was higher in children who were least marginalized:

- 22% of households in areas with the least residential instability compared to 16% from those in the most unstable households,

- 28% of households in areas with the least material deprivation compared to 19% from those in the most deprived households,
- 18% of households in areas with the least level of dependency compared to 14% from those in the most dependent households.

Conversely, the rates were highest in areas with the most ethnic concentration (23%) compared to the least ethnically concentrated (11%). (Appendix XI).

Given the small number of records, no further analysis by PHU or FHT was conducted.

DISCUSSION

The potential burden and adverse health consequences of childhood overweight and obesity can be enormous. While there is a provincial mandate to monitor healthy weights among children and youth, the absence of a local data source for measured height and weight, and the risk and protective factors for overweight and obesity, in children under three years of age presents a critical gap in public health surveillance(4,5).

The first purpose of this study was to develop a process and test the feasibility of acquiring EMR data from BORN Ontario. While there is an existing partnership between BORN Ontario and many PHUs, this was the first time PHUs requested the 18-month WBV data. BORN Ontario, in partnership with two EMR vendors, captured data from 11 FHTs between September 2013 and June 2014. Although 2,126 records from 24 PHUs were captured successfully, 4 PHUs accounted for 74% of the data capture. Furthermore, only 779 records (37% of the 2,126 records) reflected an appropriate age for an 18-month WBV (i.e., the records met the inclusion criteria of containing data pertinent to children aged 17 to 22 months). While the reasons for the inconsistencies and inaccuracies in data inputted by FHTs requires further investigation, the role of BORN Ontario as the central support system with a capacity to gather data from the FHTs, perform rigorous data cleaning, ensure patient confidentiality, and disseminate results to the PHUs in a timely and secure manner was integral for acquiring the EMR data. As a centralized hub of data from multiple FHTs, BORN Ontario ensured the data were consistent across multiple sites, resulting in more comparable data within and across PHUs.

Given the infancy of the WBV pilot program at BORN Ontario, the low, non-representative coverage of the data capture was not surprising and BORN Ontario continues to make efforts to expand their vendor partnerships. Since the structure of FHTs varies (i.e., some FHTs may include pediatricians in their practice, while others may not), coverage and representativeness may be improved by including pediatricians in

the data collection process. In 2012, pediatricians conducted 35% of all WBVs in Ontario(17).

The second purpose of this study was to examine the data quality for the height, weight, nutrition and socio-demographic variables currently collected through EMRs from BORN Ontario. Among records of children 17 to 22 months of age, data on height, weight, and nutrition were consistently present and within acceptable ranges (i.e., over 75%). The high accuracy of the height and weight data is likely because of the standardization of the RBR©, demonstrating its value as a successful tool to collect data for early childhood heights and weights. Ensuring standardization in EMR data collection is important for improving accuracy, comparability, and adoption; although, this is generally not as difficult for classifying growth in early childhood since height and weight are structured data elements and generally consistent across EMR software(18,19).

The quality of EMR data depends on a number of factors including the varying workflow, education, commitment, technical support and technical abilities of staff working in various primary care settings(12,19,20). Measurement error can be addressed through increased educational sessions to ensure adequate collection and standardization of growth data for childhood(18). Although there are varying workflow environments (i.e., data entry, data collection personnel, etc.), broad business rules or prompts in the EMR platform (e.g., using date of birth to extract the correct age-specific WBV form or using standard reporting guidelines for the nutrition module) may be helpful guides for primary care practitioners.

Of the 779 records, 4% were missing a valid postal code with 15% missing data on the ON-Marg quintiles. Unsuccessfully linking the 2013 and 2014 valid postal codes to an ON-Marg quintile in the older 2006 ON-Marg file may explain this discrepancy.

The third purpose of this study was to estimate the prevalence of optimal growth in Ontario children at their 18-month WBV. Prevalence estimates from this study showed that 14% of children aged 17 to 22 months were at risk of being overweight and 8% were overweight or obese. These estimates approximately reflect other literature findings: 8% of children younger than two years had high weight for recumbent length (i.e., >= 95 percentile) in the United States(21); 29% of children were classified as overweight or obese at 18 months in Peterborough, Ontario(22). While the findings from this study are not generalizable to Ontario's population, they underscore the need to identify a valid data source that can be accessed for public health surveillance to inform early childhood prevention and promotion strategies. The low, non-representative coverage may also explain the inconsistencies in the analysis by the ON-Marg. The ON-Marg patterns observed in this study (i.e., risk of overweight and

overweight or obese combined was higher in children who were least marginalized) are inconsistent with a recent report, *Reducing Childhood Obesity in Ontario through a Health Equity Lens*(23).

These initial results demonstrate the potential of using the 18-month WBV to increase awareness of the prevalence of overweight and obesity, and the importance of health information standards. The results from this study are therefore of benefit to multiple stakeholders; EMR vendors, primary care practitioners, BORN Ontario, and public health professionals.

Vendors could use this information to enhance their EMR platform, tailoring it to the needs of their customers. This may lead to improved customer relations and potentially higher adoption rates. Similarly, primary care practitioners could use the data on rates of overweight and obesity to tailor their practice to the needs of their patients and community; however, improving the delivery of care is not without its challenges. A recent systematic review emphasized conflicting study results regarding EMRs and positive improvements in quality of care; earlier studies indicate a positive effect, whilst more recent studies indicate neither positive or negative effects(24).

In addition to their role as the central support system, BORN Ontario could use this information to provide leadership to conduct further quality improvement initiatives, such as sensitivity analyses or data linkages within the BIS (e.g., 99% of the gestational age and 71% of birth weight were missing in the RBR© relative to only 4% missing from the BIS). With BORN Ontario's existing relationship with PHUs, opportunities for providing technical leadership to disseminate rates of overweight and obesity within the BIS may be explored in the future.

Public health could play a role in increasing awareness of the prevalence of overweight and obesity in this early childhood population, advocating for the use and transmission of clinical data with the EMRs to better facilitate care and management, and the monitoring of healthy weights, increasing awareness of the importance of health information standards for system interoperability, and participating and promoting further research. Collaborative partnerships between public health and primary care could lead to a cultural shift away from the use of EMRs as simply an administrative tool, towards demonstrating the role of EMRs as a population health assessment and surveillance tool.

CONCLUSION

Although the estimates of optimal growth are not representative, this initial work demonstrates that the burden of overweight and obesity starts early in life. The

18-month WBV data from BORN Ontario is of good quality and has the potential to fill an identified data gap particularly in children younger than three years of age. An ongoing mechanism to support the interaction between BORN Ontario, EMR vendors, primary care practitioners and public health is needed to enhance the quality of the data and usability of the EMR as a data source for improving care and management, and monitoring children's height and weight, and the risk and protective factors for overweight and obesity. The centralized data collection through BORN Ontario is a key asset for the successful development and implementation of an EMR-based surveillance system for healthy childhood weights.

REFERENCES – PHASE 1

1. Roberts KC, Shields M, de Groh M, Aziz A, Gilbert J-A. Overweight and Obesity in children and adolescents: results from the 2009 to 2011 Canadian Health Measures Survey [Internet]. 2012. Available from: www.statcan.gc.ca/pub/82-003-x/2012003/article/11706-eng.pdf

2. Addressing Obesity in Children and Youth : Evidence to guide action for Ontario. Toronto; 2013.

3. Weng SF, Redsell S a, Swift J a, Yang M, Glazebrook CP. Systematic review and meta-analyses of risk factors for childhood overweight identifiable during infancy. Arch Dis Child [Internet]. 2012 Dec [cited 2013 Oct 18];97(12):1019–26. Available from: www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3512440&tool=pmcentrez&rendertype=abstract

4. Measuring the Health of Infants, Children and Youth for Public Health in Ontario: Toronto; 2013.

5. Ontario Ministry of Health and Long-Term Care. Ontario Public Health Standards. Toronto, ON: Queen's Printer for Ontario; 2008 [cited 2014 Aug] Available from: www.health.gov.on.ca/english/providers/program/pubhealth/oph_standards/ophs/ondex.html

6. The Healthy Kids Panel. No Time to Wait : The Healthy Kids Strategy. 2013 p. 66.

7. The College of Family Physicians of Canada, Canadian Medical Association TRC of P and S of C. 2013 National Physician Survey [Internet]. 2013 [cited 2014 Mar 14]. Available from: http://nationalphysiciansurvey.ca/surveys/2013-survey/survey-results/

8. Survey Results - National Physician Survey [Internet]. 2010 [cited 2014 Oct 17]. Available from: http://nationalphysiciansurvey.ca/surveys/2010-survey/2010-results/

9. Ministry of Children and Youth Services [Internet]. Government of Ontario, Ministry of Children and Youth Services, Communications and Marketing Branch; [cited 2014 Oct 16]. Available from:

www.children.gov.on.ca/htdocs/English/topics/earlychildhood/health/enhanced_18-month.aspx

10. Rourke L, Leduc D, Constantin E, Carsley S, Rourke J, , Li P. Getting it right from birth to kindergarten.Can Fam Physician. 2013;59:355–9.

11. The WHO Child Growth Standards [Internet].Geneva: World Health Organization; [cited 2014 Oct 16]. Available from: www.who.int/childgrowth/en/

12. Dietitians of Canada, Canadian Paediatric Society, College of Family Physicians of Canada, et al. promoting optimal monoitoring of child growth in Canada: Using the new WHO growth charts. Canadian Journal of Dietetic Practice and Research. 2010; 71(1): el-3.

13. Guttmann A, Klein-Geltink J, Kopp A, Cairney J. Uptake of the New Fee Code for Ontario ' s Enhanced 18-Month Well Baby Visit : A Preliminary Evaluation. 2011.

14. Ontario Marginalization Index (ON-Marg) [Internet]. [cited 2014 Oct 16]. Available from: www.torontohealthprofiles.ca/onmarg.php

15. Enhanced Postal Code Conversion File, 2013 | Community Data Program [Internet]. [cited 2014 Oct 16]. Available from: http://communitydata.ca/content/enhanced-postal-code-conversion-file-2013-0

16. Registered Persons Database (RPDB) , IntelliHEALTH [Internet]. [cited 2014 Jul 22]. Available from: www.intellihealth.moh.gov.on.ca/

17. Ontario Medical Services Database, IntelliHEALTH [Internet]. [cited 2014 Jul 22]. Available from: www.intellihealth.moh.gov.on.ca/

18. Lyver M. Standards: A Call to Action. Future Practice. Canadian Medical Association . 2013 (November):11–4.

19. Developing an Electronic Health Record-Based Population Health Letter from the NYC Health Commissioner. New York; 2013.

20. Lau F, Price M, Boyd J, Partridge C, Bell H, Raworth R. Impact of electronic medical record on physician practice in office settings: a systematic review. BMC Med Inform Decis Mak [Internet]. 2012 Jan [cited 2014 Oct 16];12:10. Available from:

www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3315440&tool=pmcentrez&rendertype=abstract

21. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011-2012. JAMA [Internet]. American Medical Association; 2014 Feb 26 [cited 2014 Jul 9];311(8):806–14. Available from: http://jama.jamanetwork.com/article.aspx?articleid=1832542

22. Wheeler J. Risk of obesity at 4 to 6 years of age among overweight or obese 18-month-olds. Can Fam Physician. 2013;59:202–8.

23. Barnes S, Reducing Childhood Obesity in Ontario through a Health Equity Lens. [internet] Wellesley Institute. 2012 [cited 2014 Jul 9] Available from: www.wellesleyinstitute.com

24. Khangura S, Grimshaw J, Moher D. Evidence Summary : Electronic Health Records (EHRs). 2008.

APPENDICES – PHASE 1

Appendix I

Additional information about BORN Ontario

BORN Ontario traces its roots to the 1980s and the Perinatal Education Program of Eastern Ontario (PEPEO). The program was led by Dr. Patricia Niday, who envisioned the use of data to support better obstetrical and neonatal care. As hospitals throughout the region began to see the value of aggregating data to examine outcomes and identify areas for improvement, PEPEO became the Perinatal Partnership Program of Eastern and Southeastern Ontario (PPPESO). Together with other Ontario perinatal networks, the organization began to lobby the provincial government for funding to expand the database, which was renamed the Niday Perinatal Database in the late 1990s.

When the Child Health Network for the Greater Toronto Area (GTA) member hospitals joined the program in 2003 – adding 51% of Ontario births to the system – the database was still housed within PPPESO and the Children's Hospital of Eastern Ontario (CHEO); however, it then became known as the Ontario Perinatal Surveillance System (OPSS). Under founding director Jim Bottomley, OPSS developed the Niday perinatal and Neonatal Intensive Care Unit (NICU)/Special Care Nursery (SCN) module, and extended its partnerships and encouraged more Ontario hospitals to contribute data.

The government's first provincial report on perinatal care was produced in 2006. Concurrently, reorganization of the Ministry of Health led to the formation of the Maternal Child Health Strategy Division. Responsible for a number of maternal child data sources in the province, the division quickly recognized the value of integrating data within a privacy environment to facilitate and improve care. The Ministry directed OPSS to bring together data from prenatal screening, the Fetal Alert Network (FAN) (for congenital anomalies), the Ontario Midwifery Program (OMP), the Niday perinatal and NICU/SCN module, and Newborn Screening Ontario (NSO).

With new provincial funding, OPSS was rebranded as the Better Outcomes Registry & Network (BORN) Ontario in 2009. The five founding partner groups, BORN Ontario staff and project consultants worked to design and build the new BORN Information System (BIS) while still carrying out partner program activities, and using the existing data to support quality improvement and practice.

In 2010, Mari Teitelbaum was named director of BORN Ontario. She led the move toward full registry status under the Personal Health Information Privacy Act (PHIPA) – which was obtained in October 2011 – as well as completion of the BIS, which was launched on January 23, 2012. The first year of data initially collected in the BIS is fiscal

2012-2013. Two additional Niday historical fiscal years (2010-11 and 2011-12) are also integrated and mapped to the BIS and available to users.

Development of the BORN Information System (BIS)
The BIS enables the collection of, and access to, data on every birth in Ontario. Sourced from hospitals, labs, midwifery practice groups and clinical programs, the data are collected through a variety of mechanisms including HL7, batch upload (automated extraction and uploads from health record system), and manual data entry. Information is reported via standard reports, patient experience record level lists and analytical tools within the BIS.

Since April 1, 2012, data have been collected from a number of sources including:

- Prenatal screening laboratories
- Specialized antenatal clinics (information about fetal anomalies)
- Hospitals (pregnancy, labour, birth and early postpartum care information)
- Newborn screening laboratory
- Prenatal screening and newborn screening follow-up clinics
- 18-month well-baby visits

In addition, data from fertility clinics have been collected since January 1, 2013.

Appendix II

Template of the Rourke Baby Record© for the 18-month well baby visit (only sections utilized for this study)

Past problems/Risk factors:	Family history:	**Rourke Baby Record: Evidence-Based Infant/Child Health Maintenance GUIDE IV: 18 mo–5 yr (Ontario)** NAME: _____ Birth Day (d/m/yy): _____ M[ ] F[ ] Gestational Age: _____ Birth Length: _____ cm Birth Wt: _____ g Birth Head Circ: _____ cm

DATE OF VISIT	**18 months**			**2–3 years**			**4–5 years**	
GROWTH[1] use WHO growth charts. Correct age until 24–36 months if < 37 weeks gestation	**Length**	**Weight**	**Head circ.**	**Height**	**Weight**	**HC if prior abN**	**Height**	**Weight**
PARENT/CAREGIVER CONCERNS								
	For each ❍ item discussed, indicate "✓" for no concerns, or "X" if concerns							
NUTRITION[1]	❍ **Breastfeeding**[1] ± Vitamin D 400 IU/day[1] ❍ Homogenized milk [500–750 mLs(16–24 oz) /day[1]] ❍ Avoid sweetened juices/liquids ❍ No bottles			❍ Breastfeeding[1] ❍ Skim, 1% or 2% milk [~ 500 mLs(16 oz) /day[1]] ❍ Avoid sweetened juices/liquids ❍ *Gradual transition to lower fat diet*[1] ❍ Inquire re: vegetarian diets[1] ❍ Canada's Food Guide[1]			❍ Skim, 1% or 2% milk [~ 500 mLs(16 oz) /day[1]] ❍ Avoid sweetened juices/liquids ❍ Inquire re: vegetarian diets[1] ❍ Canada's Food Guide[1]	

Appendix III

Data validation for height by de-identified PHU

	Valid		Not within acceptable range		Missing		Total
PHU	# of records	% of records	# of records	% of records	# of records	% of records	# of records
P	89	53%	1	1%	78	46%	168
B	97	60%	36	22%	28	17%	161
H	148	97%	0	0%	5	3%	153
J	66	88%	0	0%	9	12%	75
I	47	90%	1	2%	4	8%	52
T	29	88%	0	0%	4	12%	33
L	25	83%	3	10%	2	7%	30
V	5	56%	0	0%	4	44%	9
W	2	40%	2	40%	1	20%	5
X	5	100%	0	0%	0	0%	5
F	4	100%	0	0%	0	0%	4
O	4	100%	0	0%	0	0%	4
A	3	100%	0	0%	0	0%	3
G	1	50%	0	0%	1	50%	2
N	2	100%	0	0%	0	0%	2
Q	2	100%	0	0%	0	0%	2
S	1	50%	0	0%	1	50%	2
U	2	100%	0	0%	0	0%	2
C	1	100%	0	0%	0	0%	1
D	1	100%	0	0%	0	0%	1
K	1	100%	0	0%	0	0%	1
M	1	100%	0	0%	0	0%	1
R	1	100%	0	0%	0	0%	1
Missing	51	82%	1	2%	10	16%	62
Total	588	75%	44	6%	147	19%	779

Source: Better Outcomes Registry & Network (BORN) Ontario. Unpublished data, BORN Information System. Accessed: 26 Jun 2014.

Appendix IV

Data validation for height by FHT

	Valid		Not within acceptable range		Missing		Total
FHT	# of records	% of records	# of records	% of records	# of records	% of records	# of records
2	115	61%	41	22%	32	17%	188
7	86	48%	2	1%	90	51%	178
9	94	98%	0	0%	2	2%	96
8	81	87%	0	0%	12	13%	93
5	72	96%	0	0%	3	4%	75
3	46	96%	0	0%	2	4%	48
6	39	93%	0	0%	3	7%	42
1	26	90%	1	3%	2	7%	29
11	25	100%	0	0%	0	0%	25
10	3	100%	0	0%	0	0%	3
4	1	50%	0	0%	1	50%	2
Total	588	75%	44	6%	147	19%	779

Source: Better Outcomes Registry & Network (BORN) Ontario. Unpublished data, BORN Information System. Accessed: 26 Jun 2014.

Appendix V

Data validation of weight by de-identified PHU

	Valid		Not within acceptable range		Missing		Total
PHU	# of records	% of records	# of records	% of records	# of records	% of records	# of records
P	89	53%	1	1%	78	46%	168
B	103	64%	32	20%	26	16%	161
H	145	95%	5	3%	3	2%	153
J	63	84%	5	7%	7	9%	75
I	47	90%	2	4%	3	6%	52
T	25	76%	4	12%	4	12%	33
L	27	90%	1	3%	2	7%	30
V	5	56%	0	0%	4	44%	9
W	2	40%	2	40%	1	20%	5
X	5	100%	0	0%	0	0%	5
F	4	100%	0	0%	0	0%	4
O	4	100%	0	0%	0	0%	4
A	2	67%	1	33%	0	0%	3
G	1	50%	0	0%	1	50%	2
N	2	100%	0	0%	0	0%	2
Q	2	100%	0	0%	0	0%	2
S	1	50%	0	0%	1	50%	2
U	2	100%	0	0%	0	0%	2
C	1	100%	0	0%	0	0%	1
D	1	100%	0	0%	0	0%	1
K	1	100%	0	0%	0	0%	1
M	1	100%	0	0%	0	0%	1
R	1	100%	0	0%	0	0%	1
Missing	49	79%	3	5%	10	16%	62
Total	583	75%	56	7%	140	18%	779

Source: Better Outcomes Registry & Network (BORN) Ontario. Unpublished data, BORN Information System. Accessed: 26 Jun 2014.

Appendix VI

Data validation of weight by FHT

	Valid		Not within acceptable range		Missing		Total
FHT	# of records	% of records	# of records	% of records	# of records	% of records	# of records
2	122	65%	36	19%	30	16%	188
7	88	49%	0	0%	90	51%	178
9	94	98%	1	1%	1	1%	96
8	78	84%	5	5%	10	11%	93
5	69	92%	4	5%	2	3%	75
3	44	92%	3	6%	1	2%	48
6	34	81%	5	12%	3	7%	42
1	26	90%	1	3%	2	7%	29
11	24	96%	1	4%	0	0%	25
10	3	100%	0	0%	0	0%	3
4	1	50%	0	0%	1	50%	2
Total	583	75%	56	7%	140	18%	779

Source: Better Outcomes Registry & Network (BORN) Ontario. Unpublished data, BORN Information System. Accessed: 26 Jun 2014.

Appendix VII

Frequency of variables in the nutrition module by de-identified PHU

PHU	Breastfeeding				Homogenized Milk				Avoid Sweetened Juices/Liquids				No Bottles				Total # of records
	Valid (#)		Missing (#)		Valid (#)		Missing (#)		Valid (#)		Missing (#)		Valid (#)		Missing (#)		
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	
P	145	86%	23	14%	158	94%	10	6%	156	93%	12	7%	158	94%	10	6%	168
B	155	96%	6	4%	155	96%	6	4%	155	96%	6	4%	155	96%	6	4%	161
H	106	69%	47	31%	147	96%	6	4%	138	90%	15	10%	137	90%	16	10%	153
J	59	79%	16	21%	72	96%	3	4%	70	93%	5	7%	69	92%	6	8%	75
I	38	73%	14	27%	51	98%	1	2%	50	96%	2	4%	51	98%	1	2%	52
T	16	48%	17	52%	28	85%	5	15%	20	61%	13	39%	24	73%	9	27%	33
L	29	97%	1	3%	29	97%	1	3%	29	97%	1	3%	29	97%	1	3%	30
V	8	89%	1	11%	8	89%	1	11%	8	89%	1	11%	8	89%	1	11%	9
W	5	100%	0	0%	5	100%	0	0%	5	100%	0	0%	5	100%	0	0%	5
X	2	40%	3	60%	5	100%	0	0%	3	60%	2	40%	5	100%	0	0%	5
F	4	100%	0	0%	4	100%	0	0%	4	100%	0	0%	4	100%	0	0%	4
O	3	75%	1	25%	4	100%	0	0%	4	100%	0	0%	4	100%	0	0%	4
A	2	67%	1	33%	3	100%	0	0%	3	100%	0	0%	3	100%	0	0%	3
G	2	100%	0	0%	2	100%	0	0%	2	100%	0	0%	2	100%	0	0%	2
N	2	100%	0	0%	2	100%	0	0%	2	100%	0	0%	2	100%	0	0%	2
Q	2	100%	0	0%	2	100%	0	0%	2	100%	0	0%	2	100%	0	0%	2
S	2	100%	0	0%	2	100%	0	0%	2	100%	0	0%	2	100%	0	0%	2

U	1	50%	1	50%	1	50%	1	50%	1	50%	1	50%	1	50%	1	50%	2
C	1	100%	0	0%	1	100%	0	0%	1	100%	0	0%	1	100%	0	0%	1
D	1	100%	0	0%	1	100%	0	0%	1	100%	0	0%	1	100%	0	0%	1
K	0	0%	1	100%	1	100%	0	0%	1	100%	0	0%	0	0%	1	100%	1
M	1	100%	0	0%	1	100%	0	0%	1	100%	0	0%	1	100%	0	0%	1
R	1	100%	0	0%	1	100%	0	0%	1	100%	0	0%	1	100%	0	0%	1
Missing	54	87%	8	13%	59	95%	3	5%	59	95%	3	5%	56	90%	6	10%	62
Total	639	82%	140	18%	742	95%	37	5%	718	92%	61	8%	721	93%	58	7%	779

Source: Better Outcomes Registry & Network (BORN) Ontario. Unpublished data, BORN Information System. Accessed: 26 Jun 2014.

Appendix VIII

Frequency of variables in the nutrition module by FHTs

FHT	Breastfeeding				Homogenized Milk				Avoid Sweetened Juices/Liquids				No Bottles				Total # of records
	Valid (#)		Missing (#)		Valid (#)		Missing (#)		Valid (#)		Missing (#)		Valid (#)		Missing (#)		
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	
2	181	96%	7	4%	181	96%	7	4%	181	96%	7	4%	181	96%	7	4%	188
7	167	94%	11	6%	167	94%	11	6%	167	94%	11	6%	167	94%	11	6%	178
9	68	71%	28	29%	94	98%	2	2%	86	90%	10	10%	84	88%	12	13%	96
8	73	78%	20	22%	88	95%	5	5%	87	94%	6	6%	84	90%	9	10%	93
5	56	75%	19	25%	70	93%	5	7%	68	91%	7	9%	68	91%	7	9%	75
3	30	63%	18	38%	48	100%	0	0%	47	98%	1	2%	48	100%	0	0%	48
6	18	43%	24	57%	37	88%	5	12%	24	57%	18	43%	33	79%	9	21%	42
1	28	97%	1	3%	28	97%	1	3%	28	97%	1	3%	28	97%	1	3%	29
11	13	52%	12	48%	24	96%	1	4%	25	100%	0	0%	23	92%	2	8%	25
10	3	100%	0	0%	3	100%	0	0%	3	100%	0	0%	3	100%	0	0%	3
4	2	100%	0	0%	2	100%	0	0%	2	100%	0	0%	2	100%	0	0%	2
Total	639	82%	140	18%	742	95%	37	5%	718	92%	61	8%	721	93%	58	7%	779

Source: Better Outcomes Registry & Network (BORN) Ontario. Unpublished data, BORN Information System. Accessed: 26 Jun 2014.

Appendix IX

Growth classification by de-identified PHU

PHU	Underweight		Optimal Growth		Risk of Overweight		Overweight or Obese		Missing		Total # of records
	#	%	#	%	#	%	#	%	#	%	
P	4	2%	61	36%	15	9%	8	5%	80	48 %	168
B	1	1%	67	42%	17	11%	9	6%	67	42 %	161
H	2	1%	98	64%	32	21%	11	7%	10	7%	153
J	0	0%	43	57%	10	13%	8	11%	14	19 %	75
I	1	2%	26	50%	6	12%	12	23%	7	13 %	52
T	0	0%	20	61%	3	9%	2	6%	8	24 %	33
L	0	0%	20	67%	2	7%	3	10%	5	17 %	30
V	0	0%	2	22%	2	22%	1	11%	4	44 %	9
W	0	0%	1	20%	0	0%	1	20%	3	60 %	5
X	0	0%	2	40%	3	60%	0	0%	0	0%	5
F	0	0%	3	75%	0	0%	1	25%	0	0%	4
O	0	0%	1	25%	2	50%	1	25%	0	0%	4
A	0	0%	1	33%	1	33%	0	0%	1	33 %	3
G	0	0%	1	50%	0	0%	0	0%	1	50 %	2
N	0	0%	2	100%	0	0%	0	0%	0	0%	2
Q	0	0%	2	100%	0	0%	0	0%	0	0%	2
S	0	0%	1	50%	0	0%	0	0%	1	50 %	2
U	0	0%	2	100%	0	0%	0	0%	0	0%	2
C	0	0%	0	0%	1	100%	0	0%	0	0%	1
D	0	0%	1	100%	0	0%	0	0%	0	0%	1
K	0	0%	1	100%	0	0%	0	0%	0	0%	1
M	0	0%	0	0%	1	100%	0	0%	0	0%	1
R	0	0%	1	100%	0	0%	0	0%	0	0%	1
Missing	0	0%	31	50%	13	21%	5	8%	13	21 %	62

Total	8	1%	387	50%	108	14%	62	8%	214	27%	779

Source: Better Outcomes Registry & Network (BORN) Ontario. Unpublished data, BORN Information System. Accessed: 26 Jun 2014.

Appendix X

Growth classification by FHT

FHT	Underweight		Optimal Growth		Risk of Overweight		Overweight or Obese		Missing		Total # of records
	#	%	#	%	#	%	#	%	#	%	
2	1	1%	80	43%	19	10%	12	6%	76	40 %	188
7	5	3%	56	31%	16	9%	9	5%	92	52 %	178
9	1	1%	63	66%	19	20%	10	10%	3	3%	96
8	0	0%	49	53%	18	19%	9	10%	17	18 %	93
5	1	1%	44	59%	16	21%	7	9%	7	9%	75
3	0	0%	27	56%	8	17%	8	17%	5	10 %	48
6	0	0%	25	60%	7	17%	2	5%	8	19 %	42
1	0	0%	20	69%	2	7%	3	10%	4	14 %	29
11	0	0%	19	76%	3	12%	2	8%	1	4%	25
10	0	0%	3	100%	0	0%	0	0%	0	0%	3
4	0	0%	1	50%	0	0%	0	0%	1	50 %	2
Total	8	1%	387	50%	108	14%	62	8%	214	27 %	779

Source: Better Outcomes Registry & Network (BORN) Ontario. Unpublished data, BORN Information System. Accessed: 26 Jun 2014.

Appendix XI

At risk of being overweight, and overweight or obese by ON-Marg quintiles by dimensions

Dimensions	1 (least marginalized)		2		3		4		5 (most marginalized)		Missing		Total # of records
	#	%	#	%	#	%	#	%	#	%	#	%	
Dependency	31	18%	32	19%	28	16%	31	18%	23	14%	25	15%	170
Material Deprivation	47	28%	21	12%	31	18%	13	8%	33	19%	25	15%	170
Residential Instability	37	22%	24	14%	28	16%	29	17%	27	16%	25	15%	170
Ethnic Concentration	19	11%	27	16%	25	15%	35	21%	39	23%	25	15%	170

Source: Better Outcomes Registry & Network (BORN) Ontario. Unpublished data, BORN Information System. Accessed: 26 Jun 2014.

PHASE 2: BEYOND BMI: RISK AND PROTECTIVE FACTORS FOR CHILD HEALTHY WEIGHTS ASSESSED USING NUTRISTEP® IN PRIMARY HEALTH CARE

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INTRODUCTION

The NutriSTEP® screening tool is being used in some primary care settings to identify nutritional risk among children. However, little is known about exactly how the screening tool is being used in these settings. It seems that primary care offices would be the ideal place to conduct this screen; however, there are still a number of unknowns, including, for example, how NutriSTEP® screen is currently administered in primary care offices; how regularly the is screen used; how primary care providers support parents of toddlers and preschoolers with healthy lifestyle behaviour recommendations; and whether a tablet or another e-version of the NutriSTEP® screen would be more effective in administering the NutriSTEP® screen.

The potential for incorporating nutritional status data into electronic medical records (EMRs) is also not well understood. If nutritional status data were available in EMRs, this would have implications for combining height and weight data available in EMRs with risk and protective factors to provide a more comprehensive picture of childhood healthy weights: a picture that goes *beyond BMI*.

This study is part of a larger project that aims to explore the feasibility of establishing a surveillance system for childhood healthy weights, and risk and protective factors by using primary health care EMR data. By linking the NutriSTEP® screening tool with EMR data, primary care practices could thus improve care and management of childhood healthy weights. Public health units would be able to identify risk and protective factors for child obesity, and leverage this information to target local prevention programs and services to children.

NutriSTEP®

Nutrition is vital to support optimal growth and development and is a key component in the causal model for healthy weights. Poor nutrition in young children can lead to many negative health outcomes that may contribute to lifelong problems, including: a lack of school readiness and an inability to learn, excess weight and obesity, failure to thrive (growth failure), iron deficiency anemia, food allergies/ intolerances, delayed/restrained transition to solids/eating skills, and unhealthy feeding/eating environments (including food insecurity) (Dietitians of Canada, 2012). The NutriSTEP® questionnaires have been developed to consider determinants of nutritional health in young children, including: food and nutrient intake (e.g., types and amounts of foods eaten and how often); factors affecting dietary intake and eating behaviours (e.g., food security, and psychosocial feeding environment); physical growth and development/weight concerns;

and physical activity and sedentary behaviour (including screen time). The NutriSTEP® questionnaires are valid and reliable tools used to assess nutritional risk in toddlers (18 to 35 months) and preschool aged children (3 to 5 years). Once administered, the NutriSTEP® questionnaire can be re-administered on an annual basis (up until the child is 5 years of age), to monitor the progress of behaviour change and reduction in nutritional risk. There is also an established NutriSTEP® implementation tool kit that provides guidelines to assist with scoring and interpretation and with making referrals, as well as supportive nutrition education resources, providing an opportunity for clinical and public health follow-up with parents of children with scores indicating moderate to high risk.

Framework: Implementation of Innovations

Durlak and DuPre (2008) reviewed the literature on implementation of prevention or promotion innovations. They developed a framework based on their findings, describing contextual variables related to the innovation itself, the providers, the organization, the support system and the broader community (see Figure 1). Given that this study focused on the implementation of NutriSTEP® as an innovation in primary care practices, this framework was considered to be helpful in structuring the investigation.

Figure 1: Factors affecting the Implementation Process, Durlak and DuPre (2008) (Re-ordered and Condensed for Application to the Present Study)

I. PROVIDER CHARACTERISTICS
   - *A. Perceived need for innovation*
   - *B. Perceived benefits [and drawbacks] of innovation*
   - *C. Self-efficacy*
   - *D. Skill proficiency*

II. CHARACTERISTICS OF THE INNOVATION
   - *A. Compatibility*
   - *B. Adaptability*

III. FACTORS RELATED TO THE PREVENTION DELIVERY SYSTEM: ORGANIZATIONAL CAPACITY
   - *A. General organizational factors*
   - *B. Specific practices and processes*
   - *C. Specific staffing considerations*

IV. COMMUNITY LEVEL FACTORS

V. FACTORS RELATED TO THE PREVENTION SUPPORT SYSTEM
   - *A. Training and Technical assistance*

GOAL

The overall goal of this project was to gather information from primary care practices that would inform the development of a NutriSTEP® electronic screen in primary care to be linked with electronic medical records (EMR) that could be then used for local and provincial childhood healthy weights surveillance purposes.

Purpose

The three main purposes of this study were:

- To examine how primary care sites use NutriSTEP®, interpret results and provide feedback to parents.
- To understand barriers and facilitators to NutriSTEP® screening use by primary care providers.
- To determine receptivity of primary care sites to collect NutriSTEP® electronically and have it linked to EMR data.

Method

Interview Tool

A semi-structured interview guide was developed. The framework by Durlak and DuPre (2008) describing factors influencing effective implementation of prevention or promotion innovation was used as the basis for the interview guide, with some modifications to ensure coverage of the research objectives. Some questions were also posed to the interviewee prior to the interview, to gather basic data on the type of practice and the number of NutriSTEP® screens completed, if those data were available.

The interview guide was piloted in an interview with a dietitian familiar with NutriSTEP®. Minor modifications to the guide were made, to cover more questions in the interview as opposed to in the pre-interview questions. See Appendix A for the interview guide.

Ethics Review

The research received ethics approval from Sudbury & District Health Unit (SDHU) Research & Ethics Review Committee, Kingston, Frontenac and Lennox & Addington (KFLA) Public Health (Queen's University Health Sciences Research Ethics Board), Durham Region Health Department, and Toronto Public Health (TPH).

Recruitment

See Appendix B for the recruitment and consent protocol approved by SDHU, the lead agency for the research. Other ethics review processes used slightly different templates. Recruitment and consent procedures varied slightly for primary care

practices within each health unit area (see recruitment and consent emails in Appendix C and D). For practices not in the KFL&A PH or TPH areas, the SDHU protocol was followed.

Each public health unit participating in the research identified primary care sites that were currently using NutriSTEP®, by using their own pre-established contacts, asking their health unit colleagues, and reaching out to provincial dietitian and child/family health colleagues through various networks. The intent was to recruit across a variety of primary care practice settings.

Practice settings that were thought to meet the inclusion criteria were approached with an email or letter from the local health unit (or from the public health staff person who provided the contact information) to the organization lead, introducing the study and asking them to contact the research associate if the study was of interest.

Once their expression of interest was received, a subsequent email was sent to invite their participation, informing them that participating sites would be compensated at the rate of $200 to reflect time away from their practice. Three eligibility questions were asked by email:

1. Is NutriSTEP® screening used in your practice setting? If yes, which tools: Toddler, Preschooler, both?
2. Is NutriSTEP® screening used routinely or only occasionally?
3. Do you use an electronic medical record (EMR)? If so, which one?

All interested sites were eligible and recruitment continued until the goal of 10 interviews was reached. Once the Executive Director or organization lead agreed to participate on behalf of their organization, they were asked to identify the "most knowledgeable" interviewee about the use of NutriSTEP®, who could be from any role or disciplinary background (physician, nurse practitioner, dietitian, etc.).

Analysis

All interviews were transcribed verbatim by an experienced transcriber. For verification, two transcripts were checked against the audio recording by the research associate, with no errors found. The remaining transcripts were considered accurate.

Transcripts were imported into NVivo for analysis. An initial coding structure was established *a priori* based on the main areas of interest for the research (See Appendix E). Sections of the data considered to be relevant to the established codes were tagged with that code. Additional codes were added as subcategories of the established codes to reflect themes within that code or topic.

Results

The sample was drawn from a variety of practice settings: six Family Health Teams (FHT), two Community Health Centres (CHC), one Aboriginal Health Access Centre (AHAC), one pediatrician practice. In terms of the 'knowledgeable users', nine out of ten interviewees were dietitians. Five out of six FHTs used Practice Solutions, the most commonly used EMR, with Oscar and Nightingale on Demand being other EMRs in use.

Ten interviews were conducted with primary care practices where NutriSTEP® is in use. The nominated interviewee was approached by email to consent and to arrange an interview. Interviews were conducted by telephone by the research associate, and took approximately 40 minutes each. All interviews were audio-recorded (with consent) using a digital audio recorder. All interviewees were informed about the study details and given assurance about the confidentiality of their answers and the subsequent analysis.

The results are presented grouped by objective, and under the Durlak and DuPre (2008) framework categories, with some minor adaptations. Themes identified in the data are discussed under each category, and sample quotations from the interviews are presented to illustrate the themes. Quotations are verbatim, although some have been edited and had ellipses added to remove non-relevant materials and reduce disfluencies. Clarifications from the author are shown with square brackets.

OBJECTIVE 1: TO EXAMINE HOW PRIMARY CARE SITES USE NUTRISTEP®, INTERPRET RESULTS AND PROVIDE FEEDBACK TO PARENTS.

Practices varied in the ways they used NutriSTEP® screening. There were three main groupings of use, with variety within these:

- Use NutriSTEP® as part of the 18-month well-baby visit or well-child visit;
- Use NutriSTEP® as part of dietetic practice with child patients;
- Use NutriSTEP® as part of a nutrition-focused appointment or screening event.

The follow up from the screening also varied somewhat among practices.

- Use the results as a basis for conversation if the parent has questions;
- Discuss results at the time of the appointment; refer as appropriate for moderate or high score;
- Refer to dietitian for separate appointment if moderate or high score.

Some practices promoted the self-directed aspect of the tool, by making parents aware of online resources. See Appendix F for details on the practices and their ways of using NutriSTEP®.

I. PROVIDER CHARACTERISTICS

Interest in Pediatrics

Personal interest in pediatric health on the part of the provider was one characteristic of the provider that was thought to influence the choice to use NutriSTEP® in the practice. The interests of physicians, as leaders in the organization, were particularly influential.

> *So some physicians are champions, I would say, of pediatric health and health promotion, whereas others that's just not where their passion is….*

Awareness of NutriSTEP®

The introduction of any new tool requires that providers are aware of the tool and its benefits. Building awareness of NutriSTEP® and its potential within the practice was an important first step. In many practices, dietitians had been the initiators of the use of NutriSTEP® because they were familiar with it and could share their knowledge with others in the practice.

> *I would say when I started implementing it here, as a dietitian I knew what NutriSTEP® was, and other dietitians know, but the physicians didn't know what it was. So I guess it's making other professions aware of it, and how it could be useful.*

For some practices with multiple sites, this awareness continues to develop over time, as illustrated in this quotation:

> *A big barrier is knowledge of the NutriSTEP® screening. So we had the nurses, the nurse practitioners from our satellite sites, … and they were involved in the meeting where I was reviewing how we integrate the NutriSTEP®, and they were like, 'What is this NutriSTEP®', they didn't even know, and then of course the next question is 'Well, how can we get it?'*

I.A. Perceived need [or lack of need] for NutriSTEP®

Need for Nutrition Information

Providers who used NutriSTEP® saw value in having nutrition information for their patients. There was a sense that using NutriSTEP® augmented very limited information about nutrition from other screening tools.

> *So we implemented it for one, to see, because we didn't have any other way of screening nutrition, possible nutrition concerns, with pediatric patients…. We didn't*

have any screening tool already, and definitely for myself, hearing about using the screen, it's a validated tool.

I would see value if it's implemented into a routine visit, because nutrition is important, and I think it's just as important as any other factor that a child comes for in a medical visit, for their growth and development. So I look at some of the well-baby check screens, and the only question about nutrition is 'does the child have a balanced diet', so … I think there's a need for more in depth screening.

The potential to be able to 'roll-up' or aggregate the NutriSTEP® data in some way was also of interest for most practices, although only a small number had actually done any kind of summary. Related to this interest was the potential to track individual changes over time. For most practices, the data are not easily available electronically to facilitate the extracting and roll-up of the data, which points to potential benefits of electronic administration and storage.

[We] wanted to take a look at the data soon and see what have been overall changes, have these children gone from a higher BMI to a lower BMI, have there been changes in weight or obesity risk?

We're in the first stages of talking about how are we going to clump this information and evaluate it, and part of that was we need to start at least tracking properly, the screens that are scanned into the charts. Part of it is cleaning up our data a little bit and making sure everything is consistent, so that we're able to pull those numbers and find out where we're at. But we certainly haven't done any formal evaluation at this point, but the next steps are going to be talking about how to do that and what we want to … attach to that.

Ideally what I would like to see happen eventually is, we need the toddler screen first, … at one of the visits prior… Follow up with the preschooler screen, because one of the other questions that has been tossed around is, you know, should we be repeating this screen, in another year or something like that, and that way we can sort of evaluate any change…. I don't know how we would do that, and so possibly I guess with the electronic version, that might be a little bit easier.

The possibility of preventing future nutrition problems by screening early on was mentioned by one practice:

We use it mostly for obesity prevention, and screening, and we also implement it at age three because there is a gap between 18 months and four to six year old visits. Also we were getting a lot of 'peds' referrals that were later in age, … so we wanted to prevent some of those referrals and some of those nutrition-related issues later on by giving the parents some education earlier on.

NutriSTEP® Scores

For most practices, the number of patients scoring high is small, although this varied, from practices in which those above the moderate threshold were approximately 5% of the completed screens to those in which up to half of completed screens were above the moderate threshold.

> *The one thing that surprised me, actually, is I was definitely expecting more referrals than I've gotten out of this. So far it's only generated maybe three new referrals for me, which has been really surprising. That was actually one of the worries I had going into it was 'am I going to be flooded with new referrals, am I going to have time to manage all this', I was thinking I was going to have to develop some sort of class if that were the case, and so far it hasn't been that at all.*

Although practices saw the need for nutrition screening data provided by NutriSTEP®, a couple of practices were now questioning the extent to which their patient population actually had a need for nutrition screening, based on the results of the screening to date. These practices felt that if they were only getting a small number of moderate or high scores, there might not be enough value in the screening to warrant the time committed to it. If the screening scores were seen as an indicator of need, then for some practices the need was low and perhaps too low to warrant the time dedicated to screening. Focusing exclusively on the score as a basis for intervention seemed to have the effect of reducing the perceived value of NutriSTEP®. By contrast, other practices used NutriSTEP® screening as the basis for a conversation about nutrition, with the score being one piece of relevant data, but not the basis for a decision about whether to discuss the topic further.

> *Not that many, 12% in the moderate, again, out of 75 in total. So I think we were a little bit surprised, and it kind of made us question a little bit, is this the right tool for our population, because there were questions even on the low risk that would fall into the high risk category, but because the majority of the questions were answered low risk, it kind of had a washout effect. …We just felt that maybe there were some missed opportunities for follow up or discussion or as a touch point because of that.*

One practice had recently stopped using NutriSTEP®, for reasons of time allocation and low numbers above the threshold.

> *The committee … did a bit of an update …and they just felt that perhaps the questions that the NutriSTEP® screen were asking weren't, A, maybe there was too many, and B, maybe they weren't the right questions for us to be asking our population, being in [location] we tend to have a higher socioeconomic status, and maybe they weren't quite sensitive enough to grasp some of those. So I think the*

way that the committee was leaning was really just … a quick evaluation, kind of a five question, just addressing or exploring eating behaviours.

I.B. Perceived benefits [and drawbacks] of NutriSTEP®

Validated and Reliable Tool

For practices that had identified the need for some sort of nutrition screening, NutriSTEP® was the tool of choice because it is valid, reliable, and easy to use. It was also considered to be comprehensive in the range of topics covered and it ensured that all of these relevant topics were addressed in the appointment.

NutriSTEP® seemed like a logical choice because of its history, and the evidence supporting it, and the fact that it is validated.

We have very little time with the parents at the screen, and I like the NutriSTEP® because it covers a range of things, like their eating, their time in front of a screen, their use of supplements, and also it asks questions about their eating patterns, and also the family, the relationship between the parent and the child, which I like, and then, I like how they ask the parent are you happy with how they're growing, and are you happy with their weight. So I think it covers a wide range, which I like, in a short period of time.

The reason why I want to continue doing it, because I think it's a quick and easy screen that just brings to light any nutrition issues, so kind of an easy way, and unfortunately, many parents of children that age, … [nutrition] doesn't even come up, right, when they're coming and sometimes there's no time.

Starts the Conversation

The opportunity to introduce nutrition as a topic in an appointment was a significant perceived benefit of NutriSTEP® for many practices.

I think nutrition-related questions get put last, and things like the well-child checks, it's about growing well, I know from taking in my own children, 'Eating well? Yeah, okay, on to the next'. So this gives the parents some time to reflect on things, and it doesn't only deal with food, you know, there's questions about eating in front of the television, frequency of meals, activity, so I think it does have value to highlight some areas, and if anything, maybe make the parents think oh, maybe I should ask about that. I think there is value in it.

In clinic it actually kind of offers a mutual starting point for discussion. I think it's less invasive than a full-blown assessment where you drill into what they're doing in a day, and I find that it generates a good conversation about what's happening in a day.

Targeting Programming

Some practices also mentioned the benefit of gathering data that might, over time, guide their nutrition-focused and health promotion programming.

> *In future, it would be really, it would be nice to see it for how it can target clinical interventions, but also when we think about programming, how do we target programming and messaging.*

Time Commitment

The time at clinic appointments is carefully guarded, to ensure clinic efficiency and a good experience for patients. The addition of any screening tool is, thus, considered in light of the time it takes relative to the benefit it brings. Several interviewees talked about the balance of time versus benefit, not only with respect to the time in the appointment, but also dietitian time to review the screen, enter the scores in the EMR, and/or meet with patients (depending on the practice.) Some practices are addressing this question by looking at the screening data to determine the profile of results and the number of referrals that are resulting from the screening.

> *I have recently talked to our physicians a bit about it, and they're all interested in using this kind of screen, so there's support for it, but I think if it seemed like we weren't necessarily seeing many benefits from using it, but a lot of time was being put into handing it out, what would be kind of the cost and benefit to it that way. So I do have to report on our stats, and the use of this, so that was also part of why we were trying to collect our own data as well.*

I.C.Self-Efficacy

Personal Comfort with Nutrition Discussions

Another characteristic of the provider that influences the use of NutriSTEP® is comfort with nutrition topics. Some providers do not engage in conversations about nutrition, preferring to refer any questions to the dietitian. Others will explore the topic as needed, relying on existing resources and referrals to support patients. The dietitian role appears to be important in increasing the comfort level of other providers, by sharing knowledge, offering training, or identifying or creating resources for the provider or for the patient. Reliance on referrals to dietitians is sometimes described as an application of a multidisciplinary approach in which dietitians are given responsibility for discussions in their core area. However, some interviewees continue to feel that non-dietitian providers may not have a complete understanding of the content behind the NutriSTEP® tool, and, thus, may still miss out on opportunities to provide education for patients.

That can be quite individualized, just again, depending on where the nurse or the physician's interest is, and where they would place their kind of own personal value on nutrition, and their comfort with that. The way that we addressed that with our team was, if you do get questions, that's a great time to say we have a dietitian on staff.

I think that's the beauty of the tool, is that it does … bring up some good opportunities to highlight some red flags, but not everybody is going to be able to pick that up unless they have the training in why. So I've always thought it would be nice to have some kind of a tool with key messages[1] and kind of guidance on responses to give to providers, as kind of a secondary part of it. I don't know if that exists or not, but you know, to kind of explain the weight of the questions, and some of the research behind it, I think that would maybe kind of get them more involved with it, empower them to do that.

Providers really respond to catchy words like 'best practice,' and that doesn't seem to happen around a lot of the nutrition talk, …it's not necessarily seen as that across all the providers, so I think we're seeing tools like this, but we're not seeing the evidence behind it. So it doesn't really get the same amount of buy-in, and then you're missing the big education piece that, you know, because these well-baby visits have such an important time to be able to be addressing these feeding issues, and the understanding is just not there.

II. CHARACTERISTICS OF THE INNOVATION

NutriSTEP® as a tool has particular characteristics that appear to make it work well in these primary care settings. Other issues, such as validity and social desirability, were raised by some interviewees as concerns related to screening tools in general, and in this case specifically related to NutriSTEP®.

II.A. Compatibility

Easy to Use

Providers found NutriSTEP® easy to use and easy for parents to complete, relevant for parents, and helpful for starting a conversation about nutrition.

I like the NutriSTEP® tool because it's short, and parents seem to be able to, in my experience, to complete it, and although they don't necessarily add it up, in my

[1] The NutriSTEP Implementation Toolkit, available at www.nutristep.ca/en/toolkit_resources.aspx addresses this need.

experience, I think the questions resonate with them, and the questions are also I think nice conversation starters. So that's the way I do like using it.

Accessible Literacy Level

Some interviewees raised the possible challenge of literacy as a concern about the tool, but all of those who mentioned literacy also commented that in fact it had not been a problem.

The other concern I had personally was literacy, and whether or not this was going to be possible for parents, out in the waiting room. We do have a mix of patients within our practice, but that's not been an issue either.

I haven't had people question too much, and I do work with a population that have a low literacy level, … but I personally haven't noticed that there's any problems.

Validity and Social Desirability

In some cases, the use of the tool can bring challenges, such as for parents who are not familiar with a North American diet, or who are uncertain about the purpose of some questions. Some interviewees wondered whether parents were honest in their responses, or were answering to present themselves in a positive light. It was noted, for example, that parents who have child protection involvement would be cautious about suggesting that they have difficulty affording food for their child, or that their child may not be eating a balanced diet. Rapport with and trust in the provider seems to make a difference in mitigating any social desirability, as would be true with many other health assessment questions asked by a health provider.

Yes, I think it's harder for ethnic cultures, where their diets aren't really similar to the standard North American diet. I think they have trouble just identifying, you know, what is a grain, and what food groups count, like when you ask the first four questions. Other than that, some parents question why some of the questions are asked, like, for example, the one question assessing whether they have difficulty affording food, some parents find offense to that question. But other than that, yeah, it's easily done with some assistance.

So I guess one of my concerns with NutriSTEP® in general is, I know it's validated and it's a great screen, but you know, how many parents are actually fully honest when they're writing the screen and answering those questions, because of course they want to impress the provider, they don't want to look bad.

A lot of these families are involved with CAS, and … they don't necessarily know where the results are going to be going. I think there's a lot of vulnerable kind of things coming up.

II.B. Adaptability

The use of the screening tool carried with it certain very practical considerations for practices, such as access to the tool in a way that worked for their practice and their patients. The availability of the screen in hard copy often relied on supplies through the local public health unit (for practices where the license was held by the health unit).

> *Having enough screens available so that we're not running out, access by our satellite sites, so that was something that we've been talking to the dietitian at public health about: How would they get access to the screen?*

The cost of the license had been a consideration for some practices, although one felt it was a cost they did not want to incur, whereas another felt the cost was very low and easily absorbed.

> *The family health team didn't want to pay for licensing, so we actually get the hard copies from our public health unit.*
>
> *I think the low cost of the NutriSTEP® is also a big factor, because if it was really expensive I'm sure a lot of FHTs wouldn't use it.*

OBJECTIVE 2: TO UNDERSTAND BARRIERS AND FACILITATORS TO NUTRISTEP® SCREENING USE BY PRIMARY CARE PROVIDERS.

III. FACTORS RELATED TO THE PREVENTION DELIVERY SYSTEM: ORGANIZATIONAL CAPACITY

The Durlak and DuPre (2008) model provides subcategories under the mid-level categories of organization capacity. For this study, the mid-level categories (general organizational factors, specific practices and processes, specific staffing considerations) carry the right level of detail to describe the findings.

III.A. General organizational factors

Organizational Strategy

Some practices made the decisions to use NutriSTEP® in the context of a broader organizational direction or strategy, for example, to prioritize child health or to reduce obesity. The existence of a relevant strategy appeared to be a driver of adoption of NutriSTEP® and commitment to it.

I think the priority is just to improve the health of younger children. I know that the three year old visit one, you know, that's a separate program, and I think we made it a separate program just to put emphasis on the importance of it. I think it's good for the organization to have the information in the EMR, so that in a couple of years down the road we can see whether, you know, doing the [three-year old] visit is actually improving obesity rates, or improving health outcomes of children. So I think that is one of the bigger strategies.

We have our quality plan, … so it does fit under our childhood obesity strategy, but also just it fits nicely with the 18 month well-baby visit.

Committee

In some cases, a committee or working group made the decision to use NutriSTEP®, and this organization-level decision was also helpful in gaining acceptance for the tool.

The main part is because it's coming from the quality improvement team, and so because it's sort of accorded by that committee, everyone seems to have pretty good uptake. It's not really a matter of can we do this, it's more like okay, this is what we're doing. ….When we decided to roll it out to the rest of the providers, everyone was like 'oh, this sounds good, we're on board'.

I initiated it, coming in from public health, and having experience with NutriSTEP®, and the committee that approved it was the 18 month well-baby visit committee, as well as our [innovation group], which is a representation of all doctors, nurses, allied health, management. So it had to be approved at that level as well.

Supports within Practice

One key facilitator of using NutriSTEP® was having support and enthusiasm within the practice. When practices implemented NutriSTEP®, it was often with the support of policies and procedures. These were important both because they communicated the organization's direction and priority on the screening, but also because the specifics of implementation had been worked out, minimizing the burden on providers to adapt to the innovation. A related point raised by one practice was that they set a target for completion of the screens, and were tracking to see whether the target was met. Gradual and planned roll-out was also seen as a helpful way of introducing the screening tool.

Support, it's been really, really helpful, and you know, I think the gradual roll out was helpful too, that way we could just iron out any kinks as we went. I think one of the biggest concerns initially was the time factor and how much time it was actually going to take. [The practitioners] said it takes a maximum of an extra five minutes, for screening and goal setting and that kind of thing. So it really hasn't been a big extra burden on them.

Oh, definitely, I think it's a great kind of starting point for these kinds of discussions, and for bringing, you know, high risk individuals, kind of to light, and I guess also family practices, we actually have a huge broad effect, but I definitely think the policy and procedures have to be developed to make sure that it's being implemented.

We also created a formal policy, and we just ensure that we have a high quality standard of care with our clinical programs, that policies are followed, appropriate people are trained, so that was all done kind of in the background, behind the scenes, then we rolled it out.

We had a goal set for this year of completing out of all the 18 months [well-baby visits], at least having 75%, as our goal for NutriSTEP® completion, and we surpassed that, we're at 80%.

Value on Innovation and Leading

Some practices see themselves as innovators and leaders in their fields, and, thus, are more inclined to try something new or to experiment. This organizational orientation toward innovation appears to be a facilitator of NutriSTEP® use.

Yeah, I think we're definitely into that kind of stuff. I think we're one of the family health teams that tries to be on top of quality improvement, or seeing what works.

III.B. Specific practices and processes

Practices integrate the screen a variety of different ways in their practices, from integrating the screen into well baby/child visits to parent administration of the screen while they wait for their appointment in the clinic waiting room.

Incorporation of the Screen into a Well-Baby or Well-Child Visit

Building the screen into the well-baby or well-child check was seen as a facilitator of the NutriSTEP® screening. The use of the screen became routine through this process, and providers became familiar with the tool because they used it regularly.

We wanted to include some more of a nutrition component to our 18 month well-baby visit, being mindful not to take over, that is a very busy visit. It's a way that we thought we could kind of screen for those high risk toddlers, around feeding and nutrition, sedentary behaviours, physical activity, and just it would be a good opportunity we felt to provide parents with some information at that point.

A practice where the screen was *not* part of the well-baby visit had this to say:

No, we haven't had that conversation. …. I would anticipate it being a challenge, because they've already got a busy visit, so the logistics of how a screen would

happen, and how it would be reviewed with the parent, I think that I foresee some challenges.

Integration of Reminders into EMR

In some practices, automatic reminders to use the screening tool had been integrated into EMRs, which was considered to be helpful because the reception staff or providers are reminded through the EMR to give the screen to the parent. In some cases, the reminder was there automatically for every well-baby or well-child visit. In some practices without automatic EMR reminders, the dietitian went through upcoming appointments and added a reminder for patients in the appropriate age group.

Referral Capacity and Systems

A key factor for effective use of the NutriSTEP® screening was having a referral system and having a dietitian to whom to refer. For most of the practices in this study, dietitians were part of the team and were available to receive referrals as needed. The providers needed to feel comfortable that if they are screening, they have supports and resources to offer in the event that the screening shows a level of risk that would benefit from follow up. There were also challenges, mostly potential rather than realized at this point, about expansion of screening beyond the resources available to respond.

It would be important to have those resources available, so having a multidisciplinary team that could support those questions, because … you don't ask a question unless there's a reason why you want to know the answer to it, and again, you kind of need to have something in place to be able to offer should there be any concern there.

If we're talking about physicians, really don't necessarily really want to screen unless the screening is shown to be effective, unless there's resources at the other end that they feel that they can access, so that may or may not be the case in a different primary care environment. I would imagine in a family health team practice where there may be a dietitian as part of their practice team members, that would be much easier to implement a treatment strategy, as opposed to if you're talking, you know, a solo practitioner, or even group practices where they don't have access to a dietitian.

The follow up piece, you know, so now you have this score, what do you do with it. Dietitians have been a big part of that, and I … think it's good, but we see some pretty complicated kids, and I hesitate how much a couple of phone calls would be able to really address. ….I think it's something, but I don't know that it's sufficient. For example, when the public health representative went to [community agency], they don't have a dietitian on site. I am their dietitian. But if every single person in

a group scores [high], how are we going to do this, right, how are we going to do this in a practical manner.

Although practices referred moderate or high scoring patients to a dietitian, compliance with those referrals was frequently a challenge.

If they're moderate or high risk and require a follow-up, via MD or RD, we're finding that they aren't coming in, so really poor compliance for follow-ups. There were only two follow-ups completed in 2014, actually.

And then the moderate to high risk referrals, they are being referred, but the uptake is rather low. So for parents to come back and then see the dietitian, it's been few and far between.

Carving Out Time

Part of making the NutriSTEP® screening work is having enough time in an appointment to administer the screen and discuss it. Interviewees talked about ways they have tried to ensure enough time is allocated, although some continue to experience challenges.

I think also having specific program time for using the questionnaire, so we have two half-days dedicated to just the three year old visits, where they book three year old visits on each of those half days, so dedicate time for the program.

One of our complications is that the parent isn't able to complete it before going in to see the doctor, so they don't necessarily know any questions to ask, or they kind of get put to the side, or it doesn't get completed until after the appointment.

When moms come in, usually they come with their little ones, sometimes there's lots of distractions in the room, the mothers sometimes just want to be in and out, they just want the info, whereas the screen, it kind of takes a little bit of time, and I haven't seen people get annoyed with it, but I can see them being 'okay, more questions, more questions'.

III.C. Specific staffing considerations

Administrative Staff Roles

There are specific roles for administrative staff, among others, to ensure the appropriate and regular use of NutriSTEP®.

We just have all the right people in place here, because it's a big family health team. We have our clinical program coordinator, our data analyst, our reception plays a big role, our admin.

The usual things like ensuring that the patient actually is handed the tool before they come to see me, or during the visit, so someone has to do that, so that takes coordination, and you know, sometimes in a busy clinic, you need someone to help you, that's not always consistent.

… having it become a routine to hand it out. We worked through who was to set appointment alerts, because originally that was assigned to the administrative staff, but you know, it would get done for about two weeks, and then not get done, so over the last year it became the dietitian's job to do that. ***Interviewer:***

Mmhmm, and what's your experience with that, do you find that's workable for you? *It's been workable. …I was kind of thinking oh no, but it actually isn't that bad, we see maybe six patients a week that would fit using a NutriSTEP®, so it's not that big of a task to do it, but it is something that's taking up time.*

Dietitian Roles

Several practices commented that part of the reason they wanted to use NutriSTEP® was that it served as a showcase for the dietitians in the practices, and created opportunities to make full use of their expertise.

We were really looking for a good kind of in, especially with the dietitians, I think, sometimes we feel we're not used to our full capacity, and there was just the interest on the team around pediatrics.

[We have said to the team that] if there's a question that you don't feel comfortable answering, that's a great time to reinforce the fact that we do have someone that can, who is happy to meet with you, and can work with you to find answers for those questions.

Having the dietitian is key, I did a lot of the, well, all of the training and resource development for the packages, …. I don't know if this would have been actually to completion, you know, if the dietitian wasn't a key player, for sure.

There was also a sense that having a dietitian present to discuss the screen is value-added relative to discussions with other providers.

Sometimes if a child is moderate risk and I see something, I can even just do a little education session there, so then they don't have to come back for a separate appointment with an RD to get that little bit of information, so I think that's helpful, whereas probably the nurse won't be able to provide more in-depth information.

Among the interesting and creative ways that NutriSTEP® is being used in primary care practices, one dietitian is considering doing more internal marketing of the NutriSTEP® screen, and dietitian services in general, in the practice setting.

I've been thinking about …some internal promotion, maybe even a poster, so they're able to ask, while patients are waiting around, 'oh nutrition, you need some info?', something catchy. That could be the next thing, because we're even pushing self-referrals to the dietitian in general, just so people know that, we're here, and even if you don't have a quote-unquote problem.

IV. COMMUNITY LEVEL FACTORS

Although the implementation of NutriSTEP® screening was largely decided by the providers and the practice, there were a couple of practices that had taken steps to share their experiences beyond their practice, or had learned from other practices in their communities.

We're on a committee that's trying to support dietitians in other practices,… to be able to start it up at their practice. So as part of that we've actually created just like a one-page blurb just about what NutriSTEP® is, so that RDs can feel confident talking to their teams about it, and then we've also created a really basic guide so that gives them ideas on how they could roll it out depending on the practice, so just strategies that they could use, whether it be even just leaving screens in the waiting room, so that parents would be the instigator there, or having hand them out by front staff, or even by maybe the nurse while they're waiting for a doctor's office visit, and giving them ideas on what they would then do, like the next steps for the screen, and we've also got a little package of resources that we put together, like supporting handouts, depending on the office or the dietitian, whatever he or she feels that would work well with the practice, they can sort of pick and choose from those resources.

V. FACTORS RELATED TO THE PREVENTION SUPPORT SYSTEM

Innovations such as NutriSTEP® often require supports, training, or technical assistance to be successful, as shown in the Durlak and DuPre (2008) framework.

V.A. Training and Technical assistance

Having dietitians involved to do the screening or to train or support other providers was a facilitator. The NutriSTEP® implementation package and resources were also helpful. Online training was suggested as a possible valuable option.

All of the stuff online is great, that implementation package is really helpful. ….We haven't really gone beyond just the dietitians doing it, we haven't really been able to use it to its full potential, [but] now, [when introducing the tool to other

providers] I'm seeing the real benefit of that tool. And I do find that the online forum, the NutriSTEP® community, for email, is very helpful as well.

I'm going forward with training, so I could see if there were some sort of online training module, either targeted at primary care, and perhaps lay health workers, I think having something like that would be helpful, because then it would take some of the burden off of me developing that training.

Many practices identified local public health as a support. In many cases, the license holder for NutriSTEP® was the public health unit, and the access to the tool for the practice came through public health. This may be an advantage because it ensures an ongoing link between public health and the primary care practice. The support from public health appears to have been a key factor in moving toward implementing the screening for many practices, and the ability of public health to provide the hard copies is a key enabler as well.

Public health is already offering support, to family health teams and CHCs that are interested in implementing NutriSTEP®, so with training and resources and all that stuff. So they're doing well there.

I had received something from a dietitian, let me see if I can find it here, it was a NutriSTEP® key messages resource, it was adapted from a health unit…. So it was created there, and I don't know where it came from, but it has key messages about why each question, and what the high risk would be, so that's wonderful that I found that.

I have talked with the dietitian at the health unit in the past, about what they're doing with it and understanding how they implemented it. So that's been helpful, having that networking, and I think maybe what I could do more of too is request that sort of advocacy, to come in to the community and do a presentation, but then again, I'm pretty comfortable with it so I usually end up doing it. ... And, I mean, at this point it's manageable, because it is just one community, and we're the license holder, so we could, I think we can manage that, but if it were rolled out larger, I think that support [from public health] would be very helpful. So being able to support the lay health workers and primary health workers.

Yes, so we, the family health team didn't want to pay for licensing, so we actually get the hard copies from our public health unit.

It was very helpful to have someone who had had, I would say, experience with NutriSTEP®, was able to provide the screening tools, and was also in touch on a regular basis with other people that were using it as well. They facilitated a telephone conference with [another] family health team, that was generous enough to share their results with us, going into it, kind of pitch it to the team, with

'this is what they were doing, this is what they found, can we give it a try and see what we come out with'. …. I do think that that helped create a bit of buy-in as well, just because, I mean, if others are doing it….

I do know that any time you call them, they always give me the copies, and I have actually a few copies in another language as well.

OBJECTIVE 3: TO DETERMINE RECEPTIVITY OF PRIMARY CARE SITES TO COLLECT NUTRISTEP® ELECTRONICALLY AND HAVE IT LINKED TO EMR DATA.

One of the evaluation questions asked interviewees whether they would be interested in a version of NutriSTEP® that was electronic, that could be completed on a tablet in the clinic setting, and for which the data would be linked automatically with their EMR. The answer, unanimously, was a resounding yes. Sample quotations indicate the strong level of support for the idea. In some cases, practices have discussed the possibility for this option or have already taken steps to use the tool electronically. Some practices do complete the online tool (the Nutri-eSTEP® available on the Dietitians of Canada website) as part of routine process, in which they ask the questions and enter the results online, producing a printout once the scan is complete. That option does not integrate the results into the EMR, but it is a step toward the possibility.

If there was to be an electronic NutriSTEP® tool that I could give my patients in my waiting room, …, they complete it and it would be linked to my EMR, there'd be no reason for me to say I wouldn't want that. That would be very useful for me. If it could be scored, and then, and linked even to a referral map of a dietitian, you know, that would be brilliant.

Yeah, I think it's great, like even for a selfish point of view, it would be nice to just have it automatically in my chart.

I think if it was built right into the system, I mean, there's no question people would use it.

And for the EMR, at one point I actually, because I'm part of the EMR working group, and I have put NutriSTEP® in there as a template, so you can actually enter the scores in and have the information available in there, but I've never used it, I wasn't sure about copyright or anything like that, so I kind of… ***Interviewer: You just manually entered it in.*** *Yeah, so we haven't actually used that as a template or anything.* ***Interviewer: Okay, but you're thinking about it.*** *Yeah, we are, because it would be awesome.*

There's multiple different EMR systems that are supported in the province, so it would need to be compatible with those different systems. Even if you can convince one EMR provider to implement NutriSTEP®…

It would just be part of the database, right, and then even putting in height and weight in there, because we can definitely do that at the screening, we can definitely measure them, and stick it in as part of the screen. There could be a template, like, a NutriSTEP® template. So I think it would be great, and then if you can collect it from any community health centre that has [EMR], and then you can just collect that, and you've got the data right there.

We really haven't considered the e-version, only because of it not being linked to the EMR right now, there's a barrier, right, what do you do with that once you've done it. If it was linked to the EMR I think that would really open a lot of possibilities there. The tablet is a great idea, again, getting the practice to buy into that, because that's going to have a cost factor, that could be a little bit of a challenge.

The interviews also posed another hypothetical possibility, in which patients would receive a link to an online survey before their appointment. The reactions to this idea were more cautious, but most felt that this is an option that could work for some clients. Absent from this situation is the option to assist the patient while completing the tool, so for interviewees who already provide assistance to clients while they complete the tool, they were concerned that the tool would not be completed accurately without such supports.

Well, I'd say the second option, the email one, was in line with what our physicians were asking could be done. The tablet, I guess it would still rely on the patient having enough time to fill it out in the waiting room, which is one of our barriers, and then the other option, we were thinking email, because it's not available through the internet anywhere, so you know, we had thought, you know, is there a way that people can access it, you know, if we give the email notification, your appointment is in five days, can you fill this out before your appointment, and then that, you know, they could either, oh, I mean, we weren't thinking, you know, that data being directly sent to the EMR, but you know, they could print it off, bring it in. …. I know a question that I think would come up with having it linked to the EMR would be confidentiality, and how all of that would work, linking charts to outside sources, and things like that. …. But yes, if there was a way to send it to patients ahead of time, we think that would probably be helpful.

I think, like, the online, like doing the e-stuff, it's a bit more of a challenge, because you have to then have internet access, and you're completing it at home, and I have some concerns about what happens after. They get a score, and then what,

and I'm not sure, I don't know enough about the e-program to know what happens. ***Interviewer: Right, do they still have supports.*** *Yeah, so like I could see that being less advantageous, because I think for the most part we've talked about, where the provider is there, or somebody is there, to either answer questions or to work through a referral if there is a concern.*

And then the emailing, you know, I think it's great in theory, but I wonder how many parents would actually follow through with that.

I guess with the electronic version, I mean that might be a little bit easier, because we are getting to collecting email addresses as well for communication, so that you can get reminders via email, so I mean down the road that might be an option too, is to email them and say hey, it's been a year since you completed the screen, would you mind doing it again. ….If it's possible to have the electronic screen tied to the EMR, I think that would actually probably work. I didn't even know that that was a possibility in the past, and we've never really considered the e-screens, because how do you collect that information? The parent has done it, but now what?

Not only were interviewees enthusiastic about the electronic administration of NutriSTEP® linked to an EMR, but some also spoke of challenges they experienced because the screen is currently on paper. Thus, the appeal of electronic administration may be partly in the fact that it would NOT require the practices to manage paper.

The fact that it was a hard copy and kind of separate entity created some difficulty, maybe, just with the paper trail that it left.

We're using paper, and what we do afterwards is we then scan it into the chart. What we've started doing is we actually had to start photocopying it [laughing] because that way they can just take the staple out and then put it through the machine to scan it more easily than having to flip back and forth.

Exploratory Applications

One practice had recently begun exploring the use of a software product that works alongside their EMR, and included electronic versions of NutriSTEP® that link to the EMR – exactly the situation that the interviews had been describing in hypothetical terms. The interviewee's comments about this option are positive.

We just got tablets into our family health team, with the Ocean software, and we've been playing around with them, and both the screenings, the toddler and the preschooler one, are on the Ocean software, so it's an option, and I'm actually testing it out with my patient on Wednesday, with the parent. It looks beautiful, and it actually links. What I've been trying to summarize that takes forever -- it populates, it's beautiful. So if it works well, it would be lovely. The only concern

that we have is if the parent's sitting in the waiting room, and they don't come early, you know, they're kind of sitting there doing it while I'm in my office waiting for them to come in, so the parents need to come early enough, I guess, to do it as they're waiting.

In a follow-up email, the experience was described very positively as well.

As promised, I just wanted to let you know that I did pilot the use of the Ocean tablet using the NutriSTEP® screen last week and it worked very well. All of the answers populated into the patient's chart and any answers of concern were highlighted using a different colour. I had the mother answer the questions on her own, in my office, and then I could automatically see the results and discuss them when she had submitted her answers. I will definitely consider this for future appointments!

Provincial Surveillance Data

Related to the questions about the potential for electronic administration of NutriSTEP® was a question about the hypothetical potential for data to be gathered from EMRs across the province and combined for surveillance purposes. Overall, interviewees saw the merit in this possibility. The main challenges were confidentiality assurances and data quality, along with the feasibility of having practices collect the data.

So I could see the privacy and that side of things maybe being a bit of a hurdle to get through …, and having that conversation and understanding of how the information is going to be used, in the end I think they would find an interest in having that aggregate data and being able to compare.

I think there's a need for more in depth screening, so yeah, I think it would be valuable to implement it provincially, and I think then you would get more support from the doctors if it is provincial-wide, you know what I mean, they don't want to be the only FHT not doing something, so yeah, I think it's more valuable.

It would need to be implemented with some oversight and fidelity, I mean, someone would have to be ensuring that primary care team members would enter the data somewhere, or first of all that they would actually decide to use the tool, so I'm not sure how well that's going. Probably I would suspect people would need incentives in some way to do that. Then you'd need some way to enter the data in a robust way, and then you'd need to be able to pull the data effectively from those processes. So I think it would be an exciting opportunity, and I think it would be very interesting and exciting, and you know, of course there'd be some challenges along the way, and it would probably require some funding, but yeah, it would be great.

No, I think it would be kind of sad if we weren't able to share our data, because it's good information. I think it would be great for the province to look up, you know, how many low, moderate, and high risks….

I think their concerns would be just the time factor, and getting some adequate support, you know, if it can be as easy as possible, I think that there would be no problem with it.

MOVING FORWARD

Interviewees were asked to suggest ways that the implementation of NutriSTEP® screening could be made easier or be enhanced. Some thought of ways to support other practices in their use of the screening. Many of their suggestions went beyond the level of the individual primary health care practice to facilitators that would need to be implemented at the provincial level.

Increase Awareness about NutriSTEP®

It was suggested that if parents were more aware of NutriSTEP®, they might bring it up with their providers and specifically ask for it. There might also be potential for other agencies to administer the screening that would be integrated with primary care practices.

I wonder also about collaboration with other community agencies like Ontario Early Years, for example, or the Y, or you know, again, just maybe other areas where you could target parents a little bit more. You know, it all comes back to the family practice, again, an e-screen that's tied with EMR, or even if they have the paper form, then they can always bring that back in to the doctor as well.

Provincial Initiatives to Support Population-Level Screening

When asked about the potential for sharing data collected by primary care practices, several interviewees talked about the need for supports from the province in creating a population-level system. They reflected that although they personally had seen the value in implementing NutriSTEP®, they felt it was unlikely to achieve broad implementation without provincial-level direction. NutriSTEP® 'champions' were also seen to be important as a way of increasing momentum and the profile of NutriSTEP®.

I think there'd have to be a champion really sort of pushing. So if you had a good tool, and resources to go with it, I still think that alone may not be the ticket to success. Then I think you need advocates for the use of that tool more broadly.

I think if they, the promotion of it, but I also think if an official body recommends all children of whatever age be screened for nutrition risks by a nutrition professional,

I don't really know what the mandate is for well-baby visits, I don't really know how, through who that's done, but that organization, kind of just making it part of it, that would be definitely, I think, helpful, not even forcing people to do it, I think that would definitely see numbers, I know that they do some basic questions, looking to the well-baby visit charting, breastfeeding, feeding, self-feeding, basic questions, and then they don't go into as much detail as, you know, we would. So yeah, if there was more of a focus, you know, the government recommends, or some kind of statement where, you know, all blah blah age should be screened by a nutrition professional.

We don't have a lot of information on child health in general. We don't have a lot of information on nutrition in children. We have no information in Canada on children under three, nationally. There's no survey or anything, so I think there's a big gap. We have … limited information on a provincial level on this age group, and I think children do access primary health care. So I absolutely think NutriSTEP®, your team is on the right track, so I think it's very important. I think I am skeptical that one might be able to implement the NutriSTEP® province-wide in primary health care with no support.

Incentives

From the primary care practice perspective, incentives have been a tool that has been effective at moving initiatives to scale rapidly. Although most talked about financial incentives, other kinds of enhanced support for NutriSTEP® screening were also envisioned.

In general, implementing screening tools typically have come with incentives, so you know, like the 18 month developmental screening assessment.

When I was talking about incentives, because that always seems to work really well. Like diabetes or whatnot.

Build the Case for a Well-Supported NutriSTEP® in Primary Care

Provincial-level direction on NutriSTEP® would provide a solid case for the feasibility and benefit of NutriSTEP® screening in primary care by leveraging the necessary systems to support practices to implement the screening.

I don't think incentives is actually the big draw, I mean, I know I've said incentives, but I'm not sure that's meant as most peoples' drivers, I think people want to do good for their patients. So I think if the clinicians and the teams felt like the tool is useful for them, and they had resources to implement after completing the tool, and they saw results from those resources, and it didn't take them too long, and it didn't take away from their other work, then I think people would be very willing to implement screening tools, but I think one would need to show evidence of all

those things. So what could a public health unit do, and I guess the other sort of overall statement, is in my experience, when people feel, when primary care or consultants feel like they get support, or have someone to call when they're concerned, then I think people are much more likely to try new things.

Maybe offering things like lunch and learns, like having someone come into the practice and show the practice how they could actually use it within their setting, because every practice is different. So maybe having someone to basically be able to get an idea of how their practice runs, and then give them sort of ideas around it, and then support in how to use it or roll it out.

DISCUSSION AND IMPLICATIONS

This project set out to understand the current uses of NutriSTEP® in primary care practices in Ontario. The screening is being used effectively in the practices that participated in the research, with certain enabling factors being identified. In particular, the incorporation of NutriSTEP® into the well-baby or well-child visit was a common practice. Practices had made efforts, in various creative ways, to bring NutriSTEP® into their EMRs, but all were interested in a system that would bring NutriSTEP® screening results automatically into the EMR.

With the potential to have NutriSTEP® integrated into EMRs comes the potential for evaluation and surveillance uses of the data, both at the level of the practice and at the provincial level. Interviewees were supportive of the idea of provincial-level data pooled across practices. They recognized that provincial direction would be needed to achieve a scaled-up version of what they had been doing individually and in different ways.

Implications for EMR Vendors

There is interest among primary care practices in incorporating NutriSTEP® into EMRs, which would significantly reduce their data management burden. Some practices are already manually entering the NutriSTEP® data, but more streamlined incorporation of NutriSTEP® was an appealing prospect.

Implications for Primary Care

The practices interviewed for this research were using NutriSTEP®, often as part of the Well-Baby Visit or other structured visits. As with many screening tools, the overall number of concerns identified was low (for some settings), but practices where they were using the screen to go "beyond BMI" and identify risk and protective factors for obesity found that, regardless of the score, the screening starts an important conversation with parents. The use of the NutriSTEP® implementation toolkit may allow practices to feel more comfortable in how they are using the tool and how they respond to questions and concerns.

Implications for Public Health

NutriSTEP® is a Ministry-mandated public health unit accountability indicator. Public health units have several avenues open to them to support and promote the use of NutriSTEP, but certainly supports for primary care practices are needed and valued. Several primary care practices identified a need for more training and resources related to the use of NutriSTEP, and were not entirely familiar with NutriSTEP® implementation tools. Public health working with dietitians in primary care practices appears to be a direct route to being able to support their use of NutriSTEP® and make them aware of the resources that area available. Several practices relied on health units to provide hard copies of the screen, which was another enabling factor to get NutriSTEP® into use.

CONCLUSIONS

This research has contributed to an understanding of some enabling factors toward a collaborative healthy weights screening program that could be used for improving child health care and management, and for local population health assessment and surveillance purposes. The exploration of the significant potential for the integration of NutriSTEP® into EMRs is a clear next step from this study, to build understanding in practical terms of the feasibility of the main components of an EMR-based surveillance system for childhood healthy weights. A mechanism is needed to support interactions between public health and primary care practitioners, along with partners such as BORN Ontario and EMR vendors.

REFERENCES – PHASE 2

Dietitians of Canada (2012). Toddler and preschool nutrition: Background/population health/lifecycle pathway. Practice-Based Evidence in Nutrition [PEN]. Access by subscription [Internet] 2012. Available from: www.pennutrition.com.

Durlak, J.A. and DuPre, E.P. (2008) Implementation Matters: A Review of Research on the Influence of Implementation on Program Outcomes and the Factors Affecting Implementation. American Journal of Community Psychology, 41:327–350.

APPENDICES – PHASE 2

Appendix A: Interview Guide

Beyond BMI: Investigating the Feasibility of using NutriSTEP® and Electronic Medical Records as a Surveillance System for Healthy Weights including Risk and Protective Factors in Children

<u>Check:</u> Recruitment Screening Questions

1. Is NutriSTEP® screening used in your practice setting? If yes, which tools: Toddler, Preschooler, both?
2. Is NutriSTEP® screening used routinely or only occasionally?
3. Do you use an electronic medical record (EMR)? If so, which one?

Pre-Interview Questions: (To be answered before the interview)

<u>Practice Description</u>

- Describe type and size of practice; practitioner mix, # providers
- Population size (how many patients are rostered; how many patients seen annually; how many children in target ages (18 mos-5 years) seen annually)
- How many screens were completed in the past year (if possible to determine)

Interview Questions

<u>How NutriSTEP® is used</u>

1. Tell me about how NutriSTEP® is used in your practice setting.

- Prompts (asked if not covered):
    - Which tools: Toddler, Preschooler, both?
    - Which providers use it?
    - When/in what contexts/what guides decisions about when to use it? Is the screen administered at particular time points, such as 18 month well-baby visit, or other scheduled visits?
    - How long has it been in use?
    - There are several ways that practices access the tool. Are you the holder of the NutriSTEP® license, or have you received access through another means?
    - How do patients actually complete it?
    - How is the screen completed:

        - Guided (screen administrator reviews score, advises parent and parent is responsible to follow up on referrals)
        - Assisted (screen administrator reviews score, advises parent and follows up by forwarding appropriate referrals)
        - Self (parent independently reviews scores, identifies risk level and makes own referrals)
    - What is done with the screening results?
        - How are the data from the screen stored and entered (e.g., on paper, entered in to electronic database)?
        - If entered into EMR, what process is used for entry?

<u>Value of NutriSTEP® screening</u>

2. Why do you use NutriSTEP®?

- Prompts:
    - Do you have any organizational priorities re: child health? Does NutriSTEP® fit in at all to how you address the priorities?

<u>Challenges</u>

3. What challenges did or do you encounter with NutriSTEP® screening in your setting?

- Prompts:
    - Are there any other challenges with the use of NutriSTEP®?
    - Any challenges at the individual level (e.g., preferences of practitioners)? Any organizational factors?

<u>Enablers</u>

4. What factors enable NutriSTEP® screening to be used effectively in your setting/practice?

- Prompts:
    - Are there any other critical elements that facilitate the use of NutriSTEP®?
    - How easy was it to incorporate NutriSTEP® into your practice environment?
    - What is your perception of the extent to which providers find NutriSTEP® easy to use?
    - To what extent do you feel that this screening is a good fit for your practice setting (in terms of population served; in terms of staff mix)
    - Anything at the individual level (e.g., preferences of practitioners)? Any organizational factors?
    - Under what conditions would you *stop* using NutriSTEP®?

Applications of NutriSTEP

5. How have you adjusted the use of NutriSTEP® to make it work for your setting/population?

6. What is done once the screening is completed?

- Prompts:
    - Who interprets the results?
    - What actions are taken? (e.g., recommendations, follow-up, referrals)

7. Has any evaluation been done for screening and the follow up/referral process? If so, what are the results?

Surveillance Uses of NutriSTEP®

8. Have you done any yearly reporting/roll-up of nutritional status or risk among your patients? Would this be something you would consider? Why or why not?

9. If there were a provincial initiative to have primary care users of NutriSTEP® share their data for this type of surveillance/population-level purpose, would you be willing to share your data? What considerations would arise before doing so?

Future Considerations

10. Do you have any suggestions to improve the NutriSTEP® screening process at your setting?
11. What would it take to 'scale up': to use NutriSTEP® routinely, for all children in the age group (if not done now)?
12. How could Ministry and/or local public health contribute to enhance uptake?
13. Would you have an interest in implementing an e-version of the screen (to be completed by parents) and having this data linked to your EMR?
14. Are there other providers/practices in your region that are using NutriSTEP®? If yes, have you had any collaboration around its use?
15. Would you see value in having the NutriSTEP® screening used on an ongoing basis in primary care settings?

Appendix B: Recruitment and Consent Protocol

Recruitment email:

I am writing to invite your organization's participation in a research project that will focus on the use of NutriSTEP® screening in primary care settings. NutriSTEP® is a reliable screening tool that has been validated for assessing risk and protective factor data as it relates to child nutritional risk.

[If the initial contact is not the organization lead: If you feel that this project might be of interest to your organization, would you please respond to me with the name of your organization's lead, and please let them know that you are aware of the study and that they will receive an email inviting participation.]

The research is funded by Public Health Ontario as part of a Locally Driven Collaborative project titled: "Beyond BMI: Investigating the Feasibility of using NutriSTEP® and Electronic Medical Records (EMR) as a Surveillance System for Healthy Weights including Risk and Protective Factors in Children". The developers of NutriSTEP® are consulting with our research team and are in full support of this work.

We intend to interview approximately 10 primary care providers who currently use NutriSTEP® screening in paper form, with the following objectives:

- to understand the barriers and facilitators associated with the screening
- to examine how primary care sites interpret results and provide feedback to parents
- to determine receptivity of primary care sites to collect NutriSTEP® electronically and have it linked to EMR data.

If your organization chooses to participate, and is selected for participation, we will ask that a person from your practice setting who is knowledgeable about NutriSTEP® be available for a 1 hour telephone interview during the fall of 2014.

Participating organizations will be compensated, in acknowledgement of your valuable time and contribution. The organization and/or the interviewee may withdraw at any time or decline to answer any questions with no consequences. All data you provide will be kept confidential. Your organization will be listed as one of the participating sites, unless you advise us that you do not wish to be listed. No data will be presented as specifically linked to your organization. The identity of the interviewee will not be disclosed in any reporting arising from this research, although we may identify the interviewee's professional role (physician, dietitian, etc.). No patient data will be requested as part of this study.

Benefits to you will be the opportunity to contribute to the potential future implementation of NutriSTEP® more broadly in primary care settings, including the feasibility of an electronic form of NutriSTEP® that could be linked to EMR.

There are no known risks to participation. We are only interested in your experiences with NutriSTEP®, and will not link the interview data to your practice in any way.

By agreeing to participate in this research, you are agreeing to have the interview data used in reporting for the current project and other future uses of the data. You would be contacted again if we seek to access the data for a future research project.

There are three eligibility questions:

1. Is NutriSTEP® screening used in your practice setting? If yes, which tools: Toddler, Preschooler, both?
2. Is NutriSTEP® screening used routinely or only occasionally?
3. Do you use an electronic medical record (EMR)? If so, which one?

If participation in this research is of interest to you, please reply to me as soon as possible with your responses to these questions. We will be selecting ten primary care practices to participate in the research interviews. We will advise you if your site is selected for participation, based on our need for representation of different practice types across the province, and will invite you to identify an interviewee at that time.

Participating sites will receive a summary of the research by email in June 2015.

If you have any questions about the ethics process, you may contact:

Ido Vettoretti, MHS
Chair, Research Ethics Review Committee
Sudbury & District Health Unit
vettorettii@sdhu.com
Tel: 705.522.9200 x213

If you have any questions about the research, you may contact:

Lesley Andrade, MHSc, RD
Public Health Nutritionist
Sudbury & District Health Unit
andradel@sdhu.com
Tel: 705.522.9200 x364

Consent email for interviewee:

This research project focuses on the use of NutriSTEP® screening in primary care settings. The research is funding by Public Health Ontario as part of a Locally Driven Collaborative project titled: "Beyond BMI: Investigating the Feasibility of using NutriSTEP® and Electronic Medical Records as a Surveillance System for Healthy Weights including Risk and Protective Factors in Children". The developers of NutriSTEP® are consulting with our research team and are in full support of this work.

You have been invited to participate in this interview as a representative of your primary care setting which currently uses NutriSTEP® screening. If you choose to participate, you will participate in a 1 hour telephone interview during the fall of 2014, focused on:

- to understand the barriers and facilitators associated with the screening
- to examine how primary care sites interpret results and provide feedback to parents
- to determine receptivity of primary care sites to collect NutriSTEP® electronically and have it linked to EMR data.

Participating organizations will be compensated with a $200 honorarium, in acknowledgement of your valuable time and contribution. You may withdraw at any time or decline to answer any questions with no consequences. All data you provide will be kept confidential. Your organization will be listed as one of the participating sites, unless you advise us that you do not wish to be listed. No data will be presented as specifically linked to your organization. Your identity will not be disclosed in any reporting arising from this research, although we may identify your professional role (physician, dietitian, etc.). No patient data will be requested as part of this study.

Benefits to you will be the opportunity to contribute to the potential future implementation of NutriSTEP® more broadly in primary care settings, including the feasibility of an electronic form of NutriSTEP® that could be linked to EMR.

There are no known risks to participation. We are only interested in your experiences with NutriSTEP®, and will not link your interview data to your practice in any way.

By agreeing to participate in this research, you are agreeing to participate in an audiorecorded interview, and to have your interview data used in reporting for the current project and other future uses of the data. A transcript of the interview will be available for your review if you wish.

Participating sites will receive a summary of the research by email in June 2015.

If you have any questions about the ethics process, you may contact:

Ido Vettoretti, MHS
Chair, Research Ethics Review Committee
Sudbury & District Health Unit
vettorettii@sdhu.com
Tel: 705.522.9200 x213

If you have any questions about the research, you may contact:

Lesley Andrade, MHSc, RD
Public Health Nutritionist
Sudbury & District Health Unit
andradel@sdhu.com
Tel: 705.522.9200 x364

Appendix C: Recruitment and Consent Protocol for Practices in KFL&A Region

Recruitment email:

I am writing to invite your organization's participation in a research project that will focus on the use of NutriSTEP® screening in primary care settings. NutriSTEP® is a reliable screening tool that has been validated for assessing risk and protective factor data as it relates to child nutritional risk.

[If the initial contact is not the organization lead: If you feel that this project might be of interest to your organization, would you please respond to me with the name of your organization's lead, and please let them know that you are aware of the study and that they will receive an email inviting participation.]

The research is funded by Public Health Ontario as part of a Locally Driven Collaborative project titled: "Beyond BMI: Investigating the Feasibility of using NutriSTEP® and Electronic Medical Records (EMR) as a Surveillance System for Healthy Weights including Risk and Protective Factors in Children". The developers of NutriSTEP® are consulting with our research team and are in full support of this work.

We intend to interview approximately 10 primary care providers who currently use NutriSTEP® screening in paper form, with the following objectives:

- to understand the barriers and facilitators associated with the screening
- to examine how primary care sites interpret results and provide feedback to parents
- to determine receptivity of primary care sites to collect NutriSTEP® electronically and have it linked to EMR data.

If your organization chooses to participate, and is selected for participation, we will ask that a person from your practice setting who is knowledgeable about NutriSTEP® be available for a 1 hour telephone interview during the fall of 2014.

Participating organizations will be compensated, in acknowledgement of your valuable time and contribution. The organization and/or the interviewee may withdraw at any time or decline to answer any questions with no consequences. All data you provide will be kept confidential. Your organization will be listed as one of the participating sites, unless you advise us that you do not wish to be listed. No data will be presented as specifically linked to your organization. The identity of the interviewee will not be disclosed in any reporting arising from this research, although we may identify the interviewee's professional role (physician, dietitian, etc.). No patient data will be requested as part of this study.

Benefits to you will be the opportunity to contribute to the potential future implementation of NutriSTEP® more broadly in primary care settings, including the feasibility of an electronic form of NutriSTEP® that could be linked to EMR.

There are no known risks to participation. We are only interested in your experiences with NutriSTEP®, and will not link your interview data to your practice in any way.

By agreeing to participate in this research, you are agreeing to have your interview data used in reporting for the current project and other future uses of the data. A transcript of the interview will be available for your review if you wish.

There are three eligibility questions:

4. Is NutriSTEP® screening used in your practice setting? If yes, which tools: Toddler, Preschooler, both?
5. Is NutriSTEP® screening used routinely or only occasionally?
6. Do you use an electronic medical record (EMR)? If so, which one?

If participation in this research is of interest to you, please reply to me [by date] with your responses to these questions. We will be selecting ten primary care practices to participate in the research interviews. We will advise you if your site is selected for participation, based on our need for representation of different practice types across the province, and will invite you to identify an interviewee at that time.

Participating sites will receive a summary of the research by email in June 2015.

If you have any questions about the ethics process, you may contact:

Dr. Albert Clark, Chair,
Queen's University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board
clarkaf@queensu.ca
(613) 533-6081

If you have any questions about the research, you may contact:

Dr. Paul Belanger
Associate Director Knowledge Management
KFL&A Public Health
Paul.Belanger@kflapublichealth.ca
(613) 549-1232 ext. 1602

Suzanne Biro
Foundational Standards Specialist
KFL&A Public Health
Suzanne.Biro@kflapublichealth.ca
(613) 549-1232 ext. 1144

Consent email for interviewee:

This research project focuses on the use of NutriSTEP® screening in primary care settings. The research is funding by Public Health Ontario as part of a Locally Driven Collaborative project titled: “Beyond BMI: Investigating the Feasibility of using NutriSTEP® and Electronic Medical Records as a Surveillance System for Healthy Weights including Risk and Protective Factors in Children”. The developers of NutriSTEP® are consulting with our research team and are in full support of this work.

You have been invited to participate in this interview as a representative of your primary care setting which currently uses NutriSTEP® screening. If you choose to participate, you will participate in a 1 hour telephone interview during the fall of 2014, focused on:

- to understand the barriers and facilitators associated with the screening
- to examine how primary care sites interpret results and provide feedback to parents
- to determine receptivity of primary care sites to collect NutriSTEP® electronically and have it linked to EMR data.

Participating organizations will be compensated with a $200 honorarium, in acknowledgement of your valuable time and contribution. You may withdraw at any time or decline to answer any questions with no consequences. All data you provide will be kept confidential. Your organization will be listed as one of the participating sites, unless you advise us that you do not wish to be listed. No data will be presented as specifically linked to your organization. Your identity will not be disclosed in any reporting arising from this research, although we may identify your professional role (physician, dietitian, etc.). No patient data will be requested as part of this study.

Benefits to you will be the opportunity to contribute to the potential future implementation of NutriSTEP® more broadly in primary care settings, including the feasibility of an electronic form of NutriSTEP® that could be linked to EMR.

There are no known risks to participation. We are only interested in your experiences with NutriSTEP®, and will not link your interview data to your practice in any way.

By agreeing to participate in this research, you are agreeing to participate in an audio-recorded interview, and to have your interview data used in reporting for the current project and other future uses of the data. A transcript of the interview will be available for your review if you wish.

Participating sites will receive a summary of the research by email in June 2015.

If you have any questions about the ethics process, you may contact:

Dr. Albert Clark, Chair,
Queen's University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board
clarkaf@queensu.ca
(613) 533-6081

If you have any questions about the research, you may contact:

Dr. Paul Belanger
Associate Director Knowledge Management
KFL&A Public Health
Paul.Belanger@kflapublichealth.ca
(613) 549-1232 ext. 1602

Suzanne Biro
Foundational Standards Specialist
KFL&A Public Health
Suzanne.Biro@kflapublichealth.ca
(613) 549-1232 ext. 1144

Appendix D: Recruitment and Consent Protocol for Practices in Toronto Public Health Region

Recruitment email:

I am writing to invite your organization to participate in a research project that will focus on the use of NutriSTEP® screening in primary care settings. NutriSTEP® is a reliable screening tool that has been validated for assessing risk and protective factor data as it relates to child nutritional risk.

[If the initial contact is not the organization lead: If you feel that this project might be of interest to your organization, would you please respond to me with the name of your organization's lead, and please let them know that you are aware of the study and that they will receive an email inviting participation.]

The research is funded by Public Health Ontario as part of a Locally Driven Collaborative Project titled: "Beyond BMI: Investigating the Feasibility of using NutriSTEP® and Electronic Medical Records (EMR) as a Surveillance System for Healthy Weights including Risk and Protective Factors in Children". The developers of NutriSTEP® have consulted with our research team and are in full support of this work.

We intend to interview approximately 10 primary care providers who currently use NutriSTEP® screening in paper form, with the following objectives:

- to understand the barriers and facilitators associated with the screening
- to examine how primary care sites interpret results and provide feedback to parents
- to determine receptivity of primary care sites to collect NutriSTEP® data electronically and have it linked to EMR data.

If your organization chooses to participate, and is selected for participation, we will ask that a person from your practice setting who is knowledgeable about NutriSTEP® be available for a 1 hour telephone interview during the fall of 2014.

Participating organizations will receive a $200 honorarium, in acknowledgement of your valuable time and contribution. The organization and/or the interviewee may withdraw at any time or decline to answer any questions with no consequences. All data you provide will be kept confidential. Your organization will be listed as one of the participating sites, unless you advise us that you do not wish to be listed. No data will be presented as specifically linked to your organization. The identity of the interviewee will not be disclosed in any reports arising from this research, although we may identify the

interviewee's professional role (physician, dietitian, etc.). No patient data will be requested as part of this study.

Benefits to you will be the opportunity to contribute to the potential future implementation of NutriSTEP® more broadly in primary care settings, including the feasibility of an electronic form of NutriSTEP® that could be linked to EMR.

There are no known risks to participation. We are only interested in your experiences with NutriSTEP®, and will not link your interview data to your practice in any way.

By giving consent to participate in this research, you agree to participate in an audio-recorded interview and to permit the data generated from your interview to be reported in the current project. Your data will only be used in future related research projects with your consent. Do you agree to be contacted to provide consent regarding any future uses of your data for research purposes? A transcript of the interview will be available for your review if you wish.

There are three eligibility questions:

7. Is NutriSTEP® screening used in your practice setting? If yes, which tools: Toddler, Preschooler, both?
8. Is NutriSTEP® screening used routinely or only occasionally?
9. Do you use an electronic medical record (EMR)? If so, which one?

If participation in this research is of interest to you, please reply to me – Susan Snelling - [by date] with your responses to these questions. We will be selecting ten primary care practices to participate in the research interviews. We will advise you if your site is selected for participation, based on our need for representation of different practice types across the province, and will invite you to identify one or more persons knowledgeable with NutriSTEP® use as a potential interviewee, and will interview only one as a representative of your agency.

Participating sites will receive a summary of the research by email in June 2015.

If you have any questions about the ethics process, you may contact:

Ido Vettoretti, MHS
Chair, Research Ethics Review Committee
Sudbury & District Health Unit
vettorettii@sdhu.com

Tel: 705.522.9200 x213

If you have any questions about the research, you may contact:

Lesley Andrade, MHSc, RD
Public Health Nutritionist
Sudbury & District Health Unit
andradel@sdhu.com
Tel: 705.522.9200 x364

Sincerely,

Susan Snelling, PhD
Research Associate
susan@socialresearchconsulting.ca
Tel: 705.282.8044

Consent email for interviewee:

This research project focuses on the use of NutriSTEP® screening in primary care settings. The research is funded by Public Health Ontario as part of a Locally Driven Collaborative project titled: "Beyond BMI: Investigating the Feasibility of using NutriSTEP® and Electronic Medical Records as a Surveillance System for Healthy Weights including Risk and Protective Factors in Children". The developers of NutriSTEP® have consulted with our research team and are in full support of this work.

You have been invited to participate in this interview as a representative of your primary care setting which currently uses NutriSTEP® screening. If you choose to participate, you will participate in a 1 hour telephone interview during the fall of 2014, focused on:

- understanding the barriers and facilitators associated with the screening
- examining how primary care sites interpret results and provide feedback to parents
- determining receptivity of primary care sites to collect NutriSTEP® data electronically and have it linked to EMR data.

Participating organizations will receive a $200 honorarium, in acknowledgement of your valuable time and contribution. You may withdraw at any time or decline to answer any questions with no consequences. All data you provide will be kept confidential. Your

organization will be listed as one of the participating sites, unless you advise us that you do not wish to be listed. No data will be presented as specifically linked to your organization. Your identity will not be disclosed in any reports arising from this research, although we may identify your professional role (physician, dietitian, etc.). No patient data will be requested as part of this study.

Benefits to you will be the opportunity to contribute to the potential future implementation of NutriSTEP® more broadly in primary care settings, including the feasibility of an electronic form of NutriSTEP® that could be linked to EMR.

There are no known risks to participation. We are only interested in your experiences with NutriSTEP®, and will not link your interview data to your practice in any way.

By giving consent to participate in this research, you agree to participate in an audio-recorded interview and to permit the data generated from your interview to be reported in the current project. Your data will only be used in future related research projects with your consent. Do you agree to be contacted to provide consent regarding any future uses of your data for research purposes? A transcript of the interview will be available for your review if you wish.

Participating sites will receive a summary of the research by email in June 2015.

If you have any questions about the ethics process, you may contact:

Ido Vettoretti, MHS
Chair, Research Ethics Review Committee
Sudbury & District Health Unit
vettorettii@sdhu.com
Tel: 705.522.9200 x213

If you have any questions about the research, you may contact:

Lesley Andrade, MHSc, RD
Public Health Nutritionist
Sudbury & District Health Unit
andradel@sdhu.com
Tel: 705.522.9200 x364

If you agree, please respond to myself (susan@socialresearchconsulting.ca) by (date). I will then contact you to arrange an interview time.

Sincerely,

Susan Snelling, PhD
Research Associate
susan@socialresearchconsulting.ca
Tel: 705.282.8044

Appendix E: Coding Framework

- Provider characteristics
- NutriSTEP® characteristics
- Organizational characteristics
- How NutriSTEP® is used
- Facilitators
- What would help
- Challenges
- What would make you stop
- Value of NutriSTEP®
- Roll up or evaluation
- Provincial data sharing for surveillance
- Electronic administration of NutriSTEP®
- Collaboration with other NutriSTEP® users

Appendix F: Primary Care Practice Administration of NutriSTEP®

Practice #	Type of appointment	Who hands out	When	Self-completed or assisted	Discuss	Storage	Referral
1	Well baby visit (WBV)	Admin	Arrival for appointment	Self	Yes	Scanned and parent keeps hard copy and dietitian makes chart notes based on scan	To dietitian if moderate or high -- appointment made before they leave. Referral sent to dietitian through EMR
2	Well baby and in dietitian appointments	Dietitian or provider	In appointment	Done online with pt. Sometimes just ask some of the questions	Yes	Score entered in EMR	Give printout of strategies to improve. Dietitian summarizes into chart
3	Well baby and Healthy Beginnings appointment at 3 years	Provider	In appointment	Self; at 3 year old visits the parents complete e-screen online version.	No, just refer if moderate or high	Score entered in EMR	Refer as needed
4	Well baby	Provider	During appointment with nurse	Self or assisted as needed	If any questions	Returned to dietitian for review; Scanned into EMR; note and scores entered into EMR	Dietitian calls if moderate or high, offers appointment
5	Well child	Admin staff	Arrival for appointment	Self	Yes, may set a goal if needed	Scanned	To dietitian if high
6	Well child	Admin staff	Arrival for appointment	Self	If any questions	Returned to dietitian box for review; scanned; dietitian enters score into EMR	Contact for dietitian appointment if warranted, or talk by phone. Put score in chart.
7	Clinical dietitian appointment	Dietitian	During appointment with dietitian	Assisted	Yes	Paper copy kept in chart. Dietitian enters score into EMR	Discussed with dietitian
8	Clinical appointment	Research assistant	In appointment	Assisted	No	Entered into database	Results sent to MD for follow up as needed
9	Clinical appointment	Provider	In appointment	Self	Basis for conversation	Scanned into EMR	Referrals are sometimes a problem, because there is no dietitian available
10	Screening event	Dietitian	At event	Assisted (many ESL)	Yes	No	Offer dietitian appointment if moderate or high or if there is a need