Article

Implementation of a Novel Tool to Collect Milk Feeding Data on Infants in Primary Care Clinics

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Abstract

We aimed to capture milk feeding type in real time in a racially and socioeconomically diverse population. An electronic tool to assess milk feeding type at every medical visit for children aged 0 to 2 years was designed and incorporated into nursing workflows. The Milk Box tool was successfully added to the electronic clinical workspace of a large health system. There were eight clinics, with diverse characteristics, which incorporated the use of the Milk Box tool over 12 months. Time to 50% uptake of Milk Box varied from 3 to 5 months. Time to >80% uptake varied from 6 to 8 months. Our results show that Milk Box can be quickly incorporated into a clinical workflow when the team is given appropriate training and support. The tool also allows a primary care practice to study local breast milk consumption trends and to provide both individualized and system-level lactation support.

Keywords

infant feeding, breastfeeding, electronic health record, breast milk

Introduction

Breastfeeding is associated with numerous health benefits for both mother and child, including decreased rates of morbidity and mortality from a long list of offenders including gastrointestinal and respiratory infections, sudden infant death syndrome (SIDS), and maternal cancers.[1,2] Evolving research about the infant microbiome is exploring how exclusive breastfeeding may prevent disease in the newborn period and later in life.[3-5] The economic burden of not breastfeeding affects individual families as well as the United States as a whole.[6] The detrimental health impacts of not breastfeeding affect non-white populations at disproportionate rates.[7,8]

Improving breastfeeding rates has been a perennial national and international quality improvement goal.[9] In the United States, Healthy People 2030 goals aim to increase the proportion of infants who are breastfed exclusively through 6 months of age to 42.4%, and who are breastfed at 1 year to 54.1%.[10] Despite breastfeeding rates increasing since 2009, infants in the United States are still not meeting these goals. Currently, 25.8% of infants are breastfed exclusively through 6 months and 35% are breastfed at 1 year.[10] Breastfeeding disparities are increasing among infants living in the Southeast United States and among non-Hispanic black infants.[8]

Information for assessing US rates and trends in breastfeeding comes from The Centers for Disease Control and Prevention (CDC) annual Breastfeeding Report Card. The Report Card summarizes information on breastfeeding collected through the National Immunization Survey-Child (NIS-Child),[11] which surveys households with children aged 19 to 35 months via random digit dialing to obtain vaccination and

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breastfeeding data. Although these data are the main form of reporting breastfeeding rates in the United States, they may not represent local rates and trends.[12,13] National and even state-level prevalence of breastfeeding may be less likely to mirror local demographics that include race, ethnicity, level of education, language spoken, payer, and other important descriptors.

Prior research that reviewed an electronic health record (EHR) for breastfeeding data suggested that EHR data provide a more representative assessment of local population feeding trends than an analysis of survey data.[14,15] However, longitudinal assessment of key factors in child health, such as breastfeeding rates, is not typically available in EHRs.[16] Therefore, we aimed to incorporate a tool into the EHR to capture breastfeeding rates among infants over time. This type of tool adds a critical health measure not typically found in EHR systems. These data can then be analyzed to provide ongoing surveillance and to identify specific actionable opportunities to improve breastfeeding rates. Here, we describe the successful design and implementation of a milk feeding assessment tool in the EHR as a necessary first step to understand and improve breastfeeding rates.

Methods

In 2016, a group of physicians, nurses, and other staff at Duke Children's Primary Care (DCPC) discussed the need to have accurate milk feeding type (i.e., what kind of milk a baby is receiving: breast milk, formula, or a combination of both) data for our patients. DCPC is an academic pediatric practice affiliated with Duke University Medical Center and has 3 different locations in Durham, NC. It employs more than 40 faculty members, trains more than 70 pediatrics and medicine-pediatrics residents, delivers care to about 30000 infants, children, and adolescents per year, and has more than 72000 annual patient visits. The pediatric population served at DCPC is similar to the population of Durham, with 54% of patients identifying as white/mixed/other, 35% black or African American, and 16% Hispanic/Latino. The overall Medicaid rate is 49% and ranges from 28% to 65% by location.

We engaged a partner (co-author T.K.) at another institution, who designed a tool in her clinical setting to address the same need to clarify milk feeding type. Her experience with this tool led us to identify key goals for implementation: (1) design a question with 3 simple response choices (available in English and Spanish), (2) place the information in a high visibility area of the EHR (alongside other measurements obtained during clinical intake, eg, vital signs), and (3) use a codified field in the EHR rather than free text so data could be easily extracted.

We adapted the existing tool for use at our own institution. To assess milk feeding type in one question we asked: "Since your child's last well visit, what have you been feeding your child: breast milk only; formula/other milk only; breast milk and formula/other milk?" This question became known by our providers as the "Milk Box" question.

We made it possible to obtain the response to the Milk Box question via 3 different methods (Figure 1). These 3 methods were interconnected, and all of them delivered the responses into a common data repository: an EHR flowsheet assigned specifically to Milk Box. By design, the data collected in this flowsheet could then automatically be extracted and placed into a prominently visible location in the clinical documentation at the point of care, as well as into reports for future research.

The first (and preferred) method to capture a response to the Milk Box question was to send caregivers a previsit questionnaire via our online patient portal. The Milk Box question was asked in this questionnaire and the 3 possible responses (option to select only 1) were listed as menu items. This questionnaire was available to any caregiver with a child proxy account and was delivered 1 week before any scheduled well visit for children between 0 and 2 years of age.

The second method available was to allow a direct response from the caregiver via an electronic tablet at the time of the visit. The format was similar to that presented in the patient portal. This option was available for clinics that routinely used electronic tablets during the check-in process. It captured responses by caregivers with online patient portal access (who had not yet answered their preclinic questionnaire before arrival to clinic) as well as by caregivers without online patient portal access. Both methods 1 and 2 increased the efficiency of capturing responses to Milk Box and maximized the opportunities for families to respond before entering an actual exam room.

The third method required the clinic staff member responsible for putting the patient in an exam room to ask the Milk Box question directly of the caregiver. The staff member would then transcribe the caregiver's verbal response into the associated flowsheet in the EHR. This method was used if and when the caregiver had not yet responded to the Milk Box question via method 1 (online patient portal) or method 2 (tablet).

While our initial workflow design allowed for electronic completion via the patient portal (method 1) and the clinic tablets (method 2) at the time the electronic build was approved, during our initial deployment the percentage of patients who were enrolled in our patient

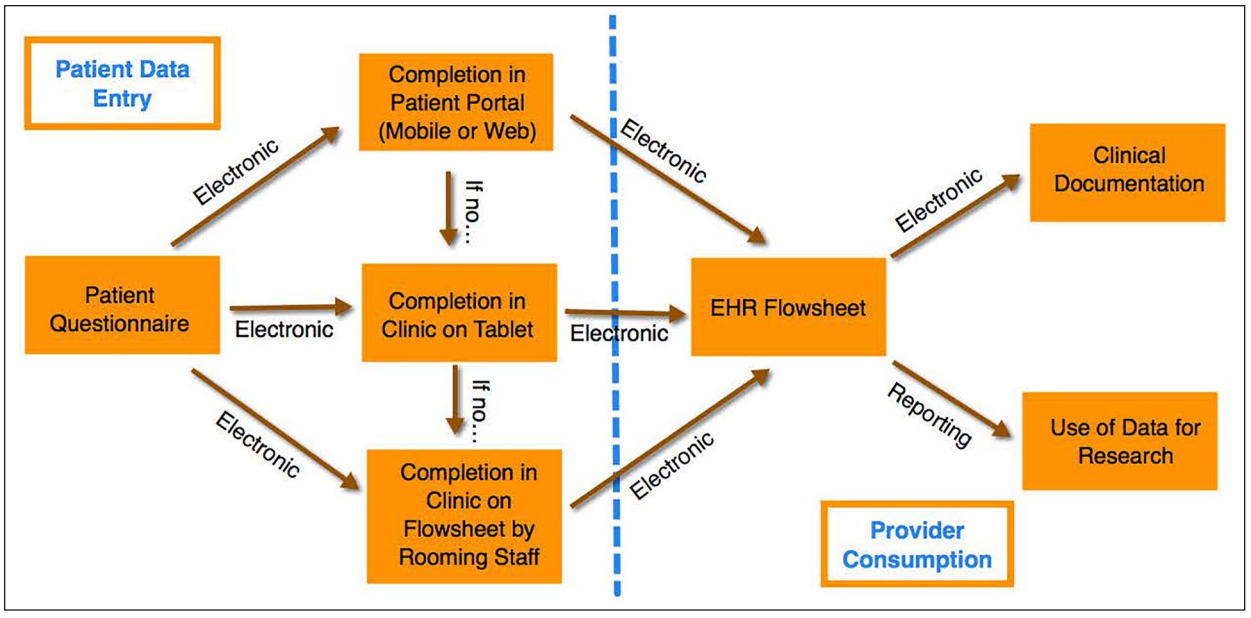

Figure 1. Flow of information for Milk Box data from patient entry to provider consumption.

Milk Box - Type of Milk being fed to 0-24 month		11/13/2019	12/15/2019	1/16/2020	2/27/2020
Since your child's last well visit, what have you been feeding your child? / ¿ Desde la ultima cita de control de su hijo/a hasta hoy, que le ha dado de beber?		Breast Milk and Formula / Other Milk / (Leche materna y formula / otro tipo de leche)	Breast Milk Only / (Leche materna)	Breast Milk Only / (Leche materna)	Formula / Other Milk Only / (Formula / otro tipo de leche)

Figure 2. Sample of Milk Box data summary table as it appears to clinicians in a well-child documentation template.

portal was still relatively low, and we had not yet acquired tablets for the sites where we were launching Milk Box. As a result, in the initial implementation of Milk Box, it was method 3 (in-person assessment) that was most frequently used to collect data. The intent was that we would gradually expand the use of method 1 as our patient portal enrollment improved and the use of method 2 once we had sufficient tablets available.

The information entered in Milk Box was designed to automatically import into the health system's Well Child documentation templates (Figure 2). Up to 7 previously recorded answers to the Milk Box question appeared in the form of a table, alongside the response for that day's visit. The direct visualization of the Milk Box data in an electronic clinical Progress Note allowed the user to easily see milk feeding type over time. As part of routine well-child visits, providers then had the opportunity to review the caregiver response to the Milk Box question with the caregiver present during the face-to-face encounter as a way to verify the accuracy of the information captured. If and when the provider discovered that the family misunderstood the question (e.g., mother initially answered "formula/other milk only" to the nurse but then told the doctor she also did some breastfeeding at night), the provider could then go back to edit the response so that the most accurate data were recorded.

In November 2016 (Figure 3), we obtained approval to incorporate the Milk Box tool, as described above, into our health system's EHR. In January 2017, DCPC leadership decided to implement the use of Milk Box in all 3 of its clinics and the tool was introduced to faculty

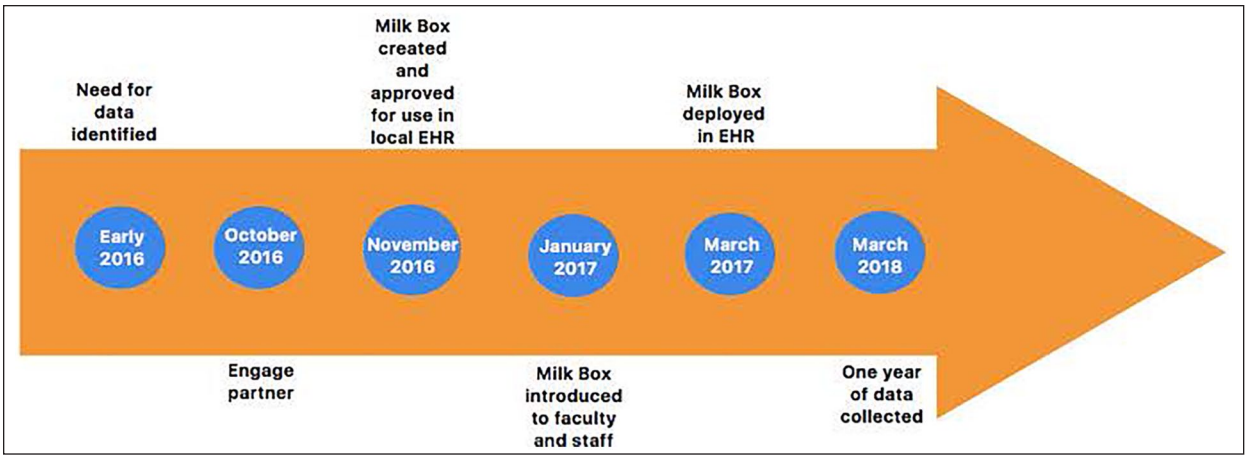

Figure 3. Timeline for development and implementation of Milk Box tool.
Abbreviation: EHR, electronic health record.

Figure 4. Visualization of the Milk Box tool, with dual language display, in sample electronic clinical workspace.

and nursing staff. The initial workflow was developed in conjunction with nursing leadership. The goal for deployment within DCPC was to have Milk Box completed at every patient visit, including both sick and well visits, for all children aged 0 to 2 years.

In March 2017, Milk Box went live in the EHR and became available to all clinics under the Duke Health umbrella that provided primary care to children, including the 3 DCPC sites and any affiliated clinics. We collected data from every instance of Milk Box completion across the Duke Health system from March 2017 until March 2018 to assess implementation and uptake over its first 12 months of use. As previously mentioned, the majority of these data were collected via method 3, though the other 2 methods were available and sometimes used.

This study was approved by the Duke University Health System Institutional Review Board.

Results

The Milk Box tool was successfully added to the clinic visit electronic workspace and was made available to all clinicians caring for children in the Duke Health System (Figure 4). This tool allowed the person obtaining the information (eg, nurse) to easily enter milk feeding type data obtained during the clinic visit. A very small percentage of families entered their information prior to the visit (0.2%). The question was formatted with dual language display, using both English and Spanish.

There were 8 clinics in the Duke Health system with Milk Box data available between March 2017 and March 2018. The clinics that used the Milk Box tool had both similar and distinguishing characteristics (Table 1). Clinics 1, 2, and 3 are part of DCPC. There are also 5 affiliated pediatric primary care clinics in the Duke Health System, not part of DCPC, which reported the use of the Milk Box tool.

Clinic 1 was the initial DCPC site used for deployment of the Milk Box tool. This clinic provides the majority of patient care for DCPC and is the location where the largest number of faculty members practice. Faculty members at DCPC provide care only at their home clinic and there is no routine overlap of practice location among providers. Clinic 1 is also the primary teaching site for pediatrics and medicine-pediatrics

Table 1. Characteristics of Clinics in the Duke Health System that Used Milk Box Between March 2017 and March 2018.

Characteristic	Clinic 1	Clinic 2	Clinic 3	Affiliated (n = 5 clinics)
Residents on site	Yes	Yes	No	No
Number of faculty	22	9	4	4-10
Champion[a] on site	Yes	No	No	No
IBCLC[b] on site	Yes	Yes[c]	Yes[c]	Mixed[d]
Accept Medicaid	Yes	Yes	Yes	Yes
Total unique patients served per year	14957	10785	5908	NA
Total number of encounters per year	31007	23758	12714	Range (2501-15544)

[a]Champions took ownership of the project, assisted with implementation, were responsible for necessary changes in practice patterns, and helped in encouraging the use of the Milk Box tool.
[b]International Board Certified Lactation Consultant.
[c]IBCLC available on site some days of the week.
[d]Three out of 5 affiliated clinics had an IBCLC available.

residents. Clinic 2 hosts a smaller group of pediatric residents for their weekly primary care clinic. Clinic 3 does not have residents. During the initial deployment of Milk Box, International Board Certified Lactation Consultants (IBCLCs) were available at clinic 1 regularly, and less frequently at clinics 2 and 3.

DCPC's rollout of Milk Box was directed by a breastfeeding task force located at clinic 1. This task force is made up of physicians, nurses, IBCLCs, and other allied health professionals that meet once a month to discuss ways to improve the practice's support for breastfeeding families. During the initial phase of Milk Box deployment, the task force reviewed implementation, challenges, and successes at every meeting. The physician and nursing leaders in this group were designated the operational champions. They took ownership of the project, assisted with implementation, were responsible for necessary changes in practice patterns, and helped encourage providers and staff to use the tool.

The Milk Box tool was also discussed periodically at clinic 1's operational meetings, which occurred monthly and included representatives from the clinical, clerical, nursing, administrative, and medical cohorts of the practice. Based on the feedback from these meetings, iterative changes were made at clinic 1 that improved the workflow around the tool, with the goal of providing complete uptake at every eligible patient care visit.

The physician and nursing leaders at clinic 1 provided guidance on implementation of Milk Box to clinics 2 and 3 via email and telephone. These regular communications allowed for similar iterative changes at those clinics to improve site-specific workflow. Updates on Milk Box at division-wide medical provider meetings allowed faculty at all 3 sites to become engaged in the active use of the tool. The physician leader for the Milk Box tool (author GMMP) was able to directly contact the medical directors at clinics 2 and 3 to troubleshoot any implementation problems.

The other Duke-affiliated pediatric primary care clinics (n = 5) were made aware of the Milk Box tool via their EHR liaisons, who were clinician leaders from general pediatric and family medicine practices in the Duke Health system. The EHR liaisons attended monthly meetings for stakeholders of the Duke Health System, during which electronic tools for the care of children in the health system were discussed and approved. These EHR liaisons had previously approved the build of the Milk Box tool. When the Milk Box tool was made available to all sites, their EHR liaisons were given tip sheets and slide presentation summaries of all the features of the new Milk Box tool. These sites did not have any operational champions, like the 3 DCPC sites did, to provide site-specific guidance on how to use the tool or to help encourage the use of the tool by their providers.

The EHR was queried to determine how often Milk Box was completed during well child visits for children aged 0 to 2 years (Figure 5). More than 30000 visits in this category took place at all 8 sites between March 2017 and March 2018. Most of the Milk Box usage occurred at DCPC's clinics 1, 2, and 3.

The uptake of Milk Box at clinic 1 reached greater than 50% within 3 months of implementation, and greater than 80% by 6 months. Uptake of Milk Box at clinic 2 was similar to clinic 1. Uptake of Milk Box at clinic 3 reached greater than 50% at 5 months, and greater than 80% by 8 months. Usage of Milk Box at affiliated practices hovered below 10% for the entire 12-month study period.

Discussion

Our team successfully developed a tool, Milk Box, to capture milk feeding type data in our EHR for children aged 0 to 2 years. We believe this implementation process could be replicated across many health systems for successful real-time capture of infant feeding data. The

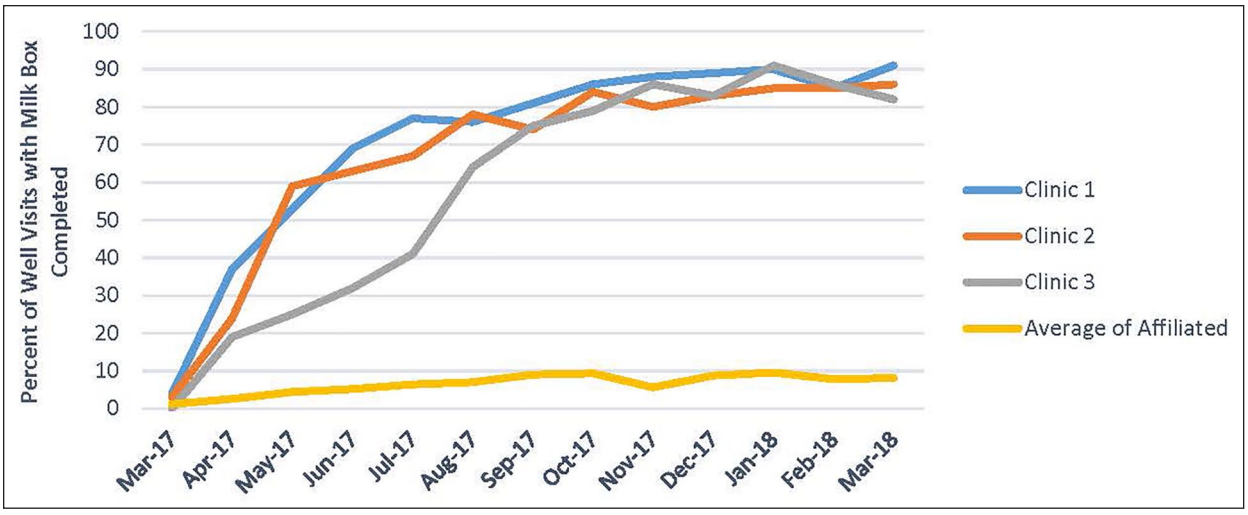

Figure 5. Uptake of Milk Box in 4 different types of clinics.

uptake data show that implementation of this tool can be successful across multiple sites with one central group of champions leading the effort. Near complete utilization at all well visits can be achieved in less than 1 year's time.

Success rates for utilization were much higher at Duke Children's Primary Care, where Milk Box champions were an integral part of the process, provided training, ongoing guidance, and motivation to providers and clinic staff. Their leadership encouraged the use of Milk Box correctly and consistently. The Duke-affiliated clinics did not have their own champions on site. This highlights the likely positive impact that on site or accessible champions have on Milk Box utilization rates. Next steps included engaging with these affiliated sites to understand their needs and barriers to improve implementation of Milk Box.

The presence of an IBCLC on site is also likely to have a positive influence on uptake of the tool. Clinic 1, with an IBCLC on site every day, had the fastest rate of uptake of Milk Box. Clinics 2 and 3, with an IBCLC on site only a few days of the week, had slower rates of uptake. Providers without an IBCLC on site may not feel well equipped to counsel on issues that are brought up when administering the tool, affecting their likelihood to administer it.

Support by the health care provider is only one of the many layers of support that leads to successful breastfeeding. Improving breastfeeding rates in one's community requires knowledge of breastfeeding patterns at the local level as well as individualized, timely data that can be used to personalize interventions to those mother–baby dyads most at risk of reduced breastfeeding duration.[17]

Prior efforts to report breastfeeding rates using an EHR have relied on retrospective chart review.[14] Challenges with using retrospective EHR data for secondary purposes include incomplete feeding data and the need for manual abstraction when automatic abstraction is not possible. Implementation of our tool allows for a more complete data set, with nearly 100% of all children at DCPC who visited their primary care medical home for well-child care providing their milk feeding type. To our knowledge, there are no other reports of this kind in the published literature.

It is questionable how well the national data reflect the feeding practices of all families in the United States, and whether they capture those with low literacy and/or immigrants and others who may be hesitant to complete written or telephone surveys. Breastfeeding rates are known to vary widely by race and other demographic factors.[18] The population in our study shows a diverse sample by race, income (based on health insurance payer), and primary language spoken. Milk Box offers a novel way to study the intersection of breastfeeding and social determinants of health. These data will be crucial when designing policy and interventions to address gaps in breastfeeding support.

Future directions of the Milk Box concept include use by other clinics and institutions, sharing of data, and efficient data abstraction from the EHR for research purposes.[19] With the rise of EHR use across the country, one could imagine a national Milk Box repository that would allow extensive analyses of breastfeeding practices at a national level.[20] While milk feeding-type data were mostly obtained via in person assessment, adoption of the Milk Box tool may improve as patient portal enrollment increases and more tablets become available.

There were several limitations to the study. Our data come from the responses of the caregiver present at that clinic visit, who may not be the one primarily responsible for feeding the infant and thus may not provide an accurate answer. It is also possible that the responses given to nursing/intake staff or responses via previsit questionnaire differed from what was discussed with the infant's health care provider in the exam room, and we were not able to assess how many times the clinician edited responses to the tool after clarifying with families. As with any tool that relies on delivery by different individuals, there is the possibility that the language of the question was not standardized at every collection.

We acknowledge that our question only asks about qualitative milk intake, not quantitative, and does not address breastfeeding exclusivity like the NIS-Child survey does, which asks about other liquids like juice or tea. These decisions were guided by a desire to match what is presented on the Breastfeeding Report Card and to make implementation practical in a busy clinical setting. In addition, there was no prompt provided for the use of human donor milk, and it is unclear if families using it would choose the "breast milk only" option or one of the others. The use of consistent definitions of breastfeeding in the research literature is an ongoing challenge.[21]

The Milk Box tool was designed and implemented because of a clinical imperative to create a reliable system of data capture. We believe the implementation strategies presented here could be successfully used in other clinics both in our system and in other health system contexts. Further development and implementation of the Milk Box tool, and assessment of its derived data, could be used as part of a larger quality improvement project, with its formal methodology, in the future.

Conclusion

We successfully implemented Milk Box, an EHR tool that prospectively captures real time breastfeeding rates in an outpatient primary care setting, allowing clinicians to respond to changes in milk feeding type for an individual mother–baby dyad and react promptly with support as needed. Our results show that Milk Box can be quickly incorporated into a nursing workflow when the clinical team is given appropriate training and support, and is most successful with on site with physician and staff champions. Patient portals and electronic tablets at the point of care can be used to capture data directly from patients and can ease the burden on clinical staff. Milk Box allows ongoing analysis of local breast milk consumption trends and associations between milk feeding and other elements in the EHR and could be implemented easily across many health care settings.

Author Contributions

GMMP: Conceptualized and designed this study; contributed to analysis and interpretation of data; drafted the manuscript; critically revised the manuscript; gave final approval; agrees to be accountable for all aspects of work ensuring integrity and accuracy.
DSM: Assisted with the electronic design of the tool, including the direct build of the EHR patient portal and tablet questionnaires, as well as the data-visualizing flowsheet, documentation and reporting tools for clinicians working in the EHR; contributed to analysis and interpretation of data; critically revised the manuscript; gave final approval; agrees to be accountable for all aspects of work ensuring integrity and accuracy.
EAH: Contributed to analysis and interpretation of data; critically revised the manuscript; gave final approval; agrees to be accountable for all aspects of work ensuring integrity and accuracy.
MCK: Conceptualized and designed this study; performed analyses and interpretation of data; critically revised the manuscript; gave final approval; agrees to be accountable for all aspects of work ensuring integrity and accuracy.
SKS: Contributed to interpretation of data; critically revised the manuscript; gave final approval; agrees to be accountable for all aspects of work ensuring integrity and accuracy.
KRJ: Contributed to interpretation of data; critically revised the manuscript; gave final approval; agrees to be accountable for all aspects of work ensuring integrity and accuracy.
EE: Contributed to conception of Milk Box tool and design of study; contributed to interpretation of data; critically revised the manuscript; gave final approval; agrees to be accountable for all aspects of work ensuring integrity and accuracy.
TK: Contributed to interpretation of data; critically revised the manuscript; gave final approval; agrees to be accountable for all aspects of work ensuring integrity and accuracy.
CTW: Conceptualized and designed this study; performed analyses and interpretation of data; helped draft initial manuscript; critically revised the manuscript; gave final approval; agrees to be accountable for all aspects of work ensuring integrity and accuracy.

Declaration of Conflicting Interests

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