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Outcome measures in interventions that enhance breastfeeding initiation, duration, and exclusivity: A systematic review

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Abstract

Objective—The purpose of this review was to examine outcome measures used in interventions focusing on enhancement of breastfeeding initiation, duration, and exclusivity.

Methods—A literature search guided by search terms on outcome measures of breastfeeding interventions was conducted using PubMed, CINAHL Plus, & PsycINFO databases on publications between 2006 and 2017.

Results—Nine studies were included in this review, using PRISMA guidelines. Rates of breastfeeding initiation, duration, and exclusivity were measured during specific points in time. Data collection methods involve interviews, self-report, observations, and/or feeding logs. Although breastfeeding types (exclusive breastfeeding, predominant breastfeeding, and complementary breastfeeding) were measured, methods of infant feeding (breastfeeding and bottle feeding) were rarely assessed, ignoring significant mediators or moderators of breastfeeding.

Conclusions—There were methodological limitations to the reviewed studies: (1) a 24-hour recall bias, (2) misclassification of breastfeeding categories, (3) lack of consistency in breastfeeding definitions, and (4) few reports of the reason for breastfeeding discontinuation. Future studies should focus on the modifiable cause of the problem: outcome measures attributed to the targets of the intervention, followed by breastfeeding initiation, duration, and/or exclusivity.

Keywords

Breastfeeding; Outcomes; Measures; Randomized controlled trials

Introduction

Breastfeeding increases an interactive process between mother and infant (Wood & Sanders, 2018) and is an optimal feeding method for infants. Benefits of breastfeeding affect infant health, a child's long term health, and maternal health. The World Health Organization (WHO, 2002) and the American Academy of Pediatrics (AAP, 2012) recommend exclusive breastfeeding either through direct breastfeeding or expressed milk in a bottle for the first 6

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months and partial breastfeeding with combination of complementary foods for at least 1 year and preferably for up to 2 years or beyond; therefore, breastfeeding initiation, duration, and exclusivity are major outcomes for breastfeeding intervention studies.

Randomized controlled trials (RCTs) represent the gold standard for evaluating the effectiveness of interventions when they are appropriately designed, tested, and analyzed. They provide causal relationships between independent variables and dependent variables. The RCT method minimizes potential threats to internal validity, strengthening validity of the inference and evidence (Polit & Beck 2017). Earlier, we proposed that an intervention should not directly try to change problems such as breastfeeding initiation, duration, and exclusivity, but instead focus on a modifiable cause of breastfeeding discontinuation (e.g. maternal perception of infant behavior: the modifiable cause of perceived insufficient milk) (Wood, Woods, Blackburn, & Sanders, 2016). Choice of outcomes should be attributable to the target of the intervention: the modifiable cause of breastfeeding discontinuation. Primary outcomes are the most important outcomes with the greatest intervention effect. Secondary or tertiary outcomes have intermediate connection to the intervention and the least intervention effect.

The purpose of this review is to analyze measures for breastfeeding that were used to examine outcomes including at a minimum, breastfeeding initiation, duration, and/or exclusivity in RCTs. Strengths as well as limitations of the outcome measures are analyzed. Recommendations are generated for improvement of the outcome measures.

Method

A literature search was conducted with consultation from a nursing liaison librarian at the University of Washington, using the PRISMA guidelines (Moher, Liverati, Tetzlaff, Altman, & The PRISMA Group, 2009). Search engines: PubMed/MEDLINE (National Library of Medicine), CINAHL Plus (EBSCO), and PsycINFO (EBSCO) were used. Search terms included breastfeeding, feeding behavior, prenatal/patient education, health promotion, social support, perinatal/prenatal/intrapartum/postpartum care, and postpartum period. Additional limits included RCTs, humans, English language, female, and January 2006 to March 2017. Through this process, 229 articles were retrieved as follows: PubMed/MEDLINE (n = 168), CINAHL Plus (n = 42), and PsycINFO (n = 19). After two duplicates were eliminated, 227 abstracts were reviewed. Abstract selection criteria included breastfeeding intervention tested, control group used, randomization to study group, and breastfeeding status as study outcomes, 208 articles were excluded. Then 19 full-text English articles were reviewed after the study criteria were met. Criteria were studies of outcomes of breastfeeding initiation, duration or exclusivity as a primary or secondary and/or tertiary outcome, healthy term singleton infants and healthy mothers, no smoking, alcohol or drug abuse during pregnancy and throughout the postpartum period. Exclusion criteria included studies targeting adolescents, mothers with HIV positive status, and study outcomes focused on breastfeeding friendly hospital practices. Ten articles were excluded due to incongruity with exclusion criteria. Nine articles met the selection criteria and were included in the review (see Figure 1).

Standardized Definitions of Breastfeeding

The Interagency Group for Action on Breastfeeding (Labbok & Krasovec, 1990) first developed standardized terminology to assess breastfeeding and test interventions. Definitions include full breastfeeding, partial breastfeeding, and token breastfeeding. The terminology was categorized this way because of a dose response relationship between the different levels of breast milk consumed and health outcomes including morbidity and mortality in the infant and fertility consequences in the mother.

In 1991 WHO, for simplicity, proposed modifications to the definitions as outlined by IGAB. The definition then focused solely on what enters the infant's mouth. There are three types of breastfeeding: exclusive breastfeeding, predominant breastfeeding, and complementary breastfeeding, and two methods of infant feeding: breastfeeding and bottle feeding. In 2008, WHO changed exclusive breastfeeding to infants exclusively getting breast milk in addition to allowing oral rehydration salt drops, and syrups that contain vitamins, minerals, and medicines.

There are similarities and differences in breastfeeding definitions between IGAB (Labbok & Krasovec, 1990) and WHO (1991; 2008). Both agencies do not differentiate between the physical and psychological effects of direct breastfeeding on the breast and those of indirect breastfeeding such as bottle feeding with expressed milk. The breastfeeding category of "token" which include infant comfort and consoling measures was omitted in the WHO. The terminology of WHO has changed from "almost exclusive breastfeeding" to "predominant breastfeeding." There is an acceptance of oral rehydration salt in the category of exclusive breastfeeding in the WHO (2008) terminology. For the methods of infant feeding in the WHO (2008) definition, it is not clear that which category expressed milk in a bottle falls.

The statement of age-based feeding recommendations by WHO (1991) is consistent with the health benefits and protective effects in the systematic review by Kramer and Kakuma (2012). Exclusively breastfeeding mother and infant dyads for 6 months received several more health benefits than mother and infant dyads who were exclusively breastfed for 3 to 4 months followed by a mixed feeding. Mixed feeding is defined as in a combination of breast milk and formula milk. Those health benefits for exclusive breastfeeding for the first 6 months include lower risk of gastrointestinal infection for the infant, more rapid maternal weight return to pre-pregnancy size after childbirth, and delayed onset of menstrual periods (Kramer & Kakuma, 2012). Early initiation of breastfeeding refers to mothers who put her infant to the breast within one hour after birth (WHO, 2017). Breastfeeding duration was equivalent with the infant age when the mother completely stopped breastfeeding.

Results

Operational Definitions of Breastfeeding

The types of breastfeeding were defined using different terminology across different studies. Five out of nine studies adapted the definitions of "exclusive breastfeeding" from WHO (1991), two studies from WHO (2008), and in two studies definitions were adapted from IGAB (Labbok & Krasovec, 1990) (Table 1). Noel-Weiss, Rupp, Cragg, Bassett, &

Woodend (2006) adapted six categories by IGAB (Labbok & Krasovec, 1990) and delineated exclusive breastfeeding into directly breastfeeding or expressed milk in a bottle. Moore and Anderson (2007) did not consider expressed milk by pumping to be breastfeeding because the primary outcome was success of first breastfeeding with emphasis on the sucking component of the infant, not the amount of breast milk consumed.

“Any breastfeeding” refers to any types of breastfeeding except exclusive breastfeeding (Fu et al., 2014; Kronborg, Maimburg, & Vaeth 2012; Moore & Anderson, 2007; Su et al., 2007). “Predominant breastfeeding” contains vitamins, minerals, water, juice, or ritualistic feeds given infrequently in addition to breastfeeding (Ahmed, Roumani, Szucs, Zhang, & King, 2016; Mattar et al., 2007). However, Ahmed et al. (2016) re-categorized this to “partial” which includes predominant breastfeeding and formula feeding because of a low response rate in that category.

Two studies defined breastfeeding initiation differently from the WHO (1991): Matter et al. (2007) described breastfeeding initiation within the first 2 weeks of delivery, and Moore and Anderson (2007) in the first 2 hours of birth. Duration of breastfeeding was equal to the infant’s age when the mother completely stopped breastfeeding.

Types of Outcome Measures

The majority of studies measured rates of breastfeeding initiation, duration, and exclusivity as a primary and/or secondary outcome. There was variability among the studies on the time points when data were collected.

Primary Outcomes—Table 2 shows primary outcomes. Primary outcomes were recorded for initiating breastfeeding by means of breastfeeding success in terms of infant breastfeeding behavior as well as breastfeeding rate at birth. Rate of exclusive breastfeeding was collected at a single point from birth to 6 months. Duration of exclusive breastfeeding was measured by number of days, weeks, and months in the first 6 months.

Secondary Outcomes—Secondary outcomes were recorded for the rate of exclusive breastfeeding at varied points in time or along with any or full breastfeeding rate (Table 3). Other outcomes were measured including breastfeeding problems at 1 month postpartum (Moore & Anderson, 2007), level of mother’s breastfeeding knowledge (Kronborg et al., 2012), breastfeeding self-efficacy (Kronborg et al., 2012; Noel-Weiss et al., 2006), postpartum depression (Ahmed et al., 2016), and mother’s satisfaction during breastfeeding (Kronborg, Vaeth, Olsen, Iversen, & Harder, 2007).

Data Collection Methods

Data collection methods varied among studies (Table 4). Breastfeeding initiation was assessed using chart reviews, breastfeeding observations, and online surveys by research assistants. Rate of exclusive breastfeeding was collected after the interventions which include prenatal lactation consultant support (Mattar et al., 2007), postpartum support by RNs (Kronborg et al., 2007), web-based breastfeeding support (Ahmend et al., 2016; Giglia, Cox, Zhao, & Binns, 2015), weekly post-discharge breastfeeding telephone support by

research nurses (Fu et al., 2014). Timing of data collection was different across studies, ranging from birth to 1 year. Duration of breastfeeding up to 6 months postpartum was assessed by number of weeks or days of different types of breastfeeding using either mailed or emailed questionnaire surveys, online surveys, or telephone interviews.

Definition of exclusive breastfeeding varied across studies; therefore caution is warranted when interpreting results of collective studies. However, it is likely that exclusive breastfeeding was explained either as the infant receiving only breast milk or by inversely asking whether the infant has received anything besides breast milk. Mothers were able to answer both types of questions.

Discussion

Strengths of Outcome Measures

This analysis of outcome measures reveal several strengths. Telephone interview offered a purposeful conversation in which the interviewer asked prepared questions and mothers answered them. It was particularly useful when the definitions of breastfeeding needed clarification. Telephone interviews allow a probe into the initial responses of the mother to gain accurate information about breastfeeding. This avoids misclassifying breastfeeding categories. However, compared to face-to-face interviews, telephone interviews are more suitable for short and less complex interviews.

Self-report questionnaires is the simplest way of obtaining information concerning breastfeeding initiation, breastfeeding status, the introduction of complimentary food, and breastfeeding discontinuation. Questionnaires offer an effective way of obtaining specific information about breastfeeding from a large sample size, are cost effective and limit interviewer bias.

Structured observations of the patterns of infant feeding behavior in terms of breastfeeding success (Moore & Anderson, 2007) provided the most accurate information about breastfeeding initiation. Feeding logs entered in the web-based monitoring system diaries (Ahmed et al., 2016) kept track of daily infant feeding including the type and method of breastfeeding which provided sufficient information about breastfeeding status through the classification of exclusive breastfeeding and partial breastfeeding at 1 month postpartum.

Limitations of Outcome Measures

The 24-hour recall may give the types of feeding at a point in time; however, this method is not a reliable representation of breastfeeding over longer recall periods (Hector, 2011; Noel-Weiss, Boersma, & Kujawa-Myles, 2012; Thulier, 2010). It is possible to resume exclusive breastfeeding on the breast after supplementing with formula feedings as an adjunct to breastfeeding during infant physiological/iatrogenic weight loss, concomitantly occurring delayed onset of lactogenesis II in the first month postpartum (Wood, Sanders, Lewis, Woods, & Blackburn, 2017). Recall bias might have resulted in misclassification and/or over and/or under reporting of breastfeeding.

Lack of consistency in breastfeeding definitions remains a problem (Chapman & Perez-Escamilla, 2009; Hector, 2011; Thulier, 2010). Breastfeeding definitions from IGAB (1990) and WHO (1991, 2008) focus on the types of breastfeeding and not on the methods of breastfeeding (Noel-Weiss et al., 2012). However, separating breastfeeding from breast milk feeding is a crucial component of breastfeeding outcomes because breastfeeding involves a stronger relationship between mother and infant (Wood & Sanders, 2018), distinctive suckling patterns which contribute to health benefits and protective effects for both mothers and infants (Ip, Chung, Raman, Trikalinos, & Lau, 2009; Kramer & Kakuma, 2012; Labbok, 2015), and comfort sucking (non-nutritive sucking) which is relevant to increased alertness, social awareness, and responsiveness in infants (Nugent, Keefer, Minear, Johnson, & Blanchard, 2007). Lack of precise and consistent breastfeeding definitions lead to problems with the collection of valid and reliable information on breastfeeding outcomes, misinterpretation of data, and having difficulty with comparability across studies (Hector, 2004).

Each data collection method has limitations. Interviews are expensive and time consuming and require trained interviewers. Interviewers can introduce bias into a study in recording or interpreting information. Interviews and telephone surveys provide additional interaction between researchers and mothers and may influence the findings. Misclassifications in self-report questionnaires will occur with inappropriate terminology. Mailed questionnaires and online surveys may be less sensitive in detecting breastfeeding problems and concerns than interviews. A high attrition rate was noted in online surveys. Few reports were made for the reason for discontinuation of breastfeeding in questionnaires. Rates of breastfeeding initiation, duration, and exclusivity alone do not tell what caused breastfeeding discontinuation. This is a sensitive topic but having that information is essential to determine the causes of breastfeeding discontinuation. This should be asked during interviews. Over-reporting of breastfeeding, particularly in the treatment group, might occur if mothers provided socially desirable answers, especially when they develop a good relationship with interventionists. Under and/or over reporting of breastfeeding might occur if mothers do not keep an accurate record of their infant feeding.

Recommendations to Future Research

The feeding log is a method of recording breastfeeding events contingent on infant behavior and breastfeeding experiences that offer a tool that enables communication with health professionals. Recall bias is avoided if the mother keeps feeding logs every 4 to 6 hours daily with minimum burden (Barnard & Eyres, 1979; Barnard & Thomas, 2014; Pollard, 2011; Wood et al., 2017). Feeding logs provide subjective data, but they increase validity and reliability when used with objective data of breastfeeding observations and interviews. (Wood et al., 2016; Wood et al., 2017)

The type of breastfeeding was collected as primary and/or secondary outcomes. However, outcomes of the modifiable causes of breastfeeding discontinuation, e.g. maternal misattribution of infant behavior to perceived insufficient milk (Wood et al., 2016) are few. This is one of the methodological limitations. When choosing outcomes, researchers should

first consider outcome variables attributed to the targets of the intervention, followed by outcomes of breastfeeding initiation, duration, and exclusivity.

Methodological Limitations

This review has limitations. The limited number of qualified studies yielded by the constrained search strategy which only focused on English articles has the potential for selection bias. Variations in methodology across studies limited comparisons of the findings.

Clinical Implications

The evidence suggests that failure to assess both types and methods of breastfeeding are attributable, at least in part, to the effects of mediators and moderators of breastfeeding outcomes (e.g. a strong relationship between mother and infant.) Poor quality of outcome measures: a 24-hour recall bias, misclassification of breastfeeding categories, lack of consistency in breastfeeding definitions, and few reports of the reason for breastfeeding discontinuation is attributed to the compromising effects of interventions. However, breastfeeding observation and feeding logs augmented by interviews appear to promote understanding between breastfeeding events contingent on infant behavior. Enhancement of the clinical application of outcomes measures will likely require considering outcomes measures that are attributed to the target of the intervention, followed by breastfeeding initiation, duration, or exclusivity as next steps in research.

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Callouts

- Studying the outcomes of breastfeeding and breast milk feeding via bottle is important because of their connection to health, nutrition, and relationship building between mothers and infants.
- Breastfeeding types such as exclusive breastfeeding, predominant breastfeeding, and complementary breastfeeding were measured but rarely were breastfeeding methods such as breastfeeding and bottle feeding in intervention outcomes.
- Problems affecting validity of outcome measures include a 24-hour recall bias, misclassification of breastfeeding categories, lack of consistency in breastfeeding definitions, and scarce reports of the reason for breastfeeding discontinuation.
- Combining the measurement of feeding logs and breastfeeding observations augmented by interviews appears to be beneficial for the evaluation of intervention outcomes.

Suggested Clinical Implications

- The feeding log is a method of recording the types, methods, and patterns of breastfeeding contingent on infant behavior and breastfeeding experiences that offers a tool that enables mothers communicate and gains support from health professionals.
- Structured breastfeeding observations can help health professionals objectively assess breastfeeding types and methods as well as mother-infant interactions.
- Interviews encourage breastfeeding mothers to talk about their breastfeeding experiences.
- These outcomes measures will separate breastfeeding from breast milk feeding via bottle that underscore the importance of health benefits, protective effects, and a stronger relationship between mother and infant.

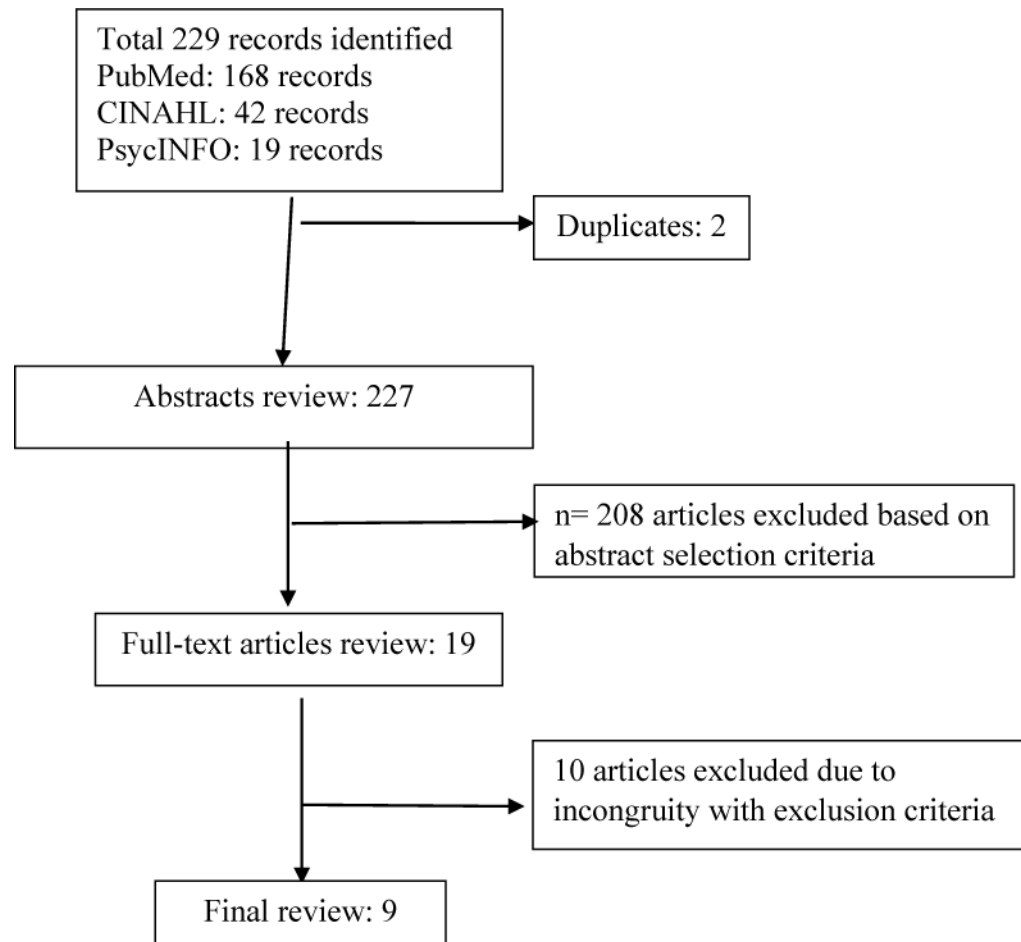


Figure 1.
Flow Diagram for Selecting Studies for Literature Review

Table 1

Breastfeeding Categories Used for Research by Study.

Category	Breastfeeding research
WHO (1991)	Fu, 2014; Kronborg, 2007 & 2012; Mattar, 2007; Su, 2007
WHO (2008)	Ahmed, 2016; Gigila, 2015
IGAB (1990)	Moore, 2007; Noel-Weiss, 2006

Note. WHO = The World Health Organization; IGAB =The Interagency Group for Action on Breastfeeding.

Table 2

Primary Outcomes at Times of Measurement by Study.

First Author and Year	Outcomes	Time
Moore, 2007	BF initiation rate	The first 7 days pp
Gigila, 2015	BF initiation rate & duration	At birth, 4,10,16,26,32,40, &50 weeks pp
Kronborg, 2007	EBF rate & duration	Up to 6 months pp
Su, 2007	EBF & any BF rate	At hospital discharge, 2,6 weeks & 3,6 months pp
Noel-Weiss, 2006	EBF, almost exclusive, & bottle feeding rates	At 4 weeks and 8 weeks
Mattar, 2007	EBF & predominant BF rate	At 2 weeks, 6 weeks, 3 months, & 6 months pp
Ahmed, 2016	EBF rate & intensity rate	At 1,2, & 3 months pp
Fu, 2014	Prevalence of EBF & any BF	At 1,2, & 3 months pp
Kronborg, 2012	Full & any BF duration	From 6 weeks up to 1 year

Note. BF = breastfeeding; EBF = exclusive breastfeeding; pp = postpartum.

Table 3

Secondary Outcomes at Time of Measurement by Study.

First Author and Year	Outcomes	Time
Gigila, 2015	EBF rate	At birth, 4,10,16,26,32,40, & 50 weeks pp
Fu, 2014 Moore, 2007	EBF & any BF duration	At 1, 2, & 3 months pp At 1 month pp
Su, 2007	Any BF rate	At 4 months pp
Kronborg, 2012	Full & any BF duration	At 1 year
Mattar, 2007	Overall BF rate	At 2 weeks, 6 weeks, 3 months, & 6 months pp

Note. BF = breastfeeding; EBF = exclusive breastfeeding; pp = postpartum.

Table 4

Data Collection Methods.

First Author/Year	Outcomes	Measures
Kronborg, 2007	Breastfeeding initiation	Chart reviews
Moore, 2007		Breastfeeding observations
Gigila, 2015		Online surveys
Ahmed, 2016; Gigila, 2015	Exclusive breastfeeding rate	Online surveys
Fu, 2014		Telephone interviews
Mattar, 2007		Telephone questionnaires/in person questionnaires
Kronborg, 2012	Breastfeeding duration	Mailed/emailed questionnaires
Gigila, 2015		Online surveys
Fu, 2014; Noel-Weiss, 2006		Telephone interviews