Chapter 7
Review of breastfeeding assessment tools

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Many malnourished infants present with reports of breastfeeding problems (Chapter 6) and exclusive breastfeeding in infants <6m is the treatment goal of most guidelines (Chapter 4). Therefore breastfeeding assessment to identify feeding problems and monitor recovery is an important part of MAMI. Since most current SAM guidelines do not include or refer to specific breastfeeding assessment tools, this chapter reviews those tools currently available and their potential application to the MAMI context[iii].

7.1   Scope of review

Existing reviews, focused on developed countries, have identified a number of breastfeeding assessment tools with none clearly identified as a gold standard.[153] This chapter identifies areas of consensus between tools, gaps in coverage and advantages and disadvantages in different settings. To do so, a framework is used that identifies three aspects or settings of severe acute malnutrition (SAM) care: community screening/case detection, case finding in clinical contexts, and diagnosis in clinical contexts.[154] We conceive that there is a gradient of importance of different tool characteristics from community to clinical contexts. For example a community-health worker (CHW) with responsibility for treating malnourished infants would want a highly sensitive tool to identify women experiencing breastfeeding problems, but a clinician diagnosing a reported breastfeeding problem in a hospital-setting would benefit from using a tool with higher specificity so that 'false positives' did not result in unnecessary inpatient admission.

Objectives of the review are as follows:

- To identify published breastfeeding assessment tools, and document which breastfeeding domains are covered and which omitted (adapted from Hall Moran, 2000[155]).
- To consider tool value in emergency settings and other nutritionally vulnerable contexts, looking at performance characteristics for identifying breastfeeding problems in community and clinical settings (adapted from Myatt et al, 2006[156]).
- To grade the tools based on the quality and level of evidence underlying their development and validation.

When talking about 'case-finding', we envisage that the tools would be used in combination with anthropometric assessment. Exact use will depend on context. In MAMI, their main importance is identifying the immediate cause of poor anthropometric status. The better the diagnosis, the faster and better the patient can be directed to treatment services. For example, a young infant may be identified in the community as having a simple breastfeeding problem due to poor positioning. He/she might benefit from early referral to a breastfeeding support group before severe malnutrition and clinical complications develop. Another infant may have a low weight-for-length but no identified breastfeeding problem; in this case clinical referral and assessment is needed. Other approaches, such as establishing HIV status, should be considered. Maternal factors may also determine breastfeeding 'success' and other strategies will be needed as a result, e.g. a severely malnourished mother who is exclusively breastfeeding will require nutritional rehabilitation of the mother to enable adequate nourishment of her infant; children of HIV-infected mothers who are ill or die are more likely to die themselves, independent of the HIV status of the infant[157].

7.2   What should a breastfeeding assessment tool include?

Effective breastfeeding can be divided into several essential elements that are important for overall success. One study that critically analysed six breastfeeding assessment tools identified the following elements: baby's behaviour, mother's behaviour, positioning, attachment, effective feeding (e.g. audible swallow), health of the breast, health of the baby and mothers' perception of the breastfeeding experience.[158] Other elements, such as severe maternal wasting and maternal HIV status, are important considerations in emergency settings. Determining the main issues for an individual mother/infant dyad matters: more precise diagnoses will direct infants and their carers to more tailored and ultimately more effective treatment. Simple issues can be pinpointed and rapidly resolved (e.g. attachment difficulty). More complex issues can be referred for further care (e.g. breastfeeding support alone is unlikely to address maternal depression). Good assessment can also help rule out breastfeeding problems as the main cause of infant SAM (e.g. an infant may be breastfeeding well yet be malnourished due to underlying HIV disease).

Table 36: Importance gradient of key properties of breastfeeding assessment tools from community to clinical contexts

Tool Property	Context (score)[a]			Reasons for grading
	Community screening/ case detection	Case finding in clinical contexts	Diagnosis in clinical contexts	
Simplicity (for CHWs[b] & doctors)	3	2	1	Simplicity is important in community settings as CHWs have lower education/training. Simplicity is less important in clinical contexts unless there is a high caseload & limited time/resources.
Acceptability (by mothers)	3	2	1	BF[c] assessment by definition is intimate. Male CHWs or insufficient privacy/comfort are likely to be unacceptable. Some tools rely on questions alone, not assessment, and are likely to be more acceptable to mothers.
Cost/Time	3	2	1	Resource-poor settings would demand that assessment be cost & time-effective in all contexts, although at diagnosis there is potentially more time to spend identifying specific problems.
Objectivity	1	2	3	Most tools are observational & will be subjective. Objectivity may be more crucial in diagnostic settings if decisions about admission are being made.
Quantitativeness	1	2	3	Assessment scores give useful indication of risk (e.g. BF cessation). A total score is less useful for diagnosis as specific problems would be masked, but may be helpful in making decisions about admission. Some scoring systems are arbitrary & could detract from finding ways to overcome specific problems.
Precision (reliability)	1	2	3	Important that a tool can pick out specific BF problems in a reliable consistent way, although CHWs may just refer all SAM infants with a breastfeeding problem to more specialised care, or for specific diagnosis of a breastfeeding problem.
Accuracy (Validity)	1	2	3	Very important to be able to pinpoint which aspects of BF are causing problems in order to provide simple solutions. Timing of feed & emotional state could affect the ability to pinpoint a problem if only one assessment is made.
Sensitivity (Identifying true cases)	3	2	1	Sensitivity is less important in clinical contexts because the infant is already present at hospital.
Specificity (identifying true negatives)	1	2	3	False positives' could overload the health system; make mothers feel inadequate & unlikely to resume BF. Unnecessary inpatient care could increase risk of infection, & may cause mother to leave other children unattended, or lose money through not being able to go to work.
Predictive value	1	2	3	Important that assessments predict infant nutritional outcomes & preventable mortality. For a CHW involved in referral to more specialist BF services, predictive value is less important, better that they identify as many potential true cases as possible to refer for further help.

[a] Scoring: 1=least important 2=medium importance 3=most important   Table and scoring system adapted from Myatt et al, 2006[159]
[b] Community Health Worker;
[c] Breastfeeding

7.3   Methods

7.3.1 Literature search strategy

Pubmed was systematically searched for articles with no date parameters set using AND/OR combinations of the following key words and MeSH (medical subject headings) terms:

- Breastfeeding, breastfeeding problems, breastfeeding technique, breastfeeding performance assessment, breastfeeding skill, breastfeeding ability, breastfeeding assessment tool, breast milk, human, actual or perceived milk insufficiency, insufficient milk supply, latch, root, suck, swallow, position, milk transfer.
- Needs assessment, risk assessment, nutrition assessment, psychometrics, nursing diagnosis, index, checklist, questionnaire, diagnostic tools, guidelines.
- Infant nutrition disorders, infant nutritional physiological phenomena, infant very low or low birth weight, infant welfare, infant behaviour, infant premature, infant postmature, infant newborn, infant small for gestational age, infant diseases, infant care, infant growth, developing countries.

Reference lists of breastfeeding assessment tools fitting the inclusion criteria were searched for further relevant tools. Due to the small number of tools identified that were designed for use in developing countries and emergency contexts, a purposive search of WHO/UNICEF and initiatives on infant and young child feeding in emergencies (IFE) in the emergency nutrition sector was conducted. A secondary search was conducted to identify any studies attempting to validate or examine the underlying properties and predictive value of these tools.

7.3.2 Tool inclusion/exclusion criteria

Criteria for inclusion in the current review were articles written in English that described the development of breastfeeding tools applied in clinical or community contexts that were designed to assess breastfeeding performance of the mother-infant dyad through observations or questionnaires. Tools were excluded if they were designed to assess bottle-feeding or breastfeeding problems of women who have undergone breast surgery. Tools using complex assessment methods (e.g. analysis of feeding behaviour with direct linear transformation[160]) were also excluded on the basis that these would be unavailable in developing country settings. Single item and survey questions seeking population-level data about infant feeding were not considered to function as diagnostic tools and were also excluded. Tools assessing frenulum function were considered beyond the scope of this review. Maternal self-reported questionnaires assessing maternal perceptions of breastfeeding are summarised in this paper but not explored in detail.

7.4   Results and Discussion

Fifteen tools were identified in the literature search. The Lactation Assessment Tool (LAT™) fitted our inclusion criteria, however we were unable to obtain sufficient information about the development and validation of the tool to include it in the final review. Generally, the methodological quality of studies was suboptimal. At best, tools were tested in observational studies; at worst tools were not tested at all. There was some consensus between tools about breastfeeding domains for inclusion in assessment, but few tools achieved comprehensive coverage and particular domains were frequently neglected. Most were designed for newborn infants, often preterm, whose breastfeeding problems are likely to differ from those of SAM infants. In terms of suitability of tools for different contexts, no single tool would be suitable for use without adaptation.

7.4.1 Development and validation of tools

The majority of tools (9/15) have not been tested against short or long-term nutritional or breastfeeding outcomes and it is therefore difficult to make recommendations for their use. Five were developed purely from existing literature and clinical experience, whilst a further three have been internally assessed for inter-rate consistency and test re-test reliability with results ranging from poor to excellent (Table 37). Overall, just three tools were designed for use by CHWs in developing settings and the majority were developed for North American neonatal populations for use by highly trained health professionals (e.g. NOMAS), although some were also used by mothers (e.g. LATCH). None of the tools was developed for or tested on acutely malnourished infants.

Table 37: Theory-based breastfeeding assessment tools

BF Tool*	Author(s) & Date	Tool Description	Country, setting	Sample size & participants	Infant age (mean, sd)	Infant/maternal outcomes	Statistical Analysis	Results Summary	Author Comments/notes	Our comments
IFE Module 2 - (SRA[a] & FA[b] of BF[c]).	IFE Core Group (2004)[d]	SRA: Age appropriate feeding, BF ease, baby's condition. Refer problems for FA: observe: attachment, suckling, mother's confidence, feed end. Listen/learn from mother re BF practices/beliefs/worries. Observe artificial feed if relevant.	Training material developed on the basis of 'existing best practice & published evidence where it exists. Where it does not it draws upon extensive experience & a broad base of expert opinion.' BF assessment sections based extensively on the WHO 40 hour breastfeeding counselling course (2004).						Field workers should systematically record & identify most effective methods.	Requires module 1 training (1-3 hours) & module 2 (5 hours). Developed for CHWse in emergency/developing country settings.
Mother-infant BF assessment tool	Johnson et al, 1999[161]	Mother & infant scored on 8 items to indicate BF failure risk: latch (2 items), suck, nipple type, frequency of nursing/wet nappies, previous success w/ BF, supportive partner.	USA, home visit	n=981; not stated	Not stated	Re-admission rate w/ BF problems.	Compared % readmissions w/ BF problems of women receiving home visits vs not.	Re-admission rate higher if no home visit was made.	Tool is a useful guide for novice nurses.	
A BF Evaluation & Education Tool (BEET)	Tobin, 1996[162]	8 sub-scales: Feedings, positioning, latch, suck, milk flow, intake, output, weight gain.	Tool based on 2 published & 4 unpublished BF references. No reference to clinical experience or attempted validation of tool against measurable outcomes, or internal reliability.						Can use tool prenatally, by phone or in hospital.	Rationale for items discussed but not tested against measurable outcomes.
Mother-Baby Assessment (MBA)f	Mulford, 1992[163]	5 steps in BF assessed: signalling; positioning; fixing; milk transfer; ending. Scores for mother & infant separately.	USA, not stated	Limited information given re evidence MBA items based on. Positioning, fixing & milk transfer items from published work describing common signs. Tool not validated in this study, although was in a further study.					Tool tracks BF in hospital triage/referral or research	
Systematic Assessment of the Infant at the Breast (SAIB)	Shrago & Bocar, 1990[164]	Observation of: alignment; areolar grasp; areolar compression; audible swallowing. No scoring system.	USA, not stated	Instrument based on scientific understanding of lactation & clinical experience. Not psychometrically tested or validated against maternal or infant nutritional or BF outcomes.						

7.4 Results and Discussion

Table 37 cont'd

BF Tool*	Author(s) & Date	Tool Description	Country, setting	Sample size & participants	Infant age (mean, sd)	Infant/ maternal outcomes	Statistical Analysis	Results Summary	Author Comments /notes	Our comments
UNICEF b-r-e-a-s-t observational checklist	WHO/ UNICEF, 1993[165]	27 items/6 scales: signs that BF going well vs possible difficulty: Body position, Responses, Emotional Bonding, Anatomy, Suckling, Time suckling.	Not stated, although designed for CHW w/ WHO/UNICEF BF training.						None stated	Tool covers wide range of BF domains, but no evidence of development/ validation against external outcomes.
Mother-Infant Breastfeeding Progress Tool (MIBPT)	Johnson et al, 2007[166]	8 items observe: responsiveness to feeding cues; timing of feeds; nutritive suckling; positioning/latching factors; nipple trauma, infant behaviour state & mother/ parent response to infant.	USA, hospital	n=62; Healthy mother &baby; 35-42 weeks GA?.	2 hours to 5 days old	n/a	% agreement between raters	Inter-rater agreement 79-95%.	Caution if relying upon single scores because mother/infant progress with BF over time.	Rationale for items discussed but not tested against nutritional/BF outcomes.
Pre-term Infant Breastfeeding Behaviour Scale (PIBBS)	Nyqvist et al, 1996[167]	6 items assess pre-term infants on: rooting, areolar grasp; duration of latch; sucking; longest sucking burst; swallowing.	Sweden, hospital	n=24; Full/preterm infants in neonatal intensive care, transitional/ maternity units.	Not stated	n/a	Inter-rater reliability of observers, & observers/ mothers. Unclear analysis testing tool ability to detect different GA/maturity of infant BF.	Good inter-rater reliability for observers (0.64-1.00), but poor for observers vs mothers (0.27-0.86). Poorer items revised.		
BF Support guidelines for a Baby- Friendly Hospital: BF Observation Aid	UNICEF, 2006[168]	21 dichotomous items: signs that BF going well vs possible difficulty. General items and items assessing: breast condition, positioning, attachment, suckling.	Material field tested in Zimbabwe	Not stated					None stated	Tool is revised UNICEF checklist. Piloting in Sierra Leone early 2009.

* Includes tools developed on the basis of expert opinion and literature searching; tools may have been 'internally' validated

Table 38: Breastfeeding assessment tools validated against maternal and infant outcomes

BF Tool*	Author(s) & Date	Tool Description	Country, setting	Sample size & participants	Infant age (mean, sd)	Infant/ maternal outcomes	Statistical Analysis	Results Summary	Author Comments /notes
BF[a] Assessment Score (BAS)	Hall et al, 2002[169]	Risk of BF cessation (first 7-10 days). 5 items: mother's age, previous BF experience, latching problems, BF interval, formula bottles. 2 extra items: breast surgery, hypertension, vacuum vaginal delivery.	USA, hospital	n=1108; No information on maternal or infant health indicators.	Mean 40 hours (sd=13)	BF cessation rate 7-10 days after birth	Single variable logistic regressions identified candidate predictors. Predictors entered into multiple logistic model; evaluated with OR[b] & RR[c] to give optimal ROC[d]	10.5% of mothers reported cessation of BF; All BAS items sig[e] predicted BF cessation.	
	Gianni et al, 2006[170]	Usefulness of an assessment score to predict early EBF[f] cessation.	Italy, hospital	n=175; Mothers of healthy EBF infants. Birth weight ≥2500g, GA[g] 37-42 weeks.	Not reported. Mean hospital stay 2.2 days	BF cessation, introduction of complem-entary feeding, continued EBF at 1 month	Chi[2] & Mann-Whitney U Tests to test for differences in BAS scores by BF behaviour 1 month postpartum.	Baseline scores of EBF mothers at 1 month sig lower than non-EBF. NS[h] difference if complem-enting BF at 1 month vs no BF. Latching problems & no prior BF success negatively associated w/ BF duration.	
Infant Breastfeeding Assessment Tool (IBFAT)	Matthews, 1988[171]	6 items measure 4 infant behaviours: readiness to feed, rooting, fixing & sucking. Two non-scoring items: infant state & maternal satisfaction w/ BF.	Canada, hospital	n=60; Spontaneous delivery, APGAR[i] score ≥8 after 5 mins; appropriate weight for GA.	Early neonatal period'	BF status at 4 weeks	inter-rater reliability (% agreement)	IBFAT scores did not predict BF status at 4 weeks. Limited variability as 80% still BF. Inter-rater agreement 91%.	IBFAT scores did not predict BF status at 4 weeks. Limited variability as 80% still BF. Inter-rater agreement 91%.
	Furman, 2006[172]	Evaluation of VLBW: can we use the IBFAT?	USA, hospital	n=34; Mothers of VLBW infants	35 weeks corrected GA	Milk intake (test-weighing)	Correlation of IBFAT scores w/ milk intake, compared with association of a feeding observation form designed to assess efficiency of BF vs bottle feeding.	IBFAT positively correlated w/ feeding observation & milk intake; IBFAT sucking score sig correlated w/ % time sucking/suck bursts.	IBFAT does not discriminate between adequate/ inadequate milk intake.

Table 38 cont'd

BF Tool*	Author(s) & Date	Tool Description	Country, setting	Sample size & participants	Infant age (mean, sd)	Infant/maternal outcomes	Statistical Analysis	Results Summary	Author Comments/notes
Infant Breastfeeding Assessment Tool (IBFAT) (cont'd)	Schlomer, 1999[173]	Evaluating the association of two BF assessment tools with BF problems & satisfaction.	USA, hospital	n=30; First time BF mothers of term infants	12 hours & 1 week postpartum	Maternal satisfaction & BF problems	Paired t-tests to assess score improvement 12 hours-1 week postpartum. Compared correlation strength of IBFAT & LATCH w/ maternal satisfaction & BF problems	Low predictive validity for maternal satisfaction & BF problems (ns=0.06-0.50) w/ both tools.	
	Riordan, 1997[174]	Reliability & validity testing of 3 BF assessment tools.	USA, hospital & home visit	n=28; Mothers of healthy, term new borns.	1st week postpartum	n/a	Compared validity & reliability (inter-rater & test/re-test) of IBFAT, MBA & LATCH w/ Spearman's correlations.	Inter-rater correlations: IBFAT (r=0.27-0.69), LATCH (0.11-0.46), MBA (0.33-0.66). Test-re-test correlations 0.64-0.88).	Methodological issues using taped BF sessions.
LATCH[k] Assessment	Jensen et al, 1994[175]	5 items: Latch; Audible swallowing; Type of nipple; Comfort of mother's breasts/nipples; Help needed to hold baby to breast.	USA	This instrument was based on scientific understanding of lactation & clinical experience. It was not psychometrically tested or validated against any maternal or infant nutritional or BF outcomes, although it has since been tested.					
	Riordan, 2001[176]	Predicting BF duration using the LATCH BF assessment tool.	USA, hospital	n=133; Mothers of healthy singletons (38-42 weeks GA) intending to BF ≥6 weeks	39 hours	Not BF at 8 weeks (no BF in past 24 hours)	Fisher's Exact test: LATCH scores of women BF vs not BF at 6 weeks. Stepwise regression to id variables associated w/ BF duration.	Regression model: LATCH score, mother's age, intended BF duration & delivery type all sig related to BF at 6 weeks.	Audible swallowing not a viable variable until day 4.
	Kumar, 2006[177]	LATCH scoring system & prediction of BF duration.	USA, hospital	n=182 (4 days) n=188 (6 weeks); Mothers of healthy term new borns	Newborn	Maintenance of BF at 4 days & 6 weeks	Wilcoxon Rank Test to compare LATCH scores of BF vs not BF women at 6 weeks. ROC analysis & Youden's J to evaluate specificity/sensitivity. Correlation of mother/nurse ratings to assess validity/subscale independence.	Sig diff LATCH scores 0-48 hours postpartum in BF vs not BF at 6 weeks. ROC analysis: score of 9 at 16-24 hours =1.7* more likely to BF at 6 weeks. Nurse/mothers scores sig correlated & w/ BF duration. Subscales independent except audible swallow/latch on.	
	Adams, 1997[178]	Maternal & professional assessment of BF	USA, hospital	n=35; First time BF mothers	First 2 weeks post-partum	n/a	Inter-rater reliability of lactation consultants using LATCH & correlation w/ mothers LATCH scores.	85-100% agreement of lactation consultants. Correlation w/ maternal reports very low-moderate	Mothers evaluate BF experience somatically, not by observation.

7.4   Results and Discussion

Table 38 cont'd

BF Tool*	Author(s) & Date	Tool Description	Country, setting	Sample size & participants	Infant age (mean, sd)	Infant/maternal outcomes	Statistical Analysis	Results Summary	Author Comments /notes
Neonatal Oral-Motor Assessment Scale (NOMAS)	Palmer et al, 1993[179]	28 items: nutritive/non-nutritive sucking. Outcomes: normal, disorganised or dysfunctional. Latter two graded by severity (mild, moderate, severe)	USA, hospital	n=35; Infants 35-49 weeks GA, ≥ 1900g.	35-49 weeks PMA[i]; term & preterm	n/a	% percentage agreement of 3 coders	Inter-rater reliability: 80% agreement.	
	Howe, 2007[180]	Psychometric characteristics of NOMAS in healthy pre-term infants	USA, medical centre	n=147; mothers of pre-term, but otherwise healthy infants	32-36 weeks PMA	Infant feeding performance: transitional rate & volume of milk consumed from bottle.	Reliability of normal/disorganised scales & correlation w/ infant feeding skills. NOMAS ability to detect change in feeding skills over time (SRMS[m]) & sig of change scores.	Acceptable reliability of normal category (32-35 PMA) & disorganised category (32 weeks PMA). All categories moderately correlated w/ transitional milk rate.	Moderate convergent validity for normal & disorganised categories.
	da Costa, 2008[181]	The reliability of NOMAS	Holland, not stated	n=75; Healthy & VLBW infants. Some risk of other health problems	26-36 PMA.	Inter-rater agreement.	Cohens Kappa reliability coefficient	Test-retest of NOMAS with 4 raters=moderate-near perfect (0.33-0.94)	Adjust tool to improve reliability & incorporate new knowledge of infant suck/swallow
Checklist from paper: 'BF & the use of pacifiers'	Righard, 1997[182]	16 observations: breast offering (3 items), sucking at the breast (8 items), after feeding (2 items), & conclusions (2 items)	Sweden, hospital	n=82; EBF mothers w/ intention to BF ≥6 months. Healthy mothers /infants, normal delivery/birth weights.	4-5 days postpartum	BF rate & pacifier use (hours/day) at 2 weeks, 1, 2, 3 & 4 months	Group comparisons (Chi2 or Fisher's exact test) of BF technique & duration.	Pacifier-users sig higher BF at 4 months in correct vs incorrect sucking groups but sig lower than non-users. Non-users no difference in BF at 4 months in correct vs incorrect sucking groups.	Incorrect sucking technique may not be corrected if pacifiers used.
Hands off technique (HOT)	Ingram, 2002[183]	8 guidelines to guide mothers in 'hands off' way to position & attach baby. Includes leaflet w/ pictures & explanations about BF.	UK, hospital	n=395; Mothers were BF on discharge.	Not reported	BF (any BF/EBF) 2 & 6 weeks post partum	Chi² to identify factors sig associated w/ BF at 6 weeks. Logistic regressions to identify independent variables associated w/ BF & factors associated w/ BF at 6 weeks.	High BF technique score associated w/ BF at 6 weeks.	Short, pragmatic training for midwives to teach good BF technique.

a BF = Breastfeeding;
b OR = Odds Ratio;
c RR = Relative Risk;
d ROC = Receiver Operating Characteristic;
e Statistical significance (p<0.05);
f EBF = Exclusive Breastfeeding;
g GA = Gestational Age;
h NS = Not statistically significant (p>0.05);
i APGAR = Appearance, Pulse, Grimace, Activity, Respiration score used to assess the health of newborn infants;
j VLBW = Very Low Birth Weight;
k LATCH was assessed against external outcomes by 2 further studies - Riordan 1997 and Schlomer 1999. These studies are detailed in the IBFAT portion of Table 2b;
l PMA = Postmenstrual age;
m SRMS - Standardised Response Means.

Six tools have been validated against a range of outcomes, although none of these include infant nutritional status (Table 38). Outcomes include immediate assessment of milk transfer through test-weighing, cessation of breastfeeding from the first days of life up to four months, introduction of complementary feeding, maternally reported breastfeeding satisfaction and problems. On the basis of consistency and volume of existing evidence, the NOMAS and BAS emerge as the strongest tools. NOMAS categories have been associated with transitional rate of milk, and its key properties (Table 37) are adequate. In two studies, BAS scores predicted early breastfeeding cessation in newborns. However, these tools include the least comprehensive coverage of breastfeeding domains and the NOMAS is arguably the most complex and least user-friendly tool overall. The Hands-off technique checklist technique score was associated with breastfeeding at six weeks, therefore this may be a good way to teach newly delivered mothers good breastfeeding technique. Interventions from this checklist are also more empowering to the mother as she corrects her own technique and there are pictures to help identify problematic aspects of the feed.

The LATCH should be considered a weaker tool because of contradictory findings and questionable reliability and validity. Similarly, the IBFAT (Infant Breastfeeding Assessment Tool) lacks predictive validity for a range of outcomes and is unable to adequately discriminate between sufficient and insufficient milk intake. Righard's assessment[184] of correct vs incorrect sucking was associated with breastfeeding status at four months if pacifiers were used, but not in the non-pacifier group.

7.4.2 Coverage of breastfeeding domains

It is striking that only one tool (BEET (Breastfeeding Evaluation and Education Tool)) achieves full coverage of domains (Table 39). The tools that achieve the widest coverage (IFE Module 2, BEET, UNICEF b-r-e-a-s-t and UNICEF Breastfeeding Observation Aid) are generally those that have been developed with developing country settings in mind. However, although these tools are based on extensive clinical and field experience, they suffer from a lack of validation, and some miss important domains (e.g. IFE Module 2 misses 'positioning', UNICEF b-r-e-a-s-t misses 'health of the baby'). These shortfalls could be addressed with appropriately designed studies and modifications. Furthermore, tools would need to take into account whether and how acute malnutrition in the infant affects assessment of any of the breastfeeding domains.

There is general consensus among the tools for inclusion of 'attachment' and 'effective feeding' domains. What is not clear, however, is the best way to assess these aspects of the breastfeed given the lack of validation against measurable outcomes. The important domain 'health of the baby', is only captured by 4/15 tools. It is crucial that this be included as an infant can be effectively breastfed but malnourished for another reason (e.g. HIV infected, severe wasting in the mother). Only half of the tools assess mothers' own behaviour towards the baby, which may be very telling about her psychosocial status and could help guide appropriate management. Furthermore, the influence of severe malnutrition on the mother's interaction with her infant is not addressed in any tool reviewed.

7.4 Results and Discussion

Table 39: Tool coverage of breastfeeding domains and value of use in different contexts

BF Tool	Domains covered[a]							Extra domains that may be important			Contexts in which BF assessment tools may be applied[b]
	Baby Behaviour	Mother Behaviour	Position	Attach-ment	Effective Feeding	Health of Breast	Health of Baby	Mother's Experience of feed	Number, timing or duration of feeds	other	
BF Assessment Score (BAS)	✓			✓					✓	previous BF experience	**General:** *Pros* - simple, acceptable, cheap & quick to administer. 3/5 items objective, quantitative. Some predictive validity. *Cons:* non-comparable setting; does not assess nutritional status; only aimed at 1st 7-10 days of life. **Diagnosis:** Does not discriminate underlying causes of not BF.
Infant BF Assessment Tool (IBFAT)				✓	✓			✓			**General:** *Pros* - simple (includes definitions), acceptable, cheap, & quick to administer. Scores weakly associated w/ milk intake. *Cons* - only 1/6 items objective. Some items vague. Limited predictive value & variable reliability. **Diagnosis:** Does not discriminate underlying causes of not BF.
LATCH Assessment			✓	✓	✓	✓					*Pros* – simple, quick, cheap & quantifiable. Identifies specific BF problems. Mother can use modified version for self-monitoring. Some predictive validity. *Cons* - Reliability/validity inconsistent. Audible swallow n/a to colostrum. Acceptability of nipple stimulation is questionable. No objective items.
Mother-infant BF assessment tool				✓	✓	✓	✓		✓	previous BF experience, supportive partner	**General:** *Pros* - cheap & quick to administer. Quantitative 'risk' score generated. 2/8 objective items re milk intake, (e.g. wet nappies-but misleads if infant given other liquids). *Cons* - some items subjective/ unclear descriptions of behaviours. Validity/reliability unknown. **Diagnosis:** General items do not allow specific diagnosis or treatment decision.
Neonatal Oral Motor Assessment Scale (NOMAS)				✓	✓						**General:** *Pros* - Identifies specific sucking problems. *Cons:* designed for neonates; sole focus on oral-motor patterns, does not assess overall BF. Only 5/28 items objective. Complex & time-consuming. Categorisations potentially unacceptable to mother (e.g. dysfunctional). Variable reliability, no validity data. **Community setting:** Not simple to use, complex terminology.
Checklist from paper: 'BF & the use of pacifiers'	✓	✓	✓	✓	✓			✓	✓		**General:** *Pros* - acceptable, cheap, quick to administer; covers different stages of BF from before starts to after finish. Some predictive validity. *Cons* - 1/16 items objective, not quantitative. Relevance of sucks/minute is unclear & difficult to count. **Community setting:** medical terminology needs clarification, not simple to use.

Table 39 cont'd

BF* Tool	Domains covered[a]							Extra domains that may be important			Contexts in which BF assessment tools may be applied[b]
	Baby Behaviour	Mother Behaviour	Position	Attach-ment	Effective Feeding	Health of Breast	Health of Baby	Mother's Experience of feed	Number, timing or duration of feeds	other	
Checklist from paper: 'BF & the use of pacifiers'	✓	✓	✓	✓	✓			✓	✓		**General:** *Pros* - acceptable, cheap, quick to administer; covers different stages of BF from before starts to after finish. Some predictive validity. *Cons* - 1/16 items objective, not quantitative. Relevance of sucks/minute is unclear & difficult to count. **Community setting:** medical terminology needs clarification, not simple to use.
IFE - Simple, rapid & full BF assessment	✓	✓	✓	✓	✓	✓	✓	✓	✓	Mixed feeding, feed end, pacifier use	*Pros* - designed for developing/emergency settings. Clear & suitable for use by CHW[d] w/ 1 training day. Acceptable. Identifies underlying causes of BF problems & promotes maternal confidence. Mixture of objective questions (13/32) & subjective assessment. *Cons* - Time-consuming, training costs, no reliability/validity data, not quantitative.
A BF Evaluation & Education Tool (BEET)	✓	✓	✓	✓	✓	✓	✓	✓	✓	signs of milk transfer in mother	**General:** *Pros* - 13/36 objective items. Many items indicate milk transfer, could reassure mother about milk adequacy; acceptable; *Cons* - Not simple/quick to administer. Some items need accurate self-report of quantifiable items. No reliability/validity data. Some items monitor infant over weeks, but in our setting only 1 opportunity to assess. **Hospital setting:** Easier to monitor in-patient on some items on hospital chart compared to CHW.
Mother-Baby Assessment (MBA)	✓	✓	✓	✓	✓	✓				signs of milk transfer in mother	*Pros* – simple & quick to administer. Quantitative, meaningful items (e.g. odd number score indicates progress of one of the dyad but not the other) Acceptable. *Cons* - contains only 1 objective item (amount of areola that infant should take into mouth). Poor to moderate reliability. No validity data.
Systematic Assessment of Infant at Breast (SAIB)	✓	✓	✓	✓	✓						**General:** *Pros* - Simple, acceptable & quick to administer. Identifies specific BF problems. Positioning diagrams provided could be an adjunct to assessment & to mothers. *Cons* - No reliability/validity data. No quantifiable/objective items. **Community setting:** Medical terminology would need clarification (e.g. iliac crest, mandible etc).
UNICEF B-R-E-A-S-T observational checklist	✓	✓	✓	✓	✓	✓			✓		**General:** *Pro* - quick, simple, cheap & acceptable. Identifies specific BF problems. *Con* - developed for intensive training module & involves cost & time. No reliability/validity data. Not quantitative, only 1 objective item. **Community setting:** some items need clarification for CHWs. **Hospital setting:** identifies specific BF problems & treatments that could ease e.g. nipple pain.

Table 39 cont'd

BF[c] Tool	Domains covered[a]							Extra domains that may be important			Contexts in which BF assessment tools may be applied[b]
	Baby Behaviour	Mother Behaviour	Position	Attachment	Effective Feeding	Health of Breast	Health of Baby	Mother's Experience of feed	Number, timing or duration of feeds	other	
Mother-Infant BF Progress Tool (MIBPT)		✓	✓	✓	✓	✓		✓	✓		**General:** *Pros* - Acceptable, cheap & quick to administer. Good reliability. *Cons* - Items need defining. Tool tested w/ mothers w/ good BF so may not identify problems well. 1/8 items objective. Some ambiguous items (e.g. 'redness' to identify nipple trauma). No validity data or quantitative scoring. **Community setting:** May not be suitable for CHWs. **Hospital setting:** could identify specific problems & treatments (e.g. attachment advice; nipple care).
Pre-term Infant BF Behaviour Scale (PIBBS)	✓			✓	✓				✓		General: Pros - identifies specific BF problems. Assesses BF from start to finish. Acceptable & quick to administer. Reliability is good between health professionals. Cons - only 3 objective/quantifiable items. No clear scoring. Reliability between mothers & health professionals is poor. No validity data. Community setting: Designed for premature infants & neonates in hospital & n/a to general populations. Hospital setting: Maybe useful in specialised nursery setting.
UNICEF 2006: BF Observation Aid	✓	✓	✓	✓	✓	✓	✓	✓			General: Pros - simple, acceptable, quick & cheap to administer. Identifies problems that directly translate into intervention (e.g. nipple cream for nipple trauma). Cons - some items vague (e.g. 'mother looks healthy'). Not quantitative. No reliability/validity data, but tool being used in Sierra Leone 2009 & may provide relevant data. Community setting: need to clarify 'oxytocin reflex'
Hands off technique (HOT	✓	✓	✓	✓	✓						Pros – simple, acceptable & quick to administer. Includes leaflet w/ pictures to aid BF assessment & for mothers to keep. Good predictive validity & identifies specific BF problems. Cons - cost of leaflets (if used), training required. Assumes optimal surroundings & relaxation

a   adapted from Hall Moran et al (2000)
b   adapted from Myatt et al (2006) to include: population screening (by community volunteers of primary level healthcare workers) case finding in clinical context & diagnosis in clinical contexts
c   Breastfeeding
d   Community Health Worker

7.4.3 Tool performance characteristics

We were unable to apply a formal grading procedure (e.g. GRADE[185]) to the tools, given the largely observational study designs of which none would have achieved higher than a GRADE 2, or the complete lack of tool testing. Other reviews of breastfeeding assessment tools have excluded studies on the basis of design and validation issues. We, however, deliberately included as many tools as possible, though this meant we were unable to assign formal grades. Instead, we analyse here a number of performance characteristics:

a) Community-based care
Community-based management of acute malnutrition (CMAM) is increasingly the approach of choice for the management of SAM in children six to 59 months with no co-existing medical complications. If such a model of care was extended to infants <6m, breastfeeding assessment tools to help CHWs identify, resolve and refer breastfeeding problems would be needed. Such tools should also benefit children to two years or beyond, to support sustained and continued breastfeeding.

Eight of the tools are either not relevant to a community setting or would require adaptation for use by a CHW. Many items also involve complex medical terminology, so some adaptation or the provision of clear definitions would be of benefit. Training lasting several days would be necessary for some of the tools, which is a time and financial cost that may not be feasible in an emergency setting. However one tool, the BAS, could be a useful basis to help CHWs to decide on referral to a facility. A study to test the BAS tool in a community based setting for managing acute malnutrition would be valuable.

b) Hospital-based care
Eight of the tools appear to be useful in a clinical context. One tool, the BAS, was considered to be of limited use in a hospital setting as it would not provide extra information about specific elements of the breastfeed to diagnose specific problems. Currently most cases of SAM in infants <6m are managed in inpatient settings. We suggest a study to evaluate a tool(s) for breastfeeding assessment and problem identification in a clinical setting where MAMI takes place.

The recent implementation of a checklist to ensure simple guidelines were followed during surgery resulted in significant reduction of patient mortality and morbidity.[186] We believe a breastfeeding checklist as part of admission assessment could operate in a similar way by highlighting simple problems that could be easily overlooked.

Overall, few of the tools were sufficiently versatile to be used across community and hospital contexts without substantial modification.

c) Lack of 'gold standard' treatment of malnourished infants <6m
The success of a breastfeeding assessment tool in relation to nutritional/mortality outcome is dependent on the interventions available to address the problems identified. As stated in earlier chapters, there is currently no gold standard treatment for MAMI. Intensive, inpatient programmes as suggested in current guidelines might be enhanced by a tool that identifies breastfeeding problems and appropriate remedial action. Community-based programmes have a larger potential capacity for provision of treatment; the question remains which infants <6m with SAM can be managed in the community.

d) Continued breastfeeding in older infants and children
Breastfeeding assessment and support is not just a consideration for infants <6m. Actions to support and sustain breastfeeding as part of complementary feeding should feature in the therapeutic management and rehabilitation of children up to two years of age and beyond. One promising initiative is the development of a training content to integrate training on infant and young child feeding into CTC/CMAM programming, piloted in Sierra Leone Feb/March 2009 (ENN/Valid/UNICEF) and in Zimbabwe in June 2009 (ENN/SCUK/UNICEF) (personal communication, Mary Lung'aho).[187] Reliable and valid breastfeeding assessment tools developed for infants <6m could have wider application in children up to two years of age and build upon current initiatives to address shortfalls in infant and young child feeding support available to this older age-group.

7.5   Limitations

This review was systematically conducted, but it was not exhaustive due to time and resource constraints. Formal grading of each of the breastfeeding assessment tools was not possible due to a lack of appropriately designed study, and no gold standard for treatment of SAM in the <6m age group. The review is therefore more subjective than ideal, which limits any strong recommendations about which tools perform best in each context.

7.6   Conclusions

This review highlights the need for simple, accurate and valid assessment tools predictive of breastfeeding and infant nutritional outcomes. Different tools, or different versions of the same tool, are necessary for several related but separate purposes:

- A short, sensitive and quick version to identify breastfeeding problems and actions at community level.
- A more specific, detailed tool to aid diagnosis and appropriate treatment in an inpatient/clinical context
- A tool with intermediate balance of sensitivity and specificity for use in diagnosis and management for outpatient primary healthcare services

At present, there is no single tool or set of tools that meets these ideals. Many existing tools are too narrow in scope or have not been robustly validated, especially in nutritionally vulnerable developing country / emergency settings. This is an important gap that warrants future research.

In the interim, UNICEF b-r-e-a-s-t, the UNICEF 2006 BF observation aid and the aids described in IFE Module 2 offer the most promise for field use in programmes managing infants <6m. Operational research could be useful in confirming their utility as 'best currently available' tools. They could also form the basis of future tools optimised to meet the needs of malnourished infants <6m. There is a need to identify the most appropriate outcome(s) for validating new tools (e.g. rate of weight gain after stabilisation).

7.7   Summary findings and recommendations

Summary findings
15 breastfeeding assessment tools were identified in the literature search. No single tool or set of tools was identified for use in MAMI. Many tools are either too narrow in scope or have not been robustly validated against nutritional or health outcomes, or applied in nutritionally vulnerable developing country/emergency settings.

The influence of infant SAM on the mother's interaction with her infant is not addressed in any tool reviewed.

The Breastfeeding Assessment Tool (BAS) could be tested for its suitability to community settings (e.g. use by community health workers for case finding and assessment). Half of the tools reviewed could be useful for inpatient assessment.

There is no tool that is sufficiently sensitive for community use or specific for use in inpatient settings. It is likely that different tools will be needed for each setting, and possibly a third that is a balance of both for use in primary healthcare services.

In the interim, UNICEF b-r-e-a-s-t, the UNICEF 2006 breastfeeding observation aid and the aids described in IFE Module 2 were identified as most useful to assess breastfeeding in programmes managing infants <6m.

Summary recommendations
There is a need for simple, accurate and valid assessment tools that are predictive of breastfeeding and infant nutritional outcomes. Such tools could also have wider application for children up to two years.

Quality research studies to test the validity of existing breastfeeding assessment tools are needed. For example, the Breastfeeding Assessment Tool (BAS)[188] could be tested for its suitability to community settings (e.g. use by community health workers for case finding and assessment). Half of the tools reviewed could be useful for inpatient assessment.

New tools should be developed, possibly based on existing tools, to meet the needs of malnourished infants <6m, suitable for use in case finding in the community, inpatient settings and outpatient primary healthcare programmes.

The success of a breastfeeding assessment tool and how it relates to nutritional/morbidity outcomes is dependent on the interventions available to address problems identified. The lack of a 'gold standard' treatment for infants <6m is a limiting factor in this regard.

Severe maternal wasting and maternal and infant HIV status are important considerations in assessing breastfeeding effectiveness.

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