SECTION 4

4

The importance of breastfeeding to infant and young child health and HIV-free survival

TABLE OF CONTENTS

Key messages 2

4.1 HIV and infant feeding definitions and guidelines 3
- Key elements of the 2016 HIV and infant feeding guidelines 3

4.2 Breastfeeding and HIV-free survival 5
- The importance of breastfeeding to infant and young child health and survival 5
- HIV-free survival 6
- Reducing postnatal transmission to virtually 'Nil' 7

4.3 Continued breastfeeding and weaning 9
- Duration of breastfeeding 9

4.4 Positioning and attachment at the breast 11
- Key Points to enable attachment 11

4.5 Expressed breastmilk and storage 12
- Benefits of expressing breastmilk 12
- How to express breastmilk by hand 12
- Guidance for storage of expressed breastmilk 13
- Alternative practices utilising breastmilk 13
- Benefits of receiving the heat-treated breastmilk of a mother living with HIV to the baby 15

4.6 Types of alternative feeding methods 15
- Cup-feeding 15
- Droppers 16
- Syringe-feeding 16
- Spoon-feeding 16

4.7 Mixed feeding and replacement feeding 16
- Mixed feeding before 6 months of age 16
- Health outcomes due to formula-feeding, especially increases in overall rates of infant malnutrition, morbidity and mortality 17

2nd Edition, 2018

KEY MESSAGES

- National or sub-national health authorities should decide how health services will principally counsel and support mothers living with HIV to ensure the greatest chance of HIV-free survival. The decision has to be made whether to counsel and support for:
  - Breastfeeding and lifelong ART, or
  - Avoid all breastfeeding.
- ART reduces the risk of HIV transmission through exclusive breastfeeding in the first six months and during mixed feeding after six months, and has shifted the risk/benefit analysis in favour of breastfeeding. Wherever possible, an HIV infected mother and her child should be given lifelong ARV treatment or prophylaxis, while practising exclusive and continued breastfeeding, but if ARV drugs are not yet available, exclusive breastfeeding in the first six months and continued breastfeeding with adequate complementary foods remain the safest option;
- The aim of revised global infant feeding recommendation is HIV-free survival of infants and improved health and survival of mothers living with HIV;
- Mothers living with HIV should receive lifelong ARV therapy, are recommended to breastfeed until their babies reach at least 12 months of age and may continue breastfeeding for up to 24 months or longer (similar to the general population);
- ARV drugs given to the mother and baby substantially reduce HIV transmission through breastfeeding, and exclusive and continued breastfeeding provides the majority of infants with the greatest chance of HIV-free survival;
- For mothers living with HIV in most settings, exclusive breastfeeding for six months, with appropriate antiretroviral therapy (ART), and continued breastfeeding with adequate complementary foods to at least 24 months is the safest feeding option leading to maximum HIV-free survival for their infants;
- When mothers living with HIV continue to receive adequate ART from 6 to 24 months, the risk of HIV transmission to the baby is very low;
- Where antiretroviral (ARV) drugs are not yet available, exclusive breastfeeding in the first six months and continued breastfeeding with adequate complementary foods remains the safest infant feeding method;
- The very low risk of HIV transmission through breastfeeding with appropriate interventions needs to be balanced against the risk of illness and death due to replacement feeding especially in resource-limited settings;
- Where ART is not yet available, exclusive breastfeeding in the first six months and continued breastfeeding with adequate complementary foods remains the safest infant feeding method. However, every effort should be made to accelerate access to ARV drugs;
- Mothers living with HIV and healthcare workers can be reassured that ART reduces the risk of postnatal HIV transmission in the context of mixed feeding. Although exclusive breastfeeding is recommended, practising mixed feeding is not a reason to stop breastfeeding in the presence of ARV drugs;
- It was concluded that this makes exclusive breastfeeding the best option for mothers who cannot sustain exclusive formula feeding, as is often the case in resource-poor settings (Natchu et al., 2012);
- Mothers living with HIV should be advised to stop breastfeeding only when they can provide a nutritionally adequate and safe diet without breastmilk after 24 months. Otherwise they should continue breastfeeding up to 24 months or beyond while remaining on (with full adherence to) ARVs. If breastfeeding is discontinued, this should be done gradually over a period of 4 weeks while maternal lifelong ARVs are continued (and with avoidance of over-fullness of the breasts) in order to avoid exposing the infant to elevated viral levels in breastmilk;
- The use of the woman's own heat-treated expressed breastmilk is a safe alternative for the HIV-exposed infant;
- Mixed feeding in the first six months after birth can increase the risk of postnatal HIV transmission compared to exclusive breastfeeding, and therefore should be avoided as the worst option. However the 2016 recommendation for mixed feeding after six months reads: "Mothers living with HIV and health-care workers can be reassured that ART reduces the risk of postnatal HIV transmission in the context of mixed feeding. Although exclusive breastfeeding is recommended, practicing mixed

feeding is not a reason to stop breastfeeding in the presence of ARV drugs.

- Some women living with HIV may seek information about alternative infant feeding options outside the national recommendation and should be supported to make an informed choice about the safest way to feed their babies.
- A simpler description of conditions for safe replacement feeding has been developed to replace the AFASS description. All criteria should be in place in all settings where mothers might consider replacement feeding. Action to avoid spill over of artificial feeding to women who do not need to use it is important for all infants including HIV-exposed infants. The International Code can protect women and children from marketing of breastmilk substitutes.

4.1 HIV AND INFANT FEEDING DEFINITIONS AND GUIDELINES

The following definitions of infant feeding are used (Labbok & Krasovec, 1990):

- Breastfeeding: feeding a baby or young child at the breast; other foods may be given.
- Mixed feeding: feeding a baby with breastmilk as well as other foods and/or liquids before the age of 6 months.
- Replacement feeding: intentionally replacing breastmilk with another kind of milk, usually formula milk.
- Exclusive breastfeeding: the breastfed infant receives no other foods and liquids at all, apart from prescribed medications, not even water.

Key elements of the 2016 HIV and infant feeding guidelines

Research shows conclusively that careful adherence to maternal/infant antiretroviral (ARV) regimens during pregnancy and breastfeeding greatly reduce vertical transmission of HIV; and that exclusive and continued breastfeeding significantly improves overall HIV-free survival rates of exposed infants (Chikhungu et al.; Kuhn & Aldrovandi, 2012; Chikhungu et al., 2016; Bispo et al., 2017). Even when ARVs are not available, WHO currently recommends that breastfeeding may still provide infants born to mothers living with HIV a greater chance of HIV-free survival. National authorities should not be deterred from recommending that mothers living with HIV breastfeed as the most appropriate infant feeding practice in their setting (WHO & UNICEF, 2016). Most studies fail to find any evidence that breastfeeding causes significant harm to the health of the HIV-infected mother.

The WHO recommendation (WHO & UNICEF, 2016) is for national and sub-national health authorities to decide on the strategy that will most likely prolong the lives and improve the health of mothers living with HIV while simultaneously providing their infants with the most likely chance of HIV-free survival. This means that most mothers living with HIV should receive lifelong ARV therapy and that a recommendation should be made that they either breastfeed until their babies reach 24 months or more (or until an adequate alternative diet can be provided), or avoid all breastfeeding (WHO et al., 2010; WHO & UNICEF, 2016). While many assume this means that all HIV-exposed infants in industrialised countries should be artificially fed, this is based on the false assumption that no risk is involved in artificial feeding; the Kit provides evidence that women in such settings who want to exclusively breastfeed should be supported in doing so (Morrison et al., 2011).

In its 2010 Framework for Priority Action (WHO et al., 2012), WHO proposes and clearly outlines how to achieve five priority actions for national governments considered to be the gold standard in breastfeeding protection, promotion and support:

- Develop or revise (as appropriate) a comprehensive evidence-based national infant and young child feeding policy which includes HIV and infant feeding;
- Promote and support appropriate infant and young child feeding practices, taking advantage of the opportunity of implementing the revised guidelines on HIV and infant feeding;
- Provide adequate support to mothers living with HIV to enable them to successfully carry out the recommended infant feeding practice, including ensuring access to ARV treatment or prophylaxis;
- Develop and implement a communication strategy to promote appropriate feeding practices aimed at decision-makers, health workers, civil society, community workers, women and their families;

- Implement and enforce locally the International Code of Marketing of Breastmilk Substitutes and subsequent relevant World Health Assembly resolutions (the Code).

Exclusive breastfeeding, a simple and cost-effective intervention to improve child health and survival, has been estimated to avert 13% to 15% of under-five mortality and contribute to reduce postnatal transmission of HIV (Jones et al., 2003). While the prevalence of exclusive breastfeeding for infants less than six months is low in most developing countries, greater political will to support breastfeeding could increase those rates.
For HIV-exposed babies, exclusive breastfeeding for the first 6 months significantly reduces their chances of contracting HIV and lengthens the life of those already HIV-infected, and continued partial breastfeeding until at least the end of the second year helps safeguard their nutritional status.

Current infant feeding recommendation for resource-poor settings

In resource-poor settings where diarrhoea, pneumonia and malnutrition are common causes of child mortality, breastfeeding with antiretroviral drugs is likely to give HIV-exposed infants the greatest chance of HIV-free survival (WHO, 2014a).

Current infant feeding recommendation for high to middle income countries

For mothers living with HIV in high to middle income countries such as Australia, Canada, South Africa, United Kingdom and United States, national recommendation and policies mainly support replacement feeding.

HIV and infant feeding recommendation in Australia

"In Australia breastfeeding is contra-indicated when a mother is known to be living with HIV (specialist advice is needed for each individual case)" (Morrison & Greiner, 2014).

HIV and infant feeding recommendation in Canada

In Canada it is recommended that breastfeeding should be avoided, even if the mother living with HIV is receiving antiretroviral therapy. This is consistent with WHO's recommendation in countries where suitable breastmilk substitutes are available. Counselling about the risks of HIV transmission during pregnancy and lactation are an important part of early prenatal care (Tudor-Williams, 2010).

HIV and infant feeding recommendation in United Kingdom

The Position Paper of the British HIV Association (Tudor-Williams, 2010) recognises in paragraph 3 that a woman living with HIV already receiving triple ART, with a repeated undetectable viral load at delivery may, after careful consideration, choose to exclusively breastfeed for the first 6 months of her baby's life. In such a scenario, the current guidance recommends:

- continuing maternal triple ART treatment and short-term infant prophylaxis.
- exclusive breastfeeding for six months.
- frequent follow-up.
- careful monitoring of maternal ART adherence until 1 week after weaning.
- monthly checks on maternal viral load and infant HIV status.

HIV and infant feeding recommendation after amendment (June 2017) in South Africa

- Exclusive breastfeeding during the first six months of life is recommended to all infants, exposed or not HIV exposed or unknown HIV status;
- Mothers living with HIV on ART and whose infants are HIV uninfected or of unknown HIV status continue breastfeeding for 24 months (recommended) while being fully supported for ART adherence (as outlined in the current PMTCT guidelines of South Africa). In addition, the infant should receive prophylactic ARVs in accordance with current PMTCT guidelines of South Africa (Pillay, 2017);
- Mothers living with HIV and whose infants are HIV infected, should continue breastfeeding for 2 years or longer while being fully supported for ART adherence for mother and infant pathology;
- The current SA IYCF policy/2017 strengthens the position of no difference in breastfeeding recommendation for mothers regardless of their HIV status. The recommendation have been designed to provide the same breastfeeding support to all, for optimal infant health and nutrition, and in order to reduce discrimination, spill over and stigma experienced by women living with HIV.

4.2 BREASTFEEDING AND HIV-FREE SURVIVAL

The importance of breastfeeding to infant and young child health and survival

Breastfeeding is advantageous in almost all settings, but the HIV/AIDS epidemic and its potential for vertical transmission, has challenged the established notion of optimal breastfeeding for all (WHO, 2001).

Recommendation and Guidance for the General Population in All Countries (WHO, 2001; WHO & UNICEF, 2003; Save the Children, 2012)

- start breastfeeding within one hour of birth.
- breastfeed exclusively for the first six months of life.
- give nutritionally adequate and safe, age-appropriate complementary foods after six months, while continuing to breastfeed for up to two years of age or beyond.

Exclusive breastfeeding for the first 6 months

With increasing recognition that in most developing countries replacement feeding is neither affordable, feasible, acceptable nor, most importantly, safe or sustainable, alternative research has focused on ways to make breastfeeding safer so as to maintain its important general health benefits (Doherty et al., 2007; Jamieson et al., 2012; Natchu et al., 2012).

Factors which increase the risk of HIV transmission during breastfeeding

There is an increased risk of transmission if the mother is not receiving (or has recently begun) antiretroviral treatment (ART) under any of the following conditions:

- A high viral load, (e.g. >3500 copies/mL) (Garcia et al., 1999; Shapiro et al., 2009) due to:
  - Primary infection with HIV during late pregnancy or during the breastfeeding period (Johnson et al., 2012).
  - A very long-standing HIV infection, with a low CD4 count (<225 cells/mm^3), which indicates active AIDS (Shapiro et al., 2009).
  - Short duration of ART, facilitating on-going seeding of milk by viruses from the blood (Slyker et al., 2012).
- Suffers breast pathology, also more likely with a high viral load (>3500 copies/mm^3) or low CD4 count (<225 cells/mm^3):
  - Inflamed/infected breasts (mastitis, abscess) (Semba et al., 1999a; Willumsen et al., 2003; Semrau et al., 2011) (more likely with mixed feeding) (Embree et al., 2000).
  - Bacterial or fungal nipple infection (John-Stewart et al., 2004).
  - Painful/damaged nipples (Walker et al., 2006).

Infant factors which increase the risk of infection during breastfeeding in the absence of ART are:

- oral thrush, though this may also be a proxy for immune suppression (Hamza et al ., 2008), i.e. a symptom of an already-infected infant whose immune system has already been severely compromised by early HIV-infection (Chisenga et al., 2005).
- effects on the infant of frenulotomy for perceived ankyloglossia.
- mixed feeding (i.e. breastfeeding plus other foods or fluids before the age of 6 months) has caused damage to the intestinal mucosa.
- early introduction of solid foods and animal milks (Coovadia et al., 2007).
- partial breastfeeding, because exclusive breastfeeding protects the integrity of the gastrointestinal tract, presenting a more effective barrier to HIV (Coovadia et al., 2007).

Possible confounders regarding exclusive breastfeeding in the HIV context

Some researchers have also noted reverse causality, i.e. the association of exclusive breastfeeding with lower rates of MTCT of HIV may be secondary to poor maternal or infant health which in turn led to less exclusive breastfeeding (Phiri et al., 2006).

Interventions to reduce the risk of HIV transmission through breastfeeding

Since the discovery in 1985 (Ziegler et al., 1985) that HIV can be transmitted during breastfeeding, and recognising that the risk of HIV transmission continues throughout the breastfeeding period (Breastfeeding and HIV International Transmission Study Group, 2004; WHO et al., 2010), various interventions to reduce postnatal transmission have been employed in different countries, including:

- provision of lifelong ART (WHO & UNICEF, 2016).
- provision of ARVs to mothers and/or babies during the breastfeeding period.
- Modification of infant feeding with:
  - complete avoidance of breastfeeding from birth, i.e. replacement of breastmilk with formula milk.

- early cessation of breastfeeding at 3-6 months to reduce the length of time for infant's exposure to virus in breastmilk.
- gradual cessation (weaning) to avoid increasing transmission during this period.
- exclusive breastfeeding.
- heat-treating of mother's own expressed breastmilk to inactivate HIV.
- use of heat-treated breastmilk from a milk bank.

HIV-free survival

Revised recommendation capitalise on the maximum benefit of breastfeeding to improve the infant's chance of survival while reducing the risk of HIV transmission. In the presence of ARV interventions, being able to breastfeed for up to 24 months or longer avoids many of the difficulties caused by ending breastfeeding, i.e. in providing a safe and adequate diet to an infant without breastmilk, and facilitating gradual weaning from the breast.

Recommendation on ARVs and HIV transmission through breastfeeding

Several important trials with differing ARV approaches have demonstrated that mothers with HIV can breastfeed safely for longer durations and that this can be lifesaving for their infants. Although longer-term exposure to ARVs may have undiscovered consequences, the best available evidence suggests that the risk of infants dying from other diseases if breastfeeding stops before the age of 2 is greater than the potential side effects of prolonged drug exposure. Thus ARVs that reduce the risk of HIV transmission through breastfeeding have shifted the risk/benefit analysis in favour of breastfeeding (Sint et al., 2013; Chikhungu et al., 2016).

Exclusive breastfeeding should be strongly encouraged (UNICEF, 2011; WHO & UNICEF, 2016). According to a 2013 study, breastfed infants had a 47% lower risk of pneumonia than those never breastfed, independent of infant growth, maternal viral load and maternal CD4 count. Breastfeeding was also associated with a 74% lower risk of pneumonia-related hospitalisation (Ásbjörnsdóttir et al., 2013).

Support of exclusive breastfeeding is a standard part of usual lactation management (WHO & UNICEF, 1993; Lawrence & Lawrence, 1999). Outside the context of HIV, increased rates of diarrhoea and respiratory infection have been associated with the early introduction of non-human milks and solid foods (mixed feeding) compared to exclusive breastfeeding (Victora et al ., 1987; Brown et al ., 1989; Ahmed et al., 1992; WHO Collaborative Study Team on the Role of Breastfeeding on the Prevention of Infant Mortality, 2000; Arifeen et al., 2001; Bahl et al., 2005).

Exclusive breastfeeding facilitates normal physiological regulation of milk production and helps to prevent milk stasis which underlies the development of avoidable breast problems (Neville & Neifert, 1983; Smith & Kuhn, 2000; Semrau et al., 2011). This is especially necessary when a woman is infected with HIV.

ARV during breastfeeding

WHO recommends that women living with HIV should be provided with lifelong ARV treatment and infant prophylaxis for several weeks after birth. Every effort should be made to accelerate access to ARVs for both maternal health and prevention of vertical transmission (WHO, 2010a; WHO et al., 2010; WHO, 2012c; WHO, 2016c).

The 2013 (WHO, 2013a) and 2016 (WHO, 2016c) WHO guidelines represent an important step towards achieving universal access to ARV drugs for treating and preventing HIV, and realising the ultimate goal of ending the HIV epidemic. The Consolidated Guidelines are valuable resources for clinicians and should inform the priorities of governments, development agencies, international organisations, nongovernmental organisations and other implementing partners during the next few years.

Pending universal access to ARVs, national authorities should not be deterred from recommending that women living with HIV should breastfeed.

Breastfeeding as the safest feeding option

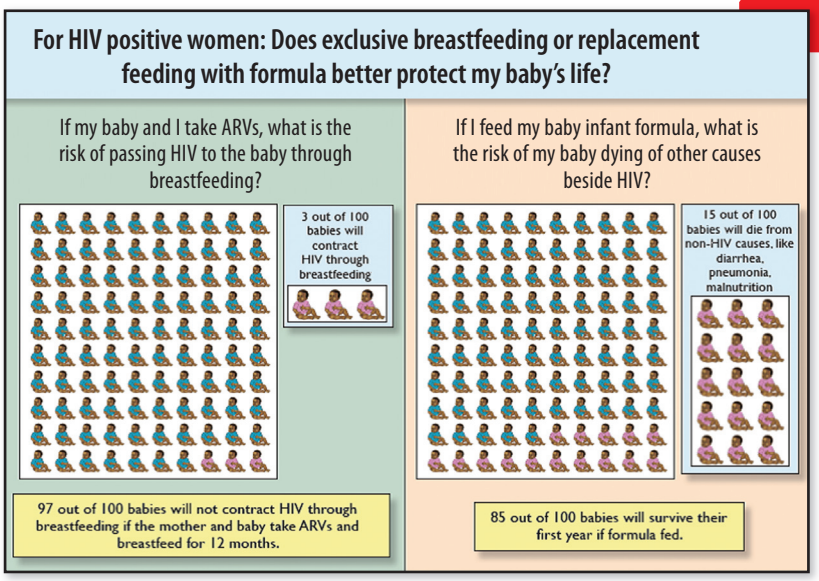
Exclusive breastfeeding for six months, with appropriate ARVs, and continued breastfeeding with adequate complementary foods to 24 months or beyond is the safest feeding option, leading to maximum HIV-free survival in most low-income settings (WHO et al., 2010; WHO & UNICEF, 2016).

The known benefits of breastfeeding to reduce mortality from other infections justify an approach that strongly recommends the option of breastfeeding plus ARVs as the standard of care (WHO et al., 2010). This evidence has major implications for how women living with HIV might feed their infants, and how health workers should counsel them. See Figure 1 for details.

Rather than presenting breastfeeding as an option, there are few current resource-poor settings in which artificial feeding is justified. Breastfeeding is currently almost always recommended for mothers living with HIV in resource-poor settings:

- enabling breastfeeding to continue to 12 months with ARV interventions.
- providing additional developmental and other health benefits of breastfeeding for infants who do not become HIV-infected (Ahmed et al., 2013).
- eliminating replacement feeding as the sole way to avoid postpartum transmission of HIV.
- avoiding increased rates of infant morbidity and mortality due to withholding breastfeeding.
- avoiding the complexities associated with stopping breastfeeding and attempting to provide a safe and adequate diet without breastmilk to the infant 6–12 months of age (Walls et al., 2010; ABA, 2011; Morrison et al., 2011).
- facilitating the greatest likelihood of infant and young child HIV-free survival.
- study on household food insecurity, maternal nutritional status and infant feeding practices among HIV infected women receiving ART in Uganda. Household food insecurity in the context of HIV has been found to significantly influence cessation of exclusive breastfeeding, especially between 4 and 6 months, and the causal relationship between mixed feeding and access to sufficient food should be further explored (Young et al., 2014).

FIGURE 1: Balancing competing risks



Source: USAID et al. (2010)

Good Practice and recommendation when ARVs are not available

Even when ARVs are not available, breastfeeding may still provide infants born to HIV-infected mothers with a greater chance of HIV-free survival. Mothers should be counselled to exclusively breastfeed in the first six months of life and continue breastfeeding thereafter unless environmental and social circumstances are safe for, and supportive of replacement feeding.

Good practice on parents living with HIV and HIV testing of children

In all settings, children with parents living with HIV should be routinely offered HIV testing and, if found to be either infected or at high risk of infection through breastfeeding, should be linked to services for treatment or prevention (WHO, 2016a).

Reducing postnatal transmission to virtually 'Nil'

Recommendation and Guidance

Postnatal transmission of HIV (i.e. through breastfeeding) can be reduced still further to between 0-1% when:

- upon diagnosis, pregnant women living with HIV have access to effective ART which is continued for life (WHO, 2013; WHO, 2016a).
- ART is provided for at least 13 weeks prior to delivery to achieve an undetectable viral load by the time of birth (Chibwesha et al., 2011).
- mothers living with HIV are fully adherent to their medications (Shapiro et al., 2010; Ngoma et al., 2011).
- mothers living with HIV breastfeed their babies exclusively for the first six months of life (see Table 1) (Morrison et al., 2011).

When to start ART in pregnant and breastfeeding women

ART should be initiated in ALL pregnant and breastfeeding women and continued for life on diagnosis of HIV infection (WHO, 2016c).

Long-term antiretroviral interventions and exclusive and continued breastfeeding (ART+EBF)

In recent years, significant programmatic experience and research on the use of antiretroviral regimens (ART) has accumulated. Wherever ART is routinely available,

rates of vertical transmission of HIV have been reduced by between 1 to 2% (Townsend et al., 2008a).

The full effectiveness of ART in reducing maternal viral load to undetectable, thus preventing vertical transmission during labour and birth, is achieved by ensuring maternal adherence to ART for at least 13 weeks prior to delivery (Chibwesha et al., 2011).

The results from the 8 studies outlined in Table 1 show that the risk of postnatal transmission during the period of exclusive breastfeeding can be reduced to 0 to 1% when:

- mothers and/or their babies receive appropriate ARVs from early/mid-pregnancy and throughout the breastfeeding period.
- breastfeeding is exclusive for up to six months.

Studies of postnatal HIV transmission rates <1% at 6 months (inclusion criteria: mother or child received ART and infants were exclusively breastfed). Breastfeeding-associated transmission was defined as excluding transmission diagnosed during the first month postpartum.

TABLE 1: Risk of postnatal transmission with maternal ART and exclusive breastfeeding

References	Duration of Exclusive Breastfeeding	Antiretroviral treatment and/or prophylaxis	Postnatal transmission	Determined by first infant HIV-positive test result period
Palombi et al. (2007)	6 months	Maternal HAART from 25 weeks gestation until weaning; infant sdNVP after birth	0.8% (2/251)	1 - 6 months
Kilewo et al. (2008)	18 weeks	Maternal ZDV & 3TC from ~34 weeks gestation to 1 week postpartum; infant ZDV & 3TC from 0-1 week, then 3TC alone during breastfeeding	1% (4/398)	6 weeks - 6 months
Kilewo et ak. (2009)	maximum of 6 months	Maternal HAART from 34 weeks gestation to 6 months postpartum; infant ZDV & 3TC to 1 week of age	0.9% (4/441)	6 weeks - 6 months
Marazzi et al. (2009)	6 months; mothers advised to start weaning by 6 months ending within 2 months, but likely some breastfeeding 6-12 months;	Maternal HAART from 15 weeks gestation to 2 months post weaning; infant sdNVP after birth + AZT for 1 week	0.6% (2/341) 0.6% (2/239)	6 weeks - 6 months 6-12 months
Peltier et al. (2009)	6 months; mothers advised to wean at 6 months;	Maternal HAART from 28 weeks gestation to 7 months postpartum; infant sdNVP after birth + ZDV for 1 week	0.44% (1/227)	6 weeks - 9 months
Shapiro et al. (2010)	EBF for 93% of infants to weaning: 71% breastfed >5months; <1% >6 months	Randomised and varied HAART regimens for mothers from 18-34 weeks gestation until weaning; all mothers also received supplemental AZT during labor: infant sdNVP after delivery plus 1 months AZT	0.3% (2/709)	1 - 6 months
Homsy et al. (2010)	EBF for 92% for 4 months, weaned at 5 months	Maternal FDC, median duration 5.2 - 20.3 months preceding delivery and during breastfeeding: infant sdNVP post birth or sdNVP + ZDV 1 week	0% (0/109)	6 weeks of age - 6 weeks post weaning
Thomas et al. (2011)	6 months	Maternal HAART from 34 weeks gestation to 6 months postpartum: infant sdNVP at birth	0.8% (4/487)	6 weeks - 6 months

Source: Morrison et al. (2011)

Continued mixed breastfeeding after 6 months + maternal ART

Two Zambian studies (Ngoma et al., 2011; Gartland et al., 2013) showed that where maternal HAART was initiated during pregnancy and continued throughout breastfeeding for 12 months, HIV transmission during complementary feeding or partial breastfeeding after 6 months could be reduced to 1%. Further research shows that breastfeeding can safely continue to 24 months or longer (WHO & UNICEF, 2016).

In the first study (Ngoma et al., 2011) ART was initiated between 14 and 30 weeks gestation, and continued to 12 months postpartum. When infants were exclusively breastfed to 6 months and continued breastfeeding with complementary foods to 12 months, the risk of transmission of HIV from 6 weeks to 12 months was 1.1%.

In the second study (Gartland et al., 2013), where mothers had received ART from pregnancy until cessation of breastfeeding, infant HIV infection at 12 months postpartum was 1% compared to a transmission rate of 12.1% for infants whose mothers received only antenatal ZDV and peripartum NVP, the standard of care at the time.

Thus, consideration of various strategies employed to improve overall child survival as well as protect the health of mothers reveals that the safest is to breastfeed with ART, as shown in Figure 2.

"Effective use of antiretroviral drugs can now reduce transmission to such low levels that there are few circumstances in developing countries where artificial feeding can be justified."

Source: WHO et al. (2010)

4.3 CONTINUED BREASTFEEDING AND WEANING

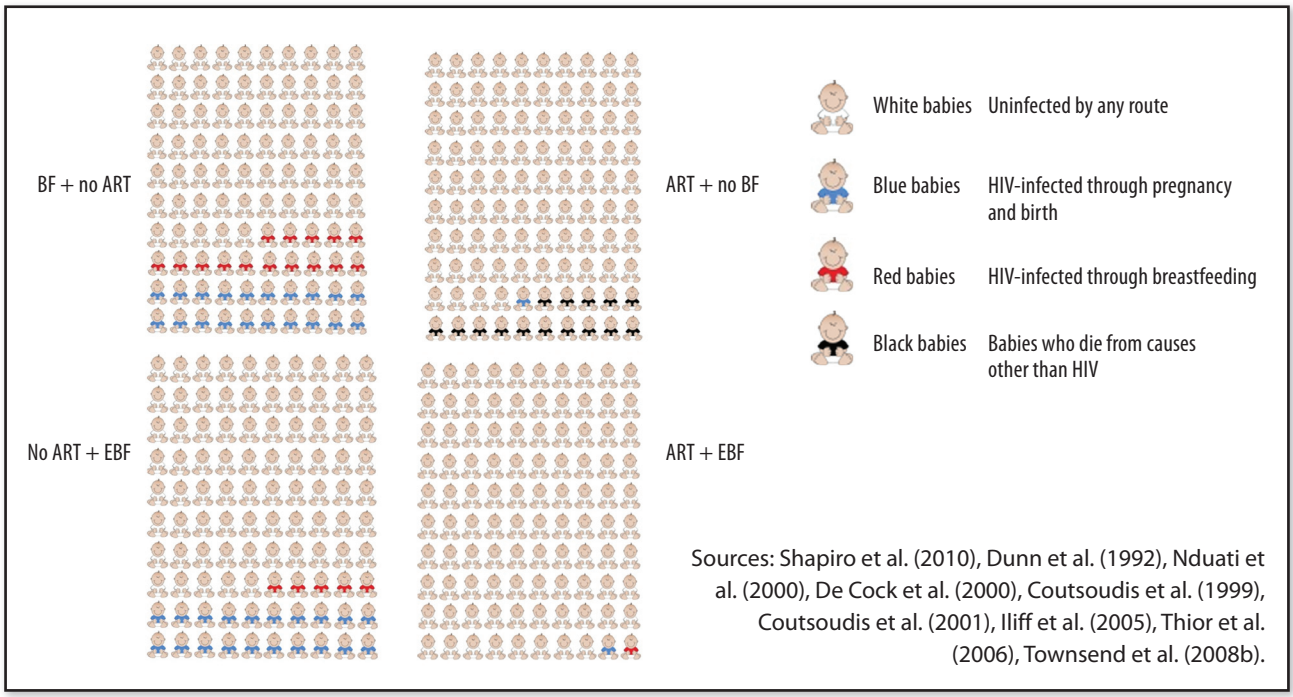
Duration of breastfeeding

In the second six months of life, the ongoing possible risk of transmission of HIV through breastfeeding by an untreated mother living with HIV is less than 1% per month. This needs to be weighed against the greater risk of infant death from other infections and malnutrition when a child is not breastfed.

Recommendation on breastfeeding duration in the context of HIV

When the mother continues to receive, and takes, appropriate ARVs beyond six months (lifelong ART), then the risk of HIV continues to be almost negligible (Morrison et al., 2011; Ngoma et al., 2011; Ngoma et al., 2015). The WHO Guidelines (2010 and 2016) propose that mothers known to be HIV-infected (and whose infants are HIV uninfected or of unknown HIV status) should

FIGURE 2: HIV-free survival, different ART regimens and feeding methods



Sources: Shapiro et al. (2010), Dunn et al. (1992), Nduati et al. (2000), De Cock et al. (2000), Coutsoudis et al. (1999), Coutsoudis et al. (2001), Iliff et al. (2005), Thior et al. (2006), Townsend et al. (2008b).

continue breastfeeding for the first 24 months of life or longer (WHO & UNICEF, 2016).

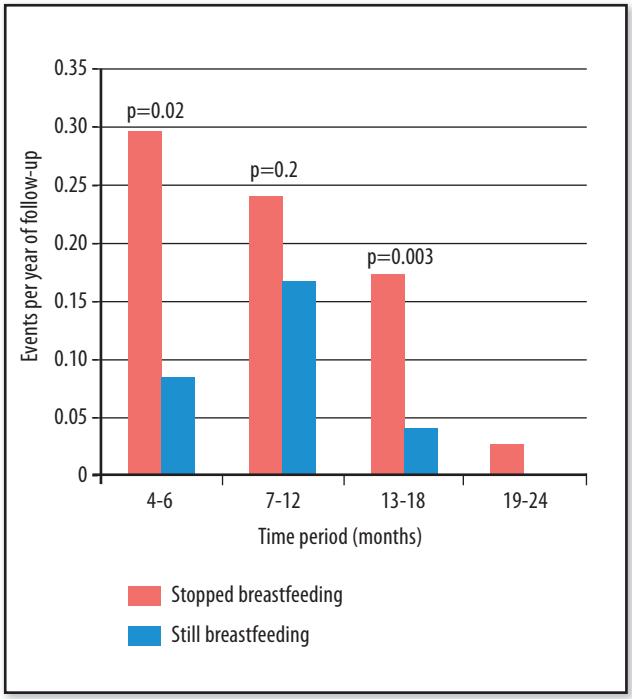
A study from 2013 shows that changes in frequency of breastfeeding before cessation of breastfeeding and with non-exclusive breastfeeding influenced milk viral concentrations. This may explain the reduced risk of HIV-1 transmission associated with exclusive breastfeeding and why early weaning does not achieve the magnitude of HIV prevention predicted by models. This possibility supports the rationale of continuing maternal antiretroviral drug interventions over the full duration of time when any breastmilk exposures may occur after planned cessation of breastfeeding (Kuhn et al., 2013).

Partial feeding after 6 months

Studies on the low risk of HIV transmission when a woman receives and adheres to appropriate ART

- Concerns have been expressed about the risk of HIV transmission during mixed feeding after 6 months. However, recent research suggests that when mothers living with HIV continue to receive adequate ART from 6 to 24 months, then the risk of HIV transmission to the baby in this period is also very low at 1 to 1.1% (Ngoma et al., 2011; Gartland et al., 2013; Ngoma et al., 2015).
- Revised recommendation to continue breastfeeding past six months (WHO & UNICEF, 2016) are based on the results of several important trials which demonstrate that mothers living with HIV and on ART can breastfeed for longer durations with only small increases in postnatal transmission rates and that this can be life-saving for their infants. The best available evidence suggests that the risks of infants dying from other diseases if breastfeeding stops prematurely are greater than the potential side-effects of prolonged exposure to maternal ART.
- Continued maternal ART allows the infant to receive the maximum benefit of breastfeeding to improve the infant's chance of survival while reducing the risk of HIV transmission. In the presence of ARV interventions, being able to breastfeed for up to 24 months or longer avoids many of the difficulties due to stopping breastfeeding, including the provision of a safe and adequate diet without breastmilk. Thus ARVs that reduce the risk of HIV transmission through breastfeeding have shifted the risk/benefit analysis in favour of breastfeeding.

FIGURE 3: Rates of diarrhoea-related hospital admission or death among HIV-exposed uninfected infants by actual breastfeeding practice and by age

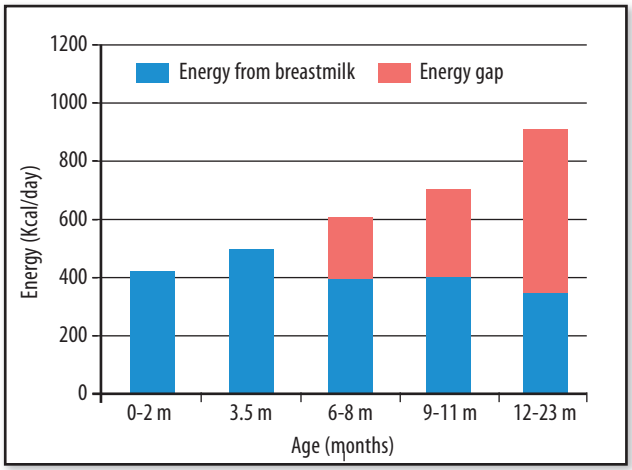


Source: Fawzy et al. (2011)

Breastfeeding with complementary foods after 6 months

All children between 6 to 24 months or beyond, need safe and adequate complementary feeding. Breastmilk continues to help meet a child's nutrient needs for at least 2 years. While the amount of breastmilk a mother produces is not determined by the baby's age but by his or her suckling pattern, typically, breastmilk can provide the following percentage of energy needs at the relevant ages (Williams, 2003). See Figure 4 for details.

FIGURE 4: Energy required by age and the amount from breastmilk



Source: WHO (2009b)

Breastfeeding into the second year of life reduces infant morbidity and mortality. For instance, breastfeeding prevents half of infant deaths due to infection from 6 to 23 months. Breastfeeding for up to 2 years or beyond also protects against otitis media. In addition, longer duration of breastfeeding decreases the risk of infant overweight or obesity and breastfeeding duration is directly associated with elevated IQ (Victora et al., 2016).

Recommendation on weaning in the context of HIV

When the mother stops breastfeeding, she should do so slowly over a 4-week period. Abrupt or rapid cessation of breastfeeding is no longer generally recommended at any time because it can cause painful breast engorgement and mastitis for the mother and distress for the infant or young child and may result in elevated viral levels in her milk (Kuhn et al., 2013).

If there are doubts about maternal adherence to ART, it has been postulated that directly treating the infant during the risky period of mixed feeding prior to full weaning may be the most effective means for preventing transmission of HIV during this vulnerable period (Dorosko et al., 2012). Another effective approach would be to express and heat treat milk during the weaning (cessation of breastfeeding) period.

Recommendation and guidance on breastfeeding for HIV infected children

HIV-infected children can continue breastfeeding for up to 2 years or longer, as breastfeeding increases their chances of survival (WHO & UNICEF, 2007).

The risk of HIV transmission through premastication of food

Little attention has been given to the possibility that premastication of weaning foods for young children by mothers living with HIV or other care-givers could be a cause of transmission of HIV.

Isolated reports have confirmed premastication of food as a route of infection of children, and it is possible that the risk of vertical HIV transmission through breastfeeding, particularly late transmission, has been inflated due to under-reporting of infection via this route (CDC, 2011b; Labraña et al., 2013).

Public health officials and healthcare providers should educate the public about the risk for disease transmission via premastication and advise HIV-infected caregivers against the practice.

4.4 POSITIONING AND ATTACHMENT AT THE BREAST

4

Key Points to enable attachment

Good positioning helps maintain correct attachment. The baby should be positioned with:

- head and body in a straight line, neck slightly extended.
- nose/upper lip opposite the mother's nipple, facing her breast.
- whole body supported (for a newborn baby), with no pressure on back of baby's head.
- body held close to the mother.

There are many different positions. One position will not necessarily work well for all mothers, because mothers have arms of different lengths and breasts of different sizes and heights. The mother needs to be well supported and comfortable so that she can hold her baby close to her breast and relax without straining any muscles.

These are the main points for attachment and positioning specified from booklet for mothers by BFF 2008:

- Start with nose opposite nipple.
- Move the baby's mouth across nipple until mouth opens wide, tongue down.
- Bring the baby quickly to breast–place the baby's chin on the breast with nose at nipple level and this will trigger the baby's mouth to open wide.

Signs of good attachment

- More areola visible above baby's mouth than below.
- Baby's mouth wide open.
- Lower lip turned outwards.
- Chin close to breast.
- Mother feels no pain.
- Baby suckles effectively
  - a few quick initial "call-up" sucks,
  - then slow deep sucks, sometimes pausing.
- Cheeks round.

Signs of poor attachment

- More areola visible below baby's mouth, or same above and below.
- Mouth not wide open.
- Lower lip turns inwards or points forwards.
- Chin away from breast.
- Mother feels pain or marked discomfort.
- Rapid sucks throughout feed.
- Indrawing of cheeks.

4.5 EXPRESSED BREASTMILK AND STORAGE

Benefits of expressing breastmilk

Skilled health and community workers should know how to show mothers how to express their breastmilk. Expressing can be a useful technique:

- To avoid postpartum breast over-fullness which, if left untreated, may lead to increased levels of HIV in breastmilk (Semrau et al., 2011; Kuhn et al., 2013), and impacts negatively on the mother's future breastmilk supply.
- To complete breast emptying for a sleepy baby (especially a newborn) and offer more milk by cup and/or assist with increasing milk supply.
- To provide adequate milk for a baby who is premature or who has neurological impairment or congenital abnormalities (e.g. Down Syndrome or cleft lip/palate) and is not yet breastfeeding effectively, e.g. who cannot latch, or stay attached to the breast.
- To provide expressed milk using cup-feeding if breastfeeding needs to be interrupted due to separation (eg for work or serious maternal or infant illness precluding breastfeeding or if breastfeeding is too painful (eg abraded nipples) or if the mother needs to drain her breasts due to infectious mastitis, breast abscess.
- To stimulate a dwindling milk supply or treat a breast condition (e.g. plugged ducts and mastitis).
- To use for heat-treating.

How to express breastmilk by hand

The mother needs to (WHO, 2009c):

- Have a clean, dry, wide-necked container with a screw-cap for the expressed breastmilk.
- Wash hands thoroughly.
- Sit or stand comfortably and hold the clean container under nipple and areola.
- Cup the breast with the thumb on top of her breast and her index finger underneath so that they are opposite each other, about 4 cm from the tip of the nipple.
- Compress the breast tissue between fingers and thumb, pushing back into the chest wall, and then squeezing the thumb and fingers gently together to express the milk, before releasing and repeating this back-squeeze-release motion. After several breast compressions milk starts to drip or spray from the breast.
- If milk does not appear, re-position thumb and finger a little closer or further away from the nipple and compress and release a number of times as mentioned before.
- Avoid rubbing or sliding fingers along the skin or squeezing or pinching the nipple itself. Hand-expressing should not hurt–if it does, the technique is wrong.
- When the flow of milk slows, the mother should move her fingers around the nipple/areola, in order to continue expressing different milk-producing lobes of breast tissue and can use gentle massage prior to expressing to increase/re-stimulate milk flow.
- Express each breast until the milk drips slowly (milk will appear creamy when the breast is well drained). Express each breast several times until there is enough milk for the baby and until both breasts are soft and comfortable.
- Avoid the presence of domestic animals when expressing breastmilk

FIGURE 5: Expressing breastmilk by hand

Source: www.realbabymilk.org

Guidance for storage of expressed breastmilk

- Freshly expressed breastmilk should be stored in covered jar, e.g. jam-jar with a plastic cap.
- For reasons of safety, cup-feeding is recommended over bottle-feeding. Jars for storing breastmilk, cups and spoons for feeding should be washed and cleaned properly, but need not be sterilised.
- Should be stored away from other food, especially raw meat, alternatively the container could be placed inside a plastic bag in the refrigerator or freezer.
- Should be stored in its jar in a vertical position.
- Should not be stored in the door of the refrigerator, as the temperature can be altered by frequent opening of the door.
- Previously frozen and thawed breastmilk may be stored in the refrigerator for 12 hours before being used (ANVISA, 2008).
- Fresh breastmilk can be safely stored as explained in Table 2.

TABLE 2: Temperature and maximum recommended storage duration of fresh breastmilk in room temperature, refrigerator and freezer according to clinical protocol 2017

Location of storage	Temperature	Maximum recommended storage and duration
Room temperature	16 – 29° C (60 – 85°F)	4 hours optimal 6 – 8 hours acceptable under very clean conditions
Refrigerator	~ 4°C (39.2°F)	4 hours optimal 6 – 8 hours acceptable under very clean conditions
Freezer	< -4°C (24.8°F)	6 months optimal 12 months acceptable

Source: Eglash et al. (2017)

Alternative practices utilising breastmilk

Pasteurisation of banked human milk

Pasteurised human milk is available in many neonatal intensive care units. It is mainly used for premature babies in small quantities and has a lower risk of necrotizing enterocolitis compared to infant formula (Naicker et al., 2015). It is typically pasteurised by Holder pasteurisation, i.e. heated to 62.5 °C /144.5 °F for 30 minutes, in order to inactivate communicable pathogens including HIV (Orloff et al., 1993). This method is routinely used by human milk banks. The milk is heated to 62.5°C for 30 minutes (Orloff et al., 1993). Banked milk, if available, is suitable for feeding HIV-exposed babies.

The high-temperature short time (HTST) pasteurisation process (72°C for 16 seconds) is also effective in the elimination of bacteria as well as of certain important pathogenic viruses including HIV. One example of HTST is the Flash-heating method used in Human Milk Banking in South Africa i.e., heating human milk at 72°C (high-temperature, short-time) (PATH, 2011). For a comparison between Holder Pasteurisation and Flash-heating see Table 3.

TABLE 3: The figure from the PATH 2015 shows the comparison among Holder Pasteurisation and Flash-heating Pasteurisation considering % retention of key human milk components

Milk component	Holder Pasteurisation	Flash-heating
Lactoferin ***Iron-binding protein that has antimicrobial and antiviral properties***	44%	100%
Immuniglobulin A ***Major antibody that protects against pathogens***	80 – 100%	80%
Lysozyme ***Enzyme with antimicrobial properties***	75 – 100%	74%
Thiamine, folic acid ***Vitamins important for neurological development***	100%	100%

Source: PATH (2011)

FIGURE 6: The figure from the PATH 2015 summarises safe-guarding quality of post-pasteurisation procedures at Human Milk Banking

Safe-guarding quality at the Milk Bank

Post-pasteurization procedures

- Sample are tested regularly for bacterial contamination
- Donor pasteurized milk stored at -18°C for up to 6 months
- Pre-term infants, breast milk stored for only 3 months.

Source: PATH (2011)

Pasteurisation at human milk bank for full-term and older babies of mothers living with HIV is not usually available due to fears of contamination within the milk bank. However, this service is known to be available in a human milk bank in Sao Paulo, Brazil for milk from mothers of HIV-exposed babies (Da Silva, 2004). For details on how to safe-guard the quality of post-pasteurisation procedures at human milk bank see Figure 6.

Feasibility of human milk banking in the HIV context

Stigmatisation is common among health professionals and the general public, related to safety of pasteurised human milk. Such concern arises due to fear of transmission of infection through donors' breastmilk and lack of awareness on human milk bank, considering also the benefits of Human Milk Banking as the first choice for preterm infant feeding (Arslanoglu et al., 2013), including for infant survival in developed and developing countries.

In settings with high HIV prevalence the fear of transmission of HIV from pasteurised milk is increased due to cultural, and religious non-acceptability and lack of knowledge by health professionals of the safety of banked pasteurised human milk (Coutsoudis et al., 2011). However, the study findings of Coutsoudis et al. (2011) from a public hospital in Durban in South Africa, shows the feasibility of supplying pasteurised donor milk at a Neonatal Premature Unit, reinforcing the importance of HIV exposed preterm infants receiving milk from a Human Milk Bank rather than infant formula that is a source of allergens and contaminants that could increase the risk of HIV transmission.

From a quantitative cross-sectional study at a Nigerian teaching hospital, looking at women's perceptions of using pasteurised human milk, the study findings suggested that 51% of women have heard about Human Milk Banking before, but most women (85%) would not give pasteurised donor milk to their infants, due to fear of transmission of infectious disease. On the other hand, the same study result shows 59.1% of women would consider Human Milk Banking as a support for mother's in need (Alemu, 2016).

According to the European Society for Paediatric Gastroenterology, Hepatology, and Nutrition, donated human milk is associated with a lower risk of Necrotizing Enterocolitis in comparison to infant formula. Appropriate human milk pasteurisation is microbiologically safe and Human Milk Banking can contribute to decreased infant formula use during the first weeks of life (Arslanoglu et al., 2013).

Heat-treatment of mother's own expressed milk

Heat-treated expressed breastmilk is a safe alternative to breastfeeding. Mothers living with HIV and who choose not to breastfeed because of the risk of HIV transmission to their infants would be well served if the possibility of using their own heat-treated expressed breastmilk could be made possible. There seems no good reason why it cannot be a realistic option in the near future. Clearly, feeding expressed breastmilk is far more superior to infant formula, the product is locally manufactured, the procedure will have benefits to the mother's health and will reduce her likelihood of an early pregnancy (Latham & Kisanga, 2001).

Home pasteurisation

Chantry et al. (2000) have shown that home-pasteurisation methods can inactivate HIV in breastmilk. It is possible for mothers to express their breastmilk and heat-treat it using simple methods at home so that they can safely feed it to their babies and thus eliminate all risk of postnatal transmission (Young et al., 2011).

Research shows that flash-heating is a safe method of home-pasteurisation. Flash-heat retains the antibacterial activity in breastmilk and may be of particular value during times of greater risk for postnatal transmission of HIV, such as during episodes of infant oral thrush, maternal mastitis, or interrupted antiretroviral prophylaxis and/or during weaning (Chantry et al., 2011).

Guidance on safe methods of home-pasteurisation

Flash-heating is a somewhat superior method to inactivate viral activity, compared to Pretoria pasteurisation, and retains more nutrients (Israel-Ballard et al., 2005; Israel-Ballard et al., 2006b). These are the procedures for both methods:

A. Pretoria pasteurisation (Jeffery et al., 2001; Israel-Ballard et al., 2005; Israel-Ballard et al., 2006b)

- Place 50ml to 150ml breastmilk into a clean glass jar and cover.
- Boil 450ml water in a small aluminium pot, and remove from the heat-source.
- Place covered milk jar upright in the pan of boiled water, cover the pan and leave for 15 to 20 minutes before removing. Milk may be fed to the baby once cooled.

- previously heat-treated breastmilk can be stored for 12 hours at room temperature, in an unopened jar.

B. Flash-heating (Israel-Ballard et al., 2005; Israel-Ballard et al., 2006b; Israel-Ballard, 2007; Israel-Ballard et al., 2007; Israel-Ballard et al., 2008a)

- place 50ml to 150ml milk in a clean covered 450ml glass jar.
- place the jar upright in a small pan of cold water. the level of water in the pan should be two finger-widths above the level of the milk in the jar.
- place the pan on the stove over high heat until the water reaches a rolling boil–this helps to prevent overheating and damage to mother's milk nutrients.
- remove the pan from the heat and remove the jar from the hot water.
- put the lid on the jar, and cool the milk before feeding to the baby.
- previously heat-treated breastmilk can be stored for 8 hours, room temperature (23°C).

Re-heating previously heat-treated breastmilk that has been refrigerated is generally unnecessary for healthy term babies.

If you prefer to warm the milk, you can place the covered jar in a pot of hot water (which is no longer on the stove) and gently swirl until the milk is warm. Pour the milk into a clean cup and test that it is roughly body temperature (warm but not hot), before offering it to the baby

Benefits of receiving the heat-treated breastmilk of a mother living with HIV to the baby

Benefits of heat-treated expressed breastmilk

- physiologically normal and non-allergenic.
- nutritionally adequate (some components slightly changed) (Israel-Ballard et al., 2008b).
- inactivates HIV and bacteria (Israel-Ballard et al., 2006a; Israel-Ballard et al., 2007).
- a free and feasible infant feeding method (Sibeko et al., 2008; Chantry et al., 2012).
- retains some immunological protection (Israel-Ballard et al., 2006a; Israel-Ballard et al., 2008b; Chantry et al., 2009).
- likely to maintain a normal maternal postpartum hormonal profile, to.
  - promote maternal-infant bonding.
  - facilitate lactational amenorrhea/reduced fertility.
- the supply / sustainability / baby's food security remains within the mother's control (Gashumba et al., 2010; Mbuya et al., 2010).
- can be safely stored after pasteurisation for 8 hours at room temperature (Israel-Ballard et al., 2006a).
- causes no risk of HIV transmission if used as a mixed feeding method, since HIV is inactivated.
- can be used from birth, or may be particularly valuable as a short-term feeding strategy during times of high risk such as:
  - If the baby is low birth weight or sick and unable to breastfeed.
  - If the infant has oral thrush.
  - If the mother has mastitis, or damaged/abraded nipples.
  - To assist mothers to cease breastfeeding.
  - If ARVs are temporarily unavailable.
  - If the mother is awaiting HIV test results.

4.6 TYPES OF ALTERNATIVE FEEDING METHODS

Cup-feeding

There are some situations in which the baby may not be able to feed from the mother's breast. Cup-feeding may be appropriate in these situations as:

- baby does not need to suck.
- encourages rhythmic movements of baby's tongue and jaw.
- baby paces its own feed.
- baby takes what it wants.
- baby is held close during feed.
- no danger of aspiration, and very safe if properly done.

Some characteristics of cups for feeding newborn babies

- can contain 50 to 90 ml of milk.
- glass or plastic and easily washable.
- smooth/rounded edge.
- with a lid for storing expressed breastmilk.

How to offer fresh breastmilk using cup-feeding (WHO & UNICEF, 1993)

Step 1 The caregiver should wash her hands with soap and dry them.

Step 2 The caregiver should hold the baby comfortably on her lap in an upright or semi-upright position.

Step 3 The caregiver should gently hold the cup to the baby's lips, placing the rim of the cup on its lower lip, with the edge of the cup just touching part of the baby's upper lip.

Step 4 The caregiver should let a full term baby or older baby to draw the fresh milk from the cup using the tongue, spilling some of it.

Step 5 The caregiver should not pour the fresh milk into the baby's mouth, but gently hold the cup to its baby's lips and let it take the milk on its own.

Step 6 The baby will close its mouth and refuse to take any more when it has had enough.

Step 7 The more the caregiver and baby practice with the cup, the easier it will become.

Step 8 In the event that the baby does not take the expected amount at any one feeding, it is likely that it will take more at the next feeding.

Step 9 Try to measure baby's intake per 12 or 24 hours rather than at each feed.

Droppers

- Ideal for small amounts.
- Can be used to drop breastmilk on to the mother's areola or nipple for the baby to lick.
- Difficult to clean.

Syringe-feeding

- Ideal for small amounts of breastmilk e.g colostrum.
- Makes use of lingual lipases.
- Avoids the need to suck.
- The baby must be able to co-ordinate swallowing and breathing.
- The baby is not in control of pace of feed or bolus size.
- Milk should be put into the side of the mouth or just under the tongue.
- Difficult to clean.

Syringes can be used to:

- drop breastmilk on to the areola or nipple for a baby to lick.
- store colostrum until it can be given to a baby.

Spoon-feeding

- ideal for semi-solids.
- ideal for expressed colostrum if:
  - baby is hypoglycaemic.
  - mother is unwell.
  - infant not yet suckling well.
- baby not in control of the bolus size or pace of the feed.

4.7 MIXED FEEDING AND REPLACEMENT FEEDING

Mixed feeding before 6 months of age

Mixed feeding before 6 months should be strongly discouraged because:

- it poses the same risks of contamination as artificial feeding, increasing the risk of HIV-transmission, diarrhoea, pneumonia, malnutrition and diminishing the chances of survival (Kuhn et al., 2007).
- replacing breastmilk with other foods leads to compromised breastmilk supply (Lawrence & Lawrence, 1999; Riordan & Auerbach, 1999).

According to the last WHO 2016 recommendation, mixed feeding is not a reason to stop breastfeeding (WHO & UNICEF, 2016).

Mothers living with HIV as well as health-care workers can be assured that:

- ARV treatment reduces the risk of postnatal HIV transmission in the context of mixed feeding. Although exclusive breastfeeding is recommended, practicing mixed feeding is not a reason to stop breastfeeding in the presence of ARV drugs.
- a short period of breastfeeding of less than 12 months is better than never initiating breastfeeding at all (WHO & UNICEF, 2016).

While women in most low-income countries breastfeed, the rates of exclusive breastfeeding are low, particularly in Africa (though they are increasing there now more than elsewhere). This has implications for an increased risk of HIV-transmission compared to exclusive breastfeeding (Kuhn et al., 2007; WHO & UNICEF, 2016) due to:

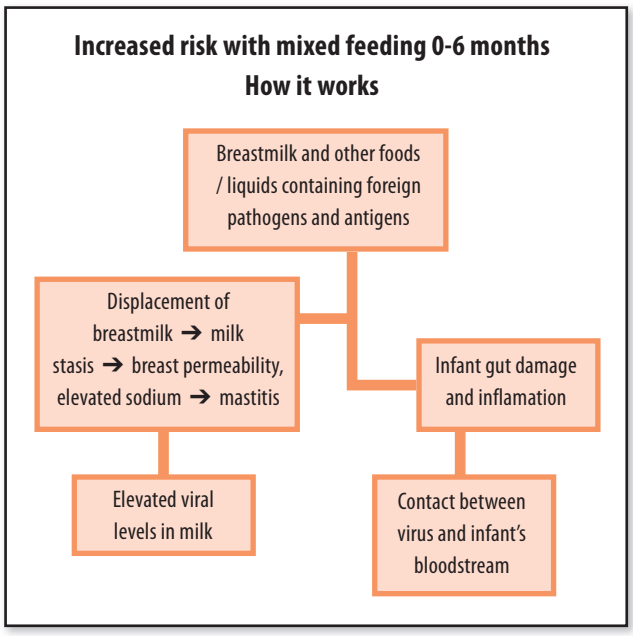
- damage to infant gut as a result of exposure to foreign pathogens in other foods and liquids (solid foods may pose a 4 to 10-fold greater hazard than liquids) (Coovadia et al ., 2007; Lunney et al., 2010).
- inflammation within the infant gut due to the introduction of foreign antigens (Smith & Kuhn, 2000).
- elevations in breastmilk viral load as a result of decreased frequency of infant suckling and

consequent milk stasis (breast engorgement) (Kuhn et al., 2013).

- epithelial permeability or increase in leaky tight junctions in the breast allowing more efficient paracellular transfer of cell-free and cell-associated HIV into breastmilk (Kourtis et al., 2003).
- irregular versus regular milk removal, i.e. occasional long intervals between breastfeeds, or shifts in breastfeeding frequency, leading to elevated viral load in breastmilk (Smith & Kuhn, 2000).
- infrequent breastfeeding may also result in elevated breastmilk sodium, and or subsequent mastitis, also known to be a risk factor for HIV transmission (Semba et al., 1999b).

Figure 7 shows how the combined effect of mixed breastfeeding both on the infant gut (infant susceptibility) and on the mother's milk production and milk viral load (maternal infectivity) exacerbate the risk of HIV transmission during birth to 6 month period.

FIGURE 7: Combined effect of mixed breastfeeding on mother and baby



Source: Morrison (2010)

Recommendation for the risk of replacement feeding

For most of the developing world, the risks of increased morbidity, mortality and malnutrition due to replacement feeding exceed the risks of HIV-transmission due to breastfeeding, especially when breastfeeding is exclusive in the first six months of life and when appropriate ARVs are provided. WHO suggests that mothers known to be HIV-infected should only give commercial infant formula as a replacement feed to their HIV-uninfected infants or infants who are of unknown HIV status when specific conditions are met (WHO et al., 2010).

Health outcomes due to formula-feeding, especially increases in overall rates of infant malnutrition, morbidity and mortality

Health outcomes for replacement feeding versus exclusive and continued breastfeeding in developing countries

Despite reductions in postnatal HIV-transmission, replacement feeding by mothers living with HIV, either from birth, or after a shortened period of breastfeeding, was associated with:

- A 47% higher risk of pneumonia compared to those never breastfed in Kenya during 1999 – 2002. Breastfeeding was also associated with a 74% lower risk of pneumonia-related hospitalisation (Ásbjörnsdóttir et al., 2013).
- Increased infant morbidity and mortality in programmatic settings in India (Phadke et al., 2003; Alvarez-Uria et al., 2012), Malawi (Kafulafula et al., 2010; Jamieson et al., 2012), South Africa (Coovadia et al., 2007; Doherty et al., 2007), Uganda (Kagaayi et al., 2008; Homsy et al., 2010; Onyango-Makumbi et al., 2010) and Botswana (Thior et al., 2006; Creek et al., 2010).
- Extremely high infant mortality rates (217 per 1000 live births) mostly in the first 6 months of life in Haiti (Coutsoudis et al., 2008).
- Increased rates of malnutrition, serious infections, including pneumonia and diarrhoea, growth faltering and death for uninfected infants who avoided postnatal transmission (Nduati et al., 2000; Chopra et al., 2005; Manzi et al., 2005; Arpadi et al., 2009; Moland et al., 2010; Fawzy et al., 2011; Våga et al., 2014).
- Increased morbidity and mortality after weaning with early cessation of breastfeeding. Though stopping breastfeeding after 4-6 months reduces the length of time that the infant is exposed to HIV in breastmilk, there is increased mortality after weaning compared to continuing breastfeeding for the locally normal span of time (Kuhn et al., 2008; Kafulafula et al., 2010; Kuhn et al., 2010; Onyango-Makumbi et al., 2010; Becquet et al., 2012).

Health outcomes for replacement feeding versus exclusive and continued breastfeeding in developed countries

In developed and less developed countries, despite different government policies on infant feeding and HIV, most women living with HIV are discouraged from breastfeeding and have further restrictions due to inadequate support and weak counselling from health system and fears of possible late HIV infection of lactating women (Blumental et al., 2014). Even so, in developed and less developed countries the risks of HIV must be balanced with the benefits of breastfeeding to women and infants and the potential risks for infant's and women's health as a result of artificial feeding (Stuebe, 2009; Victora et al., 2016), eg:

- The association of not breastfeeding with infection morbidity, for instance, otitis media, gastroenteritis and pneumonia (Stuebe, 2009; Victora et al., 2016);
- The association of artificial feeding with non-communicable diseases, for example, asthma, infant overweight or obesity, and infant type 1 and type 2 diabetes (Stuebe, 2009; Victora et al., 2016);
- Sudden infant death syndrome (SIDS) and childhood leukaemia are also associated with non-breastfed infants (Stuebe, 2009; Victora et al., 2016);
- For the premature newborn, no breastfeeding is associated with an increased risk of neonatal necrotizing enterocolitis (Stuebe, 2009; Victora et al., 2016);
- Breastfeeding is associated with less chance of malocclusions (Victora et al., 2016);
- Breastfeeding is associated with higher IQ in children and adolescents, higher educational attainment and adult earning (Victora et al., 2016);
- Risk of contaminants such as *Cronobacter sakazakii* in powdered infant formula or water used to mix powdered infant formula (Hardy, 2016);
- No breastfeeding can be associated with negative health outcomes for women such as increased incidence of premenopausal breast cancer, ovarian cancer, retained gestational weight gain, type 2 diabetes, and metabolic syndrome (Blumental et al., 2014).

Exceptions to national one-policy recommendation

Mothers living with HIV who wish to replacement feed in settings where the national policy supports breastfeeding should follow the new description of conditions needed for safe replacement feeding.

Formula feeding has not become any safer as a result of the discovery that HIV could be transmitted through breastfeeding. Mothers and families need to be informed of the risk (WHO, 2009b).

New description of conditions needed for safe replacement feeding

Mothers known to be HIV-infected should only give commercial infant formula as a replacement feed to their uninfected infants when all six specified conditions are met (WHO, 2009b):

- Safe water and sanitation are assured at the household level and in the community, and
- The mother, or other caregiver can reliably provide sufficient infant formula milk to support normal growth and development of the infant, and
- The mother or caregiver can prepare it cleanly and frequently enough so that it is safe and carries a low risk of diarrhoea and malnutrition, and
- The mother or caregiver can, in the first six months, exclusively give infant formula milk, and
- The family is supportive of this practice, and
- The mother or caregiver can access health care that offers comprehensive child health services.

Non-breastfed infants should be provided with safe and adequate replacement feeds, or heat-treated, expressed breastmilk, to enable normal growth and development. Replacement feeding should only be undertaken when explicit conditions regarding safety and sustainability are met. A simplified version of the "AFASS" concept (whether replacement feeding was acceptable, feasible, affordable, sustainable and safe) was developed to make it easier for health workers to recommend if replacement feeding would be appropriate.

Recommendation and guidance on replacement feeding with artificial milk

- Formula feeding requires sufficient formula to feed the baby for the time that he would have been breastfed (40kg of powdered infant formula to feed one baby for one year). The caregiver should be able to follow directions regarding hygiene, measuring and mixing formula powder and water sufficient for the baby's needs (150ml formula per kg of infant's weight per day divided into 8 or more feeds). Recently boiled water should be mixed with the powdered formula milk when it is still hot (>70°C) to kill micro-organisms in the water and harmful bacteria which are sometimes present in the milk powder (WHO &

FAO, 2007). If replacement feeding is used in the first six months for HIV-exposed babies, it must be fed exclusively – with no breastfeeding at all – to avoid the high risk of HIV transmission associated with premature mixed feeding (Coutsoudis et al., 2001).

- Home-modified animal milk is no longer recommended by the WHO for replacement feeding, due to concerns about nutritional adequacy (WHO, 2006). An exception would be for the shortest possible time in an emergency setting until another source of donated breastmilk or commercial infant formula becomes available. There is some concern that there is insufficient evidence for these recommendation, and several countries are still recommending animal milk as the first choice for replacement feeding. In addition, advice against the use of animal milk only applies during the first 12 months of life.

The criteria for safe replacement feeding in emergency settings

Emergencies such as conflicts, floods, earthquakes, fires and power supply failures can occur in both affluent and poor communities. Refugees, internally displaced populations, asylum-seekers and homeless people, are often in situations where the criteria for replacement feeding cannot be met (ICDC, 2009a). In unstable situations, ARVs may not be available, formula donations may not be sustainable, water and fuel supplies may be limited, and the risk of infection may be high. Under such conditions, breastfeeding of HIV-exposed infants is recommended to increase survival (Wellstart International, 2005; ENN et al., 2007; WHO et al., 2010).

Key information on infant formula or boiled animal milk

Non-breastfed infants aged 6-12 months may receive commercial infant formula or boiled animal milk, as part of a diet providing adequate micronutrient intake, as long as home conditions outlined above are fulfilled. Meals, including milk-only feeds, other foods, and combinations of milk and other foods, should be provided 4-5 times per day (WHO et al., 2010).

Recommendation on cup-feeding

Cup-feeding is safer for feeding replacements than bottle-feeding because cups are easier to clean than bottles, and cup-feeding requires the mother's full attention during feeding.

Wet-nursing is recommended in emergency settings

However, there may be concerns because of cultural and religious values.

- In most cultures, the mother and the members of the mother's family only accept wet-nursing if the wet-nurse belongs to the same family.
- For Muslims, the Koran refers to breastmilk as white blood, thus the infant becomes a blood relation to the wet-nurse after five suckling episodes.
- Jehovah's Witnesses may refuse the donation of fresh breastmilk in the same way as they refuse blood transfusions.
- This can be protective to the infant since it is important to know the wet-nurse well, including her HIV status.
- The wet-nurse may also require HIV counselling to reduce the risk of HIV-infection.

Recommendation for wet-nursing considering a review of evidences for transmission of HIV from children to breastfeeding women and implications for prevention

Wet nurses should be aware that HIV can be transmitted from an HIV-infected infant via breastfeeding (Little et al., 2012) in case of lack of full adherence of the infant to ART. They should be vigilant to avoid breastfeeding when there is either an oral lesion in the infant or a breast lesion and in such cases give expressed breastmilk.

Notes:

The World Alliance for Breastfeeding Action (WABA) is a global network of individuals and organisations concerned with the protection, promotion and support of breastfeeding worldwide. WABA action is based on the Innocenti Declaration, the Ten Links for Nurturing the Future and the Global Strategy for Infant & Young Child Feeding. WABA is in consultative status with UNICEF and an NGO in Special Consultative Status with the Economic and Social Council of the United Nations (ECOSOC).