

# BMJ Open Translating new evidence into clinical practice: a quasi-experimental controlled before–after study evaluating the effect of a novel outreach mentoring approach on knowledge, attitudes and confidence of health workers providing HIV and infant feeding counselling in South Africa

Ameena Goga <sup>1,2,3</sup> Tanya Doherty,<sup>1,4,5</sup> Samuel Manda,<sup>6,7</sup> Tshifhiwa Nkwenika,<sup>6</sup> Lyn Haskins,<sup>8</sup> Vaughn John,<sup>9</sup> Ingunn M S Engebretsen <sup>10</sup> Ute Feucht,<sup>2,11,12,13</sup> Ali Dhansay,<sup>14,15</sup> Nigel Rollins,<sup>16</sup> Max Kroon,<sup>17,18</sup> David Sanders,<sup>4,19</sup> Shuaib Kauchali,<sup>20</sup> Thorkild Tylleskär,<sup>10</sup> Christiane Horwood<sup>8</sup>

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David Sanders

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For numbered affiliations see end of article.

## Correspondence to

Dr Ameena Goga;  
Ameena.Goga@mrc.ac.za

## ABSTRACT

**Objectives** We report the effectiveness of a mentoring approach to improve health workers' (HWs') knowledge, attitudes and confidence with counselling on HIV and infant feeding.

**Design** Quasi-experimental controlled before–after study.

**Setting** Randomly selected primary healthcare clinics (n=24 intervention, n=12 comparison); two districts, South Africa.

**Participants** All HWs providing infant feeding counselling in selected facilities were invited.

**Interventions** Three 1–2 hours, on-site workshops over 3–6 weeks.

**Primary outcome measures** Knowledge (22 binary questions), attitude (21 questions—5-point Likert Scale) and confidence (19 questions—3-point Likert Scale). Individual item responses were added within each of the attitude and confidence domains. The respective sums were taken to be the domain composite index and used as a dependent variable to evaluate intervention effect. Linear regression models were used to estimate the mean score difference between intervention and comparison groups postintervention, adjusting for the mean score difference between them at baseline. Analyses were adjusted for participant baseline characteristics and clustering at health facility level.

**Results** In intervention and comparison sites, respectively: 289 and 131 baseline and 253 and 114 follow-up interviews were conducted (August–December 2017). At baseline there was no difference in mean number of correctly answered knowledge questions; this differed significantly at follow-up (15.2 in comparison; 17.2 in intervention sites ( $p<0.001$ )). At follow-up, the mean attitude and confidence scores towards breast feeding were better in intervention versus comparison sites ( $p<0.001$  and  $p=0.05$ , respectively). Controlling for confounders, interactions between time and intervention group and preintervention values, the attitude score was

## Strengths and limitations of this study

- Fieldwork was conducted in two geographically and historically different provinces, facilitating generalisability of results.
- The intervention was participatory, low-intensity, on-site and integrated into routine services.
- Several types of analyses were conducted which all yielded congruent results.
- However, limitations were that (1) We purposively selected districts for inclusion, (2) We could not control for health workers' (HWs') personal breastfeeding experience as we did not gather these data, (3) The follow-up evaluation was undertaken 3 months after the intervention—thus, we measured short-term benefits, (4) We did not measure the direct effect of improved HWs' knowledge, attitudes and confidence on HWs' counselling and mothers' infant feeding practices and (5) We did not co-design the intervention with women living with HIV. Co-designing the intervention with women living with HIV may have resulted in a different intervention and results, and needs to be undertaken in future work.
- The finding that knowledge scores among participants who attended three workshops were significantly better than knowledge scores among participants who attended less than three workshops, may simply reflect better motivation among attendees of more workshops, rather than the effect of the workshops themselves. We could not tease out these effects.

5.1 points significantly higher in intervention versus comparison groups.

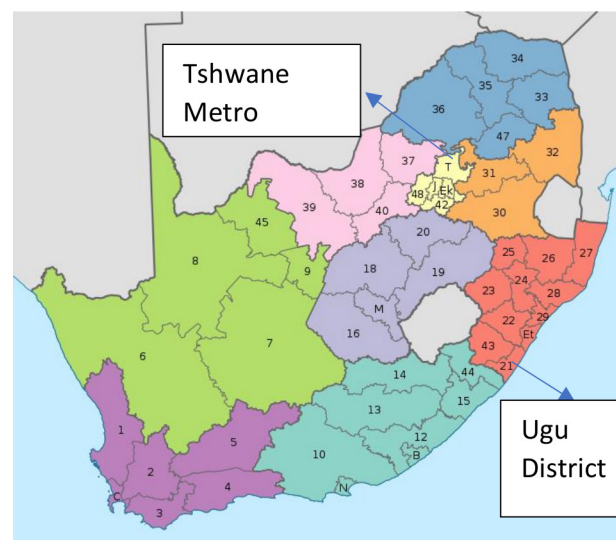
**Conclusion** A participatory, low-intensity on-site mentoring approach to disseminating updated infant feeding guidelines improved HWs' knowledge, attitudes

and confidence more than standard dissemination via a circular. Further research is required to evaluate the effectiveness, feasibility and sustainability of this approach at scale.

## INTRODUCTION

The benefits of breast feeding in all settings, and particularly in low-income middle-income settings with high HIV prevalence, are undisputed.<sup>1 2</sup> Policies and clinical practice guidelines on preventing vertical transmission (PVT) of HIV, also known as preventing mother to child transmission (PMTCT) of HIV and infant feeding, have undergone frequent evidence-based revisions. For example South African PMTCT policy and its accompanying infant feeding recommendations have been revised five times since 2001 (2008, 2010, 2013, 2015, 2019).<sup>3–7</sup> Additionally, in 2011 a national infant feeding declaration withdrew free commercial infant formula as part of the PVT programme,<sup>8</sup> and in 2017 the infant and young child feeding policy was updated to recommend that women living with HIV may continue breast feeding for up to 24 months or longer (similar to the general population) while being fully supported for antiretroviral therapy (ART) adherence. This followed a 2016 WHO update which also stated that mixed feeding is not a reason to stop breast feeding in the presence of antiretroviral (ARV) drugs.<sup>9</sup> However, a key gap is that these policies have not been effectively communicated to all health workers (HWs)—a requirement of the mother-baby friendly initiative.<sup>10 11</sup> HWs play a critical role in guiding infant feeding choices and sustaining infant feeding practices;<sup>11–13</sup> they wield power and authority<sup>12 14</sup> but their potentially positive influence on infant feeding is compromised by confusion over HIV and infant feeding, which has eroded their own confidence.<sup>11 13</sup> Identifying and implementing optimal strategies to effectively disseminate updated guidelines have lagged behind. Multicomponent dissemination strategies, which aim to increase the reach, ability and motivation of HWs, are more effective than one strategy alone.<sup>15</sup> However, in reality there are few published studies that inform guideline dissemination. Most of these are from high-income settings and may not be relevant to low-income settings which have unique challenges.<sup>15</sup>

Research has demonstrated that improving HWs' capacity can significantly improve their skills, self-efficacy and confidence to counsel, support and promote breast feeding among women living with HIV.<sup>16 17</sup> Consequently, a key question was: What learning approach could best develop HW capacity and confidence to implement the updated HIV and infant feeding guideline, using a methodology that is sustainable and feasible to implement at scale? Pedagogical research highlights the advantage of participatory training compared with standard didactic teaching for improving HW skills.<sup>18 19</sup> Thus, we sought to determine whether a participatory outreach mentorship approach to disseminate the updated HIV and infant feeding guidelines, using simple low-technology activities, improves HWs' knowledge of, attitudes towards and



**Figure 1** Study districts: Tshwane Metropolitan Municipality in Gauteng Province and Ugu District in KwaZulu-Natal Province of South Africa.

confidence with counselling on HIV and infant feeding. We chose to focus on HWs' knowledge, attitudes and confidence as HWs in South Africa consider themselves as advocates for babies.<sup>20</sup> Additionally, they are one of the key influential groups in the complex socioecology of infant feeding.<sup>12 13 21 22</sup>

## METHODS

### Study design

A quasi-experimental before–after design with intervention and comparison sites was used. Two purposively selected districts (Ugu District and Tshwane Metro/District) in South Africa in each of two geographically disparate provinces, KwaZulu-Natal (KZN) and Gauteng (figure 1), were included. Both provinces experienced a policy change in June 2017, when the 2013 South African Infant and Young Child Feeding Policy was amended to align with the 2016 WHO/UNICEF update on HIV and infant feeding.

### Sampling

In Ugu District all four subdistricts were selected; within Tshwane District two of the seven service delivery regions were randomly selected.

Twelve intervention and six comparison primary health-care (PHC) clinics were randomly sampled in Ugu District and Tshwane District (separately). Only clinics with above the median number of annual clinic visits for children under 5 years in the district were eligible for inclusion in the sampling frame. The comparison clinics served to capture any temporal changes in HW knowledge, confidence and attitudes due to other interventions or trainings; hence a smaller sample was required in comparison versus intervention sites as the latter required more precise estimates of the intervention effect. A two-stage process was used to recruit participants. First, research

staff explained the study and participant inclusion and exclusion criteria to each facility manager during face-to-face on-site introductory meetings. The facility manager compiled a list of all eligible HWs involved in the care of pregnant women and children, including nurses, midwives, visiting doctors, lay counsellors, dieticians, nutritionists, facility managers and community health workers (CHWs). In the second stage, research staff approached eligible HWs and invited them to participate in the research. We aimed to recruit a manageable size of 8–10 HWs per clinic for participation in the intervention, and in the evaluation. The same staff were approached for the baseline and follow-up evaluations.

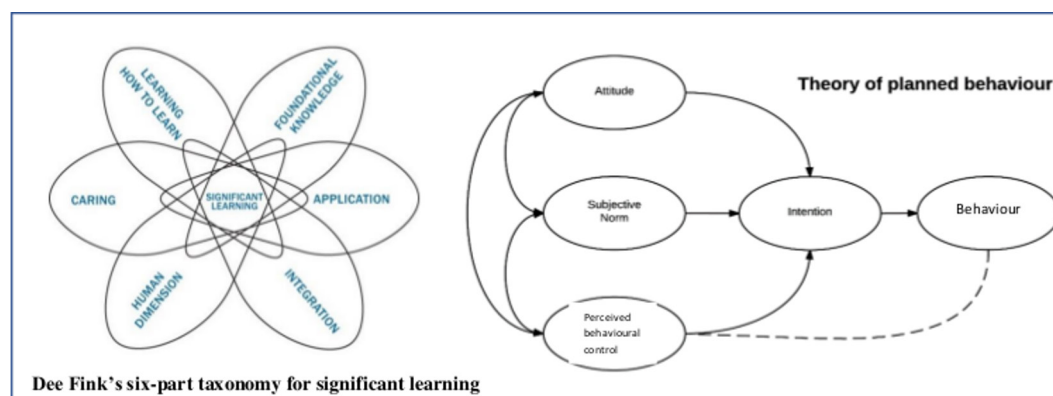
### Sample size

The sample size was determined based on 80% power and  $\alpha$  0.05 to measure a 15 percentage points difference in HW confidence in HIV and infant feeding counselling between the intervention and comparison clinics comparing baseline and follow-up. The expected effect was based on the researchers' experience and data from recent studies in South Africa with the baseline level of high confidence to counsel HIV-positive women on breastfeeding duration set at 45%.<sup>23</sup> It was assumed that the confidence score would remain unchanged in the comparison clinics, implying a two-sample test in the postintervention period. Clinic-level analyses were used for the sample size calculations, assuming a sampling ratio of 2:1 for the intervention clinics and a SD of 15% in the mean score between clinics. Based on these assumptions, and adjusting for clustering, the sample size was determined to be 24 intervention clinics and 12 comparison clinics.<sup>24</sup> Within the intervention and comparison clinics, all HWs (nurses, midwives, visiting doctors, lay counsellors, dieticians, nutritionists, facility managers and CHWs), involved in caring for pregnant women and children were invited to participate in the study—we anticipated a mean number of HWs per participating facility to be 8–10.

### Description of the intervention

We designed a participatory intervention comprising on-site mentoring through three workshops in each clinic,

involving 303 selected HWs who provide care for pregnant women, breastfeeding mothers and their infants. This mentoring approach had five distinct features: (1) On-site: learning occurred in context; (2) Open to all cadres of HWs; (3) Team-based, participants learnt together; (4) Content was led by self-identified gaps in knowledge; and (5) Activities were piloted and rooted in a theoretical framework. The intervention was delivered by the same trained facilitator (a nurse in Gauteng and nutritionist in KZN) in each intervention clinic. Each workshop lasted 1–2 hours and three were conducted over a period of 3–6 weeks; all had well-defined learning outcomes. The intervention has been described elsewhere.<sup>25</sup> In summary, our participatory intervention was guided by evidence that HWs' attitudes and practices are influenced by various factors, not just exposure to training and information.<sup>26</sup> We used Dee Fink's six-part taxonomy as a guiding theory. This proposes that significant learning only occurs by developing foundational knowledge, applying skills, integrating ideas, developing new feelings/interests and values, and learning how to learn (encouraging the spirit of enquiry) (figure 2).<sup>27</sup> Additionally, we applied the Theory of Planned Behaviour to the intervention design (figure 2).<sup>28 29</sup> This states that an individual's intention to perform a behaviour is influenced by the person's attitudes towards performing the behaviour, their beliefs about whether people who are important to them will approve of the behaviour (subjective norms) and their beliefs about how likely they are to implement the behaviour successfully. According to this theory, if HWs are to provide infant feeding counselling and support in accordance with updated infant feeding guidelines to HIV-positive or HIV-negative mothers, they need to agree with the change, believe that their colleagues and other stakeholders will approve of the action, and believe in their ability to implement it successfully. The workshops were tailored to achieve these goals: workshop 1 covered knowledge gaps reported by participants, controversial statements and advantages of breastfeeding. Following workshop 1, a poster or cards with key messages were placed in a prominent place in the clinic. Workshop 2 comprised a progressive case study discussed



**Figure 2** Theoretical frameworks which informed the development of the intervention.



in small groups. Workshop 3 involved one-to-one mentorship: each participant was observed providing infant feeding counselling or a case study was discussed if no mothers were available for counselling. The same facilitator conducted all three workshops at each clinic. In addition, a WhatsApp cellphone messaging group was established to support participants in intervention sites to facilitate sharing of concerns, tips for counselling and dealing with difficult situations. Key messages were posted on the group approximately weekly. Comparison and intervention subdistricts were exposed to routine supervision and training activities that took place at district level. The study team documented that the June 2017 circular issued by the National Department of Health, informing health facilities of the change in the infant and young child feeding policy, was disseminated to comparison clinics as an announcement via email and other electronic communication as well as during meetings or trainings. We documented that in Tshwane, 15 of the 18 clinics had received the circular; 11 via email and 3 at a meeting. In Ugu 9 of 17 clinics had received the circular; 8 received it via hand delivery and 1 via email.

### Patient and public involvement

Patients and the public were not involved in the design of this study, as the main population of interest were HWs. The intervention and tool were piloted among a separate group of HWs to determine length, complexity of questions and level of understanding. These details are explained in our intervention paper.<sup>25</sup>

### Data collection

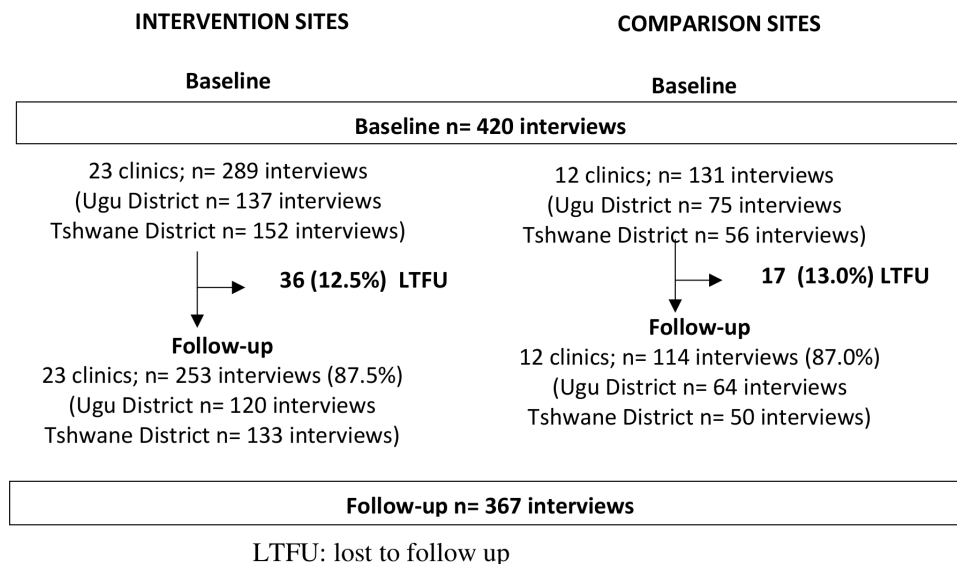
Data were collected between August and December 2017 by dedicated trained non-nurse data collectors who were independent of the intervention staff. As per study design, data collection staff were not part of any intervention activities and had never been exposed to the intervention. The primary outcome measure for the study was the confidence level of HWs to counsel on infant feeding, evaluated using a Likert Scale tool, developed after reviewing the WHO breastfeeding counselling course, and the WHO HIV and infant feeding counselling course<sup>9 30–33</sup> (see tool in online supplemental material). Secondary outcomes included HW knowledge and attitude about breastfeeding counselling. A baseline assessment among all participating HWs in intervention and comparison sites was undertaken prior to the start of the intervention (August 2017). HWs self-completed the assessment on study-provided electronic tablets at their workplaces. Questions covered basic demographic information, types of activities undertaken at work, knowledge, attitudes and confidence around counselling on infant feeding (see tool in online supplemental material). Approximately 12 weeks after the baseline assessment, a follow-up assessment using the same tool was conducted among the same group of HWs. HWs who were not in the clinic on the day of the follow-up assessments were included in a special catch-up assessment. Questionnaire

software had built in range and skip logic and data were transferred automatically to a database held at the University of KwaZulu-Natal.

### Data analysis

There were three outcomes in the study: (a) 22 knowledge statements which were scored 1 if correctly answered and 0 if not; evaluation of answers were based on existing literature and guidelines (binary outcomes); (b) 21 attitude questions whose responses were measured on a 5-point Likert Scale—given as completely disagree (1); disagree (2); neutral (3); agree (4) and completely agree (5); positive attitudes received higher scores; and (c) 19 statements on confidence item questions which were also measured on a Likert Scale, scored as such: not at all confident (1), not confident (2), confident (3) and very confident (4). For both attitude and confidence domains, a participant outcome was measured by the sum of the responses to the respective items (we verified that there was not a missing response on the items). Thus, the ranges for the attitude and confidence scores were 21–105, and 19–75, respectively.

Participants' baseline and follow-up characteristics and outcomes between the intervention and control areas were compared using  $\chi^2$  tests for categorical variables and two-sample t-tests for continuous measures, after confirming that data were normally distributed. To assess the effect of the proposed intervention, several analysis methods for comparing intervention effect in before (pre)–after (post) quasi-experimental designs were considered. These included using postmeasures and change from preintervention to postintervention as the response variables. These approaches that use change and postmeasurements as the outcome, adjusting for preintervention measurements are recommended, and often give similar results.<sup>34</sup> In this paper, we considered three methods for estimating and testing the intervention effect using the sum of individual attitude or confidence scores as an outcome variable in a linear regression. The first method used the postintervention measurements as the outcome variable but adjusted for the preintervention values; the second method analysed the change score as an outcome variable adjusting for pretreatment values. The third method analysed the vectors of premeasurements and postmeasurements as the outcome variable, and used time (coded 1 at follow-up and 0 at baseline) and treatment (coded 1: intervention group and 0: comparison group) as a covariates with an interaction term for time and treatment, in addition to an adjustment for pretreatment values). Using methods 1 and 2 the coefficient for the intervention estimated the differences in the postintervention means and differences in the mean change of sum scores mean between the groups, controlling for the preintervention measurement. Using the third method, the sum of coefficients of intervention and the interaction terms was taken as the mean difference between groups post-treatment, allowing for pretreatment mean differences between the groups. All analyses also controlled



**Figure 3** Study population at baseline and follow-up for intervention and comparison sites.

for baseline participant characteristics and prior training. Analyses adjusted for possible clustering effect at the site level, using a variance-correction method.<sup>24</sup> All the treatment effect comparison analyses were done on an intention-to-treat, rather than per-protocol, basis. Data can be obtained by emailing the corresponding author.

## Ethics

Permission for undertaking the study was obtained from Tshwane and Ugu Districts. Informed consent was sought from all study participants and no personal identifying information was captured in the questionnaires, only a study identification number.

## RESULTS

At baseline and follow-up, 23 intervention clinics (one large clinic was sampled twice with two rounds of data collection per time point) and 12 comparison clinics were visited; 289 and 131 HW interviews were conducted at baseline in intervention and comparison clinics, respectively (figure 3). Loss to follow-up between baseline and follow-up did not differ between intervention and comparison sites (17 (13.0%) in comparison sites vs 36 (12.5%) in intervention sites).

Tshwane and Ugu Districts did not differ in the main outcome measures at baseline (knowledge, attitude and confidence). Additionally, they were similar in all HW characteristics except three: Tshwane had significantly more participants with less than 2 years employment (14.4% vs 6.2%,  $p=0.007$ ), more registered nurses (57% vs 26.2%,  $p=0.02$ ) and fewer lay counsellors/CHWs (7.3% vs 50.0%, respectively,  $p=0.02$ ). Given the lack of a statistically significant difference in the main outcome variables at baseline, data from the two sites were combined for the analysis.

All staff approached agreed to participate in the interviews. There were no statistically significant differences

between intervention and comparison sites at baseline, regarding district of origin, median age of respondent, gender, cadre of HW and working duration (table 1). The proportion of participants who had received previous training (through the routine health system) on specific topics was similar in intervention versus comparison sites, except for three topics which had better coverage in comparison sites (online supplemental figure 1). These were: ever trained on how to assess and support ART adherence for HIV-positive women (78.6% in intervention sites vs 89.2% in comparison sites,  $p=0.01$ ); ever trained about managing breastfeeding problems (76.5% in intervention sites and 86.2% in comparison sites,  $p=0.02$ ); and received any information or training about the revised infant feeding policy (55.1% in intervention sites vs 67.4% in comparison sites,  $p=0.02$ ). At baseline, activities around breastfeeding counselling and management were similar between comparison and intervention sites in all respects except that comparison site participants reportedly spoke more frequently to HIV-positive pregnant women about feeding than intervention participants (67% vs 71.6% spoke more than 1–3 times per month,  $p=0.04$ , data not shown).

In intervention sites, workshops were attended by 84%–88% of participants interviewed at follow-up (table 2).

## Effect of the intervention on HW knowledge

At baseline, knowledge about key infant feeding statements or facts was similar between intervention and comparison sites, except for knowledge about soft porridge (table 3). Although at baseline, more than 90% of intervention and comparison site participants knew that a baby under 4 months should not be given soft porridge if hungry, significantly more intervention site participants knew this recommendation (table 3). The percentage of participants at baseline correctly answering the more difficult

**Table 1** Characteristics of the participants in the intervention and comparison groups at baseline

Characteristic	Intervention group (n=289) (N (%))	Comparison group (n=131) (N (%))	P value
District			0.06
Tshwane	152 (52.6)	56 (42.8)	
Ugu	137 (47.4)	75 (57.3)	
Age categories			0.11
23–35 years	56 (19.4)	38 (29.7)	
36–41 years	61 (21.2)	25 (19.5)	
42–46 years	53 (18.4)	26 (20.3)	
47–54 years	64 (22.2)	18 (14.1)	
Over 54 years	54 (18.8)	21 (16.4)	
Gender			0.66
Female	267 (92.7)	118 (91.5)	
Male	21 (7.3)	11 (8.5)	
Cadre of health worker			0.05
Community-level worker	84 (29.5)	52 (40.0)	
Trained health professional*	151 (53.0)	64 (49.2)	
Enrolled nurse	50 (17.4)	14 (10.8)	
Work experience in year/years			0.20
Less than 1 year	4 (1.4)	3 (2.3)	
1 to <2 years	23 (8.0)	12 (9.3)	
2 to < 5 years	36 (12.5)	18 (14.0)	
5 to <10 years	71 (24.7)	43 (33.3)	
10 years or more	154 (53.5)	53 (41.1)	

\*Includes 68% nurses in the intervention arm and 58% nurses in the comparison arm. This group also includes operation managers, dieticians, doctors and nutritionists.

questions (on bottle sterilisation, storing expressed breast milk, feeding HIV-exposed infants) was low (table 3). At follow-up significantly more intervention site participants correctly answered knowledge questions, regarding the leading cause of death in children under 5 years, the risk of formula feeding, duration of breast feeding for

HIV-negative mothers and women living with HIV, how to stop breast feeding, complementary feeding, storing expressed breast milk, feeding while at work, breast feeding and viral suppression, mixed feeding in women living with HIV, adherence to ART and breast feeding, breastfeeding difficulties in women living with HIV and managing women living with HIV who are breast feeding, than comparison site participants (table 3). The significant differences between intervention and comparison sites regarding soft porridge were not present at follow-up. Although improvements were seen in knowledge relating to the risks of mixed feeding for women living with HIV, most HWs still provided incorrect responses at follow-up. At baseline, the mean number of correctly answered knowledge questions was 15.0 (68%) in comparison sites versus 15.2 (69%) in intervention sites,  $p=0.89$  (table 3). At follow-up the mean number was 15.2 (69%) in comparison sites and 17.2 (78.2%) in intervention sites,  $p<0.001$  (table 3). For two questions measuring knowledge about the 2017 change in infant feeding guidelines, namely, 'Continued breastfeeding for 2 years is the recommended infant method in SA for ALL children, regardless of mother's HIV status' and 'In South Africa, HIV-infected women who are breastfeeding should be supported to adhere to antiretroviral treatment and should introduce complementary foods at 6 months and be supported to continue breastfeeding for at least 2 years. (True)', there was a 36% improvement in knowledge in the intervention group at follow-up compared with a 13% increase in knowledge in the control group. For the second question there was a 15% increase in correct knowledge in the intervention group at follow-up while for the comparison group knowledge decreased from 89% to 81%. At follow-up, knowledge scores of participants who attended three workshops compared with knowledge scores of participants who attended less than three workshops was significantly better ( $p<0.001$ ).

### Effect of the intervention on attitudes

At baseline, intervention and comparison sites were similar in HW attitudes except for attitudes towards feeding a crying baby and expressing breast milk, which

**Table 2** Attendance at workshops 1–3 measured at follow-up in intervention sites

Number of staff attending each workshop	Attended workshop, n	Attended catch-up, n	Total attended n/N (%)
Group workshop 1	202	63	265/303 (87.5)
Group workshop 2	223	34	257/303 (84.8)
Workshop 3 (clinical mentoring)	216	40	256/303 (84.5)
Number of workshops attended			Number %
No workshop			42 13.9
One workshop			8 2.6
Two workshops			6 2.0
All three workshops			247 81.5
<b>Total</b>			<b>303 100</b>

**Table 3** Knowledge of health workers about breast feeding in the intervention and comparison sites at baseline and follow-up

Knowledge statements	Number (%) with correct answers at baseline			Number (%) with correct answers at follow-up		
	Intervention (n=289)	Comparison (n=131)	P value*	Intervention (n=250)	Comparison (n=112)	P value*
<b>Knowledge relating to updates in the HIV and infant feeding guidelines</b>						
<b>Significant improvements between intervention and comparison groups at follow-up</b>						
Continued breast feeding for 2 years is the recommended infant method in SA for <i>all</i> children, regardless of mother's HIV status (true)†	190 (65.7)	91 (70.0)	0.39	224 (89.6)	88 (78.6)	<0.01
An HIV-positive mother who is virally suppressed on antiretroviral treatment should breast feed her child rather than not breast feed to improve the child's survival (true)†	237 (82.0)	108 (83.1)	0.79	236 (94.4)	96 (85.7)	<0.01
A mother who has missed six tablets of fixed-dose combination antiretroviral therapy in 1 month is considered to be poorly adherent and should stop breast feeding immediately (false)†‡	181 (62.6)	89 (68.5)	0.25	201 (80.4)	72 (64.3)	<0.01
In South Africa, HIV-infected women who are breast feeding should be supported to adhere to antiretroviral treatment and should introduce complementary foods at 6 months and be supported to continue breast feeding for at least 2 years (true)†	245 (84.8)	116 (89.2)	0.22	244 (97.6)	91 (81.3)	<0.01
When an HIV-infected mother is ready to add complementary feeds she should stop breast feeding rapidly over a 24-hour period (false)†	214 (74.1)	103 (79.2)	0.25	217 (86.8)	86 (76.8)	<0.05
If a mother misses two doses of her antiretroviral therapy in 1 month, she should be classified as a treatment failure (false)†‡	185 (64.0)	82 (63.1)	0.85	191 (76.4)	73 (65.2)	<0.05
<b>Low levels of knowledge (&lt;80%) at baseline in both groups—no significant differences between intervention and comparison groups at follow-up (concept that this relates to)</b>						
If an HIV-exposed baby is receiving both breast milk and formula milk, the mother should choose either breast feeding or formula feeding if she is adherent to antiretroviral therapy (false)† (mixed feeding with formula and breast milk)	69 (23.9)	29 (22.3)	0.71	75 (30.0)	28 (25.0)	0.33
A mother living with HIV and adherent to antiretroviral treatment cannot exclusively breast feed her 4-month-old infant because she is working. It is better for this mother to give formula during the day and breast feed at night rather than giving no breast milk at all (true)† (mixed feeding with formula milk and breast milk)	22 (7.6)	14 (10.8)	0.29	40 (16.0)	14 (12.5)	0.38
<b>High levels of knowledge (≥80%) at baseline in both groups—no significant differences between intervention and comparison groups at follow-up</b>						
In South Africa, HIV-infected women who are breast feeding should be supported to adhere to antiretroviral treatment and should be counselled and supported to exclusively breast feed their infants for the first 6 months of life while maintaining an undetectable viral load (true)†	281 (97.2)	123 (94.6)	0.18	242 (96.8)	109 (97.3)	0.79
Mothers living with HIV who are receiving antiretroviral treatment and are virally suppressed should be advised not to breast feed their infants (false)†	252 (87.2)	115 (88.5)	0.85	230 (92.0)	99 (88.4)	0.27
<b>General breast feeding</b>						
<b>Significant improvements between intervention and comparison groups at follow-up</b>						
In South Africa, the leading cause of death among children under 5 years is pneumonia (true)	189 (65.4)	82 (63.1)	0.65	230 (92.0)	75 (67.0)	<0.01
Giving any formula milk during the first 6 months of life increases the risk of death from diarrhoea and/or pneumonia (true)	246 (85.1)	104 (80.0)	0.17	232 (92.8)	95 (84.8)	0.02

Continued



Table 3 Continued

Knowledge statements	Number (%) with correct answers at baseline			Number (%) with correct answers at follow-up		
	Intervention (n=289)	Comparison (n=131)	P value*	Intervention (n=250)	Comparison (n=112)	P value*
It is safe to give the baby expressed breast milk that has been kept outside the fridge for 8 hours (true)	106 (36.7)	43 (33.1)	0.48	120 (48.0)	38 (33.9)	<0.05
A mother who is working and giving formula milk should mix the milk herself and leave for the carer to give during the day (false)‡	218 (75.4)	94 (72.3)	0.50	189 (75.6)	68 (60.7)	<0.01
<b>Low levels of knowledge (&lt;80%) at baseline in both groups—no significant differences between intervention and comparison groups at follow-up</b>						
When sterilising feeding bottles cover the bottles with water in a saucepan and place on the heat. As soon as the water boils remove from heat and do not leave the bottles in the water until completely cool (false)‡	64 (22.2)	27 (20.8)	0.75	53 (21.2)	25 (22.3)	0.81
<b>High levels of knowledge (≥80%) at baseline in both groups—no significant differences between intervention and comparison groups at follow-up</b>						
Exclusive breast feeding is the recommended infant feeding method for all infants aged 0–6 months in SA, regardless of mother's HIV status (true)	271 (93.8)	118 (90.8)	0.27	234 (93.6)	102 (91.1)	0.32
A baby under 4 months should be given soft porridge once he/she seems hungry (false)‡	284 (98.3)	124 (95.4)	0.09	247 (98.8)	108 (96.4)	0.13
Giving a baby expressed breast milk is not as good as breast feeding (false)‡	234 (81.0)	106 (81.5)	0.89	218 (87.2)	96 (85.7)	0.70
There are long-term health benefits of breast feeding for mother and child that last beyond the breastfeeding period (true)	264 (91.4)	116 (89.2)	0.49	232 (92.8)	100 (89.3)	0.26
<b>Breast feeding and HIV</b>						
<b>Significant improvements between intervention and comparison groups at follow-up</b>						
An HIV-positive mother who has cracked nipples should continue to breast feed unless they are bleeding (true)	143 (49.5)	64 (49.2)	0.96	187 (74.8)	59 (52.7)	<0.01
If a baby has a positive PCR (HIV test) at birth the mother should stop breast feeding if this is affordable and feasible in her situation (false)‡	224 (81.0)	100 (76.9)	0.90	214 (85.6)	82 (73.2)	<0.01
<b>High levels of knowledge (&lt;80%) at baseline in both groups—no significant differences between intervention and comparison groups at follow-up</b>						
An HIV-exposed baby who is exclusively breast feeding should be given some water when the weather is very hot (false)‡	270 (93.4)	122 (93.9)	0.87	239 (95.6)	105 (93.8)	0.45
<b>Mean Knowledge Score (SD) out of 22</b>	<b>15.2 (2.6)</b>	<b>15.0 (3.1)</b>	<b>0.61*</b>	<b>17.2 (2.1)</b>	<b>15.2 (2.8)</b>	<b>&lt;0.01</b>

The tables displays numbers with correct knowledge.

\*Independent t-test comparing intervention and comparison sites at the relevant time point.

‡These questions measure the change in knowledge relating to the South African Department of Health June 2017 circular and the WHO 2016 updated HIV and infant feeding guidelines.

‡The statement is false; thus, the scales were inverted during data analysis.

were significantly better in intervention sites (online supplemental table 1). At follow-up, attitudes to breast feeding and HIV were significantly better in the intervention group for 13 of the 21 questions and the mean attitude score towards breast feeding was significantly better in intervention sites ( $p<0.001$ ) (online supplemental table 1). At follow-up, HWs in the intervention group were significantly less confused about what to tell women living with HIV about infant feeding. Methods 1 and 2 yielded the same results, except for the effect of baseline attitude score. Thus, in table 4 below, we only show results

for Methods 1 and 3. Controlling for other variables, postintervention attitude was significantly better in intervention, compared with comparison, sites (table 4). Using Method 1, attitude at follow-up was 5.4 points higher in the intervention group than in the comparison group; Method 3 analysis showed a significant 5.1-point higher score in the intervention compared with the comparison group. Using Method 1, being an enrolled nurse, and being in the youngest (36–41 years) or oldest (>54 years) age group was associated with a significantly lower attitude



**Table 4** Adjusted effect of the intervention on health worker attitude score using different methods (effect estimate and 95% CI)

Variable	Method 1		Method 3	
	Effect estimate	95% CI	Effect estimate	95% CI
Attitude score at baseline	0.5	0.3 to 0.7*	N/A	N/A
Intervention	5.4	3.9 to 6.9*	5.1	2.1 to 8.1*
Follow-up period	N/A	N/A	1.8	0.2 to 3.4*
Professional role versus community level				
Trained health professional	1.6	-0.05 to 3.2	4.8	2.8 to 6.7*
Enrolled nurse	-2.4	-5.0 to -0.2*	0.9	-1.4 to 3.2
Ugu District versus Tshwane District	-0.83	-2.2 to 0.5	-1.4	-3.1 to 0.2
Age category versus 23–35 years				
36–41 years	-2.8	-5.4 to -0.2*	-1.8	-4.1 to 0.6
42–46 years	-0.9	-3.3 to 1.5	-0.2	-2.5 to 2.2
47–54 years	0.5	-2.0 to 2.9	-1.2	-3.1 to 0.8
Over 54 years	-3.3	-5.7 to -1.0*	-2.2	-4.8 to 0.3
Work experience <5 years vs ≥5 years	-0.3	-2.5 to 1.9	-1.3	-3.4 to 0.8
Received training or information at work about the revised policy	0.5	-1.4 to 2.3	1.7	0.1 to 3.24
Received any training about managing common breastfeeding problems?	0.3	-2.5 to 3.0	3.2	0.9 to 5.5
Ever received any training about how to assess and support antiretroviral therapy adherence for HIV-positive women?	-0.1	-2.2 to 2.0	1.6	-0.5 to 3.8

All analyses are adjusted for clustering.

\* $p < 0.05$ .

N/A, not applicable.

score. Using Method 3, trained health professionals had a significantly higher attitude score at follow-up ( $p < 0.05$ ).

### Effect of the intervention on confidence

At baseline there was no difference in the percentage of participants in the intervention and control sites who were confident or very confident in counselling mothers on HIV/infant feeding (online supplemental table 2). However, at follow-up HWs from intervention sites were significantly more confident in counselling women living with HIV about HIV and infant feeding, returning to school/work, continuing breast feeding for 2 years, assessing ART adherence in women living with HIV, and advising women living with HIV about breast feeding with cracked nipples (online supplemental table 2). Confidence had not shifted about how to stop breast feeding, identifying when a mother is not ART-adherent and managing poor adherence, advising on formula feeding and counselling that a shorter breastfeeding duration is better than no breast feeding. The mean confidence score at follow-up was significantly higher in the intervention compared with the comparison sites at follow-up ( $p = 0.05$ ) (online supplemental table 2). Methods 1 and 2 yielded the same results, except for the effect of baseline confidence score. Thus, in table 5 below, we only show results for Methods 1 and 3. Controlling for other variables, postintervention confidence was significantly better in

intervention, compared with comparison, sites; however this was only statistically significant under Method 1. Our analysis demonstrated that, controlling for other factors, being a trained health professional significantly increased confidence score by 3.1 (Method 1) or 3.7 (Method 3). Additionally, Method 3 demonstrated that, controlling for other factors, working for less than 5 years significantly reduced the confidence score.

### Dose-response analysis

We also conducted a dose-response analysis to assess whether or not the mentored HWs responded differently according to the number of workshops attended (0, 1 or 2, and 3). Even though postintervention attitude and confidence scores as well as their increases were higher in the higher workshop attendance participants, there was no statistically significant dose-response effect ( $p$  value  $> 0.05$ , data not shown).

### DISCUSSION

We demonstrate that a participatory, side-by-side, team-based mentoring approach to disseminating updated HIV and infant feeding guidelines was associated with an improvement in HWs' attitudes. when controlling for other factors. There was also a significant improvement in mean knowledge score between intervention and control

**Table 5** Adjusted effect of the intervention on health worker confidence scores, using different multivariable analysis methods (effect estimate and 95% CI)

Variable	Method 1		Method 3	
	Effect estimate	95% CI	Effect estimate	95% CI
Confidence Score at baseline	<b>0.4</b>	<b>0.3 to 0.6*</b>	N/A	N/A
Intervention	<b>2.4</b>	<b>0.3 to 4.5*</b>	1.5	−2.2 to 5.1
Follow-up time	N/A	N/A	0.5	−1.5 to 2.5
Cadre of health professional versus community level				
Trained health professional	<b>3.1</b>	<b>0.3 to 5.9*</b>	<b>3.7</b>	<b>1.5 to 5.9*</b>
Enrolled nurse	−0.8	−4.3 to 2.7	−0.7	−3.1 to 1.6
Ugu District versus Tshwane District	0.00	−2.1 to 2.1	−1.	−3.2 to 1.2
Age category versus 23–35 years				
36–41 years	−1.0	−3.7 to 1.6	−0.1	−2.7 to 2.5
42–46 years	0.3	−2.9 to 3.4	0.4	−1.2 to 2.9
47–54 years	1.4	−0.7 to 3.5	−1.3	−3.4 to 0.8
Over 54 years	−2.5	−5.7 to 0.7	−0.9	−4.0 to 2.2
Work experience <5 years vs ≥5 years	−0.5	−3.4 to 2.4	<b>−1.9</b>	<b>−3.7 to −0.2*</b>
Received training or information at work about the revised policy	0.05	−1.5 to 1.6	1.7	−0.3 to 3.6
Received any training about managing common breastfeeding problems?	−0.6	−3.2 to 2.1	1.8	−0.5 to 4.1
Ever received any training about how to assess and support antiretroviral therapy adherence for HIV-positive women?	0.8	−2.1 to 3.7	5.7	3.5 to 7.9

All analyses are adjusted for clustering.

\*p<0.005.

N/A, not applicable.

sites at follow-up. However, we were not successful in shifting knowledge and attitudes about mixed feeding (breast milk and formula milk) and HWs at the end of the study were not confident in advising that a shorter duration of breast feeding is better than no breast feeding at all. This demonstrates the success of at least 15 years of frequent publicity about the dangers of mixed feeding in the context of HIV and no ART, exacerbated by the fact that the two seminal papers on feeding practices and HIV were led by South African researchers.<sup>35 36</sup> Concerted communication efforts are needed to highlight the acceptability of mixed feeding in the context of ART and maternal viral load suppression to facilitate a shift in knowledge about mixed feeding. Although some individual attitude and confidence items did not change, or only changed marginally, the overall analyses demonstrated an improvement in follow-up attitude and confidence scores. However, confidence in the intervention group was still low and HWs performed poorly on some of the more difficult confidence questions such as confidence with counselling when a mother is not ART-adherent, managing high viral loads during breast feeding, explaining HIV transmission risks to a mother with a high viral load, assisting women living with HIV to safely formula feed and advising that some breast feeding is better than no breast feeding. The complexity of changing HWs' attitudes and confidence towards breast feeding has been documented repeatedly in many African

settings including South Africa.<sup>11 25 37–39</sup> We hypothesise that poor performance on some of the individual items or on the overall confidence score may be attributed to the short duration of the intervention. An alternative hypothesis is that HWs' low confidence around topics like non-adherence and high viral load reflect more complex dynamics that are not easily addressed through counselling/mentoring interventions.<sup>39</sup> In fact a study from South Africa demonstrated how HWs' personal beliefs affect their ability to provide supportive counselling.<sup>11</sup>

There is evidence that in-service training, supervision and follow-up improves the knowledge, skills and practices of HWs managing childhood undernutrition, and can improve HW job satisfaction and motivation, but no data exist on how to improve HW knowledge, skills and confidence in the tricky area of HIV and infant feeding.<sup>40–42</sup> For training/supervision interventions, implementation challenges include inadequately trained supervisors or shortages of supervisors, inappropriate job aids for follow-up, and poor alignment between community views/practice and health programmes.<sup>43</sup> Our approach attempted to circumvent these challenges by using a low technology mentorship model for skills development at clinic level. At the outset of the intervention we acknowledged that HWs were members of their community: we discussed their fears and beliefs, and then introduced facts and evidence to extend their knowledge, change their attitudes, and increase their confidence

to implement updated guidelines on HIV and infant feeding. Thus, we aimed to change inherent, deep-seated beliefs and attitudes that are sustained in the absence of outside supervision.

We used a side-by-side mentorship approach, as reviewed by Schwerdtle *et al*, to conduct team-based mentoring to empower HWs.<sup>44</sup> A team-based approach allowed collaborative learning between different cadres of HWs, facilitating any future change in practice. In accordance with Dee Fink's theory, a participatory mentorship approach allows participants to develop foundational knowledge, apply skills, integrate ideas, develop new feelings/interests and values, and learn how to learn.<sup>26</sup> Our experience suggests that such an approach allowed discussion of participants' attitudes towards performing the behaviour, beliefs about whether critical, important people will approve of the behaviour (subjective norms), and about their likelihood of successfully implementing the behaviour.<sup>28 29</sup> Our findings corroborate a scoping review which demonstrated that mentorship improves certain quality of care outcomes;<sup>44</sup> in our study it improved knowledge, attitudes and confidence. However, only four studies were included in this scoping review, and the nature of the mentorship varied from videoconferencing to monthly, 6-weekly or annual visits interspersed with other contact forums, conducted over 1 day to an entire week. A list of desirable features of mentorship interventions include at least one dedicated mentor per facility, ensuring an adequate mentor:mentee ratio so that all staff can be supported, forming meaningful relationships between mentors and mentees, ensuring cultural congruency between mentee and mentor, and using mentors for protocol-driven programmes such as Integrated Management of Childhood Illness Strategy (IMCI) or HIV.<sup>44</sup> Our intervention related to HIV and infant feeding guidelines, was low cost and low technology (one mentor working with pen, flip chart and paper in the health facility), and was implemented by a dedicated mentor from the same cultural background as the mentees. She provided onsite support during the workshops, which lasted approximately 1 hour, and additional support through a WhatsApp messaging group.

There is an ongoing health worker crisis in resource-limited settings, including maldistribution of staff, an imbalance in skills mix, increasingly complicated health programmes and complicated sociocultural-political-economic environments. Against this background, questions arise about the feasibility of an on-site mentorship approach to guideline dissemination among HWs, and an on-site peer-peer mentorship approach between women living with HIV to supporting mothers with infant feeding. In this study we chose to focus specifically on an on-site mentorship approach to guideline dissemination among HWs. We argue that strengthening investment in on-site mentorship rather than off-site training, may be a cost-saving approach. In our setting, all clinics receive regular visits from district PHC supervisors, but these mostly focus on administration and clinic management matters. These

supervisors, as well as existing district PHC trainers, could be capacitated to provide clinical mentoring for HWs in the clinics they oversee. Our model of team-based learning and mentoring can be used for on-site mentoring, and avoids accommodation and travel costs, and absence from work that off-site training requires.

Our study had several limitations: We purposively selected districts for inclusion. We could not control for previous breastfeeding experiences of HWs as we did not gather these data. The study tools were piloted before finalisation, but no factor analyses or validation exercises were conducted. The follow-up evaluation was conducted 3 months after the intervention; thus, we were only able to measure short-term benefits. Additionally, we did not co-design the intervention with women living with HIV, did not measure the effect of improved knowledge, attitudes and confidence on HWs' counselling practices and on mothers' infant feeding practices, and could not tease out whether the relationship between number of workshops and outcomes was due to staff motivation (more motivated staff attended more workshops) or the workshops themselves. Co-designing the intervention with mothers living with HIV may have resulted in a different intervention and results; this needs to be considered in future work. Our study's strengths are that the design was quasi-experimental, measuring knowledge, and attitudes and confidence. Additionally, results are robust as three different analytical methods yielded congruent results.

## Conclusion

We demonstrated improved knowledge, attitudes and confidence of HWs following a participatory mentorship approach to HIV and infant feeding guideline dissemination compared with a standard approach. More research is needed to better understand how to change HWs' counselling practices, and whether this changes mothers' feeding practices.

## Author affiliations

<sup>1</sup>Health Systems Research Unit, South African Medical Research Council, Tygerberg, South Africa

<sup>2</sup>Department of Paediatrics, University of Pretoria, Pretoria, South Africa

<sup>3</sup>HIV Prevention Research Unit, South African Medical Research Council, Tygerberg, South Africa

<sup>4</sup>School of Public Health, University of the Western Cape, Cape Town, South Africa

<sup>5</sup>School of Public Health, University of the Witwatersrand, Johannesburg, South Africa

<sup>6</sup>Biostatistics Unit, South African Medical Research Council, Tygerberg, South Africa

<sup>7</sup>Department of Statistics, University of Pretoria, Pretoria, South Africa

<sup>8</sup>Centre for Rural Health, University of KwaZulu-Natal, Durban, South Africa

<sup>9</sup>School of Education, University of KwaZulu Natal, Pietermaritzburg, South Africa

<sup>10</sup>Centre for International Health, University of Bergen, Bergen, Norway

<sup>11</sup>Gauteng Department of Health, Tshwane District Health Services, Pretoria, South Africa

<sup>12</sup>Research Centre for Maternal, Fetal, Newborn and Child Health Care Strategies, University of Pretoria, Pretoria, South Africa

<sup>13</sup>Maternal and Infant Health Care Strategies Research Unit, South African Medical Research Council, Tygerberg, South Africa

<sup>14</sup>Division of Human Nutrition and Department of Paediatrics and Child Health, Stellenbosch University, Cape Town, South Africa

<sup>15</sup>Burden of Disease Research Unit, South African Medical Research Council, Tygerberg, Switzerland



<sup>16</sup>Department of Maternal, Newborn, Child and Adolescent Health, World Health Organization, Geneva, Switzerland  
<sup>17</sup>Department of Neonatology, Faculty of Health Sciences, University of Cape Town, Cape Town, South Africa  
<sup>18</sup>Mowbray Maternity Hospital, Cape Town, South Africa  
<sup>19</sup>Department of Paediatrics and Child Health, University of Cape Town, Cape Town, South Africa  
<sup>20</sup>National Department of Health, Pretoria, South Africa

**Twitter** Ingunn M S Engebretsen @ingunnengebret1

**Contributors** AG: Study conceptualisation and tool development, protocol writing including intervention development, oversight of sampling and field work, writing of the first draft of this manuscript, receiving and incorporating coauthor comments, finalisation of the paper. TD: Study conceptualisation and tool development, protocol writing including intervention development, set up the sample frame and sampling, contributed to the manuscript, reviewed and approved the final version of the manuscript. SM: Led the statistical components of the protocol; provided overall oversight on the statistical analysis, contributed to the manuscript, reviewed and approved the final version of the manuscript. TN: Performed the work on the statistical components of the protocol, under SM's guidance; provided data analysis under SM's guidance, contributed to the manuscript, reviewed and approved the final version of the manuscript. LH: Contributed to study conceptualisation and tool development, protocol writing including intervention development; was overall Project Manager; established, managed and cleaned the database; contributed to the manuscript, reviewed and approved the final version of the manuscript. VMJ: Provided guidance on intervention development. Contributed to the manuscript, reviewed and approved the final version of the manuscript. IMSE: Contributed to study conceptualisation and tool development, protocol writing including intervention development; contributed to the manuscript, reviewed and approved the final version of the manuscript. UF: Contributed to study conceptualisation, assisted with district-level buy-in in Tshwane District, provided information on routine dissemination of updated infant feeding guidelines; contributed to the manuscript, reviewed and approved the final version of the manuscript. AD: Contributed to study conceptualisation and tool development; contributed to the manuscript, reviewed and approved the final version of the manuscript. NR: Contributed to study conceptualisation; contributed to the manuscript, reviewed and approved the final version of the manuscript. MK: Contributed to study conceptualisation and tool development; contributed to the manuscript, reviewed and approved the final version of the manuscript. DS: Contributed to study conceptualisation and tool development; contributed to the manuscript, reviewed and approved the final version of the manuscript. SK: Contributed to study conceptualisation, assisted with national-level buy-in, provided information on - routine dissemination of updated infant feeding guidelines; contributed to the manuscript, reviewed and approved the final version of the manuscript. TT: Contributed to study conceptualisation and tool development; contributed to the manuscript, reviewed and approved the final version of the manuscript. CH: Study conceptualisation, protocol writing including intervention development, high-level oversight of study implementation, contributed to the manuscript, reviewed and approved the final version of the manuscript.

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## ORCID iDs

Ameena Goga <http://orcid.org/0000-0002-2394-6486>  
 Ingunn M S Engebretsen <http://orcid.org/0000-0001-5852-3611>

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## QUESTIONNAIRE FOR HEALTHCARE WORKERS

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Section 1. Admin		
1.1.	Interview Date	<div> <input type="text"/> <input type="text"/> / <input type="text"/> <input type="text"/> <input type="text"/> / <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> </div> <div> D D M M M Y Y Y Y </div>
1.2.	District	<input type="radio"/> OTshwane <input type="radio"/> OUgu
1.3.	Sub district	<b>If Tshwane chosen above:</b> <input type="radio"/> OTshwane 1 <input type="radio"/> OTshwane 2 <input type="radio"/> OTshwane 3 <input type="radio"/> OTshwane 6 <b>If Ugu chosen above:</b> <input type="radio"/> Omdoni <input type="radio"/> UmZumbe <input type="radio"/> Hibiscus <input type="radio"/> uMuziwabantu
1.4.	Facility	<b>If Tshwane 1 selected the following clinics can be chosen:</b> <input type="radio"/> Soshang Block JJ clinic <input type="radio"/> KT Motubatse clinic <input type="radio"/> Boikhutsong clinic <input type="radio"/> Sedilega clinic <input type="radio"/> Shoshanguve 2 clinic <input type="radio"/> Soshang Block TT clinic <b>If Tshwane 2 selected:</b> <input type="radio"/> Jubilee gateway clinic <input type="radio"/> Kekanastad clinic <input type="radio"/> Suurman clinic <input type="radio"/> Ramotse clinic <input type="radio"/> Kekana gardens clinic <input type="radio"/> New Eersterus clinic <b>If Tshwane 3 selected</b> <div> Atteridgeville Clinic  Bophelong Clinic (Tshw 3)  Saulsville Clinic </div>

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		<p><b>If Tshwane 6 selected</b></p> <p>S Bopape CHC Eersterust CHC Nelmapius Clinic</p> <p><b>If Omdoni selected</b></p> <p>GJ Crooke's Gateway Pennington Clinic Philani Clinic Scottburgh Clinic Umzinto Clinic</p> <p><b>If UmZumbe selected</b></p> <ul style="list-style-type: none"> <li>• Gqayinyanga clinic</li> <li>• St Faiths clinic</li> <li>• Phungashe clinic</li> <li>• Ntimbankulu clinic</li> <li>• Turton CHC</li> <li>• Ndelu clinic</li> </ul> <p><b>If Hibiscus coast selected:</b></p> <ul style="list-style-type: none"> <li>• Gamalakhe CHC</li> <li>• Southport Clinic</li> <li>• Marburg Clinic</li> </ul> <p><b>If uMuziwabantu selected</b></p> <ul style="list-style-type: none"> <li>• Santombe clinic</li> <li>• Meadowsweet clinic</li> <li>• Mbonwa clinic</li> </ul>
1.5.	Health worker number	Assigned number to each participant



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Section 2. Demographics		
2.1.	What is your date of birth?	<div> <input type="text"/> <input type="text"/> / <input type="text"/> <input type="text"/> / <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> </div> <div> D   D   M   M   Y   Y   Y   Y </div>
2.2.	Gender	<div> <input type="radio"/> Male </div> <div> <input type="radio"/> Female </div>
2.3.	What is your role in this clinic?	<input type="radio"/> Lay counsellor or nutritional advisor <input type="radio"/> Enrolled nurse assistant <input type="radio"/> Enrolled nurse <input type="radio"/> Registered nurse <input type="radio"/> Medical degree (MB ChB or equivalent) <input type="radio"/> community health worker (CCG) <input type="radio"/> dietician <input type="radio"/> Registered nurse operational manager <input type="radio"/> other specify below
2.4.	Other	
2.5.	How long have you been working as a health worker?	<input type="radio"/> less than 1 year <input type="radio"/> 1- <2 years <input type="radio"/> 2- <5 years <input type="radio"/> 5- < 10 years <input type="radio"/> 10 or more years

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Section 3	<b>Updated HIV and infant feeding guidelines.</b> <b>In this section you will be asked about new infant feeding guidelines adopted in South Africa.</b>		
3.1	During 2017 have you received any information or training at work about the revised Infant and Young Child Feeding Policy – in the form of a circular, letter, workshop, meeting or lecture	1 <input type="radio"/> Yes	0 <input type="radio"/> No SKIP
3.2	If yes, how did you receive this information?	1. <input type="radio"/> Circular/letter 2. <input type="radio"/> Meeting 3. <input type="radio"/> Workshop 4. <input type="radio"/> Feedback/information from colleague 5. <input type="radio"/> lecture 6. <input type="radio"/> other	
3.3	Who gave you this information/ training?	1 <input type="radio"/> District trainer/ DoH staff member 2 <input type="radio"/> Outside/ private company	
3.4	How long was this training?	_____ hours	

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SECTION 4.	<b>TRAINING Topics</b> Have you received any training on the following topics (either in-service or formal training). <b>Usuke wathola uqeqesho kulezihloko ezilandelayo?</b>		
4.1	Did the content of your training include the importance of breastfeeding in preventing common childhood illness such as diarrhoea?	1 <input type="radio"/> Yes	0 <input type="radio"/> No
4.2	Have you ever had any training about correct positioning and attachment of an infant during breastfeeding?	1 <input type="radio"/> Yes	0 <input type="radio"/> No
4.3	Have you ever had any training about the management of common breastfeeding problems?	1 <input type="radio"/> Yes	0 <input type="radio"/> No
4.4	Have you ever had any training about advising a mother about how to provide breastmilk for her baby when she returns to work or school	1 <input type="radio"/> Yes	0 <input type="radio"/> No
4.5	Have you ever had any training about how to advise a mother about formula feeding safely?	1 <input type="radio"/> Yes	0 <input type="radio"/> No
4.6	Have you ever had any training about how to advise an HIV infected woman about how to feed her baby?	1 <input type="radio"/> Yes	0 <input type="radio"/> No
4.7	Have you ever had any training about how to manage breastfeeding problems in HIV infected women (cracked nipples, mastitis etc.)?	1 <input type="radio"/> Yes	5.0 <input type="radio"/> No
4.8	Have you ever had any training about how to assess and support ART adherence for HIV infected women?	1 <input type="radio"/> Yes	0 <input type="radio"/> No
4.9	Have you ever had any training on viral load monitoring?	1 <input type="radio"/> Yes	0 <input type="radio"/> No

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<b>Section 5</b>	<b>ACTIVITIES:</b> <i>Think carefully about your work in this facility.</i> For the activity mentioned consider whether you ever perform this activity and if so how regularly do you perform this activity? If you do not perform this activity at all select the option 'Never'				
5.1	How often do you talk to groups of pregnant women attending the antenatal clinic about infant feeding (group counselling)	1 <input type="radio"/> one or more times per week	2 <input type="radio"/> one to three times per month	3 <input type="radio"/> Less than once a month	4 <input type="radio"/> Never
5.2	How often do you talk to a pregnant woman individually about her plan for feeding her baby	1 <input type="radio"/> one or more times per week	2 <input type="radio"/> one to three times per month	3 <input type="radio"/> Less than once a month	4 <input type="radio"/> Never
5.3	How often do you talk to an HIV infected pregnant woman about her plan for feeding her baby	1 <input type="radio"/> one or more times per week	2 <input type="radio"/> one to three times per month	3 <input type="radio"/> Less than once a month	4 <input type="radio"/> Never
5.4	How often do you assist a mother with breastfeeding within the first hour post delivery	1 <input type="radio"/> one or more times per week	2 <input type="radio"/> one to three times per month	3 <input type="radio"/> Less than once a month	4 <input type="radio"/> Never
5.5	How often do you talk to a mother about how she is feeding her baby?	1 <input type="radio"/> one or more times per week	2 <input type="radio"/> one to three times per month	3 <input type="radio"/> Less than once a month	4 <input type="radio"/> Never
5.6	How often do you observe a mother breastfeeding during a clinic or home visit	1 <input type="radio"/> one or more times per week	2 <input type="radio"/> one to three times per month	3 <input type="radio"/> Less than once a month	4 <input type="radio"/> Never
5.7	How often do you talk to a mother about positioning and attachment of the baby during breastfeeding	1 <input type="radio"/> one or more times per week	2 <input type="radio"/> one to three times per month	3 <input type="radio"/> Less than once a month	4 <input type="radio"/> Never
5.8	How often do you talk to an HIV infected mother about managing a breastfeeding problem (e.g. cracked nipples, baby crying all the time, mother says she does not have enough milk)	1 <input type="radio"/> one or more times per week	2 <input type="radio"/> one to three times per month	3 <input type="radio"/> Less than once a month	4 <input type="radio"/> Never
5.9	How often do you talk to a mother about how to maintain breastfeeding when away from the baby (going back to school or work)	1 <input type="radio"/> one or more times per week	2 <input type="radio"/> one to three times per month	3 <input type="radio"/> Less than once a month	4 <input type="radio"/> Never
5.10	How often do you talk to an HIV infected breastfeeding mother about taking ARVs	1 <input type="radio"/> one or more times per week	2 <input type="radio"/> one to three times per month	3 <input type="radio"/> Less than once a month	4 <input type="radio"/> Never



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SECTION N 6	INFANT FEEDING KNOWLEDGE			
please state whether the statement is true or false or you do not know				
	Statement	True	False	Do not know
6.1	Exclusive breastfeeding is the recommended infant feeding method for ALL infants aged 0-6 months in SA, regardless of mother's HIV status	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>
6.2	Giving any formula milk during the first six months of life increases the risk of death from diarrhoea and/or pneumonia	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>
6.3	Continued breastfeeding for 2 years is the recommended infant method in SA for ALL children, regardless of mother's HIV status	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>
6.4	Mothers living with HIV who are receiving antiretroviral treatment and are virally suppressed should be advised not to breastfeed their infants	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>
6.5	When an HIV infected mother is ready to add complementary feeds she should stop breastfeeding rapidly over a 24hour period	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>
6.6	If an HIV exposed baby is receiving both breastmilk and formula milk, the mother should chose to either breastfeeding or formula feeding if she is adherent to ART	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>
6.7	A mother who is working and giving formula milk should mix the milk herself and leave for the carer to give during the day	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>
6.8	An HIV positive mother who is virally suppressed on antiretroviral treatment should breastfeed her child rather than not breastfeed to improve the child's survival	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>
6.9	When sterilising feeding bottles cover the bottles with water in a saucepan and place on the heat. As soon as the water boils remove from heat and leave the bottle in the water until completely cool	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>
6.10	In South Africa, the leading cause of death amongst children under 5 is pneumonia	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>
6.11	In South Africa, HIV infected women who are breastfeeding should be supported to adhere to antiretroviral treatment and should be counselled and supported to exclusively breastfeed their infants for the first six months of life whilst maintaining an undetectable viral load	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>
6.12	A baby under 4 months should be given soft porridge once he/she seems hungry	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>

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6.13	A mother living with HIV and adherent to antiretroviral treatment cannot exclusively breastfeed her 4-month old infant because she is working. It is better for this mother to give formula during the day and breastfeed at night rather than giving no breast milk at all	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>
6.14	An HIV exposed baby who is exclusively breastfeeding should be given some water when the weather is very hot	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>
6.15	If a baby has a positive PCR (HIV test) at birth the mother should stop breastfeeding if this is affordable and feasible in her situation	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>
6.16	Giving a baby expressed breastmilk is not as good as breastfeeding	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>
6.17	If a mother misses 2 doses of her ART in one month, she should be classified as a treatment failure	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>
6.18	An HIV positive mother who has cracked nipples should continue to breastfeed unless they are bleeding	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>
6.19	A mother who has missed 6 tablets of FDC in one month is considered to be poorly adherent and should stop breastfeeding immediately	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>
6.20	There are long term health benefits of breastfeeding for mother and child that last beyond the breastfeeding period	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>
6.21	In South Africa, HIV infected women who are breastfeeding should be supported to adhere to antiretroviral treatment and should introduce complementary foods around 6 months and be supported to continue breastfeeding for at least two years.	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>
6.22	It is safe to give the baby expressed breastmilk that has been kept outside the fridge for 8 hours	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>

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SECTION 7.		<b>INFANT FEEDING ATTITUDE</b>  Please state whether you completely disagree, disagree, neutral, agree or completely agree with the statement				
		Completely disagree	Disagree	Neutral	Agree	Completely agree
7.1	There have been so many changes to the infant feeding guidelines and breastfeeding guidelines that I am confused about what to tell mothers who are HIV infected about	1 ○	2 ○	3 ○	4 ○	5 ○
7.2	When a baby cries all the time it is usually because the baby is hungry and needs more food than just breastmilk	1 ○	2 ○	3 ○	4 ○	5 ○
7.3	Exclusive breastfeeding in the first 6 months of life is the best choice for all mothers and babies in South Africa	1 ○	2 ○	3 ○	4 ○	5 ○
7.4	For an HIV exposed infant any breastfeeding is better than no breastfeeding at all, as long as the mother is virally suppressed and on antiretroviral therapy	1 ○	2 ○	3 ○	4 ○	5 ○
7.5	The benefits of breastfeeding for protecting children from illness such as diarrhoea and pneumonia outweighs the risk of acquiring HIV if the mother is on antiretroviral treatment	1 ○	2 ○	3 ○	4 ○	5 ○
7.6	I feel that an HIV infected mother who has not disclosed to her partner is at high risk of non-adherence to ART and should stop breastfeeding as soon as possible	1 ○	2 ○	3 ○	4 ○	5 ○
7.7	I should support all mothers, regardless of HIV status, to continue breastfeeding until 2 years, as long as HIV infected women are virally suppressed	1 ○	2 ○	3 ○	4 ○	5 ○
7.8	I should advise an HIV positive virally suppressed mother who has cracked and bleeding nipples to temporarily stop breastfeeding	1 ○	2 ○	3 ○	4 ○	5 ○
7.9	HIV exposed babies who are PCR negative must stop breastfeeding as soon as possible	1 ○	2 ○	3 ○	4 ○	5 ○

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7.10	Formula feeding is the best choice for mothers living in good socioeconomic circumstances who are going back to work	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>
7.11	For an HIV positive mother on antiretroviral treatment and virally suppressed mixed feeding is better than not breastfeeding at all	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>
7.12	Exclusive breastfeeding for six months is an achievable goal for the majority of mothers	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>
7.13	It is safer for HIV positive mothers to breastfeed than to formula feed	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>
7.14	In our community working mothers can successfully maintain exclusive breast feeding while going to work	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>
7.15	An HIV positive mother who is on ART and not virally suppressed and is mixed feeding is putting her child at risk of acquiring HIV	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>
7.16	It is very difficult for mothers to express breastmilk while they are at work or school	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>
7.17	If an HIV positive mother can afford to buy formula it is better for her to formula feed her baby	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>
7.18	Promoting breastfeeding for two years for HIV exposed infants is a risk because mothers will be unable to maintain good ART adherence for that long	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>
7.19	In South Africa it is possible to improve exclusive breastfeeding rates	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>
7.20	There are exceptional circumstances where an HIV positive mother would be advised not to breastfeed, such as failure of 2 <sup>nd</sup> or 3 <sup>rd</sup> line ART treatment, but these are not common	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>
7.21	Formula feeding is more convenient for a mother than breastfeeding	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>	5 <input type="radio"/>



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SECTION N 8.	INFANT FEEDING COUNSELLING CONFIDENCE				
For each activity below, please indicate how confident you feel to undertake each activity. Do you feel "Not at all confident", "Not very confident", "Somewhat confident" or "Very confident".					
		Not at all confident	Not very confident	Confident	Very confident
8.1	How confident do you feel about counselling an HIV positive pregnant woman about how she will feed her baby	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>
8.2	How confident do you feel about giving information about the risks and benefits of breastfeeding to an HIV infected mother	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>
8.3	How confident do you feel about assessing whether there is good positioning and attachment during breastfeeding	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>
8.4	How confident do you feel about advising an HIV positive mother about how to continue to breastfeed her baby when she	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>
8.5	How confident do you feel about advising an HIV infected mother who is virally suppressed who is mixed feeding her infant	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>
8.6	How confident do you feel about advising an HIV infected mother to continue breastfeeding for two years	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>
8.7	How confident do you feel about advising an HIV infected mother about how to stop breastfeeding	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>
8.8	How confident do you feel about advising an HIV positive mother about starting complementary feeds	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>
8.9	How confident do you feel about assessing ART compliance in an HIV positive mother	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>
8.10	How confident do you feel about identifying when an HIV positive mother is not adhering to her ART treatment	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>
8.11	How confident do you feel about reassuring a mother living with HIV who is virally suppressed that a shorter duration of breastfeeding is better than never initiating breastfeeding	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>
8.12	How confident do you feel about explaining the risks of HIV transmission through breastmilk to an HIV infected mother with high viral load	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>

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8.13	How confident do you feel about assisting a mother with HIV to safely formula feed her baby	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>
8.14	How confident do you feel about advising an HIV infected mother who is exclusively breastfeeding and has cracked nipples with bloody milk about how to feed her baby	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>
8.15	How confident do you feel about using the guidelines for safe replacement feeding when you counsel a mother who is not adherent to ART and has a viral load above 1000 copies/ml	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>
8.16	How confident do you feel about advising an HIV infected mother who is exclusively breastfeeding and has defaulted from her ART about how to feed her baby	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>
8.17	How confident do you feel about explaining to a mother about expressing and storing milk	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>
8.18	How confident do you feel about managing poor ART compliance in an HIV infected breastfeeding mother	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>
8.19	A mother is not adherent to ART and her last viral load is 1000 copies per ml. How confident do you feel about counselling her about feeding her infant?	1 <input type="radio"/>	2 <input type="radio"/>	3 <input type="radio"/>	4 <input type="radio"/>

**Supplementary Figure 1: Prior training reported by participants at baseline (intervention versus comparison groups)**



\* $p < 0.05$

Abbreviations: ART= antiretroviral therapy; BF= breastfeeding

**Supplementary Table 1: Attitude scores of health workers at baseline and follow-up**

Attitude statements	Number (%) who agreed or strongly agreed with the statement at baseline			Number (%) who agreed or strongly agreed with the statement at follow-up		
	Intervention (n=289)	Comparison (n=131)	P-value *	Intervention (n=252)	Comparison (n=114)	p-value*
<i>Significant improvements between intervention and comparison groups at follow-up</i>						
There have been so many changes to the infant feeding guidelines and breastfeeding guidelines however I am NOT confused about what to tell mothers who are HIV-infected about breastfeeding	155 (53.6)	74 (56.9)	0.59	175 (69.4)	65 (57.0)	0.02
For an HIV-exposed infant any breastfeeding is better than no breastfeeding at all, as long as the mother is virally suppressed and on antiretroviral therapy	189 (65.4)	79 (61.2)	0.31	196 (77.8)	74 (64.9)	0.01
When a baby cries all the time it is NOT usually because the baby is hungry and needs more food than just breastmilk	260 (90.0)	107 (83.0)	0.02	230 (91.3)	91 (79.8)	<0.01
Exclusive breastfeeding in the first 6 months of life is the best choice for all mothers and babies in South Africa	256 (88.6)	114 (88.4)	0.65	239 (94.8)	98 (86.0)	<0.01
The benefits of breastfeeding for protecting children from illness such as diarrhoea and pneumonia outweighs the risk of acquiring HIV if the mother is on antiretroviral treatment	224 (77.5)	93 (72.1)	0.15	218 (86.5)	87 (76.3)	0.02
I feel that an HIV-infected mother who has not disclosed to her partner is NOT at high risk of non-adherence to ART and should NOT stop breastfeeding as soon as possible	128 (44.3)	51 (39.5)	0.30	137 (54.4)	46 (40.4)	0.01
I should support all mothers, regardless of HIV status, to continue breastfeeding until 2 years, as long as HIV-infected women are virally suppressed	237 (82.0)	101 (78.3)	0.24	237 (94.1)	87 (76.3)	<0.01
I should NOT advise an HIV-positive virally suppressed mother who has cracked and bleeding nipples to temporarily stop breastfeeding	80 (27.7)	40 (31.3)	0.55	97 (38.5)	24 (21.1)	<0.01
Formula feeding is NOT the best choice for mothers living in good socio-economic circumstances who are going back to work	202 (70.0)	95 (74.2)	0.58	198 (78.6)	74 (64.9)	<0.01
It is safer for HIV-positive mothers to breastfeed than to formula feed	231 (79.9)	89 (69.5)	0.63	226 (89.7)	85 (74.6)	<0.01
It is NOT very difficult for mothers to express breastmilk while they are at work or school	164 (53.0)	57 (44.5)	0.01	168 (67.1)	51 (44.7)	<0.01
If an HIV-positive mother can afford to buy formula it is NOT better for her to formula feed her baby	170 (58.8)	83 (64.9)	0.38	185 (73.4)	68 (59.7)	<0.01
Promoting breastfeeding for two years for HIV-exposed infants is NOT a risk because	197 (68.2)	85 (66.4)	0.51	210 (83.3)	79 (69.3)	<0.01

mothers will be able to maintain good ART adherence for that long						
<b>Low levels of knowledge (&lt;80%) at baseline in both groups - no significant differences between intervention and comparison groups at follow-up [concept that this relates to]</b>						
For an HIV-positive mother on antiretroviral treatment and virally suppressed mixed feeding is better than not breastfeeding at all	39 (13.5)	15 (11.7)	0.56	57 (22.6)	16 (14.0)	0.06
In our community working mothers can successfully maintain exclusive breast feeding while going to work	219 (75.8)	89 (69.5)	0.09	208 (82.5)	92 (80.7)	0.67
There are exceptional circumstances where an HIV-positive mother would be advised not to breastfeed, such as failure of 2 <sup>nd</sup> or 3 <sup>rd</sup> line ART treatment, but these are not common	225 (77.9)	93 (72.7)	0.13	201 (79.7)	87 (76.3)	0.46
<b>High levels of knowledge (≥80%) at baseline in both groups – no significant differences between intervention and comparison groups at follow-up</b>						
HIV-exposed babies who are PCR negative must NOT stop breastfeeding as soon as possible	238 (82.4)	104 (81.3)	0.47	221 (87.7)	95 (83.3)	0.26
Exclusive breastfeeding for six months is an achievable goal for the majority of mothers	249 (86.2)	105 (82.0)	0.11	227 (90.1)	96 (84.1)	0.11
An HIV-positive mother who is on ART and not virally suppressed and is mixed feeding is putting her child at risk of acquiring HIV	256 (88.6)	109 (85.2)	0.13	219 (86.9)	97 (85.1)	0.64
In South Africa it is possible to improve exclusive breastfeeding rates	244 (84.7)	108 (84.4)	0.61	230 (91.3)	97 (85.1)	0.08
Formula feeding is NOT more convenient for a mother than breastfeeding	253 (87.5)	109 (85.2)	0.23	211 (83.7)	100(87.7)	0.32
<b><u>Number (%) participants whose attitude was to at least agree (Attitude score ≥84)*</u></b>	<b><u>71 (24.6)</u></b>	<b><u>23 (17.9)</u></b>	<b><u>0.12</u></b>	<b><u>123 (49.2)</u></b>	<b><u>27 (24.1)</u></b>	<b><u>&lt;0.01</u></b>
<b><u>Mean attitude score out of 105 (95% CI)</u></b>	<b><u>76.9 (75.9 – 77.9)</u></b>	<b><u>75.0 (73.0 – 77.0)</u></b>	<b><u>0.07</u></b>	<b><u>82.7 (81.6 – 83.8)</u></b>	<b><u>76.8 (75.0 – 78.5)</u></b>	<b><u>&lt;0.01</u></b>

\*84 was the minimum score obtainable if a participant at least agreed with all statements



**Supplementary Table 2: Confidence statements of health workers at baseline and follow-up**

Confidence statements	Number (%) who felt confident or very confident at baseline			Number (%) who felt confident or very confident at follow-up		
	Intervention (n=289)	Comparison (n=131)	p-value	Intervention (n=252)	Comparison (n=114)	p-value
<b><i>Significant improvements between intervention and comparison groups at follow-up</i></b>						
How confident do you feel about counselling an HIV-positive pregnant woman about how she will feed her baby	265 (91.7)	116 (88.6)	0.30	240 (95.2)	100 (87.7)	0.01
How confident do you feel about advising an HIV-positive mother about how to continue to breastfeed her baby when she returns to work or school	258 (89.3)	117 (89.3)	0.99	242 (96.0)	101 (88.6)	<0.01
How confident do you feel about advising an HIV-infected mother to continue breastfeeding for two years	216 (74.7)	105 (80.2)	0.23	236 (93.6)	93 (81.6)	<0.01
How confident do you feel about assessing ART compliance in an HIV-positive mother	240 (83.1)	111 (84.7)	0.67	230 (91.3)	94 (82.5)	0.02
How confident do you feel about advising an HIV-infected mother who is exclusively breastfeeding and has cracked nipples with bloody milk about how to feed her baby	196 (67.8)	84 (64.1)	0.45	201 (79.8)	80 (70.2)	0.04
<b><i>Low levels of knowledge (&lt;80%) at baseline in both groups - no significant differences between intervention and comparison groups at follow-up [concept that this relates to]</i></b>						
How confident do you feel about advising an HIV-infected mother about how to stop breastfeeding	214 (74.1)	89 (67.9)	0.20	188 (74.6)	86 (75.4)	0.87
How confident do you feel about identifying when an HIV-positive mother is not adhering to her ART treatment	224 (77.5)	104 (79.4)	0.67	218 (86.5)	90 (79.0)	0.07
How confident do you feel about reassuring a mother living with HIV who is virally suppressed that a shorter duration of breastfeeding is better than never initiating breastfeeding	227 (78.5)	103 (78.6)	0.99	215 (85.3)	96 (84.2)	0.78
How confident do you feel about assisting a mother with HIV to safely formula feed her baby	212 (73.4)	102 (77.9)	0.33	191 (75.8)	95 (83.3)	0.11
How confident do you feel about using the guidelines for safe replacement feeding when you counsel a mother who is not adherent to ART and has a viral load above 1000 copies/ml	191 (66.1)	99 (75.6)	0.05	185 (73.4)	75 (65.8)	0.14
How confident do you feel about advising an HIV-infected mother who is exclusively breastfeeding and has defaulted from her ART about how to feed her baby	205 (70.9)	97 (74.1)	0.51	189 (75.0)	80 (70.2)	0.33
How confident do you feel about managing poor ART compliance in an HIV-infected breastfeeding mother	215 (74.4)	104 (79.4)	0.27	209 (82.9)	89 (78.1)	0.27

A mother is not adherent to ART and her last viral load is 1000 copies per ml. How confident do you feel about counselling her about feeding her infant?	199 (68.9)	98 (74.8)	0.21	198 (78.6)	80 (70.2)	0.08
<b>High levels of knowledge (<math>\geq 80\%</math>) at baseline in both groups – no significant differences between intervention and comparison groups at follow-up</b>						
How confident do you feel about giving information about the risks and benefits of breastfeeding to an HIV-infected mother	268 (92.7)	120 (91.6)	0.67	238 (94.4)	102 (89.5)	0.09
How confident do you feel about assessing whether there is good positioning and attachment during breastfeeding	263 (91.0)	125 (95.4)	0.11	243 (96.4)	107 (93.9)	0.27
How confident do you feel about advising an HIV-infected mother who is virally suppressed who is mixed feeding her infant	243 (84.1)	113 (86.3)	0.57	226 (89.7)	99 (86.8)	0.43
How confident do you feel about advising an HIV-positive mother about starting complementary feeds	251 (86.9)	115 (87.8)	0.79	229 (90.9)	103 (90.4)	0.87
How confident do you feel about explaining the risks of HIV transmission through breastmilk to an HIV-infected mother with high viral load	247 (85.5)	114 (87.0)	0.67	220 (87.3)	105 (92.1)	0.17
How confident do you feel about explaining to a mother about expressing and storing milk	269 (93.1)	124 (94.7)	0.54	237 (94.1)	109 (95.6)	0.54
<b>Number (%) participants who were confident or very confident (Sum Score <math>\geq 57</math>)</b>	<b><u>164 (56.8)</u></b>	<b><u>86 (67.2)</u></b>	<b><u>0.09</u></b>	<b><u>175 (70.0)</u></b>	<b><u>72 (64.3)</u></b>	<b><u>0.28</u></b>
<b>Mean confidence score out of 76 (95% CI)</b>	<b><u>59.1</u></b> <b><u>(58.0-60.2)</u></b>	<b><u>59.1</u></b> <b><u>(57.0-61.3)</u></b>	<b><u>1.0</u></b>	<b><u>61.2</u></b> <b><u>(60.8-63.1)</u></b>	<b><u>59.9</u></b> <b><u>(58.1-61.7)</u></b>	<b><u>0.05</u></b>