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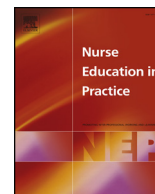
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Midwifery Education in Practice

Educational videos for practitioners attending Baby Friendly Hospital Initiative workshops supporting breastfeeding positioning, attachment and hand expression skills: Effects on knowledge and confidence



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ABSTRACT

UNICEF Baby Friendly Initiative (BFHI) is the global standard for maternity and community services requiring all practitioners to be trained to support mothers in the essential skills of supporting positioning and attachment, and hand expression. These studies aim to rigorously assess knowledge in nurses, midwives, and doctors in these skills, tested before and after watching short videos demonstrating these skills. Practitioners were attending BFHI education, and the video study was additional. In Phase 1 clinicians in England were randomised to one of two videos (practitioner role play or clinical demonstration). The results showed improvements in knowledge and confidence, and a preference for clinical demonstration by mothers and infants. The clinical demonstration video was evaluated in China in Phase 2 where expert trainers viewed the video after completing the BHFI workshop, and in Phase 3 practitioners viewed the video before the BHFI workshop. Phase 2 with expert trainers only showed improvement in knowledge of hand expression but not positioning and attachment. In Phase 3 clinicians showed improved knowledge for both skills. In all Phases there were statistically significant improvements in confidence in practice in both skills.

Viewing short videos increased knowledge, particularly about teaching hand expression, and confidence in both skills.

1. Background

The UNICEF Baby Friendly Hospital Initiative (BFHI) is an evidence-based global standard to support breastfeeding in maternity and community services (WHO, 1989, WHO, 2003). BFHI accreditation is marker of excellence in care. A review of 58 studies found that greater adherence to the standards has a “dose dependent” effect on rates and duration of breastfeeding (Perez-Escamilla et al., 2016). A review of six studies of BHFI training interventions showed improved practitioner knowledge (Balogun et al., 2017). The training standard requires all maternity and community practitioners dealing with breastfeeding mothers to be trained to support breastfeeding, including the two essential skills of supporting positioning and attachment (P & A) and teaching hand expression (HE). Training is typically conducted by group educational workshops with a structured format and content of a minimum of 18 h duration. There are no specific requirements for methods of training delivery, including teaching the practical skills. There are organisational, pedagogic and practical challenges with large

numbers of multidisciplinary practitioners, with varied education and expertise (Atchan et al., 2014). Although BFHI workshops in the UK has for many years included the use of approved videos, presentation slides and discussion exercises, at the time of the study only one short video was in use, neither was video used for practice skills education in BFHI workshops in China. The study aimed to evaluate videos designed to teach the two BFHI essential practice skills in two countries (England and China) with low breastfeeding rates, as an adjunct to BFHI workshops.

Breastfeeding rates in the UK are some of the lowest in Europe. The most recent UK Infant Feeding Survey showed that while although 81% of mothers initiated breastfeeding, there was a steep decline in breastfeeding thereafter. Just 57% of infants were being given any breast milk at 6 weeks and the rates of exclusive breastfeeding were even lower (McAndrew et al., 2012). In China the National Programme of Action for Children's Development (NPA) has been setting national targets every ten years since 1990 for exclusive breastfeeding rates at 6 months to achieve improvements in the nation's child health and

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development. The new target set by the NPA for 2011–2020 was to increase the exclusive breastfeeding rate for infants aged 0–6 months to over 50% (The State Council of People's Republic of China, 2016). Part of the strategy involves supporting all hospitals to achieve BFHI accreditation. In China there are 7036 accredited BFHI hospitals (The National Health and Family Planning Commission of the People's Republic of China, 2015), accounting for almost half of the total number of hospitals accredited worldwide. However, the BFHI standards are not applied in the same way as in England, including allowing formula feed marketing in many services, contributing to low rates of exclusivity in China. A recent cross-sectional survey about breastfeeding rates in China, recruited 14 539 children aged 2 years and younger (0–730 days) from 55 counties in 30 provinces in China. It showed that only 20.8% were exclusively breastfed at 6 months in China in 2013 (Cannon et al., 2016).

The reasons for cessation are complex. Many mothers cite sore nipples, insufficient milk and other common breastfeeding problems as reasons for early weaning, many of which could be prevented by learning effective breastfeeding techniques (McAndrew et al., 2012; Qiu et al., 2009; Qiu et al., 2014; Ouyang et al., 2016). The essential breastfeeding support skills for practitioners are intended to help mothers to establish effective practices from the outset. Correct positioning and attachment (P & A) is important for babies to obtain milk and for mothers to avoid pain and nipple injury (Kronborg and Væth, 2009). Breastmilk expression is important to prevent and overcome difficulties of milk production and to provide flexibility of feeding options, allowing mother and baby separation (Labiner-Wolfe et al., 2008). Breastmilk expression (which may include using breast pumps) in the early days is associated with longer exclusive breastfeeding, (Win et al., 2006), and is also used to stimulate breast milk production when the amount of breast milk seems to be insufficient (Morton et al., 2009).

One reason for less than optimal duration of breastfeeding is that practitioners may not be sufficiently educated to support breastfeeding (Wallace et al., 2009). A UK survey revealed that maternity and health visiting practitioners had recognised but unmet training needs, and they consistently over estimated their knowledge (Wallace and Kosmala Anderson, 2007), while in China, a study with 600 female physicians working with mothers and infants from 10 randomly selected BFHI hospitals in Hubei province showed that 79.3% participants had never received education in breastfeeding support skills (Ouyang et al., 2012).

In the UK, the assessment of the effectiveness of BFHI training has included for many years and currently, a “practical skills review” via a role-played assessment undertaken up to several weeks after the workshop, but there is no test of knowledge of these skills (<https://www.unicef.org.uk/babyfriendly/baby-friendly-resources/training-resources/practical-skills-review-forms/>). Educating practitioners in these skills using a video as an adjunct to the workshop may consolidate knowledge and confidence in practice. To date there are no studies which have both used short videos to educate practitioners in these skills, and tested practitioners' knowledge of what to observe as correct technique by mothers before and after viewing videos specifically designed to educate practitioners.

Learning is not only about gaining factual knowledge; it is also about gaining confidence to apply the skills in practice. A positive association was established between Australian midwives' perceptions of effectiveness of their role in supporting breastfeeding and their objectively assessed knowledge (Cantrill et al., 2003). Bandura's self-efficacy theory suggests that people with higher self-efficacy (self confidence in a behaviour) are more likely to persevere with a specific behaviour in the face of difficulties (Bandura, 1977). Bandura states that mastery is needed to continue pursuing a goal in the face of obstacles and that mastery can be achieved in four ways: 1) personal achievements, 2) vicarious achievements 3) verbal persuasion and 4) emotional arousal. It is likely that breastfeeding support education workshops use verbal persuasion and imparting factual knowledge, whereas videos that demonstrate a skill will additionally use observational learning by

demonstration (Bandura, 2004), and by vicarious achievement where the skill is applied correctly. As the essential breastfeeding support skills involve observation of correct technique and verbally instructing mothers, it is plausible that demonstration of skilled behaviour by mothers with their infants, which affords opportunities for observational learning, will be more effective on immediate learning outcomes of knowledge and self-efficacy than a video of a role play by practitioners with a baby manikin and breast model. The first phase of the study in the UK tests this hypothesis by selecting two videos with comparable factual content and skills demonstration related to the BFHI curriculum (and approved by UK UNICEF BFI assessors), but which differ in the use of educator and learner role play with manikins and breast models versus clinical demonstration by mothers and infants. The next two phases conducted in China tests the effect of the clinical demonstration video (with a Mandarin sound track). The second phase tests the video with national BFHI trainers, the third phase tests the video with practitioners similar to those in the first phase in the UK.

In the study the effectiveness of the videos is evaluated on practitioners' objectively tested knowledge and on their self-reported confidence (self-efficacy) to apply these skills. The videos are evaluated as an adjunct to BFHI educational workshops. The objective of the study is to establish whether knowledge and confidence in practice improve as a result of viewing the videos, since it is likely improvements in both would be required to influence practice.

2. Method

2.1. Phase 1

Design: A randomised quasi-experimental trial comparing the effect of English educator and practitioner role play versus clinical (mother-infant) demonstration training videos.

Setting: Phase 1 was conducted after the two-day workshops in National Health Services (NHS) premises for midwives and health visitors in England, between 2011 and 2013, where three hospitals (one tertiary hospital and two local hospitals) delivered around 8000 births in 2013. The workshops were required for any practitioner who would work with breastfeeding mothers in publically funded maternity hospitals and community services.

Sample: Mixed groups of midwives, health visitors, doctors and support workers (n = 117).

Materials: The UK BFHI video entitled ‘Teaching Breastfeeding Skills’ (TBS) is 18 min long and the ‘Breastfeeding: Essential Support Skills’ (BES) video is 15 min long. Practice knowledge content is similar. The main difference is in how practice skills are demonstrated. The UK BFHI (TBS) video portrays a BFHI education workshop with role-play between a practice educator and practitioners, with very short scenes (about 20% of the video running time) with mothers demonstrating part of the sequence of actions involved in either skill. The UK clinical demonstration (BES) video uses clinical scenarios with a mother demonstrating the complete sequence of actions involved in the skills competently with an expert voice-over.

Measures: Closed survey questions were used for gender, age, job type, workplace organisation, recency and type of relevant prior breastfeeding education and clinical qualifications. Knowledge of the two practice skills (P & A, HE) was assessed using a multiple-choice test. Items were drawn from validated and internally reliable measures (Coventry University Breastfeeding Assessment), (Wallace et al., 2009; Weddig et al., 2011), and Neonatal Unit Clinician Assessment Tool (Wallace et al., 2013). The Coventry University Breastfeeding Assessment-Essential Skills (CUBA-ES) consists of six items measuring P & A and six items measuring HE. As items all had only one correct answer and four possible answers were supplied, there is a 25% chance of guessing correctly. So, with a range of scores from 0 to 12, a score of 3 (25%) could be obtained by chance.

Self-efficacy in applying the practice skills was measured using the

Coventry University Breastfeeding Support Self-Efficacy Scale (CU-BSES). Conceptually similar to the Breastfeeding Self-Efficacy Scale for mothers (Dennis and Faux, 1999), the scale measures self-efficacy to support P & A (six items), and self-efficacy to teach HE (two items). A 10-point scale with 1 being 'not confident at all' and 10 'completely confident' was used. Scores could range from 8 to 80. Participants were invited to give open text comments on the usefulness of the video to their practice.

Recruitment, randomisation and data collection procedures: All participants were briefed prior to the start of the workshop and those who gave informed consent undertook the study. Participants were randomised using a predetermined random number list against the register of completed attendees by a researcher who was not involved in data collection and analysis. Immediately after the BFHI workshop (Time 1) participants were given the survey containing personal and job relevant questions, CUBA-ES and CU-BSES. When completed, all participants were asked to view the relevant video on a computer without discussion with others. Then they were then given their personally pre-coded Time 2 survey evaluating the usefulness of the video before they repeated the knowledge and self-efficacy questions. All participants participated in both assessments.

Analyses: The statistical programme Epidata (3.1) was used for double entry of data and the accuracy of entries was checked. SPSS version 22.0 was used for analyses and the level of statistical significance in all phases was set at $p < 0.05$. Planned analyses included descriptive statistics, Chi Squared for associations with categorical variables; two-way mixed ANOVA was used for differences between groups in Phase 1 on knowledge and confidence scores. To compare confidence in breastfeeding support skills measured by the two confidence sub-scales, because they had different numbers of items, mean scale scores are used in analyses. Knowledge sub-scales were of the same length, so sub-scale and total scores are presented. There was minimal missing data in dependent variables. Cases were excluded from the analysis where any data from personal variables was missing.

Answers to opened ended questions were analysed thematically (Braun and Clarke, 2006) and numbers of responses categorised as either positive, neutral or negative.

2.2. Phase 2: video provided to national educators after attending a BFHI workshop

Design: Single cohort pre/post-video design.

Setting: Phase 2 was conducted during a BFHI breastfeeding training course in Zhejiang Province, China. The Ninghai hospital is a county hospital in Zhejiang province, which has around 5000 births each year and has achieved BFHI accreditation.

Sample: The National Center for Women and Children's Health (China CDC) provided a national breastfeeding course in China for provincial breastfeeding practice educators who were from hospitals throughout China's 31 provinces. These expert educators were responsible for educating practitioners in breastfeeding support in their provinces. All 74 national educators were invited and 54 participated.

Materials: Phase 2 tested a Mandarin voiced version of the clinical (mother-infant) demonstration video used in Phase 1.

Measures: The same personal descriptive questions, knowledge and confidence measures from Phase 1 were translated into Mandarin (including back-translation) and pre-tested for understanding.

Recruitment and data collection procedures: All participants consented to participate and were tested immediately pre/post watching the video. Researchers were not involved in the workshops.

Analyses: Paired *t*-test was used. The formula $\text{Eta squared} = \frac{t^2}{t^2 + N - 1}$ was used for the paired-samples *T*-test. Eta squared 0.01 = small effect, 0.06 = moderate effect, 0.14 = large effect (Bergen et al., 2012).

Table 1
Demographic, job, and breastfeeding training experience variables of the sample in Phase 1.

Variable	BES video		TBS video		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Total participants	61	52.1	56	47.9	117	100
Gender						
Male	0	0	1	1.8	1	0.9
Female	56	91.8	50	89.3	106	90.6
missing	5	8.2	5	8.9	10	8.5
Age						
≤ 39	27	44.3	19	33.9	46	39.3
≥ 40	19	31.1	22	39.3	41	35.0
missing	15	24.6	15	26.8	30	25.6
Job role						
Unqualified/support	7	11.5	20	35.7	27	23.1
Midwife	20	32.8	9	16.1	29	24.8
Health Visitor (Community nurse)	18	29.5	18	32.1	36	30.8
Hospital Nurse	10	16.4	5	8.9	15	12.8
missing	6	9.8	4	7.1	10	8.5
Clinical qualifications						
Health Visitor (community nurse)	3	4.9	6	10.7	9	7.7
Vocational Qualification	10	16.4	17	30.4	28	23.9
Registered Nurse	27	44.3	16	28.6	43	36.8
Registered Midwife	27	44.3	14	25	41	35.0
Other	10	16.4	21	37.5	31	26.5
missing	–	–	–	–	–	–
Setting						
NHS Hospital	32	52.5	22	39.3	54	46.2
NHS Community Health Provider	16	26.2	13	23.2	29	24.8
Primary Healthcare	3	4.9	5	8.9	8	6.8
Non-NHS community provider	9	14.8	16	28.6	25	21.4
missing	1	1.6	0	0	1	0.9
Time working in with breastfeeding mothers and infants						
Under a year	22	36.1	25	44.6	47	40.2
1-10 years	15	24.6	18	32.1	33	28.2
More than 10 years	19	31.1	9	16.1	28	23.9
Missing	5	8.2	4	7.1	9	7.7
Most recent breastfeeding training						
None	11	18.0	11	19.6	22	18.8
Part of qualification	6	9.8	8	14.3	14	12.0
Previous UK UNICEF BFHI	37	60.7	34	60.7	71	60.7
Other	6	9.8	3	5.4	9	7.7
missing	1	1.6	0	0	1	0.9
Recency of breastfeeding training						
Never	11	18.0	7	12.5	18	15.4
0-3 months	30	49.2	29	51.8	59	50.4
3 months–2 years	5	8.2	10	17.9	15	12.8
2 years or more	13	21.3	9	16.1	22	18.8
missing	2	3.3	1	1.8	3	2.6

2.3. Phase 3: video provided to practitioners before attending a BFHI workshop to assess its utility as self-study aide

Design: Single cohort pre/post-video design.

Setting: The third phase was conducted before a BFHI training course delivered once every year to practitioners in the Ninghai Women and Children's Health Hospital.

Sample: Participants were midwives, health visitors, nurses and doctors. Of 170 attendees of a BFHI workshop, 169 completed the pre-post video measures.

Materials, measures, recruitment, data collection procedures and analyses: As in Phase 2.

Ethical approval was granted by Coventry University, UK (ref:P5842), and Zhejiang University, China (ref:20120002).

3. Results

Phase 1: There were 117 participants recruited. The majority were midwives, health visitors, and nurses. See [Table 1](#).

In Phase 1 all but one participant were female, and ages ranged from 19 to 59 years old with a median of 39 years. The sample had worked with breastfeeding mothers for between 0 and 6 months to over 10 years, with 47 (40.2%) under one year. The largest number ($n = 36$, 30.8%) worked as qualified health visitors, with 29 (24.8%) working as midwives, 27 (24.8%) support staff, 15 (12.8) nurses and 10 who did not report this data. Almost half of the sample ($n = 54$, 46.2%) was based in hospitals, the remainder in community health providers. There was a range of nursing and midwifery professional qualifications, none with medical or with lactation practice qualifications. No prior education in breastfeeding was reported by 22 participants. The majority ($n = 59$, 50.4%) had undergone some breastfeeding education recently, but were required to undertake the workshop as a new employee in a health care organisation aspiring to achieve UK BFHI accreditation. For 22 employees (18.8%) breastfeeding education occurred more than 2 years ago.

In Phase 2 (national BHFI educators) more than half (51.9%) were aged 39 years or older, the majority were nurses, 70.4% had worked with breastfeeding mothers for 10 or more years, and 11.1% had had no formal breastfeeding training.

In Phase 3 (county hospital practitioners about to attend BHFI training), the majority were in junior grades, students or in unqualified support roles. More than half (56.2%) were under 30 years old, 35.5% had worked with breastfeeding mothers for 10 or more years, and 94.6% had had no prior formal breastfeeding education. There were no significant differences in proportions by group tested by Chi Squared in all phases (See [Tables 1 and 2](#)).

The internal reliability of the two sub-scales of P & A and HE confidence was calculated using Cronbach's alpha ([Pallant, 2013](#)) in Phase 1, (Cronbach's alpha coefficient of 0.97 or 0.98 respectively).

Phase 1: Is there a difference in knowledge and confidence related to the use of role-played or clinical scenarios to reinforce teaching of the essential skills?

Analyses of variance of Group (video type) by Time (before versus

after watching the video) were run for all knowledge and confidence scales and sub-scales. The results in all analyses showed no significant interaction term, which means there was no differential improvement in knowledge and self-efficacy according to which video they viewed. There was a significant training effect as shown by the main effect by Time (Pre to post-video) on all knowledge and confidence variables except for knowledge of P & A. The high mean and small standard deviation pre-video scores on P & A suggest a ceiling effect, which also is likely to reflect that participants have just completed a workshop in which this skill is discussed in detail. (See [Table 3](#)).

Phase 1: What are the job relevant variables associated with improvement in knowledge and confidence?

Analyses were conducted using paired t-tests on change in total knowledge and confidence scores by age, breastfeeding education and job relevant variables. There were no significant effects on knowledge for any variables, and the only significant effect on confidence was a small significant effect for prior breastfeeding education. Total confidence scores increased more for those with none compared to those who had prior breastfeeding education ($t = 2.22$ (106), $p = 0.04$; None, mean difference = 0.54 SD = 1.07; Some, mean = 0.19, SD = 0.5). Open text comments were provided by 96 participants. Comments on both videos were overwhelmingly positive. However, there were substantially more comments about the usefulness of real clinical scenarios, particularly clinical demonstration of HE by a mother as practitioners said they seldom have the opportunity to see this skill being competently demonstrated by mothers.

Phases 2 and 3: Is practitioner knowledge and confidence improved by watching the Mandarin version of the clinical demonstration of the essential breastfeeding support skills?

Phase 2: In the national educators sample tested after a BHFI workshop, knowledge was not significantly improved, except on the sub-scale of hand expression (HE); $t = 2.15$ (53) $p = 0.04$). Confidence in practice was improved for both sub-scales. See [Tables 4 and 5](#). There was no effect for any demographic or job-related variables.

Phase 3: The Ninghai sample of practitioners tested before a BHFI workshop improved their knowledge on all measures of knowledge and confidence. See [Tables 4 and 5](#). There was no effect for any demographic or job-related variables.

Table 2
Characteristics of participants completing pre-post video questionnaires in Phases 2 and 3.

Items	National (Phase 2) (N = 54)		Ninghai (Phase 3) (N = 169)		
	Number	Percentage (%)	Number	Percentage (%)	
Age	< 30 years	5	9.3	95	56.2
	30–39 years	21	38.9	61	36.1
	> 39 years	28	51.9	13	7.7
Working hospital	Provincial hospital	18	33.3	3	1.8
	Municipal hospital	27	50.0	2	1.2
	County hospital	9	16.7	164	97.0
Job type	Nurse	32	59.3	138	81.7
	Midwife	11	20.4	27	16.0
	Doctor and administrator	11	20.4	4	2.3
Job title	Senior	14	25.9	5	3.0
	Mid-grade	29	53.7	36	21.3
	Junior-grade ^a , student, or no qualification	11	20.4	128	75.7
Working with breastfeeding mothers	0–1 years	9	16.7	40	23.6
	2–5 years	3	5.6	37	21.9
	6–10 years	4	7.4	32	18.9
	> 10 years	38	70.4	60	35.5
Previous training on breastfeeding	Yes	48	88.9	159	94.6
	No	6	11.1	10	5.4

^a Junior grade = first post qualification job role.

Table 3
ANOVA of Time (Phase 1 Before and after watching a video) by video type (TBS role play versus BES clinical demonstration) on knowledge and confidence scores.

	TIME 1 MEAN SD	TIME 2 MEAN SD	ANOVA
Total Knowledge			
BES	8.26 1.90	9.25 1.60	Interaction: F(1,107) = .597
TBS	8.46 1.92	9.15 2.06	Main effect DVD: F(1,107) = .030
			Main effect Time: F(1,107) = 19.902*
Total Confidence			
BES	8.24 1.94	8.49 1.77	Interaction: F(1,107) = .147
TBS	8.27 1.35	8.57 1.08	Main effect DVD: F(1,107) = .035
			Main effect Time: F(1,107) = 17.244
Sub-Scale P & A Knowledge			
BES	5.11 1.08	5.37 0.88	Interaction: F(1,107) = .657
TBS	4.96 1.12	5.06 1.09	Main effect DVD: F(1,107) = 1.751
			Main effect Time: F(1,107) = 3.040
Sub-Scale HE Knowledge			
BES	3.16 1.08	3.88 1.04	Interaction: F(1,107) = .269
TBS	3.50 1.32	4.10 1.33	Main effect DVD: F(1,107) = 2.052
			Main effect Time: F(1,107) = 30.695*
Sub-Scale P & A Confidence			
BES	8.27 1.96	8.49 1.77	Interaction: F(1,107) = .0001
TBS	8.36 1.32	8.59 1.08	Main effect DVD: F(1,107) = .103
			Main effect Time: F(1,107) = 13.529*
Sub-Scale HE Confidence			
BES	8.18 1.95	8.47 1.80	Interaction: F(1,107) = 1.302
TBS	8.01 1.63	8.51 1.17	Main effect DVD: F(1,107) = .044
			Main effect Time: F(1,107) = 20.389*

* = P < 0.001.

Table 4
Breastfeeding knowledge scores between pre- and post-video education in Phases 2 and 3.

Knowledge type	Study	n	Mean score		df	T	p
			Pre SD	Post SD			
P & A (scores 0–6)	Study 2	54	4.44	4.46	53	-0.11	0.91
	National		1.02	0.86			
	Study 3	169	3.21	4.30	168	-10.49	0.0001
HE (scores 0–6)	Ninghai		1.21	1.01			
	Study 2	54	3.59	3.90	53	-2.15	0.04
	National		1.24	1.12			
Total (scores 0–12)	Study 3	169	3.22	4.63	168	-13.52	< 0.0001
	Ninghai		1.25	0.79			
	Study 2	54	8.04	8.37	53	-1.52	0.14
	National		1.66	1.66			
	Study 3	169	6.43	8.98	168	-14.76	< 0.0001
	Ninghai		2.01	1.36			

4. Discussion

This study is the first to test the effect of educating practitioners in the two essential practice skills required by BFHI using videos. The first phase showed small (but statistically significant) improvements in

Table 5
Confidence scores pre- and post-video education in Phases 2 and 3.

Knowledge type	Group	n	Mean score		df	t	p
			Pre Mean SD	Post Mean SD			
P & A range 0–10	Phase 2	41	9.49	9.66	40	-2.08	0.04
	National		0.66	0.55			
	Phase 3	145	7.78	9.08	144	-8.80	< 0.0001
HE range 0–10	Ninghai		1.88	1.6			
	Phase 2	43	9.40	9.55	42	-2.00	0.05
	National		0.89	0.73			
Total range 0–10	Phase 3	145	7.94	9.05	144	-5.63	< 0.0001
	Ninghai		2.78	1.05			
	Phase 2	41	9.46	9.65	40	-2.57	0.01
	National		0.69	0.56			
	Phase 3	145	7.77	8.98	144	-11.03	< 0.0001
	Ninghai		1.88	1.04			

knowledge of about an average of one point on a 12 point knowledge scale, and about half a point average on a 10 point scale for confidence, whether practitioners viewed videos using either role-played demonstration by educators using manikins in a workshop with practitioners, or real clinical demonstration by mothers and infants. The results do not support the hypothesis that clinical rather than role-play demonstration is superior in terms of knowledge and confidence outcomes, although participants more often commented upon the former favourably. A further study might evaluate whether the knowledge is retained and applied differentially as a result of being more clinically relevant. However, the comments favouring the reality of clinical demonstration informed the choice of video, with a Mandarin voice-over applied to it, on two samples in China. The improvement for educators in the national sample (Phase 2) was only significant for knowledge and confidence for HE, suggesting that educators along with other practitioners that they will train, will benefit from more education in this practice skill.

In Phase 3 the results showed very statistically significant increases in knowledge (equating to an average of more than 3 knowledge points) and around 12% average improvement in total confidence. This was a mixed sample of practitioners tested before the BFHI workshop, whereas practitioners were tested after a training workshop in Phase 1. Since these practitioners had not yet attended the BFHI workshop, this greater effect may be expected, and would support the use of the video as part of BFHI training, perhaps with shorter workshops and more use of video for self-study.

A limitation of the study's design is there is no control group. It is possible that knowledge would change by repeated testing. However, in a study with an objective knowledge test, researchers found no change over a similar short time period (Law et al., 2007). In the current study, participants were not allowed to discuss the results nor did they gain access to their scores prior to retesting, supporting the interpretation of the results as showing strong training effects. The studies are limited by not having longer follow up outcomes and no test of the application of the skills in practice. A further limitation is that in Phase 2 there was a 30% attrition of the sample by the post-video test, so the effects may be biased towards those who felt more ready to be retested, although there were no significant differences in pre-video knowledge and confidence scores between those who did and those who did not submit to post video testing. There was some missing data in Phase 2 and 3 on confidence ratings, may be due to some difficulty in translating into Mandarin what is meant by confidence in practice, but per protocol analyses showed this had no effect on the results.

A strength of the evidence produced by the three phases of the study is the use of the same validated and reliable tests of knowledge and confidence. Other studies of breastfeeding training use different tests, so results are not comparable across studies. Some studies have used

validated tests but with only two possible answers (Tender et al., 2014; Ingram et al., 2011) where correct guesses are at 50%. Other studies used instruments for knowledge assessment with open text responses (Hillenbrand and Larsen, 2002), or survey items (Williams et al., 2013) but neither study used rigorous means of assessing whether each answer is correct or not. The CUBA-ES uses four options, reducing guesswork to 25% chance, thus allowing a greater range of knowledge scores to be demonstrated by participants, as well as data being available on the frequently chosen incorrect options (misconceptions) which could be addressed by further training. Self-efficacy for use of breastfeeding knowledge taught in a one-hour session for 20 paediatric nurses in the USA used a similar instrument, and achieved improvements, but the study did not measure knowledge (Washburn, 2016).

Despite all participants having just completed the UNICEF BFHI 18 h training in Phase 1 the wide standard deviations (1.6 and 2.06 on a 12 point scale), shows there is high variability in their knowledge of the two practice skills. Further, practitioners are more knowledgeable in P & A than in HE. After the BFHI course they are on average only scoring around 3 to 4 out of 6 for HE where 1.25 would be possible by guesswork. This is likely to reflect the reality of clinical practice for many midwives, nurses and health visitors in the UK. In a previous study using the clinical demonstration video and other training materials, the researchers interviewed similar practitioners to those who took part in Phase 1 in another part of England. The participants reported that as many women are discharged home within hours of birth in the UK, the practitioners are unable to provide adequate education of the two essential skills to the mothers prior to discharge. In the community, they do not often see successful breastfeeding, still less successful hand expression, as they are more often called upon when there are feeding problems. (Wallace et al., 2009; Kehal et al., 2013). There was a similar finding in a survey of practitioners in Ireland (Mulcahy et al., 2011). The median length of stay in the hospital after birth was 5.6 days in Hangzhou city, Zhejiang Province of China (Qiu et al., 2007). This may mean in China practitioners working on post-natal wards will have greater opportunity for seeing a range of clinical practice, but the data on pre-video knowledge in Phase 3 shows low average scores for both skills, suggesting that this exposure is not a sufficient substitute for specific training.

Further improvement in breastfeeding support education may be achieved by giving direct feedback of knowledge scores in order to enable practitioners to understand the limits of their knowledge. But feedback of knowledge scores without the provision of training was associated with reductions in confidence in practice in a study conducted with neonatal practitioners (Wallace et al., 2013), who therefore recommended doing so only when there is an immediate opportunity for exposure to learning content and retesting. In the current studies, the experience of viewing videos improved confidence in all Phases and on both skill areas, so it may have focussed the practitioners' learning while watching the video on the areas where they found the test more challenging to their knowledge and confidence in practice. For those, such as the educators in Phase 2 who are already highly knowledgeable and confident, the video can still improve confidence, perhaps by confirming knowledge by exposure to clinical demonstration.

It is already established that those who volunteer for training are those who have greatest interest and knowledge about breastfeeding (Wallace and Kosmala Anderson, 2007). Managers may seek to target scarce training resources on those they think most need it. In the absence of any formal tests of breastfeeding knowledge being used routinely to select those for training, they may rely on job and training characteristics as proxies. But this research suggests this will not target those with least knowledge and confidence, as age, job and breastfeeding training variables did not moderate any of the effects of the results of testing knowledge and confidence, except for a modestly greater improvement in confidence in those without prior breastfeeding support education in Phase 1. An alternative approach would be to perform a test of knowledge of breastfeeding to identify and then target

those in need of additional education, for example by using the CUBA-ES or its longer form, which tests all knowledge domains required by BFHI. This approach has been used both in the USA (Weddig et al., 2011) and in England (Wallace et al., 2009; Kehal et al., 2013) where practitioners across whole services have been tested.

Knowledge of HE was lower on average for all Phases than for P & A at both assessment times. There were no differences by any subgroup suggesting it is an area that all participants were least familiar with, even in Phase 1 and 2 after attending an 18-h training workshop. These results are similar to others, showing that this practice skill is often neglected in training and in exposure to observation of this skill in clinical practice. A Turkish study used a questionnaire to determine the level of knowledge of 857 midwifery and nursing students about breast milk expression (Col-Araz et al., 2013). The findings suggested they had a fair knowledge of the principles of breast milk expression and storage, but they lacked practical experience. In the UK, researchers assessed neonatal practitioners' knowledge and confidence in breastfeeding practices (Wallace et al., 2013). They found that although 92.2% (n = 47) of practitioners scored half or more correctly on their knowledge of breast milk expression, when results were fed back to them their confidence in their knowledge was reduced. The researchers concluded that practitioners may over estimate their knowledge and without objective assessment, they may apply incorrect knowledge in their practice.

5. Conclusions

The study supports the utility of objectively testing knowledge of breastfeeding support education in practice skills using self-study videos. The UNICEF BFHI requires that all practitioners are trained to a common standard to enable women to receive a consistent and high level of service. It may be cost effective to require all to view a short video as a self-study refresher on a regular basis, and prior to attending a course if there is a long waiting list, and with a particular focus on HE for all practitioners. The videos themselves could also be incorporated into the course, since the results showed the participants' knowledge was not uniformly high even after attending the course. We recommend that practitioners' knowledge and confidence in practice are assessed both before and after training, both so that practitioners have a record of their achievements and any further learning needs, to enable training delivery to be improved, and if necessary targeted on those with most to gain. Further research is required to assess how well this knowledge is applied in clinical practice.

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Conflicts of interest

Louise Wallace and Orla Dunn are Directors of Health Behaviour Research Limited. The Mandarin version and original items in English of the CUBA (Coventry University Breastfeeding Assessment), and the Breastfeeding EssentialSkills video are jointly owned by Health Behaviour Research Limited and Coventry University.

Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.nepr.2018.04.005>.

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