

Early Care and Education Professionals' Breastfeeding Knowledge and Practices Before and After an E-Learning Program

Dunn RL^{1*}, Phillips SM², Arnold L³, Messer J⁴, Nelson B⁵ and Kalich KA⁶

¹Professor Emeritus of Public Health, Department of Public Health, Keene State College, Keene, NH, USA

²Assistant Professor, Department of Nursing and Health Professions, Rivier University, Nashua, NH, USA

³Program Coordinator, School of Sciences, Sustainability, and Health, Keene State College, Keene, NH, USA

⁴Public Health Nutrition Student (former), Department of Public Health, Keene State College, Keene, NH, USA

⁵Dietetic Intern (former), Department of Public Health, Keene State College, Keene, NH, USA

⁶Dean, School of Sciences, Sustainability, and Health, Keene State College, Keene, NH, USA

Abstract

Objective: To assess early care and education professionals' breastfeeding knowledge and practices before and after an e-learning program. **Participants:** Early care and education professionals from New Hampshire (U.S.A.) licensed child care programs were invited to complete a pre-assessment followed by a 90-minute e-learning breastfeeding program. Three months post-training, participants were invited to complete the post-assessment. **Analysis:** McNemar tests were used to assess changes from pre-post-assessment for dichotomous variables. McNemar-Bowker tests were used to determine differences from pre-post for variables with more than two categories. When the McNemar-Bowker test was significant, a multiple comparison correction (Bonferroni) was used. **Results:** 114 participants completed the e-learning program and pre-post assessment. Results showed significant improvement from pre-post in 10 of 15 breastfeeding knowledge questions related to health of baby, mother and child care centers, economics, and environmental impact. There were significant changes from pre-post in 24 of 50 breastfeeding practice questions in handling breast milk, promoting breastfeeding, and supporting mothers. **Conclusions and Implications:** This study indicates improvement in early care and education professionals' breastfeeding knowledge and practices; however, opportunities exist to design targeted initiatives to further strengthen practices that support breastfeeding families in the child care environment.

Keywords: Breastfeeding; Child care; Breastfeeding education; Infant nutrition; Breastfeeding support; Early care and education

Abbreviations:

ECE : Early care and education , CACFP: Child and Adult Care Food Program , WIC: Special Supplemental Nutrition Program for Women Infants and Children.

Introduction

Early care and education (ECE) professionals have an essential role in supporting families in their breastfeeding journey when women return to work. In the U.S., 58% of women with infants under 1 year of age are in the workforce [1], which can lead to non-parental care arrangements. The types of non-parental care include relative (e.g. grandparent), non-relative (e.g. home-based), and center-based programs. From 2001 to 2012, participation in at least one type of non-parental care arrangement for infants under 1 year of age increased from 40% to 46%, averaging 22 to 28 hours per week [2].

Research indicates that women who return to work with their infants in non-parental care during the first year of life have lower initiation and duration rates of breastfeeding [3-5] potentially leading to undesirable health outcomes such as

those that weaken the immune system and increase the risk of gastrointestinal, respiratory, and ear infections [6-8]. These undesirable health outcomes may be mitigated through breastfeeding as described extensively in the literature [6-8]. When infectious illnesses develop, this poses a risk of spreading, and in the child care setting this could affect the well-being of children, families, and ECE professionals. To provide the necessary support for breastfeeding families when women return to work, and to mitigate undesirable health outcomes, The Surgeon General's Call to Action to Support Breastfeeding in the U.S. recommends that states facilitate lactation-based education opportunities for ECE professionals [8].

Numerous states in the U.S. (e.g. Arizona, Kansas, New Hampshire, North Carolina, Vermont, and Wisconsin) have educational opportunities and accessible resources for ECE professionals on topics associated with promoting and supporting breastfeeding in the child care setting. These opportunities align with the professional development needs for ECE providers, as they are responsible for an ongoing process of acquiring knowledge and skills to deliver quality care for children. Despite an interest in accessing breastfeeding education information [9-11], ECE professionals do not always receive formal training on topics associated with breastfeeding [12,13]. For example, Garth and

colleagues reported that only 40% of their participating centers provide staff with formal training [13]. Schafer and colleagues note a lack of standard industry-wide breastfeeding education resources for ECE providers [14], suggesting inconsistent approaches to supporting breastfeeding families.

Internet-based breastfeeding education options (e-learning) and resources are available through various state agencies, organizations, and coalitions to develop and sustain breastfeeding friendly child care policies and practices (e.g. Wisconsin Breastfeeding Coalition, Florida Breastfeeding Coalition). Prior research indicates that online platforms are a desirable delivery mode for ECE professionals [9,11], as they find it difficult to attend traditional in-person trainings [15]. Therefore, e-learning programs are a viable option for delivering knowledge to ECE professionals.

The use of e-learning has expanded rapidly in numerous settings and among professionals throughout the 21st century. The benefits and challenges of e-learning as well as its effectiveness have been documented in the literature. Several advantages have been noted, including learners having the flexibility to determine their own pace, place, and time of learning, quicker access to knowledge acquisition, larger-scale distribution of knowledge, and cost-effectiveness [16]. However, challenges are noted such as limited access to technology, lack of computer literacy skills, less face-to-face interaction with peers and instructor, competing commitments with work and family, and lack of self-motivation [16,17]. Occupations that require an ongoing process of professional development (e.g. health providers, ECE professionals) have found e-learning effective despite the challenges.

E-learning for continuing education in the health professions has demonstrated desirable results for improving knowledge, skills, and patient care, particularly when interactive components (e.g. e-mail, asynchronous or synchronous discussion boards, case studies with scripted interaction) are embedded within the platform [18,19]. Improved breastfeeding knowledge of health providers through e-learning has been shown in pre-post assessment designs [20-22]. With ECE professionals, Clark and colleagues found improvements with attitudes and behaviors in areas of the perceived benefits of breastfeeding and providing a breastfeeding friendly environment [23]. However, recent research emphasizes the need to provide education and training about breastfeeding to ECE professionals [14,24]; therefore, additional exploration on breastfeeding education through e-learning with ECE professionals is warranted. This study was designed to assess ECE professionals' breastfeeding knowledge and practices within the child care setting before and after an e-learning program.

Methods

Developing the e-learning program

The creation of the e-learning breastfeeding program for ECE professionals began with an assessment of the breastfeeding environment in licensed New Hampshire child care settings. The assessment, a 26-question telephone survey, was developed using guidelines from *Caring for our Children: National Health and Safety Performance Standards*;

Guidelines for Early Care and Education Programs [25] and drew upon those states with best practices that support breastfeeding friendly child care. Survey questions focused on breastfeeding policies and practices (e.g. storage and handling, education, lactation spaces) in the child care environment, and content was reviewed by the New Hampshire state breastfeeding coordinator.

The state of New Hampshire's Department of Health and Human Services, Child Care Licensing Unit provided a listing of the 956 licensed child care centers and we identified those that provided infant care (n=576). A total of 160 programs (28% sampling) that provide infant care completed the 20-minute telephone interview with trained research assistants. There was representation from all 10 New Hampshire counties with 72.5% being center-based, and 27.5% family-based. Interviews were conducted with either a child care program director or infant teacher. We found that 78% of respondents indicated that they did not receive formal training on how to care for breastfed infants, 69% were interested in receiving breastfeeding friendly child care education, 73% stated an interest in an online format, and 91% valued a breastfeeding friendly designation for their child care programs.

Findings from the telephone survey and literature provided guidance on the mode of delivery and content. We determined that an e-learning platform (Canvas by Instructure) would be the delivery method to provide widespread accessibility (i.e. larger distribution throughout the state) over a sustained period of time and flexibility (i.e. pace, place, and time) for ECE professionals. The flexible approach included a format that was asynchronous and 90-minutes in length. Recognizing that some ECE professionals, who are adult learners, may not have Internet access outside of the work environment, have the option to complete the training at their child care locations over time (e.g. three 30-minute sessions). The e-learning program included other characteristics that align with adult learning strategies such as multimedia (text, graphics, and audio), easy-to-read font, a menu of topics, and interactive content [26].

To meet the educational interests of ECE professionals, the content of the program includes topics of interest as identified from the telephone survey and literature within five modules: a) The Benefits of Breastfeeding, b) Supporting Breastfeeding Mothers, c) Handling Breast Milk, d) Feeding Breastfed Infants, and e) Breastfeeding Friendly Policies. Each module must be viewed in its entirety before moving on to the next sequential area. The e-learning breastfeeding program content was developed using best practices from state agencies, recommendations as set forth by professional organizations (e.g. Academy of Breastfeeding Medicine and the American Academy of Pediatrics), and peer-reviewed literature. A comprehensive listing of references is included in the e-learning program.

The program has six learning objectives that align with the five modules. Each module has didactic information, simulated scenarios, and an extensive list of downloadable resources for ECE professionals. The state's breastfeeding coordinator, a subgroup of the New Hampshire Breastfeeding Task Force, and 40 ECE professionals reviewed the program prior to its launching. Feedback was sought on the technical aspects of the training, what was liked, areas to improve upon,

and any additional suggestions. This step provided useful feedback that enabled us to refine the e-learning program prior to its dissemination to ECE professionals.

Recruitment

A total of 576 licensed child care programs in New Hampshire received a direct mailing about the availability of the no-fee e-learning breastfeeding program that included information on how to self-enroll, the availability of professional development contact hours approved by New Hampshire Child Care Licensing, and the voluntary opportunity to participate in a pre-post assessment. Approval for the pre-post assessment design was granted from Keene State College's Institutional Review Board and informed consent was obtained from all participants prior to completing the pre-assessment.

Self-enrolled participants voluntarily completed the pre-assessment prior to accessing the e-learning program. The self-enrollment process involved choosing a login and password that linked to a random identification number that synchronized pre-post assessment data. Those who completed the pre-assessment and e-learning program received an e-mail invitation three months later to complete the post-assessment. We decided to administer the post-assessment three months after completing the pre-assessment and e-learning program as this would provide time to shift practices and policies within participants' child care environments. Participants received a \$10 gift card to a local grocery store after completing the e-learning breastfeeding program, and the pre-post assessments.

Pre-post instrument

The pre-post assessment included 78 closed-ended questions and two open-ended questions. The questions assessed breastfeeding knowledge of ECE professionals and practices within the child care environment aligning with the content of the e-learning program. The New Hampshire state breastfeeding coordinator reviewed the pre-post assessment in its entirety and provided feedback prior to launching the e-learning program. The pre-post assessment included questions that were similar to those in the telephone survey, and some (breastfeeding knowledge) were from a previously developed survey [27].

There were 15 breastfeeding knowledge questions focusing on the benefits of breastfeeding such as health of the baby and mother, economic implications, and environmental impact. All knowledge questions used a 5-point Likert response format (strongly agree, agree, disagree, strongly disagree, and unsure). There were 50 questions about practices such as feeding breastfed infants, handling breast milk, promoting and normalizing breastfeeding, supporting mothers (e.g. designated space to breastfeed and express milk, educational resources), and breastfeeding policies. Some questions had follow-up inquiries on various practices, such as types of learning and play materials for children that normalize breastfeeding (e.g. books, stuffed animals) and designated spaces for expressing milk (e.g. quiet, comfortable, private). The majority of practice-related questions were "yes" or "no" options. The remainder of the questions (15) collected general information (e.g. type of facility, number of infants served, interest in breastfeeding friendly designation) and

some were open-ended inquiries about reasons why a center does not handle breast milk and the number of infants served by the program. The learning management system reported that the pre-post assessment took ~45 minutes to complete.

Data analysis

Data was analyzed using IBM SPSS Statistics software (Version 23); significance was set at $p < 0.05$. McNemar tests were used to assess significant changes from pre-post-assessment for dichotomous variables. To assess statistically significant differences from pre-post for variables with more than two categories, McNemar-Bowker tests were used. For questions where the McNemar-Bowker test was significant, a multiple comparison correction (Bonferroni) was used to assess for differences in knowledge where comparisons were categorized by agree vs. unsure, agree vs. disagree, and unsure vs. disagree.

Results

A total of 249 ECE professionals from New Hampshire licensed child care programs enrolled, completed the pre-assessment, and finished the e-learning breastfeeding program. Of those 249, 114 returned to complete the post-assessment. All 114 participants were women, 82% were from center-based facilities, 18% from family-based programs, and 113 were at the same location from pre-post assessment (maximum time span was 6 months). Of the 114 participants, 52.6% indicated they received training (prior to our e-learning program) on breast milk storage and handling with 27% indicating the training was within the past two years.

Pre-post assessment questions were categorized by changes in breastfeeding knowledge and practices in the child care setting. Likert format responses were categorized as strongly agree/agree, unsure, and disagree/strongly disagree. The categories were then renamed into agree, unsure, and disagree. Results from the pre-post assessment indicated an improvement in ECE professionals' breastfeeding knowledge in the following areas: health of baby, mother, and child care centers, economic implications related to healthcare costs and policy, and environmental impact. A statistically significant shift in responses was seen from pre-post assessment in 10 of 15 questions, and across all three Likert response categories. However, there were no significant changes from pre-post assessment on breastfeeding knowledge questions related to mother-infant bonding, nourishment, cost of breastfeeding compared to formula, and the role of child care programs. Table 1 provides a summary of the questions where significant changes were detected from pre-post assessment.

Despite the statistically significant changes, it is noted that opportunities exist to further strengthen and improve ECE professionals' breastfeeding knowledge. For example, when examining the post-assessment data, 38% of ECE professionals indicated that they were either unsure or agree that "breast milk is not a reimbursable component of the Child and Adult Care Food Program (CACFP) infant meal pattern" and 37% responded unsure or agree that "Special Supplemental Nutrition Program for Women Infants and Children (WIC) benefits are better for those not breastfeeding." The post-assessment also revealed that 33% of participants responded unsure or disagree that breastfeeding

“results in less illness in child care centers” with 35% indicating unsure or agree that “formula is as healthy as breast milk.”

There were significant changes in breastfeeding practices from pre-post assessment in 24 out of 50 questions. These changes indicated an improvement in breastfeeding practices in the areas of handling breast milk, promoting and

normalizing breastfeeding, and supporting mothers in the child care setting. The shift in responses were primarily from “no” to “yes.” Table 2 provides a summary of the questions where a significant shift was detected from pre-post assessment for changes in breastfeeding practices in the child care environment.

Breastfeeding Knowledge Questions ^a	Percent Shift ^b (participant shift, Pre, Post)	P Value
Unsure to Agree, Pre to Post		
<i>Breastfeeding or Breast milk...</i>		
Helps to prevent obesity in children (n = 82)	79% (24, 19 shifted)	<0.001
Assists mothers in losing the postpartum “baby weight” (n = 102)	86% (21, 18 shifted)	0.012
Reduces risk of certain cancers in women (n = 100)	61% (44, 27 shifted)	<0.001
Saves money on healthcare costs (n = 91)	64% (33, 21 shifted)	<0.001
Has a lower environmental impact than formula feeding (n = 98)	71% (21, 15 shifted)	0.02
Results in less illness in child care centers (n = 76)	75% (28, 21 shifted)	0.018
Disagree to Agree, Pre to Post		
<i>Breastfeeding or Breast milk...</i>		
Babies fed breast milk are less likely to get sick than formula fed babies (n = 98)	57% (21, 12 shifted)	0.04
Saves money on healthcare costs (n = 68)	62% (13, 8 shifted)	0.02
Unsure to Disagree, Pre to Post		
WIC benefits are better for those not breastfeeding (n = 81)	64% (44, 28 shifted)	< 0.001
Breast milk is not a reimbursable component of CACFP infant meal pattern (n = 78)	54% (48, 26 shifted)	< 0.001

^aDenotes the total number of participants who responded to the question with agree, unsure, or disagree

^bIndicates the percent shift (the number of participants who responded unsure or disagree pre, and of those, who shifted to agree or disagree post).

^cPost-assessment responses where ≥25% of participants indicated “unsure or agree”.

Table 1: Changes in breastfeeding knowledge of ECE professionals from pre-post assessment.

Breastfeeding Practices Questions ^a	Percent Shift ^b (participant shift, Pre, Post)	P Value
Confident to Very Confident, Handling Breast Milk		
Confident to Very Confident, Handling breast milk (n = 92)	57% (52, 30 shifted)	<0.001
No to Yes, Pre to Post, Handling Breast Milk		
Written instructions provided to parents on how to properly store breast milk for use within the child care center (n = 99)	49% (69, 34 shifted)	<0.001
Written instructions provided to parents on how to label breast milk for use within child care center (n = 101)	54% (63, 34 shifted)	<0.001
Breast milk heated by a warm water bath (n = 114)	37% (59, 22 shifted)	0.008
Breast milk storage and handling guidelines posted where bottles are heated (n = 102)	36% (77, 28 shifted)	<0.001
Breast milk storage and handling guidelines posted where bottles are stored (n = 101)	38% (79, 30 shifted)	<0.001
Yes to No, Pre to Post, Handling Breast Milk		
Breast milk heated in crockpot filled with water (n = 114)	51% (33, 17 shifted)	0.001
No to Yes, Pre to Post, Promoting and Normalizing Breastfeeding		
Visible breastfeeding promotion messages in the center (n = 110)	32% (81, 26 shifted)	0.001
Promotion messages are posters (n = 114)	20% (89, 18 shifted)	0.011
Promotion messages are brochures (n = 114)	23% (99, 23 shifted)	0.002
Promotion messages are books (n = 114)	16% (106, 17 shifted)	0.017
Promotion messages are pictures (n = 114)	13% (107, 14 shifted)	0.03
Learning and play materials available that normalize breastfeeding (n = 107)	32% (90, 29 shifted)	<0.001
Learning and play materials as books (n = 114)	27% (95, 26 shifted)	0.001
No to Yes, Pre to Post, Supporting Mothers		
Designated space is not a bathroom for mothers to breastfeed that is quiet (n = 114)	34% (50, 17 shifted)	0.007
Designated space is not a bathroom for mothers to express milk (n = 83)	61% (28, 17 shifted)	0.007
Space is quiet (n = 114)	29% (62, 18 shifted)	0.04
Space is comfortable (n = 114)	45% (64, 29 shifted)	0.002
Space has an electrical outlet (n = 114)	39% (52, 20 shifted)	0.009
Space has running water (in room or nearby) (n = 114)	39% (62, 24 shifted)	0.014
Space is private (n = 114)	27% (64, 17 shifted)	0.003
Breastfeeding information available to mothers (n = 108)	36% (56, 20 shifted)	0.019

Breastfeeding information available to mothers as brochures (n = 114)	33% (76, 25 shifted)	0.017
^a Early childhood professionals know where to refer mothers in community for breastfeeding help (n = 108)	78% (18, 14 shifted)	<0.001
Refer to Certified Lactation Consultant (n = 114)	34% (67, 23 shifted)	0.002

^aDenotes the total number of participants who responded to the question with agree, unsure, or disagree.

^bIndicates the percent shift (the number of participants who responded no or yes pre, and of those, who shifted to yes or no post).

^cDenotes shift from “no” to “yes” or “somewhat” post-assessment.

Table 2: Changes in breastfeeding practices in the child care environment from pre-post assessment.

Although significant changes were noted, it is recognized that there are opportunities for targeted initiatives to further enhance breastfeeding practices within child care centers. Table 3 summarizes post-assessment data where there are opportunities for improving: 1.) breastfeeding policy development; 2.) handling procedures for breast milk; 3.) promoting and normalizing breastfeeding; 4.) and, supporting

mothers in the child care setting. For example, post-assessment data indicated 49% of centers do not display storage and handling guidelines where breastmilk is heated. Post-assessment data also shows that 90% do not have play materials (baby dolls and stuffed animals) that normalize breastfeeding, and 67% do not have visible breastfeeding promotion posters on display.

Breastfeeding Policy and Practice Questions	Post-Assessment, Percent who responded “No” (n)
Breastfeeding Policies	
Created a breastfeeding policy as a result of the training (n = 61)	85% (52)
Handling Breast Milk	
^a Written instructions provided to parents on how to properly store breast milk for use within the child care center (n = 104)	46% (48)
^a Written instructions provided to parents on how to label breast milk for use within child care center (n = 105)	37% (39)
^a Breast milk storage and handling guidelines posted where bottles are heated (n = 104)	49% (51)
^a Breast milk storage and handling guidelines posted where bottles are stored (n = 102)	52% (53)
^a Breast milk heated by a warm water bath (n = 114)	39% (44)
Breast milk heated by holding under warm water (n = 114)	69% (79)
Breast milk heated by bottle warmer (n = 114)	73% (83)
Promoting and Normalizing Breastfeeding	
^c Visible breastfeeding promotion messages in the center are posters (n = 114)	67% (76)
Learning and play materials available that normalize breastfeeding as books (n = 109)	66% (75)
Learning and play materials as baby dolls and/or stuffed animals (n = 114)	90% (103)
Supporting Mothers	
Designated space is not a bathroom for mothers to breastfeed or express milk that is quiet (n = 114)	32% (37, breastfeed); 45% (51, express)
Designated space is not a bathroom for mothers to express milk that is comfortable (n = 114)	39% (45)
Designated space is not a bathroom for mothers to express milk that has an electrical outlet (n = 114)	33% (38)
Designated space is not a bathroom for mothers to breastfeed or express milk that has running water (in room or nearby) (n = 114)	34% (39, breastfeed); 41% (47, express)
Designated space is not a bathroom for mothers to breastfeed or express milk that is private (n = 114)	45% (51 breastfeed); 44% (50, express)
The center’s approach to infant feeding: feeding plan completed by parent (n = 114)	40% (46)
Breastfeeding information available to mothers as brochures (n = 114)	54% (62)
^d Early childhood professionals know where to refer mothers in community for breastfeeding help (n = 108)	28% (30)
Refer to Certified Lactation Consultant (n = 114)	44% (50)
Refer to WIC office (n = 114)	43% (49)
Refer to Obstetrician (n = 114)	62% (71)
Refer to Pediatrician (n = 114)	36% (41)
Refer to La Leche (n = 114)	44% (50)

^aThese questions showed a statistically significant shift from pre-post (Table 2).

^bSummary of post-assessment responses where >25% of participants indicated “no” for the practice.

^cOther visible promotion messages included brochures, books, and pictures with 72% to 84% of post-assessment responses indicating “no”.

^dDenotes “no” and “unsure”.

Table 3: Summary of selected opportunities for targeted initiatives to improve breastfeeding practices in the child care setting^{a,b}.

Discussion

The current study assessed ECE professionals' breastfeeding knowledge and practices within the child care setting before and after completing an e-learning program. Half of our participants reported receiving prior education on topics associated with breastfeeding, which is higher when compared to other studies [12,13]. The Surgeon General's Call to Action to Support Breastfeeding encourages states to offer and/or require breastfeeding education for ECE professionals to meet the needs of breastfeeding families [8], which has evolved over the past several years with states creating breastfeeding friendly child care resources. For example, the Carolina Breastfeeding-Friendly Child Care Initiative has materials and trainings to assist early childhood providers in their day-to-day activities [28]. However, Schafer and colleagues recommend defining breastfeeding friendly child care and assessing its overall effectiveness in supporting breastfeeding families [14].

The results of our research indicate an improvement in areas of breastfeeding knowledge and practices. However, there are opportunities to enhance breastfeeding education materials and initiatives for ECE professionals to further support families in the child care environment. To our knowledge, previous breastfeeding research with ECE professionals has not included policy-related questions regarding benefits for those women who participate in WIC. Our post-assessment results indicate that a little over one-third of participants were unaware of policy-related breastfeeding benefits for WIC recipients as well as the provision of CACFP reimbursement for meals that contain breast milk for participating centers. Research conducted by Schafer et al. note that child care administrators discussed their participation in CACFP and program guidelines for feeding formula, but not breast milk [14]. These findings suggest the need to reinforce policy-related information on the benefits of breastfeeding in education platforms designed for ECE professionals.

It is noted that significant improvements were not detected for some questions on breastfeeding knowledge, which has been reported in other research [23]. This could be due to ECE professionals already having the necessary breastfeeding knowledge in these areas and/or our e-learning platform could be refined to improve the delivery of content. For example, research has reported ECE professionals' perceptions of breast milk being "better nutritionally" with 83% and 87% responding as an advantage [9,29]. Yet, 33% of our participants were "unsure or agreed" post-assessment that formula is as healthy as breast milk, which is congruent with other research that found 38% of its providers felt that formula had no disadvantage over breast milk [9], indicating additional emphasis is needed on the benefits of breastfeeding.

Our research showed improvement in breastfeeding knowledge from pre-post assessment on concepts previously cited in the literature as areas to reinforce in breastfeeding education for ECE professionals. For example, the shift from pre-post assessment ("unsure to agree") with breastfeeding assisting as an obesity prevention strategy in children indicated an improvement in knowledge. Previous research indicates a lack of awareness between breastfeeding and obesity prevention in children [9,11,29]. Our pre-post assessment suggests the importance of education on this topic

as a benefit of breastfeeding given obesity prevalence rates in the U.S. among youth and adults do not meet Healthy People 2020 goals [30]. Our research also revealed improvements in knowledge on content that has been reported in the literature as areas to focus on in education efforts such as environmental impact (less trash), and health benefits to baby and mother (less illness and disease risk) [9,11,29].

Despite having knowledge on the benefits of breastfeeding, research shows that this does not necessarily translate into practices and perceptions that provide a supportive breastfeeding environment in the child care setting based on qualitative data with early childhood administrators [14]. In our research, there were modest improvements in breastfeeding practices from pre-post assessment on concepts previously cited in the literature as an opportunity for further education [9,11-14]. For example, only 9 of 61 participants created a breastfeeding policy after the e-learning program indicating that 85% of centers did not have one in place post-assessment, which is similar to previous research by Cameron and colleagues [12]. Despite significant shifts on topics related to handling breast milk, our post-assessment results indicate a need for additional emphasis in areas such as provision of instructions to parents on labeling and storage, posting guidelines where bottles are heated and stored, and appropriate techniques for heating breast milk. These findings are consistent with Clark et al. [9], while also indicating that education is not sufficient for modifying practices, and suggests the need for centers to create and adopt policies with accessible, visible handling practices (e.g. magnets or other signage in storage locations) for ECE professionals to refer to on a daily basis.

Despite shifts in areas such as visible breastfeeding promotion messages (i.e. posters, brochures, books, and pictures), availability of information to mothers, and knowing where to refer mothers in the community for breastfeeding support, there are opportunities to further advance these practices in the child care environment. Our post-assessment responses revealed that 84% did not have visible breastfeeding promotion messages in the form of pictures and 54% did not have breastfeeding information (e.g. brochures) available to mothers. Other research has found that 97% and 81% of their participating centers did not have breastfeeding promotion messages (posters, pictures, breastfeeding welcome signage) on display [12,13] with one study indicating that their participants had no materials available for breastfeeding families [14]. Our research also showed that 72% of participants indicated they knew where to refer mothers for breastfeeding support in their communities; however, who to refer to (e.g. lactation consultant, WIC office, pediatrician, obstetrician, and La Leche League) varied from 36% to 62% with "no" or "unsure" responses post-assessment. Schafer and colleagues reported that their participants all indicated that they would refer a breastfeeding mother to her physician or pediatrician, but nobody mentioned a lactation consultant [14].

ECE professionals have indicated that written information for parents and posters on display would improve breastfeeding rates in their child care environments [11]. Even though research has found breastfeeding information available at child care centers, there were concerns with it being current, credible, and available in another language [9]. The child care setting is a viable environment for delivering health promotion education as indicated by Gupta et al. [31] where

they found that 45% of their parents received health information or materials from ECE professionals and 40% indicated that information on nutrition from the child care program would be useful.

Evidence has also indicated that a supportive child care environment has been associated with breastfeeding duration. Batan and colleagues [32] found that providing mothers with the opportunity to breastfeed before and after work was a predictor of breastfeeding duration at six months. Even though 80% of our participants indicated in the pre-assessment (84% post-assessment) that their centers provide a designated space that is not a bathroom for mothers to breastfeed (82% post-assessment to express breast milk), there are opportunities for improving practices for milk expression locations and amenities (e.g. privacy, electrical outlet, running water, quiet, and comfortable). While research indicates that there is encouragement for mothers to visit and breastfeed during the day [9,13], there is variation across studies on the availability of designated spaces [9,13,14,23] with some child care centers requesting that mothers "cover" while breastfeeding [14].

To our knowledge, prior research in the early child care setting has not included questions that focus on availability of learning and play materials that normalize breastfeeding. Despite the significant improvements in this area of our research, 66% of our participants post-assessment did not have learning materials such as books, and 90% did not have play materials (e.g. dolls or stuffed animals) available to children that depict breastfeeding. ECE professionals and the child care environment play an important role in shaping the health behaviors of young children [33]. Therefore, the availability of learning and play materials that normalize breastfeeding serve as a way for ECE professionals and the child care environment to role model breastfeeding as a healthy behavior.

The current study has its limitations that warrant acknowledgement. Without a comparison group, we are not able to determine the effectiveness of the e-learning platform and its impact on improving breastfeeding knowledge and practices. Similar studies have found an increase in breastfeeding knowledge through e-learning platforms but without intervention/control groups [20-22]. Clark and colleagues found improvements in their intervention group of ECE professionals' breastfeeding attitudes and behaviors from pre-post assessment indicating e-learning as a viable platform for nutrition information but without evidence that it sustains change over time [23].

We acknowledge that our research lacked the collection of demographic data on certain characteristics such as age of participants, race, number of years in the early childhood profession, director vs. provider completing the assessment, highest level of education, preference for delivery method (e.g. online vs. face-to-face), Internet access at work, children of one's own, if participants had breastfed their own children, and center participation in CACFP, which limits comparisons to other studies. For example, Lucas and colleagues found that ECE professionals with higher education levels who had their own children were more knowledgeable about breastfeeding as compared to other providers [11]. In addition, Lucas et al. [11] also found that age (older) and access to the Internet at work was associated with a more favorable attitude toward breastfeeding. However, Clark et al. found no differences in

their intervention and control group demographic characteristics at the time of their pre-test [23].

The accessibility of an e-learning platform makes the delivery of breastfeeding education ideal for ECE professionals. However, we did not utilize an authentication process that guarantees the same person completed the pre-post assessment and that some ECE professionals may have been from the same center. In addition, the time to complete the assessment may have precluded some providers to return for the post-assessment, and warrants re-examination if used again in the future. Lastly, we would institute a pre-post assessment validation process with a group of ECE professionals. Our current approach included a review with breastfeeding experts and utilized survey questions from prior research [27]. Despite the identified limitations, our findings are consistent with other research studies thus indicating a degree of reliability, and provide insight on ECE professionals' breastfeeding knowledge and practices in the child care environment.

Implications for Research and Practice

This research responds to the Surgeon General's Call to Action [8] to support breastfeeding families in the child care setting, contributes to the limited research in this area, and emphasizes the importance of breastfeeding education for ECE professionals. Findings from our study identify opportunities to further strengthen knowledge among ECE professionals, improve practices within the child care environment, and ultimately achieve Healthy People breastfeeding duration rates. Specifically, areas to leverage in breastfeeding education platforms and materials for ECE professionals include: 1) Policy-related benefits (e.g. WIC provisions for breastfeeding mothers, CACFP meal reimbursement); 2) Health advantages of breastfeeding vs. formula feeding (e.g. obesity prevention strategy); 3) Guidance on establishing center-specific breastfeeding policies; 4) Accessible breast milk handling practices; 5) Visible breastfeeding promotion messages; 6) Support for families (education materials, community resources, and designated spaces within the child care center for milk expression); and 7) Available learning and play materials for children. Our research identifies important limitations to address for future work in this area while also determining if an e-learning platform is an effective delivery modality for disseminating breastfeeding education to ECE professionals.

Acknowledgements

The authors thank the early care and education professionals who participated in the pre-post assessment and those who provided valuable feedback on the e-learning program. Additional gratitude to Lissa Sirois and members of the New Hampshire Breastfeeding Task Force for their contributions. Funding for the work was through the following: Keene State College Faculty Development Grant, New Hampshire Department of Health and Human Services, Division of Public Health Services, and New Hampshire INBRE through an Institutional Development Award (IDeA), P20GM103506, from the National Institute of General Medical Sciences of the NIH.

References

1. U.S. Bureau of Labor Statistics (2020) Employment status of mothers with own children under 3 years old by single year of age of youngest child and marital status, 2017-2018 annual averages.
2. Redford J, Desrochers D, Mulvaney Hoyer K, et al. (2017) The years before school: Children's nonparental care arrangements from 2001 to 2012. Department of Education, National Center for Education Statistics, Washington DC, US.
3. Benjamin SE, Rifas-Shiman SL, Taveras EM, et al. (2009) Early child care and adiposity at ages 1 and 3 years. *Pediatrics* 124(2): 555-562.
4. Kim J, Peterson K (2008) Association of infant child care with infant feeding practices and weight gain among US infants. *Arch Pediatr Adolesc Med* 162(7): 627-633.
5. Li R, Darling N, Maurice E, et al. (2005) Breastfeeding rates in the United States by characteristics of the child, mother, or family: The 2002 National Immunization Survey. *Pediatrics* 115(1): e31-e37.
6. American Academy of Pediatrics (2012) Breastfeeding and the use of human milk. *Pediatrics* 129(3): e827-e841.
7. Lessen RL, Kavanaugh K (2015) Position of the Academy of Nutrition and Dietetics: Promoting and supporting breastfeeding. *J Acad Nutr Diet* 115(3): 444-449.
8. U.S. Department of Health and Human Services (2011) The Surgeon General's Call to Action to Support Breastfeeding. Department of Health and Human Services, Office of the Surgeon General, Washington DC, US.
9. Clark A, Anderson J, Adams E, et al. (2008) Assessing the knowledge, attitudes, behavior and training needs related to infant feeding, specifically breastfeeding, of child care providers. *Matern Child Health J* 12(1): 128-135.
10. Dirige O, Oglesby A, Bassoff B (1991) An assessment of the nutrition education needs of day care providers. *J Am Diet Assoc* 91(6): 714-715.
11. Lucas A, McMahon PM, Asling Brewer M, et al. (2013) Assessing child care providers' knowledge and attitudes regarding support of breastfeeding in a region with low breastfeeding prevalence. *J Hum Lact* 29(4): 556-563.
12. Cameron B, Javanparast S, Labbok M, et al. (2012) Breastfeeding support in child care: An international comparison of findings from Australia and the United States. *Breastfeed Med* 7(3): 163-166.
13. Garth E, Messer AL, Spatz DL (2016) Child care centers' role in supporting breastfeeding families. *MCN Am J Matern Child Nurs* 41(3): 154-161.
14. Schafer EJ, Livingston TA, Roig-Romero RM, et al. (2021) "Breast is best, but..." According to childcare administrators, not best for the childcare environment. *Breastfeed Med* 16(1): 21-28.
15. Centers for Disease Control and Prevention (2013) Strategies to Prevent Obesity and Other Chronic Diseases: The CDC Guide to Strategies to Support Breastfeeding Mothers and Babies. Department of Health and Human Services, Atlanta, US.
16. Choudhury S, Pattnaik S (2020) Emerging themes in e-learning: A review from the stakeholders' perspective. *Computers & Education* 144: 1-20.
17. Samnan A, Uppal MA, Gulliver SR (2017) A conceptual framework highlighting e-learning implementation barriers. *Information Technology & People* 31(1): 156-180.
18. Cook DA, Levinson AF, Garside S (2008) Internet-based learning in the health professions: A meta-analysis. *JAMA* 300(10): 1181-1196.
19. Lam-Antoniades M, Ratnapalan S, Tait G (2009) Electronic continuing education in the health professions: An update on evidence from RCTs. *J Contin Educ Health Prof* 29(1): 44-51.
20. O'Connor ME, Brown EW, Lewin LO (2011) An internet-based education program improves breastfeeding knowledge of maternal-child healthcare providers. *Breastfeed Med* 6(6): 421-427.
21. Deloian BJ, Lewin LO, O'Connor ME (2015) Use of a web-based education program improves nurses' knowledge of breastfeeding. *J Obstet Gynecol Neonatal Nurs* 44(1): 77-86.
22. Cianelli R, Villegas N, Azaiza K, et al. (2014) Developing and testing an online breastfeeding training among undergraduate nursing students. *Clin Nurs Stud* 3(1): 82-88.
23. Clark A, Anderson J, Adams E, et al. (2009) Assessing an infant feeding web site as a nutrition education tool for child care providers. *J Nutr Educ Behav* 41(1): 41-46.
24. Lundquist A, McBride BA, Donovan, SM, et al. (2019) An exploratory look at the role of childcare providers as a support and resource for breastfeeding mothers. *Breastfeed Med* 14(5): 313-319.
25. American Academy of Pediatrics, American Public Health Association, National Resource Center for Health and Safety in Child Care and Early Education (2011) Caring for our Children: National Health and Safety Performance Standards; Guidelines for Early Care and Education Programs. 3rd edtn, American Academy of Pediatrics, American Public Health Association, Elk Grove Village, IL, Washington DC.
26. Cercone K (2008) Characteristics of adult learners with implications for online learning design. *AACE J* 16: 137-159.
27. Dunn RL, Kalich, KA, Fedrizzi R, et al. (2015) Barriers and contributors to breastfeeding in WIC mothers: A social-ecological perspective. *Breastfeed Med* 10(10): 493-501.
28. Carolina Global Breastfeeding Institute (2020) Breastfeeding-Friendly Child Care.
29. Manhire KM, Horrocks G, Tangiora A (2012) Breastfeeding knowledge and education needs of early childhood centre staff. *Community Practitioner* 85(9): 30-33.
30. U.S. Department of Health and Human Services (2020) Office of Disease Prevention and Health Promotion. Healthy People 2020 Topics & Objectives: Nutrition and weight status.
31. Gupta RS, Shuman S, Taveras EM, et al. (2005) Opportunities for health promotion education in child care. *Pediatrics* 116(4): e499-e505.
32. Batan M, Li R, Scanlon K (2013) Association of child care providers breastfeeding support with breastfeeding duration at six months. *Matern Child Health J* 17(4): 708-713.
33. Larson N, Ward DS, Benjamin Neelon S, et al. (2011) What role can child-care settings play in obesity prevention? A review of the evidence and call for research efforts. *J Am Diet Assoc* 111(9): 1343-1362.

Please help us to assess the effectiveness of the online breastfeeding training you completed approximately 3 months ago by taking a 10-minute post-training survey. Upon completion of the survey, you will be sent a \$10 gift card (based on your preference and availability) to acknowledge your time.

Online Breastfeeding Friendly Child Care Post-Training Survey:

1. Are you currently working at the same facility you were when you took the first survey?
 - a. Yes
 - b. No
2. How many infants (if any) does your child care facility serve at this time? _____
3. As a result of the breastfeeding training, does your child care facility now feed breast milk to breastfed babies while in your care?
 - a. Yes
 - b. No
 - c. N/A - There have been no changes in our offering of breast milk to breastfed babies

If no, what are the top three reasons as to why your center does not handle breast milk?

1. _____
2. _____
3. _____

4. As a result of the breastfeeding training, did your facility:
 - a. create a breastfeeding policy
 - b. update your previous breastfeeding policy
 - c. make no changes to your policy

If your facility has a breastfeeding policy, is the policy:

- | | | |
|--|-----|----|
| a. Communicated to all staff? | Yes | No |
| b. Communicated to families with infants | Yes | No |

5. At the present time how confident are you that you are handling breast milk correctly?

Very confident	confident	neither	unconfident	very unconfident
----------------	-----------	---------	-------------	------------------
6. Do you provide written instruction to parents on how to properly store breast milk for use at your facility?

Yes	No
-----	----
7. Do you provide written instruction to parents on how to properly label breast milk for use at your facility?

Yes	No
-----	----
8. Is there designated refrigerator space for breast milk storage?

Yes	No
-----	----
9. Is there designated freezer space for breast milk storage?

Yes	No
-----	----
10. Do you heat breast milk prior to serving it?

Yes	No
-----	----

If yes, it is heated by:

- | | | |
|----------------------------|-----|----|
| Warm water bath | Yes | No |
| Microwave | Yes | No |
| Holding under warm water | Yes | No |
| Bottle warmer | Yes | No |
| Crockpot filled with water | Yes | No |

Are breast milk storage and handling guidelines posted where bottles are heated? Yes No

11. Are breast milk storage and handling guidelines posted where filled bottles are stored? Yes No
12. Are there visible breastfeeding promotion messages in your facility? Yes No

If yes, which of the following promotion messages are on display:

- | | | |
|-----------|-----|----|
| Posters | Yes | No |
| Brochures | Yes | No |
| Books | Yes | No |
| Pictures | Yes | No |

13. Are learning and play materials that normalize breastfeeding available for children (i.e. books with pictures of mothers nursing, baby dolls or stuffed animals that are nursing)? Yes No

If yes, which of the following are available for children:

- | | | |
|---|-----|----|
| Books with pictures of mothers and/or animals breastfeeding | Yes | No |
| Baby dolls and/or stuffed animals that are breastfeeding | Yes | No |

14. Are mothers invited to visit throughout the day to breastfeed her child? Yes No

If yes, is there a designated space that is not a bathroom for mothers to breastfeed? Yes No

If yes:

- | | | |
|---------------------------|-----|----|
| Is the space quiet? | Yes | No |
| Is the space comfortable? | Yes | No |

Is the space private?	Yes	No			
Is there a sink with running water in the room or nearby?	Yes	No			
15. Are mothers invited to visit throughout the day to express milk?	Yes	No			
If yes, is there a designated space that is not a bathroom, for mothers to express milk?	Yes	No			
If yes:					
Is the space quiet?	Yes	No			
Is the space comfortable?	Yes	No			
Is the space private?	Yes	No			
Is an electrical outlet available?	Yes	No			
Is there a sink with running water in the room or nearby?	Yes	No			
16. How does your facility approach infant feeding:					
No written feeding plan	Yes	No			
In response to baby's cues	Yes	No			
Feeding plan filled out by parent	Yes	No			
Feeding plan filled out by provider	Yes	No			
Other (please explain):					
17. Is breastfeeding information available to expectant mothers?	Yes	No			
If yes, how is information provided:					
Brochures	Yes	No			
Books	Yes	No			
Other (please explain)					
18. Do you know where to refer a mother in the community to get breastfeeding help?	Yes	No			
If yes, where are they referred:		Somewhat			
WIC office					
Obstetrician					
Pediatrician					
Certified Lactation Consultant					
La Leche					
Other (please explain): _____					
19. Are staff members at your facility provided with flexible breaks to accommodate breastfeeding and milk expression?	Yes	No			
Yes	No	N/A			
20. Would you value having your facility being designated as a breastfeeding friendly child care facility?	Yes	No			
Yes	No				
21. What would motivate you to want to be designated as a Breastfeeding Friendly Child Care Facility?					
Your facility listed on a website with special notation	Yes	No			
Window cling stating your facility is Breastfeeding Friendly	Yes	No			
Recognized in a press release during World Breastfeeding Week	Yes	No			
Receive an award from the New Hampshire Breastfeeding Task Force as a Breastfeeding Friendly Child Care Center	Yes	No			
Yes	No				
22. In your opinion, how much do you agree or disagree with the following statements?					
Formula is as healthy as breast milk.	Strongly Agree	Agree	Disagree	Strongly Disagree	Unsure
Babies that are fed breast milk are less likely to get sick than formula fed babies.	Strongly Agree	Agree	Disagree	Strongly Disagree	Unsure
Breastfeeding helps to prevent obesity in children.	Strongly Agree	Agree	Disagree	Strongly Disagree	Unsure
Breast milk provides all the nourishment infants need for the first six months.	Strongly Agree	Agree	Disagree	Strongly Disagree	Unsure
Breastfeeding costs less money than formula feeding.	Strongly Agree	Agree	Disagree	Strongly Disagree	Unsure
Breastfeeding assists postpartum mothers with losing the "baby weight".	Strongly Agree	Agree	Disagree	Strongly Disagree	Unsure
Breastfeeding helps mothers bond with their babies more quickly than formula feeding.	Strongly Agree	Agree	Disagree	Strongly Disagree	Unsure
Breastfeeding reduces the risk of certain types of cancers for women.	Strongly Agree	Agree	Disagree	Strongly Disagree	Unsure
WIC benefits are better for women who are <u>not</u> breastfeeding.	Strongly Agree	Agree	Disagree	Strongly Disagree	Unsure
Child care facilities can make a difference in a mother's ability to continue breastfeeding.	Strongly Agree	Agree	Disagree	Strongly Disagree	Unsure
Breast milk is <u>not</u> a reimbursable component of the Child and Adult Care Food Program (CACFP) infant meal pattern.	Strongly Agree	Agree	Disagree	Strongly Disagree	Unsure

Dunn RL, Phillips SM, Arnold L, et al. (2021) Early Care and Education Professionals' Breastfeeding Knowledge and Practices Before and After an E-Learning Program *J Health Sci Educ* 5: 218.

Strongly Agree	Agree	Disagree	Strongly Disagree	Unsure
Having a higher percentage of breastfed infants in your care results in having less illness in your center.				
Strongly Agree	Agree	Disagree	Strongly Disagree	Unsure
A breastfeeding-friendly center is more attractive to prospective parents.				
Strongly Agree	Agree	Disagree	Strongly Disagree	Unsure
Breastfeeding saves money on healthcare costs.				
Strongly Agree	Agree	Disagree	Strongly Disagree	Unsure
Breast milk has a lower environmental impact than does formula feeding				
Strongly Agree	Agree	Disagree	Strongly Disagree	Unsure

Concluding Remarks:

Thank you for taking the time to complete the survey. We are appreciative of your time and feedback. Thank you!

***Corresponding author:** Dr. Rebecca Dunn, RD, LD, CNSC, 229 Main Street, Rhodes Hall, Keene, NH 03435, USA; Tel: 1-603-313-4520, e-mail: rdunn@keene.edu

Received date: September 25, 2021; **Accepted date:** October 15, 2021; **Published date:** October 18, 2021

Citation: Dunn RL, Phillips SM, Arnold L, Messer J, Nelson B, Kalich KA (2021) Early Care and Education Professionals' Breastfeeding Knowledge and Practices Before and After an E-Learning Program. *J Health Sci Educ* 5(4): 218.

Copyright: Dunn RL, Phillips SM, Arnold L, Messer J, Nelson B, Kalich KA (2021) Early Care and Education Professionals' Breastfeeding Knowledge and Practices Before and After an E-Learning Program. *J Health Sci Educ* 5(4): 218.