Maternal and co-parental experiences and satisfaction with a co-parenting breastfeeding eHealth intervention in Canada

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ABSTRACT

Background: Suboptimal breastfeeding rates are a public health priority. Interventions that include both breastfeeding women and their co-parents can increase breastfeeding initiation, duration, and exclusivity. eHealth can be an effective means of designing such interventions, as parents increasingly use the internet to access health information. The objective of this study was to determine maternal and co-parent satisfaction with an eHealth intervention.

Methods: The study was part of a larger randomized controlled trial that took place in Canada between March 2018 and April 2020. Data was collected from mothers ($n = 56$) and co-parents ($n = 47$). Intervention: The eHealth intervention group received: 1) continued access to an eHealth breastfeeding co-parenting resource from the prenatal period to 52 weeks postpartum; 2) a virtual meeting with a research assistant; and 3) 6 weekly emails reminders. Follow-up data were collected via online questionnaires completed at 2 weeks post enrollment and 4, 12, 26, and 52 weeks postpartum to determine use and satisfaction with the intervention components.

Findings: The majority of mothers and co-parents independently reviewed the eHealth resource (95% and 91%, respectively), with higher use in the prenatal period. Participants found the resource to be useful (92%), informative (93%), targeted both parents (90%), and easy to understand (97%). Participants indicated the resource was comprehensive, easily navigated, convenient, and engaging.

Application to practice: Providing mothers and their co-parents with breastfeeding co-parenting support via an eHealth intervention delivers accessible, comprehensive information which may assist them in meeting their breastfeeding goals.

Introduction

Enhancing breastfeeding rates remains a global public health priority (World Health Organization, 2021). The significant health benefits of breastfeeding are well-documented (Victora et al., 2016). Exclusive breastfeeding is the recommended feeding for all infants from birth to six months with continued breastfeeding for up to two years or more after introducing solid foods (Government of Canada, 2015). Although >90% of women now initiate breastfeeding, duration rates remain suboptimal with <40% meeting the recommendation of exclusive breastfeeding to six months, with these rates remaining consistent in Canada (PHAC, 2018; Statistics Canada, 2020). Designing and evaluating interventions for use in clinical practice to support breastfeeding

families is warranted (Gavine, Marshall, et al., 2022). As such, an eHealth breastfeeding co-parenting resource was designed based on a comprehensive program of research for health care professionals to use to provide breastfeeding education to mothers and their co-parents over the perinatal period and beyond.

Providing breastfeeding education and support to breastfeeding women and their families in clinical interactions is needed. The World Health Organization and UNICEF's implementation of the Baby Friendly Hospital Initiative, calls on facilities that provide maternal and newborn services to adopt the 10 steps to successful breastfeeding (World Health Organization/UNICEF, 2018), and recommends breastfeeding education be provided to families throughout the perinatal period. Designing such interventions using a breastfeeding co-parenting framework encourages

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parents to work in partnership to meet their breastfeeding goals (Abbass-Dick & Dennis, 2017) and would address family members whose involvement has been found to increase breastfeeding rates (Abbass-Dick et al., 2019; Gavine, Marshall, et al., 2022; Koksal et al., 2022; McFadden et al., 2019).

Designing eHealth resources to deliver breastfeeding co-parenting support facilitates the provision of accessible, engaging, comprehensive information that can be provided to families during clinical interaction with health care professionals, and allows them continual access to this information at home (Abbass-Dick et al., 2017). *E*-technologies and remote provision of breastfeeding support and education have been found to significantly improve exclusive breastfeeding initiation, exclusive breastfeeding, breastfeeding attitude, and breastfeeding knowledge (Gavine, Shinwell, et al., 2022; Lau et al., 2016). eHealth and web-based interventions are increasingly being designed for use in breastfeeding education provided by health care providers to support breastfeeding women and have been found to be useful tools available in multiple varieties (Almohanna et al., 2020). Mobile health (mHealth) interventions have expanded, with web-based/online education and smartphone application availability having increased significantly during the COVID-19 pandemic (Lewkowitz & Cahill, 2021). More information is needed regarding the design of such interventions for mothers and fathers, as well as their effectiveness in replacing traditional methods of support and education for breastfeeding (Giglia & Binns, 2014). Previously evaluated digital interventions to support breastfeeding have predominantly focused on mothers, indicating a need to include stakeholders such as partners in the design (Tang et al., 2019). Additionally, little is known of mothers' and co-parents' satisfaction with using a breastfeeding co-parenting eHealth resource.

The objective of this study was to determine maternal and co-parental satisfaction with an intervention they received while participating in a breastfeeding co-parenting eHealth support trial. This randomized controlled trial (RCT) compared two study conditions, Study Condition #1 (SC1) who received access to an eHealth resource, in addition to generally available resources they could access in the community, and Study Condition #2 (SC2) who accessed only generally available resources, to determine which was more effective in providing breastfeeding education to increase breastfeeding rates and secondary outcomes such as breastfeeding knowledge and attitude. Both study groups were found to have high exclusive breastfeeding rates at six months (SC1 63% and SC2 57%) and SC1 had significantly higher breastfeeding knowledge and attitude scores when compared to SC2 at 2 weeks post-intervention and 4 weeks post-partum. Additionally, both study groups indicated websites were the most frequently used resource for finding breastfeeding information (Abbass-Dick et al., 2020). This study aimed to determine parents' perspectives of an eHealth breastfeeding co-parenting resource used across the perinatal period and has clinical implications regarding the use of eHealth tools by health care providers in clinical interactions to increase parent breastfeeding knowledge.

Methods

This study is part of a larger RCT conducted between March 2018 and April 2020 in Canada with 113 couples. The findings of the RCT are published elsewhere (Abbass-Dick et al., 2020). A subset of data was collected from SC1 group participants (mothers [$n = 56$], co-parents [$n = 47$]) who received the eHealth intervention to determine their satisfaction with the intervention. The birthing parents recruited into this study were expectant women. Expectant women and their co-parents were recruited from health care practitioners' offices in Ontario and throughout Canada via social media between March and December 2018, after approval was obtained from the Institutional Review Boards (IRB) from the university and the regional health department. Eligible and consenting couples were randomized into study groups using sealed opaque envelopes. Eligible women were primiparous, over 25 weeks

pregnant, singleton birth, planning to breastfeed, read and able to speak English, living with a co-parent, and had access to the internet. Co-parents were invited to participate. Follow-up data were collected independently from women and co-parents with online, self-administered questionnaires at 2 weeks post-enrollment, and 4, 12, 26, and 52 weeks postpartum.

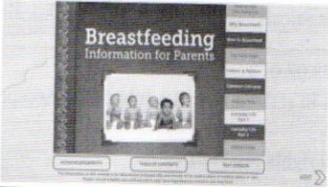### The breastfeeding co-parenting eHealth support intervention

The eHealth group received an intervention with three components: 1) continued access to an eHealth breastfeeding co-parenting resource from the prenatal period to 52 weeks postpartum; 2) a virtual meeting with a research assistant to review the eHealth resource; and 3) weekly reminder emails of the eHealth resource for a six-week period.

eHealth resource

The development of the eHealth resource has been described elsewhere (Abbass-Dick et al., 2017; Abbass-Dick et al., 2018; Abbass-Dick et al., 2020). Three versions were created (1) for mothers and co-parents, which included fathers and same-sex partners (Abbass-Dick et al., 2017); (2) for Indigenous families (Abbass-Dick et al., 2018); and (3) for young and single mothers (Abbass-Dick et al., 2021). All versions were created in partnership with the populations according to their preferences and the breastfeeding content remained consistent. An additional text-based HTML version was created for improved usability on mobile devices (Table 1).

The eHealth resource had nine main pages with sub-pages within each: 1) How to use this resource, 2) Why breastfeed, 3) How to breastfeed, 4) Early Days, 5) Supporting mom/Fathers and Partners, 6) Common Concerns, 7) Where to get help, 8) Everyday Life, and 9) Helpful links. Consistent with multimedia learning theory, the

Table 1
Versions of eHealth Resource.

eBook versions	Text version
Main Version	Mobile Version

Indigenous Family Version

Couples Version

information was provided in a variety of ways (Low & Sweller, 2005). These included: text, narration, videos of slides with images and narration, educational videos from health care providers, videos of parents describing their experiences, animations, illustrations, photos, games, quizzes, and links to additional resources on the internet.

Virtual meeting

The intervention group of participant couples had a virtual meeting via telephone with a research assistant (RA) to review the eHealth resource. A PDF document was emailed to the couple containing the link to the resource and the script to follow during the meeting, where the resource was reviewed in detail. They were instructed not to share this information with others. The RA reviewed each page with the couples and highlighted the content on each page. Content covered included: "How to Use the Resource", a 3-min video illustrating the content and different features; "Why Breastfeed", the breastfeeding recommendations; "Where to get help" the types of help available 24/7 and where to locate it; "Supporting mom/Fathers and Partners", the first three minutes of a video with parents described how they worked as a team to meet their breastfeeding goals and covered the 5 elements of the Breastfeeding Co-parenting Framework (joint breastfeeding goal setting, shared breastfeeding responsibility, proactive breastfeeding support, father/partner's child involvement, productive communication, and problem-solving) (Abbass-Dick & Dennis, 2017). It was recommended that they finish the videos and review the eHealth tool on their own time. Additionally, the participants were directed to a PDF to be downloaded and put up in their homes with tips on co-parenting and breastfeeding. Participants were then able to ask the RA any questions about the intervention or eHealth resource. The meetings ranged from 15 to 30 min.

Email reminder

Emails were sent to both the mother and co-parent. These were sent to them individually on a weekly basis for 6 weeks. The email was a reminder that the participant had been provided with an innovative eHealth breastfeeding resource designed to assist them in working as a team to meet their breastfeeding goals and that their feedback would be sought in future surveys.

Measures

The measures used to determine satisfaction with the intervention and components were previously created by the study team and used in previously published studies (Abbass-Dick et al., 2017; Abbass-Dick et al., 2018; Abbass-Dick et al., 2021). At each time point, participants were informed that the questions would be referring to the time period since they last completed the survey.

Demographics

RCT demographic data was analyzed for SC1 mothers and co-parents (Abbass-Dick et al., 2020). Baseline data was collected on participants' age, ethnicity, education, breastfeeding intentions, and breastfeeding experiences.

Use

At each follow-up time point, participants were asked questions regarding how thoroughly they covered each section and the version they reviewed.

Design

The overall appearance and design questions were assessed at 2

weeks post enrollment with ten questions that had response options on a five-point Likert scale ranging from strongly agree (1) to strongly disagree (5). The helpfulness of each mode of information delivery was determined through the questions with response options ranging from very helpful (1) to not at all helpful (5). An additional question listed all modes with a response option, choose all methods you found helpful.

Usability

At 2 weeks post-enrollment, participants were asked if they had navigation issues and if so, to explain them as well as indicate the web browser and operating system they were using.

Content

The content was assessed at each follow-up time point in four ways; (1) four questions about the content (informative, interesting, up to date, and useful) with response options on a five-point Likert scale that ranged from strongly agree to strongly disagree; (2) the helpfulness of each section of the eHealth resource was determined through the questions with response options ranging from very helpful to not at all helpful which was asked at each follow-up time point; (3) an additional question listed all sections with response option to select all sections found most helpful (all time points); and (4) what the participant couples learned about breastfeeding from this resource was asked in two ways, with topics listed and response options on a Likert scale with options ranging from very helpful to not helpful at all and a second question with nine options listed for the participants to select from.

Overcoming breastfeeding difficulties

At each postpartum follow-up time point, participants were to select the breastfeeding challenges the eHealth resource assisted them in overcoming from a list provided that included sore nipples, not enough milk, too much milk, baby not latching on, baby slow weight gain, clogged ducts, mastitis, thrush/yeast, and other. As well, they were asked to select from the options provided the way in which the resource helped with overcoming challenges. The response options included, it helped us understand what it was that we were experiencing and how to fix it, it helped us know where to get help, it helped us to work as a team to stay calm and figure it out, and other.

Overall satisfaction

Overall feedback was collected with open-ended questions at each follow-up time point. Participants were asked: what do you like most about the resource; what do you like least about the resource; what would you suggest be changed about the eHealth resource; would you recommend a different way of providing this information, and is there anything else you would like to tell us about the eHealth resource? Participants were asked if they would recommend the resource to other parents and to explain their response.

Evaluation of intervention components

The participants were asked, at the last follow-up time point, to rate the intervention components as either helpful or very helpful: (1) the session over the phone with the research assistant (RA) when the resource was explained, (2) continuous access to the eHealth resource, and (3) the 6 weekly email reminders. For components indicated to be helpful, participants were asked to explain why with an open-ended response option.

Data analysis

Data were analyzed with SPSS version 27 (IBM Corp, 2020).

Frequencies and percentages were calculated for those who agreed or disagreed, or found helpful or not helpful, the statements regarding the quality of the resource and intervention components, and for the response options provided. Content analysis was used for the analysis of responses to open-ended questions through identifying themes in participants' responses. Variations in responses were analyzed to determine participants' differing perspectives using constant comparison. Qualitative content was examined by two reviewers (JA and WS) to ensure consistency in coding of themes and data interpretation.

Results

Fifty-six mothers and fifty co-parents were allocated to the eHealth resource study group. The majority of participants were over 30, born in Canada, had attended university, and planned to exclusively breastfeed (Table 2).

Table 2
Participants' Demographic Data.

Variable	Response options	Mother N = 56	Co-parent N = 50
Age	M (S·D)	32.0	33.4
	Range	(4.7)	(5.5)
		21–45	25–47
Born in Canada	No	12	13 (26)
	Yes	(21.4)	37 (74)
	No response	43	-
		(76.8)	
		1 (1.8)	
Relationship to Co-parent	Spouse	50	-
	Partner	(89.3)	-
	Relative	4 (7.1)	-
	Friend	1 (1.8)	-
		1 (1.8)	
Children	First child	55	46 (92)
	Additional children	(98.2)	4 (8)
		1 (1.8)	
Education level	high school	2 (3.6)	5 (10)
	collage	7 (12.5)	13 (26)
	undergraduate degree	23	14 (28)
		(41.1)	18 (36)
	graduate degree	24	
	no response	(42.8)	
Infant feeding intention	only breastfeeding	51	38 (76)
	breastfeeding and formula	(91.1)	10 (20)
		4 (7.1)	2 (4)
	don't know	1 (1.8)	
Made infant feeding decision	mother	20	17 (34)
	co-parent	(35.7)	3 (6)
	together	1 (1.8)	30 (60)
	No response	34	-
		(60.7)	
		1 (1.8)	
Co-parent support	very supportive	53	48 (96)
	somewhat supportive	(94.6)	-
	no response	3 (5.4)	2 (4)
		-	
Importance of breastfeeding recommendations	very important	34	13 (26)
	important	(60.7)	26 (52)
	somewhat important	13	7 (14)
	not very important	(23.2)	3 (6)
	not at all important	6 (10.7)	1 (2)
	no response	2 (3.6)	-
		-	
		1 (1.8)	
Reviewed breastfeeding resources	no	15	34 (68)
	yes	(26.8)	16 (32)
		41	
		(73.2)	

Use

At 2-weeks post-enrollment, in the prenatal period, the majority of mothers and co-parents reviewed the eHealth resource (95% and 91%, respectively). Use decreased at each time point (Fig. 1) with the main reason being the information was not needed (63% at 12 weeks, 70% at 24 weeks, and 75% at 52 weeks) followed by the participants not having time (18% at 12 weeks, 12% at 24 weeks and 19% at 52 weeks). Longer periods of time were spent reviewing the resource prenatally (Fig. 2) and the majority of participants reviewed the resource multiple times. The version used most often by mothers was the main version (initially designed for young mothers), while the couples' version was used most often by co-parents (Supplemental file 1).

Design

The participants' responses regarding the design of the resource were very positive with the majority of them indicating they agreed or strongly agreed the resource was well organized (89%), written in plain English (97%), interactive (82%), presented information in a variety of ways (87%), targets both mothers and co-parents (90%), and they liked the images (82%) and layout (78%). Participants were asked to rate the helpfulness of the different information modes of delivery used in the resource (Fig. 3). Narration and videos of parents and professionals were rated highly among the participant couples that used these methods. Text information was used by the largest number of participant couples, followed by illustrations, and videos with narration, photos, and animations. Games and quizzes were used by the least number of participants and were rated as least helpful.

Usability

At 2 weeks post-intervention, participants were asked about their ability to navigate the resource. Overall, the navigation worked well for the majority of participants, 89% indicated they did not have any problems with navigation. Of the 11 participants who indicated they had trouble, 6 mothers indicated it was slow to load and they needed to refresh the browser, and 5 co-parents had similar concerns. The majority of participants used Google Chrome ($n = 68$), followed by Safari ($n = 17$), and Firefox ($n = 8$) for the web browser. The operating systems varied with the most frequently used being Windows 7+ ($n = 31$), iOS ($n = 20$), Mac OS ($n = 20$), and Windows XP (12).

Content

The majority of participants agreed or strongly agreed the eHealth resource was informative (93%), useful (92%), interesting (85%), and up to date (82%). When those who indicated they had reviewed the resource at each time point were asked to select the most helpful sections, "How to breastfeed" and "Early Days" were selected most often at 2 weeks post-intervention (prenatally). "How to breastfeed" and "Common Concerns" were selected most often at 4 and 12 weeks postpartum, and "Supporting mom" was among the sections selected most often at 24 and 52 weeks postpartum. At 2 weeks post-intervention, a higher percentage of mothers selected "How to breastfeed" (58% vs 40%) and "Common concerns" (35% vs. 17%) when compared to co-parents. However, a higher percentage of co-parents selected "Why breastfeed" (42% vs. 18%). The section reviewed by the most participants was "Why breastfeed" and "How to breastfeed" at 2 weeks post-intervention and 4 weeks postpartum. "How to breastfeed" and "Common concerns" were reviewed most often at 12 weeks postpartum. When asked to rate the helpfulness of each section, all sections were indicated to be helpful by the majority of participants who had viewed them (Fig. 4)

At 4 weeks postpartum, participants were asked how helpful the resource was in teaching them about different topics, with the
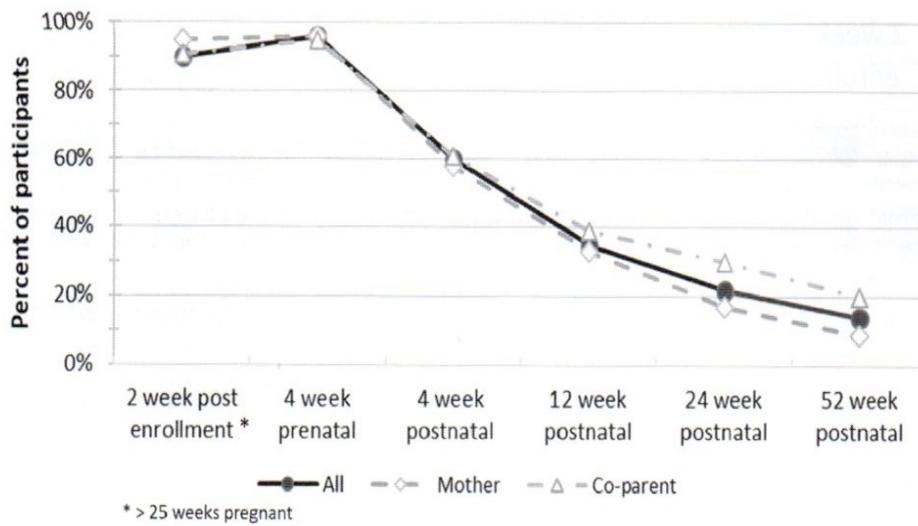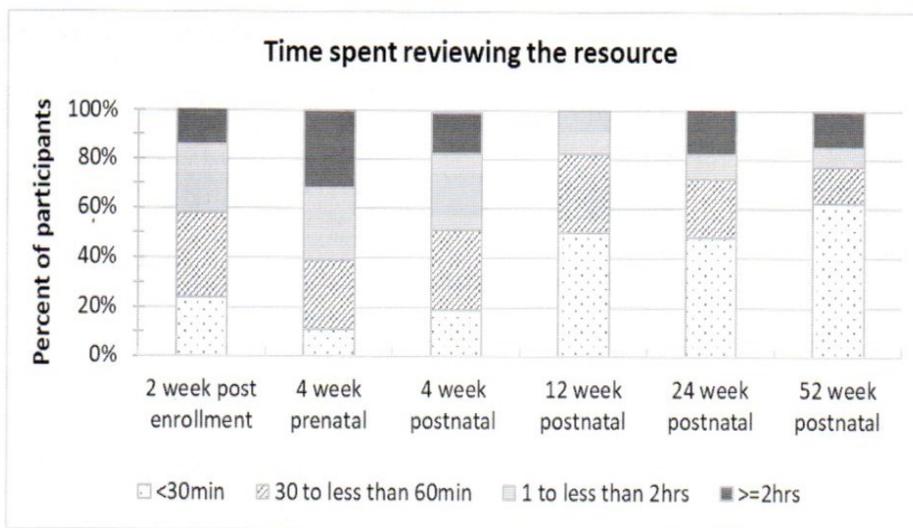
Fig. 1. Participant use at each time point.

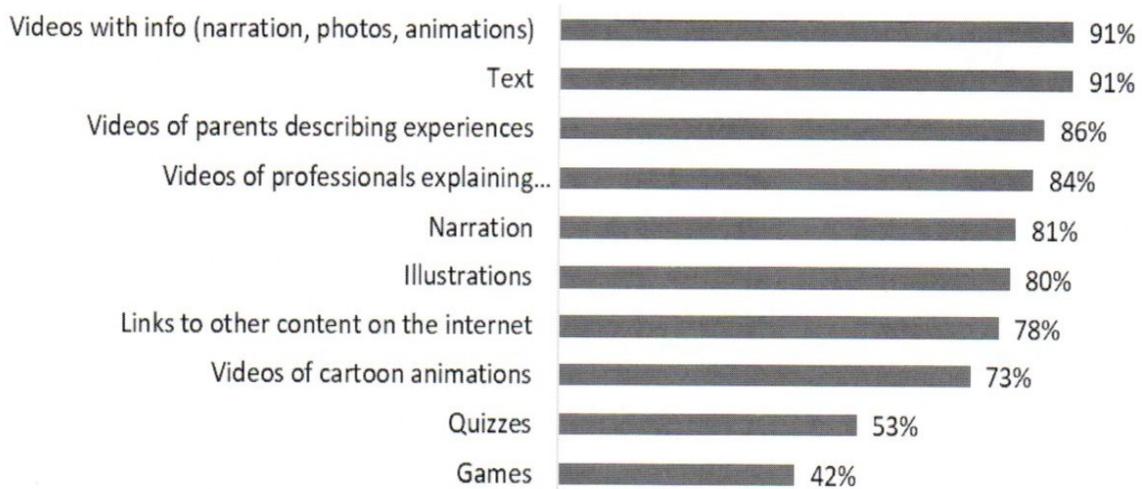**Fig. 2.** Time spent reviewing resource at each time point.

Fig. 3. Helpfulness of information modes of delivery.

importance of breastfeeding being selected by the greatest number of participants, followed by what to expect in the early days, positioning, how to latch, and breastmilk compared to formula (Table 3). Differences between mother and co-parent were noted as more co-parents indicated they found the resource helpful in learning about the importance of breastfeeding (86%) and breastmilk compared to formula (86%), whereas the mothers found the resource most helpful in learning about positioning (76%) and what to expect in the early days (76%). At each time point, participants were asked to select from a list of topics what they had learned from the eHealth resource. The top responses were "Why breastfeeding is important", "How breastmilk is made", "How to overcome problems and solutions", "How to work as a co-parenting team", and "How co-parents can support the breastfeeding mom".

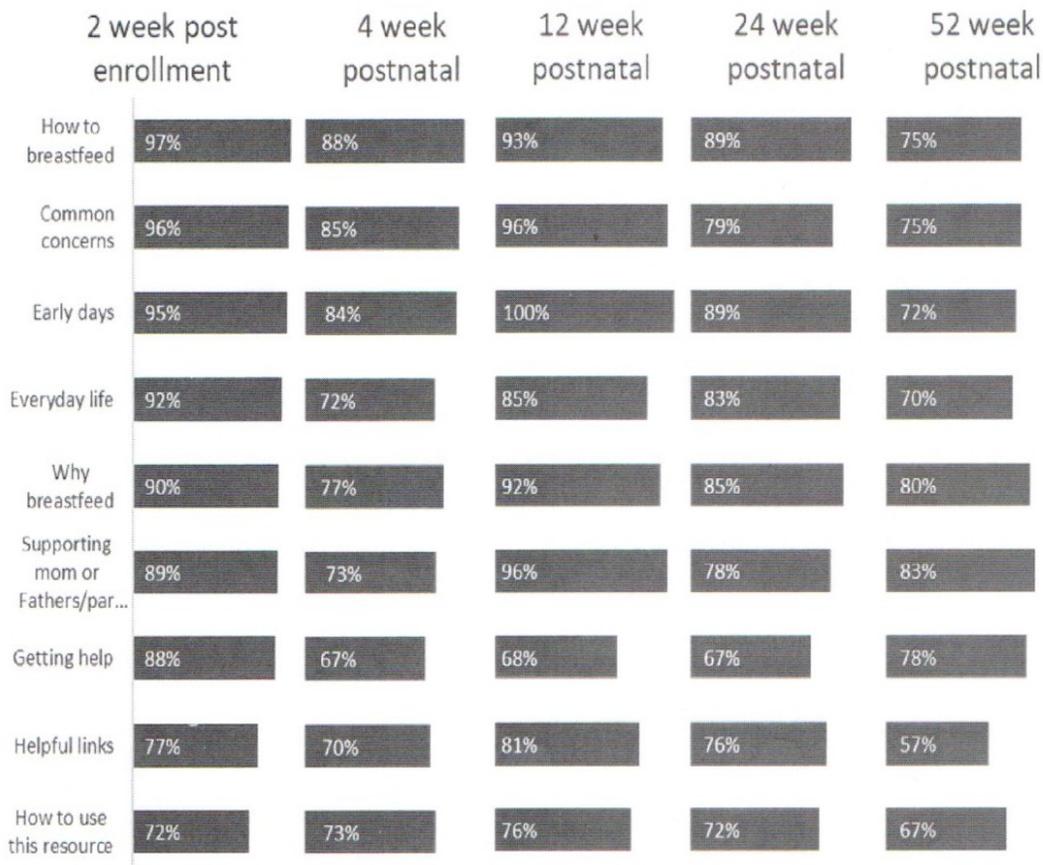|	2 week post enrollment	4 week postnatal	12 week postnatal	24 week postnatal	52 week postnatal
How to breastfeed	97%	88%	93%	89%	75%
Common concerns	96%	85%	96%	79%	75%
Early days	95%	84%	100%	89%	72%
Everyday life	92%	72%	85%	83%	70%
Why breastfeed	90%	77%	92%	85%	80%
Supporting mom or Fathers/par...	89%	73%	96%	78%	83%
Getting help	88%	67%	68%	67%	78%
Helpful links	77%	70%	81%	76%	57%
How to use this resource	72%	73%	76%	72%	67%

Fig. 4. Section rated by users as helpful or very helpful at each time point.

Table 3
Participants' helpfulness rating of the eHealth resource on teaching topics at 4 weeks.

Topic	Total $n = 99$ (%)	Mother $n = 55$ (%)	Co-parent $n = 44$ (%)
Importance of breastfeeding	77	69	86
Positioning	75	76	73
What to expect in the early days	75	76	73
How to latch	74	71	77
Breastmilk compared to formula	74	64	86
How to know your baby is getting enough	69	69	68
Common problems and solutions	67	71	61
Making an informed decision	62	56	68
How the breast makes milk	61	62	59
Tips for co-parents	60	56	64
How your co-parent can support you	60	56	64
The cost of breastfeeding	60	55	66
Where to get help	56	56	55
Maternal nutrition	55	47	64
Problem solving	53	49	57
Effective communication	49	42	59
Breastfeeding in public	48	47	50
Sleep	47	40	57
Friends and peer support	44	36	55
Goal setting	40	38	43

Overcoming breastfeeding difficulties

When asked to select the breastfeeding challenges the eHealth resource assisted participants in overcoming from a list provided, the most common challenges selected were "sore cracked nipples", "baby not latching", "not enough milk", "slow weight gain", "clogged ducts", "too much milk", "yeast", and "mastitis". The challenge the eHealth resource helped overcome reported most often at 4 weeks was baby not latching on, and at 12 and 24 weeks was sore cracked nipples. Participant couples were asked to select from the options provided the way in which the resource helped with overcoming challenges. The two most frequently chosen responses at all time points were "It helped us to work as a team to stay calm and figure it out" and "It helped us understand what it was we were experiencing and how to fix it".

Overall satisfaction

There were four themes identified in our analysis of the open-ended question responses: 1) Impact of Resource, 2) Strengths of Resource, 3) Areas for Improvement, and 4) Future Recommendations. Each of these themes, including sub-themes, descriptions, and supporting quotes are summarized in Table 4 below.

Intervention component evaluation

At the 52 week follow-up, the participant couples rated the following intervention components as either helpful or very helpful: (1) the session over the phone with the RA when the resource was explained (70%), (2) continuous access to the eHealth resource (67%), and (3) the 6 weekly email reminders (50%). When asked which component they found most helpful, the website was selected most often. Open-ended question responses indicated they valued the human interaction during the session with the RA, one participant commented, "the human interaction always adds an element of connection and support and an opportunity for clarification and feedback" (C63). The participants indicated the eHealth resource was a self-paced, accessible resource that provided a comprehensive way to understand information. One participant indicated, "the online resource had the most information in the easiest to digest method of presentation" (C49). The weekly emails were helpful to the participants as it reminded them about the eHealth resource. Some participants noted that, "without the email reminders... I wouldn't have accessed the resource as often" (M83), "I needed reminders as I was so busy with baby" (M66), and "it was helpful to have reminders to keep me on track" (C4).

Table 4

Themes identified in the analysis of open-ended question responses.

Themes	Sub-theme	Description	Supporting quote (s)
1. Impact of Resource	Preparation for breastfeeding, provided anticipatory guidance	The eHealth resource content provided the participants with information on what to expect with breastfeeding, including common challenges to anticipate	"It is a great learning reference. My husband and I enjoyed the videos, and we are feeling a little more prepared for breastfeeding our daughter once she's born" (M72) "We've got a ton of information from it and are feeling very prepared for baby to be here and to start breast feeding exclusively" (C72)
	Problem-solving approaches to overcome breastfeeding challenges	The eHealth resource provided helpful information to enable participants to problem-solve breastfeeding problems as a co-parenting team.	"The whole site was very helpful sometimes my wife would be feeding, and I'd look things up on the website especially when her breast was very painful, and we determined it was a clogged milk duct" (C72) "It helped provide information about breastfeeding in areas I was unsure of." (M29) "As first-time parents, everything is scary and not knowing if you are doing what's right for your baby leaves you feeling like your failing. I'm very glad that my wife had this resource. I'm not a big research kind of person but she is and it helped put her mind at rest knowing some of our experiences are common and sometimes have a simple fix. (C52)
	Provision of reassurance to promote confidence in breastfeeding	The eHealth resource provided reassurance and increased participants'	"It helped us understand that what we were experiencing was normal" (C33) "Simple

Table 4 (*continued*)

Themes	Sub-theme	Description	Supporting quote (s)
		confidence that they would be able to overcome common challenges	information, made me feel confident as a partner" (C76) "My partner and I felt very knowledgeable about breastfeeding, and felt very confident in getting our baby to breastfeed once she was born; I am still breastfeeding at 12 months" (M7)
2. Strengths of Resource	Comprehensive contents to support self-paced learning	The participants found the information was very comprehensive, enabling them to find the information they required when needed.	"Very comprehensive information about breastfeeding. I am glad I read through this tool before the baby came" (M41) "Self-paced, can choose topics in any order to view" (M33) "you can go at your own pace, any time, the right amount of detail and many sections provide references for more info if needed/wanted" (M9) "In depth info and I could skip over parts that didn't apply to my situation" (C97)
	Highly accessible with ease of use	The participants appreciated that they could access the information easily, anytime and anywhere.	"Many parents want to have accessible information about breastfeeding that they can read and see all the time, at home or at work" (M060)
	Multi-modality approach used to present information	Participants' engagement with learning materials was enhanced by the multiple modes in which the information was presented	"The multimedia information, Clean, organized, website looked professional with nice pictures mixed with video clips and links to extra info along with the written info" (C7) "Easily accessible, multiple ways information is displayed" (M44)

Table 4 (*continued*)

Themes	Sub-theme	Description	Supporting quote (s)
3. Areas for Improvement	Technical issues related to slow navigation	Some participants had difficulties with the functionality, and slow loading times which negatively impacted their ability to use the eHealth resource.	"The full version of both the main content and the 'for couples' content caused technical issues in two different browsers: very slow loading; in Safari, got a warning from browser that webpage is using excessive memory and I should close it; seemed to freeze up and I couldn't click on any of the section." (C46) "Had technical issues initially with the site, not as user friendly as it could be" (M109)
	Streamline repetitive and redundant content	Some participants found the content on why breastfeeding is important to be too highly emphasized, which they found off-putting.	"There were multiple videos where everyone was saying the same thing over and over again." (M83) "Way way too much repetition....I understand that repetition is important to reinforce an idea - especially from varied sources. But I think because I have been exposed to some of the information before - it feels almost aggressively repetitive." (C83)
	Reduce information overload to facilitate engagement	Some participants wanted only the essential information and found the amount of content presented to be overwhelming.	"There is too much information, some could be cut in order to focus on the important information and avoid being overwhelming." (M82) "Would much prefer linear presentation of information, rather than many different buttons and pop-ups. Find it overwhelming, confusing and difficult to know if I've seen everything important." (C46)
4. Future Recommendations	Importance of including human facilitators to complement self-paced learning	Including opportunities for human interactions in breastfeeding education delivery enhances independent self-paced learning	"Speaking with the research assistant forced me to look at the materials which I might not have found the time or brain space otherwise." (M57) "It was nice to have a personal conversation and be able to ask questions in real time." (M76) "Nice to have someone walk you through the website" (M105)
	Inclusion of discussion forum to promote networking and interaction	Participants suggested the eHealth resource platform could incorporate networking and peer support opportunities	"Discussion panel with other parents" (M15) "Add a community forum where parents can communicate" (M109)
	Addressing gaps in breastfeeding contents	Participants identified areas in which more information was needed to support self-management of challenges experienced.	"It would be great if there was a little bit more info on problems such as milk blisters." (M112) "More information on combination feeding and a more understanding platform about when and how to use formula." (M63) "More information on not enough milk, increasing milk supply" (M9)

M = mother C = Co-parent.

Discussion

One hundred and one intervention group participants, including mothers and their co-parents, provided feedback on their experiences and satisfaction with using a breastfeeding co-parenting eHealth resource as part of the RCT from the prenatal period through to 52 weeks postpartum. The participants' satisfaction with the design, usability, and content was found to be rated positively. There are no other studies which have examined satisfaction with an eHealth resource to provide breastfeeding education to mothers and their co-parents over the peri-natal and breastfeeding period. However, the results of this study were in line with the study conducted by Abbass-Dick and Dennis (2018) who found that mothers and fathers were both satisfied with a co-parenting breastfeeding support intervention.

The majority of participants used the eHealth resource, with the

highest use noted in the prenatal period with some participants continuing to access the resource throughout the postpartum period to 52 weeks. Prenatal education has been found to be an important period for parents to improve their knowledge (Di Mario et al., 2015), suggesting the possible reason for higher use prenatally. The access prenatally enabled parents to retrieve information regarding what to expect with breastfeeding which allowed them to feel prepared for breastfeeding and provided anticipatory guidance. "It is a great learning reference. My husband and I enjoyed the videos, and we are feeling a little more prepared for breastfeeding our daughter once she's born" (M72). "Very comprehensive information about breastfeeding. I am glad I read through this tool before the baby came" (M41).

The eHealth resource design was rated positively with the participants indicating the resource was well organized and was tailored to both mothers and their co-parents with design features such as the layout and photos that they liked. The multi-modal approach to information delivery increased the participants' engagement and was indicated to be helpful, with preference given to the text, narrations, illustrations, and video content. "The multimedia information, clean, organized, website looked professional with nice pictures mixed with video clips and links to extra info along with the written info" (C7). There is not a lot of information in breastfeeding education related to using multimodal resources for engagement with eHealth resources, therefore, there is the potential to explore this in future research. However, it was found that using multiple modes to communicate information promotes interaction and participation which can lead to increased health literacy, personal autonomy, and empowerment (Nutbeam, 2000).

Participant couples appreciated that the eHealth resource was highly accessible, could be accessed anywhere and anytime, was self-paced, and easy to use. These findings are similar to that of (Abbass-Dick et al. (2018); Abbass-Dick et al. (2015)) where it was found that having 24/7 accessibility to an eHealth breastfeeding resource was comforting for the parents as they knew they could get help whenever they needed it. The majority of participants did not have any trouble with using or navigating the resource and for the few that did, difficulties were noted with the functionality and slow loading times.

The content was rated highly with 93% of participants indicating the content was informative and useful. For the participants who reviewed each section at each time point, the content was rated as helpful or very helpful the majority of the time. The participants found that the information was very comprehensive, enabling them to find the information they required when needed. "Importance of breastfeeding", "positioning", "what to expect in the early days", "how to latch", and "breastmilk compared to formula" were rated highest. Participants indicated the information in the eHealth resource promoted confidence in breastfeeding, as illustrated in these participant quotes: "Simple information, made me feel confident as a partner" (C76), "My partner and I felt very knowledgeable about breastfeeding, and felt very confident in getting our baby to breastfeed once she was born; I am still breastfeeding at 12 months" (M7). Additionally, it was indicated that the resource assisted the participant couples in learning how to work as a co-parenting team and how co-parents can support the breastfeeding mom. These comments from the participants align with evidence which indicates that having confidence as a partner in breastfeeding can positively influence breastfeeding outcomes as a couple (Dennis et al., 2018).

The inclusion of the most relevant information on a broad range of topics in this eHealth resource is consistent with the recommendations of the elaboration theory design (Reigeluth, 1992). The users can access general information on a variety of topics regarding how breastfeeding works and when challenges occur, more detailed information is provided, building on the general principles. This enabled a number of participants to learn ways to overcome breastfeeding problems and find solutions, as evident by the high rates of breastfeeding in this study sample, in which 91% experienced breastfeeding difficulties and yet 71% were still breastfeeding at 52 weeks postpartum (Abbass-Dick et al., 2020). The eHealth resource provided helpful information to enable participants to problem-solve breastfeeding obstacles as a co-parenting team. "The whole site was very helpful, sometimes my wife would be feeding, and I'd look things up on the website especially when her breast was very painful, and we determined it was a clogged milk duct" (C72). This aligns with the results from Abbass-Dick et al. (2019) who found that having breastfeeding resources that targeted both mothers and their partners helped them overcome challenges related to breastfeeding and improved their breastfeeding outcomes.

A number of participants rated the conversation with the research assistant where the eHealth resource was introduced and covered together to be the most helpful component of the intervention, suggesting the importance of including human facilitators to complement self-paced learning. "Nice to have someone walk you through the website" (M105). "It was nice to have a personal conversation and be able to ask questions in real time. Call explained all details instead of me having to read them all and missing something" (M109). Half of them indicated the email reminders were helpful, as some indicated, they appreciated the reminders during a busy time with their infant, and a co-parent indicated, "speaking with the research assistant forced me to look at the materials which I might not have found the time or brain space otherwise" (M57). Being able to interact with health care professionals throughout the breastfeeding journey improves the parent's health literacy by increasing their access to information and empowering them to reach their breastfeeding goals (Sykes et al., 2013). These finding will inform the future implementation study that will be conducted with this eHealth resource. Diverse health care providers will refer to the resource in clinical interactions throughout the perinatal period, with the aim of increasing standardized education throughout a health region to promote health literacy and breastfeeding rates.

Although the majority of responses regarding the eHealth resource were positive at all follow-up time points, some areas to be improved were noted. Themes that emerged from the responses to open-ended questions suggested that some participants found the content on why breastfeeding is important to be overly emphasized, which they found off-putting. It has been noted in a study by Abbass-Dick and Dennis (2018) that mothers who are unable to breastfeed feel disappointed when having to use formula. This concern was reflected in participants' responses suggesting the way the importance of breastfeeding is communicated can elicit emotional responses in parents who are unable to meet their goals. Additionally, some participants wanted only the essential information and found the amount of content presented to be overwhelming. This needs to be considered in the design of eHealth resources as having too much information presented to a learner can induce a cognitive overload where the learner is overwhelmed with new information which hinders the learning process (De Jong, 2010). Lastly, participants identified areas in which more information was needed to support self-management of specific breastfeeding challenges which they experienced. This requires further research as hands-on support in addition to informational resources are most effective when more complex challenges are experienced (Gavine, Marshall, et al., 2022; Gavine, Shinwell, et al., 2022).

This study had many strengths which included collecting data from both mothers and co-parents from the prenatal period to 52 weeks postpartum. The response rate was high at all time points and the longitudinal design provided greater insight into the use and perspectives of participants throughout the perinatal and breastfeeding period when access to comprehensive and credible breastfeeding information remained necessary. Including couples in the study provided insights on how they worked as a team to meet their breastfeeding goals as well as highlighted some similarities and differences in the manner in which they prefer to receive information and the content they found most helpful.

Limitations

This study had limitations which included the manner in which the data were collected, with self-report repeated measures. Although the online surveys were deidentified, with identification codes assigned to participants, and they are a feasible way of collecting information, the depth of knowledge obtained is limited and social disability bias may have impacted the participants' responses. Additional data collection methods would enable greater insights into the preferences of users in designing eHealth resources and additional methods should be employed in future research. More detailed data regarding the duration of time should be collected as <30 min was the shortest unit of time collected in this study. Lastly, this study included participants who were highly motivated to breastfeed, used an eHealth resource, and worked as a team to meet their breastfeeding goals, as well, all birthing parents identified as expectant women and this may not be representative of the general population. More research with diverse populations is needed.

Implications for practice

eHealth is increasingly being used in the provision of effective breastfeeding education and support (Almohanna et al., 2020). Parents require credible, comprehensive breastfeeding information to ensure they understand how breastfeeding works and how to overcome common challenges throughout the breastfeeding period, which spans two years and beyond (World Health Organization/UNICEF, 2018). This study illustrated that parents found having access to an eHealth resource over the perinatal period and beyond to be helpful and they valued having it introduced by the RA with frequent reminders. This suggests incorporating eHealth interventions into breastfeeding support programs and clinical interactions throughout the perinatal period, may provide parents with continued access to credible information to increase breastfeeding health literacy and assist them in meeting their breastfeeding goals.

Conclusion

This study illustrated that providing mothers and their co-parents with breastfeeding co-parenting support via an eHealth intervention was well received by parents, delivering accessible, comprehensive information that was easy to use throughout the breastfeeding period over the first year of their child's life. Continuing to work with parent populations in the design and evaluation of eHealth resources for breastfeeding education and support is needed to enhance this field of study.

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Ethical approval received from the university.

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CRediT authorship contribution statement

Jennifer Abbass-Dick: Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Visualization, Formal analysis, Writing – original draft, Writing – review & editing. **Winnie Sun:** Conceptualization, Methodology, Writing – review & editing. **Amber Newport:** Conceptualization, Investigation, Writing – review & editing. **Fangli Xie:** Conceptualization, Investigation, Writing – review & editing. **Julia Micallef:** Writing – review & editing. **Adam Dubrowski:** Conceptualization, Writing – review & editing.

Declaration of Competing Interest

None to declare.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pedn.2023.07.013.

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