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ORIGINAL STUDY

Positive impact of a co-designed digital resource for women with early menopause

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Abstract

Objective: To evaluate a co-designed early menopause digital resource, including audio/video clips, question prompt list, and information links.

Methods: Pre/post-test study. Women with early menopause, defined as menopause before age 45 years, were recruited from the community. Following online informed consent, participants were emailed links to the digital resource and online surveys to complete before (baseline) and, immediately and 1 month after viewing the resource. Main outcome measures: Health-related empowerment (Health Education Impact Questionnaire), illness perception (Brief Illness Perception Questionnaire), menopause symptoms (Greene Climacteric Scale), risk perception, and knowledge change.

Results: One hundred fifty women participated. Compared to baseline, at 1-month health-related empowerment, 'health directed behavior' scores increased (mean change: +0.13; 95% CI: 0.01-0.24; and $P = 0.03$), 'emotional distress' decreased (mean change: −0.15; 95% CI: −0.25 to −0.05; and $P = 0.003$) and physical and emotional menopause symptom scores decreased ($P = 0.001$ and $P = 0.02$, respectively). Illness perception scores increased at both immediate and 1-month follow-up versus baseline for 'personal control' ($P < 0.001$ and $P = 0.02$) and 'coherence' ($P = 0.003$ and $P < 0.001$). After viewing the digital resource, more women perceived that hormone therapy decreases heart disease risk, reduces hot flashes, and prevents fractures versus baseline (all $P < 0.05$). More women correctly answered questions regarding early menopause prevalence (60% vs 35%), cause (46% vs 33%), risk (76% vs 55%), effect of phytoestrogens (60% vs 27%), and osteoporosis prevention (64% vs 44%) at immediate or 1-month follow-up versus baseline (all $P < 0.05$).

Conclusions: A co-designed early menopause digital resource may improve women's health-related empowerment, illness perception, menopause symptoms, risk perception, and knowledge.

Key Words: Digital resource – Early menopause – Health-related behaviors – Illness perception – Knowledge change.

Video Summary: http://links.lww.com/MENO/A923.

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Early menopause (EM; menopause before age 45 y) affects over 10% of women.[1] EM occurs spontaneously or following medical interventions[2] and is associated with multiple health risks,[3,4] increased mortality,[4] and impaired quality of life (QoL).[2] Many women with EM believe they have insufficient access to information about menopause[5,6] and limited choices.[5] Available evidence indicates a lack of women's knowledge regarding EM that could be a major barrier to early detection, treatment satisfaction, and appropriate management, contributing to care variation.[6,7] Provision of reliable and accurate information is part of high-quality patient-centered care, with impacts on patient experience (including illness perception, understanding, satisfaction, and compliance).[8,9] Evidence indicates a strong association between health literacy, behavior change, and improved health outcomes.[10] Educational health resources have been reported as an efficient means of raising women's awareness that can improve self-management, optimize health-related behaviors, promote informed decision making, and improve outcomes.[7,11]

The Internet is widely used as a source of information about health and healthcare with over 70% of adults accessing the Internet to research a health issue.[12] A systematic review of online patient narratives indicated benefits in regard to improving consumer understanding, providing emotional support, and impacting behavioral change.[13] The Internet was perceived as the best or second best source of information by Australian women with EM.[5] However, before the development of the co-designed EM digital resource,[14] a systematic search revealed no website specifically for women with EM, and existing menopause consumer websites had substantial shortcomings in quality and content information limiting their usefulness.[15]

The development and usability of the co-designed novel EM digital resource addressing women's and health practitioners' needs comprising audio/video clips of women's and health practitioners' experiences, a question prompt list, and links to online information has been previously reported.[7,14] This study aimed to evaluate this digital resource in regard to effect on health empowerment, menopausal symptoms, illness perception, and knowledge.

METHODS

This pre/post-test study was conducted from January to June 2019. This study was approved by the Monash Health Human Research Ethics Committee (Project 07062A) and was registered in the ''Australian New Zealand Clinical Trials Registry'' website (ACTRN12619000107123).

Participants

Women with a self-reported diagnosis of EM were recruited from a range of sources, including outpatient clinics, support groups, women's health websites, cancer websites, medical centers, and professional medical societies, and invited to view the website and participate in an online survey. Eligibility criteria were: (1) age over 20 years, (2) formal diagnosis of EM (spontaneous or iatrogenic), (3) residing in Australia, (4) computer and Internet access, (5) having a personal e-mail address, and (6) English literacy.

Procedure

Research Electronic Data capture (REDCap) software[16] was used to conduct the study completely online. Online surveys were administered at three time points: i) before viewing the website (baseline), ii) immediately after viewing the website (follow-up 1), and iii) 1 month after viewing the website (follow-up 2).

Women who expressed interest in participating were emailed a link to participant information and an online screening survey. Eligible women with self-reported spontaneous or iatrogenic EM providing online consent were sent an automated e-mail invitation with a link to the baseline survey. After completing the baseline survey, an automated e-mail link to the digital resource was sent with the immediate post-test online survey (follow-up 1). An e-mail invitation link to the 1-month post survey was sent automatically (follow-up 2). Reminders were automatically generated after 2 weeks if the surveys had not been completed. This study was conducted using both validated and devised online scales. Data collection included demographics, medical history, validated, and devised surveys (detailed below).

The evidence-based digital resource located on the Healthtalk Australia (HTA) platform (https://healthtalkaustralia.org/early-menopause-experiences-and-perspectives-of-women-and-health-professionals/) included audio/video clips of women with EM and HPs providing EM care, a question prompt list, information links, and a list of services.[14]

The study was initially designed as a randomized controlled trial with computer generated randomization to either the novel online HTA resource (intervention) or a currently available women's health website (comparator) after the baseline survey (Fig. 1). However, an unanticipated system upgrade of Redcap resulted in an irretrievable failure of the randomization process after 75 comparator women were randomized and only 35 had completed all surveys. As we were unable to randomize an adequate comparator sample size, the decision was made to focus on the intervention group and convert the study to a pre-post design with all subsequent participants allocated to the novel online HTA resource.

Outcome measures

The primary outcome was the change in health-related empowerment and the secondary outcomes were changes in menopause symptoms, illness perception, knowledge, and risk perception.

Health-related empowerment was measured by the Health Education Impact Questionnaire (heiQ),[8] a self-report questionnaire which provides a comprehensive evaluation of patient education or self-management programmes. It is used across a wide range of settings and disease groups and provides useful information for researchers, healthcare providers, and policy makers. The heiQ assesses eight independent dimensions (described in Supplementary Table S1, http://links.lww.com/MENO/A921) related to key self-management skills,

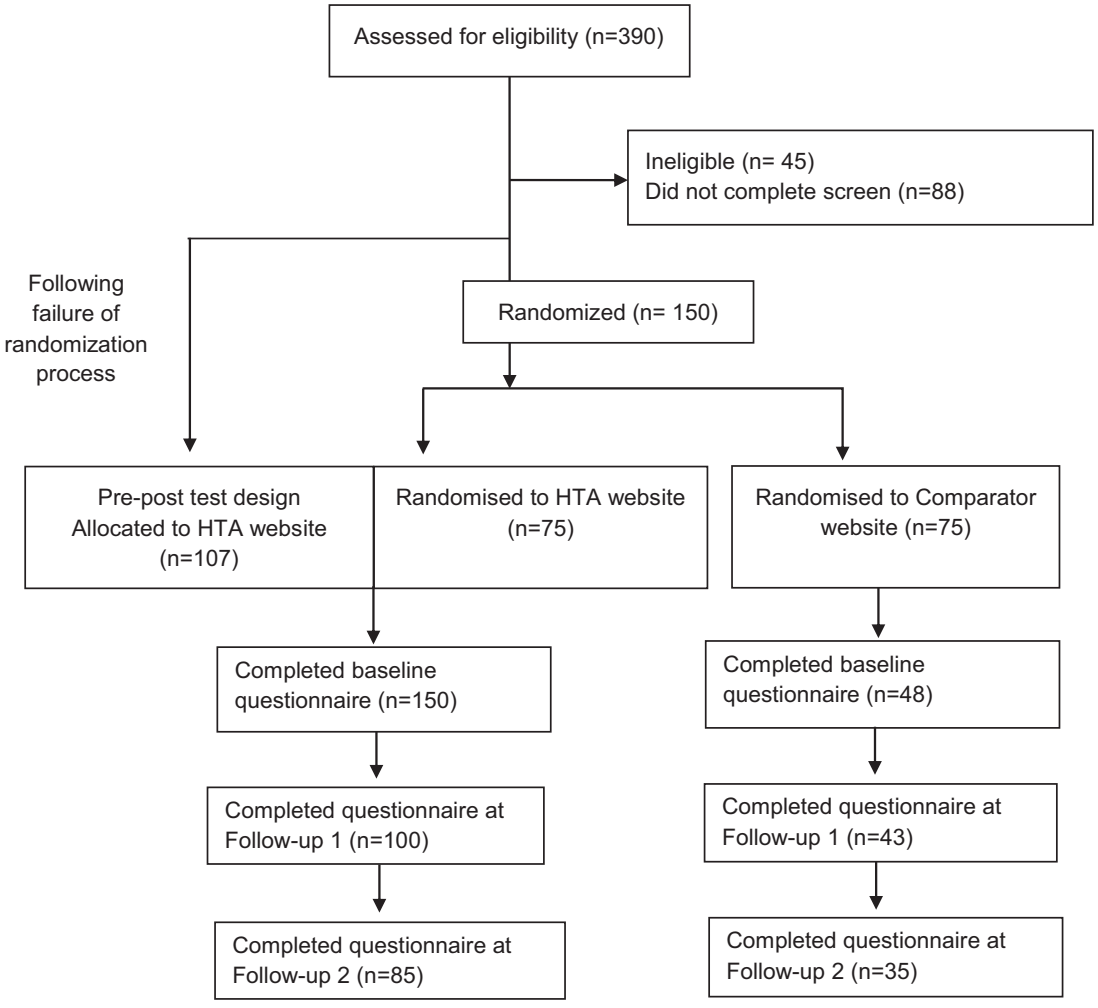

FIG. 1. Flow diagram.

including: Health Directed Activity, Positive and Active Engagement in Life, Self-Monitoring and Insight, Constructive Attitudes and Approaches, Skill and Technique Acquisition, Social Integration and Support, Health Services Navigation, and Emotional Distress. Each of the eight subscales has 4-6 items that are rated on a 4-point scale from 1 (strongly disagree) to 4 (strongly agree). The items were summed and divided by the total number of items in the subscale for both baseline and follow-up to retain the score ranges of 1-4. A higher score indicates better self-management, except for the emotional distress scale, which is reversed. Higher scores on emotional distress indicates high levels of negative affect and a decrease in scores on this subscale would be regarded as a desirable outcome of a self-management program.[8]

Menopause symptoms were measured using the Greene Climacteric Scale (GCS).[17] The GCS measures 21 symptoms using a 4-point rating scale from 0 (not at all) to 3 (extremely). The GCS can be subdivided into subscales, including psychological (anxiety, questions 1-6 and depression, questions 7-11), somatic (questions12-18), vasomotor (questions 19 and 20), and loss of interest in sex (question 21). The sum of scores was calculated for each subscale. Higher scores indicate a higher frequency of symptoms and/or symptom severity. Anxiety score of $\geq$10 or depression score of $\geq$10 indicates clinically relevant symptoms.[17]

Illness perception was measured by the Brief Illness Perception Questionnaire (BIPQ),[18] an eight-item questionnaire designed for assessment of the cognitive and emotional representations of illness. Five items assess cognitive illness representations: consequences (item 1), timeline (item 2), personal control (item 3), treatment control (item 4), and identity (item 5). Two items assess emotional representations: concern (item 6) and emotions (item 8). One item assesses illness comprehensibility (item 7). All items are rated using a 0-10 scale. The BIPQ is a reliable and valid measure of illness perception across a range of patient ages and conditions.[19]

Knowledge change was assessed using a questionnaire adapted from a previously published study[20] and included 14 statements with true, false, or don't know responses (Supplementary Table S2, http://links.lww.com/MENO/A922). Questions measured women's knowledge regarding the prevalence and cause of spontaneous early menopause,

osteoporotic fractures, the role of diet and exercise, hormone therapy (HT), and the effect of chemotherapy on the risk of EM.

Risk perception was assessed using a previously published questionnaire[21] including 28 questions measuring women's perception of risks associated with treatments (HT and herbal therapies) for menopausal symptoms.

Statistical analysis

The power calculation, based on the primary outcome of health empowerment as measured by the heiQ, shows that for a sample size of 82 subjects, the study has a power of 83% for emotional distress (mean change: 0.15, SD: 0.46) assuming the parameters were from the dataset and level of significance was set at 5%. Power calculations were performed in PS Power and Sample Size software (V3.0).

Categorical variables were expressed as number (percentages) and continuous variables were expressed as median/interquartile range (IQR) or mean/standard deviation (SD). The Shapiro-Wilk test was used to determine the normality of the data distribution. The mean/SD for heiQ and GCS domains at each point in time, the mean and 95% confidence interval (CI) for changes in scores between baseline versus immediate and 1-month follow-up and also the standardized effect size (ES) was calculated. To analyze the differences in scores on continuous variables before and after viewing the EM digital resource a paired *t* test was used. ES Cohen's d was calculated to measure the magnitude of changes in scores between baseline and each time point using the sample SD of the mean difference. We considered ES = 0.1, ES = 0.3, and ES = 0.5 as small, moderate, and large, respectively, as has been reported in a previous study using the heiQ.[11] If the data were not normally distributed the Wilcoxon sign rank test was used. For before and after comparison for binary variables, McNemar test was used. A logistic regression model was used to measure the association between independent variables, such as age and time since EM diagnosis with dichotomous outcomes such as women's knowledge regarding EM. BIPQ scores were compared between women with EM diagnosed recently (<5 y ago) with those diagnosed ≥5 years ago using the Mann-Whitney *U* test. A *P* value < 0.05 was considered statistically significant. Data analysis was performed using Statistical Package for Social Sciences (SPSS Inc., Chicago, IL) version 23.0.

RESULTS

A total of 182 women with EM viewed the HTA digital resource and of these 150 completed the baseline survey and were included for analysis (Fig. 1). Reasons for exclusion were: incomplete questionnaires ($n = 15$), not formal diagnosis for EM ($n = 10$), and age at diagnosis was ≥45 years ($n = 7$). The mean (SD) age of respondents was 50.56 (11.05) and median (IQR) age at diagnosis was 41 (36-43). Most women reported iatrogenic EM (57.4%) with EM diagnosis ≥5 years ago (71.3%). Most women were Australian born (75.3%), metropolitan residing (62.7%), and had a postschool qualification (75.3%). Almost 25% of women reported use of systemic HT (age range: 25-70 y) and 16% reported using nonhormonal medication for menopause. Almost 42% of women ($n = 62$) had premature ovarian insufficiency (POI; menopause before age 40 y). The baseline characteristics of the participants are presented in Table 1.

TABLE 1. *Demographic characteristics of participants*

Characteristics ($n = 150$)	
Age (y) (mean ± SD)	50.56 ± 11.05
Age at EM diagnosis (y), median (IQR)	41 (36-43)
Describe where you live, *n* (%)	
Metropolitan	94 (62.7)
Regional	42 (28)
Rural/remote	14 (9.3)
Education, *n* (%)	
Year 12 or equivalent	37 (24.7)
Associate/undergraduate	30 (20)
Postgraduate diploma/Bachelor/MSc/PhD	69 (46)
Vocational qualification	14 (9.3)
Australian born, *n* (%)	113 (75.3)
Duration since EM diagnosis, *n* (%)	
<5 y ago	43 (28.7)
≥5 y ago	107 (71.3)
Cause of EM, *n* (%)	
Cancer treatment	46 (30.7)
Bilateral salpingo-oophorectomy	40 (26.7)
Autoimmune/genetic/metabolic/others	14 (9.3)
Unknown	50 (33.3)
Current use of menopausal therapies, *n* (%)	
Systemic HT	38 (25.3)
Vaginal estrogen	16 (10.7)
Nonhormonal medication (antidepressant)	24 (16)
CBT or mindfulness	23 (15.3)
Complementary medicine	11 (7.3)

CBT, cognitive behavioral therapy; EM, early menopause, HT, Hormone therapy; IQR, interquartile range; SD, standard deviation.

Health-related empowerment

Compared to baseline, increased heiQ score for 'health directed behavior' with a small ES and decreased score for 'emotional distress' with a moderate ES were observed at 1-month follow-up compared with baseline. No differences were observed in other heiQ subscales (Table 2). There were no differences in heiQ 'health directed behavior' and 'emotional distress' scores between immediate (follow-up 1) and 1-month follow-up (follow-up 2).

Menopause symptoms

GCS scores significantly decreased at 1-month follow-up compared to baseline for somatic and vasomotor subscales. No differences were observed for scores of psychological and sexual symptoms at immediate and 1-month follow-up (Table 2).

Illness perception

BIPQ median (IQR) scores were increased for 'personal control' at both immediate and one-month follow-up compared to baseline. A similar pattern was observed for 'coherence' at both immediate and 1-month follow-up compared to baseline. The BIPQ median (IQR) score was increased at immediate follow-up compared to baseline for 'treatment control'. No differences were observed for 'identity,' 'illness concern,' or

TABLE 2. *Health-related empowerment and menopausal symptoms. Change from baseline to immediately after (follow-up 1) and 1 month after (follow-up 2) viewing the digital resource*

	Baseline to follow-up 1 ($n = 90$)						Baseline to follow-up 2 ($n = 82$)					
heiQ scale[a]	Baseline (mean ± SD)	Follow-up 1 (mean ± SD)	Change from baseline	95% CI of mean change	*P* value	ES	Baseline (mean ± SD)	Follow-up 2 (mean ± SD)	Change from baseline	95% CI of mean change	*P* value	ES
Health-directed behavior	2.94 ± 0.80	2.96 ± 0.82	0.02	−0.08 to 0.14	0.63	0.05	2.94 ± 0.82	3.07 ± 0.75	0.13	0.01 to 0.24	**0.03**	0.25
Positive & active engagement in life	3.04 ± 0.61	3.05 ± 0.58	0.008	−0.07 to 0.09	0.84	0.02	3.09 ± 0.61	3.14 ± 0.61	0.05	−0.03 to 0.13	0.24	0.13
Self-monitoring and insight	3.04 ± 0.48	3.05 ± 0.45	0.01	−0.06 to 0.10	0.65	0.04	3.08 ± 0.48	3.12 ± 0.43	0.04	− 0.05 to 0.12	0.40	0.09
Constructive attitudes and approaches	3.15 ± 0.64	3.08 ± 0.58	−0.06	−0.15 to 0.02	0.13	−0.16	3.20 ± 0.64	3.17 ± 0.53	−0.03	−0.12 to 0.04	0.40	−0.09
Skill and technique acquisition	2.83 ± 0.56	2.88 ± 0.54	0.04	−0.05 to 0.14	0.34	0.09	2.89 ± 0.56	2.96 ± 0.56	0.07	−0.02 to 0.16	0.16	0.16
Social integration and support	2.76 ± 0.64	2.81 ± 0.62	0.05	−0.03 to 0.14	0.26	0.11	2.81 ± 0.62	2.88 ± 0.58	0.07	−0.03 to 0.16	0.17	0.15
Health services navigation	3.07 ± 0.57	3.08 ± 0.55	0.01	−0.08 to 0.10	0.78	0.02	3.12 ± 0.54	3.14 ± 0.56	0.02	−0.08 to 0.12	0.70	0.04
Emotional distress	2.25 ± 0.71	2.20 ± 0.72	−0.05	−0.12 to 0.02	0.17	−0.14	2.21 ± 0.73	2.06 ± 0.71	−0.15	−0.25 to −0.05	**0.003**	−0.34
Greene Climacteric Scale[b]	Baseline to follow-up 1 ($n = 91$)						Baseline to follow-up 2 ($n = 83$)					
Psychological:	10.94 ± 6.62	11.14 ± 6.96	0.19	−0.48 to 0.87	0.56	0.06	10.18 ± 6.57	9.48 ± 6.12	−0.69	−1.59 to 0.19	0.12	−0.17
Anxiety	5.64 ± 3.45	5.94 ± 3.56	0.29	−0.09 to 0.68	0.13	0.16	5.24 ± 3.37	5.00 ± 3.30	−0.24	−0.71 to 0.22	0.31	−0.11
Depression	5.29 ± 3.64	5.19 ± 3.80	−0.09	−0.49 to 0.29	0.62	−0.05	4.93 ± 3.68	4.48 ± 3.29	−0.45	−1.01 to 0.09	0.10	−0.18
Physical	5.53 ± 4.12	5.53 ± 4.16	0.00	−0.47 to 0.47	1.00	0.00	5.41 ± 4.24	4.43 ± 3.45	−0.98	−1.55 to −0.40	**0.001**	−0.37
Vasomotor	2.48 ± 2.11	2.34 ± 2.02	−0.13	−0.34 to 0.07	0.20	−0.13	2.15 ± 2.04	1.77 ± 1.84	−0.38	− 0.69 to −0.05	**0.02**	−0.26
Sexual	1.80 ± 1.14	1.83 ± 1.07	0.03	−0.15 to 0.22	0.70	0.04	1.67 ± 1.14	1.60 ± 1.09	−0.06	−0.26 to 0.13	0.53	−0.07

The numbers that are in bold are those with *P* value <0.05.
CI, confidence interval; ES, standardized effect size; SD, standard deviation.
[a]Health education impact questionnaire[8]: Each of the eight subscales has 4-6 items that are rated on a 4-point scale, where 1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree.
[b]Greene Climacteric scale[17]: Each symptom is rated based on its severity on a 4-point rating scale, where 0 = Not at all, 1 = a little, 2 = quite a bit, and 3 = extremely.
Psychological score ranges 0-33 (anxiety score ranges 0-18, and depression score ranges 0-15), physical symptom score ranges 0-21, vasomotor symptom score ranges 0-6, and sexual symptom score ranges 0-3.

TABLE 3. *Perceptions of illness. Change from baseline to immediately after (follow-up 1) and 1 month after (follow-up 2) viewing the digital resource*

		Baseline to Follow-up 1 ($n = 93$)			Baseline to Follow-up 2 ($n = 85$)		
BIPQ Scoring items [18]	Questions	Baseline Median (IQR)	Follow-up 1 Median (IQR)	*P* value	Baseline Median (IQR)	Follow-up 2 Median (IQR)	*P* value
Consequences	[a]How much does your EM/POI affect your life?	5.00 (2.15-7.00)	6.70 (5.00-8.00)	**<0.001**	5.00 (1.75-6.80)	5.00 (2.55-6.60)	0.63
Timeline	[b] How long do you think your EM/POI will continue?	8.20 (5.00-9.90)	8.80 (6.15-9.90)	**0.01**	8.10 (4.35-10)	7.90 (5.00-9.70)	0.70
Personal control	[c] How much control do you believe you have over your EM/POI?	3.60 (1.20-7.20)	6.10 (2.75-8.15)	**<0.001**	4.80 (1.40-7.75)	5.60 (2.75-7.95)	**0.02**
Treatment control	[d] How much do you think your treatment can help your EM/POI?	5.00 (1.45-6.80)	5.30 (3.35-7.15)	**0.02**	5.00 (1.45-7.35)	5.00 (2.75-7.10)	0.35
Identity	[e] How much do you experience symptoms from your EM/POI?	5.60 (2.45-7.25)	6.10 (2.70-7.00)	0.17	5.10 (2.25-7.15)	5.00 (2.25-6.80)	0.39
Illness concern	[f] How concerned are you about your EM/POI?	5.00 (2.05-7.00)	5.40 (3.30-7.10)	0.21	5.00 (1.65-6.80)	5.00 (1.85-6.35)	0.04
Coherence	[f] How well do you believe you understand your EM/POI?	6.00 (3.25-7.95)	6.90 (5.00-8.20)	**0.003**	6.40 (3.50-8.00)	7.30 (5.00-8.40)	**<0.001**
Emotional representation	[g] How much does your EM/POI affect you emotionally?	5.70 (2.25-7.10)	6.10 (3.35-7.65)	0.14	5.00 (1.70-7.00)	5.00 (1.40-6.60)	0.14

The numbers that are in bold are those with *P* value <0.05.
BIPQ, Brief Illness Perception Questionnaire; EM, early menopause; IQR, Interquartile range; POI, premature ovarian insufficiency.
BIPQ Scoring ranges 0-10.
[a]0 (not affect at all)-10 severely affects my life.
[b]0 (a very short time)-10 (forever).
[c]0 (absolutely no control) – 10 (extreme amount of control).
[d]0 (not at all) – 10 (extremely helpful).
[e]0 (no symptoms at all) – 10 (many severe symptoms).
[f]0 (not concerned at all) – 10 (extremely concerned).
[g]0 (not at all affected emotionally) – 10 (extremely affected emotionally).

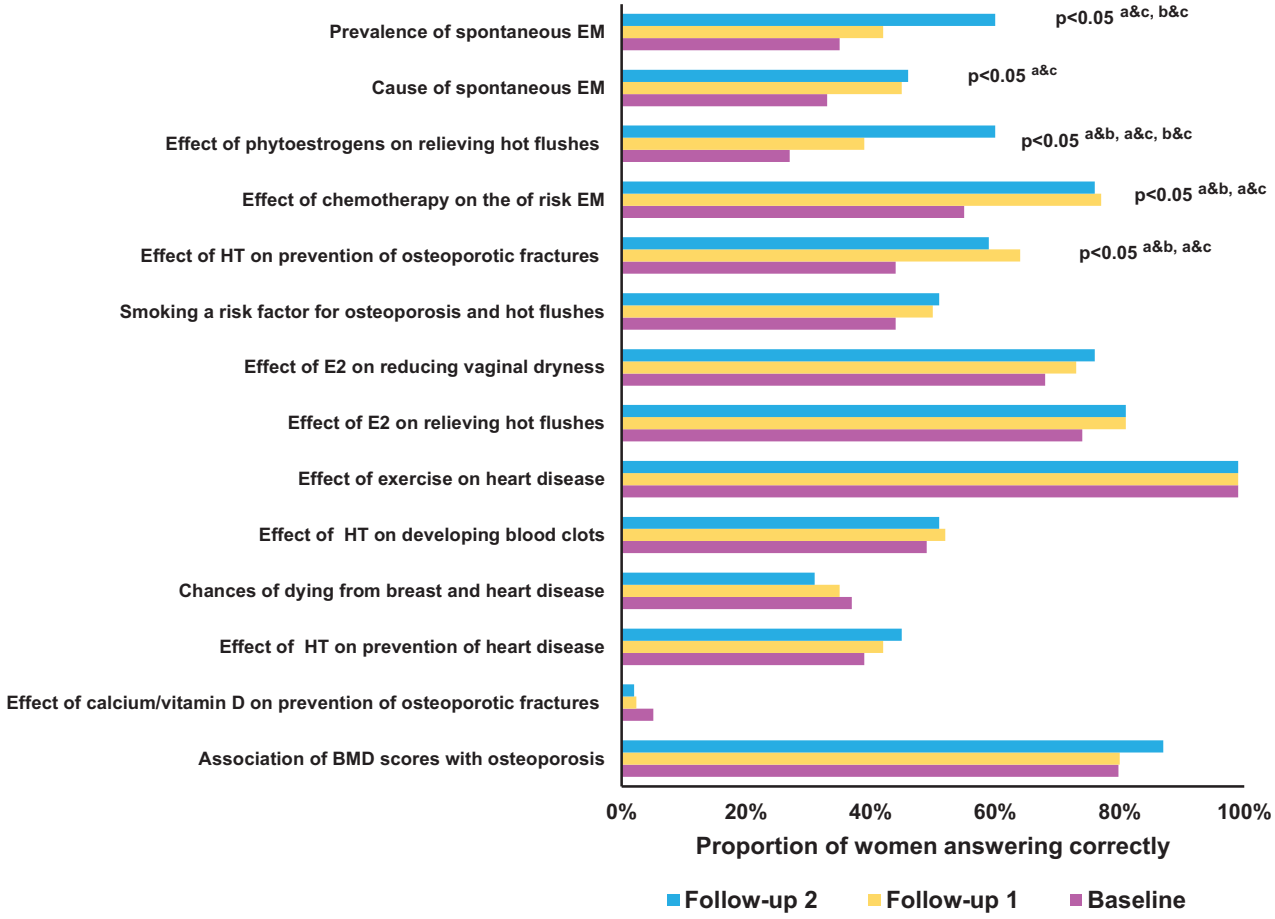

FIG. 2. Effect of the online early menopause digital resource on women's knowledge. The proportion of women selecting the correct response for each statement is shown at different time points including: at baseline before viewing the digital resource, immediately after (Follow-up 1) and 1 month after (Follow-up 2) viewing the digital resource. Significant differences between time points are indicated where 'a' represents Baseline, 'b' represents Follow-up 1 and 'c' represents Follow-up 2. Knowledge questions and answers are provided in Supplementary Table S2, http://links.lww.com/MENO/A922. BMD, Bone mineral density; E2, Estrogens; EM, early menopause; HT, hormone therapy.

'emotional representation' (Table 3). Women who were diagnosed with EM <5 years ago showed higher BIPQ scores in consequences ($P = 0.03$), identity ($P = 0.04$), illness concern ($P = 0.01$), and emotional representation domains ($P = 0.01$) at baseline compared with women diagnosed ≥5 years ago. At immediate follow-up (follow-up 1), women who were diagnosed with EM <5 years ago, showed higher scores in identity ($P = 0.04$) and illness concern ($P = 0.04$) compared with women diagnosed ≥5 years ago. At 1-month follow-up (follow-up 2), BIPQ scores for personal control ($P = 0.02$) and coherence ($P = 0.001$) were higher in women who were diagnosed with EM ≥5 years ago than women who were diagnosed recently (<5 y ago).

Knowledge change

A greater proportion of women correctly answered questions regarding the prevalence of EM (60% vs 35%), cause of EM (46% vs 33%), effect of chemotherapy on the risk of EM (76% vs 55%), the effect of phytoestrogens on relieving hot flashes (60% vs 27%), and the effect of HT on prevention of osteoporosis (64% vs 44%) at immediate or 1-month follow-up compared with baseline (all $P < 0.05$) (Fig. 2). The univariate logistic regression model was used to assess the association of women's knowledge regarding EM with age and time since EM diagnosis and no significant associations were observed at any of the three time points (baseline or follow-up 1 and 2).

Risk perception

A greater proportion of women correctly perceived that HT decreases the risk of heart disease (39.6% vs 27.5%, $P = 0.03$) and prevents fractures (56% vs 42.9%, $P = 0.01$) at immediate follow-up compared with baseline. Also, a higher percentage of women perceived that HT effectively reduces hot flashes at immediate (79.1% vs 63.7%, $P = 0.003$) and 1-month follow-up (75.3% vs 63.5%, $P = 0.04$) compared with baseline. At 1-month post, fewer women reported ''don't know'' in regard to the risk and benefits of herbal therapies compared with baseline (71% vs 81%; $P = 0.04$) (Table 4).

There was no reported change in menopausal therapy use (including systemic HT, cognitive behavioral therapy/

TABLE 4. *Perceived benefits and risks associated with treatments for menopausal symptoms. Change from baseline to immediately after (follow-up 1) and 1 month after (follow-up 2) viewing the digital resource. Values represent the number (%) of women selecting each response*

	Baseline to follow-up 1 ($n = 91$)			Baseline to follow-up 2 ($n = 85$)		
	Baseline *n* (%)	Follow-up 1 *n* (%)	*P* value	Baseline n (%)	Follow-up 2 *n* (%)	*P* value
Hormone Therapy						
Increases all cancers	4 (4.4)	5 (5.5)	1.00	1 (1.2)	3 (3.6)	0.62
Increases breast cancer	56 (61.5)	57 (62.6)	1.00	51 (60)	45 (52.9)	0.26
Increases heart disease	11 (12.1)	15 (16.5)	0.39	9 (10.6)	10 (11.8)	1.00
Decreases heart disease	25 (27.5)	36 (39.6)	**0.03**	22 (25.9)	26 (30.6)	0.42
Increases stroke	25 (27.5)	26 (28.6)	1.00	19 (22.4)	20 (23.5)	1.00
Decreases stroke	8 (8.8)	4 (4.4)	0.22	9 (10.6)	12 (14.1)	0.55
Effectively reduces hot flashes	58 (63.7)	72 (79.1)	**0.003**	54 (63.5)	64 (75.3)	**0.04**
Causes blood clots	33 (36.3)	36 (39.6)	0.63	29 (34.1)	26 (30.6)	0.64
Reduces blood clots	2 (2.2)	5 (5.5)	0.37	3 (3.5)	6 (7.1)	0.37
Causes bowel cancer	2 (2.2)	4 (4.4)	0.62	1 (1.2)	0 (0)	1.00
Reduces bowel cancer	3 (3.3)	5 (5.5)	0.50	2 (2.4)	4 (4.7)	0.68
Prevents fractures	39 (42.9)	51 (56)	**0.01**	37 (43.5)	42 (49.4)	0.33
Causes fractures	1 (1.1)	4 (4.4)	0.37	0 (0)	0 (0)	1.00
Don't know	12 (13.2)	9 (9.9)	0.45	13 (15.3)	8 (9.4)	0.26
Herbal Therapy						
Increases all cancers	1 (1.1)	0 (0)	1.00	0 (0)	1 (1.2)	1.00
Increases breast cancer	1 (1.1)	0 (0)	1.00	0 (0)	2 (2.4)	0.50
Increases heart disease	0 (0)	1 (1.1)	1.00	0 (0)	1 (1.2)	1.00
Decreases heart disease	7 (7.7)	5 (5.5)	0.68	4 (4.7)	2 (2.4)	0.62
Increases stroke	0 (0)	0 (0)	1.00	0 (0)	1 (1.2)	1.00
Decreases stroke	5 (5.5)	3 (3.3)	0.68	3 (3.5)	1 (1.2)	0.50
Effectively reduces hot flashes	22 (24.2)	29 (31.9)	0.19	16 (18.8)	22 (25.9)	0.21
Causes blood clots	0 (0)	0 (0)	1.00	0 (0)	0 (0)	1.00
Reduces blood clots	4 (4.4)	2 (2.2)	0.62	3 (3.5)	1 (1.2)	0.50
Causes bowel cancer	0 (0)	0 (0)	1.00	0 (0)	0 (0)	1.00
Reduces bowel cancer	2 (2.2)	3 (3.3)	1.00	1 (1.2)	1 (1.2)	1.00
Prevents fractures	5 (5.5)	3 (3.3)	0.68	3 (3.5)	1 (1.2)	0.62
Causes fractures	0 (0)	1 (1.1)	1.00	0 (0)	0 (0)	1.00
Don't know	69 (75.8)	64 (70.3)	0.33	69 (81.2)	60 (70.6)	**0.04**

The numbers that are in bold are those with *P* value <0.05.
Values represent the number (%) of women selecting each response.

mindfulness, vaginal estrogen, and complementary medicines) at 1-month follow-up compared with baseline ($P > 0.05$).

DISCUSSION

This study provides a comprehensive evaluation of the first digital resource specifically for women with EM. This study demonstrated small to moderate positive effects of the online resource on women's health-directed behavior and emotional distress and significant reductions in somatic and vasomotor symptoms at 1-month follow-up. Illness perception scores improved for personal control, coherence, and treatment control after viewing the digital resource. Although this effect differed according to time since EM diagnosis. After viewing the website, positive effects were observed in relation to women's knowledge and risk perception regarding EM and therapies.

A 2017 systematic search and review of Web-based interventions related to menopause identified only 18 studies and reported that most were treatment decision support systems with a minority addressing relief of menopausal symptoms and none specific to women with early menopause.[22] Thus, the co-designed comprehensive digital resource evaluated in this study provides a novel online resource directed at the disregarded group of women with EM.

Health education programs, via the principle of individual empowerment, facilitate knowledge increase, change illness perception, and promote behavior change. This can lead to improved health-related QoL, decreased disability, symptomatology and mortality, and ultimate benefits for public health.[8-10] The results of our study are consistent with this proposal and provide evidence in support of the usefulness of this digital resource for women with EM. Our findings are also consistent with a recent systematic review of Web-based patient narratives[13] which indicated positive effects in regard to providing information, engaging, modeling behavior, and emotional support. However, further research is needed with longer follow-up and specified clinical outcomes including those related to cardiovascular and bone health.

The reasons underlying the improvement in somatic and vasomotor symptom scores are unclear but may relate to changes in affect, therapies, and/or health behaviors. Negative affect is associated with increased vasomotor symptoms frequency and symptom reporting;[23] whereas decreased emotional distress, improved personal control, and coherence were observed in response to the digital resource. There was no change in the proportion of women using HT, cognitive behavioral therapy, antidepressants, or complementary medicines. Health behaviors associated with vasomotor symptoms include smoking and, inconsistently, diet and exercise.[23] As observed in a study of an in person or online health promotion program for midlife women, reduction in menopausal symptoms may be associated with improved lifestyle.[24] In our study,

health-directed behavior scores increased at 1-month follow-up; however, details regarding diet and exercise were not collected. This finding requires further exploration.

Systematic reviews demonstrate that illness perception influences health-related behaviors, medication adherence, QoL, clinical outcomes, and use of health services.[19,25,26] Higher perceived personal control (self-efficacy), treatment control, and coherence (understanding) are correlated with better QoL, lower depression and anxiety, and improved clinical outcomes.[19] Thus, the observed sustained increases in BIPQ personal control and coherence, together with the positive changes in health-related empowerment and knowledge, indicate that the digital resource has the potential to positively influence women's lives. Higher BIPQ scores for consequences, emotional representation, and identity which are associated with higher depression and anxiety, lower QoL, and poorer clinical outcome,[19] were observed in women with more recently diagnosed EM. This suggests that the digital resource may be of greatest benefit for women at or shortly after EM diagnosis.

Viewing the digital resource reduced knowledge gaps which can influence health-related behaviors, including medication choice and adherence.[27,28] This is important as current guidelines recommended the use of HT in women with POI/EM until at least the usual age of menopause.[2] After viewing the resource, 22% more women correctly answered the question regarding HT and osteoporosis prevention. Osteoporosis is a common[2] and feared consequence of EM[5] and we have previously demonstrated that greater osteoporosis knowledge is associated with increased self-efficacy and positive health-related behaviors in women with EM.[28] Complementary and alternative medicines (CAM) are commonly used by Australian menopausal women despite a lack of evidence regarding efficacy[29] and, as also observed in the present study, poor consumer knowledge regarding CAM risks.[21] Knowledge and risk perception regarding CAM increased after viewing the resource which may facilitate better therapy choices.

The strengths of this study include the use of a variety of validated tools to prospectively evaluate this novel co-designed online digital resource at two future time points. Study limitations include (i) relatively small sample size which may result in some outcomes measures underpowered to detect significant change; (ii) limited longer term follow-up period of 4 weeks; and (iii) use of self-reported diagnosis of EM. Participants with English literacy, Australian born, a postschool qualification, longer duration since EM diagnosis, and iatrogenic EM were overrepresented limiting the generalizability of our findings. Further engagement with a larger and more diverse group of women with EM would be valuable.

CONCLUSIONS

A co-designed EM digital resource may improve women's health-related empowerment, illness perception, menopause symptoms, risk perception, and knowledge, translating to potential benefits regarding women's QoL and health outcomes. Further research with longer follow-up and larger sample sizes is required to determine the effect of the digital resource on clinical outcomes relevant to QoL, co-morbidities, and public health related to early menopause.

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