Pilot Study

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DWELL: Design for WELLness. A pilot study of an online Facebook intervention to improve perceptions of knowledge, engagement, and self-efficacy in the creation of healthy home environments

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Abstract

Background: Many factors in the environment influence healthy behaviors. Designing user-friendly environments, by changing the way choices are presented in the environment, may result in behavioral changes and promote the well-being.

Objectives: To run a pilot study to evaluate the feasibility and acceptability of DWELL (Design for WELLness), which is an online Facebook intervention to improve perceptions of knowledge, engagement, and self-efficacy in the creation of healthy home environments.

Methods: Both quantitative and qualitative methods were used to evaluate this 7.5-week pilot study. The intervention was conducted during the first wave of COVID-19 lockdown in Israel. Participants answered an online questionnaire at the beginning and end of the pilot. Afterwards, eleven semi-structured telephone interviews were conducted with some of the participants.

Results: There were 36 mothers who participated in the study. The overall DWELL index increased by 15.43 points ($p < 0.001$) from the beginning of the pilot [Mean(SD) = 48.14(17.91)] to the end [Mean(SD) = 63.57(11.98]. There were significant increases in all 5 items of DWELL ($p < 0.05$). Positive feedback was obtained from interviewees about their experience with the program, including being interested with the posts and having a mutual learning experience with other members. The intervention was found to be beneficial to most families during COVID-19 lockdown time.

Conclusions: DWELL was found to be a promising intervention for improving perceptions regarding designing home environments for wellness. These results justified the continuation of the program toward its next phase of the RCT.

Keywords

Environmental home design, pilot study, feasibility and acceptability, wellness, nudging, social media

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Background

Wellness and well-being

Health promotion is a whole-system approach which reflects a holistic vision of well-being.[1] Well-being can be influenced by adopting a healthy lifestyle, which means making healthier choices and creating a better environment.[2] Well-being and wellness deal with the measurement and promotion

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of subjective and physical states.[3,4] In this work, we will use the two terms synonymously.[5,6]

Environmental cues and behavioral change

Many health behavior interventions suffer from limited effectiveness, as they assume that human behavior follows conscious decisions. However, it is hard to change behaviors, as they are mostly habitual and influenced by cues in the environment.[7] Different factors in the environment have the power to influence healthy behaviors. For example, visibility and accessibility of objects, their physical settings, and different qualities such as texture, colors, shapes, temperature, and lightings.[8,9] "Nudge" is a relatively new concept from behavioral economics. It uses the environment to influence behaviors, consciously or unconsciously, by designing the presentation of options, without removing options or changing economic incentive. Hence, designing user-friendly environments may result in behavioral change and promote the well-being.[7,10]

Ways to foster wellness and online communities

Traditional lifestyle modification programs for behavioral change are typically delivered face-to-face by professionals to individuals or small groups. However, this approach is time consuming and expensive.[11] Reaching vulnerable populations and communicating with them effectively is a critical public health challenge.[12] The dramatic increase in technology and online social networks provide innovative and cost-effective ways to potentially deliver programs with personal interaction at the population level. This medium is available 24/7, requires minimal staffing, and has unlimited geographic reach.[11,13,14] The Center for Disease Control and Prevention and the WHO also use social media sites for risk communication.[15]

Social learning to facilitate change

The transition from a structured, traditional learning environment to an informal and flexible one, makes the learners more comfortable and encourages them to adopt materials they perceive useful and easy to apply in their daily lives.[16] The informal environment provides opportunities for collaborative learning, shifting learning strategies towards a more active and group oriented learning approach.[16,17] Different means of engagement, such as skill-building and scenario-based learning, are effective modes of learning to generate change.[18]

Study aims and potential impact

This study was multiphase and aimed to develop, pilot, implement and assess an online Facebook intervention, to improve knowledge, engagement, and self-efficacy in the creation of healthy home environments. The phased system was found effective in development of lifestyle interventions.[19] The current article focused on the pilot study, which was part of a process to develop the intervention program—"DWELL: Design for WELLness." Pilot studies are designed to provide preliminary evidence of efficacy, before conducting a large and more expensive randomized controlled trial (RCT). Assessing the feasibility prior to the main study, and adjusting as necessary, can enhance the likelihood of success. Hence, conducting pilots are an essential prerequisite.[20]

Online interventions are easily accessible and have the potential to reach diverse populations. With limited resources, it is feasible to maintain the long-term sustainability of a Facebook group. As far as we know, there is currently no thriving Facebook group in Israel which functions as an online community, fostering participants' efforts to create a healthy living environment. Furthermore, health interventions on social media, which are backed by experimental designs, are still in their early stages of development and more research is needed to advance our knowledge of this area.[21]

The goal of this pilot study was to evaluate the feasibility and acceptability of the DWELL intervention, as a preliminary stage to the RCT. The program was piloted to evaluate DWELL contents, understand which ones were more useful and to which ones the participants responded better. Also, we aimed to gain experience in managing a Facebook group, and to evaluate how the idea of DWELL was accepted by the target population. If the intervention is found to be effective, it will justify the continuation of this program to a more rigorous RCT. This group has the potential to become a model and serve as a valuable resource for health promotion and lifestyle interventions.

Methods

Objectives

The pilot study had two main objectives to evaluate the feasibility and acceptability of the DWELL intervention:

1. Feasibility: to obtain an estimate of the effect of the intervention:
   (a) Primary: To estimate change in the participants' overall score on the DWELL index (as measured by knowledge and awareness, engagement, and self-efficacy regarding DWELL), in order to design the RCT.
   (b) Secondary: To estimate change in each one of the components of DWELL separately: knowledge and awareness, engagement, and self-efficacy.
   (c) Secondary: To estimate change in the participants' wellness (as measured by the specific items of I COPPE and WHO-5 instruments).

2. Acceptability: To obtain feedback on the intervention (as assessed by Facebook insights and the qualitative assessment).

Trial design, participants, and recruitment

A before and after study design was used for this pilot study intervention. The pilot was conducted in Israel and lasted for 7.5 weeks, from 11 March 2020, through 2 May 2020. Unintentionally, the Facebook group was opened only few days before the educational institutes in Israel were closed (on 15 March 2020) due to the coronavirus (COVID-19) crisis. At that time, the Israeli government instructed citizens to stay home in lockdown. Therefore, the pilot was conducted during the first wave of COVID-19 full or partial lockdown, with educational institutions closed throughout that period.

The study was mostly online and included: (1) Online Google Forms questionnaires at the beginning and end of the pilot; (2) Participation in a Facebook group; and (3) Semi-structured telephonic in-depth interviews (for some of the participants). Assessment combined the insight gained from qualitative methods with a rigorous, generalizable quantitative approach.

Participants' inclusion criteria were Israeli mothers who were at least 18 years old and had children up to 18 years of age (the age of majority in Israel), who were willing to participate in the study and respond to the questionnaires, could read and write Hebrew, and had internet access and a Facebook profile. Mothers were chosen as the target population since mothers in Israel are often responsible for household management and raising the family.[22] Therefore, by addressing mothers, the intervention could be beneficial to the entire family. Also, motherhood is a basis of shared identity that is perceived to be trustworthy.[23] Creating a Facebook group with perceived similarity and enhanced trust between its members can help us increase the cohesion between community members and motivate them to be more engaged in the group. The group's administrator (TAI, the PhD student carrying out this study) is also a mother herself and thus had a shared identity with the participants.

Recruitment for the pilot was mainly via word-of-mouth, in a convenience sampling. Mothers who were eligible to participate according to inclusion criteria and had a previous acquaintance with the PhD student who was carrying out this study, were asked to join and to invite their friends. There were two reasons for the recruitment of mothers with whom there was a previous acquaintance: (1). In Facebook groups, most of the participants are passive users.[24] As the pilot was designed for a relatively small group of women and for a short period of time, previous acquaintance was meant to increase the probabilities that there would be an immediate engagement in the group, which would enable to evaluate all the intervention's contents. (2). This would enhance the chances of getting a reliable and trustworthy feedback from the participants regarding the contents of DWELL. A few mothers with whom there was no previous acquaintance were also recruited, to enable the investigators to get a real-life experience in managing a Facebook group.

Intervention

DWELL was an online Facebook intervention meant to improve perceptions of knowledge, engagement, and self-efficacy in the creation of healthy home environments. The intervention was designed to: (a) provide participants with an accessible and convenient online setting for active and group oriented collaborative learning, in an informal and personalized environment; and (b) motivate participants to enhance their engagement with the DWELL online community through different reinforcements (e.g., providing feedback or tasks, and different modes of delivery such as written materials, photos, or videos). The dynamic platform was meant to enable participants to consume reliable content delivered in enjoyable ways, and to produce content themselves, by chatting with other members within the community, writing posts, uploading pictures and engaging with different aspects of wellness issues.

The intervention addressed multiple components of health behaviors, such as healthy eating, physical activity, tobacco free environment, hygiene, family conversations regarding wellness issues, reduction of stress, etc. Practical ideas regarding designing environments for wellness were given, to handle each one of these behaviors. We defined "design the home environment" as the organization of the internal home surroundings, such as where things are placed, what we see first, what is accessible to us and what is stored out of sight, etc. Designing healthy home environment means modifying the cues within the environment to promote healthy choices. For example, designing the refrigerators so healthy food items will be at eye level, using a sandglass to help children brush their teeth for 2 minutes, exchange recommendations on children's books which promote healthy behaviors to raise family conversations regarding wellness issues, etc. The full overview of the intervention program is presented in Appendix 1. The first posts of the program were introduction, the group admin presented herself and the purpose of the group.

Research stages and data collection methods

Participants were asked to complete two online Google Forms, including a consent form and the study's questionnaire. After submission, they received an invitation to join a private and hidden Facebook group, which is a closed group

hidden from other people on Facebook, except current, invited, and former members.[25] Only those who got the invitation could find the group and join.

Most of the posts for the Facebook group intervention were prepared before the pilot began. As this study followed a community participatory research approach,[12] each one of the posts was re-edited before it was uploaded to the Facebook newsfeed, considering real-time occurrences in the group and the new routine during COVID-19 time.

At the beginning of the pilot, participants were asked to set the group's notification settings to "all posts," ensuring that they would get notifications any time members posted in the group. The group's administrator (the PhD student carrying out this study) posted almost every day, more frequently at the beginning and less intensely toward the end. The participants could enter the group as they pleased, in a time and a place of their convenience. The purpose of the group and a brief description on appropriate behaviors were written in the "about this group" information section.

At the end of the pilot, the participants were asked to fill out the study's questionnaire again, together with open-ended questions for feedback. Afterwards, the PhD student carrying out the study (TAI) interviewed 11 participants via phone, to fully understand their input on the pilot.

Assessment tools

To assess the pilot's objectives, we used quantitative and qualitative methods. For the quantitative measurements, we used three questionnaires: DWELL,[26] I COPPE,[27] and WHO-5.[28] We also used Facebook insights.[29,30] The assessment tools are described in the following sections.

Objectives 1.a and 1.b–DWELL instrument to assess the primary and secondary outcomes

To evaluate DWELL intervention, we developed and validated a new questionnaire.[26] The development and validation of the assessment tool was part of this multiphase study, aimed to develop, pilot, implement, and evaluate an online Facebook intervention for designing the home environment for wellness. As we did not find in the literature any instrument which could help us assess the new concept of DWELL, building an assessment tool was an essential part of the program.

A short 5-item online questionnaire was developed to detect changes in:

1. Knowledge and awareness, in the context of designing a home for a healthy lifestyle, which affects one's wellness.
2. Intellectual engagement: This level of engagement is about "thinking DWELL." Intervention will cause participants to be interested and think about DWELL.
3. Verbal engagement: This level of engagement is about "talking DWELL." Intervention will cause participants to talk about designing their home environment for wellness.
4. Behavioral engagement: This level of engagement is about "doing DWELL." Intervention will cause participants to design their home environment for wellness.
5. Self-efficacy regarding DWELL.

All the questions were on a 0–4 scale, as 0 represented: not at all, and 4 represented: to a very large extant. Thus, the overall DWELL score was on a 0–20 scale. To obtain a percentage score ranging from 0–100, the score was multiplied by 5. A percentage score of 0 represented the lowest level of DWELL, whereas the percentage score of 100 represented the highest level of DWELL.

An online study was conducted to validate the instrument in Hebrew. Validation took place in December 2019 with eligible participants, according to the study's inclusion criteria. There were 613 participants who answered the questionnaire at the first time, and 397 who answered the questionnaire again for the second time two weeks later, for test-retest reliability. Factor analysis and Cronbach's alpha indicated that all 5 DWELL questions load into one single factor (the model explained 61.84% of total variance), and measure a reliable scale of the same construct, with high levels of internal consistency (Cronbach's $\alpha = .85$) at both first and second administrations. Spearman correlations between DWELL first and second administrations of the questionnaire indicated moderate-to-high test-retest reliability (0.55–0.70, $p < 0.001$). DWELL was found to be a valid tool in a population of Israeli mothers and was able to serve as an online measurement instrument in this study. The process of tool validation is described elsewhere.[26]

Objective 1.c–WHO-5 and I COPPE questionnaires to measure the secondary outcome of wellness

1. The 5-item World Health Organization Well-Being Index (WHO-5): A short and generic global rating scale, which is one of the most widely used questionnaires to assess subjective well-being. The WHO-5 questionnaire is claiming high internal consistency. It measures general well-being and emphasizes positive feelings.[3,28] The WHO-5 questionnaire has been translated into over 30 languages and has been used in research all over the world.[28] It was also translated to Hebrew and validated in Hebrew.
2. The relatively new I COPPE Scale: Integrating important aspects of well-being into a single tool: interpersonal, community, occupational, physical, psychological, economic, and overall. The correlations among these factors were found to be meaningful and statistically

significant.[27] We translated the I COPPE questionnaire to Hebrew, and together with DWELL questionnaire validated the I COPPE factors which were relevant to this intervention, and were found to be correlated and statistically significant in preliminary results: interpersonal, physical, psychological and overall well-being.[27]

Objective 2–Facebook insights to measure engagement

We used Facebook insights for evaluation, which is a free tool provided by Facebook, giving group admins engagement analyses within their group.[30]

For the qualitative assessment, we used open-ended questions and semistructured telephonic interviews.

Objective 2–Open-ended questions items and an interview guide to obtain feedback on the intervention

At the end of the second questionnaire administration, participants were asked to answer 7 open-ended questions. The purpose was to fully understand how they felt in the group, what was needed to improve, and whether the group was beneficial during COVID-19 time. After they filled in the questionnaire, 11 participants were interviewed by phone. The semi-structured interviews were in Hebrew and lasted 20–70 minutes each. All interviews were transcribed. This qualitative assessment was made to gather as much information as possible from participants. An interview guide was used as an overall guideline, but participants were encouraged to speak their minds freely and express their thoughts and opinions openly, in an unstructured way. The use of the interview guide in a flexible manner was recommended in a thematic analysis of the literature to develop criteria for telephonic qualitative interviews. The emphasis is on carefully listening to the interviewees and adjusting the interview guide according to the conversation. A natural free-flowing conversation should be loosely guided by the interview guide.[31] A similar qualitative assessment was used in another randomized feasibility study as a novel intervention to reduce children's exposure to secondhand smoke in their homes.[32] A qualitative content analysis was used as a methods for identifies themes in qualitative data.[33] The use of inductive content analysis is recommended when there are no previous studies dealing with the phenomenon or the knowledge is limited.[34] After we had finished with the interviews, the PhD student carrying out this study (TAI) read the transcriptions of the interviews twice. This helped in gaining comprehensive understanding of the content and identifying any initial impressions or ideas. Afterwards, codes were created to represent different concepts found in the data. The codes were later grouped into themes. Afterward, the transcriptions were viewed again to ensure the themes accurately captured the data.

Statistical analyses

All analyses were done using 2-tailed *p*-values. Descriptive statistics are presented for explanatory variables of the pilot sample, and for primary and secondary outcome variables. Socio-demographic variables were measured using questions from validated Hebrew questionnaires.[35] Paired-samples *t*-tests were used to assess differences of means between the beginning and end of study, for primary outcome of overall DWELL index, and also for individual items of wellness: I COPPE and WHO-5 variables. Pearson tests were used to assess correlations between both administrations for the overall DWELL index and for each of the wellness variables. Paired Wilcoxon-rank-sum test was used to examine the differences between the two timepoints for each of the 5 individual variables of DWELL. Independent *t*-tests were used to compare differences of overall DWELL index between participants with whom there was or was not a previous acquaintance with.

Results

Participants

There were 49 participants in the pilot Facebook group (including the group's administrator (TAI) who was carrying out this study). Out of them, a small sample of 36 eligible mothers participated in the study, filled in the questionnaires, and included in the analyses. The other 12 participants were family members and dietitians who were invited to the group but were not part of the study. Out of the 36 participants, 22 (61%) had previous acquaintance with the PhD student who was carrying out this study, and 14 (39%) were friends of friends with no previous acquaintance. Out of these 14 participants, one did not answer the second administration questionnaire (nor was she active in the group). There were 35 participants who answered the questionnaire at the second administration. All were mothers to children up to the age of 18, according to inclusion criteria. A description of the sample is presented in Table 1.

All respondents were Jewish, with mean age 37.26 years, and mean 2.44 children under 18 years old. Most of them were secular (88.6%), married (97.2%), and their mother tongue was Hebrew (94.4%). Most responders (80.5%) lived in the central district (including central (22.2%) and Sharon (58.3%) areas). Most of them attended a university or a community college (94.8%) and had a high income (including above average income (41.2%) and much above average income (14.7%)), as the average monthly gross money income per household defined in the questionnaire was mean NIS 21,000 (around 6000 US $ at the time of the questionnaire administration), according to the Israel Central Bureau of Statistics.[36] Most responders (75%) reported very good health status, said that they had

Table 1. Description of the pilot sample.

Variable	*N*	Mean (SD)	Median	Mode	Range
Age	35	37.26(4.44)	36	34	30–46
No. of children up to 18	36	2.44(0.70)	2.5	3	1–4
Variable				***N***	**Valid percent**
Sex		Female		36	100
Mothers to children up to 18		Yes		36	100
Residence		Northern district		6	16.7
		Central area		8	22.2
		Sharon area		21	58.3
		Shfela area		1	2.8
Ethnicity		Jewish		36	100
Religion		Secular		31	88.6
		Traditional		4	11.4
Family status		Married		35	97.2
		Divorced		1	2.8
Education		Courses		1	2.8
		Academic institute		34	94.8
		Refuse to answer		1	2.8
Mother tongue		Hebrew		34	94.4
		English		1	2.8
		other		1	2.8
SES		Much below average		1	2.9
		Below average		5	14.7
		Average		3	8.8
		Above average		14	41.2
		Much above average		5	14.7
		Refuse to answer		6	17.6
Health status		Very good		27	75.0

(continued)

Table 1. Continued.

Variable	*N*	Mean (SD)	Median	Mode	Range
		Good		8	22.2
		Fair		1	2.8
Smoking status		Never smoked		31	86.1
		Smoked in the past, not today		3	8.3
		Smoking but not everyday		1	2.8
		Smoking everyday		1	2.8
Someone smoked at home in the last month		Never		29	80.6
		Seldom		1	2.8
		About once a week		1	2.8
		Once a day		3	8.3
		A couple of times a day		2	5.6

N: Number; SD: Standard deviation; and SES: Socioeconomic status.

Table 2. Descriptive statistics, Pearson correlation, and paired sample *t*-test for the overall DWELL index at both administrations of the questionnaire.

Time	*N*	Mean (SD)	Median	Mode	Min–Max	*t*-Test *p*-Value	Pearson correlation	Pearson *p*-value
First	36	47.50 (18.07)	47.5	40	10–75	<0.001	0.573	<0.001
Second	35	63.57 (11.98)	65.0	65	35–100			

Time: Time of administration; N: Number; SD: Standard deviation; Min: minimum; and Max: maximum.

never smoked (86.1) and that no one had smoked at their home in the last month (80.6%).

Objective 1.a–Sum of DWELL (Primary outcome)

We built an overall DWELL index ranging from 0 to 100, representing levels of DWELL. The overall DWELL score was normally distributed at both administrations. A paired-samples *t*-test was conducted for the new overall DWELL index to test differences between the first pre-pilot questionnaire administration to the second post-pilot questionnaire administration. DWELL score increased significantly [$t(34) = -6.179$, $p < 0.001$] from the first administration [Mean(SD) = 48.14(17.91), $N = 35$], to the second administration [Mean(SD) = 63.57(11.98), $N = 35$]. Pearson's $r = 0.573$ indicated large effect size.[37,38] Description of the overall DWELL index and result of the paired sample *t*-test, for both the first and second administrations of the questionnaire, is presented in Table 2. Independent *t*-tests were also conducted to test the differences for the overall DWELL index between participants with whom we had a previous acquaintance with [first administration results: mean(SD) = 45.91(16.16), $N = 22$), second administration results: mean(SD) = 63.86(13.45), N = 22)], and participants with whom we did not have a previous acquaintance with [first administration results: mean(SD) = 50.0(21.12), $N = 14$), second administration results: mean(SD) = 63.08(9.47), $N = 13$)]. There were no significant differences between the groups at the beginning of the study ($p = 0.52$) and the end of the study ($p = 0.85$).

Objective 1.b–individual items of DWELL (secondary outcomes)

Paired Wilcoxon-rank-sum test was conducted to test the difference between the two timepoints for each of the 5

individual variables of DWELL (1 knowledge and awareness question; 1 self-efficacy question; and 3 engagement questions on: (a) Intellectual engagement—thinking DWELL, (b) Verbal engagement—talking DWELL, and (c) Behavioral engagement—doing DWELL). Results are presented in Table 3. All 5 items of DWELL were improved significantly at the pilot intervention.

Objective 1.c–wellness (secondary outcomes)

Individual items of I COPPE. Descriptive statistics, Pearson correlations and paired-samples *t*-tests of I COPPE variables (regarding interpersonal, physical, psychological and overall well-being) are presented in Table 4. Data are presented for both administrations of the questionnaire.

Table 3. Descriptive statistics and Wilcoxon tests for DWELL variables at both administrations of the questionnaire

DWELL variables	Time of administration	*N*	Mean (SD)	Median	Mode	Minimum–Maximum	*p*-Value
Knowledge and awareness of DWELL	First	36	2.61 (0.90)	3	3	0–4	0.002
	Second	35	3.14 (0.65)	3	3	2–4	
Thinking DWELL	First	35	1.37 (1.22)	1	1	0–4	0.028
	Second	35	1.91 (0.82)	2	2	0–4	
Talking DWELL	First	36	1.19 (0.95)	1	1	0–3	0.001
	Second	35	1.86 (0.77)	2	2	1–4	
Doing DWELL	First	36	1.58 (1.08)	2	2	0–4	<0.001
	Second	35	2.60 (0.85)	3	3	1–4	
Self-efficacy regarding DWELL	First	36	2.78 (0.83)	3	3	0–4	0.006
	Second	35	3.20 (0.53)	3	3	2–4	

DWELL: Design for WELLness; *N*: Number; and SD: Standard deviation.

Table 4. Descriptive statistics, Pearson correlations, and paired-samples *t*-tests for I COPPE variables at both administrations of the pilot's questionnaire

I COPPE variable	Time	*N*	Mean (SD)	Median	Mode	Min–Max	*t*-test *p*-Value	Pearson correlation	Pearson *p*-value
Overall well-being	First	36	8.14(1.15)	8	8	5–10	0.64	0.52	0.002
	Second	35	8.23(0.97)	8	8	6–10			
Interpersonal well-being	First	36	8.69(1.28)	9	10	6–10	0.18	0.77	<0.001
	Second	35	8.49(1.25)	9	9	5–10			
Physical well-being	First	36	6.89(2.04)	7	9	2–10	0.72	0.73	<0.001
	Second	35	6.94(1.73)	7	7	3–10			
Psychological well-being	First	36	8.03(1.54)	8	9	5–10	0.28	0.74	<0.001
	Second	35	7.80(1.43)	8	8	4–10			

Time: time of administration; *N*: Number; SD: Standard deviation; Min: minimum; and Max: maximum.

Since the variables are on a 10-level scale and the distributions are close to normal, we consider these variables as continuous and not ordinal. In paired-samples *t*-tests, no significant differences were found between the two time-points of questionnaire, for each of the I COPPE variables. Pearson Correlations were found to be moderate-to-strong (ranging between 0.52–0.77 Pearson correlation coefficient), positive and statistically significant $p < 0.01$.

Individual items of WHO-5. Descriptive statistics, Pearson correlations and paired-samples *t*-tests of WHO-5 variables are presented in Table 5. Data are presented for both first and second administrations of the questionnaire.

Variables were on a 6-level scale and most distributions were close to normal at both administrations. WHO-5 variables were analyzed as continuous and also ordinal scales and got similar results. Data are presented for the continuous analyses only. Paired-samples *t*-tests were conducted for each of the WHO-5 variables separately, to test differences between first and second administration. Each of the questions referred to the last two weeks prior to time of administration. Only two out of the five variables were significantly different between the two administrations. The participants felt more fresh and rested at the end of the pilot [Mean(SD) = 2.46(1.27)], compare to the beginning [Mean(SD) = 1.97(1.11), N = 35, and $p = 0.030$]. Also, they felt that their daily life had been less filled with things that interested them [Mean(SD) = 2.31(1.23)], compare to the beginning of the pilot [Mean(SD) = 3.03(1.07), N = 35, and $p = 0.002$].

In Pearson tests, correlations between both administrations for each of the variables were moderate-to-strong (ranging between 0.42 and 0.70 Pearson correlation coefficient), positive and statistically significant $p < 0.01$.

Objective 2–engagement data from Facebook insights

During the 7.5 weeks intervention pilot, there were 52 posts, 820 comments and 1057 reactions at the Facebook group. Data are presented in Figure 1.

Objective 2–pilot's qualitative findings

The participants answered open-ended questions for feedback at the end of the second administration of the questionnaire. A total of 11 participants took part in telephonic interviews following the completion of the pilot study and questionnaire.

Themes and findings. The qualitative assessment of the telephonic interviews revealed several key themes and findings related to the intervention. These findings encompassed the quality and frequency of the posts, the quality of the Facebook group and their engagement within it, the discussions and mutual learning experiences, the fitness of the contents to the study's population, and the impact of

Table 5. Descriptive statistics, Pearson correlations, and paired-samples *t*-tests for WHO-5 variables at both administrations of the pilot's questionnaire

WHO-5 variable	Time	*N*	Mean(SD)	Median	Mode	Min–Max	*t*-test *p*- value	Pearson correlation	Pearson *p*-value
Joyful	First	36	3.19(1.06)	4	4	1–4	0.83	0.70	<0.001
	Second	35	3.20(0.90)	3	4	1–4			
Relaxed	First	35	2.83(1.01)	3	3	1–4	0.70	0.61	<0.001
	Second	35	2.91(0.98)	3	4	1–4			
Vigorous	First	36	2.58(1.11)	3	3	0–4	0.57	0.45	0.006
	Second	35	2.66(1.16)	3	23,4	1–5			
Rested	First	36	1.97(1.11)	2	2	0–4	0.030	0.44	0.008
	Second	35	2.46(1.27)	2	2	0–5			
Interested	First	36	3.03(1.06)	3	3	1–5	0.002	0.42	0.013
	Second	35	2.31(1.23)	2	2	0–5			

WHO: World Health Organization; Time: time of administration; *N*: Number; SD: Standard deviation; Min: minimum; and Max: maximum.

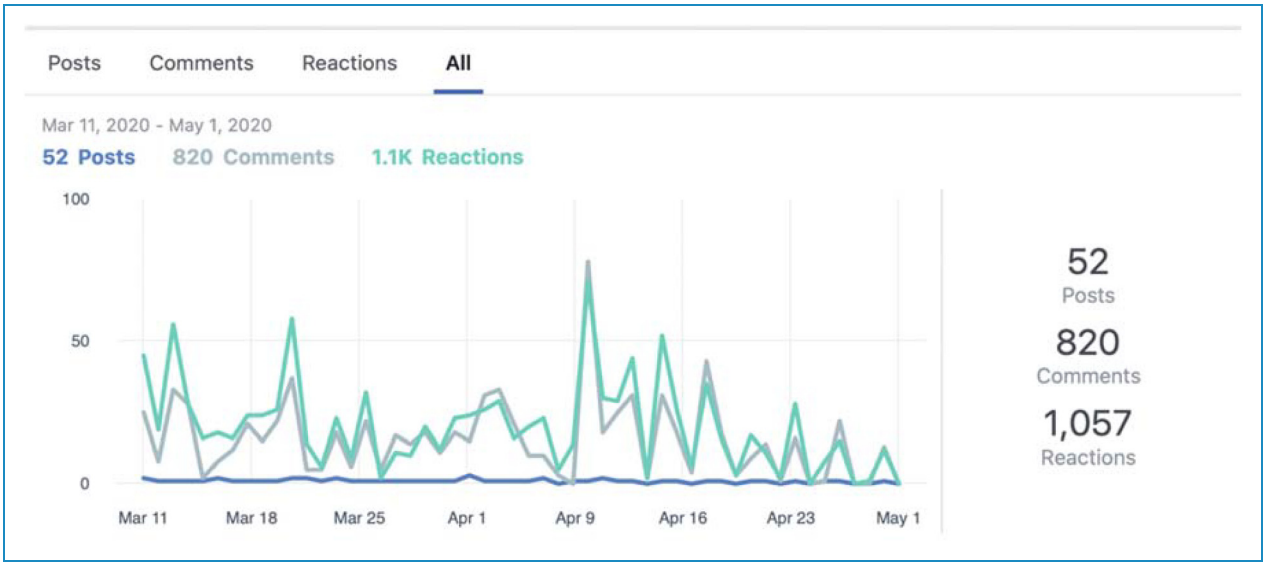

Figure 1. Facebook insights data on engagement in the pilot Facebook group.

participating in the group during the COVID-19 quarantine period.

Quality and frequency of posts. Participants expressed positive views regarding the quality of the posts shared within the Facebook group. They described the posts as well written, easy to read, funny, and interesting, with clear messages. Most of them waited for the posts, wanted to see what would come next. They mostly mentioned the posts regarding ways of serving food and drinks (color, size, and shape of dishes) as the ones which contributed them the most.

Regarding the frequency of the posts (approximately one post per day), most of the participants considered it suitable, enough but not burdensome. A few participants mentioned difficulty in keeping up with all the posts. Only few expressed a preference for even more frequent posts, but not too many.

Quality of the Facebook group and their engagement within it. Most of the participants felt that they had participated in a high-quality Facebook group. They found it to be an enabling and nonjudgmental environment, which encouraged them to be involved. Some of the participants knew each other prior to the pilot, and they were the most active ones. In the interviews, they mentioned that having friends in a Facebook group can encourage you to be more engaged. An important finding which came up in most interviews was that most of the participants did not understand that they were encouraged to upload new posts themselves. Because the Facebook group was presented to them as part of a study, they thought that they were only expected to consume the contents, read, and comment on the posts. They thought that it was not part of the group norms to create and post new contents.

Discussions within the group and mutual learning experiences. The participants expressed enjoyment in reading the discussions that took place within the group. They found value in observing what other participants did in their own homes and learning from their experiences. One participant, for example, said that she had learned from the post in which the participants were asked to upload photos of their refrigerators and comment to each other on how they can arrange it better for DWELL. She said it prompted her to rearrange her own refrigerator after realizing that her fruits and vegetables were not easily visible. She replaced her storage containers with transparent ones, enhancing the visibility of healthy food options.

Fitness of contents to the study population. Only mothers who had children up to the age of 18 years old were recruited to the study. While some mothers to adolescents enjoyed their participation in the group, others perceived the majority of the contents to be more suitable for mothers with young children. Consequently, their interest in the group was somewhat diminished, leading them to read fewer posts and perceive the intervention as less beneficial compared to participants with younger children.

Impact during the COVID-19 quarantine. The pilot was conducted during the time of the first Coronavirus lockdown in Israel, which took place in March-April 2020. Most participants thought that their impression of the group would have been the same if the pilot had been conducted in regular times. Even so, this was a unique time to have an

online intervention dealing with home environment changes for wellness. Some participants said that it was an opportunity for them to make changes since they were home, but it was also a stressful time, and they did not always find the availability to be involved in the group. Most participants said that the group was helpful during this time, when they were home constantly with their families and there was a need to adapt healthy lifestyle habits at home. On the contrary, one participant said that she had enough from home at this time, so she did not want to deal with anything that was related to it.

Discussion

This study was designed to evaluate a new online Facebook intervention named DWELL: Design for WELLness, created to improve perceptions regarding the design of the home environments for wellness. The purpose of this pilot phase was to test the program contents and to experience the management of a Facebook group. Quantitative and qualitative methods were used to gain a rigorous insight into the program and evaluate its feasibility and acceptability as a preliminary phase to a robust RCT intervention.

DWELL Facebook pilot study was found to be a beneficial intervention. This was supported by results of DWELL questionnaire, which was developed and validated in the context of this research,[26] and by the interviews which were conducted with some of the participants at the end of the pilot. The results of the study showed a significant increase in DWELL scores from the beginning to the end of the pilot. The score of each of the 5 questions of DWELL increased significantly ($p<0.05$), and also the study primary outcome – overall DWELL index, ranging on a 0–100 scale – increased significantly by 15.43 points ($p<0.001$). The qualitative interviews provided positive feedback from most of the participants regarding their experiences as being members of the Facebook group. Also, there was a mutual learning experience between members of the group. These results justified the continuation of the program toward its next phase of the RCT.

The intervention in this study addressed the design of the home environment for multiple components of health behaviors, such as healthy eating, tobacco free environment, physical activity, hygiene, family conversations regarding wellness issues, reduction of stress, etc. Most studies on unhealthy risk factors examine the factors in isolation, but some look at combinations of risks.[39] The presence of multiple risk behaviors has been shown to have an additive or synergistic negative effect on health, as most individuals engage in multiple unhealthy lifestyle behaviors.[40] While most of the nudging interventions we found in the public health literature dealt with one component of healthy behaviors,[7,41–47] health promotion interventions which simultaneously target to improve multiple risk behaviors could have a greater impact on individuals health, compared to interventions which targeted single risk behaviors.[40]

This study also assessed the well-being of the participants as a secondary outcome. As opposed to the improvement, we found in DWELL scores, we did not find an improvement in the reported well-being of the participants. For lifestyle interventions, as per the Health Belief Model,[48] behavioral change comes prior to the target outcome which concerns health status.[49] In the I COPPE questionnaire,[27] the interpersonal, psychological, physical and overall well-being of the participants were evaluated, and no significant change from the beginning to the end of the pilot were found in any of the variables ($p>0.05$). In the WHO-5 questionnaire,[3,28] there was no significant change in the participant reports on their spirits, calmness, and active mood, but at the end of the pilot they reported to feel more fresh and rested ($p=0.030$) and less interested in their daily life ($p=0.002$). The WHO-5 questionnaire referred to well-being in the last two weeks prior to time of administration. The participants answered the first questionnaires administration between March 4–11, 2020. Soon after that time, educational institutions in Israel were closed due to COVID-19 (closed fully on March 14, 2020), and lockdown began (partly on March 19, and fully on March 25). The participants answered the second questionnaire administration between 2 and 5 May 2020. It was just before the educational institutions were opened again fully on 14 May 2020, and during the time of releasing the restrictions on the economy. Thus, the WHO-5 questionnaire referred to the participants' well-being in a unique time.

At the end of the first lockdown, the participants reported feeling significantly fresher and more rested when they woke up in the morning. This result might have been biased from being in a lockdown, as they probably did not need to get up early, drive to work, drive their children, look for afternoon and weekends activities, etc. They also reported that their daily life had been significantly less filled with things that interested them. This was probably because they worked less than usual and had less time for themselves, doing things that interested them.

Conducting the DWELL pilot intervention during COVID-19 lockdown had some benefits: First, during COVID-19, many people around the world remained at home more frequently than usual. Thus, a program to design the home environment for wellness, to the benefit of the whole family, was more relevant than ever. Moreover, since mothers spent more time at home, it was an opportunity for them to implement ideas. Second, quarantine is associated with negative psychological and physical effects.[50–52] DWELL contents were aimed to help participants stay healthy while home, as in eating well, stay active at home, reduce level of stress, preserve hygiene, etc. Third, the intervention was online, enabling the participants to consume contents without exposing

themselves to unnecessary risks. At the time of this writing, though most countries have dispensed with COVID-19-related restrictions, people may be remaining at home and working at home more frequently than previously. Also, it is possible that people may stay home more in the future due to COVID-19 or other emerging viral threats. Therefore, it is possible that the ideas in this project will be even more relevant in the future than in previous times.

Implications from the pilot for the next step of the study: the RCT

An important conclusion we learned from the pilot concerned the inclusion criteria. In order to succeed in creating a shared sense of belonging and a community identity, it is preferred to create a Facebook group with as much perceived similarity between its members as possible.[16,23,53] In the pilot study, we received feedback from mothers to adolescents which felt that the contents in the group were less relevant to them, and more suited for mothers with younger children. While the concept of DWELL is suitable for families with children of all ages, parents of teenagers deal with different issues than do parents of young children. Also, the teenagers are more independent and spend less time at home with their families. Thus, they may need an intervention with contents tailored specifically for them. Creating a DWELL intervention for mothers with adolescents is a further topic which should be investigated. This pilot study demonstrated that it is preferable to be more specific in the inclusion criteria. Thus, recruitment for the RCT will be only of mothers who have children up to 10 years old. We believe that it would help the RCT's participants to consume contents which are more relevant and beneficial to them and will help them to feel more as part of a coherent group.

Another implication concerned to the participants' level of engagement. The Facebook group in the pilot was very active, considering it contained only small group of participants and lasted for a relatively short period of time. Yet, most participants did not understand that they were encouraged to upload new posts themselves. This important issue needs to be addressed in the RCT. There should be a clear message in the future Facebook intervention group, encouraging the participants to be more active users, if they wish to.

Limitations

This was a small pilot study, designed to test the feasibility and acceptability of a new intervention program, before continuing to the next phase of the study, the RCT. Participants in the pilot study were found to be a non-representative population to the Israeli society, with higher socio-economic status, higher education, central areas residence, etc. In the next stage of the study, the RCT, we will advertise the study in Facebook groups with more diverse populations (according to the study's inclusion criteria). It is still possible that the study population will not be representative of the overall population, since as we know from literature, education and health status influence participation in studies.[54] Disadvantaged populations are usually less responsive to participate in research studies.[55]

Other limitations of the study were related to the effects the COVID-19 lockdown had on the participants. Firstly, this study examined the perceptions of the participants regarding their wellness, as a secondary outcome, during the time of lockdown. Being in a lockdown the entire duration of the intervention had probably affected the participants' wellness, and it might have biased the study results. Secondly, being in a lockdown had probably influenced the participants capability to participate in the Facebook group. While some participants may find this group to be beneficial in this particular time, and they even had more time to participate while they were home, others who needed to continue working as usual, while taking care of the children as the educational institutions were closed, were unable to find a time to participate in the group as they had wished to when they signed up.

Another limitation was related to the fact that some of the participants knew each other previously to the study, and it had encouraged them to feel more comfortable and be more engaged in the Facebook group. In the RCT, recruitment will be of participants who may not know other participants in the group. We do not know how it will affect their engagement in the group.

A final limitation was that the Facebook group and the questionnaires were in Hebrew. A future study can test this intervention in other populations, as the Israeli Arabs.

Conclusions

DWELL was found to be a promising Facebook intervention to improve perceptions of knowledge, engagement, and self-efficacy in the creation of healthy home environments.

This study used both quantitative and qualitative methods. The results from this small-scale pilot study justified the continuation of this program to the next phase of the study, the RCT. The intervention was also found to be beneficial to most families during COVID-19 lockdown. It helped them to be engaged with the idea of organizing their home for wellness, in a time when they needed it the most. An online intervention, focusing on home, family, and wellness, is found to be beneficial during emerging viral threats.

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Appendix

Appendix 1. An overview of the intervention program

Post number	Objectives	Contents	Format
1	Instructions	Turn on notifications to "all posts"	An explanation and a photo
2	Create welcoming environment	Introduction, purpose of the group	An explanation and a question
3	Create a sense of community and belonging	Introduction, self-presentation, purpose of the group	A personal story
4	Theory to understand DWELL and the need for this group	Research information People are driven by instincts	A question and an answer
5	Theory to understand DWELL and the need for this group	Research information Design environment is inevitable and influences our decisions	A poll
6	Theory to understand DWELL and the need for this group	Research information Design environment is inevitable and influences our decisions	A question and an answer
7	Theory to understand DWELL and the need for this group	Research information People stick with default choices	A question and an answer
8	A summary of theory (posts 4–7) From theory to practice	Repeating important messages and conclusions	Questions and answers
9	Share knowledge	A recommendation for DWELL to encourage hygiene	A picture
10	Share knowledge	A recommendation for DWELL to encourage physical activity	A YouTube video
11	Share knowledge, create openness, and sharing	Family conversations about wellness	A personal story
12	Share knowledge, create engagement, and raise awareness of DWELL	Research information regarding smoking at balconies	A picture and a question
13	Raise awareness to wellness, identify resistances	Wellness	A poll
14	Create engagement, raise self-efficacy	A challenge	Take and upload a picture
15	Create engagement, encourage hygiene	DWELL to encourage hand washing by a conversation	A selfie video of an experiment
16	Share knowledge, create engagement	Research information	A text and questions
17	Share knowledge, create engagement	Research information A recommendation for DWELL to encourage healthy eating habits	A poll

(continued)

Appendix 1. Continued.

Post number	Objectives	Contents	Format
18	Create engagement, encourage participants to share content with their young children	Family conversations about wellness	A rhyme and a question
19	Share knowledge, create engagement	DWELL to prevent third-hand smoking	A text and questions
20	Share knowledge, create engagement	Recommendations on children's books to raise family conversations regarding wellness	A personal story and questions
21	Share knowledge, create engagement	A recommendation for DWELL to encourage 2 minute brushing teeth	A picture and a selfie photo
22	Share knowledge, create engagement	A recommendation for DWELL to increase wellbeing and reduce stress	A text and a YouTube song
23	Create engagement, raise self-efficacy	A challenge	Take and upload a picture, comment to others
24	Create engagement	Raise interest toward physical health	A question
25	Share knowledge	A recommendation for DWELL to encourage physical and mental health	A video and an explanation
26	Share knowledge	A recommendation for DWELL to encourage physical health	A video and an explanation
27	Create engagement	DWELL for stress management	questions
28	Create engagement, encourage participants to share content with their young children	Family conversations about healthy food	A rhyme
29	Share ideas, create engagement	A recommendation for DWELL to encourage physical activity	A selfie photo
30	Share knowledge, create engagement and sharing	A recommendation for DWELL to encourage healthy eating habits	A personal story
31	Share ideas, create engagement	A recommendation for DWELL to encourage healthy eating	A personal story and pictures
32	Share knowledge, create engagement	Research information A recommendation for DWELL to encourage healthy eating habits	A poll
33	Create engagement and a sense of community, share ideas	Ideas for inside activities; encourage physical activity and enhance interpersonal wellbeing	Questions
34	Share knowledge, create engagement	Research information	A question

(continued)

Appendix 1. Continued.

Post number	Objectives	Contents	Format
		A recommendation for DWELL to encourage healthy eating habits	
35	Share knowledge, create engagement	A recommendation for DWELL to encourage healthy eating habits	A personal story and pictures
36	Create engagement, share ideas	A recommendation for DWELL to encourage sun-proofing	Ask for ideas
37	Create engagement	A recommendation for DWELL to encourage good behaviors and family conversations	Text and pictures
38	Create engagement	Encourage them to bring DWELL solutions for corona masks storage at home	A question
39	Create engagement, share ideas	A recommendation for DWELL to encourage good sleep	A question
40	Thank you for participating		A text and a GIF
41	The questionnaire	DWELL, I COPPE, and WHO-5 questionnaire + open questions for feedback	A text and a link to an online questionnaire