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Research Article

Evaluation of an online cardiometabolic and weight loss program: a mixed methods study

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Abstract

Risk factors contributing to cardiovascular diseases (CVD) can be addressed through behavior modification, including changes in diet and physical activity. In 2021, The Wellness Institute (WI), located at Seven Oaks General Hospital, created a virtual cardiometabolic risk reduction program in response to COVID-19 pandemic public health restrictions, encompassing virtual health coaching and lifestyle education. The objective was to evaluate the acceptability, adherence, efficacy, and engagement of the WI online cardiometabolic and weight loss program. The study followed a mixed methods quasi-experimental design. A total of 93 participants enrolled. Quantitative measures including anthropometrics, blood chemistry, and lifestyle were assessed for changes via paired *t* tests at baseline and 16 weeks. Qualitatively, short answer questionnaires and three focus groups were completed to understand participants' experiences and program acceptability. We combined qualitative and quantitative data for analysis. Seventy-three participants (64 females, 87.7%) completed the final study visit (age 58 ± 11 years, weight 98 ± 20.9 kg). Of those, 98% attended all coaching sessions, would recommend the program, and reported the coaching sessions helped them stay motivated. A reduction in weight (5 ± 9 kg, $p < 0.001$), systolic blood pressure (6 ± 10 mmHg, $p < 0.001$), and diastolic blood pressure (4 ± 8 mmHg, $p < 0.001$) were observed. Lifestyle factors also improved, including increases in physical activity ($p < 0.05$). Most participants adhered to the program and found it acceptable. Completion was associated with an improvement in weight and blood pressure. These findings highlight the potential of virtual programming to contribute to improving lifestyle and health. Clinicaltrials.gov (ID# NCT04784624CT).

Key words: cardiometabolic, exercise, online health, digital health, behavioral change, qualitative research

Introduction

Cardiovascular diseases represent a significant health challenge in Canada, with nine out of ten Canadians having one or more risk factors associated with these conditions (Heart and Stroke Foundation of Canada n.d.-*a*). As the second leading cause of death in Canada, cardiovascular disease represents a critical public health concern. It is also the most financially burdensome, with direct and indirect costs totaling 21.2 billion dollars annually (Heart and Stroke Foundation of Canada n.d.-*b*; Smith 2006). Key factors such as high blood pressure, high cholesterol, type 2 diabetes, obesity, and smoking increase the risk of developing cardiovascular disease.

The risk factors contributing to cardiovascular diseases are on the rise, including obesity, type 2 diabetes, hypertension, and elevated lipid profiles (Petrie et al. 2018). Many of these risk factors are modifiable through appropriate changes in lifestyle behavior, including dietary habits, physical activity, stress management, and sleep hygiene. Chronic stress and poor sleep can exacerbate cardiovascular risks by contributing to high blood pressure and inflammation, further highlighting the importance of a holistic approach and management (Miller and Howarth 2023). Tackling obesity plays a pivotal role in chronic disease prevention and management reducing both the prevalence and severity of type 2 diabetes and hyperlipidemia.

To address these challenges, the Wellness Institute (WI) in Winnipeg, Manitoba, plays a pivotal role. As a certified medical fitness facility owned and operated by Seven Oaks General Hospital, WI offers comprehensive programs for chronic disease prevention and management. Programs offered include a medical weight loss clinic: a 6-month lifestyle

program with physician oversight, one-on-one health coaching, nutritional guidance with a registered dietitian, and counselling with a cognitive behavioural therapist. In 2020, as a result of the COVID-19 pandemic, public health measures imposed severely restricted access to recreational and wellness-related services, either through reduced capacity allotments or facility closure (Erickson 2020). To help navigate lifestyle disruptions and the possible adverse cardiometabolic health effects of the pandemic restrictions, the WI launched a newly developed virtual cardiometabolic risk reduction program in 2021. The program included virtual face-to-face health coaching, nutrition and mindful eating education, physical activity programming, and health education. This study employs a mixed methods approach to evaluate the effectiveness of the online cardiometabolic risk reduction program offered by the WI. The evaluation focused on three key objectives: (1) assessing program acceptability and adherence, (2) measuring its efficacy in promoting healthy lifestyle changes, and (3) evaluating participant engagement.

Methods

Research design

Between March 2021 and May 2022, we performed a prospective mixed methods study, which involved collecting both quantitative and qualitative indicators of the success of the online WI program and integrating these data into a more complete understanding of the outcomes achieved (Wannamethee et al. 2005). This study was conducted in accordance with the Declaration of Helsinki and received approval from the Manitoba Research Ethics Board (Ethics # HS24424 (H2020:495)). It was registered on Clinicaltrials.gov (ID# NCT04784624CT).

Cardiometabolic and weight loss program

The WI online Cardiometabolic and Weight Loss Program was a comprehensive 16-week virtual program designed to help individuals who are overweight or obese and at risk for or living with cardiometabolic conditions, such as prediabetes, diabetes, hypertension, and high cholesterol. This program focusesd on achieving healthy weight reduction and reducing cardiometabolic risk through lifestyle interventions and motivational interviewing principles, drawing from components of WI's clinically managed weight loss program (Cachero et al. 2023).

Delivered via a digital platform powered by artificial intelligence and supported by health coaches, the program begins with a detailed health risk assessment and the creation of a personalized wellness plan. This plan is tailored using WI's algorithms, which take into account users' health risk assessments, biometric data, readiness for change, interests, fitness levels, and personal health goals. Participants receive a customized exercise plan and nutrition strategy, which integrates with their own health tracking apps and devices for monitoring progress. Participants are paired with a health coach at the beginning of the program. Once per month, they meet with their health coach via video call or phone call to discuss their progress, address barriers they have been facing, and have the opportunity to ask questions about their program. Participants can also contact their health coach at any time throughout the program utilizing the chat function in the digital platform.

The program uses advanced algorithms to deliver personalized content, including interactive education modules (health library) and recommended habits related to diet, exercise, sleep, stress management, smoking cessation, alcohol consumption, and overall self-care. Each week, the program introduces a new focus area—such as getting active, nutrition, goal setting, and problem-solving skills—with lessons designed to take approximately 15 min. Users also engage in weekly exercise sessions supported by a library of workouts and on-demand WI exercise classes covering strength, balance, flexibility, and cardio.

Rather than prescribing specific meal plans, the program employs lessons, food tracking, and four health coaching sessions to develop a personalized nutrition strategy. This approach emphasizes making healthier food choices over calorie counting, promoting long-term health and sustainability.

Throughout the program, algorithms adjust daily and weekly goals based on the user's condition, health data, and engagement with the platform. A feedback loop of messaging recognizes goal achievements and encourages ongoing participation. Progress is tracked through self-reporting and remote biometric data capture.

Following the initial 16-week intervention, participants can transition to a maintenance phase that can last up to one year. During this phase, users regularly check in with their personal health coach, who provides expert advice, support, and accountability while helping them overcome obstacles and establish new, healthy behaviors.

Participants

Participants were enrolled directly from the online program. The program enrolled individuals over the age of 18 years who were overweight or obese (body mass index (BMI) > 25 kg/m^2) and had tried to lose weight in the past but had been unsuccessful. People who were pregnant or lactating were not eligible for the program. Participants were approached by a research team member to gauge their interest in the evaluation. After providing informed consent, they received a discounted program fee of $199 (regular price $399) as reimbursement for their participation and received $70 remuneration for the completion of the end of study visit.

Procedures

Participants were scheduled to meet with the coordinator virtually at the beginning (visit 1) and end of the program (visit 2). The coordinator demonstrated and provided instructions on how to do all measures, and a blood pressure machine and scale were couriered to participants homes/work addresses. Weight and blood pressure were self-measured during the virtual study visits. Height was self-reported by participants. Participants were also asked to complete questionnaires about physical activity levels, sleep, stress, and a 3-day diet recall before the visits. Lab requisitions were

provided for various clinical chemistry measurements (blood lipids, fasting glucose, insulin, HbA1C). Participants were instructed to arrive fasted 10–12 h for these tests. The only in-person interaction during the study was with a certified phlebotomist at a Shared Health facility. All blood draws followed COVID-19 guidelines for blood collection at the time. Additionally, within the last week of the program, an additional exit questionnaire was also completed before the visit. All participants enrolled in the cardiometabolic risk reduction program were invited to participate in focus groups. Informed consent was obtained before participating. These focus groups aimed to gather feedback on the program's overall design and acceptability. Conducted virtually via Microsoft Teams, each session lasted approximately 90 min and each included 3–5 participants. A trained patient engagement facilitator led the discussions, with a research coordinator also present. A discussion guide was used for the main questions (semi-structured question guides with probing questions included when necessary) with no field notes being taken. Focus groups were audio recorded and transcribed verbatim with all names and identifying information removed. Participants only attended one focus group each and did not receive the transcripts for review.

Outcomes

For objective 1, the acceptability of the new WI online program was evaluated by inviting all program participants to complete a mixed-method exit questionnaire involving 17 close-ended questions and 7 open-ended questions designed to survey participants' experiences and perceptions of the program. Additionally, participants were invited to participate in a virtual focus group discussion to investigate their experience in the program further. Questions included their favorite and least favorite parts of the virtual program, how the program has impacted their health, and whether they found the platform easy or hard to use. The quantitative results and qualitative findings on program acceptability were then compared and combined to obtain a more complete understanding of how well study participants received the new program and the extent to which the program helped them reach their health goals through positive lifestyle changes (Fig. 1). Incorporating qualitative data helped illuminate and contextualize the experiences of program participants and complemented the quantitative data on program acceptability and adherence (Creswell and Plano Clark 2011). Adherence was evaluated by recording health coaching sessions and activity attendance during weeks 12–16 of the program. Participants were considered to have adhered to the program if they attended at least 3 out of 4 health coaching sessions and participated in at least 1 activity during the final 4 weeks (weeks 12–18).

For objective 2, the efficacy of the WI program was assessed by measuring changes in lifestyle behaviours and risk factors for chronic disease from the beginning of the program to the end (Supplemental Material). This was done following a quasi-experimental, pre-post repeated measures design. Lifestyle measures: physical activity (International Physical Activity Questionnaires Long and Short (IPAQ-L and IPAQ-S) and wearable device data), diet (ASA24 3 days food recall, mindful eating, and three-factor questionnaires), sleep (Pittsburgh sleep quality index questionnaire), and stress (perceived stress questionnaire (PSQ)). Clinical chemistry: total cholesterol, high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), triglycerides, total cholesterol/HDL ratio, fasting glucose, insulin, and hemoglobin A1C. Clinical characteristics: weight, BMI, blood pressure, and change in medication. Cardiovascular Assessment: A cardiovascular risk assessment based on age, HDL-C, total cholesterol, systolic blood pressure, smoking status, and diabetes status was done to determine the participant's 10-year risk of cardiovascular disease and identification of metabolic syndrome (Wannamethee et al. 2005). All measurements were conducted at the beginning and end of the study.

For the third objective, engagement was assessed by the proportion of workbook steps completed, the average number of activities engaged in per week, and the number of times per week health library material was reviewed at the end of the 16-week program.

Quantitative statistical analysis

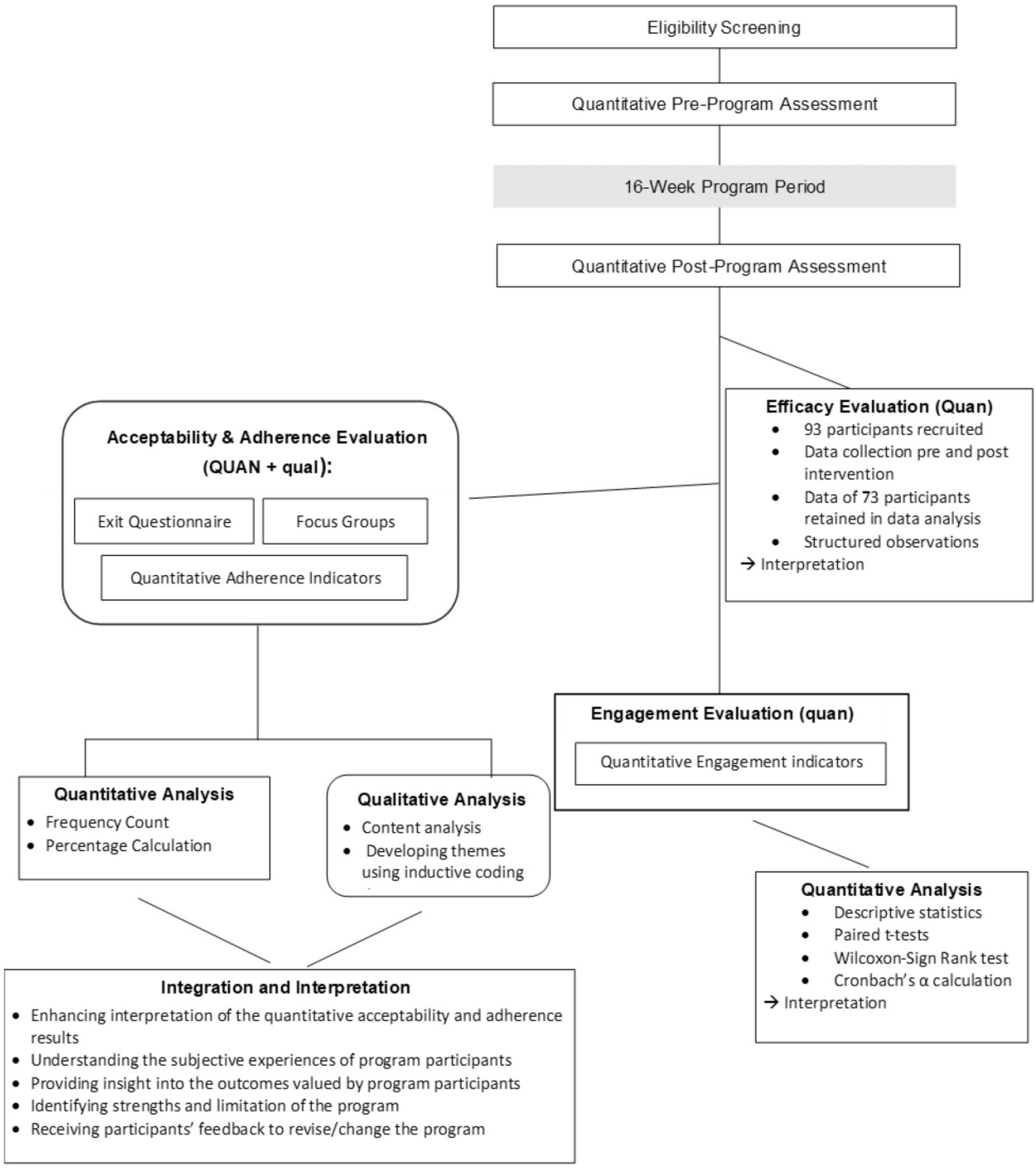
Quantitative data were analyzed using SAS software, version 9.4 (SAS 9.4, Cary, NC. SAS Institute Inc.). We reported continuous baseline data and outcomes with mean and standard deviation (SD), or median and interquartile range (IQR) as appropriate. Changes in study outcomes at visits (from visit 1 to visit 2) were analyzed using the paired t test for parametric data, and the corresponding examination of the nonparametric data was performed utilizing the Wilcoxon-Sign Rank test. We reported categorical baseline data and outcomes with frequencies and proportions, and comparisons from visit 1 to visit 2 were conducted using the z test. A p-value of <0.05 was considered statistically significant.

Qualitative content analysis

All narrative data (including the exit interview answers and focus group transcripts) were analyzed using conventional qualitative content analysis (CA). Conventional qualitative CA is a pragmatic and flexible inductive approach to analyzing textual data that is strictly descriptive and uses both manifest and latent inferences to understand a phenomenon (Sandelowski 2000; Leung and Chung 2019). This approach is used when limited research or theory exists about the phenomenon.

The conventional qualitative CA process implemented here involved assigning codes to label key thoughts or ideas expressed by study participants (Hsieh and Shannon 2005). Related codes were then grouped into meaningful categories, and initial categories helped organize subsequent codes into meaningful patterns or themes by two separate reviewers. Code frequency was central to this analytical process as it was considered a core marker of relevance (Zhang and Wildemuth 2009). This analytic process provided a comprehensive picture of the phenomenon being investigated through new insights exclusively grounded in the data (Hsieh and Shannon 2005; Leung and Chung 2019).

Fig. 1. Diagram of the mixed methods evaluation study.

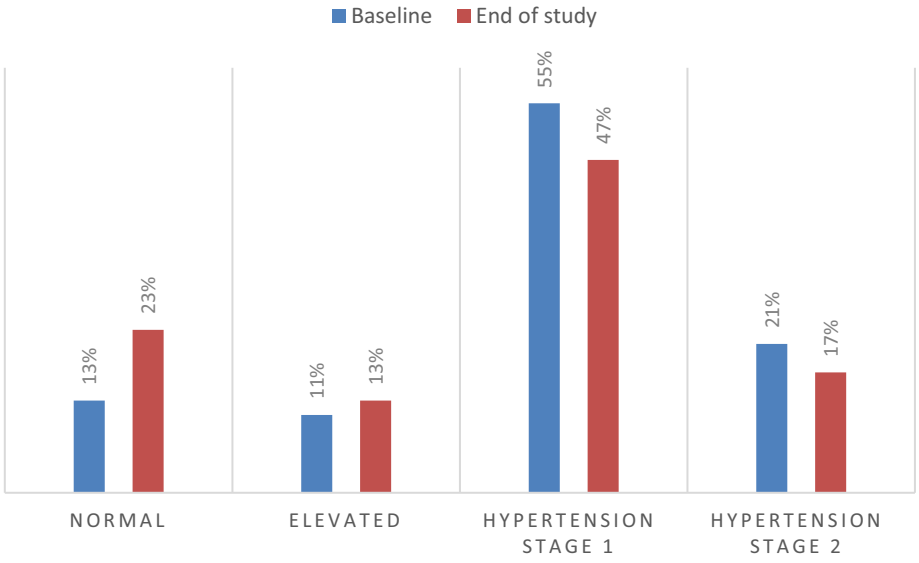


Results

Participants

A total of 95 people consented to the evaluation study. Of these, 93 completed the first visit, and 73 completed the final study visit (completers) (Fig. 2). In total, 20 participants dropped out of both the cardiometabolic program and the evaluation study (noncompleters), while 1 dropped out of the evaluation but continued participating in the program. The reasons for dropout included 9 participants who stopped responding (lost to follow-up) and 11 who withdrew voluntarily for personal reasons. Thus, 73 participants were included in our quantitative analysis, with only those who had initial and final measurements for each of the variables included in each comparison. At study entry, mean age was 56.5 (±11.5) years, and 82% were females. Completers were older (58.6 years (±10.8) vs 52.4 years (±13.2), p-value = 0.25, and had a higher baseline BMI (37.1 (±16.2) vs 34.2 (±7.1) kg/m^2, p-value < 0.001) as well as a higher HbA1c (5.8 (±0.9) vs 6.2 (±1.7) mmol/L, p-value < 0.01)

Fig. 2. Blood pressure changes: following the ACC/AHA hypertension guidelines blood pressure (BP) categories.



compared to those who did not complete (non-completers) (Table 1).

Program acceptability and adherence

The results of the mixed methods questionnaire used to evaluate program acceptability are presented below; when available, quantitative results are accompanied by relevant quotes. Participants in the program had various health-related goals. These goals included weight loss, reducing blood pressure and cholesterol, increasing physical activity, improving dietary habits, and promoting healthy aging. Participants sought external guidance and internal motivation to develop sustainable, healthy lifestyle habits. Overall, participants achieved these goals successfully, with a mean score of 6.7 out of 10. Additionally, 87% felt they gained knowledge/skills/confidence during the program, as reported in the exit questionnaire.

> *"This program helped me to build a healthy lifestyle. I'm now tracking my foods; that helps a lot. Exercising more, I have a trainer who helps. But I'm doing more on my own too. The information was very good. I've tried to incorporate it in my daily living. Overall very satisfied."*

Most participants (64%) reported using the platform two times per week or more, while 36% reported using it only once a week or less. The mean total score for how easy it was to use the program was 4 (maximum mean score of 5). Challenges encountered when using the program included a lack of clear scheduling information about the day and time of group sessions; the large amount of information required to use some of the tracking; the inability to change reminders/notifications; and the video-chat function not working.

> *"I think for myself it took a while to figure it out. Initially I just didn't have a clue, but once I got used to it and figured out how to navigate it then it seemed…I think pretty straightforward. I don't know how…again I wouldn't know what kind of improvements could be made. Maybe for the notifications, when those group meetings were…-maybe if there was something else there because really, truly would've attended more if I had a proper notification."*

The most helpful parts of the program according to participants were the health coach and motivational messages, bloodwork, and health library/educational modules.

> *"For me it was the visits with the health coach and motivation and suggestions she gave you."*

> *"The coaching sessions. It was helpful to have someone to talk to about how I'm doing in the plan and ask questions to."*

> *"Having the ability to read and think about the workbooks at my own pace."*

The least helpful parts of the program were the group sessions and physical activity trackers.

> *"The group coaching sessions were least helpful. Unfortunately, I was unable to experience them as the times they were available was not I time I could attend."*

> *"The offer of group sessions that didn't fit my schedule. I wasn't able to integrate into the learning community, "trackers (very difficult to use)."*

Most participants were either satisfied (55.71%) or somewhat satisfied (25.71%) with the quality of the program. About 70% of the participants rated the program's overall quality as satisfactory or very satisfactory. The mean score of participants who would recommend this service to a friend or family member was 7.5 out of 10.

Most participants (98%) completed at least 3 out of the 4 coaching sessions and logged activity during weeks 12 to 16 of the program. One year after program initiation, 61 (83%) participants were still using the app. Participants completed 90% of the workbooks offered through the program. Of the 20 who did not complete the evaluation: 14 completed at least 3

Table 1. Baseline demographics.*

	Initial visit cohort	Completed the study	Did not complete the study	*p*-value
Age (years)	$N = 93$ 56.5 ± 11.48	$N = 73$ 57.58 ± 10.84	$N = 20$ 52.37 ± 13.15	0.25
Biological sex (female)	76 (81.72%)	64 (87.67%)	12 (60%)	0.005
Systolic blood pressure	$N = 92$ 133.73 ± 13.99	$N = 72$ 134.16 ± 14.10	$N = 19$ 132.08 ± 13.77	0.96
Diastolic blood pressure	$N = 91$ 80.99 ± 10.21	$N = 72$ 80.36 ± 10.78	$N = 19$ 83.37 ± 7.43	0.08
Heart rate	$N = 91$ 73.27 ± 11.63	$N = 72$ 72.53 ± 11.41	$N = 19$ 76.06 ± 12.32	0.62
Weight (kg)	$N = 93$ 98 ± 20.61	$N = 73$ 98.27 ± 20.90	$N = 20$ 97 ± 19.99	0.86
Height (cm)	$N = 92$ 166.51 ± 11.70	$N = 72$ 165.89 ± 12.49	$N = 20$ 168.75 ± 8.16	0.04
BMI	$N = 92$ 36.43 ± 14.72	$N = 72$ 37.06 ± 16.20	$N = 20$ 34.17 ± 7.09	<0.001
Framingham	$N = 85$ 11.04 ± 5.41	$N = 69$ 11.04 ± 5.17	$N = 16$ 11 ± 6.51	0.20
Total cholesterol	$N = 88$ 5.10 ± 1.10	$N = 71$ 5.14 ± 1.12	$N = 17$ 4.90 ± 1.05	0.81
HDL	$N = 88$ 1.37 ± 0.33	$N = 71$ 1.41 ± 0.32	$N = 17$ 1.21 ± 0.31	0.87
LDL	$N = 85$ 2.99 ± 0.91	$N = 69$ 3.02 ± 0.91	$N = 16$ 2.87 ± 0.89	0.98
Triglycerides	$N = 88$ 1.65 ± 1.01	$N = 71$ 1.57 ± 0.93	$N = 17$ 1.99 ± 1.25	0.09
HbA1c	$N = 87$ 5.89 ± 1.12	$N = 70$ 5.81 ± 0.94	$N = 17$ 6.19 ± 1.67	<0.01
Comorbidities at baseline				
Dyslipidemia	21 (24.71%)	17 (23.29%)	4 (20%)	0.98
Hypertension	37 (43.53%)	30 (41.10%)	7 (35%)	0.98
Smoking (currently)	1 (1.19%)	1 (1.37%)	0	0.63
Diabetes	13 (15.29%)	9 (12.33%)	4 (20%)	0.23
Heart disease	3 (3.53%)	3 (4.35%)	0	0.40
Pacemaker, implantable cardiac defibrillator, or rhythm disturbance	2 (2.35%)	2 (2.74%)	0	0.49
Chronic kidney disease	1 (1.188%)	1 (1.37%)	0	0.63
Rheumatoid	6 (7.06%)	6 (8.22%)	0	0.22
Joint, back, or neck pain or immobility	20 (23.81%)	15 (20.55%)	5 (25%)	0.34

Notes: HbA1C, hemoglobin A1C; HDL, high-density lipoprotein; LDL, low-density lipoprotein; SD, standard deviation.
*$N = 95$

coaching sessions and of those 6 completed the program but did not complete the study.

Focus groups. Overall, all the participants felt the program was beneficial and had positive effects on their health (n = 11; 100%), including lowering blood pressure and weight, improving cholesterol and triglycerides, and increasing strength. They also described improvements in health-enhancing habits such as dietary choices, increased physical activity and mindfulness activities. Participants attributed their success to the individualized and personalized coaching, baseline and end-of-program blood testing and the program's sufficient duration to establish new habits.

"And I think the program held me accountable and I need that. The fact that (health coach) was going to be talking to me in a couple of weeks…kept me on track, yep. That component is important, not just watching the tracking yourself but having someone come back at you." FG2 Female Speaker 2

Challenges experienced by participants related to the technical aspects of the application (n = 7, 64%) including not receiving clear scheduling information about the group sessions, the amount of information input required to use some of the health tracking features, the inability to change reminders/notifications, and the video-chat function not working. Study participants were almost evenly divided between those who rated the health tracking features as their favourite portion of the program and those who rated them as their least favourite aspect of the program. Some participants felt the trackers kept them on track, reminding them

Table 2. Mixed methods findings integration.

Acceptability indicator	QUAN—exit interview	QUAL—focus group
Platform use	The platform was easy to use 56 Agree (95%)	*"On the whole I thought it was a great platform." FG2 Female speaker 2* *"For the most part I found the platform easy to use and it kind of jogged my memory. It's like "oh yeah my sleep, got to enter that". So it's like what did I have for lunch? And then I'd enter that. So that was good." FG2 Female speaker 1* *"I found the platform easy to use, I just had technical issues with my own phone sort of thing. But yeah, the platform was great." FG3 Female speaker 2*
Coaching sessions	Coaching Sessions helped participants stay motivated and achieve their goals 44 agree (80%)	*"I really liked the coach aspect of it, it was nice for someone to check in. It just made it a bit more human." FG3 Female speaker 1* *"Shayla [health coach] always had good suggestions and when I came to her with what my barrier was she always offered me a solution that worked for me. Just very grateful for that coaching." FG3 Female speaker 3*
Wellness tracker	The wellness tracker was useful 32 agree (56%)	*"But I liked the exercise [tracker] as it would sync with my phone, so I like it all, yeah." FG2 Female speaker 1* *"I had trouble with the fitness tracker, I found it hard to navigate." FG3 Female speaker 3*
Health goals	I was successful in reaching my goals 41 agree (75%)	*" I actually lost just over 15 pounds. My goal was 20 so I'm almost there." FG1 Female speaker 2* *"And then for positive changes, my bloodwork showed an improvement so that's good. Before I had some elevated bloodwork so now it's all in the normal range." FG3 Female speaker 1*
Gaining knowledge, skills, and confidence during the program	I gain knowledge, skills and confidence during the program 47 agree (87%)	*" I think the mindfulness section really helped me. I'm a single parent and it can be hard, as well with finances. Just earlier this month my son's father passed unexpectedly. Just knowing to take that time for myself, breathe through it, focus on the things that I can or learn to control the things that I can type thing has really benefitted." FG1 Female speaker 2* *"…but it's been a very positive impact. And a life-sustaining impact, I'm not denying anything, I'm not doing anything I can't "oh I'll just do it for this month, but then-" no, I'm hopefully it's been months and we're doing things we can sustain." FG1 Female speaker 4*

daily to enforce the new knowledge from the program, such as the diet or weight tracker. Some participants mentioned having difficulties syncing the fitness tracker and having to manually enter their activity into the platform, which became cumbersome. Some physical activity performed was not an option in the fitness tracker. Fitness trackers were not provided to participants and were optional for the study. Participants also had the option to sync their own fitness tracker to the online platform if they owned one. Type/models of fitness trackers varied from participant.

"No, the meal one was my favourite because that's what I wanted to work on the most. But I liked the exercise as it would sync with my phone, so I like it all, yeah" FG3 Female speaker 1

"I didn't like the way that tracking worked. And I didn't like the way the sleep tracker worked either because it said when you went to bed or when you wake up, well I go to sleep right away but I wake up four times during the night and that wasn't accommodated." FG2 Female speaker2

"If I used a tracker I'd have to that too, the only thing it took was my steps. So, I think more integration with other technology like Fitbit, which is very popular, would go a long way. I was entering things 3 times a day from my Fitbit to the app, from my app…so it just became…." FG1 Female speaker 2

"Actually, the weight tracker I found really good too, as everyone is saying we go up and down and I found that good because I can get a picture of where I was and where I had been. Yeah, sometimes it goes up and sometimes it goes down and it was really a good tracker I thought." FG1 Female speaker 3

Mixed methods integration. Study participants indicated the platform was easy to use and helpful, noting that the coaching sessions played a key role in helping them stay motivated and achieve the health-related goals they set out at the beginning of the program. Participants also listed the coaching sessions as the best component of the program. Participants shared that they gained knowledge, skills, and confidence through the program and were able to reach their health-related goals. Participants also mentioned they gained certain knowledge and skills that they will be able to use in the future to sustain their long-term lifestyle progress and maintain the health-related goals they reached or reach more advanced ones. Interestingly, a mix of positive and negative feedback was provided by study participants on the health trackers. While participants liked the trackers and found them valuable and easy to use, while others did not like them because they found them hard to use (Table 2).

Efficacy evaluation

Of 71 participants, 62 (87%) had SBP $>$ 120 mm Hg or DBP $>$ 80 mm Hg and the rest (n = 9) had BP in the normal range (11) (Fig. 2). Significant reduction in both SBP and DBP by −5.8 mmHg (95% CI: −8.30, −3.39; p-value $<$ 0.001) and −3.8 mmHg (95% CI: −5.67, −1.86; p-value $<$ 0.001), respectively, were found among completers over 16 weeks, as shown in Table 3. Participants lost an average of 5 kg (95%

Table 3. Clinical, anthropometric, and biochemical features of the study's participants at the initiation of the study and after 16 weeks.

Characteristic	Baseline $n = 73$	End of study-16 weeks	p-value
Age (years)	57.58 ± 10.84		
Weight (kg)	98.27 ± 20.90	93.87 ± 20.7	<0.01
BMI	37.1 ± 16.2	35.4 ± 15.7	<0.001
Systolic blood pressure	134.05 ± 14.22	128.52 ± 12.97	<0.01
Diastolic blood pressure	80.36 ± 10.78	76.63 ± 9.53	<0.01
Heart rate	72.53 ± 11.41	70.90 ± 9.76	0.04
Framingham	11.04 ± 5.17	10.73 ± 5.30	0.92
Low (<10%)	26 (37.68%)	19 (37.25%)	
Intermediate (10%–19%)	41 (59.42%)	30 (58.82%)	
High (>20%)	2 (2.90%)	2 (3.92%)	
Total cholesterol	5.14 ± 1.12	5.27 ± 1.14	0.03
HDL	1.41 ± 0.32	1.43 ± 0.38	0.78
LDL	3.02 ± 0.91	3.01 ± 0.93	0.77
Triglycerides	1.57 ± 0.93	1.70 ± 1.04	0.03
Total cholesterol/HDL ratio	3.68 ± 1.23	3.86 ± 1.09	0.02
Fasting glucose	5.75 ± 1.51	5.68 ± 1.56	0.60
Insulin	128.14 ± 95.34	129.28 ± 93.43	0.68
HbA1c	5.81 ± 0.94	5.77 ± 0.86	0.37

Note: HbA1C, hemoglobin A1C; HDL, high-density lipoprotein; LDL, low-density lipoprotein; SD, standard deviation.

CI: −6.74, −2.55; p-value < 0.001) of body weight over the 16 weeks of the program. This resulted in a decrease in BMI for both males and females of 1 unit (95% CI: −1.85, −0.29; p-value = 0.01) and 2 units (95% CI: −2.78, −0.97; p-value < 0.001), respectively (Table 3). At week 16, triglyceride levels and total cholesterol/HDL ratio levels were significantly higher (p-value 0.03 and 0.02, respectively). There were no significant changes in total cholesterol, HDL, LDL, fasting glucose, insulin, and HbA1c.

Eating behaviors

Eating behavior at the beginning and end of the program was assessed using TFEQ-R18. After the end of the 16 weeks, the mean score for the TFEQ decreased from 42.2 to 40.6 (mean difference −1.92; 95% CI: 8–6-12.1, p-value 0.11). Participants' dietary behavior improved over the 16 weeks. For the restrained eating behavior (conscious restriction of food intake to control body weight or to promote weight loss), it was increased after the program (mean difference 1.50, 95% CI: 0.68, 2.32; p-value 0.0005). The second factor evaluated, uncontrolled eating behavior (tendency to eat more than usual due to a loss of control over intake accompanied by subjective feelings of hunger), decreased from a mean of 20 to a mean of 16 (p-value = 0.0071) with 37% of participants with a mean value ≥20 at the end of the program versus 58% before the program. Likewise, emotional eating (inability to resist emotional cues) had a decrease (mean difference −1.15; 95% CI: −1.72, −0.57; p-value < 0.01).

At the end of the program, the mean MEQ score was 2.21 ± 0.34. The mindful eating subscales of mindful eating ranged between 2.19 and 2.84, with the highest score noted in the mindful eating subscale MEQ external (2.84 ± 0.57). Of the MEQ scores, changes were noted for the overall (mean difference −0.21; 95% CI: −0.28, −0.13; p-value < 0.01), awareness (mean difference −0.19; 95% CI: −0.31, −0.07; p-value < 0.01), disinhibition (mean difference −0.36; 95% CI: −0.47, −0.24; p-value < 0.01), and emotional response (mean difference −0.36; 95% CI: −0.50, −0.22; p-value < 0.01). At baseline, participants reported 178 kcals higher energy intake than after 16 weeks (p = 0.04). Likewise, consumption of carbohydrates was higher at baseline (mean 195.8 g ± 79) than at 16 weeks (mean 171 g ± 5) (p-value for mean difference 0.02). Consumption of protein, total fat, and dietary fibre did not change.

Physical activity

The IPAQ-S showed participants increased their MET-Vigorous activity (mean difference 264.9; 95% CI: 2.83, 526.3; p-value = 0.047), MET walking (mean difference 204.3; 95% CI: 8.6, 400; p-value = 0.04), and MET total (mean difference 549.7; 95% CI: 94.02, 1005.5; p-value = 0.02) with physical activity increasing during their leisure time following the program compared to the initial assessment (mean difference 396.4; 95% CI: 190.2, 602.7, p-value < 0.01).

Sleep quality and stress

Results from the PSQI showed a significant improvement in sleep quality (mean difference −1.36; 95% CI: −2.17, −0.56; p-value < 0.01). The mean PSQI single-component scores showed significant difference between the end of the study questionnaire and the initial visit questionnaire, with an improvement in the areas of sleep quality (mean difference −0.22; 95% CI: −0.37, −0.07; p-value < 0.01), sleep

duration (mean difference −0.26; 95% CI: −0.43, −0.09; p-value < 0.01), and sleep disturbances (mean difference −0.20; 95% CI: −0.35, −0.06; p-value < 0.01).

There were no changes in the PSQI in the study (mean difference—+0.03; 95% CI: −0.07, 0.01; p-value = 0.15). All eating behaviors, physical activity, sleep quality, and stress results can be found in the Supplemental Material.

Engagement evaluation

Among the study participants, the number of interactions and activities within the application remained fairly stable during the first 3 weeks after the program began, but there was a decrease in activity at week 5. From week 5 until week 13, there was an average of 178 (±199) activities logged (Supplemental Material Fig. 1). The mean number of completed workbook content step activities was 111 (±62). However, by week 7, participants recorded the lowest mean number of completed workbook content steps per week (20.7 ± 8.1). After that point, there was a gradual increase in completion, reaching (85.3 ± 82.5) by week 15. At week 1 and 6, the participants had the highest mean number of interactions viewing the health library (25.0 ± 17.0 at week 1 and 25.9 ± 24.8 at week 6). The mean interactions per week during the 16 weeks of viewing the health library was 16.9 ± 15.4 per week. During the 16 weeks, the five most common activities in the application were: (1) "Complete workbook content step"; (2) "Track "Steps"—streak"; (3) "View Message"; (4) "Track "Walking"—streak"; and (5) "Track "Physical Activity"—streak". The five most common activities reported in the platform in the last 4 weeks of the study were "Track "Steps"—streak", "Complete workbook content step", "Track "Walking"—streak", "View Message", and "Track "Physical Activity"—streak". Participants completed 90% of the workbooks. Workbooks included sleep, stress, smoking, diet, and physical activity information.

Discussion

In this prospective study of individuals who completed the WI online cardiometabolic and weight loss program, we found that participants were pleased with the program's quality and found the platform easy to use. With a high completion and satisfaction rate, this level of adherence and acceptability indicates the program was well received and maintained participants' motivation. Over the 16-week program, body weight and blood pressure were reduced, and lifestyle measures improved. These improvements are consistent with the program's intended goals and demonstrate effectiveness.

Participants highlighted the key role the health coach played in their success in the program, providing enthusiasm, acceptance, creative solutions for success, encouragement, accountability, and the "human touch". Most participants (87%) felt they gained knowledge/skills/confidence during the program and made lasting lifestyle changes. Although the application was an acceptable tool and served its purpose for most, some technical aspects (e.g., health tracking) were problematic. Some participants wished they could meet more frequently with the health coaches and enjoyed the support. It is important to note that this was when many people were locked down and living in isolation during the COVID-19 pandemic and may be a result of overall reduced human connection at the time.

A major challenge for lifestyle and weight loss programs is the high risk of participants dropping out. However, our program demonstrated a notable level of adherence. Specifically, 98% of participants who completed the evaluation attended at least 3 out of 4 coaching sessions and logged their activity during the final 4 weeks. Additionally, participants completed 90% of the workbooks offered in the program. Among the 20 participants who did not complete the program, 14 still managed to attend at least 3 coaching sessions. This data confirms our participants' high level of engagement and motivation. Furthermore, our retention rates in this program exceeded other lifestyle programs. Programs focused on weight loss have reported dropout rates of 56%–69.5% (Moroshko and Brennan 2011; Perna et al. 2018). These findings suggest programs offered virtually may have higher retention. Our findings are congruent with a broad body of research conducted in various programs and encompassing the pre-pandemic, pandemic, and post-pandemic eras (Moore et al. 2008; Morgan et al. 2009; Moroshko and Brennan 2011; Greene et al. 2012; Svensson et al. 2014; Frederix et al. 2015; Perna et al. 2018; Desai et al. 2021; Braun et al. 2022; Rababah and Al-Hammouri 2022; Dhaver et al. 2023).

Our evaluation identified a statistically and clinically significant reduction in blood pressure. An average of 6 mmHg reduced systolic blood pressure and diastolic was reduced by 4 mmHg. Following the ACC/AHA hypertension guidelines blood pressure (BP) categories, there was an increase in the proportion of participants in the normotensive category and a decrease in participants in the hypertensive Stage 1 and Stage 2 categories. This result is similar to that of the 2008 DASH study, a 12-month internet-based nutrition education program, which observed a similar decrease in systolic blood pressure (6.8 mmHg) among participants engaged in a 12-month virtual weight loss program (Moore et al. 2008). Other virtual studies, such as the 2021 SHRED-IT virtual weight loss program and 2021 WHY-WAIT multidisciplinary hybrid model weight loss program, also reported decreases in blood pressure, although the changes were not statistically insignificant (Morgan et al. 2009; Dhaver et al. 2023).

Participants lost an average of 5 kg of body weight, with BMI decreasing by 1.19 for males and 1.74 for females. These results are consistent with those from the DASH, SHED-IT, WHY-WAIT, and CO-NRPC studies, which reported weight loss of 4.2 lbs, 5.3 kg, 8.2 kg, and 4.79 kg, respectively (Moore et al. 2008; Morgan et al. 2009; Dhaver et al. 2023). Interestingly, the Why-WAIT program found significant reductions in HbA1c in 56 participants after 12 weeks, while our program only showed a minimal average reduction. These findings highlight the feasibility and effectiveness of virtual lifestyle and weight loss programs. Our program incorporated individualized health plans and regular meetings with trained health coaches to ensure participants remained on track with their goals.

Study participants had an improved diet after 16 weeks. The WI program increased restrained eating behavior and

decreased uncontrolled and emotional eating, as assessed by the TFEQ-R18. These findings parallel those from a 2014 web-based study of 620 participants, noting increases in restrained eating behaviors and decreases in uncontrolled eating behaviors over six months (Svensson et al. 2014). In support of this, another study found that virtual counseling reduced uncontrolled and emotional eating, though restrained eating did not improve (Rababah and Al-Hammouri 2022). Conversely, a study assessing web-based lifestyle modification and self-compassion reported improvements in dietary disinhibition behaviors only after 6 and 9 months (Braun et al. 2022). Our study observed a significant increase over 16 weeks in physical activity, aligning with findings from other studies, including one involving 1689 participants over 15 months and another with 77 participants engaged in an internet-delivered physical activity program for nine weeks (Greene et al. 2012; Frederix, et al. 2015).

Sleep quality, duration, and reduction in sleep disturbances improved among our study's participants over 16 weeks. Interestingly, while improvements in sleep behavior were noted, there was no improvement in reducing stress through the program. Other programs conducted during the COVID-19 pandemic and in a non-pandemic setting have reported significant improvements in both sleep and stress through online programming (Morgan et al. 2009; Okazaki et al. 2014; Nuss et al. 2022). These findings highlight the potential of virtual interventions in promoting healthier eating behaviors and physical activity and offer insights for future program design and implementation.

Strengths and limitations

This study exhibits several strengths. Data were collected from an ongoing and existing program, ensuring the availability of rich and real-world data. The study was deliberately designed to be a virtual research initiative, enabling it to continue during the challenging COVID-19 pandemic and adhering to pandemic guidelines. Blood pressure and body weight were measured while meeting with the coordinator virtually, allowing the coordinator to observe and record the measures. Additionally, the study employed a mixed-method study design, allowing the quantitative results to be supported by qualitative insights. Comparing the quantitative results of the exit interview with the focus group findings helped generate more robust conclusions on the program's acceptability.

There were limitations in this study, including the absence of a control group. The number of participants recruited was based on program capacity and the number of participants who chose to enroll in both the program and evaluation study. Additionally, the drop-out rate of 22% is significant enough that it may contribute to attrition bias when interpreting the results. However, the differences in baseline characteristics between those who completed the study compared to those who did not were small, and therefore the drop-out rate did not likely affect the generalizability of our findings. Lifestyle factors, including diet, physical activity, sleep, and stress, were based on self-reported data. Lastly, participants completed questionnaires and 24 h diet recalls independently, which could have led to data inaccuracies or incomplete responses. However, participants were encouraged to contact the coordinator if they had any questions to reduce the likelihood of this happening.

Conclusion

In conclusion, this evaluation demonstrated the effectiveness of the WI virtual program delivered through a digital platform in enhancing lifestyle and health. Our findings reaffirm the potential of these types of programs to provide accessible and effective services and support a wide range of community members' needs. The versatility of digital platforms allows for their integration into hybrid models or as supplementary tools for in-person programming.

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Data availability

Deidentified data described in the manuscript, code book, and analytic code will be made available upon request pending application to and approval of the corresponding author.

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Competing interests

The authors declare there are no competing interests.

Supplementary material

Supplementary data are available with the article at https://doi.org/10.1139/apnm-2024-0190.

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