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Original Article

Effectiveness of an Education Intervention Among Cardiac Rehabilitation Patients in Canada: A Multi-Site Study

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ABSTRACT

Background: Although patient education is considered a core component of cardiac rehabilitation (CR) programs, to our knowledge, no educational program designed for CR has been standardized in Canada. This absence of standardization may be due to a lack of reliable resources to educate these patients. The objective of this study was to assess the effectiveness of an education intervention in

RÉSUMÉ

Contexte : Bien que l'éducation du patient soit considérée comme un élément essentiel des programmes de réadaptation cardiaque (RC), il n'existe, à notre connaissance, aucun programme éducatif standardisé en RC au Canada. Cette absence de standardisation peut être attribuable à un manque de ressources fiables en matière d'éducation des patients. Cette étude visait à évaluer l'efficacité réelle d'une

Cardiovascular diseases are among the leading burdens of disease and disability worldwide[1] and in Canada.[2] Cardiac rehabilitation (CR) is an outpatient secondary prevention care model designed to mitigate this burden through comprehensive delivery of secondary prevention strategies.[3,4] These strategies will lead to optimum health outcomes if patients are able to understand and adhere to multiple healthy behaviour, including being physically active, eating a healthy diet, stopping smoking, and adhering to their medication prescription.[5-9] A systematic review demonstrated that educational interventions tailored to patients with coronary artery disease (CAD) can increase their disease-related knowledge and improve self-management behaviours.[8] In addition, findings from meta-analysis also demonstrated the effectiveness of patient education in patients with CAD for behaviour change,[10-12] health-related quality of life,[13] and recurrence of acute events.[10]

Unfortunately, Canada has insufficient capacity to manage all patients with cardiac indications, with one of the reasons being that many CR programs are under-resourced,[14] and thus do not have the capacity to offer comprehensive CR.[15,16] No educational program has been standardized for CR patients in Canada to our knowledge, although patient education is considered a core component of these programs.[6]

Our research group has developed and pilot tested an evidence- and theoretically based comprehensive education intervention[17] that incorporates the use of manuals, patient-oriented didactics, online tools, and a small-group format.[18] This intervention has been tested in a low- and middle-income setting and was shown to improve clinical outcomes,[19] change healthy behaviours,[20] increase disease-related knowledge,[20] and decrease morbidity,[21] with maintenance of gains 1 year after CR. Accordingly, the objective of this study was to assess the effectiveness of an education intervention in improving knowledge and health behaviours among CR patients in 3 sites in Canada.

Material and Methods

Design and procedure

This study was a prospective longitudinal study in design, with assessments undertaken pre- and post-CR. Ethics approval

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Ethics Statement: The research reported has adhered to the relevant ethical guidelines.

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improving knowledge and health behaviours among CR patients in 3 sites in Canada.

Methods: CR patients were exposed to an evidence- and theoretically based comprehensive education intervention. Patients completed surveys assessing knowledge, physical activity, food intake, self-efficacy, and health literacy. All outcomes were assessed pre- and post-CR. Paired *t* tests were used to investigate variable changes between pre- and post-CR, Pearson correlation coefficients were used to determine the association between knowledge and behaviours, and linear regression models were computed to investigate differences in overall post-CR knowledge based on participant characteristics.

Results: A total of 252 patients consented to participate, of whom 158 (63.0%) completed post-CR assessments. There was a significant improvement in patients' overall knowledge pre- to post-CR, as well as in exercise, food intake, and self-efficacy ($P < 0.05$). Results showed a significant positive correlation between post-CR knowledge and food intake ($r = 0.203$; $P = 0.01$), self-efficacy ($r = 0.201$; $P = 0.01$), and health literacy ($r = 0.241$; $P = 0.002$). Education level (unstandardized beta $= -2.511$; $P = 0.04$) and pre-CR knowledge (unstandardized beta $= 0.433$; $P < 0.001$) were influential in changing post-CR knowledge.

Conclusion: In this first-ever multi-site study focusing on patient education for CR patients in Canada, the benefits of an education intervention have been supported.

intervention éducative au regard de l'amélioration des connaissances et des comportements touchant la santé chez des patients en RC dans trois établissements au Canada.

Méthodologie : Une intervention éducative globale fondée sur des données probantes et théoriques a été menée auprès de patients en RC. Les patients ont répondu à des questionnaires d'évaluation des connaissances, de l'activité physique, de l'apport alimentaire, de l'autoefficacité et de la littératie en matière de santé. Tous les résultats ont été évalués avant et après la RC. Des tests *t* pour échantillons appariés ont été utilisés pour étudier les changements touchant les variables évaluées avant et après la RC, des coefficients de corrélation de Pearson ont servi à déterminer l'association entre les connaissances et les comportements, et des modèles de régression linéaire ont été calculés pour étudier les différences dans les connaissances globales après la RC en fonction des caractéristiques des participants.

Résultats : Au total, 252 patients ont accepté de participer; de ce nombre, 158 (63,0 %) ont pris part aux évaluations postérieures à la RC. Les connaissances globales des patients se sont améliorées de façon significative d'avant à après la RC, tout comme l'activité physique, l'apport alimentaire et l'autoefficacité ($p < 0,05$). Les résultats ont montré une corrélation positive significative entre les connaissances et l'apport alimentaire ($r = 0,203$; $p = 0,01$), l'autoefficacité ($r = 0,201$; $p = 0,01$) et la littératie en matière de santé ($r = 0,241$; $p = 0,002$) après la RC. Le niveau d'éducation ($B = -2,511$; $p = 0,04$) et les connaissances avant la RC ($B = 0,433$; $p < 0,001$) ont influé sur les changements touchant les connaissances après la RC.

Conclusion : Cette toute première étude multicentrique axée sur l'éducation des patients en RC au Canada a permis de confirmer les avantages d'une intervention éducative.

was obtained from the review board of all 3 hospitals where CR programs were located. Data were collected between September 2017 and October 2019.

This study was conducted in 3 CR programs in Canada: the UHN-TRI Cardiovascular Prevention and Rehabilitation Program (Toronto, ON), the Programme PREV Prévention Secondaire et Réadaptation Cardiovasculaire (Lévis, QC), and the Réseau de santé Vitalité Health Network, Programme Cœur en santé/Cardiac Wellness Program (Moncton, NB). The duration of the programs varied from 3 to 6 months.

Patients were informed about the study during their first assessments in each centre by a staff member, asking for permission to have the recruiter approach them to discuss the study. They were also provided with information to take home and consider if desired. Consenting patients were invited to complete a self-administered survey in paper format (pre-CR survey) and wear a pedometer for 7 days. The survey included sociodemographic items and psychometrically validated scales to assess knowledge and health behaviours. Clinical data were extracted from electronic patient records.

At the end of the CR program, patients were approached to complete the post-CR survey. The survey assessed knowledge and health behaviours as per the initial survey, as well as patient satisfaction with the education received. Electronic patient records were reviewed to ascertain degree of CR participation and completion.

Education intervention

CR participants in all 3 sites were offered weekly supervised exercise classes for 12 to 24 weeks and provided a home exercise prescription for the other days of the week. The variability of the number of sessions was due to the characteristics of each program (ie, the way they are structured, the capacity, and the resources).

The education provided is called "Cardiac College,"[18] which is part of Health e-University, a virtual institute to improve health literacy, and self-management. The colleges of Health e-University are focused on the management and prevention of specific chronic diseases, being designed for patients and their caregivers. Cardiac College is a patient education intervention that assembles best practices and an evidence-based program for patients in our community and globally. The program specifically aims to help people treat cardiac disease, get active, eat healthy, feel well, and take control of their health. Cardiac College is delivered mainly through 2 main tools: a website and a patient guide. The development of this education program involved a multidisciplinary team of healthcare providers and patient partners, as described previously.[18] The patient guide, entitled "A Guide to Help You Live and Thrive with Cardiovascular Disease," is written in plain language and has 22 chapters.

Participants of this study received education through the Cardiac College, which was standardized (ie, educational materials and topics were the same) but adapted to meet the

characteristics of each site. Therefore, duration and number of education sessions varied between sites. Education was delivered by an interdisciplinary team of healthcare providers from each program. Topics covered included treating heart disease, getting active, healthy eating, emotional well-being, and taking control, and were delivered in large and small group sessions, lectures, a patient guide, and online videos. Materials were available in English and French. Supplemental Table S1 presents a description of the education intervention delivered in each site.

Participants

This study included CR patients (with a diagnosed heart disease) recruited from 3 CR programs in Canada. The exclusion criteria were lack of English or French language proficiency, and any visual, cognitive, or psychiatric condition that would preclude the participant from completing the surveys.

At present, there are no reports of reliable effect sizes for CR interventions aiming at the improvement of knowledge through educational interventions. Therefore, sample size was based on conservative calculations with an expected small to moderate effect size ($d = 0.25$), a statistical power of 0.95, and a 1-sided alpha of 0.025. A total sample size of $n = 50$ at each site was shown to be necessary to gain significant results. Calculations were made with GPower 3.1 using the following parameters: F-test, analysis of variance repeated measures, within factors, number of groups = 1, number of measurements = 3, correlation among repeated measures = 0.5, and nonsphericity correction $\varepsilon = 0.99$. By anticipating a 60% retention rate based on previous studies,[17,22] a minimum of 84 participants were required to achieve a final sample size of 50 per site. Patients were approached consecutively until the required sample size was achieved.

Measures

Clinical characteristics extracted from medical records included CR referral indication and cardiac risk factors. Patients self-reported their sociodemographic characteristics, which included ethnicity, highest educational attainment, and family income. Knowledge, physical activity, food intake, self-efficacy, and health literacy were assessed pre- and post-CR. Post-CR, all participants completed a satisfaction survey, which included 10 Likert-type, yes/no, and open-ended questions.

Knowledge was assessed using the short version of the Coronary Artery Disease Education Questionnaire,[23] which is designed to be a true/false/I don't know questionnaire, with 20 items, 4 in each domain as follows: medical condition, risk factors, exercise, nutrition, and psychosocial risk. Each correct answer equals to 1 point; therefore, the maximum score possible is 20 overall, 4 by domain and 1 per item.[23]

Physical activity was assessed by the number of steps per day using the PiezoRx device (StepsCount, Ontario, Canada). Participants were asked to wear this device on their hip for 7 days (preferably 7 consecutive days before CR intake) pre- and at post-test from the time of waking up to the time of going to bed. They were provided a log to record their daily total number of steps. The PiezoRx, which is a uniaxial accelerometer-based physical activity monitor developed for researchers and physicians that uses step rate thresholds to measure intensity related physical activity, has been shown to be valid and reliable in different groups, including adults.[24] Mean steps per day was computed, with 7500 considered commensurate with guideline recommendations for 150 minutes/week in populations with chronic disease.[25]

Food intake was assessed by the self-administered version of the Mediterranean Diet Score tool, which consists of 13 questions on food consumption frequency and food intake habits considered characteristic of the Mediterranean diet.[26] The final score ranges from 0 to 13, and the scoring categories range from ≤ 5 (low adherence to Mediterranean diet) to ≥ 10 (high adherence to Mediterranean diet).

Self-efficacy was assessed using the Bandura's exercise self-efficacy scale. This tool measures exercise self-efficacy using an 18-item exercise self-efficacy scale developed by Bandura,[27,28] which has been shown to be a useful measure of exercise beliefs in adults with chronic diseases.[29] Bandura's original statement asked participants to rate how certain they were that they could get themselves to perform their exercise routine regularly (≥ 3 times per week) for a range of conditions. This was modified to reflect current guidelines of physical activity on most days of the week.[30,31] A plain language expert reviewed the tool, and the scale was changed to ask patients "How confident are you that you can exercise most days of the week?" and included a 5-point Likert scale ranging from 1 = not confident at all to 5 = very confident. These changes were made with the consent of the original author.

Health literacy was measured using the Medical Term Recognition Test[32] and the Newest Vital Sign.[33] The Medical Term Recognition Test consists of 40 medical terms and 30 nonwords. Respondents are instructed to mark which words they recognize as actual words. Scores are based on the number of "true hits" or actual medical terms the respondent correctly identified, and can range from 0 to 40. Three score ranges, consisting of 0 to 20, 21 to 34, and 35 to 40, indicate low, marginal, and functional health literacy, respectively.[32] The Newest Vital Sign asks respondents to answer 6 questions regarding the information found on an accompanying nutrition label, such as, "If you eat the entire container, how many calories will you eat?" Each correct response is worth 1 point with a total of 6 points possible. Scores ≥ 4 are considered evidence of adequate health literacy, and scores below 4 are considered evidence of inadequate health literacy.[33]

Statistical analysis

SPSS Version 26.0 (2019, IBM Inc., New York, NY) was used, and the level of significance was set at 0.05 for all tests. First, descriptive statistics were used to describe participants' sociodemographic and clinical characteristics overall and by site to ascertain if there were any differences that may affect the subsequent findings. Independent sample t tests for numerical variables and chi-square for categorical variables were used to identify differences between sites, given the normally distributed data.

Paired t tests were used to investigate variable changes between pre- and post-CR. Pearson correlation coefficients were used to determine the association between knowledge

Table 1. Sociodemographic and clinical characteristics of participants in overall sample and by site

Characteristic	Overall (n = 252)	Toronto (n = 84)	Lévis (n = 84)	Moncton (n = 84)	P^*
Sociodemographic					
Age, y (mean ± SD)	64.59 ± 9.67	64.64 ± 10.47	64.81 ± 9.16	64.32 ± 9.36	0.95
Sex n (%)					
Male	159 (69.4)	63 (75.0)	47 (67.1)	49 (65.3)	0.37
Female	70 (30.6)	21 (25.0)	23 (32.9)	26 (34.7)	
Language n (%)					
English	132 (52.4)	84 (100.0)	0 (0.0)	48 (57.1)	-
French	112 (44.4)	0 (0.0)	84 (100.0)	28 (33.3)	
Ethnicity† n (%)					
Caucasian	182 (84.3)	44 (58.7)	72 (97.3)	66 (98.5)	0.78
European	12 (5.1)	12 (16.0)	0 (0.0)	0 (0.0)	
South Asian	6 (2.8)	6 (8.0)	0 (0.0)	0 (0.0)	
Jewish	5 (2.3)	5 (6.7)	0 (0.0)	0 (0.0)	
West Asian	3 (1.4)	3 (4.0)	0 (0.0)	0 (0.0)	
African	2 (0.9)	2 (2.7)	0 (0.0)	0 (0.0)	
Aboriginal	1 (0.5)	0 (0.0)	1 (1.4)	0 (0.0)	
Arab	1 (0.5)	0 (0.0)	0 (0.0)	1 (1.5)	
South East Asian	1 (0.5)	1 (1.3)	0 (0.0)	0 (0.0)	
Education level† n (%)					
Less than high school	20 (8.6)	2 (2.4)	12 (16.0)	6 (8.0)	< 0.001§,‖
High school	67 (28.9)	23 (28.0)	19 (25.3)	25 (33.3)	
Trades certificate	32 (13.8)	3 (3.7)	20 (26.7)	9 (12.0)	
College or diploma	55 (23.7)	16 (19.5)	14 (18.7)	25 (33.3)	
University	23 (25.0)	38 (46.3)	10 (13.3)	10 (13.3)	
Family income† n (%)					
< $10,000 per year	8 (3.7)	3 (3.9)	2 (2.9)	3 (4.2)	< 0.001§,‖
Between $10,001 and $50,000	100 (45.7)	24 (31.2)	40 (57.1)	36 (50.0)	
Between $50,001 and $100,000	70 (32)	26 (33.8)	22 (31.4)	22 (30.6)	
Between $100,001 and $150,000	25 (11.4)	13 (16.9)	6 (8.6)	6 (8.3)	
> $150,001	16 (7.3)	11 (14.3)	0 (0.0)	5 (6.9)	
Clinical, n (% yes)‡					
MI	95 (41.7)	23 (27.4)	40 (58.0)	32 (42.7)	0.001§,‖
PCI	132 (58.1)	38 (45.2)	46 (66.7)	48 (64.9)	0.01§,‖
CABG	52 (22.9)	17 (20.2)	18 (26.1)	17 (23.0)	0.70
Angina	65 (28.5)	8 (9.5)	25 (36.2)	32 (42.7)	< 0.001§,‖
CHF	23 (10.1)	4 (4.8)	13 (18.8)	6 (8.0)	0.01§,¶
Risk factors and comorbidities					
Hypertension	168 (73.4)	46 (54.8)	58 (82.9)	64 (85.3)	< 0.001§,‖
Dyslipidemia	157 (68.6)	20 (23.8)	65 (92.9)	72 (96.0)	< 0.001§,‖
Diabetes Type I	-	-	-	-	-
Diabetes Type II	50 (21.8)	18 (21.4)	13 (18.6)	19 (25.3)	0.40
Obesity	84 (36.7)	-	42 (60.0)	42 (56.0)	1.00
Smoking	24 (10.5)	4 (4.8)	9 (12.9)	11 (14.7)	0.09
Sleep apnea	18 (7.9)	14 (16.7)	-	4 (5.7)	< 0.001§,‖
Alcohol	13 (5.7)	5 (6.0)	5 (7.1)	3 (4.0)	0.71
VHD	7 (3.3)	5 (6.0)	1 (1.4)	1 (1.8)	0.27
Depression	5 (2.2)	2 (2.4)	1 (1.4)	2 (2.7)	0.87

Valid percentages are reported.

CABG, coronary artery bypass grafting; CHF, chronic heart failure; MI, myocardial infarction; PCI, percutaneous coronary intervention; SD, standard deviation; VHD, valvular heart disease.

* Chi-square or *t* tests as appropriate for differences between sites.

† Self-reported.

‡ Extracted from electronic records of patients.

§ Significant differences ($P < 0.05$) between Toronto and Lévis.

‖ Significant differences ($P < 0.05$) between Toronto and Moncton.

¶ Significant differences ($P < 0.05$) between Lévis and Moncton.

and health behaviours (ie, physical activity and food intake), as well as self-efficacy and health literacy. A partial correlation analysis was also performed, adjusting for pre-CR knowledge.

Next, simple and multiple linear regression models were computed to investigate differences in overall post-CR knowledge (dependent variable) based on participant characteristics (independent variables).

Results

Respondent characteristics

A total of 496 patients were eligible to participate in the study, of whom 323 agreed to see the recruiter. Of these, 252 (78%) agreed to participate in the study. Overall, significantly more male patients (69.4%) agreed to participate in this study than female patients (30.6%), as well as

Table 2. Knowledge and behaviour change in overall sample

Variable	Maximum possible score	Pre-CR (n = 232)	Post-CR (n = 158)	*P*
Knowledge (mean ± SD)				
Total scores	20	15.58 ± 2.42	16.69 ± 2.99	< 0.001
Subscales				
Medical condition	4	2.71 ± 0.61	2.86 ± 0.64	0.16
Risk factors	4	3.47 ± 0.71	3.49 ± 0.81	1.00
Exercise	4	2.98 ± 0.96	3.43 ± 0.88	< 0.001
Nutrition	4	3.61 ± 0.59	3.71 ± 0.69	0.25
Psychological risk	4	2.81 ± 0.98	3.19 ± 0.96	< 0.001
Physical activity				
Mean number of steps per day (mean ± SD)	-	6182.33 ± 3254.51	7496.21 ± 3436.30	< 0.001
Participants who reached 7500 steps/day, n (%)	-	62 (27.4%)	78 (52.0%)	< 0.001
Food intake				
Total scores (mean ± SD)	13	7.32 ± 2.43	8.77 ± 2.18	< 0.001
Participants who scored ≥ 10, n (%)	-	47 (20.1%)	66 (41.5%)	-
Participants who scored ≤ 5, n (%)	-	60 (25.6%)	12 (7.5%)	-
Exercise self-efficacy (mean ± SD)				
Total scores	5	3.06 ± 0.81	3.46 ± 0.81	< 0.001
Health literacy				
METER total scores (mean ± SD)	40	32.05 ± 11.45	31.66 ± 12.79	0.97
METER Classification, n (%)				
Low health literacy	-	20 (8.6%)	16 (10.1%)	-
Marginal health literacy	-	80 (34.5%)	46 (29.1%)	-
Functional health literacy	-	132 (56.9%)	96 (60.8%)	-
NVS total scores (mean ± SD)	6	4.21 ± 1.78	4.27 ± 1.74	0.58

Valid percentages are reported.
CR, cardiac rehabilitation; METER, Medical Term Recognition Test; NVS, Newest Vital Sign; SD, standard deviation.

those with higher educational attainment and higher family income. In regard to comparisons between sites, the Toronto site had significantly more participants with higher educational attainment and family income and significantly less participants with history of myocardial infarction, percutaneous coronary intervention, angina, and diagnosis of hypertension, dyslipidemia, and sleep apnea than the other 2 sites. Lévis had significantly more participants with diagnosis of chronic heart disease than the other 2 sites. Sociodemographic and clinical characteristics of the sample overall and by site are shown in Table 1.

In regard to attendance of education sessions, participants in Toronto attended a mean of 19 ± 4 sessions (of 24 sessions scheduled), in Lévis 10 ± 3 sessions (of 12 sessions scheduled), and in Moncton 5 ± 3 (of 7 sessions scheduled). The percentage of attendance ranged from 75% to 85% of total sessions scheduled.

Overall, 162 participants (64.3%) completed the post-CR survey. No differences in sociodemographic or clinical characteristics were observed between those who completed and those who were lost to follow-up. Supplemental Table S2 presents the differences between those who completed the study and those who were lost to follow-up.

Change in knowledge and health behaviours

Descriptive statistics for all outcomes are shown in Table 2. There was a significant increase ($P < 0.001$) in knowledge from pre- to post-CR in the overall sample. As shown in Table 2, the increase in knowledge appeared on 2 subscales: exercise and psychosocial risk. In regard to individual items, knowledge scores improved on 16 items in the overall sample (3 items from medical condition, 3 from exercise, 2 from risk factors, 4 from nutrition, and 4 from the psychosocial risk subscale).

In regard to physical activity, the mean number of steps per day increased significantly over time ($P < 0.001$). At post-test, 78 participants (52.0%) were engaging in a mean of ≥ 7500 steps/day. In regard to food intake, there were significant differences in scores over time ($P < 0.001$), with more participants adhering to the Mediterranean diet over time. There was also a significant improvement in exercise self-efficacy scores over time ($P < 0.001$).

In regard to health literacy, no significant differences were found between pre- and post-CR in both measures. Although the number of patients classified as low and marginal health literacy decreased, these changes were not considered statistically significant.

Behavioural correlates of knowledge

Table 3 displays correlations among health behaviours, self-efficacy, health literacy, and post-CR knowledge. Results showed a significant positive correlation between post-CR knowledge and food intake (r = 0.203; $P = 0.01$), self-efficacy (r = 0.201; $P = 0.01$), and health literacy (r = 0.241; $P = 0.002$). When controlled for pre-CR knowledge, correlations between post-CR knowledge and self-efficacy and health literacy continued to be significant (r = 0.217; $P < 0.05$).

Linear regression analysis

Simple linear regression analysis (Table 4) revealed that education level (unstandardized beta [B] = −2.511; $P = 0.04$) and pre-CR knowledge (B = 0.433; $P < 0.001$) were

Table 3. Correlations among health behaviours, self-efficacy, health literacy, and post-CR knowledge

	Correlation		Partial*	
	Pearson correlation	*P*	Pearson correlation	*P*
Physical activity	0.088	0.29	0.060	0.47
Food intake	0.203	0.01	0.150	0.06
Self-efficacy	0.201	0.01	0.217	0.006
Health Literacy (METER)	0.241	0.002	0.184	0.02
Health Literacy (NVS)	0.067	0.41	0.056	0.50

METER, Medical Term Recognition Test; NVS, Newest Vital Sign.
*Control variable = pre-CR total knowledge.

Table 4. Simple and multiple regression analysis for post-CR knowledge among overall sample

	Simple regression		Multiple regression	
Variable	B	*P*	B	*P*
Age	0.019	0.47	-	-
Female	−0.582	0.25	-	-
Education, less than high school	−2.511	0.04	−2.285	0.07
Education, high school	−0.267	0.66	−0.189	0.75
Education, trade certificate	1.003	0.19	0.742	0.32
Education, college	0.706	0.27	0.411	0.52
Education, university	0	-	-	-
Income, < 10 k per year	−2.200	0.182	-	-
Income, between 10k and 50k	−0.422	0.578	-	-
Income, between 50k and 100k	−0.762	0.340	-	-
Income, between 100k and 150k	−0.367	0.707	-	-
Income, > 150k	0	-	-	-
Preknowledge	0.433	< 0.001	0.374	< 0.001
Language	−0.196	0.68	-	-
CR sessions attended	−0.003	0.96	-	-

CR, cardiac rehabilitation.

influential in changing post-CR knowledge. In addition, multiple regression analysis indicated that pre-CR knowledge was a significant and independent factor for post-CR knowledge (B = 0.374; $P < 0.001$).

Satisfaction

Overall, participants were satisfied with the education intervention, with 49.6% reporting they were satisfied with the patient guide and 71.2% were satisfied with the lectures. In regard to the use of information, 48.9% said the learning tools were useful to help manage their heart disease and 60.6% reported they were always able to find the information they were looking for through the patient guide. In regard to the content, 67.2% were always able to understand the information provided and 80.3% described the amount of information provided as "just right."

Comments from open-ended questions were positive and characterized the education provided as "informative," "useful," "relevant," "well paced," "enjoyable," and "complete." In addition, 40% of the participants said that if they had a question about their heart disease and healthy living, the first thing they would do would be to read the patient guide, even after asking their doctor (18.6%).

Discussion

Results from this first-ever multi-site study focusing on patient education for CR patients in Canada showed significantly improvements in scores for patients' knowledge, exercise, food intake, and self-efficacy after an education intervention. Other similar studies with knowledge and health behaviours as outcomes demonstrated similar results,[8,10-13] which highlights not only the importance of CR as an integral part of the standard of care for patients with cardiac disease but also supports the implementation of education interventions as part of these programs. Although application of study results on individual programs may be a complex process due to differences in both interventions and program settings, the design of this study and its results showed that a structured education program such as the one delivered for this study can be adapted and effective in different settings, generating positive and significant results.

Results from this study also reinforced the association between socioeconomic status and health,[34] showing that participants with higher educational status learned significantly more than their counterparts, which led to better health behaviours. It is also important to highlight that our sample was composed of participants with higher educational attainment and family income, which can reinforce the idea that CR is not universally used and people with low socioeconomic status might not be getting referrals and participating in these programs.[35,36] Being an important component of CR, education should be adapted to patients' culture and literacy and considerate of age, sex, comorbidities, socioeconomic status, and coexisting disabilities to be more effective. The education intervention tested in this study was translated to English and French, as well as put in plain language and designed on the basis of patients' needs and feedback, which aligns to the recommendations listed in the literature,[37-39] and can be broadly used in different socioeconomic settings, including a low- and middle-income one as reported previously.[19,20]

According to the American Medical Association, "health literacy entails more than a patient being able to read written instructions; it requires the ability to comprehend and apply the information ascertained."[40] This is an important measure in studies assessing the effectiveness of education intervention, and although our intervention was not able to statistically improve this outcome, it contributed to the scarce literature on this topic. Most studies on health literacy and cardiac patients had small sample sizes or restricted their study populations to those with suspected low health literacy.[41-43] In our study, despite the fact that the sample was highly educated and health literate, we were able to observe significant increases in the overall disease-related knowledge of patients from pre- to post-CR in the overall sample. There is a need to assess the impact of education interventions for CR patients in health literacy in a sample of patients with low health literacy.

From a patient perspective, participants were satisfied with the education provided and enthusiastic to learn. Most of them reported being satisfied and trusting the information received. Studies have shown that there are different factors that can motivate patients to adhere to their CR recommendations and to continue to follow them after discharge, including patient

education.[44,45] Therefore, a study assessing whether patient exposure to this education intervention results in sustained knowledge and better outcomes over the long-term is warranted.

Limitations

Caution is warranted when interpreting these results, chiefly because of potential selection bias and design. First, our sample of patients with CAD had a high educational level; therefore, we suggest a future research to examine the impact of this education intervention in a cohort of patients with CAD and educational levels to fill the knowledge gap left in this population. Second, a low CR completion rate was observed, which can suggest our sample was biased toward low-adherent patients. Third, results are only generalizable to patients who are referred and attend CR programs, which are a low proportion of cardiac outpatients.[46] Fourth, multiple comparisons were undertaken, which can lead to the inflation of false-positive results. With respect to the study design, the absence of a control group in this study represents a major limitation. In our study, the use of a control group was not possible because education was part of the standard of care at all 3 sites (a different type of education but still available). However, this is not the reality of most programs (in Canada and especially in low- and middle-income countries). Where possible, a randomized control trial assessing our approach in patients with CAD not receiving education as part of routine is warranted.

Conclusions

Results from this multi-site study focusing on patient education for CR patients in Canada demonstrated that an evidence- and theoretically based comprehensive education intervention significantly improves patients' knowledge, exercise, food intake, and self-efficacy. These results confirm the need for advocacy for education interventions in CR programs across Canada.

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Disclosures

The authors have no conflicts of interest to disclose.

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Supplementary Material

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