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RESEARCH ARTICLE (ORIGINAL) 🔓

The impact of an online education program on patients who underwent percutaneous coronary intervention

Impacto de um programa educativo com tecnologia online na pessoa pós-intervenção coronária percutânea

Impacto de un programa educativo con tecnología en línea en la persona sometida a una intervención coronaria percutânea

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Abstract

Background: Ischemic coronary disease is one of the leading causes of death in Portugal. As a chronic disease, it is imperative to develop skills for effective behavioural change and a higher level of acceptance and adherence to the recommendations provided.

Objective: To assess the impact of an online nursing education programme, considering socio-demographic characteristics, cardiovascular risk factors, lifestyle, clinical indicators, adherence to pharmacological therapy, therapeutic self-care skills, literacy and acceptance of the use of technology.

Methodology: Quantitative, descriptive, experimental study, with a before-after design and control group.

Results: The educational intervention resulted in a decrease in weight, abdominal circumference, body mass index, blood pressure, cholesterol, blood glucose, and in increased acceptance of the participants about their clinical condition and use of technology.

Conclusion: The implementation of a structured teaching program constitutes a good methodology for improving clinical indicators, increasing adherence to pharmacological therapy, capacity for therapeutic self-care, health literacy, lifestyle and acceptance of technology by the participants.

Keywords: nursing; educational programme; percutaneous coronary intervention; secondary prevention; online intervention

Resumo

Enquadramento: A doença isquémica coronária constituiu uma das principais causas de morte em Portugal. Como doença crónica, é imperativo desenvolver competências de mudanças comportamentais efetivas e um maior nível de aceitação e adesão às recomendações disponibilizadas.

Objetivo: Avaliar o impacto de um programa educativo de enfermagem *online*, tendo em conta as características sociodemográficas, fatores de risco cardiovasculares, estilo de vida, indicadores clínicos, adesão à terapêutica farmacológica, capacidade de autocuidado terapêutico, literacia e aceitação do recurso à tecnologia.

Metodologia: Estudo quantitativo, descritivo, do tipo experimental, com desenho antes-após e com grupo controlo.

Resultados: A intervenção educativa resultou numa diminuição do peso, perímetro abdominal, índice de massa corporal, tensão arterial, colesterol, glicemia, e no aumento da aceitação dos participantes sobre a sua condição clínica e utilização de tecnologia.

Conclusão: A implementação de um programa estruturado de ensino constitui-se como uma boa metodologia na melhoria dos indicadores clínicos, aumento da adesão à terapêutica farmacológica, capacidade de autocuidado terapêutico, literacia em saúde, estilo de vida e aceitação da tecnologia por parte dos participantes.

Palavras-chave: enfermagem; programa educativo; intervenção coronária percutânea; prevenção secundária; intervenção *online*

Resumen

Marco contextual: La cardiopatía isquémica es una de las principales causas de muerte en Portugal. Al tratarse de una enfermedad crónica, es imprescindible desarrollar competencias eficaces de cambio de comportamiento y un mayor nivel de aceptación y adherencia a las recomendaciones proporcionadas.

Objetivo: Evaluar el impacto de un programa educativo de enfermería en línea, teniendo en cuenta las características sociodemográficas, los factores de riesgo cardiovascular, el estilo de vida, los indicadores clínicos, la adherencia al tratamiento farmacológico, la capacidad de autocuidado terapéutico, la alfabetización sanitaria y la aceptación del uso de la tecnología.

Metodología: Estudio cuantitativo, descriptivo, experimental, con un diseño antes-después y un grupo de control.

Resultados: La intervención educativa se tradujo en una disminución del peso, del perímetro abdominal, del índice de masa corporal, de la tensión arterial, del colesterol y de la glucemia, así como en una mayor aceptación de los participantes sobre su estado clínico y el uso de la tecnología.

Conclusión: La implementación de un programa de enseñanza estructurado es una buena metodología para mejorar los indicadores clínicos, aumentar la adherencia a la terapia farmacológica, la capacidad de autocuidado terapéutico, la alfabetización sanitaria, el estilo de vida y la aceptación de la tecnología por parte de los participantes.

Palabras clave: enfermería; programa educativo; intervención coronaria percutánea; prevención secundaria; intervención en línea

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Introduction

Cardiovascular diseases (CVDs), including Ischemic Heart Disease (IHD), are one of the leading causes of death in Portugal. Although their influence has been decreasing, the mortality rate remains high. In 2018, IHD was responsible for 7,241 deaths, 1% less than the year before. Still, it accounted for the second highest mortality rate (6.4%) following Cerebrovascular Accidents (CVA). Acute Myocardial Infarctions (AMI) were also responsible for 4,620 deaths, or 4.1% of mortality, with a 1.7% increase in the number of deaths compared to the previous year (4,542 deaths; Instituto Nacional de Estatística, 2020). According to the Portuguese National Registry of Interventional Cardiology, 7,750 elective percutaneous coronary interventions (PCI) were performed in 2020 (910 more than in 2019) and 3,838 primary PCI (114 more than in 2019) (Sociedade Portuguesa de Cardiologia, 2020). Considering these data, after the onset of the CVD, it is essential to adopt an integrated approach to identify cardiovascular risk factors and therapeutic adherence focused on follow-up and control (secondary prevention). The present study aims to assess the impact of an online nurse-led education program, considering the participants' socio-demographic characteristics, cardiovascular risk factors, lifestyle, clinical indicators, medication adherence, therapeutic self-care skills, health literacy, and acceptance of technology use.

Background

The European Society of Cardiology (ESC) confirms the efficiency of nurse-led secondary prevention programs promoting communication and information technologies. These programs increase patients' referral and acceptance of cardiovascular risk through the use of electronic prompts or automatic referrals, the organization of referral and liaison visits, and the promotion of structured follow-up programs, starting immediately after hospital discharge, to provide and support remote clinical care (Piepoli et al., 2016). Within the scope of the COVID-19 pandemic, the Central Region Section of the Portuguese Nursing Regulator (*Ordem dos Enfermeiros*) developed a Guide of Recommendations for Remote Nursing Consultations (Ordem dos Enfermeiros, 2021). The Guide lists a set of principles and recommendations to promote the development and standardization of remote nursing consultations and strengthen the citizens' involvement in self-care and the management of their health condition/illness.

CVDs are closely associated with a set of non-modifiable risk factors, such as family history, gender, and age, and other lifestyle-related modifiable risk factors, such as smoking habits, unhealthy eating habits (diets high in salt, fat, and calories), alcohol consumption, sedentary lifestyle, obesity, stress, arterial hypertension (AHT), diabetes mellitus, and dyslipidemia (Piepoli et al., 2016). Adopting a healthy lifestyle decreases the risk of subsequent cardiovascular events and mortality and complements

appropriate secondary prevention therapy. The benefits become apparent after six months, with a reduction in the CVD progression and the risk of restenosis of the artery revascularized following PCI (Neumann et al., 2020). Also, according to the COURAGE study (Optimal Medical Therapy with or without PCI for Stable Coronary Disease), optimal therapy relies on nurses' fundamental role in promoting medication adherence and providing behavioral counseling and support for lifestyle-related risk factors (Neumann et al., 2020).

Research question

What is the impact of an online nurse-led education program using technology devices (tablets, cell phones, or computers) on secondary prevention of CVDs in patients who underwent PCI?

Methodology

This quantitative descriptive experimental-type study used a non-probabilistic, accidental, randomized sample of participants with CVDs. These participants were first admitted as outpatients to a Hemodynamics Unit. After undergoing PCI, they were admitted as inpatients to a Cardiology Unit of a central hospital in Portugal's central region in 2020. Thus, the inclusion criteria of the present study were as follows: to be over 18 years; to be admitted first as an outpatient to a Hemodynamics Unit and then as an inpatient after undergoing PCI; and to have access to a computer, tablet, or cell phone, with internet and a video call application/software, and to know how to use them (or have a family member providing support). The participants were distributed between an Experimental Group (EG) and a Control Group (CG), with weekly randomization over a period of two months. The final sample was obtained, consisting of 23 participants. The participants were randomized to one group in one week and to the other group the following week. The first week of inclusion began with 12 participants in the EG and 11 in the CG. A questionnaire was used as a data collection tool and was administered during the first and last nursing consultations. The questionnaire was divided into six dimensions: 1 - Sociodemographic Characterization and Cardiovascular Risk Factors (CVRFs), assessed based on clinical parameters, such as weight, body mass index (BMI), waist circumference (WC), blood pressure (BP), capillary blood glucose and cholesterol, during the initial and final assessment moments; 2 – Medication Adherence (MA), assessed using a Likert-type scale with scores ranging from 1 (minimum) to 6 points (maximum), where higher values correspond to higher levels of MA; this scale was developed, adapted and validated for the Portuguese population by Delgado and Lima (2001) through its administration to chronically ill patients; 3 - Therapeutic self-care capacity (TSCC), using a scale ranging from 0 (minimum) to 60 points (maximum), corresponding to a high level of performance (Cardoso

et al., 2014), focusing on patients' involvement in four aspects of self-care – MA, symptom identification and management, performance of activities of daily living, and management of changes in health conditions; 4 - Health literacy, using the Batalla Test (Calixto et al, 2013) to assess the patients' knowledge about their clinical condition, and a True/False (T/F) questionnaire with a set of questions designed by Silva (2019) and validated by three experts in the field - a cardiologist, a nurse specialist in Medical-Surgical Nursing and a nurse generalist (all with professional experience in coronary intensive care of more than 10 years); 5 – Lifestyle, using the FAN-TASTIC Lifestyle Checklist (FLC), with 30 questions exploring 10 domains of physical, psychological, and social aspects of participants' lifestyle (Silva et al., 2014), whose global score classifies participants' lifestyle habits and behaviors into five levels - *Needs Improvement* (0-46); *Fair* (47-72); *Good* (73-84); *Very Good* (85-102); and *Excellent* (103-120); and 6 - Acceptance of Technology, using the Technology Acceptance Model (TAM-version 1) with questions divided into two constructs (*perceived usefulness* and *perceived ease-of-use*) and adapted to the theme under study in a pre-test by Silva (2014), where higher scores correspond to higher degrees of acceptance. The first nursing consultation occurred in person on the day of hospital discharge. Information leaflets on CVRFs were handed out, and a questionnaire was applied to all participants (CG and EG) to assess the dimensions described above. The purpose was to make an initial diagnosis of the clinical situation and establish, together with the participants, an action plan and specific objectives to be achieved by the next nursing consultation. Over 6 months, the consultations assessed the EG participants' knowledge acquisition of the themes they were less informed about based on the data collected in the initial questionnaire and each consultation. Reference family members were also involved, and the goals concerning the action plan and objectives to be achieved by the next consultation were negotiated and established. Similar to the first nursing consultation, the last one also occurred in person. After inclusion in the study and the first nursing consultation, the investigator did not implement any intervention in the CG. The CG participants were only asked to repeat the initial questionnaire in person after six months.

The data obtained were entered into a Microsoft Excel® database built for this purpose, which was later exported to the statistical treatment IBM SPSS Statistics software, version 24.0, for Windows.

Next, a descriptive analysis was performed to characterize the variables under study according to their measurement scale. Central tendency measures were used, considering the study design and the population size and characteristics.

All ethical principles inherent to the scientific research were respected, and the Ethics Committee of the hospital where the study was conducted approved the project (authorization 003-20). Informed consent forms were signed by the participants after being informed about the study's confidentiality, methodology and objectives, the risks and benefits of their participation, and their right to abandon the study at any time.

Results

Regarding the sample's socio-demographic characterization, only one participant was female (CG), and the remaining 22 were male. The participants' age ranged from 39 to 73 years. The mean age of the EG was 59.3 years (± 8.4), and the mean age of the CG was 62.55 years (± 10). Most participants were married or were in a *de facto* union (75% in the EG; 81.9% in the CG), and only 8.3% of the EG and 9.1% of the CG lived alone. Most participants lived in urban areas (83.3% in the EG and 63.6% in the CG). Fifty percent of the EG participants completed secondary school, and 36.3% of the CG only attended the first education cycle, the most representative percentage in terms of education in the CG. Regarding work, 58.3% of the EG participants and 54.6% of the CG participants were active workers (Table 1).

Table 1

Absolute and percentage distribution of the sample's socio-demographic and and professional characteristics (N = 23)

Socio-demographic and Professional Characteristics	EG (n = 12)		CG (n = 11)		Total
	n	%	n	%	n
Living with					
Wife	4	33.3	5	45.4	9
Wife and child/children	5	41.7	4	36.4	9
Child/children	2	16.7	1	9.1	3
Alone	1	8.3	1	9.1	2
Total	12	100.0	11	100.0	23
Area of residence					
Rural	2	16.7	4	36.4	6
Urban	10	83.3	7	63.6	17
Total	12	100.0	11	100.0	23
Education					
1st Cycle	1	8.3	4	36.3	5
2nd Cycle	2	16.7	3	27.3	5
3rd Cycle	0	0	2	18.2	2
Secondary education	6	50	0	0	6
Higher education	3	25	2	18.2	5
Total	12	100.0	11	100.0	23
Employment status					
Self-employed	3	25	2	18.1	5
Employed	4	33.3	4	36.4	8
Retired	5	41.7	4	36.4	9
Unemployed	0	0	1	9.1	1
Total	12	100.0	11	100.0	23

Note. EG = Experimental group; CG = Control group; n = Number of participants.

Regarding CVRFs (Table 2), the most prevalent risk factor was AHT (EG = 50%; CG = 72.7%). The sample also presented high scores of "family history" of CVD (EG = 50%; CG = 54.5%) and "obesity" (EG = 33.3%; CG = 63.6%). The following risk factors were "alcohol consumption" (EG = 25%; CG = 36.4%), "sedentary lifestyle" and "dyslipidemia" (EG = 16.7%; CG = 36.4%), "diabetes" (EG = 8.3%; CG = 9.1%), and "smoking" (EG = 8.3%).

Table 2

Absolute and percentage distribution of the sample's cardiovascular risk factors (N = 23)

Cardiovascular Risk Factors	EG (n = 12)		CG (n = 11)		Total (n = 23)
	n	%	n	%	n
Arterial Hypertension	6	50	8	72.7	14
Family History	6	50	6	54.5	12
Obesity	4	33.3	7	63.6	11
Alcohol Consumption	3	25	4	36.4	7
Sedentary Lifestyle	2	16.7	4	36.4	6
Dyslipidemia	2	16.7	4	36.4	6
Diabetes	1	8.3	1	9.1	2
Non-smoker	11	91.6	11	100.0	22
Smoker (tobacco/other substances)	1	8.3	0	0	1

Note. EG = Experimental group; CG = Control group; n = Number of participants.

Considering systolic blood pressure (BP) values, Table 3 shows a reduction in the mean values between month zero (beginning of the assessment) and month six in the EG and CG. This reduction in the EG translated into

improving the overall BP values. The group's values passed from high normal systolic BP to normal systolic BP, according to the classification system adopted (Williams et al., 2018). In the CG, the reduction presented a change from grade 1 hypertension to high normal systolic BP. Regarding blood glucose values, a decrease was observed in the EG mean values between the two moments and an increase in the CG, with both groups having only one diabetic participant. As for cholesterol, represented by the values of low-density lipoprotein (LDL) and triglycerides (TG), in the EG, there was a reduction of 42.38 mg/dL in the LDL value in the mean value from the first to the second assessment moment and an increase of 5 mg/dL in the mean value of TG. In the CG, there was also a decrease in the mean LDL value of 34.41 mg/dL, accompanied by a decrease in the mean TG value of 6.09 mg/dL. In terms of weight, the EG mean value decreased between the two assessment moments, corresponding to an overall mean decrease of 5.4 kg in the group. The CG had a mean increase in weight values of about 0.700 kg during the same period. The weight evolution observed in the groups influenced the BMI evolution, with a mean reduction from 27.33 kg/m² to 25.66 kg/m² in the EG and an increase from 28.53 kg/m² to 28.83 kg/m² in the CG. Along with this evolution, the waist circumference (WC) values in the EG showed an overall mean decrease of 4.58 cm between the initial and final assessment moments. On the other hand, the CG had an increase of 0.82 cm between the two assessment moments.

The MA presented in Table 3 had a positive evolution from month zero to month six, ranging from 5.72 points to 5.79 points in the EG. In the CG, there was a decrease in the MA initial mean score from 5.48 points to 4.68 points.

Both groups demonstrated a positive evolution in TSCC. Nevertheless, the EG revealed a more pronounced increase in the initial mean score from 48.40 points to 54.42 points, corresponding to a difference of 6.02 points. In comparison, the CG evolved from 43.27 points to 46.00 points, corresponding to a difference of 2.73 points. The participants' lifestyle was assessed using the FLC. It was observed (Table 3) that the EG had a mean score of 94.5 points in month zero, corresponding to *Very Good*, while the CG had a mean score of 78.18 points, corresponding to *Good*" After six months of follow-up, a positive evolution was observed in the EG, with the mean score increasing to 100.7 points, still corresponding to *Very Good*. In contrast, the CG decreased its mean score and obtained 64.55 points, corresponding to the classification of *Fair*. The TAM-version 1, divided into the constructs "perceived usefulness" and *perceived ease-of-use*, initially showed higher mean scores in the EG in both constructs than in the CG. Nevertheless, the two groups increased their scores of both constructs between the assessment moments (0.58 points for *perceived usefulness* and 0.70 points for *perceived ease-of-use* in the EG and 0.31 and 0.21 points, respectively, in the CG). The EG finished with a final mean score higher than the CG that did not receive online follow-up. The Batalla Test showed a decrease in the number of EG participants classified as "non-compliant with the treatment" and a shift to the category of "compliant/adherent to the treatment "(50% - 83.3%). In contrast, the number of participants "compliant/adherent to the treatment" in the CG decreased from 27.3% to 18.2%. The number of correct answers to the T/F questionnaire (Table 3) increased in the EG (83.3%- 92.1%) and decreased (69.1% - 59.5%) in the CG between the two assessment moments.

Table 3

Statistical and percentage synthesis of the groups' evolution throughout the education program (N = 23)

Indicators	EG (*n* = 12)		CG (*n* =1 1)		+ or - Improvement	
	Month 0	Month 6	Month 0	Month 6	EG	CG
Systolic BP (mmHg)	132.08	120.58	143.45	138.73	+	+
Diastolic BP (mmHg)	78.17	73.25	84.55	83.73	+	+
Blood Glucose (mg/dL)	101.17	97.73	104.91	109.18	+	-
LDL (mg/dL)	122.11	79.73	132.19	97.78	+	+
TG (mg/dL)	108.25	113.25	124.18	118.09	-	+
Weight (kg)	83.04	77.64	79.36	80.09	+	-
BMI (kg/m²)	27.33	25.66	28.53	28.83	+	-
WC (cm)	99.79	95.21	105.41	106.23	+	-
MA	5.72	5.79	5.48	4.68	+	-
TSCC	48.40	54.42	43.27	46.00	+	+
FLC	94.5	100.7	78.18	64.55	+	-
TAM-version 1 Perceived usefulness	3.94	4.52	3.25	3.56	+	+
Perceived ease-of-use	3.91	4.61	3.31	3.52	+	+
Indicators	EG (*n*=12) %		CG (*n*=11) %		+ or – Improvement	
	Month 0	Month 6	Month 0	Month 6	EG	CG
Batalla	50	83.3	27.3	18.2	+	-
True/False Questionnaire - correct	83.3	92.1	69.1	59.5	+	-

Note. EG = Experimental group; CG = Control group; n =Number of participants; BP = Blood Pressure; LDL = Low-density lipoprotein; TG = Triglycerides; BMI = Body Mass Index; WC = Waist Circumference; MA = Medication Adherence; TSCC = Therapeutic self-care capacity; FLC = FANTASTIC Lifestyle Checklist; TAM-version 1 = Technology Acceptance Model; T/F = True/False.

Table 4 presents the sample's classification of cardiovascular risk associated (and previously confirmed) with increased WC. In month zero, the EG had the same percentage (33.3%) of participants in each category – no risk, high risk, very high risk. In month six, the percentage of participants with no risk increased to 41.7%, and the percentage of high-risk participants decreased to 25%. The percentage of participants with very high risk remained the same (33.3%) from the beginning. In the CG, in the initial assessment, 9.1% of the participants had no cardiovascular risk, the same number (9.1%) had high WC-associated risk, and 81.1% had very high risk. In the end, the CG showed a slight improvement in the degree of cardiovascular risk, which translated into a decrease to 72.7% in the percentage of participants with very high risk and a consequent increase in the number of high-risk participants (18.2%). The number of participants with no risk remained the same (9.1%).

Table 4

Classification of the sample's WC-associated cardiovascular risk (N = 23)

WC-associated cardiovascular risk	**GE** (*n* = 12)		**GC** (*n* = 11)	
	n	%	*n*	%
Month 0				
No risk	4	33.3	1	9.1
High risk: WC > 94 cm	4	33.3	1	9.1
Very high risk: WC ≥ 102cm	4	33.3	9	81.8
Month 6				
No risk	5	41.7	1	9.1
High risk: WC > 94 cm	3	25	2	18.2
Very high risk: WC ≥ 102cm	4	33.3	8	72.7

Note. WC = Waist circumference; EG = Experimental group; CG = Control group.

Discussion

The present study's results align with the literature. According to data from the Portuguese Registry of Acute Coronary Syndromes (ACS), approximately 71% of all Portuguese patients with ACS are men, a prevalence that has remained high over the years. This aspect is consistent with the present study, where most participants are male (Timóteo & Mimoso, 2018). The sample's mean age is 62.55 years ($SD = 10$) in the CG and 59.3 years ($SD = 8.41$) in the EG. This result differs slightly from Timóteo & Mimoso's study (2018), whose sample had a mean age of 66 years ($SD = 13$) and 26% of participants with 75 years or older. The present study also presents a higher prevalence of married participants or participants in a *de facto* union, with most participants living with family members. This result aligns with the Census from Statistics Portugal, where 87.09% of the Portuguese population is married and consequently lives with family members (Instituto Nacional de Estatística, 2020). Most of the present study's participants live in urban areas. Regarding education, 26.2% of the sample completed secondary education (the most frequent education level), 21.7% completed higher education, 2nd and 1st cycle each, and only 8.7% completed the 3rd cycle. These results align with the data regarding the percentage of the Portuguese population who completed secondary education (about 32%). Nevertheless, the numbers differ in the population who completed higher education, as the present study's sample has a higher percentage than the one presented by Statistics Portugal (12%). The present study's sample includes 56.5% of active workers. This aspect is easily understandable when considering the participants' mean age. Of these participants, 60.8% have AHT, similar to Reveles et al.'s study (2018), which included 87.5% of participants with AHT. Also, the Portuguese Registry of ACS data demonstrated that 64.5% of the Portuguese population suffered from AHT (Timóteo & Mimoso, 2018). Family history of CVD is present in 52.2% of the present study's participants, aligning with Silva's study (2019), in which 61.1% had family risk factors. About 30.4% of the present study's participants consumed alcohol somewhat regularly, similar to the results presented by Silva (2019). Regarding sedentary lifestyle and dyslipidemia, the present study's sample has more positive results than the previously mentioned studies. This fact is probably associated with the sample's age, ranging between 39 (minimum) and 73 years (maximum), and the fact that most participants are professionally active. Although both groups show a reduction in the mean value of LDL, the EG mean values are closer to the low-risk values considered for the population under study, remaining very close to the LDL target value (55mg/dL). The increase in the mean TG value in the EG is representative, as it is below the recommended TG limit (150 mg/dL), as in the CG. Smoking was the least prevalent risk factor in the present study's sample, with only one participant in the EG smoking tobacco and other substances. This result aligns with the current national situation in which the mean of daily smokers over 15 years old is below the mean

of the OECD - Organization for Economic Co-operation and Development (Fernandes, 2020).

Regarding weight, BMI, WC, BP, cholesterol, and blood glucose indicators, the EG results show a reduction in all parameters. These results corroborate national and international studies already conducted in this area. In Portugal, Silva's study (2019), with monthly online nursing follow-ups in post-ACS patients, showed statistically significant improvements in all clinical and anthropometric indicators in the participants belonging to the EG. Also, Reveles et al.'s study (2018), with monthly in-person nursing follow-ups in post-ACS patients, showed statistically significant improvements in weight, BMI, and BP values in the EG, with evidence of greater control of BP and blood glucose values. In the Netherlands, Jorstad et al. (2013) developed a multicenter randomized study of secondary prevention of CVD in patients after ACS. This study was nurse-led and based on nursing follow-up consultations (four consultations over six months with a reassessment at 12 months) and revealed a decrease in participants' cholesterol values. The EG participants show a positive evolution in the mean value of the MA score at six months, with the EG revealing a better MA than the CG. This MA is demonstrated by the homogeneity of answers in the second assessment moment.

The mean TSCC score increased by 6.02 points, representing an improved TSCC in the EG over 6 months and a greater homogeneity of values at the end of the follow-up. This result is similar to Du et al.'s study (2016) with patients with ACS after PCI, which found that the EG had greater control over CVRFs and therapeutic adherence and that the intensive follow-up program significantly improved the prognosis of Chinese patients with ACS after PCI.

Regarding health literacy, there is an increase in the T/F correct answers score in the EG after 6 months of follow-up, reaching 92.1% of correct answers. The Batalla Test shows the same results, with the EG increasing and reaching 83.3% of treatment compliance. On the other hand, the CG shows a decline in the percentages in both evaluations. In Portugal, Andrade et al. (2018) published data from a cross-sectional study conducted in 2012 to characterize specific knowledge on CVD, namely CVA and AMI, in the Portuguese population according to socio-demographic factors, health literacy, and clinical history. Using face-to-face interviews with a structured questionnaire, the authors assessed 1,624 participants living in mainland Portugal, aged between 16 and 79. The results showed that, in general, participants with adequate health literacy have adequate knowledge of cardiovascular health (Andrade et al., 2018).

Considering the participants' lifestyle, the EG reveals an increase in this score after 6 months, maintaining the ranking of *Very Good*. However, this results still reflect the improvement in the EG participants' lifestyles. With an initial lower mean score than the EG, the CG reveals a lifestyle-associated behavioral decline and a decrease in lifestyle rating from *Good* to *Fair*. The Medicare study conducted a 12-month follow-up to assess the effectiveness of two intensive lifestyle modification programs in 580

participants with symptomatic coronary artery disease who underwent PCI. The study concluded that most CVRFs improved significantly during the intensive intervention periods of both programs (Razavi et al., 2014). Regarding the use of technology, the EG shows a significant increase in the mean score between the two assessment moments (0.58 points in *perceived usefulness* and 0.70 points in *perceived ease-of-use*), with final mean scores being much higher than the initial ones. There is also a significant increase in the homogeneity of responses within the EG, demonstrating a high-level acceptance of technology. The CG shows an increase of 0.31 points in *perceived usefulness* and 0.21 points in *perceived ease-of-use* between the two assessment moments and also expresses a greater homogeneity in the final evaluation. Similar to Silva et al. (2012), both groups demonstrate a high level of acceptance regarding the usefulness of this type of follow-up system, believing that they can improve their performance (*perceived usefulness*) as well as the ease of use (*perceived ease-of-use*). The EG acceptance is noticeably higher, as the monthly follow-up via online nursing consultations brought EG participants closer to health care during the pandemic. On the other hand, in the final assessment moment, the CG participants highlighted the lack of online follow-up and felt more distant from health care during the pandemic.

The present study has some limitations, such as the sample size (23 participants), the limited period for participant inclusion, the reduced number of elective patients in the Hemodynamic laboratory due to pandemic-related constraints, and the compliance with the inclusion criteria.

Conclusion

The present study's results show that personalized nursing follow-ups using online technologies contribute to the positive evolution of clinical indicators (weight, WC, BMI, BP, blood glucose, LDL, and TG), MA, TSCC, literacy about one's clinical condition, lifestyle, and acceptance of the use of technology, expressed in its usefulness and ease-of-use. These results prove the importance of online nursing intervention programs in patients with stable CVD after PCI, as these programs translate into significant health gains.

Considering the theme's relevance and the limitations and results obtained by the present study, similar research designs are recommended, but with larger sample sizes, more extended periods for participant inclusion and follow-up, and hypothesis testing to verify statistical significance and increase the level of scientific evidence. Including the patient's family/caregiver in the nursing follow-ups is also suggested, as these are the patient's primary source of support after hospital discharge. Moreover, further studies on this theme must establish the connection with primary health care (by implementing collaboration protocols to assess and control clinical indicators and lifestyle and health behaviors) and standardize follow-up and health education programs among nursing teams providing care to this population.

Author contributions

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