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Article

Knowledge, Attitude, and Practice Regarding Cardiac Catheterization and Percutaneous Coronary Intervention in Patients with Stable Coronary Artery Disease

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Abstract: Background: This study aimed to evaluate the knowledge, attitude, and practice (KAP) of patients undergoing cardiac catheterization (CC) and percutaneous coronary intervention (PCI) at a university hospital. Methods: We conducted a cross-sectional study from June 2023 to August 2024 with elective patients undergoing CC and PCI at a university hospital in Brazil. To collect sociodemographic information and assess knowledge, attitude, and practice, we applied a self-developed and validated questionnaire. Data analysis included descriptive and inferential statistics. Results: The main results showed that patients had limited knowledge, positive attitudes, and proactive practices regarding preparation and general topics investigated before the procedures, as well as self-care and warning signs after the procedures. The variables associated with higher odds of achieving greater knowledge, attitude, and practice included wanting to receive information about CC and PCI, owning a mobile phone, and having completed high school education. Conclusions: These findings provide essential data and a theoretical foundation for developing future educational and training programs targeted at this population.

Keywords: nursing care; knowledge; attitudes and practice in health; cardiac catheterization; percutaneous coronary intervention

1. Introduction

Ischemic heart disease remains the leading cause of mortality worldwide, underscoring the importance of thorough diagnostic evaluation and efficient treatment for each patient [1]. This detailed diagnostic assessment and subsequent treatment are performed in the hemodynamics laboratory using procedures such as cardiac catheterization and percutaneous coronary intervention [2].

It is widely recognized that undergoing procedures like cardiac catheterization and percutaneous coronary intervention in the complex environment of the hemodynamics unit predisposes patients to negative feelings, such as distress, fear, and anxiety, which can affect procedural success [3]. The absence of appropriate guidance and inadequate patient preparation can increase the risk of complications in the pre-, intra-, and post-procedural phases, potentially resulting

in adverse events such as pseudoaneurysms, infections, hematomas, ecchymosis, peritoneal hemorrhage, and even contrast-induced nephropathy [4].

In this hemodynamics context, nurses perform managerial, educational, and care-related roles, guiding care delivery and documenting nursing assistance through the nursing process, which can reduce adverse events and promote patient safety. Thus, nurses play a crucial role from patient admission to discharge, during which the patient or their family assumes responsibility for home care/self-care. The nursing team is essential throughout this process, providing detailed guidance and preparing patients to follow their therapeutic plan, to prevent complications [5].

A well-designed and accurately conducted knowledge, attitude, and practice survey produces insightful and highly useful data for structuring strategies to enhance knowledge and modify health practices [6]. Analyzing the KAP of elective patients undergoing cardiac catheterization and percutaneous coronary intervention will support the development of educational initiatives that ensure greater precision and safety in preparing for and performing these procedures. It will also contribute to planning targeted actions for this population to optimize management and reduce complication risks. Therefore, this study aimed to assess the knowledge, attitude, and practice of patients undergoing cardiac catheterization and percutaneous coronary intervention.

2. Materials and Methods

This cross-sectional study employed a knowledge, attitude, and practice (KAP) survey to assess the understanding, perceptions, and behaviors of a population undergoing cardiac catheterization and percutaneous coronary intervention. The goal was to determine participants' comprehension levels and their attitudes and practices regarding the topic. The article was developed in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

We conducted the study between June 2023 and August 2024 in the hemodynamics department of Cassiano Antônio Morais University Hospital, part of the Brazilian Company of Hospital Services (EBSERH), located in the state of Espírito Santo, Brazil. The study population comprised patients undergoing cardiac catheterization and percutaneous coronary interventions.

The sample size was calculated using G*Power software version 3.1.9.2, based on the hospital's monthly average of 200 elective patients undergoing cardiac catheterization and percutaneous coronary angioplasty. Considering an 80% test power, a significance level (α) of 0.05, a proportion of 50%, and an effect size of 0.20, the resulting sample size was 49 patients. Selection occurred through randomization, and inclusion criteria were as follows: patients aged 18 years or older, scheduled elective procedures, and possession of a landline or mobile phone to allow for follow-up contact post-procedure. Exclusion criteria were hearing, visual, or other impairments that prevented participation in the survey.

For data collection, a structured KAP survey was developed following the methodology described in the "Guide to Developing Knowledge, Attitude, and Practice Surveys" and the recommendations of the "Guideline for Conducting a Knowledge, Attitude, and Practice (KAP) Study" [7,8]. The questionnaire was also grounded in guidelines from the Brazilian Society of Cardiology and the Brazilian Society of Hemodynamics and Interventional Cardiology [9], as well as from the European Society of Cardiology [10] and the American Heart Association and American College of Cardiology [11].

The final survey comprised the following domains:

1. Sociodemographic characteristics: 22 items.
2. Pre-procedural knowledge: 18 items, including 13 related to cardiac catheterization and 5 on percutaneous coronary intervention. Responses were scored on a 3-point scale: "true," "false," and "I don't know," with 1 point awarded for each correct response.
3. Pre-procedural attitude: 17 items, evaluated using a 3-point scale: "agree," "disagree," and "no opinion," with 1 point awarded for each "agree" response.

4. Pre-procedural practice: 6 items, assessed on a 2-point scale ("yes" or "no"), with 1 point assigned for each "yes" response.
5. Post-procedural knowledge: 16 items, scored similarly to the pre-procedural knowledge domain using a 3-point scale ("true," "false," and "I don't know"), with 1 point awarded for each correct response.
6. Post-procedural attitude: 7 items, evaluated on the same 3-point scale as the previous attitude domain.
7. Post-procedural practice: Assessed through a follow-up telephone call conducted 5 to 7 days after the procedure, including 10 items related to both procedures and 1 item specific to percutaneous coronary intervention. Responses were recorded as "yes" or "no," with 1 point assigned for each "yes" response.

The knowledge questions were designed to assess the necessary preparation, procedural details, and self-care practices following hospital discharge. For the attitude domain, questions were formulated to evaluate patients' beliefs and perceptions regarding the procedures. The practice domain questions aimed to measure their behaviors related to the procedures. The KAP survey was subdivided into (1) pre-procedural, which covered topics related to general knowledge and preparation for the procedures, and (2) post-procedural, which tested patients' knowledge, attitudes, and practices concerning self-care and warning signs after the procedures and hospital discharge.

The sum of scores from all domains results in a total KAP score ranging from zero to 75 points for PCI patients and zero to 69 points for CC patients. For this study, the KAP score was assessed using *Bloom's cutoff points*: 80%–100% (good), 60%–79% (moderate), and less than 60% (poor) [12].

Nurses and physicians with at least two years of direct experience caring for patients in the hemodynamics unit evaluated the content validity of the survey. A total of 15 specialists participated, resulting in a content validity index ranging from 88.9% to 100%, considered satisfactory for the domains of clarity, relevance, and comprehensiveness. All domains demonstrated near-perfect internal consistency, with Cronbach's alpha values exceeding 0.80. The final version of the KAP survey is publicly available at: https://enfermagem.vitoria.ufes.br/sites/enfermagem.vitoria.ufes.br/files/field/anexo/template_para_ppgenf_priscilla.pdf.

Data collection occurred at three time points: upon the patient's admission to the hemodynamics unit in the morning; after discharge instructions while still in the hemodynamics recovery area; and between 5 and 7 days post-procedure, via a telephone call.

We used the IBM SPSS Statistics version 24® and STATA version 14® software for data analysis. Data characterization was presented as observed frequencies, percentages, minimum and maximum values, measures of central tendency, and variability. Fisher's exact test was used to associate the groups with KAP survey classifications at the pre-procedural, post-procedural, and 7-day post-intervention phases. Multiple logistic and ordinal regressions associated the KAP survey classifications with sociodemographic variables across these phases. A significance level of 5% ($p < 0.05$) was adopted for all analyses.

The Ethics Committee approved the present study under approval number 5.615.377/2022. Before completing the questionnaire, all participants received a detailed description of the study, were informed of their right to refuse or withdraw at any time, and had their anonymity guaranteed.

3. Results

3.1. Participant Characterization

Among the 49 patients who underwent elective cardiac catheterization and percutaneous coronary intervention, 21 (51%) were female, 45 (91.8%) resided in urban areas, 35 (72.4%) identified as mixed-race or Black, and 22 (44.9%) were married. Regarding education level, 28 (57.1%) reported having less than a high school education. Before the procedure, family members accompanied most patients (46; 93.9%). The average age was 62.7 ± 10.8 years.

In terms of comorbidities, 36 (73.5%) patients reported having hypertension, 20 (40.8%) had diabetes, 6 (12.2%) suffered from chronic kidney disease, 21 (42.9%) had hypercholesterolemia, and 5 (10.2%) had pulmonary diseases. Regarding tobacco use, 21 (42.9%) mentioned they were either smokers or former smokers. When questioned about family history, 33 (67.3%) reported a positive family history of heart disease.

Regarding communication, 47 (95.9%) of the patients owned a mobile phone, and 42 (87.5%) used the internet independently or with someone's help. When asked whether they had received prior information about the procedure, 35 (69.4%) patients reported receiving instructions over the phone, with 25 (51%) stating these instructions were provided by the hemodynamics service administration where the study was conducted.

The primary sources of health-related information were also investigated, with 36 (73.47%) patients identifying healthcare professionals as their main source. Only 20 (40.8%) of patients actively sought information about the procedures to be performed. Among those who actively sought information, 7 (35%) turned to family members or acquaintances outside the healthcare field, while 13 (65%) consulted primary care professionals (Primary Health Units—UBS). When asked about their desire for additional information regarding catheterization and angioplasty, 42 (85.7%) participants expressed interest in receiving such information through videos, booklets, or images.

3.2. Pre-Procedure Knowledge, Attitude, and Practice

The scores for each item in knowledge, attitude, and practice domains were assessed in patients undergoing cardiac catheterization and percutaneous coronary intervention before

In the post-procedure context, 38.78% of patients understood the timing of discharge, and 65.31% knew about resuming their diet. However, inadequate responses highlighted significant misconceptions, such as the belief that it would be possible to go home immediately after the procedure or to stand up and use the bathroom right after catheterization was performed via the arm.

A detailed analysis revealed that the proportion of correct answers in the knowledge domain was considered the procedure to evaluate general aspects and patient preparation.

In the knowledge domain, the data indicated that 97.96% of patients could define cardiac catheterization, and 100% correctly recognized the concept of angioplasty. Despite this, significant gaps were identified. Only 59.18% knew the route through which the procedure is performed, and knowledge about immediate mobility was particularly limited, with only 18.37% answering correctly. Furthermore, no patient identified the need to replace the stent over time, and only 25% were aware that catheterization might need to be repeated. On the other hand, 75% recognized the importance of continuous medication use after stent placement.

Regarding pre-procedure medical instructions, there was better comprehension of aspects such as the need for fasting (89.80%), reporting allergies (93.88%), and bringing exams and documents on the day of the procedure (69.39%). Other items had intermediate scores, such as contraindications for performing the procedure in cases of fever or flu-like symptoms (61.22%) and the suspension of medications like antihypertensives (61.22%) and metformin (65.31%). However, only 20.41% of patients knew about stopping aspirin and clopidogrel before the procedure.

moderate according to Bloom's Cutoff Points [12]. Incorrect responses highlighted difficulties in understanding statements such as the idea that: cardiac catheterization is performed only through the arm; it would be possible to eat immediately after the procedure once the team permitted diet resumption; medications would no longer be needed after stent placement; the stent would require replacement after a certain time; catheterization should be repeated every six months following angioplasty; and acetylsalicylic acid (ASA) and clopidogrel need to be discontinued for the procedure.

In the attitude domain, which evaluates beliefs and perceptions, patients demonstrated good understanding in some areas, while significant gaps were observed in others. Items related to the reporting of symptoms such as fever (97.96%), dyspnea (100%), and angina (100%) received high rates of positive responses. Additionally, 95.96% understood the requirement for fasting, and 97.96% were

aware of the need to bring examinations and documents, while all patients acknowledged the importance of having a companion during the procedure.

Other aspects, such as medication suspension, showed moderate comprehension: 75.51% identified the need to stop anticoagulants, 77.55% understood the suspension of metformin, and 81.63% recognized the importance of discontinuing antihypertensive medications. The room temperature was perceived as cold by 77.55% of patients, and 77.55% also mentioned that the procedure room resembled an operating room. The need for appropriate attire during the procedure was understood by 81.63% of participants, while 95.92% correctly perceived the importance of post-procedure rest. However, only 59.18% of patients recognized the importance of cardiac monitoring after the procedure, and 77.55% understood the function of the compressive dressing.

The expected outcomes of the procedures demonstrated lower comprehension levels. Only 63.27% understood the benefits of cardiac catheterization, while 67.35% recognized the benefits of angioplasty. This level of understanding was insufficient for certain statements, particularly that catheterization does not provide immediate symptom relief, whereas angioplasty may result in such improvement. Before the procedure, only one statement had a proportion of responses classified as poor, with 59.18% accuracy, related to the importance of cardiac monitoring after the procedure. Moderately correct responses were observed for statements such as recognizing the procedure room as cold, identifying its resemblance to an operating room, understanding that the introducer will require a tight dressing for 24 hours after removal, and acknowledging that oral medications like metformin must be discontinued before the procedure for diabetic patients. Additionally, difficulties were observed in understanding the need to report the use of anticoagulants such as warfarin, rivaroxaban, dabigatran, and apixaban.

In the practice domain, 100% of patients adhered to the recommended fasting, while 95.92% properly prepared the required examinations, documents, and reports. Suspension of prescribed medications was performed by 89.80% of participants, and 93.98% reviewed the instructions provided prior to the procedure. However, only 55.10% informed the nursing team about their current medications, highlighting a gap in communicating essential information for care safety. The same proportion was observed for the item assessing patients' ability to list all regularly used medications, a rate considered insufficient and reinforcing the need for educational interventions focused on effective communication regarding medication use.

3.3. Post-Procedure Knowledge, Attitude, and Practice

The scores for each item in of knowledge, attitude, and practice domains among patients who underwent cardiac catheterization and percutaneous coronary intervention were also evaluated after the procedure to assess self-care and the recognition/management of warning signs.

Post-procedure knowledge tested patients' understanding of necessary care and warning signs after the procedures. Moderate results included the need for rest and restricted activities during the first five days post-procedure, recognized by 61.22% of patients, and information about bandage removal, such as identifying the correct time for removal (77.55%) and the possibility of having it removed at a Primary Health Unit (61.22%). The practice of removing the bandage under water was identified by 61.22% of participants, and 66.27% knew it needed to be replaced after removal. However, items such as recognizing that pain at the puncture site could be normal (8.16%), the correct duration for keeping the bandage on (36.73%), and concerns about fever exceeding 37.8°C (55.10%) revealed poor knowledge. Continuation of prescribed medications was acknowledged by 100% of patients, while warning signs, such as changes at the puncture site (93.88%) and symptoms like swelling or bluish discoloration of the fingers in the affected limb (93.88%), were widely understood. Other items, such as using regular analgesics in case of pain (63.27%) and the need for follow-up with a cardiologist after the procedure (89.80%), also showed positive results.

In the post-procedure domain of attitude, results were largely classified as good, except for the item regarding the right to a medical certificate, which received a moderate classification, with 79.59% correct responses. Positive attitudes toward rest and reducing effort with the affected limb were

observed in 95.92% of patients, while 89.90% recognized rest as part of the recovery process. The appropriate duration for keeping the bandage on was understood by 83.67%, and 95.92% of patients showed a positive attitude regarding the importance of notifying the healthcare team about excessive bandage compression. The need for medical follow-up, either at the PHU or with a cardiologist, was widely recognized, with 97.96% of patients demonstrating a favorable attitude. Additionally, 89.80% demonstrated correct attitudes toward managing bleeding.

In the practice domain, adherence to self-care was high. All patients (100%) continued taking their prescribed medications and followed recommendations to rest the affected limb. Scheduling follow-up appointments with a cardiologist, however, showed a moderate percentage, with 75.51% reporting they had scheduled their follow-up visit. Proper bandage maintenance was correctly performed by 93.88%, and 81.63% reported appropriate bandage removal. Cleaning the puncture site with water and soap was adopted by 93.88% of patients, while 97.96% adhered to restrictions on activities involving the affected limb. Warning signs were appropriately monitored by 91.84% of patients, and 75% reported continuing the use of antiplatelet medications such as acetylsalicylic acid (ASA) and clopidogrel after stent placement.

Table 1 presents the total scores for each domain of knowledge, attitude, and practice (CAP), assessed for general aspects and preparation (pre-procedure) and for self-care and warning signs (post-procedure) in patients undergoing cardiac catheterization and percutaneous coronary intervention. The overall assessment of pre-procedure knowledge showed that only 3 patients (6.1%) demonstrated “good” knowledge. In contrast, 34 patients (69.4%) demonstrated good attitudes, and 42 (85.7%) exhibited good practices. The overall assessment of the post-procedure KAP survey revealed that only 14 (28.6%) of patients achieved good knowledge, while 44 (89.8%) and 46 (93.4%) demonstrated good attitudes and practices, respectively.

Table 1. Description of pre-procedure and post-procedure KAP survey classifications for patients undergoing cardiac catheterization and percutaneous coronary intervention and for the total study population.

			CC		PCI		Total	
			n	%	n	%	n	%
Pre-procedure	Knowledge classification	Poor	11	26.83	5	62.50	16	32.65
		Moderate	27	65.85	3	37.50	30	61.22
		Good	3	7.32	0	0.00	3	6.12
	Attitude classification	Poor	2	4.88	0	0.00	2	4.08
		Moderate	12	29.27	1	12.50	13	26.53
		Good	27	65.85	7	87.50	34	69.39
	Practice classification	Poor	2	4.88	0	0.00	2	4.08
		Moderate	5	12.20	0	0.00	5	10.20
		Good	34	82.93	8	100.00	42	85.71
Post-procedure	Knowledge classification	Poor	7	17.07	0	0.00	7	14.29
		Moderate	22	53.66	6	75.00	28	57.14
		Good	12	29.27	2	25.00	14	28.57
	Attitude classification	Poor	1	2.44	0	0.00	1	2.04
		Moderate	3	7.32	1	12.50	4	8.16
		Good	37	90.24	7	87.50	44	89.80
	Practice classification	Poor	0	0.00	0	0.00	0	0.00
		Moderate	2	4.88	1	12.50	3	6.12
		Good	39	95.12	7	87.50	46	93.88

CC—Cardiac Catheterization; PCI—Percutaneous Coronary Intervention.

3.4. Fisher’s Association Analysis and Logistic Regression

In the pre-procedure phase, the KAP survey scores were associated with certain sociodemographic variables. Patients who reported wanting to receive information about

catheterization and angioplasty through videos, brochures, or images were 8.3 times more likely to achieve a higher knowledge classification compared to those who did not want to receive such information. Individuals with a mobile phone were 11.6 times more likely to achieve a better attitude classification compared to those without a mobile phone. Furthermore, individuals with a mobile phone or a high school education were 114 and 88.1 times more likely, respectively, to achieve a higher practice classification compared to individuals without a mobile phone or who were illiterate.

In the post-procedure phase, the association analysis of the KAP survey showed that individuals with a mobile phone were 25.0 times more likely to achieve a higher knowledge classification compared to those without a mobile phone. Regarding post-procedure practice, individuals who expressed a desire to receive information about catheterization and angioplasty were 16.4 times more likely to achieve a higher classification compared to those who did not wish to receive such information. Table 2 shows the association between KAP survey classifications in the pre- and post-procedure phases and the sociodemographic variables.

Table 2. Association of pre- and post-procedure KAP survey classifications with sociodemographic variables.

Associations in the pre-procedure KAP survey							
Dependent variables	Independent variables		OR	Robust standard error	P-value*	95% CI for OR	
						Lower	Upper
Knowledge classification	Would you like to receive information about CC and PCI?	No	1	-	-	-	-
		Yes	8.26	6.76	0.010	1.66	41.07
Attitude classification	Do you own a mobile phone?	No	1	-	-	-	-
		Yes	11.56	7.47	< 0.001	3.26	41.01
Practice classification	Do you own a mobile phone?	No	1	-	-	-	-
		Yes	113.99	233.75	0.021	2.05	634.15
		Incomplete elementary education	2.97	5.02	0.521	0.11	82.01
		Completed elementary education	20.97	45.51	0.161	0.30	146.43
		Incomplete high school education	1.23	1.80	0.886	0.07	21.50
		Completed high school education	88.11	196.40	0.044	1.12	654.47
		Incomplete higher education	32.00	67.00	0.992	0.00	.
Associations in the post-procedure KAP survey							
Knowledge classification	Do you own a mobile phone?	No					
		Yes	24.55	30.12	0.009	2.22	271.94
Attitude classification	Videos and news	No	1	-	-	-	-
		Yes	0.09	0.09	0.024	0.01	0.72
Practice classification	Would you like to receive information	No	1	-	-	-	-
		Yes	16.40	21.76	0.035	1.22	220.90

about CC and
PCI?

Multiple ordinal regression with forward method; OR—Odds Ratio; (1) comparison category; significant if $p \leq 0.050$. For assessing the association of the post-procedure practice classification. Multiple logistic regression with forward method was used; OR—Odds Ratio; (1) comparison category; significant if $p \leq 0.050$.

There was no significant relationship between the CC and PCI groups with the KAP survey classifications. Therefore, the classifications were similarly distributed between the groups, as shown in Table 3.

Table 3. Association of pre- and post-procedure KAP survey classifications with sociodemographic variables.

			Groups				P-value*
			CC		PCI		
			n	%	n	%	
Pre-procedure	Knowledge classification	Poor	11	26.83	5	62.50	0.154
		Moderate	27	65.85	3	37.50	
		Good	3	7.32	0	0.00	
	Attitude classification	Poor	2	4.88	0	0.00	0.591
		Moderate	12	29.27	1	12.50	
		Good	27	65.85	7	87.50	
	Practice classification	Poor	2	4.88	0	0.00	0.701
		Moderate	5	12.20	0	0.00	
		Good	34	82.93	8	100.00	
Post-procedure	Knowledge classification	Poor	7	17.07	0	0.00	0.498
		Moderate	22	53.66	6	75.00	
		Good	12	29.27	2	25.00	
	Attitude classification	Poor	1	2.44	0	0.00	0.667
		Moderate	3	7.32	1	12.50	
		Good	37	90.24	7	87.50	
	Practice classification	Poor	0	0.00	0	0.00	0.421
		Moderate	2	4.88	1	12.50	
		Good	39	95.12	7	87.50	

(*) Fisher’s Exact Test; significant if $p \leq 0.050$; CC—Cardiac catheterization; PCI—Percutaneous coronary intervention.

4. Discussion

This study explored the knowledge, attitude, and practice of elective patients from a university hospital in southeastern Brazil regarding cardiac catheterization and percutaneous coronary intervention. Our results suggest that these patients had limited knowledge, positive attitudes, and proactive practices concerning general aspects, preparation, self-care, and recognition of warning signs following these procedures. These findings provide a foundation of data and theoretical insights that can support the development of future education and training programs for this population.

The overall evaluation of pre-procedure knowledge revealed that only 3 patients (6.1%) demonstrated “good” knowledge. In contrast, 34 patients (69.4%) exhibited good attitudes, and 42 (85.7%) demonstrated good practices. The post-procedure KAP survey showed that only 14 patients (28.6%) achieved good knowledge, while 44 (89.8%) and 46 (93.4%) demonstrated positive attitudes and practices, respectively. These findings may be related to the sociodemographic profile of the evaluated patients, as it is well established that older age, lower educational attainment, and the presence of multiple comorbidities are associated with lower health literacy [13,14]. Furthermore, the fact that the information provided by healthcare professionals or administrative staff in the

hemodynamics unit, as shown in our results, focuses primarily on practical issues leaves little opportunity for patients to enhance their theoretical knowledge. This disconnect can contribute to gaps between knowledge, attitude, and practice. Another explanation might be that patients intuitively develop positive attitudes and proactive practices without proper scientific grounding [15].

Our finding of low knowledge levels regarding CC and PCI aligns with previous studies investigating patients with chronic diseases. A KAP study conducted in Lebanon revealed that patients demonstrated low knowledge, moderate attitudes, and low to moderate practice levels regarding cardiovascular disease. This result highlighted the need for health authorities to implement strategies and programs to improve the population's KAP regarding cardiovascular conditions, as it would encourage individuals to adopt appropriate preventive and corrective measures [12]. Another KAP survey on cardiovascular disease conducted in Guyana found that patients with Type 2 Diabetes Mellitus had limited knowledge of acute coronary syndrome symptoms and even less awareness of how to respond effectively to a heart attack [16]. Conversely, a study conducted in China evaluating KAP among older adults with coronary artery disease regarding self-perceived health skills demonstrated that older patients with coronary artery disease exhibited sufficient knowledge, positive attitudes, and proactive practices [17].

Nevertheless, the ownership of a mobile phone was associated with higher KAP levels among the investigated patients, which may be attributed to facilitated access to health information. This finding aligns with previous studies emphasizing the positive impact of mobile device access on promoting health literacy and engagement in preventive behaviors. For instance, a study conducted in Uganda found that individuals in households with mobile phones were 35% more likely to demonstrate greater knowledge about cardiovascular disease prevention, suggesting that mobile devices can serve as viable platforms for educational interventions and health information dissemination [18]. In the present study, the positive relationship between mobile phone use and higher KAP scores highlights the potential for leveraging these technologies to implement targeted health education programs, particularly in populations with limited access to in-person resources.

Our results identified key deficiencies in conceptual knowledge related to CC and PCI, rest, diet, hospital discharge, catheter insertion site care, and recognition of warning signs such as fever and pain. Particularly notable was the low level of knowledge regarding the suspension and resumption of continuous-use medications. Inadequate understanding of the continuity of anticoagulant and antiplatelet therapies is particularly concerning, as it can directly affect the safety and effectiveness of treatment [19].

Previous research has shown that educational programs can improve patients' knowledge, which is essential to avoid complications and promote proper recovery, as a lack of understanding may lead to risky behaviors [20,21]. Therefore, we suggest that implementing educational interventions could help improve patients' knowledge about CC and PCI, as well as preparation for procedures, self-care, and recognition of complication signs.

The fact that moderate or low average knowledge scores did not translate into negative attitudes or poor practices should be interpreted carefully. When the items within the attitude, and practice domains were assessed individually, attitudinal and practical weaknesses emerged, which may pose risks to patients' health management. Results from the pre-procedure attitude domain revealed unfavorable attitudes regarding the expected outcomes of the procedures, prior recognition of the procedure room type, and the need for cardiac monitoring. These attitudes may result in anxiety and insecurity during the post-procedure period, suggesting a need for clearer and more effective communication with patients to clarify expectations and treatment purposes [22]. However, unfavorable attitudes toward communicating the use of anticoagulants to the medical team are particularly concerning. This communication is critical to ensuring patient safety and preventing potential complications [23].

Equally concerning was the poor proportion of responses in the "practice" domain regarding the question, "Are you able to tell the nursing team the names of all the medications you take at

home?" This difficulty is alarming because knowledge of ongoing medications is fundamental for proper evaluation and care management during the procedure. Patients' inability to report their medications can lead to medication errors and compromise patient safety. These findings align with those of another study indicating that patients with low knowledge about their anticoagulant therapy are at a higher risk of severe bleeding and treatment interruption [24]. A lack of knowledge and routine regarding medication use can be a significant barrier to treatment adherence [25]. Therefore, the combination of low knowledge levels with inadequate attitudes and practices increases the risk of adverse outcomes, underscoring the need for educational interventions focused on promoting correct adherence to medication therapy.

Weaknesses in practice were also identified regarding the need to schedule a follow-up appointment with a cardiologist after the procedure and the use of antiplatelet and anticoagulant medications following stent placement. These results suggest that, despite a good overall understanding of self-care, some patients may not be rigorously following instructions, exhibiting behaviors that predispose them to risk. Adherence to medication therapy and follow-up care with a cardiologist is essential for preventing future complications and maintaining cardiovascular health [26,27].

Furthermore, this study revealed that variables associated with higher knowledge, positive attitudes, and proactive practices regarding CC and PCI include patients' desire to receive information about the procedures, mobile phone ownership, and education level—particularly completing high school compared to illiteracy. These findings suggest that access to information and technology, combined with higher educational attainment, plays a key role in empowering patients, enabling them to make more informed decisions and adopt more effective self-care practices. Moreover, the willingness to seek information reflects proactive health behaviors that can be encouraged through targeted educational programs. These variables should be considered when planning intervention strategies to improve health outcomes in this population [28].

This study has some limitations. First, it was conducted at a single center, so the generalizability of the results remains uncertain. Second, the KAP survey may have limitations regarding its ability to assess perceptions of CC and PCI, preparation needs, and complications. Third, another limitation to consider is evaluating attitudes and practices based solely on patient-reported information without direct observation of preparation and self-care.

Despite these limitations, the study provided results that may be useful for organizing health services, as the KAP model views behavior change as an integrated process, where acquired knowledge forms the foundation, generating positive attitudes and, ultimately, resulting in practice. Based on this understanding, the present study assessed the knowledge, attitude, and practice levels among patients undergoing CC and PCI to provide a database and theoretical framework that can inform the development of future education and training programs for this population. Additional studies are needed to explore the effects of educational interventions on the knowledge, attitudes, and practices of elective patients undergoing CC and PCI.

5. Conclusions

This study identified gaps in the knowledge of patients undergoing cardiac catheterization and percutaneous coronary intervention despite positive attitudes and practices. The findings highlight the need for targeted educational interventions, particularly utilizing technologies such as videos and apps, to improve preparation, self-care, and the recognition of warning signs.

Integrating educational strategies into healthcare services can empower patients, promoting greater adherence to therapeutic guidelines and improved clinical outcomes. Continuous investment in programs and future studies is essential to assess the impact of these initiatives on practice and patient safety.

Supplementary Materials: The following supporting information can be downloaded at the website of this paper posted on Preprints.org.

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Abbreviations

The following abbreviations are used in this manuscript:

KAP Knowledge, attitude, and practice
CC Cardiac catheterization
PCI Percutaneous coronary intervention

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