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Competencies and Roles of the Nurse as Part of the Interventional Cardiology Team

ABSTRACT
of a dissertation
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Health Care Management

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The dissertation consists of 192 pages and is structured into five chapters. It includes 61 figures, 19 tables, and 6 appendices. The bibliography comprises 172 literary sources, of which 45 are in Cyrillic, 104 in Latin, and 24 internet sources. The dissertation was discussed and directed for defense by the extended departmental council of the Department of Health Care at the Medical University "Prof. Dr. P. Stoyanov" - Varna, on November 12, 2024.

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The defense materials are available in the Scientific Research Department of Medical University of Varna (MU – Varna) and are published on the MU – Varna website (www.mu-varna.bg).

Contents

LIST OF ABBREVIATIONS

ACC American College of Cardiology

ESC European Society of Cardiology

AHA American Heart Association

AMI Acute Myocardial Infarction

CVD Cardiovascular Diseases

IHD Ischemic Heart Disease

MI Myocardial Infarction

RF Risk Factors

PCI Percutaneous Coronary Intervention

PTCA Percutaneous Transluminal Angioplasty

DES Drug-Eluting Stent

BMS Bare Metal Stent

SCA Selective Coronary Angiography

RN-BC Cardiovascular Nursing Certification

ICN Interventional Cardiology Nursing

AQF Australian Qualifications Framework

EAPCI European Association of Percutaneous Cardiovascular Interventions

NAP Nurses and Associated Professions

MLC Minimum Level of Competence

BAHP Bulgarian Association of Health Professionals

INTRODUCTION

Acute myocardial infarction remains a leading cause of morbidity and mortality worldwide despite significant improvements in prognosis over the past decade. Progress is due to several key trends: wider use of invasive strategies, implementation of care delivery systems prioritizing immediate revascularization through percutaneous coronary intervention or fibrinolysis, and advances in antiplatelet agents and anticoagulants.

Several factors such as quality emergency care, timely patient transport, and highly specialized services in healthcare facilities for invasive diagnosis and treatment of cardiovascular diseases can help reduce mortality. Over time, the number and complexity of invasive coronary procedures have increased.

The need for angiographic procedures is significant due to their high diagnostic accuracy and the possibility of conducting minimally invasive procedures. These procedures are crucial for the early detection and treatment of cardiovascular diseases, reducing the risk of serious complications and improving the patient's quality of life.

The increasing diagnostic and therapeutic value of invasive procedures in patients with cardiovascular diseases creates challenges for the education and training of nurses to practice in this specialized field. This trend translates into an increased need for precisely performed medical activities, professional competence, and effective professional communication by the nurse as part of the interventional cardiology team.

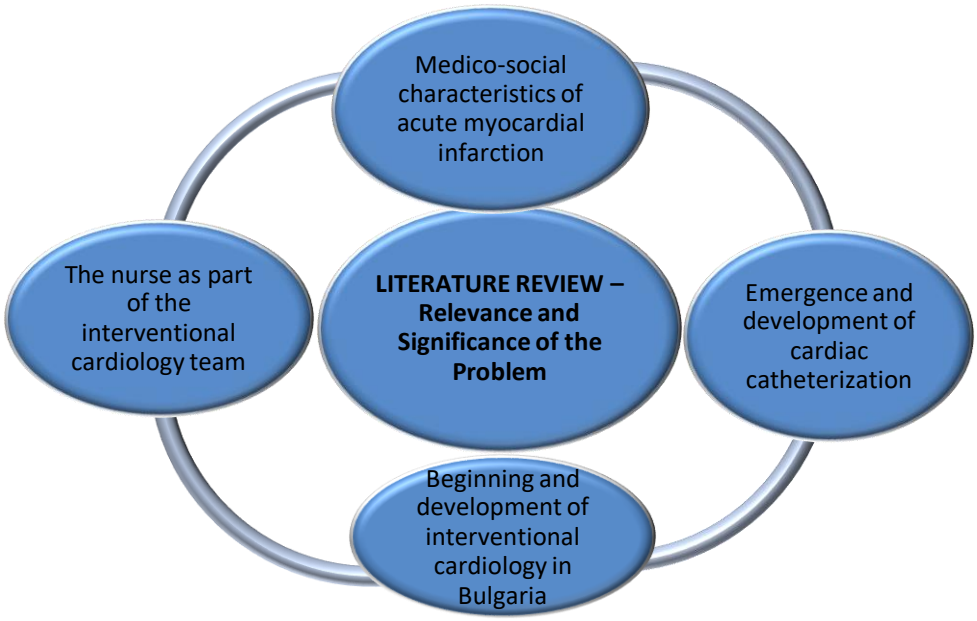
The rapid development of medicine and technology necessitates the implementation of specialized high-tech equipment in healthcare facilities for invasive diagnosis and treatment of cardiovascular diseases, requiring additional training, systematic updating, and upgrading of nurses' competencies in the respective structures.

Those nurses are an important part of the interventional radiology team. They play a crucial role in both direct patient care and the technical and organizational preparation of invasive procedures. The lack of sufficient literary sources and studies related to the roles of interventional radiology nurses prompted us to investigate the problem and outline the nurse's place as part of the interventional radiology team.

In this dissertation, we analyze the main competencies of the nurse as part of the interventional radiology team, propose the optimization of specific nursing activities through a self-developed Protocol for the Roles of the Interventional Radiology Nurse (IR nurse). A SWOT analysis of the professional development of the IR nurse and a Model of the Modern Interventional Radiology Nurse have been presented as well.

I. LITERATURE REVIEW

The first chapter of the dissertation includes a literature review, presenting in a structured manner the relevance and significance of the problem (fig. 1).



(Figure 1). Structure of the literature review

II. METHODOLOGY AND COORDINATION OF THE SCIENTIFIC STUDY

2.1. Goal, objectives, and hypotheses

Goal: To analyze the main competencies of the nurse as part of the interventional cardiology team and, based on this, to propose the optimization of specific nursing activities by developing a Model of the Modern Interventional Radiology Nurse and implementing a Protocol aimed at minimizing errors.

To achieve this goal, we set the following **objectives:**

1. **To examine and define the roles and competencies of the nurse** as part of the interventional cardiology team through a survey among IR nurses and experts.
2. To **examine the perspectives of patients** regarding the professional skills and trust in IR nurses.
3. **To establish the attitudes and readiness of nurses to engage in** various forms of **continuing education** in interventional cardiology.
4. To formulate a **Protocol for the Roles of the Interventional Radiology Nurse**
5. To conduct an experiment in a real work environment by implementing a self-developed **Protocol for the Roles of the Interventional Radiology Nurse.**
6. To examine the perspectives **of experts and nurses** regarding the effectiveness of the conducted experiment and the applied self-formulated **Protocol for the Roles of the Interventional Radiology Nurse.**
7. To **examine the perspectives of experts** in interventional cardiology on the roles and competencies of nurses as part of the interventional cardiology team **through in-depth interviews.**
8. To create a **Model of the Modern Interventional Radiology Nurse** based on the conducted experiment, survey, and in-depth interviews.

Working Hypotheses

- The professionalism of the nurse and maintaining high-quality healthcare are crucial for improving treatment, enhancing the quality of life, and increasing patient satisfaction.

- Implementing the Protocol will clarify the role of the nurse as a member of the interventional cardiology team, minimize the risk of errors, and improve the quality of healthcare.
- Introducing the Protocol might result in negative feedback from nurses due to the addition of more administrative duties.

2.2. Coordination, time, and place of the dissertation study

Subject

The subject of this study is the competencies and roles of nurses as part of the interventional cardiology team.

Object of the study

The objects of the study are:

- ***Patients*** hospitalized for planned procedures in the interventional cardiology departments in Varna, Ruse, Pleven, Gabrovo, Montana, Panagyurishte.
- ***Nurses*** working in the interventional cardiology departments in Varna, Ruse, Pleven, Gabrovo, Montana, Panagyurishte.
- ***Experts*** – interventional cardiologists, senior nurses working in interventional cardiology departments in Varna, Ruse, Pleven, Gabrovo, Montana, Panagyurishte.

Scope of the study

A total of 196 individuals **(n=196)** took part in the study, and were divided into three groups:
***First group* – Patients** hospitalized for planned procedures in interventional cardiology clinics/departments **(n=130),** (Table 1).

Table 1. Distribution of respondents from the first group by cities

City	*Medical Institution*	*Number of Respondents*
Varna	St. Marina University Multi-profile Hospital for Active Treatment – Varna (St. Marina UMHAT)	20
	Cardiolife Specialized Hospital for Active Treatment in Cardiology Ltd., Varna (Cardiolife SBALK Ltd.)	20
Ruse	Kanev University Multi-profile Hospital for Active Treatment AD (Kanev UMHAT AD)	20
Pleven	Georgi Stranski University Multi-profile Hospital for Active Treatment EAD (Georgi Stranski UMHAT EAD)	20
Gabrovo	Dr. Tota Venkova Multi-profile Hospital for Active Treatment AD (Dr. Tota Venkova MHAT AD)	15
Montana	City Clinic – St. George Multi-profile Hospital for Active Treatment Ltd. (City Clinic – St. George MHAT Ltd.)	15
Panagyurishte	Multi-profile Hospital for Active Treatment "Uni Hospital" Ltd. (Uni Hospital UMHAT Ltd.)	20

Second Group – Nurses working in IR suites in interventional cardiology clinics/departments (n=35), (Table 2).

Table 2. Distribution of respondents from the second group by cities

City	***Medical Institution***	***Number of Respondents***
Varna	St. Marina UMHAT Cardiolife SBALK Ltd.	8 5
Ruse	Kanev UMHAT AD	3
Pleven	Georgi Stranski UMHAT EAD	4
Gabrovo	Dr. Tota Venkova MHAT AD	5
Montana	City Clinic – St. George MHAT Ltd.	5
Panagyurishte	Uni Hospital UMHAT Ltd.	5

Third Group – Experts: interventional cardiologists, senior nurses working in interventional cardiology clinics/departments **(n=31),** (Table 3).

Table 3. Distribution of respondents from the third group

Medical Institution	Interventional cardiologists	Senior Nurses
St. Marina UMHAT –Varna	6	2
Cardiolife SBALK Ltd. – Varna	2	1
Kanev UMHAT AD – Ruse	3	1
Georgi Stranski UMHAT EAD – Pleven	2	1
Dr. Tota Venkova MHAT AD – Gabrovo	4	1
City Clinic – St. George MHAT Ltd. – Montana	4	1
Uni Hospital UMHAT Ltd. – Panagyurishte	2	1

Logical units of the study

- **First logical unit** – all patients hospitalized for planned admission in an interventional cardiology clinic/department;
- **Second logical unit** – all nurses practicing in an IR suite in a cardiology clinic/department;
- **Third logical unit** – all expert interventional cardiologists and senior nurses practicing in an interventional cardiology clinic/department.

Technical units

University hospitals

- St. Marina UMHAT – Varna
- Kanev UMHAT AD – Ruse
- Georgi Stranski UMHAT EAD – Pleven

Multi-profile hospitals

- Dr. Tota Venkova MHAT AD – Gabrovo
- City Clinic – St. George MHAT Ltd. – Montana
- Uni Hospital UMHAT Ltd. – Panagyurishte

Specialized hospitals

- Cardiolife SBALK Ltd. – Varna

Criteria for inclusion in the study

First group

- Patients over 18 years of age
- Patients hospitalized for planned admission in interventional cardiology departments
- Patients who agreed to participate in the study by signing a consent form

Second group

- Nurses working in an IR suite for at least 1 year
- Having qualification in Nursing
- Possessing a certificate issued by the Bulgarian Association of Health Professionals in Nursing (BAHPN)
- Participants who signed a consent form to take part in the study

Third group

- Physicians with a Cardiology specialty with professional qualification in Interventional Cardiology and at least 2 years of experience in interventional cardiology
- Senior nurses with a Master's or Bachelor's degree in Health Care Management with at least 2 years of experience in the field of interventional cardiology
- Participants who signed a consent form to take part in the study

2.3. Stages and place of the study

The coordination of the study (stages, activities performed by the doctoral student, applied tools, time, and place) is presented in tabular form (Table 4).

Table 4. Stages of the study

Stage	Activity	Place	Tools	Timeframe
Stage 1	Analysis of specialized literature regarding the relevance of the researched problem	Shumen	Specialized literature; Specialized databases with publications;	Dec 2021 - Nov 2022
Stage 2	Defining the goals and objectives of the dissertation research; Choosing appropriate methods; Developing tools for conducting the scientific research	Shumen	Questionnaire No.1 - **Experts**; Survey form No.1 - **Patients;** Survey form No.2 - **Experts**; Survey form No.3 - **IR nurses**	Dec 2022 - Dec 2023
Stage 3	Analyzing the competencies and roles of nurses working in interventional cardiology clinics/departments. Coordinating and conducting the main study after evaluation by Research Ethics Committee (KENI) of the Medical University of Varna. Conducting an experiment by implementing a Protocol for the Roles of the Interventional Radiology Nurse	Varna Ruse Pleven Gabrovo Montana Panagyurishte Varna Ruse Varna Ruse	Survey form No.1 - **Patients;** Survey form No.2 - **Experts;** Survey form No.3 – **IR nurses;** Protocol for the Roles of the Interventional Radiology Nurse; Survey form No.4 - **Experts;** Survey form No.5 - **IR nurses;**	Feb - Jun 2024; Feb 2024; Apr – Aug 2024

Stage	Activity	Place	Tools	Timeframe
	Conducting an anonymous survey on the effectiveness of the experiment. Conducting in-depth interviews	Varna Ruse	Questionnaire No.1 - **Experts**	Apr - Aug 2024
Stage 4	Statistical processing and analysis of the results	Shumen	Survey data was processed with IBM Statistics - SPSS for Windows, ver. 19 and MS Excel 2021	Sep - Oct 2024
Stage 5	Formulating conclusions, contributions, recommendations derived from the dissertation	Shumen		Nov – Dec 2024

Monitoring Bodies

The main part of the study was conducted independently to achieve greater accuracy. Collaborators were involved – doctors, senior nurses, and interventional radiology nurses from the designated medical institutions.
The selected collaborators were informed in advance about the study's purpose and methodology. They were also trained to use the toolkit, which includes the data protection notice for subjects, information for respondents, the informed consent form, and the survey forms.

Sources of information collection

- Views of patients hospitalized in the interventional cardiology clinics/departments in Varna, Ruse, Pleven, Gabrovo, Montana, and Panagyurishte.
- Opinions of nurses working in the IR suites in the interventional cardiology departments in Varna, Ruse, Pleven, Gabrovo, Montana, and Panagyurishte.

- Insights of experts – interventional cardiologists, senior nurses working in interventional cardiology departments in Varna, Ruse, Pleven, Gabrovo, Montana, and Panagyurishte.
- Legal and regulatory acts governing state health policy, educational and professional activities carried out by medical professionals.

- ✓ Ordinance No. 1 of the Ministry of Health from 8 February 2011 on the professional activities that nurses, midwives, associated medical specialists, and health assistants can perform by appointment or independently.
- ✓ Ordinance No. 1 from 2 January 2015 on acquiring a specialty in the healthcare system for specialists with professional qualifications in the medical field of Health Care.
- ✓ Ordinance No. 34 from 29 December 2006 on acquiring a specialty in the healthcare system for highly specialized activities.
- ✓ Ordinance No. 2 from 25 January 2010 on approving the medical standard for Cardiology.

2.4 Study tools

To achieve the research objectives and solve the pre-defined tasks, a custom toolkit was developed for conducting the survey among the three groups of respondents (Table 5).

Table 5. Study tools

Tools	**Questions**			
	Total number	**Closed**	**Semi-closed**	**Open**
1.Survey form №1 ***for patients***	**18**	**15** ***For question № 17, a 1 to 10 scale was used***	**2**	**1**
2. Survey form № 2 ***for experts***	**18**	**8**	**10**	

3. Survey form № 3 *for interventional radiology nurses*	**28**	**20**	**6**	***2***

Survey form No. 1 contains 18 questions and surveys the perspectives of patients hospitalized in interventional cardiology clinics/departments. The questions are structured into several sections that clarify demographic characteristics and patients' opinions on the communication and professional skills of the IR nurse. It also explores patients' trust in IR nurses.

Survey form No. 2 contains 18 questions and is aimed at checking experts' insights on the competencies and activities of nurses working in IR suites, as well as the need for implementing a Protocol for the roles of the Interventional Radiology Nurse.

Survey form No 3, with 29 questions, targets IR suite nurses to gather their opinions on the need for preliminary training for work in an IR suite; opportunities for postgraduate training, and views on implementing a Protocol for the roles of the Interventional Radiology Nurse.

The insights of experts and nurses in the field of interventional cardiology were gathered regarding the competencies and roles of nurses as part of the interventional cardiology team (Table 6).

Table 6. Study tools for in-depth interviews

Tools	**Questions**			
	Total number	**Main research questions**	**Follow-up questions**	**Concluding questions**
1. Questionnaire No. 1 *for experts,*	**6**	**2**	**2**	**2**

conducted as an in-depth interview				

Questionnaire No. **1 for conducting in-depth interviews.**

Information was collected during casual conversations, in a natural environment for the participants – at their workplace.
Participants were predisposed to maximum freedom and spontaneous sharing of professional experience, opinions, and personal impressions.

The participants in this study were selected on a voluntary basis (n=8). The study included respondents from St. Marina University Multi-profile Hospital for Active Treatment – Varna (n=6), and from Kanev University Multi-profile Hospital for Active Treatment AD – Ruse (n=2). Interventional cardiologists and senior nurses working in the IR suite were among the participants in the in-depth interview.
For the purposes of the in-depth interview, a specific study tool was developed. The following elements were included:

- *The primary research questions* were focused on the study's goal: to investigate and analyze the main competencies and roles of nurses within the interventional cardiology team.
- *The follow-up sub-questions* for respondents, asked in a flexible order, were focused on addressing the need for regular updating of knowledge and skills among Interventional Radiology Nurses.
- *The concluding questions* for each interviewee clarified whether other individuals could provide valuable insights on this topic.

The interviews were conducted by the researcher from April 2024 to August 2024. Participants were personally invited by the researcher. A request was made to the respondents for the interviews to be recorded. They lasted an average of about 60 minutes.

2.5. Experiment design

Goal of the experiment: To establish the roles and competencies of the nurse as part of the interventional cardiology team through the implementation of a **Protocol for the Roles of the Interventional Radiology Nurse.**

Goal of the protocol:

- To clearly and precisely define the place and role of the nurse as part of the interventional cardiology team.
- Establish consistent and clear steps to follow when providing invasive nursing care;
- Reduce the risk of omissions in the preparation of necessary supplies for vascular access;
- To be implemented as a guide for training newly recruited nurses;

Protocol tasks:

- Assist in the adaptation of newly recruited nurses;
- Increase the level of safety when handling specific equipment;
- Reduce the risk of omissions and errors in emergency situations;
- Reduce the risk of complications during and after invasive procedures;

Object of the experiment: Nurses and experts working at the St. Marina University Multi-profile Hospital for Active Treatment – Varna and the Kanev University Multi-profile Hospital for Active Treatment AD.

Scope of the experiment

The experiment included (n=24) respondents, divided into two groups:

First group – nurses working in the IR suite (n=12)

Second group – expert interventional cardiologists and senior nurses working in the IR suite (n=12)

After establishing the need for specific documentation for performing highly specialized invasive nursing activities, a Protocol for the Roles of the Interventional Radiology Nurse was formulated. An experiment was conducted by implementing the protocol formulated by the doctoral student, with prior instruction on the purpose and essence of the experiment. Each expert and interventional radiology nurse received a paper copy of the **Protocol for the Roles of the Interventional Radiology Nurse**, and it was available in each IR suite.

The experiment was conducted in 4 steps (Table 7).

Table 7. Steps of conducting the experiment

No.	Activity	Tool	Place	Timeframe
1	Formulating the Protocol for the Roles of the Interventional Radiology Nurse	Author's work	Medical University - Varna, Shumen Affiliate	November 2023
2	Conducting the experiment by implementing the Protocol for the Roles of the Interventional Radiology Nurse	Protocol for the Roles of the Interventional Radiology Nurse	St. Marina UMHAT - Varna Kanev UMHAT AD - Ruse	February - March 2024
3	Conducting an anonymous survey on the effectiveness of the experiment	Survey form No. 4 **Experts;** Survey form No. 5 **IR nurses**	St. Marina UM HAT - Varna Kanev UMHAT AD - Ruse	April - August 2024
4	Based on the analysis of the results - drawing conclusions and recommendations (defining the roles and competencies of the nurse as part of the interventional cardiology team)		Shumen	September - October 2024

Experiment tools

Protocol for Conducting the Experiment

During the scientific study, a Protocol for the roles of the nurse as part of the interventional cardiology team was developed.

- **Structure of the Protocol for the Roles of the Interventional Radiology Nurse**

The protocol begins with brief information on the main characteristics, equipment, and procedures performed in the IR suite. It describes the goals and tasks of the protocol, a standard operating procedures scheme for the preparation and roles of

the circulating and scrub nurse, and a list of necessary equipment, supplies, and medications. A model of a **Selective Coronary Angiography Activity Checklist** (nursing documentation) was formulated. The protocol concludes with a **Standard Operating Procedures for Interventional Nursing Activities during Cardiopulmonary Resuscitation.**

After conducting the experiment, we surveyed the insights of experts and interventional radiology nurses to determine the effectiveness of introducing specific working documentation (Protocol for the Roles of the Interventional Radiology Nurse) concerning highly specialized nursing competencies in providing interventional nursing activities.

- **Survey form No. 4 for surveying the perspectives of expert physicians and senior nurses** working in the IR suite, containing 10 questions, of which 8 are closed, 2 semi-closed, and 1 open. It includes questions regarding the necessity and effectiveness of implementing the Protocol for the Roles of the Interventional Radiology Nurse.

- **Survey form No. 5 for surveying the perspectives of nurses working in the IR suite**, containing 12 questions, of which 8 are closed, 3 semi-closed, and 1 open. It includes questions regarding the necessity and effectiveness of implementing the Protocol for the Roles of the Interventional Radiology Nurse.

2.6. Methods

The purpose of the scientific study necessitates the use of a complex of sociological and statistical methods:

Sociological methods:

- **Survey method** – direct individual surveys were used to collect, analyze, and summarize information. Three survey forms were prepared to survey respondents from different groups – patients, experts, and nurses (No. 1, No. 2, No. 3). Two survey forms were prepared regarding the opinions of respondents who participated in the experiment – nurses and experts (No. 4, No. 5).

- **Documentary method** – study of medical documentation and regulatory documents: ordinances, standards, laws.
- **Historical method** – tracing and development of cardiac catheterization through different stages of social development.
- **In-depth interview** with experts and nurses in interventional cardiology using a pre-prepared questionnaire containing 6 questions regarding the competencies and roles of the nurse as part of the interventional cardiology team.
- **SWOT analysis** of the professional development of the nurse practicing in the Interventional Radiology (IR)suite.

Experimental method:

- ✓ Implementation of the Protocol for the Roles of the Interventional Radiology Nurse. The experiment involved (n=24) respondents, (n=12) nurses and (n=12) experts working at St. Marina UMHAT - Varna and Kanev UMHAT AD.
- ✓ Conducting a survey (questionnaires No. 4 and No. 5) regarding the necessity of introducing the **Protocol for the Roles of the Interventional Radiology Nurse**. Nurses and experts working in the interventional suite where the experiment took place were surveyed.

Statistical Methods

- **The data from the survey were processed** using the IBM Statistics - SPSS for Windows, ver. 19 statistical package, and MS Excel 2021. Since all variables are qualitative, they are presented as relative shares in the descriptive analysis, and the non-parametric chi-square test was used for hypothesis testing. The significance level of the null hypothesis was $\alpha = 0.05$. The following were used in processing the results:
    - **Comparative analysis** – for comparing changes in variable indicators;
    - **Parametric and non-parametric tests** – for hypothesis evaluation – statistical comparison using chi-square analysis for testing hypotheses about the relationship between qualitative variables. The critical significance level in the studies is $\alpha = 0.05$;
    - **Graphical analysis** – graphically presents the processed survey data. MS Excel 2021 and IBM Statistics 19 were used for graphical analysis;

- **Descriptive statistics** – description of the studied parameters included in the study, such as demographic parameters and parameters of the overall condition assessment;
- **p-value of significance** – the p-value is interpreted as the probability of error when rejecting the null hypothesis (Type I error). The smaller the p-value, the more certain the rejection of the null hypothesis and the acceptance of the proposal that the observed effect is statistically significant. Null hypotheses are usually rejected at $p < 0.05$ (<5%). Values close to the threshold are marginally significant.

III. RESULTS OF OWN RESEARCH AND DISCUSSION

3.1. Socio-demographic characteristics of the studied groups

- **Patients** (n=130)

  In this study, 79 men (60.8%) and 51 women (39.2%) were included as patients, hospitalized for planned admission in the interventional cardiology departments at St. Marina UMHAT - Varna, Cardiolife SBALK – Varna, Kanev UMHAT AD – Ruse, Georgi Stranski UMHAT EAD – Pleven, Dr. Tota Venkova MHAT AD – Gabrovo, City Clinic – St. George MHAT Ltd. – Montana, and Uni Hospital UMHAT Ltd.) – Panagyurishte. The patients were asked about the professional skills of the interventional radiology nurses and their level of trust in these specialists (Table 8).

Table 8. Socio-demographic characteristics of patients

Socio-demographic characteristics	n (number)	%
Age	**n**	**%**
30-40 years	6	5
41-50 years	16	12
51-60 years	41	32
61-70 years	31	24
Over 71 years	36	28
Gender	**n**	**%**
Men	79	60.8

Socio-demographic characteristics	n (number)	%
Women	51	39.2
Place of residence	**n**	**%**
City	96	73.8
Village	34	26.2
Education	**n**	**%**
Higher	29	22.31
Upper-secondary	78	60.00
Lower-secondary	22	16.92

Regarding the age distribution of patients, the largest group is aged 51-60 years (32%), followed by those over 71 years (28%). There is a slight difference in the percentage for those aged 61-70 years (24%).

A relatively small share of patients is aged 41-50 years (12%). The smallest share is those aged 30-40 years (5%). The gender distribution shows a predominance of men (60.8%).

Most patients indicated that they live in cities (73.8%), while significantly fewer live in rural areas (26.2%). Those living in cities have broader access to specialized medical care.

Another factor influencing the respondents' opinions is their education. More than half of the respondents indicated that they have upper-secondary education (60.00%). A relatively low share of respondents has higher education (23.08%), followed by those with lower-secondary education (16.92%).

- **Nurses (n=35)**

A study was conducted among nurses practicing in the IR suite in the cardiology clinics/departments at St. Marina UMHAT - Varna, Cardiolife SBALK – Varna, Kanev UMHAT AD – Ruse, Georgi Stranski UMHAT EAD – Pleven, Dr. Tota Venkova MHAT AD – Gabrovo, City Clinic – St. George MHAT Ltd. – Montana, and Uni Hospital UMHAT Ltd.) – Panagyurishte, regarding the roles and competencies of the nurse as part of the interventional cardiology team, as well as their point of view regarding implementation of the Protocol for the Roles of the Interventional radiology nurse (Table 9).

Table 9. Socio-demographic characteristics of nurses

Socio-demographic characteristics	n (number)	%
Education	**n**	**%**
Semi-higher medical education	3	8.3
Health Care Specialist	9	27.8
Bachelor's degree in Health Care	5	13.9
Bachelor's degree in Health Care Management	9	25.0
Master's degree in Health Care Management	9	25.0
Experience in the field	**n**	**%**
5-10 years	5	16.7
10-15 years	5	13.9
15-20 years	7	19.4
20-30 years	10	27.8
Over 30 years	8	22.2
Experience in the angiography lab	**n**	**%**
1-5 years	11	33.3
6-10 years	13	36.1
11-20 years	10	27.8
Over 20 years	1	2.8

It was important for us to study the educational level of the surveyed nurses. The largest share of nurses has a Specialist degree (27.8%). It is noteworthy that a significant number of nurses have completed Bachelor's and Master's programmes in Health Care Management, demonstrating their desire and motivation for professional development. (25.00%). The smallest share of surveyed nurses has semi-higher medical education (8.3%). The data indicate that nurses enhance their competencies through additional training.

The duration of experience is an important factor influencing the respondents' opinions on the research topic. The study data show that the largest share of medical experience is between 20-30 years (27.8%), followed by those with more than 30 years of experience (22.2%). Relatively fewer respondents have 15-20 years (19.4%) and 5-10 years (16.7%) of total work experience.

Regarding experience in the IR suite, the results show that the largest group of nurses have 5-10 years of experience (36.1%), followed by those with 1-5 years (33.3%). The smallest share has over 20 years of experience (2.8%).

Based on these data, we find that nurses in IR suites have extensive practical experience accumulated during their careers, which gives us reason to believe that the opinions expressed by this group of respondents are significant for the study.

- **Experts (n=31)**

The study included interventional cardiologists, senior nurses from the interventional cardiology clinics/departments at St. Marina UMHAT - Varna, Cardiolife SBALK – Varna, Kanev UMHAT AD – Ruse, Georgi Stranski UMHAT EAD – Pleven, Dr. Tota Venkova MHAT AD – Gabrovo, City Clinic – St. George MHAT Ltd. – Montana, and Uni Hospital UMHAT Ltd.) – Panagyurishte. (Table 10).

Table 10. Socio-demographic characteristics of experts

Socio-demographic characteristics	**n (number)**	**%**
Interventional Cardiologist	23	74
Senior Nurse	8	26
Medical Institution	**n**	**%**
University Multi-profile Hospital for Active Treatment	15	48.4
Multi-profile Hospital for Active Treatment	13	41.9
Specialized Hospital for Active Treatment in Cardiology (SBALK)	3	3
Experience in the Cath Lab	**n**	**%**
1-5 years	6	19.4
6-10 years	10	32.3
11-20 years	12	38.3
Over 20 years	3	9.7

The results indicate that the largest share of experts work in University Multi-profile Hospitals for Active Treatment (48.4%), followed by experts practicing in Multi-profile Hospitals for Active Treatment (41.9%), and the smallest share in SBALK (3%).

Given the specifics and nature of work in the catheterization laboratory, the experience of experts in interventional cardiology is another significant factor we observed. Most experts have 10-20 years (38.3%) and 5-10 years (32.3%) of experience. A smaller share of experts has 1-5 years of experience (19.4%), and the smallest share has over 20 years of experience (9.7%).

3.2. Possibility of forming professional competencies in the process of lifelong learning

To ensure reliable healthcare, it is necessary to systematically maintain the competence of interventional radiology nurses by enrolling them in courses, postgraduate programmes, colloquiums, seminars, and symposiums. We sought the opinion of nurses regarding the need to maintain and improve knowledge and skills to enhance professional competencies.
Nurses are certain that postgraduate training is a necessary step for enhancing knowledge and skills (92%). A significantly small share answered “No” (5%).

The opinion of experts regarding the necessity for interventional radiology nurses to maintain and improve their knowledge and skills was studied through conducting an in-depth interview.
To preserve the anonymity of the interviewees, the responses are presented with numbers from R1 to R8.

The prevailing point of view of experts from the in-depth interview is the necessity for nurses to participate in training courses.

"It is absolutely necessary for nurses to be included in training courses. The advancement of technology in medicine requires nurses to handle specific equipment, for which they need to periodically undergo training courses." (R2)

"Yes, it is good to have periodic training courses. Interventional cardiology is continuously evolving, so it is necessary for nurses to stay updated with the latest developments." (R3)

"Regular participation in training courses ensures the provision of high-quality nursing care." (R4)

"Trained nurses can better identify risks and respond adequately to complications during procedures." (R5)

"It is absolutely necessary given the dynamic development of interventional cardiology." (R6)

"Absolutely! Enhancing knowledge and skills in the catheterization lab is part of the natural process of continuous and dynamic development of this innovative and high-tech medicine. To keep up with new technologies, treatment methods, instrument kit, and guidelines, it is necessary to constantly improve the qualifications of nurses." (R8)

For the purposes of the study, it was important to understand the opinion of nurses regarding postgraduate education based on their experience in the interventional suite (Fig. 2).

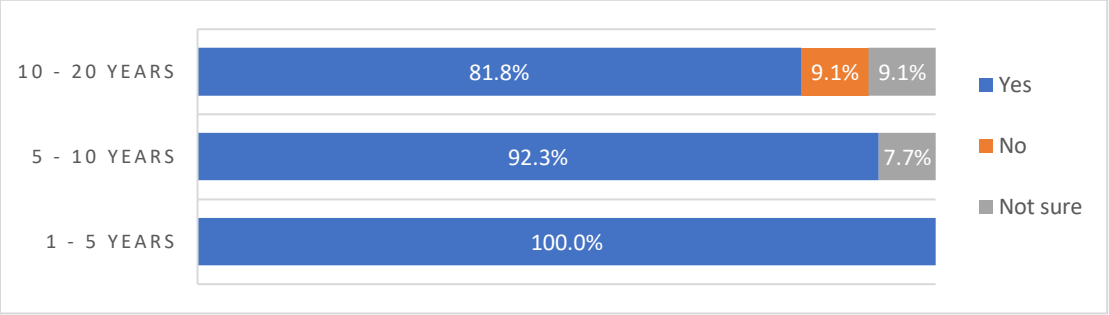


Fig. 2 Need for maintaining and enhancing knowledge and skills of nurses based on their work experience in the IR suite
(nurses)

Interventional radiology nurses with 1-5 years of experience unanimously agree on the necessity of maintaining and improving knowledge (100%). In the group with 5-10 years of experience, most respondents answered “Yes” (92.3%), with a very small share expressing hesitation (7.7%). A relatively small share of nurses with 10-20 years of experience answered “Not sure” and “No” (9.1%).

We sought the opinion of experts and nurses on which forms of postgraduate education would enhance the competencies of interventional radiology nurses (Fig. 3)

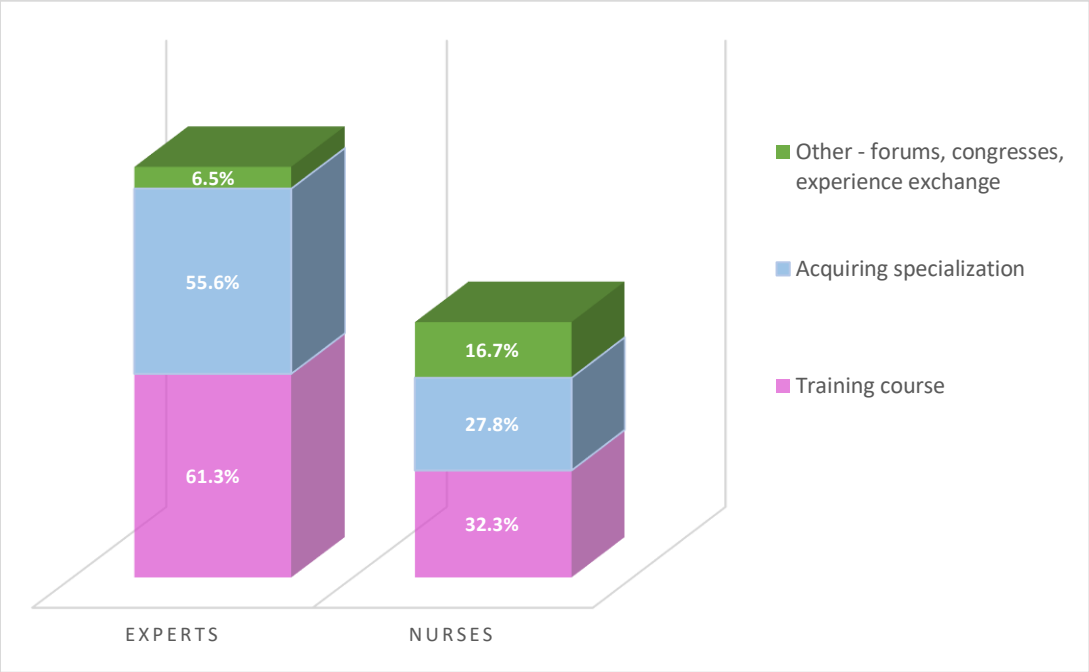


Fig. 3. Forms of postgraduate training
(experts and nurses)

Most respondents indicated training courses as a form of postgraduate training (experts – 61.3%, nurses – 55.6%). A significant portion of respondents believe that obtaining a specialization is an important form of postgraduate training (experts – 32.3%, nurses – 27.8%). A relatively smaller share indicated participation in forums and congresses (6.5%: 16.7%).

Continuously updating the knowledge of IR nurses is essential for maintaining high competence and awareness. Respondents' support for postgraduate training prompted us to seek expert and nurse opinions on the optimal intervals for conducting training sessions (Fig. 4).

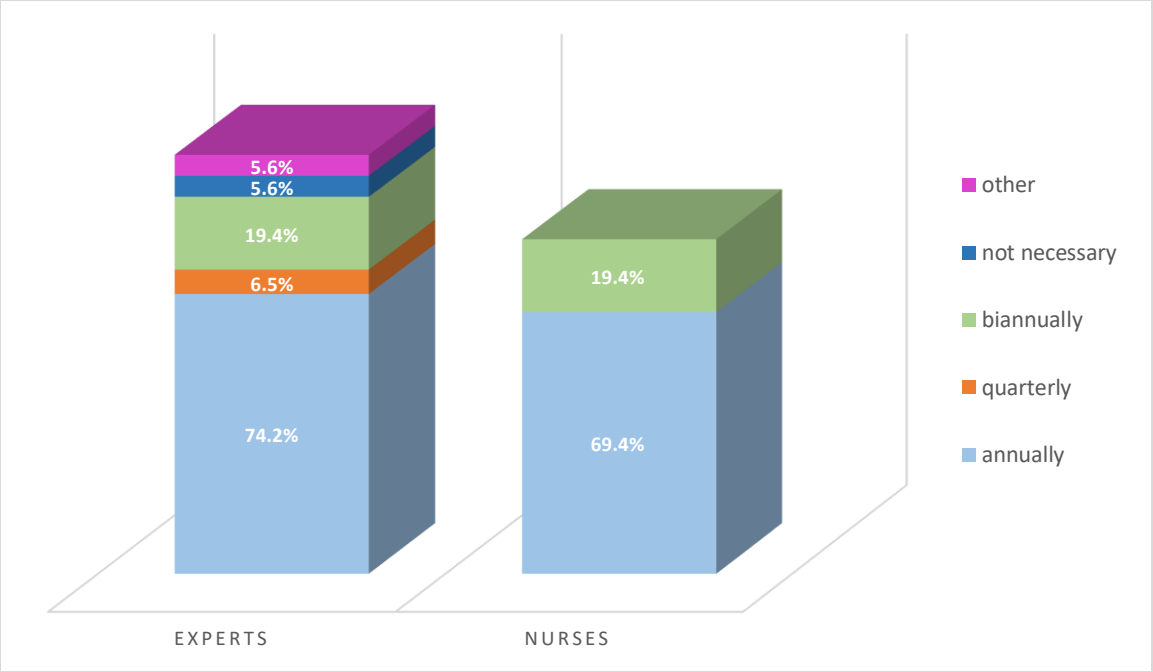


Fig 4. Frequency of updating knowledge
(experts and nurses)

A significantly high share of both groups of respondents indicated that a one-year period is optimal (experts – 74.2%, nurses – 69.4%). An equal share of both groups of respondents indicated that the period for updating knowledge should be every six months (19.4%). The frequency of knowledge updates can vary depending on various factors such as the requirements of health institutions, professional standards, and individual desire for development.

The insights of experts and nurses were surveyed regarding the necessity of introducing an Interventional Radiology Nurse specialization (Fig. 5).

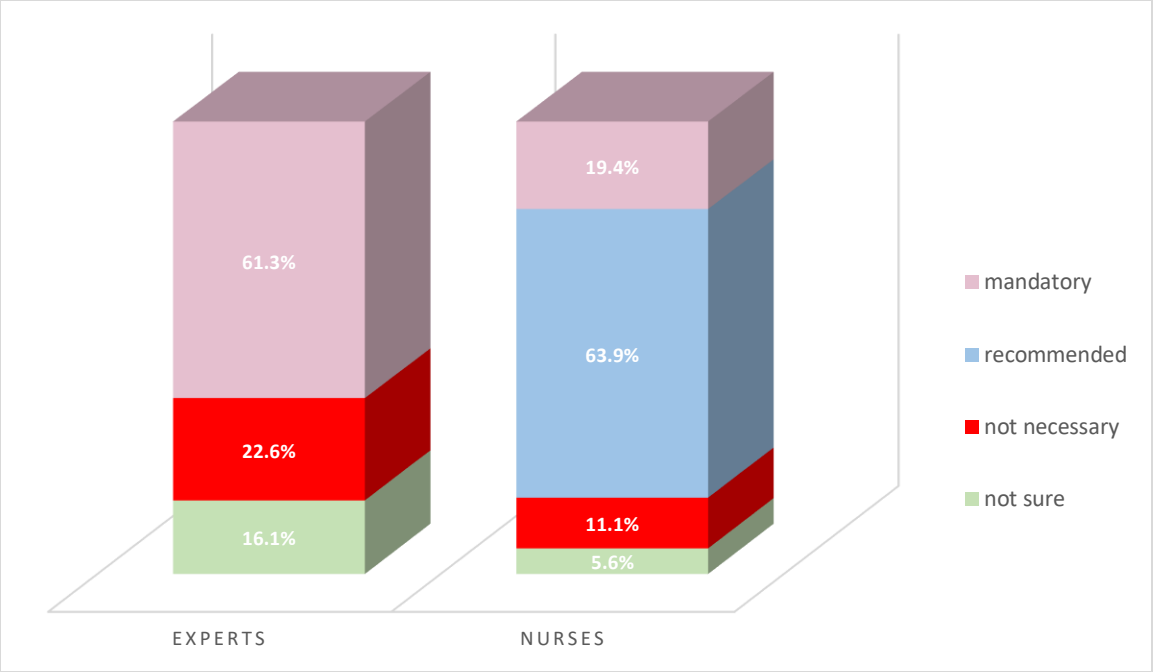


Fig.5 Attitudes of experts and nurses towards the necessity of introducing a Interventional Radiology Nurse specialization

More than half of the experts indicated the necessity of introducing a specialization for nurses (61.3%). A relatively small part answered “No” (22.6%) and “Not sure” (16.1%). Most nurses indicated that it is advisable to introduce a specialization (63.9%). A small part of the respondents believe that the introduction of a specialization is mandatory (19.4%), followed by those who think it is unnecessary (11.1%). After the analysis, we found that a large part of experts and nurses support the introduction of an Interventional Radiology Nurse specialization.

3.3. Motivation and adaptation of nurses for work in the IR suite

Motivation to work in interventional cardiology is considered a driving force in achieving set goals. The team working in the IR suite includes different professionals who work with equal intensity but based on their own competencies, knowledge and skills, temperament, and character traits.

Given the specifics of work in the interventional suite, we provided nurses with the opportunity to share the factors that motivate them to work in this environment (Fig. 6).

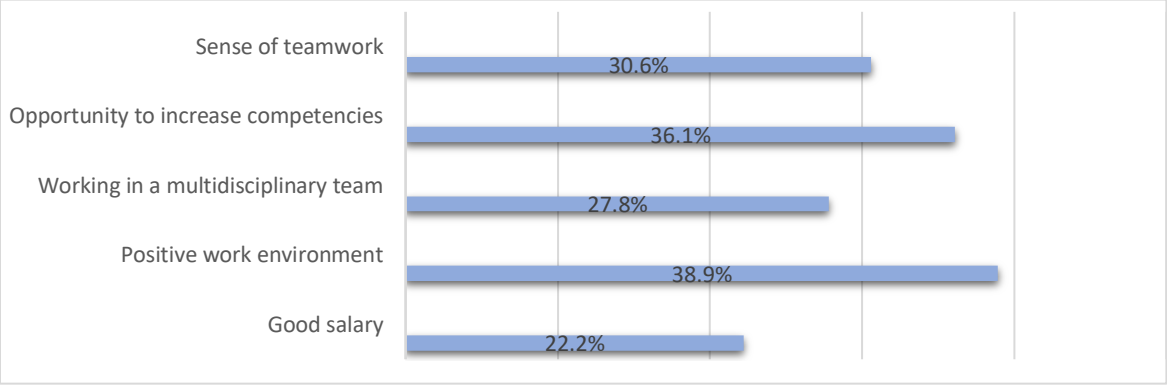


Fig. 6. Factors motivating nurses to work in the interventional suite

A positive work environment is the main reason indicated by staff for working in the IR suite (38.9%). The opportunity to improve competencies is a key factor for a significant portion of the nurses (36.1%). About one-third of the respondents agree that the sense of teamwork (30.1%) and working in a multidisciplinary team (27.8%) are driving forces for working in the IR suite. A relatively low share of nurses indicated good salary as a factor (22.2%).

Experts provided varying responses regarding the motivation of nurses to start working in an interventional suite. The prevailing opinion of experts from the in-depth interview is that good pay is an incentive for work. Other experts shared:

"I can immediately say what drives nurses to start working in the catheterization lab, and that is that they prefer to interact with patients for a short time, after the procedure they hand over the patient to the intensive care unit nurses and do not provide stationary nursing care." (R1)

"Flexible working hours would motivate a nurse to start working, as well as good remuneration." (R2)

"They are motivated by the opportunity for qualification improvement and professional development." (R3)

"Qualification obtained in interventional suites would motivate them." (R4)

"The desire to work in an innovative, dynamic environment with a high level of technological equipment and life-saving activities." (R5)

"A nurse who wants to develop and learn new specific nursing activities would be motivated to start working in the catheterization lab." (R6)

"Nurses are motivated by the interesting, diverse, dynamic, and creative activities with visible results." (R8)

The time needed for a nurse to adapt to working in the IR suite is highly individual and depends on various factors such as previous experience, training intensity, and the nurse's individual abilities.

We were interested in the perspectives of experts and nurses regarding how much time is needed for a nurse to adapt to the nature of work in the IR suite (Fig. 7).

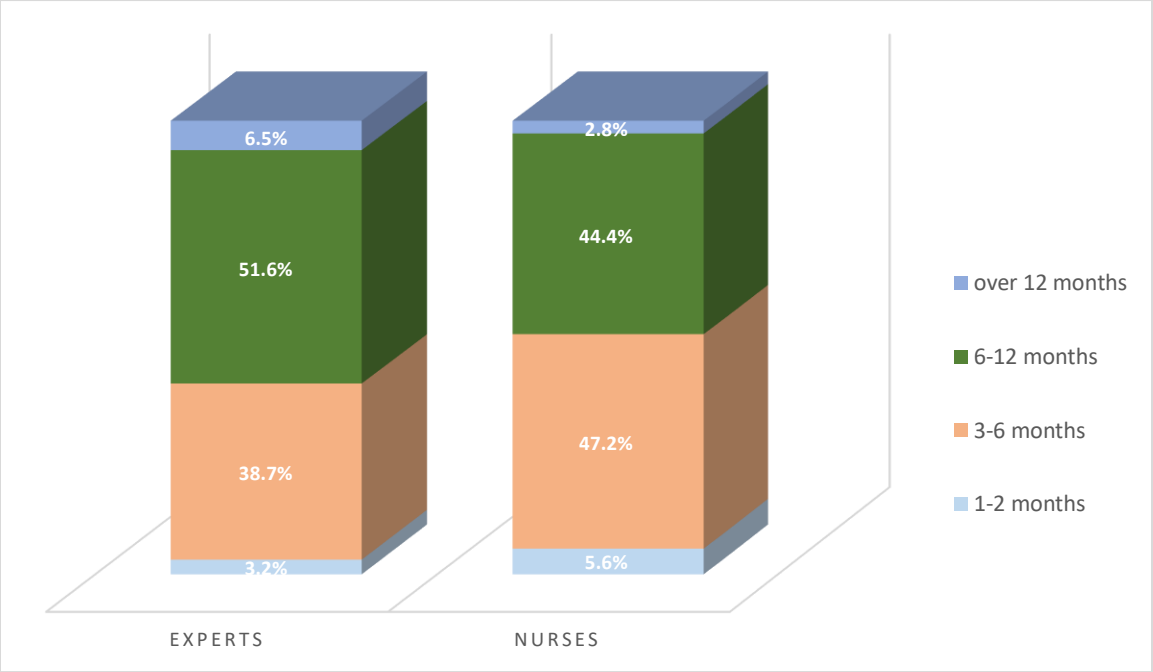


Fig 7. Adaptation period to work in an IR suite
(according to experts and nurses)

The largest share of both groups of respondents indicated a period of 6-12 months as necessary for adaptation (experts - 51.6%, nurses - 44.4%). The prevailing opinion among nurses is that a period of 3-6 months is sufficient for adaptation to

the new conditions (47.2%). A negligible part of respondents believe that 1-2 months are sufficient for adaptation (experts - 3.2%, nurses - 5.6%).

3.4. Nurse-patient relationship during interventional examination

In this study, we examined patients' perspectives on the importance of nursing care during invasive procedures. Communication is a crucial element in organizing, coordinating, and managing patient care. Effective communication is vital for providing high-quality nursing care.

We explored patients' views on the necessity of communication with the IR nurse during the invasive procedure (Figure 8).

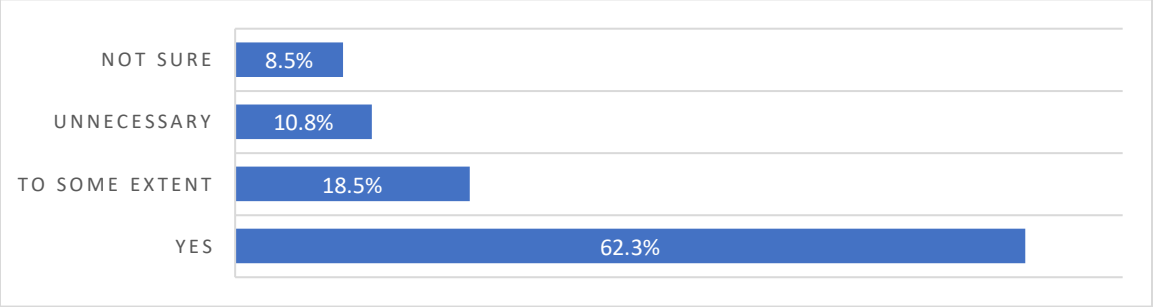


Figure 8. Need for communication with the nurse in the IR suite *(according to patients)*

More than half of the respondents felt the need to communicate with the nurse during the procedure (62.3%). A relatively small portion of respondents answered "to some extent" (18.5%). The smallest share did not feel the need for communication during the invasive procedure (10.8%).

We surveyed respondents on the need of communication with the IR nurse during procedures according to their education level. (Fig. 9)

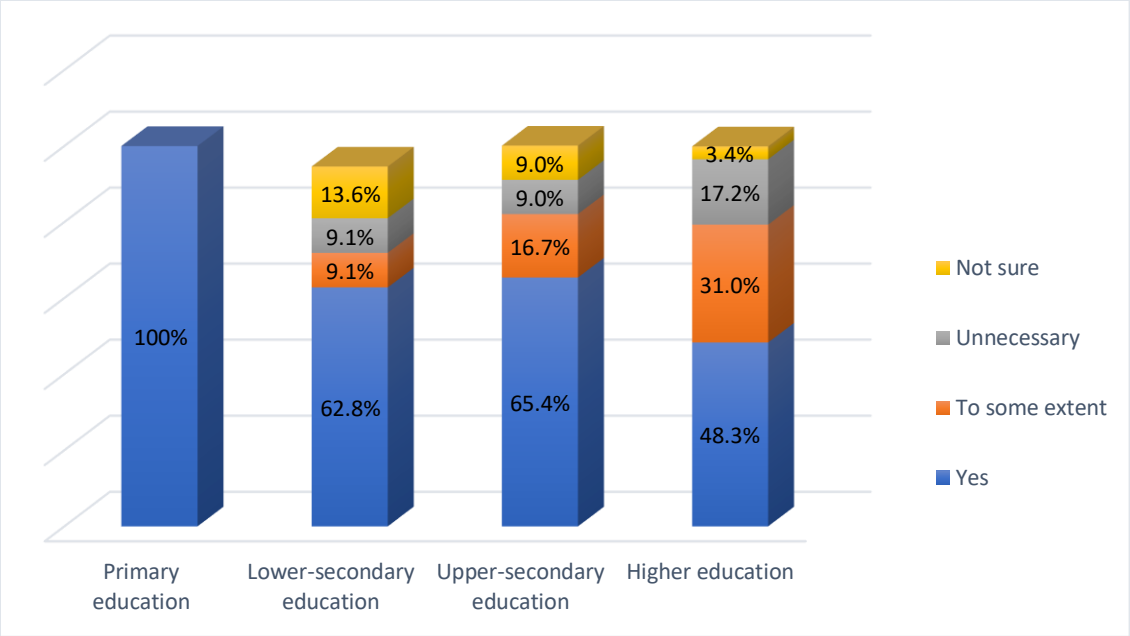


Figure 9. Need for communication with the nurse in the IR suite
(according to patients based on their education level)

Patients with primary education unanimously expressed the need for communication with the nurse during the invasive procedure (100%). The share of patients with lower-secondary and upper-secondary education who answered "Yes" was relatively equal (lower-secondary education – 68%, upper-secondary education – 65%). Almost half of the patients with higher education also believed that communication with the nurse during the procedure was necessary (48%). A relatively smaller share of respondents with higher education felt that communication was necessary to some extent (31%).

Building and maintaining trust between nurses and patients in the IR suite is essential for successful procedures. We inquired patients on their trust in interventional radiology nurses during invasive procedures. Most respondents expressed trust in the nurses during invasive procedures (81%). A small portion of respondents had doubts about the nursing care provided during invasive procedures (18%). This trust is based on specific competencies, activities, professionalism, effective communication, and emotional support provided by the interventional radiology nurse to improve the quality of care.

We were interested in determining whether the education level of patients influences their trust in IR nurses during invasive examinations (Fig. 10).

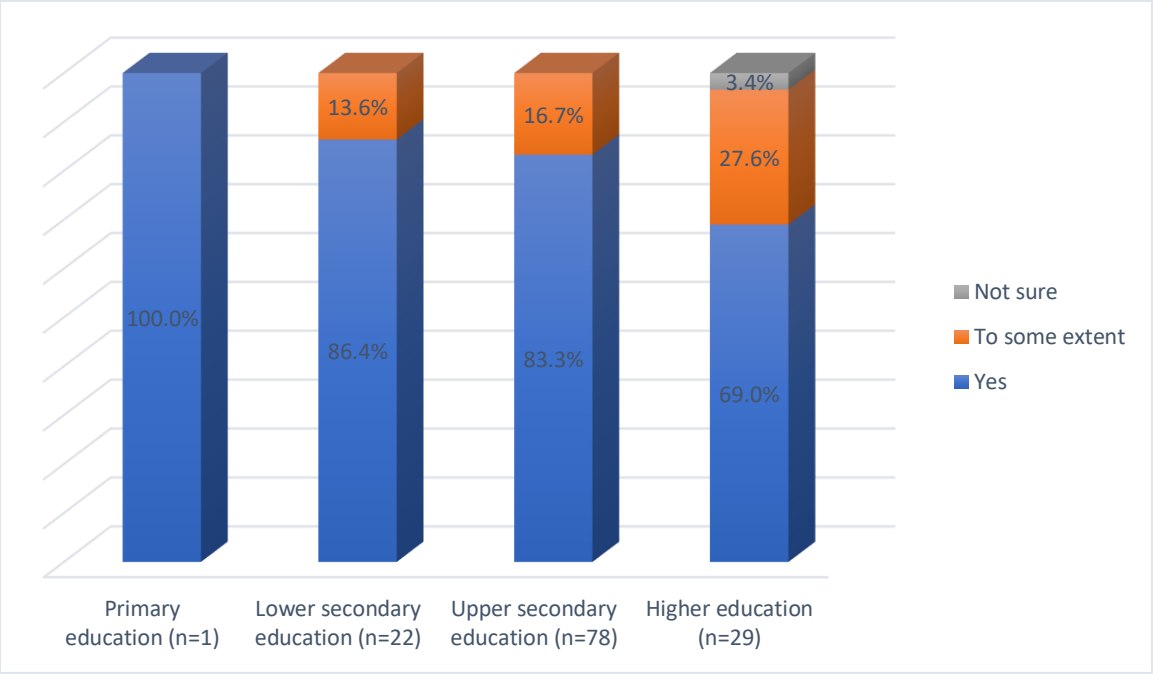


Fig. 10 Patient trust in interventional radiology nurses
(according to patients based on their education level)

Nurses working in the IR suite receive unconditional trust from patients with primary education (100%), followed by those with lower-secondary education (86.4%) and upper-secondary education (83.3%). More than half of the respondents with higher education trust nurses during the invasive examination (69.0%).

3.5. Roles and competencies of the nurse working in an IR suite

In the IR suite, the key roles of nurses are crucial. These roles include a variety of activities and responsibilities related to both the preparation and execution of invasive procedures, as well as patient care. We surveyed nurses about the roles they perform in the interventional suite: *circulating nurse, scrub nurse, and documenting nurse* (Fig.11).

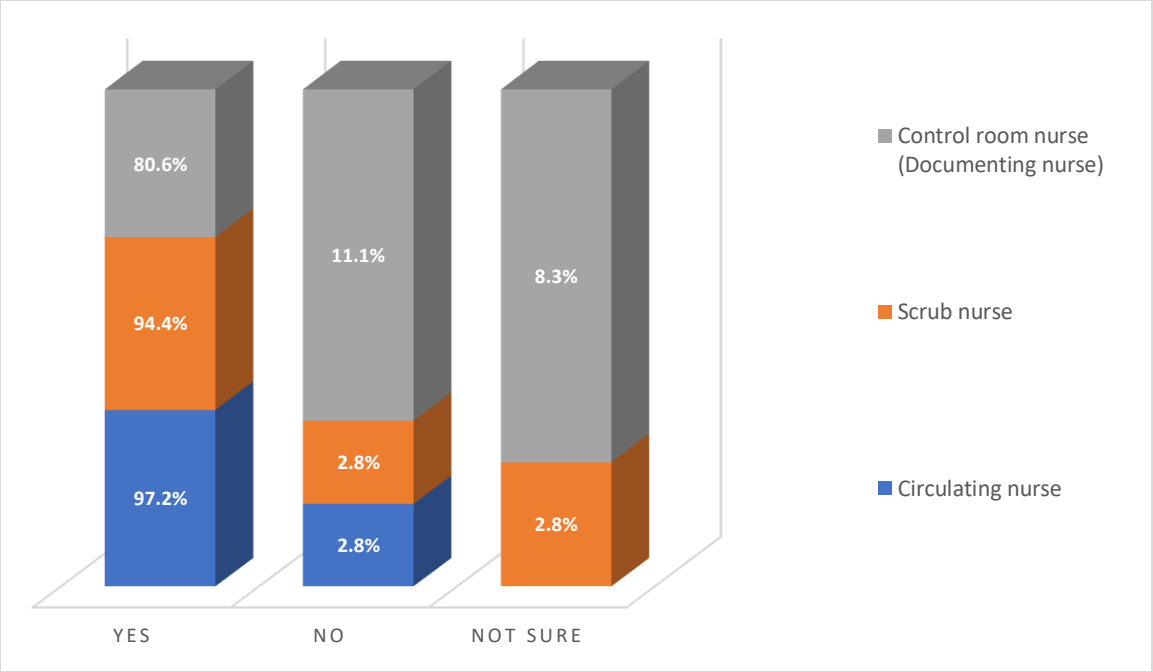


Figure 11. Roles of the nurse in the IR suite

The respondents unanimously agreed that to optimize nursing care and activities in interventional suites, the following roles are essential: circulating nurse (97.2%), who aids during invasive procedures, monitors patients, and administers medications; scrub nurse, who maintains sterile field and instruments, and assists under sterile conditions (94.4%); and documenting nurse in the control room, who organizes, coordinates, and documents the preparation of each invasive procedure (80.6%).

The roles of the IR suite nurses include various tasks and responsibilities. These activities encompass patient preparation, assistance during procedures, post-procedural care, and administrative duties. We inquired nurses regarding the activities they need to perform as part of the interventional cardiology team (Fig.12).

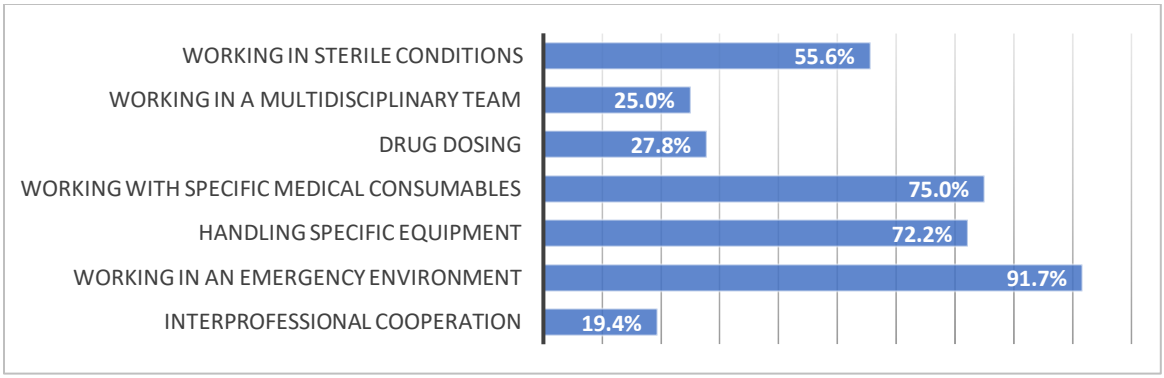


Fig. 12. Activities performed by nurses in the interventional suite
(nurses)
**% exceeds 100 because respondents indicated more than one answer*

The prevailing opinion of the respondents is that working in an emergency environment is a daily activity (91.7%), which implies noticing signs of complications and taking urgent actions. A large portion of respondents believe that using specific medical supplies is important (75.0%), as well as handling specific equipment (72.2%) that should be easily accessible and in good working condition. More than half believe that nurses need to work in sterile environment (55.6%) - ensuring a sterile field and preparing the necessary instruments and materials.

Experts were asked to share their view on the specifics of the activities of interventional radiology nurses. Their opinion is unanimous that nurses working in catheterization labs perform a set of various important activities (100%).

In response to the question "What are the main roles that interventional radiology nurses need to perform?", the prevailing opinion of experts from the in-depth interview is:

"Nurses are involved throughout the entire invasive procedure, from preparing and monitoring the patient to applying the compressive bandage, and from setting up the sterile table to adequately assisting during the procedure.“ (R2)

"Preparing the sterile table according to the intervention access is the nurse's responsibility. It is necessary to prepare the patient in advance. During the examination, the nurse must monitor the course of the procedure to adequately assist the interventional specialist." (R3)

"Most importantly the nurse must know the specific consumables and use them correctly in practice." (R6)

The competencies of interventional radiology nurses encompass a wide range of clinical, technical, and communication skills that ensure the safety and successful conduct of angiographic procedures. They include a broad spectrum of knowledge, skills, and abilities that can be categorized into several key areas, one of which is **Clinical competencies:**

- ✓ Knowledge of the anatomy and physiology of the cardiovascular system.
- ✓ Preparation and monitoring of the patient before the invasive examination.
- ✓ Assisting during the performance of diagnostic and interventional procedures such as SCA, PCI (32.3%).
- ✓ Handling high-tech medical equipment (74.2%).

Technical Competencies:

- ✓ Promptly responding to complications (93.5%).
- ✓ Handling catheters and instruments (61.3%).
- ✓ Knowledge of drug dosing and impact on critically ill patients (29.0%).

Educational Competencies:

- ✓ Continuous professional development is a key component for maintaining and enhancing the competencies of the interventional radiology nurses (97%).

We surveyed experts about the communication skills of interventional radiology nurses (Fig. 13).

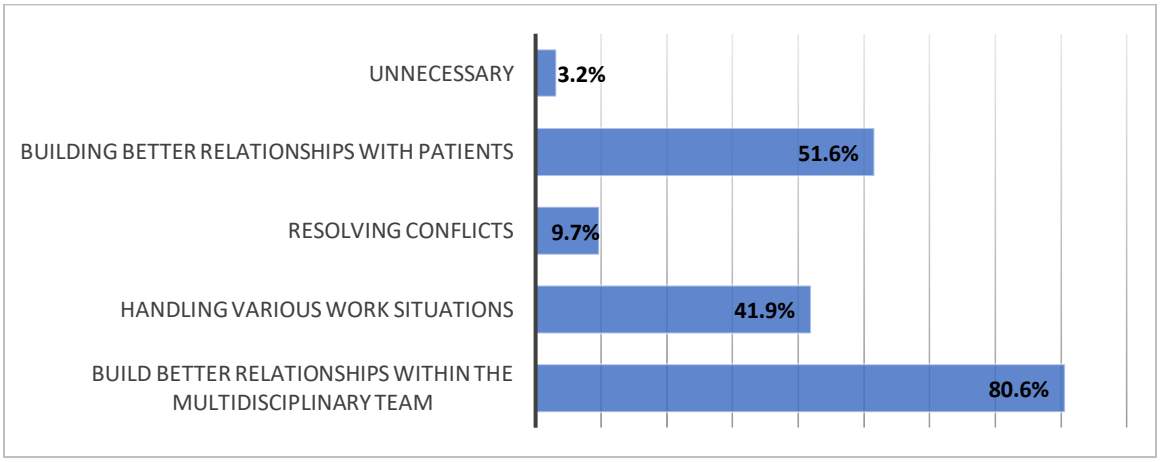


Fig. 13. Communication skills of interventional radiology nurses
(experts)
**% exceeds 100, as respondents indicated more than one answer*

Experts are confident that nurses' **communication skills** facilitate good relationships among members of the multidisciplinary team (80.6%). These skills contribute to effective communication and collaboration with physicians and other team members, and are essential for coordinating care before, during, and after procedures. Additionally, more than half of the respondents (51.6%) believe that building better relationships with patients is necessary for the effective conduct of angiographic procedures.

IV. MODEL OF THE MODERN INTERVENTIONAL RADIOLOGY NURSE

4.1. SWOT analysis of the professional development of the nurse practicing in the interventional suite

Based on the analysis of available literature, real practice, and the results of our own research, we conducted a SWOT analysis of the professional development of the nurse practicing in the interventional suite (Table 11)

Table 11. SWOT analysis for the development of the interventional radiology nurse

Strengths	***Weaknesses***
• Holds a respected position in the organization • Acquires knowledge and skills that meet modern professional qualification requirements. • Accumulated practical experience in the interventional suite improves skills and confidence in working with patients and colleagues. • Technical skills - handling angiography equipment and supplies.	• Automation of activities - possible loss of motivation and interest due to repetitive work in the interventional suite. • Prolonged stay in the interventional suite with protective lead aprons. • Lack of trained interventional radiology nurses leads to high workload and stress. • Small annual leave and no free time. • Insufficient time for continuing education and acquiring new

• Working in emergency settings - ability to notice and respond to complex medical situations. • Critical thinking - analysis, synthesis, and evaluation of information gathered from observation, experience, reflection, and communication and collaboration. • Teamwork - ability to create positive interpersonal relationships with colleagues. • Creativity and innovation - introducing new ideas and good practices that improve the efficiency and quality of care. • Communication skills - effective communication, collaboration with physicians and other members of the multidisciplinary team. High adaptability - flexibility and readiness to adapt to handling new technologies and procedures. • Training and mentoring - prepares highly qualified personnel for work in the interventional suite.	knowledge and skills outside the current ones. • Insufficiently updated programs and courses for continuous education in interventional cardiology. • Funding for training programs and courses is at personal expense. • Lack of specialization and certification of nurses working in interventional suites.
Opportunities	***Threats***
• Postgraduate training as continuing education. • Opportunity to achieve a higher education level. • Obtaining a master's degree. • Participation in university programs. • Career development - opportunity to take on leadership roles such as senior nurse or coordinator of the angiography team. • Continuous learning throughout their career. • Increasing professional competence and satisfaction.	• Rapid technological development may require constant updating of skills and training to maintain competence, which can be time-consuming and financially burdensome. • A small number of nurses work in interventional suites. • The intensity of the work process and stress can increase the risk of errors, professional burnout, and health problems. • Changes in the demographic characteristics of patients and the increased prevalence of cardiovascular

• Development of personal and interpersonal qualities. • Opportunities for conflict resolution.	diseases increase the workload and complexity of the work.

The SWOT analysis is a useful tool for strategic planning. Through it, we can create a clear picture of the personal and professional development of the interventional radiology nurse. After identifying the strengths and opportunities, we understood the weaknesses and realized the threats facing the nurses. We understood what qualities are necessary for the work of a nurse in an interventional suite.

We surveyed nurses regarding the qualities that a modern interventional radiology nurse should possess (Fig. 14)

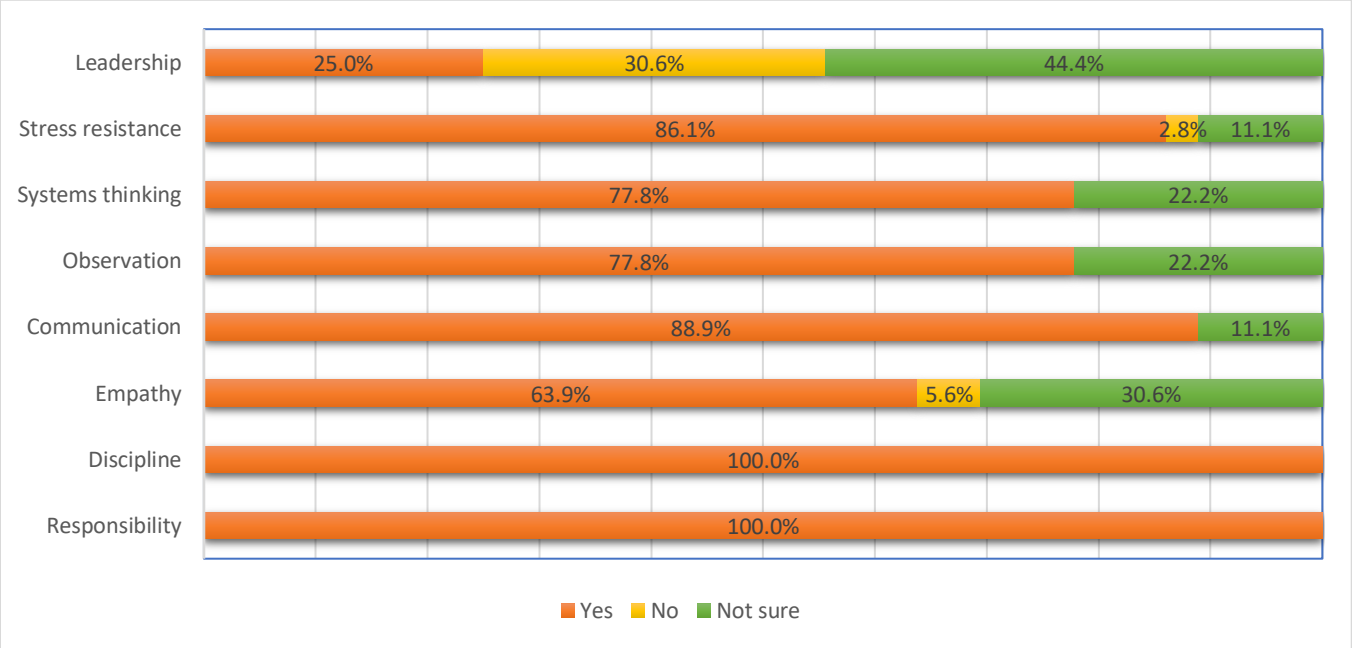


Fig. 14. Qualities of the modern IR nurse

**% exceeds 100, as respondents indicated more than one answer*

Respondents unanimously agreed that responsibility and discipline are key qualities that ensure a high level of professionalism (100%). Due to the fast-paced work environment, high levels of responsibility, and frequent stressful situations, nurses identified "stress resistance" as extremely important (86.1%). An equal share of respondents indicated observation and systems thinking as necessary qualities (77.8%). The systems thinking of interventional radiology nurses helps to

see the overall picture and coordinate different aspects of care, while their observation ensures precision and timely reaction when detecting important changes in patients' conditions. More than half of the respondents identified the need for the quality "empathy" (63.9%), the rest answered “Not sure” (30.6%). A relatively small share of the respondents identified the quality "leadership" as necessary (25.0%). A larger share of the respondents answered “No” (30.6%), and the rest chose “Not sure” (44.4%).

Our view that the interventional radiology nurse should possess significant professional skills, specialized skills, and strong communication and professional competencies is justified by the survey results. Personal qualities such as responsibility, discipline, and empathy also influence work and the desire for professional growth (Fig. 15).

Fig. 15. Professionalization of the interventional radiology nurse - qualities and skills

The motivation to enhance knowledge and skills allows nurses to work effectively with new technologies. Considering the specifics of the nurses’ work in the interventional suite and their professional competencies, we present the **Model of the Modern Interventional Radiology Nurse** (Fig. 16).

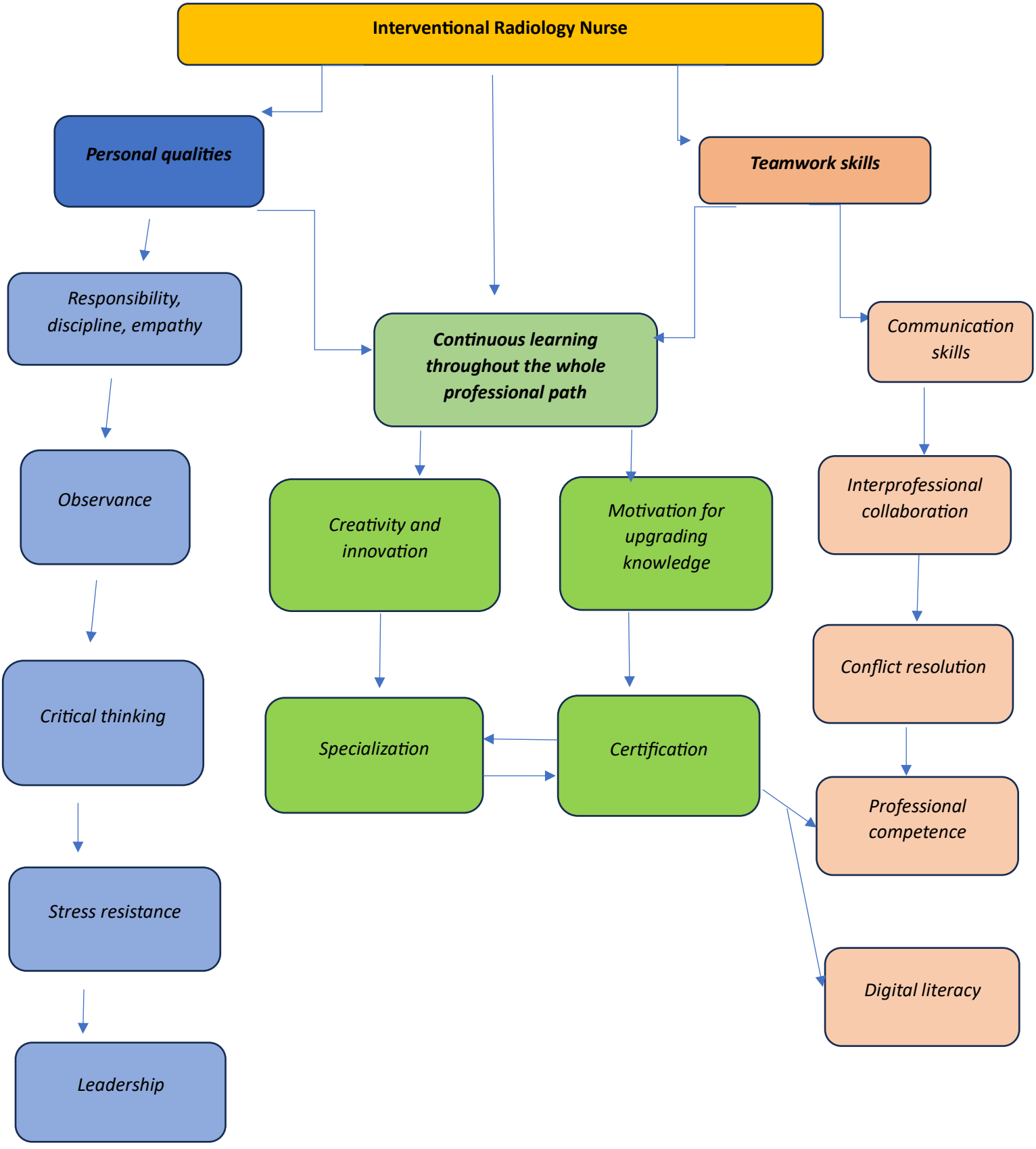

Interventional Radiology Nurse
Personal qualities
Teamwork skills
Responsibility, discipline, empathy
Continuous learning throughout the whole professional path
Communication skills
Observance
Creativity and innovation
Motivation for upgrading knowledge
Interprofessional collaboration
Critical thinking
Specialization
Certification
Conflict resolution
Professional competence
Stress resistance
Digital literacy
Leadership

Fig. 16. Model of the Modern Interventional Radiology Nurse

The justification for the theoretical model of the modern interventional radiology nurse is based on combining several key aspects that define the essence and significance of the nurse's role in contemporary healthcare. To work in an interventional suite, nurses must possess a set of **personal qualities** such as responsibility, discipline, and empathy. Observational skills, critical thinking, and stress resilience elevate interventional radiology nurses to leadership positions. The IR nurse is part of a multidisciplinary team that includes physicians and other healthcare professionals. Effective work in such a team requires specialized **teamwork skills**. A nurse's ability to work in a team is a key element for the success of procedures. This includes effective communication, interprofessional collaboration, conflict resolution, professional competence, and digital literacy. **Continuous learning throughout their career** is crucial for interventional radiology nurses to ensure quality patient care, safety, and efficiency. Their professional journey requires ongoing improvement of knowledge and skills in the rapidly developing medical field. Motivation to upgrade knowledge, creativity, and innovation are key factors for maintaining a high level of professionalism and personal satisfaction.

4.2. Trial application of the Protocol for the Roles of the Interventional Radiology Nurse

After reviewing literature sources and analyzing the obtained results, we found a lack of standardized documentation describing the sequence of steps for specific activities performed by interventional radiology nurses. This prompted us to develop a Protocol for the Roles of the Interventional Radiology Nurse, which we implemented in practice. The experiment was conducted in the interventional cardiology departments/clinics at the University Multi-profile Hospitals for Active Treatment in Varna and Ruse. The protocol was reproduced on paper according to the number of nurses and experts in interventional suites of the respective departments/clinics. The effective application of the protocol in practice was ensured with the assistance of head and senior nurses in the respective centers. After the experiment, a study was conducted regarding the effectiveness and necessity of the Protocol's implementation in practice.

PROTOCOL FOR THE ROLES OF THE INTERVENTIONAL RADIOLOGY NURSE

Roles of the Interventional Radiology Nurse:

- Circulating nurse
- Scrub nurse
- Documenting nurse (control room nurse)

Protocol content is presented in (Fig. 17)

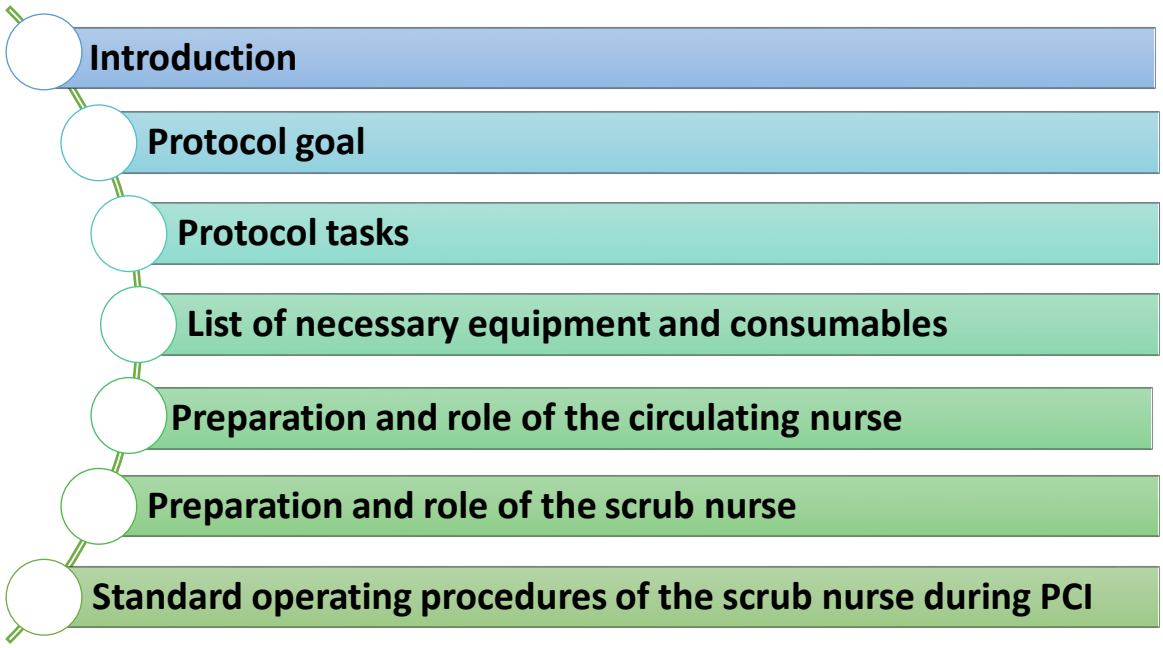


Fig. 17. Structure of the Protocol for the Roles of the Interventional Radiology Nurse

The protocol begins with brief information about the main characteristics, equipment, and procedures performed in the interventional suite. The goals and tasks of the protocol are described, a standard operating procedures scheme for the preparation and activities of the circulating and scrub nurse is prepared, and a list of the necessary equipment, supplies, and medications is compiled.

Preparation and roles of the circulating nurse

Preparation of the patient for radial access:

- Informs the patient about the access method as per the physician's instructions.
- Positions the right or left arm away from the body with slight pronation at the wrist joint.
- Secures the hand with adhesive tape.
- Disinfects with sol. Braunol from the wrist joint towards the elbow joint over a wide area.

Preparation of the patient for femoral access:

- Informs the patient about the access method as per the physician's instructions.
- Disinfects with sol. Braunol the left and right inguinal fold from inside to outside over a wide area.

Monitoring hemodynamic parameters:

- Places ECG electrodes.
- Applies a cuff for measuring arterial blood pressure.
- Attaches a pulse oximeter.

Roles the circulating nurse:

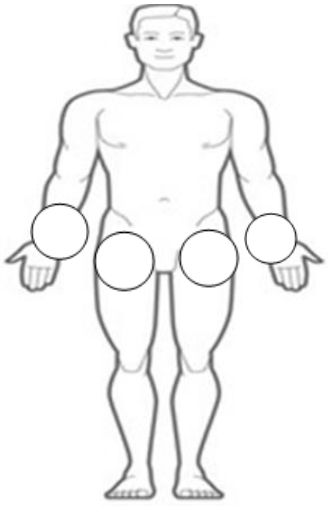
- Checks the patency of the peripheral venous line (PVL), and if necessary, inserts a new one.
- Places a three-way stopcock.
- Connects an infusion solution of NaCl 0.9%.
- Provides the necessary sterile coronary guides, diagnostic catheters, guiding catheters, angioplasty kits, thrombo-aspiration catheters, coronary balloons, and stents.
- Monitors vital signs and administers prescribed medications if necessary.
- Participates and assists in cardiopulmonary resuscitation.
- Applies a TR Band for patients with radial access.
- After the procedure, hands over the patient to the intensive care unit nurse with completed medical documentation and medication on a perfusion pump

under monitoring control.

A model of a **Selective Coronary Angiography Activity Checklist** (nursing documentation) has been formulated (Fig. 18)

Selective Coronary Angiography (SCA) Activity Checklist

(Nursing documentation)



Activity type

□ diagnosis

□ balloon dilation

□ stent placement

Procedure outcome

□ **TR Band**

Time of placement ……

Time of removal……

□ **Fixed femoral introducer**

-Time of placement ……

-Time of removal ……..

-Time of applying the compression bandage: ……

-Time of removing the compression bandage: ……

Complications during the procedure

□ ventricular fibrillation

□ asystole

□ In-stent restenosis

□ slow flow

□ no-reflow

□ other

Procedure access

□ right radial access

□ left radial access

□ right femoral access

□ left femoral access

Medications administered

Lidokaine 2%.....ml.

Isocor 2.5 mg…….ml

Nitronal 1mg…….....ml bolus

Nitronal 1mg…….ml perfusor

Adrendline 0.1%.....ml bolus

Atropine 1%.....ml bolus

Dopamin 4%.....ml perfusor

Dobutamine 5mg…….. …ml perfusor

Heparinum 25000IU…….. ...ml bolus

Tirofiban 0.25mg…… ..ml bolus

Tirofiban 0.25mg…… ..ml perfusor

Actilyse 50mg……... ml bolus

Contrast agent……ml.

Other.....

Fig. 18 SCA Activity Checklist *(Nursing documentation)*

Preparation and Roles of the Scrub Nurse are presented in Table 12.

Table 12. Preparation and Roles of the Scrub Nurse

Preparation of the sterile table for radial access	**Preparation of the sterile table for femoral access**
1.Puncture needle for radial access, surgical blade	1. Puncture needle for femoral access, surgical blade
2. 5ml syringe with Lidocaine 2%	2. 10ml syringe with Lidocaine 2%
3. 2ml syringe with Heparin (according to body weight)	3. 1ml Nitronal, diluted to 10ml with NaCl 0.9%
4. 10ml Isocor 2.5mg	4. 2ml syringe with Heparin (according to body weight) for PCI
5. 1ml Nitronal, diluted to 10ml with NaCl 0.9%	5. Container for contrast medium
6. Container for contrast medium	6. Container with heparinized water (NaCl 0.9% - 0.500 + 7500 IU Heparin)
7. Container with heparinized water (NaCl 0.9% - 0.500 + 7500 IU Heparin)	7. 5F, 6F, 7F femoral introducer, flushed with heparinized water
8. 5F, 6F radial introducer, flushed with heparinized water |	8. Sterile catheters - left and right, starting with the left Judkins catheter, flushed with heparinized water, and fitted with an EMERALD coronary guidewire, featuring a visible J-tip (1-2 cm curved soft tip). After a series of images, the right Judkins catheter is prepared.
9. Sterile Tiger catheter, flushed with heparinized water and fitted with an EMERALD coronary guidewire, featuring a visible J-tip (1-2 cm curved soft tip	9.Sterile gauze
10. Sterile gauze	10. Needle holder with suture for securing the femoral introducer to the skin

Standard Operating Procedures scheme for Scrub nurses during PCI (Fig. 19)

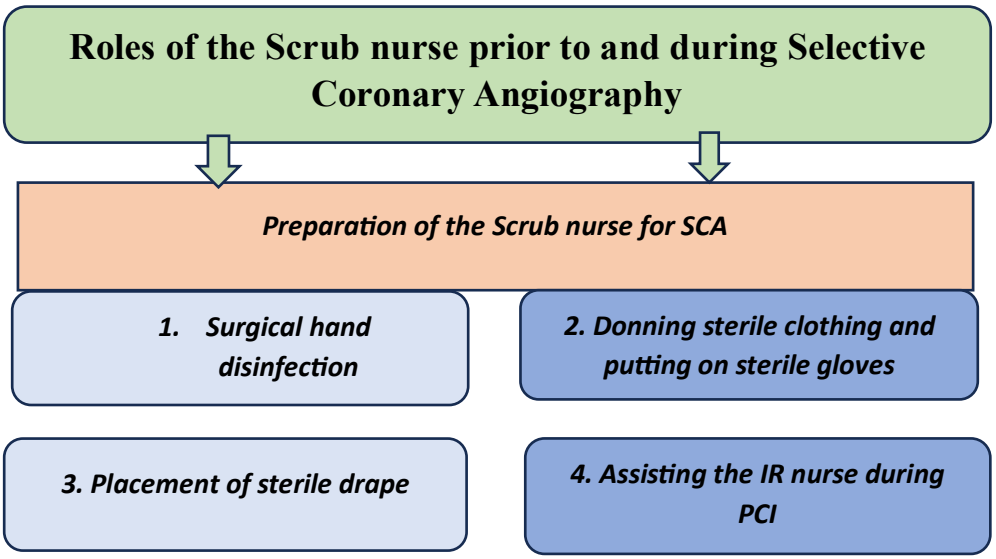


Fig. 19. Role of the Scrub Nurse

4.3. Perspectives of experts and nurses on the need to introduce the Protocol for the Roles of the Interventional Radiology Nurse (before and after the experiment)

A survey was conducted among two groups of respondents - nurses (n=12) and experts (n=12), working in the interventional cardiology departments/clinics at the University Multi-profile Hospitals for Active Treatment in Varna and Ruse. We examined the perspectives of experts and nurses who participated in the experiment regarding the need to introduce a Protocol for the Roles of the Interventional Radiology Nurse, describing sequential steps of actions for specific activities (Fig. 20).

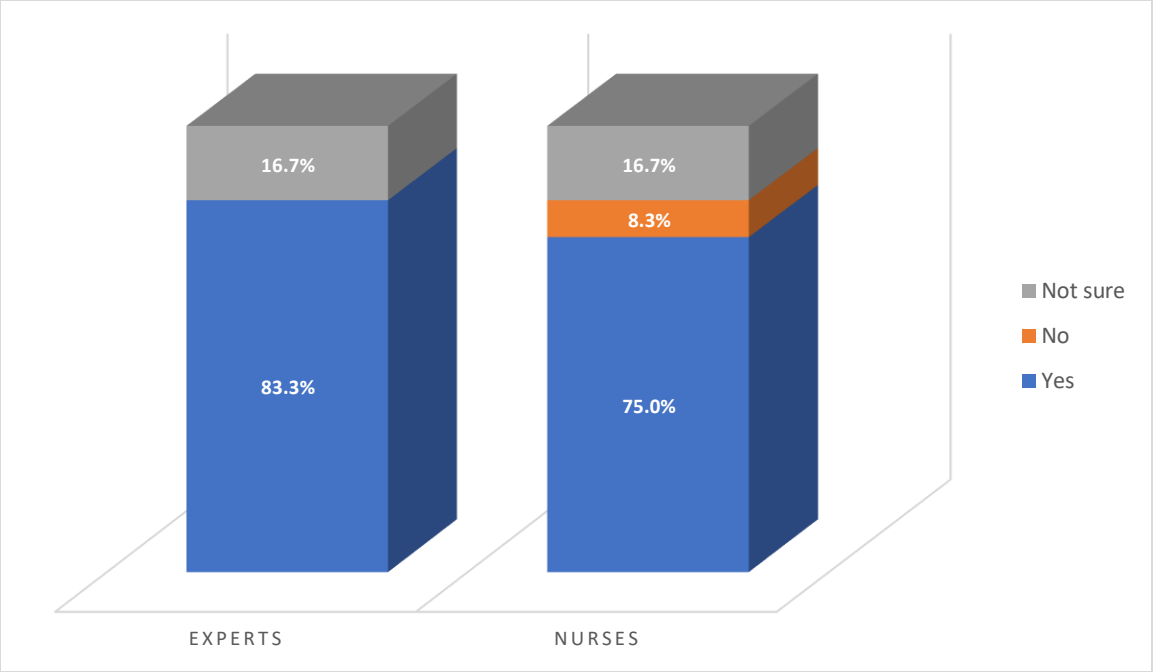


Fig. 20. Need to introduce a Protocol for the Roles of the Interventional Radiology Nurse in practice
(experts and nurses)

Respondents strongly believe that it is necessary to introduce a Protocol for the Roles of the Interventional Radiology Nurse, describing sequential steps of actions for specific activities (experts – 83.3%, nurses – 75.0%). Equal number of respondents answered "Not sure" (16.7%)

We sought the opinion of experts and nurses regarding the possibility of improving the quality of work in the multidisciplinary team by implementing the protocol in practice (Fig. 21).

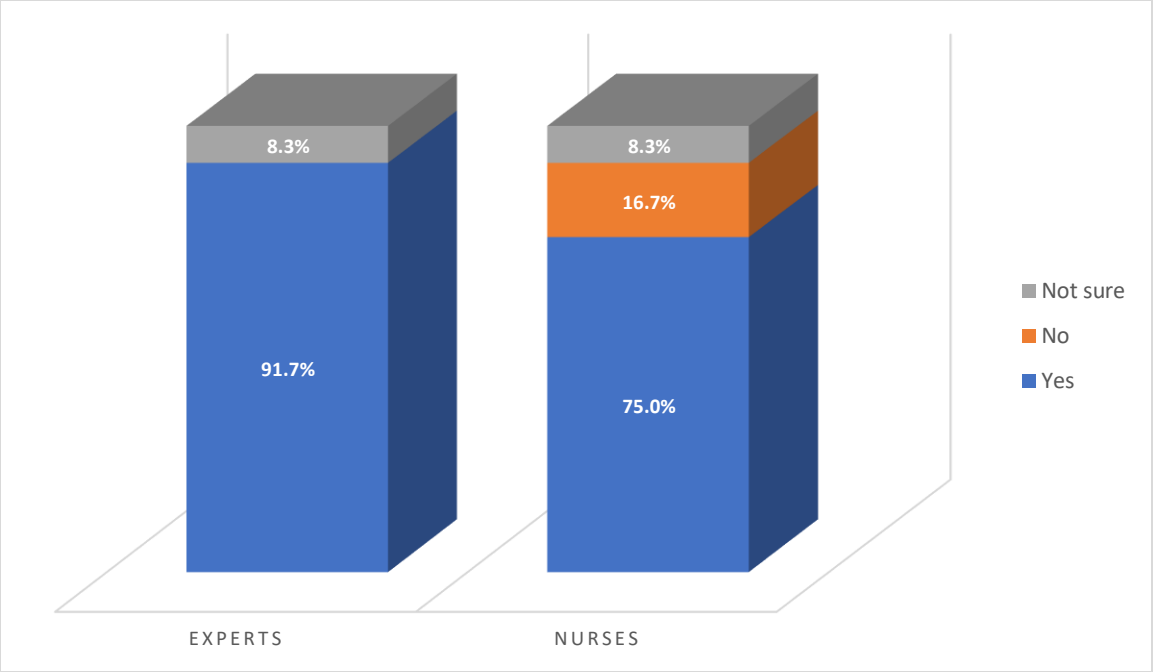


Fig. 21. Possibility of improving the quality of work in the multidisciplinary team

The prevailing opinion of the respondents is that the quality of work in the multidisciplinary team will significantly improve (experts – 91.7%, nurses – 75.0%). A small part of the respondents answered "Not sure" (8.3%), and only nurses answered "No" (16.7%). By following clear and sequential instructions, each member of the interventional cardiology team knows their role and responsibility, which facilitates communication, coordination, and improves the quality of work. Experts and nurses were given the opportunity to share their view on whether the implementation of the protocol in practice would ensure efficiency, consistency, and safety of invasive nursing care (Fig. 22).

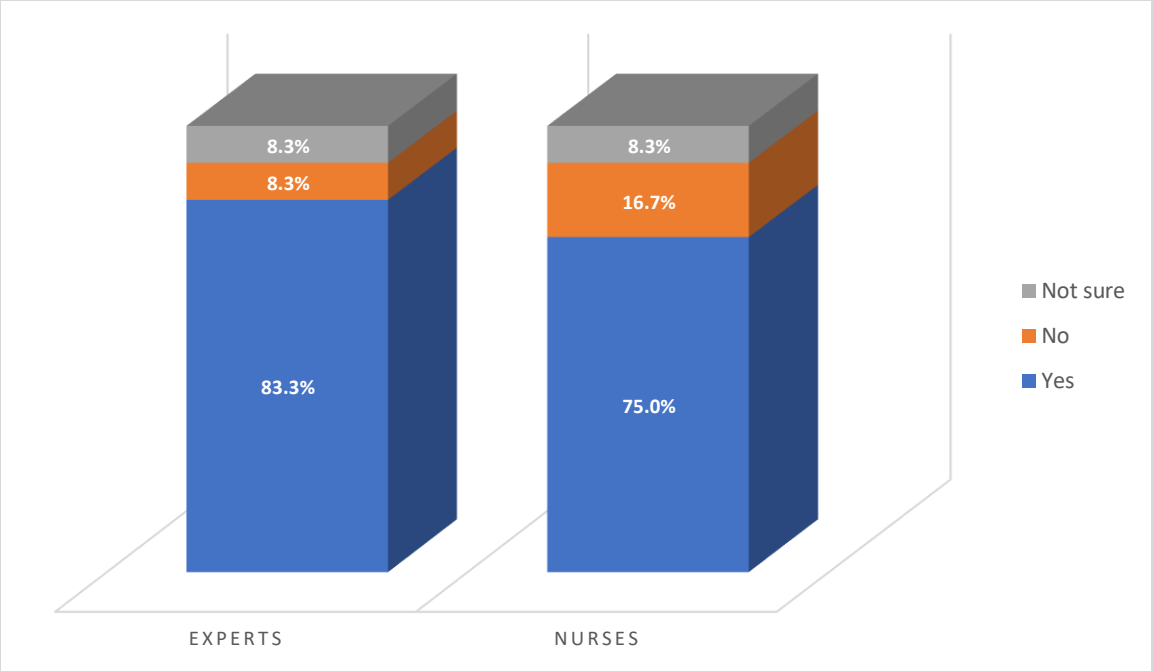


Fig. 22. Efficiency, consistency, and safety in providing invasive nursing care through the implementation of the Protocol for the Roles of the Interventional Radiology Nurse

Experts (83.3%) and nurses (75.0%) answered "Yes," indicating that the implementation of the protocol will ensure efficiency, consistency, and safety in providing invasive nursing care. A relatively small proportion of respondents answered "No" (experts – 8.3%, nurses – 16.7%).

We surveyed the nurses before and after the trial application of the Protocol for the Roles of the Interventional Radiology Nurse (Fig 23).

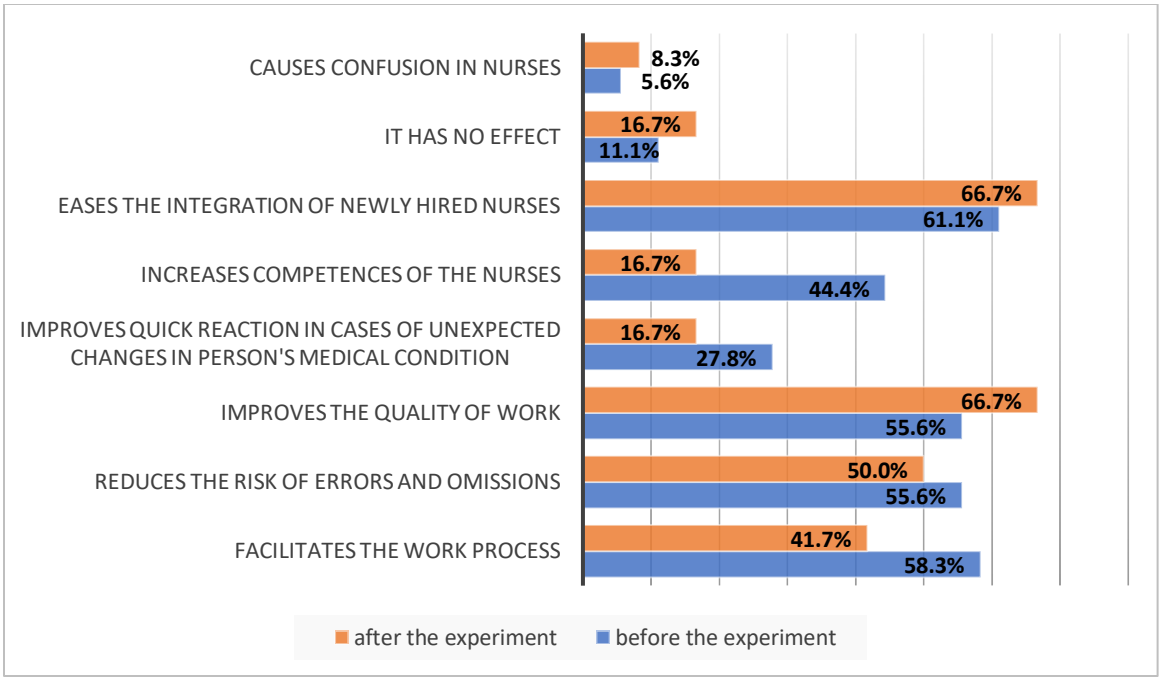


Fig. 23. Effects of implementing the Protocol for the Roles of the Interventional Radiology Nurse before and after the experiment

(nurses)

**% exceeds 100 as respondents indicated more than one answer*

Before the experiment, the analysis of the results showed that a relatively large part of the respondents believed that the effect of implementing the protocol would facilitate the work process for newly hired nurses (61.1%), reduce the risk of errors and omissions, and improve the quality of work (55.6%). Almost half of them believed that it would increase the competences nurses (44.4%). Most respondents after the experiment unanimously believed that it would facilitate newly hired nurses and improve the quality of work (66.7%). Half of them confirmed that the implementation of the protocol would reduce the risk of errors and omissions (50.0%).

The perspectives of experts on the protocol's implementation effect, both before and after the experiment, are presented in (Fig. 24).

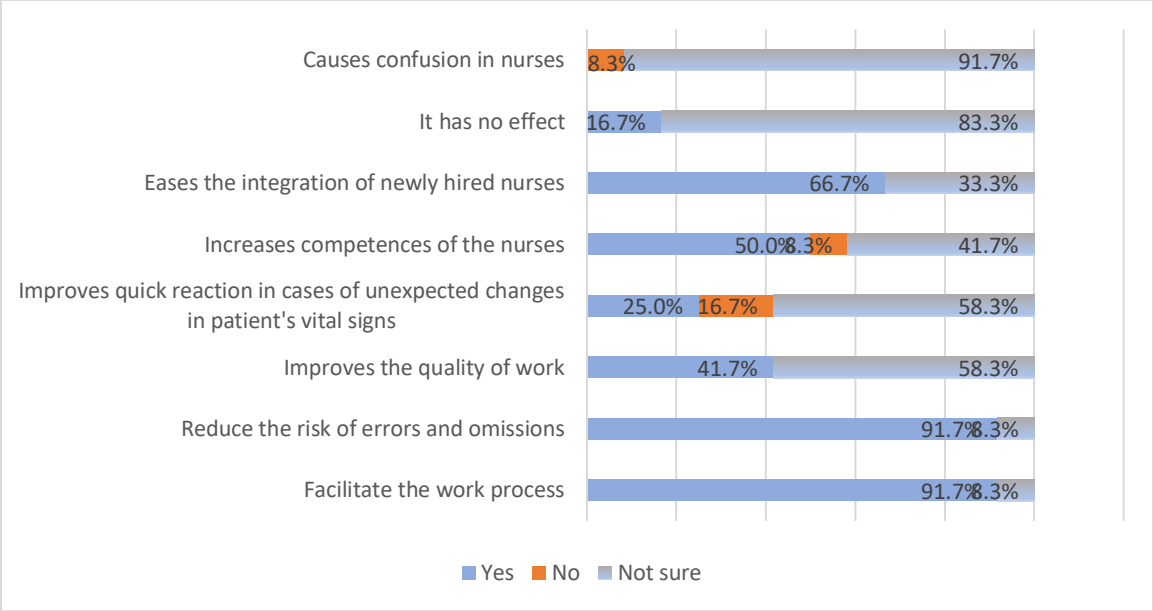


Fig. 24. Effects of implementing a Protocol for nursing activities after the experiment
(experts)

% exceeds 100, as respondents indicated more than one answer

Experts are certain that the implementation of the Protocol will facilitate the work process and reduce the risk of errors and omissions (91.7%). More than half believe that the Protocol will ease the integration of newly hired nurses (66.7%). Half of them think that it would increase the competence of the nursing staff (50%). The experts have clearly recognized the benefit of implementing a Protocol for invasive nursing care.

We conducted an in-depth interview to gather experts' insights on the need for documentation to standardize the activities of IR nurses.

> *"I believe that introducing a Protocol for the Roles of Interventional Nursing Care would streamline the work process" (R1).*
>
> *"I think the introduction of standardized documentation is necessary not only from a medical perspective, but also nurses will be protected by this type of document. It will have legal value" (R2).*
>
> *"In this documentation, the activities of nurses should be clearly defined because different interventional suites have specific organizational features that this protocol should consider or adapt to various procedures. Its*

introduction would facilitate faster learning of interventional radiology nurses' activities and reduce the chances of omissions and errors" (R3).

"A protocol for action in a dynamic medical practice like interventional cardiology is essential. According to European and American guidelines, various studies, and local experience in each catheterization lab, there should be rules and protocols for specific conditions and situations. These, combined with the team's experience, abilities, and individual decisions for each patient and case, create good medical practice and provide the best chance for a successful outcome, namely saving lives and curing patients" (R7).

Summary:

After completing the experiment on the effectiveness of the Protocol for the Roles of the Interventional Nurse, we can summarize the benefits of its introduction as follows:

- **Minimizing errors**: Reduces the likelihood of omissions or incorrect execution of procedures.
- **Efficient use of resources**: Optimizes the workflow by eliminating unnecessary steps and ensuring that necessary resources and equipment are available and used correctly (time, consumables, human resources, etc.).
- **Improved team coordination**: When every team member follows the protocol, coordination among different professionals improves, communication is facilitated, and everyone is aware of the sequence of actions and their responsibilities.
- **Ensuring patient safety**: The protocol includes measures for risk management and patient safety, such as sterility instructions, monitoring of vital signs, and adequate preparation for unexpected complications.
- **Support for training and development**: The protocol serves as a training tool for new nurses.
- **Standardization of practice**: The protocol provides clear and specific steps for the nurse's activities in the angiography room.

V. CONCLUSIONS, CONTRIBUTIONS, PROPOSALS, AND RECOMMENDATIONS

5.1. Conclusions

1. According to nurses, responsibility and discipline (100%), and empathy (63.9%) are the leading personal qualities for work in the IR suite. These qualities are followed by lifelong learning (55.6%), and teamwork skills (25%).
2. Nurses are highly trusted by patients during invasive examination (81%).
3. Competencies related to working in emergency settings (93%), handling medical equipment (74.2%), and using specific medical consumables (61.3%) are proven.
4. A positive attitude towards including nurses in various forms of continuing education is established (experts – 96.8%, nurses – 55.6%).
5. Survey participants support the need for specialization of nurses working in interventional suites (experts – 61.3%, nurses – 63.9%).
6. Respondents are certain that postgraduate education is a necessary step for improving knowledge and skills (experts – 97%, nurses – 92%).
7. Participants support the introduction of standardized specific documentation – Protocol for the Roles of the Interventional Radiology Nurse (experts – 83.3%, nurses – 75.0%).
8. After the experiment, nurses believe that the implementation of the Protocol for the Roles of the Interventional Radiology Nurse will improve the quality of work in interventional suites (66.7%), reduce the risk of errors (50.0%), and be a good guide for newly hired nurses (66.7%).
9. Based on the experiment, survey, in-depth interviews, and SWOT analysis, a **Model of the Modern Interventional Radiology Nurse** has been developed, which can be applied in practice to increase work efficiency and reduce the risk of errors.

5.2. PROPOSALS

- **To the Ministry of Health**

  - Requirements for the qualification of interventional radiology nurses in interventional suites should be included in the "Medical Standard for Cardiology".
  - An Interventional Radiology Nurse specialty should be included in Ordinance No. 1 of January 22, 2015 for acquiring a specialty in the

healthcare system.

- **To Medical Universities and BAHP**

- An elective course on Invasive Nursing Care in Interventional Suites should be included in the Nursing curriculum.
- Courses to enhance the knowledge and skills of nurses for working in interventional suites should be developed and offered.

- **To Hospital Management**

  - Specific nursing documentation that regulates the role of interventional radiology nurses to be developed and introduced.
  - The Protocol for the Roles of the Interventional Radiology Nurse to be implemented in practice.
  - A training program for nurses in interventional suites to be developed and offered.

- **To the Bulgarian Society of Interventional Cardiology**

  - Support for scientific research in the field of interventional cardiology.

5.3. CONTRIBUTIONS

Theoretical Contributions

Based on the conclusions, recommendations, and results of our research, contributions with theoretical and practical-applied character can be outlined.

Theoretical Contributions

1. International experience regarding the participation and preparation of the Interventional Radiology Nurse in interventional suites has been studied.
2. The perspectives of nurses on the need for preliminary training for work in the interventional suite has been studied.
3. The attitudes and motivation of nurses for work in interventional suites have been studied.
4. The roles and competencies of the nurse as part of the interventional cardiology team are described.

5. The readiness and attitudes for continuous education in various forms of postgraduate studies and the period of knowledge update of the Interventional Radiology Nurse have been studied.
6. A SWOT analysis of the professional development of nurses practicing in interventional suites has been conducted.
7. The need for the introduction of specific documentation to standardize the activities of interventional radiology nurses is theoretically justified.
8. A **Model of the Modern Interventional Radiology Nurse** working in the interventional suite has been developed and theoretically justified.

- **Practical Contributions**

1. The roles performed by the nurse in the interventional suite have been studied, proven, and outlined: circulating nurse, scrub nurse, and documenting nurse, as presented in the Protocol for the Roles of the Interventional Nurse
2. A **Model of the Modern Interventional Radiology Nurse**, which outlines the specific work of nurses in interventional suites and nurses' professional competencies, has been developed.
3. A self-developed **Protocol for the Roles of the Interventional Radiology Nurse**, containing a checklist and standard operating procedures scheme (nursing documentation), has been proposed.
4. The conducted experiment proves the effects and necessity of implementing the **Protocol for the Roles of the Interventional Radiology Nurse.**

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2. **Dimitrova, T.,** The modern nurse as part of the interventional cardiology team. Collection of reports MU Varna 2023, pp. 578-588
3. **Dimitrova, T., Toncheva, T.** The need for the introduction of specific nursing documentation for activities in interventional suites. Health Care Journal, Issue 3, 2024 ISSN 1312-2592