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Challenges in Establishing an Interventional Radiology Unit in Cameroon

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Abstract

Background: Although the prevalence of chronic diseases is steadily increasing in Cameroon, interventional radiology, an advanced technology offering minimally invasive solutions for diagnosing and treating these diseases, remains underutilized. This study aimed to assess the challenges in establishing an interventional radiology unit (IRU) in Cameroon.

Methods: We conducted a cross-sectional study over three months across the country, during which we conducted a rigorous survey involving 1,037 healthcare and administrative personnel from public and private healthcare facilities. Financial, technical, infrastructural, logistical, human resource, regulatory, and political challenges were assessed and analyzed using R software. Pearson's Chi-squared test was performed to compare the proportions of different challenges across healthcare personnel categories and healthcare facility types **(95% CI; $\alpha = 0.05$)**.

Results: Most healthcare facilities were referral hospitals (27%) and private clinics (26%), yet 72% lacked angiography equipment. Financial satisfaction among healthcare personnel varied significantly by professional category (**$p < 0.001$**), with 52% dissatisfied, negatively influencing staff involvement in setting up an IRU (69%, **$p < 0.001$**). The main challenges were financial, with high equipment costs (56%, **$p < 0.001$**); logistical, including equipment transportation (46%, $p < 0.001$) and medical supply procurement (43%, **$p < 0.001$**); lack of trained personnel (57%, $p < 0.001$); and regulatory barriers (45%, **$p < 0.001$**). Additionally, political support was deemed insufficient (37% neutral, 25% unfavorable, **$p < 0.001$**). Proposed solutions included improving equipment maintenance (35%), purchasing modern equipment (34%), expanding infrastructure (31%, **$p < 0.001$**), staff training through international collaborations (46%, **$p < 0.001$**), and local seminars (42%, **$p < 0.001$**). Furthermore, increased public funding (55%), public-private partnerships (31%), and international subsidies (13%, **$p < 0.001$**) were identified as key strategies for establishing an IRU in Cameroon.

Conclusion: Financial, logistical, and regulatory challenges, particularly the high cost of equipment, lack of trained personnel, and insufficient political support, hinder the implementation of interventional radiology in Cameroon. However, solutions such as infrastructure improvements, specialized training, and strengthening public and private funding could facilitate its development. Collaboration between health authorities and international partners is essential to improving chronic disease management.

Keywords: Interventional radiology; Chronic diseases; Financial obstacles; Logistical constraints; Staff training; Public-private partnerships; Health policy; Cameroon

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Introduction

Interventional radiology (IR) is a branch of radiology that utilizes medical imaging techniques (ultrasound, CT scan, angiography, or MRI) to guide minimally invasive diagnostic and therapeutic procedures [1]. Among its key innovations are tumor embolization, targeted thrombolysis for stroke treatment, vascular stent placement, and precision-guided biopsies, which enable precise treatment of many chronic diseases. For instance, in the management of liver cancer, embolization and percutaneous ablation offer less invasive and more targeted solutions than traditional surgery [2]. Similarly, for peripheral arterial diseases, angioplasty with stent placement significantly reduces the risk of amputation [3,4].

In developed countries, interventional radiology is routinely used and has led to a significant reduction in the prevalence, incidence, and mortality of various chronic diseases, particularly oncological and cardiovascular conditions [5]. However, in Africa, particularly in sub-Saharan Africa, the burden of these chronic diseases continues to rise. Despite the availability of conventional therapeutic solutions (surgery, medication), interventional radiology remains underutilized, even though it could serve as an innovative and suitable therapeutic option, reducing complications and hospital stays [6]. In Cameroon, as in many countries in the region, IR implementation rates are very low, and the factors explaining this underutilization remain poorly documented.

Given this context, it is crucial to identify and understand the specific challenges that hinder the establishment of interventional radiology units in Cameroon. Therefore, the primary objective of this study was to comprehensively assess the financial, technical, logistical, human resource, regulatory, and political challenges encountered in setting up an IRU and to propose possible solutions to improve chronic disease management in the country.

Materials and Methods

Study Design

To understand the challenges of establishing an IRU in public and private healthcare facilities in Cameroon, we conducted a cross-sectional study from November 2024 to January 2025, involving a rigorous survey among healthcare (specialist doctors, radiologists, general practitioners, radiology technicians) and administrative personnel from these facilities in regional capitals of Cameroon. The study sites were selected based on accessibility and infrastructural predisposition for IRU implementation.

Study Population and Data Collection Procedure

The study included healthcare and administrative personnel from public and private healthcare facilities in these regional capitals who met the inclusion criteria (accessibility and infrastructural predisposition). Following ethical approval from the University of Douala Ethics Committee and authorization from regional health delegations, data collection was conducted using a structured, pre-tested questionnaire validated by the research team. The questionnaire primarily collected demographic information, well-being and financial satisfaction of medical and administrative staff, as well as technical, infrastructural, financial, human resource, regulatory, and political challenges, along with proposed solutions. Data collection was conducted both in person and online via a Google Forms survey (https://forms.gle/VYRsAsjgDuwnYr8Q8) to address time and accessibility constraints.

Statistical Analysis

The data were recorded in an Excel 2013 spreadsheet and analyzed using R software version 4.4.2 for Windows Professional. Variables were presented as frequencies (N, n) and percentages (%). Pearson's Chi-squared test was performed to compare the proportions of various challenges between healthcare personnel categories and healthcare facility types. For this test, the null hypothesis (H_0), which stated that there was equality between these proportions, was set at a 95% confidence interval with a 5% margin of error. The p-value was considered statistically significant when less than 0.05.

Results

General Information on Respondents and Their Healthcare Facilities

The majority of healthcare facilities were referral hospitals (27%) and private clinics (26%), while company medical-social centers were the least represented (1.9%). Regarding angiography equipment, 72% of facilities lacked it. Among the surveyed personnel, specialist doctors (29%) and general practitioners (28%) were the most numerous, followed by radiologists (23%) and radiology technicians (10%). Administrators, ENT doctors, and pharmacists represented smaller proportions (4.4%, 3.0%, and 2.4%, respectively). In terms of experience, 40% of respondents had 1 to 5 years of practice, while 28% had less than a year of experience, and only 7.9% had over 10 years of experience (Table 1).

Impact of Financial Satisfaction and Professional Aspirations on Healthcare Personnel's Involvement in the Establishment of an Interventional Radiology Unit

Financial satisfaction varied significantly across professional categories ($p < 0.001$): 52% of respondents found it unsatisfactory, while only 5% considered it highly satisfactory. Financial aspirations also differed significantly ($p < 0.001$), with the majority demanding a salary increase (61%), while 25% were seeking more lucrative career opportunities. A lack of motivation due to insufficient remuneration significantly influenced respondents' involvement in setting up an interventional radiology unit ($p < 0.001$), with 69% stating that it would be a hindrance.

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Table 1: General Information on Respondents and Their Healthcare Facilities.

General Information	*n(%)*
Category of Healthcare Facility (FOSA)	
Referral Hospital	281 (27%)
Private Clinic	266 (26%)
District Hospital	225 (22%)
Regional Hospital	101 (9.7%)
Central Hospital	89 (8.6%)
Subdivisional Medical Center	55 (5.3%)
Company Medical-Social Center	20 (1.9%)
Presence of an Angiography Room in the Facility	
No	750 (72%)
Yes	287 (28%)
Surveyed Personnel	
Specialist Doctor	300 (29%)
General Practitioner	293 (28%)
Radiologist	236 (23%)
Radiology Technician	106 (10%)
Administrator	46 (4.4%)
ENT Doctor	31 (3.0%)
Pharmacist	25 (2.4%)
Years of Practice	
1-5 years	419 (40%)
Less than one year	290 (28%)
6-10 years	246 (24%)
More than 10 years	82 (7.9%)
n: Frequency , %: Percentage	

Similarly, the perceived impact of better financial well-being on the success of the project was significant ($p < 0.001$), with 56% of participants believing it would play a major role. The perception of interventional radiology's effect on income growth also varied significantly ($p< 0.001$), with 33% believing it would have no impact, while 30% saw it as having a significant effect. Finally, almost all respondents agreed that this specialty would improve patient care (**$p < 0.001$**), with 71% considering its impact to be highly significant (Table 2).

Technical and Infrastructural Challenges in Establishing an Interventional Radiology Unit

The analysis of technical and infrastructural challenges in establishing an interventional radiology unit revealed significant differences between private and public healthcare facilities (**$p < 0.001$**). Overall, 50% of facilities considered their infrastructure moderately adequate, with a higher proportion in the public sector (30%) compared to the private sector (21%). Infrastructure adequacy was more frequently reported in public facilities (23% vs. 2% in private facilities). The main technical shortcoming identified was the availability of equipment (60%), which affected public facilities (47%) more than private ones (13%). Issues related to adequate physical space (17%) and equipment maintenance (15%) were also more common in the public sector. Regarding equipment availability, public facilities had more ultrasound machines (21% vs. 12% in private facilities) and CT scanners (24% vs. 2.4% in private facilities). However, equipment such as angiography machines, MRI scanners, and X-ray machines were less accessible, particularly in the private sector, where some equipment, such as mammography and standard X-ray machines, was completely absent (Table 3).

Table 2: Impact of Financial Satisfaction and Professional Aspirations on Healthcare Personnel's Involvement in the Establishment of an Interventional Radiology Unit.

	Category of Healthcare Personnel						
Parameters	**Total (N = 1037)**	**Administrator (n = 46)**	**General Practitioner (n= 293)**	**Radiologist (n = 236)**	**Specialist Doctor (n = 356)**	**Radiology Technician (n = 106)**	**p-value**
Financial Satisfaction							<0.001
Unsatisfactory	537 (52%)	0 (0%)	113 (11%)	119 (11%)	227 (22%)	78 (7.5%)	
Satisfactory	285 (27%)	0 (0%)	150 (14%)	30 (2.9%)	77 (7.4%)	28 (2.7%)	
Not satisfactory	163 (16%)	21 (2.0%)	30 (2.9%)	87 (8.4%)	25 (2.4%)	0 (0%)	
Very Satisfactory	52 (5.0%)	25 (2.4%)	0 (0%)	0 (0%)	27 (2.6%)	0 (0%)	
Financial Aspirations							<0.001
Salary Increase	635 (61%)	21 (2.0%)	204 (20%)	177 (17%)	127 (12%)	106 (10%)	
Lucrative Career Opportunities	255 (25%)	25 (2.4%)	0 (0%)	32 (3.1%)	198 (19%)	0 (0%)	
Timely Salary Payment	120 (12%)	0 (0%)	89 (8.6%)	0 (0%)	31 (3.0%)	0 (0%)	
Social Benefits	27 (2.6%)	0 (0%)	0 (0%)	27 (2.6%)	0 (0%)	0 (0%)	
Can a lack of motivation due to insufficient remuneration hinder your involvement in the creation of an interventional radiology unit?							<0.001
Yes	718 (69%)	21 (2.0%)	243 (23%)	147 (14%)	201 (19%)	106 (10%)	
No	319 (31%)	25 (2.4%)	50 (4.8%)	89 (8.6%)	155 (15%)	0 (0%)	

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In your opinion, could better financial well-being contribute to the successful establishment of an interventional radiology unit in your hospital?							<0.001
Yes, significantly	579 (56%)	21 (2.0%)	157 (15%)	93 (9.0%)	202 (19%)	106 (10%)	
Yes, but with limitations	223 (22%)	0 (0%)	86 (8.3%)	116 (11%)	21 (2.0%)	0 (0%)	
I don't know	133 (13%)	0 (0%)	0 (0%)	27 (2.6%)	106 (10%)	0 (0%)	
No, it would not make a difference	102 (9.8%)	25 (2.4%)	50 (4.8%)	0 (0%)	27 (2.6%)	0 (0%)	
Do you think that the establishment of an interventional radiology unit in your hospital could increase your income?							<0.001
Not at all	341 (33%)	0 (0%)	40 (3.9%)	62 (6.0%)	188 (18%)	51 (4.9%)	
Significantly	315 (30%)	25 (2.4%)	128 (12%)	85 (8.2%)	77 (7.4%)	0 (0%)	
Slightly significantly	217 (21%)	0 (0%)	76 (7.3%)	56 (5.4%)	57 (5.5%)	28 (2.7%)	
Very significantly	164 (16%)	21 (2.0%)	49 (4.7%)	33 (3.2%)	34 (3.3%)	27 (2.6%)	
Do you think that interventional radiology could improve patient care?							<0.001
Very significantly	717 (71%)	46 (4.5%)	197 (19%)	150 (15%)	218 (21%)	106 (10%)	
Significantly	297 (29%)	0 (0%)	73 (7.2%)	86 (8.5%)	138 (14%)	0 (0%)	

The data are presented as frequencies (N, n) and percentages (%).
***P-value**: Pearson's Chi-squared test was performed to compare the proportions between different parameters and categories of healthcare personnel. For this test, the confidence interval for the null hypothesis was set at 95%, with a 5% margin of error (p is significant if and only if p < 0.05).*

Table 3: Technical and Infrastructural Challenges in Establishing an Interventional Radiology Unit.

	Category of Healthcare Personnel						
Parameters	**Total (N = 1037)**	**Administrator (n = 46)**	**General Practitioner (n= 293)**	**Radiologist (n = 236)**	**Specialist Doctor (n = 356)**	**Radiology Technician (n = 106)**	**p-value**
Financial Satisfaction							<0.001
Unsatisfactory	537 (52%)	0 (0%)	113 (11%)	119 (11%)	227 (22%)	78 (7.5%)	
Satisfactory	285 (27%)	0 (0%)	150 (14%)	30 (2.9%)	77 (7.4%)	28 (2.7%)	
Not satisfactory	163 (16%)	21 (2.0%)	30 (2.9%)	87 (8.4%)	25 (2.4%)	0 (0%)	
Very Satisfactory	52 (5.0%)	25 (2.4%)	0 (0%)	0 (0%)	27 (2.6%)	0 (0%)	
Financial Aspirations							<0.001
Salary Increase	635 (61%)	21 (2.0%)	204 (20%)	177 (17%)	127 (12%)	106 (10%)	
Lucrative Career Opportunities	255 (25%)	25 (2.4%)	0 (0%)	32 (3.1%)	198 (19%)	0 (0%)	
Timely Salary Payment	120 (12%)	0 (0%)	89 (8.6%)	0 (0%)	31 (3.0%)	0 (0%)	
Social Benefits	27 (2.6%)	0 (0%)	0 (0%)	27 (2.6%)	0 (0%)	0 (0%)	
Can a lack of motivation due to insufficient remuneration hinder your involvement in the creation of an interventional radiology unit?							<0.001
Yes	718 (69%)	21 (2.0%)	243 (23%)	147 (14%)	201 (19%)	106 (10%)	
No	319 (31%)	25 (2.4%)	50 (4.8%)	89 (8.6%)	155 (15%)	0 (0%)	
In your opinion, could better financial well-being contribute to the successful establishment of an interventional radiology unit in your hospital?							<0.001
Yes, significantly	579 (56%)	21 (2.0%)	157 (15%)	93 (9.0%)	202 (19%)	106 (10%)	
Yes, but with limitations	223 (22%)	0 (0%)	86 (8.3%)	116 (11%)	21 (2.0%)	0 (0%)	
I don't know	133 (13%)	0 (0%)	0 (0%)	27 (2.6%)	106 (10%)	0 (0%)	
No, it would not make a difference	102 (9.8%)	25 (2.4%)	50 (4.8%)	0 (0%)	27 (2.6%)	0 (0%)	
Do you think that the establishment of an interventional radiology unit in your hospital could increase your income?							<0.001
Not at all	341 (33%)	0 (0%)	40 (3.9%)	62 (6.0%)	188 (18%)	51 (4.9%)	
Significantly	315 (30%)	25 (2.4%)	128 (12%)	85 (8.2%)	77 (7.4%)	0 (0%)	
Slightly significantly	217 (21%)	0 (0%)	76 (7.3%)	56 (5.4%)	57 (5.5%)	28 (2.7%)	
Very significantly	164 (16%)	21 (2.0%)	49 (4.7%)	33 (3.2%)	34 (3.3%)	27 (2.6%)	

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Do you think that interventional radiology could improve patient care?							<0.001
Very significantly	717 (71%)	46 (4.5%)	197 (19%)	150 (15%)	218 (21%)	106 (10%)	
Significantly	297 (29%)	0 (0%)	73 (7.2%)	86 (8.5%)	138 (14%)	0 (0%)	

The data are presented as frequencies (N, n) and percentages (%).
***P-value**: Pearson's Chi-squared test was performed to compare the proportions between different parameters and categories of healthcare personnel. For this test, the confidence interval for the null hypothesis was set at 95%, with a 5% margin of error (p is significant if and only if p < 0.05).*

Financial, Logistical, Human, Regulatory, and Political Constraints in Establishing an Interventional Radiology Unit

The study highlighted financial, logistical, human resource, regulatory, and political challenges in establishing an interventional radiology unit, with significant differences between private and public healthcare facilities (**p < 0.001**). The main financial barrier was the cost of acquiring equipment (56%), which affected public facilities (43%) more than private ones (14%). Logistical constraints were primarily related to equipment transportation and installation (46%) and the supply of medical consumables (43%), with a greater impact in the public sector. The availability of trained personnel was deemed inadequate in 57% of cases, with initial staff training identified as the most critical training need (54%). The lack of qualified candidates (50%) and working conditions (33%) were the main recruitment challenges. On the regulatory level, authorization procedures (45%) and safety standards (28%) were the primary barriers. Finally, political support was perceived as neutral (37%) or unfavorable (25%) by a large proportion of respondents, with a complete absence of "very favorable" support in private facilities (Table 4).

The proposed solutions

To overcome technical and infrastructural challenges primarily included improving equipment maintenance (35%), purchasing modern equipment (34%), and expanding infrastructure (31%). To enhance staff skills, training programs in collaboration with international institutions were the most recommended (46%), followed by local seminars and workshops (42%), while online training (9.4%) and on-site internal training (2.4%) were less favored. Regarding strategies to overcome financial and logistical obstacles, the most supported measure was increasing public funding (55%), followed by public-private partnerships (31%) and international subsidies (13%) (Table 5).

Table 4: Financial, Logistical, Human, Regulatory, and Political Constraints in Establishing an Interventional Radiology Unit.

Health care Facilities				
Challenges	**Total (N = 1037)**	**Private (N = 286)**	**Public (N = 751)**	**p-value**
Assessment of the Current Infrastructure for the Establishment of an Interventional Radiology Unit				<0.001
Moderately adequate	522 (50%)	213 (21%)	309 (30%)	
Adequate	261 (25%)	21 (2.0%)	240 (23%)	
Inadequate	174 (17%)	27 (2.6%)	147 (14%)	
Highly adequate	80 (7.7%)	25 (2.4%)	55 (5.3%)	
What are the main technical shortcomings identified?				<0.001
Availability of equipment	619 (60%)	132 (13%)	487 (47%)	
Adequate physical spaces	179 (17%)	60 (5.8%)	119 (11%)	
Equipment maintenance	159 (15%)	42 (4.1%)	117 (11%)	
Consumables and training	28 (2.7%)	0 (0%)	28 (2.7%)	
Limited space	27 (2.6%)	27 (2.6%)	0 (0%)	
Availability of specialized doctors	25 (2.4%)	25 (2.4%)	0 (0%)	
Current Availability of the Following Equipment in Your Facility				<0.001
Ultrasound machines	339 (33%)	125 (12%)	214 (21%)	
Computed Tomography (CT) scanners	274 (26%)	25 (2.4%)	249 (24%)	
Angiography machines	148 (14%)	40 (3.9%)	108 (10%)	
Nothing to Report (NTR)	104 (10%)	43 (4.1%)	61 (5.9%)	

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Magnetic Resonance Imaging (MRI) machines	87 (8.4%)	53 (5.1%)	34 (3.3%)	
X-ray machines	30 (2.9%)	0 (0%)	30 (2.9%)	
Mammography machines	28 (2.7%)	0 (0%)	28 (2.7%)	
Standard X-ray	27 (2.6%)	0 (0%)	27 (2.6%)	

The data are presented as frequencies (N, n) and percentages (%).
***P-value**: Pearson's Chi-squared test was performed to compare the proportions between the different challenges and healthcare facility categories. For this test, the confidence interval for the null hypothesis was set at **95%**, with a **5% margin of error** (**p is significant if and only if p < 0.05**).*

Table 5: Solutions.

Solutions	***n(%)***
Proposed solutions to overcome technical and infrastructural challenges	
Improvement of maintenance	368 (35%)
Purchase of modern equipment	351 (34%)
Expansion of infrastructure	318 (31%)
Training initiatives proposed to improve staff skills	
Training programs in collaboration with international institutions	480 (46%)
Local seminars and workshops	435 (42%)
Online training	97 (9.4%)
On-site internal training	25 (2.4%)
Recommended strategies to overcome financial and logistical obstacles	
Increase in public funding	575 (55%)
Public-private partnerships	326 (31%)
International subsidies	136 (13%)
***n**: frequency, %: Percentage*	

Discussion

Our study reveals several key factors that hinder the establishment of an interventional radiology unit (IRU) in Cameroon. First, the typology of healthcare facilities, primarily composed of referral hospitals (27%) and private clinics (26%), highlights the diversity of the local healthcare system. However, the high proportion of facilities lacking angiography equipment (72%) reflects a severe material deficit, limiting access to interventional care [6]. This shortage of specialized equipment may be linked to budgetary constraints and insufficient investment planning in healthcare, as previously noted by Brock et al. (2023) in other African contexts [2].

Financial satisfaction emerged as an important determinant of staff involvement, with 52% of respondents dissatisfied ($p < 0.001$) and 69% stating that insufficient remuneration hindered their engagement in setting up an IRU. Several studies suggest that better remuneration and a motivating work environment are essential to attracting and retaining highly qualified professionals in advanced specialties like interventional radiology [1,2]. The low level of salary satisfaction could thus contribute to migration towards the private sector or other countries offering more attractive conditions, further exacerbating the shortage of trained personnel in this field.

Financial constraints appear to be the primary obstacle (56%, **$p < 0.001$**) to IRU implementation, reflecting the high costs associated with acquiring and maintaining high-tech equipment. In this regard, equipment transportation and installation (46%, **$p < 0.001$**), as well as the supply of medical consumables (43%, **$p < 0.001$**), add to the already substantial logistical burden for healthcare facilities [5]. Furthermore, the lack of qualified personnel (57%, **$p < 0.001$**) highlights the absence of institutionalized training pathways in interventional radiology. According to the European Society of Radiology [7], training and continuous education are crucial for the development and sustainability of this specialty, particularly in countries with a low density of specialists.

Regulatory barriers and lack of political support (37% neutral and 25% unfavorable, **$p < 0.001$**) further complicate the situation. Lengthy or complex authorization procedures, along with the absence of targeted health policies, may discourage both public and private initiatives [8]. Policymakers, often faced with competing health priorities, do not always allocate sufficient attention to the development of interventional radiology, a specialty perceived as costly and demanding in highly qualified human resources [9].

To address these challenges, our study proposes concrete solutions. On one hand, improving equipment maintenance (35%) and acquiring new equipment (34%) aim to resolve technical deficiencies. On the other hand, expanding infrastructure (31%, **$p < 0.001$**) and establishing training programs through international collaborations (46%, **$p < 0.001$**) and local seminars (42%, **$p < 0.001$**) could help enhance staff competencies.

This combination of actions, supported by increased public funding (55%), public-private partnerships (31%), and international subsidies (13%, **$p < 0.001$**), is also recommended by the World Health Organization in its strategy to strengthen healthcare systems in sub-Saharan Africa. The experience of some emerging countries shows that mixed funding models

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and resource pooling can accelerate the implementation of interventional radiology units [10].

Conclusion

Financial, logistical, human resource, and regulatory barriers—particularly the high cost of equipment, limited availability of trained personnel, and insufficient political support—currently hinder the establishment of interventional radiology units in Cameroon. However, targeted strategies combining infrastructure upgrades, improved maintenance, specialized training through international and local programs, and diversified financing (increased public funding, public–private partnerships, and international subsidies) could enable rapid and sustainable development of interventional radiology services and improve patient care.

Conflicts of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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