"So you are running between" – a qualitative study of nurses' involvement with diagnostic imaging in South Africa

Chandra R. Makanjee, PhD; Anne-Marie Bergh, PhD; Willem A. Hoffmann, DEd

Chandra R. Makanjee is Head of the Department of Radiography, University of Pretoria, South Africa. Anne-Marie Bergh is Senior Researcher at the MRC Unit for Maternal and Infant Health Care Strategies, University of Pretoria, South Africa. Willem A. Hoffmann is Senior Lecturer in the Department of Biomedical Sciences, Tshwane University of Technology, South Africa

Corresponding author. Chandra R. Makanjee, Department of Radiography, University of Pretoria, Private Bag X323, Arcadia 0007, South Africa. E-mail: Chandra.Makanjee@up.ac.za

ABSTRACT: Nurses caring for patients in radiology departments is a relatively recent phenomenon. Only a few fragmented studies appear in the literature on the interprofessional nursing domain in these departments. This paper attempts to give a more holistic picture of nurses' experiences of patient care related to diagnostic imaging and interprofessional interactions and relations with radiographers and radiologists. Focus groups were held, among others, with nurses at a district hospital and an adjacent academic hospital in South Africa. Participants were questioned about their experiences regarding referrals for diagnostic imaging, their professional roles, views on the roles of other professions, multidisciplinary interaction and radiation awareness. Three main themes emerged. (1) Patient care and communication include the sub-themes of 'being there' for patients and communicating with them. (2) Scope of professional practice is divided into activities around the request form, preparation for diagnostic imaging and further education needs. (3) Interprofessional interactions relate to hierarchical- and power relations and interprofessional communication and conflict. The study illustrates the collaborative and mediating roles of nurses at various points in the health system, from referral of patients for diagnostic imaging investigations up to discharge from the healthcare facility. More studies are needed on

interprofessional relations between radiographers, radiologists and nurses and nurses' ability to make appropriate judgments with regard to the completion and interpretation of request forms and preparing patients for specialized investigations.

KEYWORDS: Nursing care; Nurse-patient relations; Hospital radiology department; Nurse-radiographer relations; Nurse-radiologist relations.

INTRODUCTION

Nurses' caring for patients in radiology departments is a relatively recent phenomenon that started in the 1970s with the proliferation of multimodality, cutting-edge imaging technologies. The functions and competencies of nurses working in diagnostic imaging are multifaceted: ensuring patient safety, comfort and ethical care; balancing patient load; and responding to emergencies (Goodhart & Page, 2007; Brown, 2012). One of the challenges is the ability to adapt from having stable nursing care plans and routines to the frequency of changing plans when a patient is switched between modalities (Glicksman, 2008). The role of radiology nurses also entails patient education, training of radiographers, setting standards, and participating in quality-assurance activities (Goodhart & Page, 2007; CNET & RNCB, 2010).

The division of roles, responsibilities and scope of professional practice between radiographers and nurses working in radiology has developed differently in different countries. In some countries, for example Saudi Arabia and Guatemala, formal radiography education and training was in the past offered to nurses as an add-on in the absence of radiography professionals. However, after the need for qualified graduate radiographers had been identified, academic radiography education and training was introduced (Alaamer, 2012; Cowling, 2008). In countries like Sweden there is a formal Bachelor of Science degree in diagnostic radiology for nurses (Lundén, Lundgren & Lepp, 2012). In some countries bone densitometry is physically and organizationally not included under the umbrella of imaging services and is often run autonomously by nurse practitioners, with varying degrees of

radiographer involvement (Field & Snaith, 2013). In South Africa no formal radiology nursing programs are currently offered.

According to the Nursing Council of New Zealand (2009), “[n]urse practitioners are expert nurses who work within a specific area of practice incorporating advanced knowledge and skills.” As this category of specialized nursing in the radiology field is not formalized in the South African health professions education system, the term “nurse practitioner” is used to refer to nurses with this type of expertise in other countries.

Mørk, Aanestad, Hanseth, and Grisot (2008) refer to the everyday need for nursing and radiology to cooperate in sharing tasks in order to come to a common outcome of the quality of service expected, without compromising care. Goodhart and Page (2007) see the goal to be providing optimal imaging data with minimum discomfort to the patient. In this respect nurses’ collaboration with the radiology team that includes radiologists and radiographers is important.

According to Chow, Chan, Lo, Chu, Chan, and Lai (2013), imaging plays an integral role in disease diagnosis and patient treatment. Quality patient care depends on clinical findings used to justify a referral for a diagnostic investigation and on accurate interpretation of images. These activities traditionally belonged to the medical domain. As nurses’ skills and knowledge in requesting examinations and interpreting images vary, it is essential to standardize competencies to be achieved by means of education and regular audit of outcomes.

There has been a debate regarding the role of formal education versus experiential learning among nurses and nurse practitioners in acquiring skills and knowledge in plain x-ray requests and image interpretation (Summers, 2005; Coleman & Piper, 2009). Chow et al. (2013) emphasize the essence of including imaging in both formal undergraduate and postgraduate nursing education programs. This could further improve performance in this role extension for nurses as a result of the development of different imaging modalities in diagnostic investigation.

Nurses are in an ideal position to provide patients with a holistic experience by bridging gaps identified between the biomedical and technological worlds of radiology on the one hand, and the psychosocial world of the patients on the other. According to Brown (2012), nurses can help patients to understand the imaging procedures or intervene on the patients' behalf. In addition, nurses need to interact and create partnerships with a variety of health care providers involved in imaging procedures and the follow up of patients.

Despite nurses having become an integral part of radiology departments worldwide and nurses being the bridges between general care services and radiography and radiology services, only a few fragmented studies appear in the literature on the interprofessional nursing domain in radiology departments. No study could be found on the relationships and interactions between nurses, radiographers and radiologists. The aim of this paper is to report on nurses' experiences of patient care and interprofessional interactions and relations with radiographers and radiologists. This study was part of a larger qualitative inquiry into processes and interactions between health care providers and patients referred for diagnostic imaging investigations in a hospital complex that included a district and an academic, tertiary hospital. The Research Ethics Committee of the Faculty of Health Sciences of the University of Pretoria approved this study.

METHODS

The larger study entailed 24 case studies of 'shadowing' patients from admission to the casualty department or outpatient department up to discharge from the district hospital or referral to the adjacent academic hospital. In this process the patients were interviewed, consultations and diagnostic imaging investigations were observed and individual interviews were held with health professionals, including three nurses (indicated as "Nurse, Patient #" in the direct quotations).

In addition, focus group interviews were held with nurses and radiographers from both hospitals and with radiology registrars (residents) from the academic hospital. Table 1 contains a summary of the different ranks of participating professionals. Four focus groups

were held with nurses. Two groups were from the district hospital where no nurses are designated to the x-ray department (indicated as “Nurse, DH”). One group from the academic hospital consisted of ward nurses (indicated “Ward nurse, AH”), while the other group of professional nurses was permanently dedicated to the radiology department (indicated as “Nurse, Radiology, AH”). Participants were questioned about their experiences regarding referrals for diagnostic imaging, their professional roles, views on the roles of other professions, multidisciplinary interaction and radiation awareness. All participants provided written informed consent to take part in the study.

Table 1. Summary of provider participants in focus group interviews

Profession	Number of focus groups	Total number of participants	Gender		Professional rank (n)
			Male (n)	Female (n)	
Radiographers	3	15	2	13	Chief (2) Senior (11) Junior (2)
Radiology registrars	2	8	3	5	Senior (3) Junior (5)
Nurses	4	17	1	16	Professional (7) Enrolled (10)
TOTAL	**9**	**40**	**6**	**34**	

Interviews were conducted in English and/or Afrikaans. They were digitally recorded and transcribed; field notes were written during and/or after the interviews and observations. Elements of grounded theory were incorporated in the data analysis. The analysis commenced with a microanalysis where the researchers immersed themselves in the transcriptions to identify key words and broad categories (open coding). At the next level of analysis similarities and differences between the categories were identified (axial coding) and further categories and broad themes were identified (Patton, 2002).

FINDINGS

Nurses play a variety of roles in the referral for a diagnostic imaging investigation, the performance of the investigation itself and the treatment of patients as a result of the outcomes of the investigation. In our study nurses occupied different types of professional and functional spaces in relation to diagnostic imaging and related processes and procedures. At the academic hospital there was a radiology department with dedicated nurses. At the district hospital no nurses or radiologists (including radiology registrars) worked in this hospital's x-ray department. In both hospitals nurses (e.g. ward and emergency nurses) were interacting with the diagnostic imaging service providers, to whom we refer in this paper as nurse participants "outside the radiology department". Table 2 provides a typology of the roles and activities of nurses as they relate to the provision of diagnostic imaging services. Three main themes emerged from the individual and focus group interviews: patient care and communication; scope of professional nursing practice; and interprofessional interaction.

Patient Care and Communication – "We know we have to be there"

According to Gray, West, and Nadolsky (2013), patient care and communication are the backbone of quality care. In our study two sub-themes were identified around this theme: 'being there' for the patient and communicating with the patient. Nurses regarded themselves as advocates of patients when they perceived patients as being treated unfairly by the system or other health professionals, especially radiographers.

"*Being there*" for the patient. Radiographers, radiologists and radiology registrars relied heavily on the cooperation of nurses in the technical care of patients during diagnostic imaging investigations by physically supporting patients (e.g. lifting and restraining) to produce optimal quality radiographs. However, nurses outside the radiology department interpreted their restraining function for patients undergoing an x-ray investigation as an insignificant task in comparison to their other tasks − *"All we do is hold the patients"* [Nurse,

Table 2. Typology of nurses' roles in relation to diagnostic imaging activities

THEMES							
PATIENT CARE AND COMMUNICATION		SCOPE OF PROFESSIONAL PRACTICE			INTERPROFESSIONAL INTERACTIONS	
↓		↓			↓	
SUB-THEMES		**SUB-THEMES**			**SUB-THEMES**	
'Being there' for the patient	Communicating with patients	Activities around the request form	Preparation for diagnostic imaging investigations	Further education needs	Hierarchies & power relations	Interprofessional communication & conflict
↓	↓	↓	↓	↓	↓	↓
Categories	**Categories**	**Categories**	**Categories**	**Categories**	**Categories**	**Categories**
• General care • Support with investigations • Support with technical care • Patient advocacy • Accompanying role	• Filling gaps • Explanation & reassurance • Mediation between doctors & patients	• Completion • Interpretation	• Task shifting & its consequences • Informed consent dilemmas • Making judgment calls • Role confusion	• Interpretation skills • Patient preparation • Radiation risks & safety	• Radiology registrars • Radiographers • Nurses	• Nurses and radiology registrars • Nurses and radiographers • Nurses & doctors outside radiology

DH]. In the ward *"we don't communicate; we're just helping them to move the patient, then let them put their radiograph what, what under the patient"* [Nurse, Patient 22]. Similarly, another participant described the imaging encounter as follows: *"They just come in with their machines and they do the patient. And we wear those aprons and then we assist them and thereafter it is amen"* [Nurse, DH]. However, this was not the only view. At the district hospital a nurse in the casualty section described this role as being significant in the continuum of the care process, especially to stabilize the patient with minimum discomfort:

> "*My role in fact, the patient involved in the MVA [motor vehicle accident], I have to see that the patient is put in the right position so that when he goes for x-rays he must not move. They must be handled in good care."* [Nurse, Patient 22]

Outside the radiology department radiographers frequently experienced a lack of cooperation from nurses. The radiographers often felt that their professional role and/or status were perceived by the nurses as being insignificant. This perception was compounded by the subordinate role of the nurse vis-à-vis other medical professionals. As a result of this breakdown in communication and professional respect, the quality of the task at hand was often compromised and the patients' continuum of care negatively affected.

> "*Sometimes [there] is a complaint if radiographers go up to the wards to do the mobiles and when they come, especially in the ICU unit, the sisters [nurses] don't want to help the radiographers [radiologic technologists] to support them, to help lift the patient. And then the radiographers, they then get frustrated because they can't handle the patient alone. So the sisters, they're just refusing to help the radiographers and sometimes they [the radiographers] just take the mobile and come down to the unit [radiology department] and then the doctor starts fighting: 'Why is this x-rays not done?' And then there is no support. Then afterwards when the doctor talks to the sisters, they will do something about it. So with the mobile there is a lot of frustration for the radiographers.*" [Nurse, Radiology, AH]

At the academic hospital, radiographers, more so than radiology registrars, acknowledged the greater continuity of patient care provided by nurses. Nursing participants emphasized

the moral obligation to ensure patient safety and care − *"She [the radiographer] is just there to take x-rays, then it is finished; and thereafter it is the nurse's problem"* [Nurse, Radiology, AH]. The nurses' role in providing assistance was further complicated by the technical aspects of care required to enable the performance of an optimal radiographic examination, including aiding radiographers with difficult patients (e.g. patients with aggressive behavior or restless patients for whom sedation was contra-indicated).

> *"So it's difficult sometimes, [with] patients from casualty. It becomes difficult as well for the radiographers because they don't sedate the patients. They're having patients that they suspect a fracture. I mean, it is really traumatizing. Then we expect the patient to come from another stretcher to the bed in order for them to do the x-rays. It is difficult for the patient, the radiographers. Sometimes the patient is aggressive. Ninety percent of the people working in the x-ray department are ladies."* [Nurse, Radiology, AH]

The distribution and prioritization of nursing care services across all areas within radiology were reported to be negatively affected by limited human resources, as illustrated in the following excerpt:

> *"Once there is a patient, the nurse must be there. You see in MRI [magnetic resonance imaging] there is no nurse. We just go there on Thursday when they are scanning the babies. We've got lots of problems because sometimes the patient wants to go to the toilet; sometimes under screening the patient complicates, you know.* [Nurse, Radiology, AH]

Nurses also indicated that the following roles formed an important part of their 'being there' for the patients: accompanying patients; acting as communication intermediaries between patient and doctor; and being patient advocates.

> *"Sometimes they [the doctors] will call you and you must come and interpret for them. And then they don't know how far that patient, she has got knowledge. Most of them, if they see the black people, they just see that maybe she does not know anything, any language. They will call you, even if you are nowhere, 'Hey you, will you please*

come and interpret!' And then I told them, 'Just first ask the patient, can you talk English or Afrikaans?'" [Nurse, Radiology, AH]

In contrast, the role of ward nurses who accompany patients for diagnostic imaging investigations was regarded as limited. Comments in this regard include the following:

"We take forms to the x-ray department with the patient." [Ward nurse, AH]

"We don't talk too much. We just come here; they're [the doctors are] sending them with request forms. They [the radiographers] say, 'Go this way; you sit outside.'" [Nurse, DH]

Communicating with patients. Ward nurses played an essential role in communicating with patients at various points between referrals, investigations and post investigations. In our study they acted as 'gap fillers' performing explanation and interpretation roles − *"Okay, where I am working, I am assisting the doctor, more especially for the other patient who cannot communicate, like the language"* [Nurse, Patient 13].

Patients tended to turn to nurses working in the wards with requests to explain what was going to happen to them after the referral for a diagnostic investigation, or to interpret their x-rays results − *"What are they going to do with me? What is wrong? Are they going to operate?"* [Nurse, DH]. One nurse from the district hospital had the following to say with regard to preparing patients for x-rays or skimming x-ray images or reports:

"Some don't even know what x-ray [is]. They ask you, 'Am I going to feel the pain when they're going to do this?' And then I try to explain to them because I saw some chest x-rays being done before. I will tell her that you are going to stand there and they have got a big light and a big machine and they are going to take a photo of you. But this photo [is] take[n] of your inside, not your outside appearance." [Nurse, DH]

Similar to the ward nurses, nurses working in the radiology department also referred to their 'gap-filling' role in terms of allaying patient fears of the unknown – *"Patients are totally uninformed when it comes to the x-ray department"* [Nurse, Radiology, AH]. The nurses working in the radiology department also had to ensure an effective flow of information.

"Because you have to interpret what they're coming for, what is an x-ray, explain to them that they are going to do this and this. You explain the whole procedure, what x-rays is all about. Most of the time the radiographers also they don't explain. So you are like the mediator between the radiographers, the clerk, the doctor, the patient; so you are running between". [Nurse, Radiology, AH]

Others, however, held a different view:

"I think there is very little communication between the nurse and her patient. You accept things are done. But if you look deep, there was no explanation given to the patient on what is happening." [Nurse, Radiology, AH]

Nurses' role as interpreter included clarifying communication at the patients' level in order for them to understand the procedures and processes of diagnostic imaging.

"The doctors do explain to the patients, but they explain in their medical terms. Now if you come and say, 'Mrs VW, the doctor said you're going for …. Did you understand?' 'Yeah, Sister, I did not understand what he said.' So I think we must bring ourselves down to the patient's level in order for the patient to understand." [Nurse, Radiology, AH]

Outside the radiology department nurses played a similar important role in bridging communication gaps between doctors and patients by encouraging the patients to engage in more active participation.

"Let's talk about the injured patient: 'You know what, Sister, they only took the leg, but you know, my arm is always painful.' So I told the patient, 'You know, why you did not tell the doctor? You also have a problem with the arm. So when you give a history, you must always give whole history, then wherever you feel pain. So they can x-ray the whole body.' Then I have to explain to the doctor, so the doctor can call the radiographer again to do the [additional] x-ray." [Nurse, Patient 13]

Often patients not referred for an imaging investigation observed other patients being referred. In the absence of adequate doctor-patient communication nurses then had to provide these patients with a convincing justification for a doctor's decision not to refer them

as well – *"So I explain to the patient that the doctor, he is certainly examining them. If they find something wrong, then there is a need to do the x-rays."* [Nurse, Patient 23]

Health professionals' use of jargon related to diagnostic imaging investigations, specifically those dealing with complex interaction processes resulted often in patient misunderstandings and miscommunications. This, in turn, led to patients' confusion and mistrust that the nurses could more easily address.

> *"The doctor tells the patient, 'I am sending you for x-rays.' When the patient comes to radiology, he is actually for a scan. And then the patient says, 'No, the doctor says x-rays and not scan.' The patient doesn't have a clue. There is miscommunication between the doctor and the patient. You're now the middle man. You help, you must now sort it out and the patient totally refuses to go to the scan because the doctor said x-rays. Now you have to send the patient and let the doctor explain and the patient will come back."* [Ward nurse, AH]

Scope of Professional Practice –"It's really very much confusing"

The scope of professional practice provides health professionals with a framework for duties to be performed as defined by a professional body and based on the relevant academic qualifications obtained. Each health professional remains accountable for the appropriateness and quality of the various tasks he or she performs (Crane & Delany, 2013). In terms of nurses' scope of professional practice we identified the following sub-themes in this study: activities around the request form; patient preparation for imaging investigations; and nurses' need for further education.

Activities around the request form. The process to establish access to and issue a request for a radiographic investigation is a complex activity that involves several disciplines. This process impacts on several service points, but most importantly on the receiver of the diagnosis, the patient. In our study we found that even though only medical practitioners were allowed to request radiographic investigations, some nurses at the academic hospital

were actually also completing request forms based on the feedback and/or symptoms being reported by patients. In the absence of clear hospital protocols and guidelines, this caused a dilemma for radiographers in terms of incorrect or inappropriate requests and/or over-requesting.

> *"[The nurses] write but write the wrong wrist, like right instead of left. They did not check it. But in some rare cases you actually correct their mistakes. They actually wanted the left and the right wrist for comparison, but they did not write that they wanted for comparison."* [Radiographer, AH]
>
> *"[The nurses] send the patient for x-rays before the doctor see them. I know that they are not allowed to. We did question it. It is actually one of the sisters, not all of them, they ask for too many examinations."* [Radiographer, AH]

Only once nurses had started working in the radiology department and were themselves recipients of incorrect or inappropriate request forms, did they realize that completing a request form was much more than a mere procedural task. In this context they could witness first hand the impact of the justification on the request form on judgment calls to be made with regard to the preparation of patients for particular investigations.

> "*There is a difference very much, so especially regarding the request. I can clearly see the forms that we're used to in the wards [for] sending patients to investigations; it's really an eye opener."* [Nurse, Radiology, AH]

Patient preparation for diagnostic imaging investigations. Although it is generally expected of the medical provider to make direct contact with the radiologists for specialized investigations, nurses were often sent with request forms to book these investigations. This task shifting highlighted some nurses' inability to provide the full clinical picture of the patient to inform the decision on the appropriateness of the requested modality and investigation.

> "*Nurses are sent to make booking for the VCU [voiding cysto urethrogram]. The problem comes when you want to find out more detail about the patient's information. 'Has the patient been operated on? Why do you think he has got posterior urethral*

valve stricture?' Then you ask them to ask the doctor to phone you." [Radiology registrar, AH]

Dilemmas around informed consent for investigations that require the administration of contrast medium were also identified in this study. In many cases it was not clear who was responsible for providing the information to the patient and/or whether some medical providers were negligent in this regard. This gap in the continuum of communication resulted in confusion for nurses and increased the potential of putting patients at undue risk.

"Actually, even it is something to do with the procedures, you find that they [the doctors] make the patient sign, not knowing what they're signing for. You understand and it is a bit difficult for the patient. You think that at times the patient is in denial. It's like identifying that the patient has signed consent but he is allergic to iodine. It is stated on top of the medication side they're allergic to iodine, but she has signed and they must do that scan with contrast. So it's really very much confusing." [Nurse, Radiology, AH]

In the radiology department nurses were also expected to make judgment calls on the basis of information provided on request forms. An example frequently encountered in this study relates to requests for ultrasound examinations where a request for an abdominal ultrasound examination could be revised to a pelvis or lower abdominal investigation after verification by the radiologist. As a result, these patients then had to wait until their urinary bladders were full. A nurse shared her own experience of being a patient in this regard:

"I came for a sonar [ultrasound examination]. And I waited for an hour. My name was called to go inside for the examination. The doctor asked if I have been given water to drink. And I said, 'No'. I had to go out and be given water to drink and wait another hour." [Nurse, Radiology, AH]

Another example of a judgment required by nurses pertains to the administration of the contrast medium. Some radiographers expected nurses to know which contrast medium to select and how to prepare it for administration. In this context nurses relied on cues from the radiologists or radiology registrars for the selection of the type of contrast medium to be

administered. This could result in choosing the incorrect contrast medium, impacting negatively on costs and even straining interprofessional relationships.

> *"The radiographers think the nurses are their servants. So us nurses, it is not my job to work with contrast. I was reported because they say I decide which contrast. I take the form to the doctor to ask, 'Which contrast must be used?' She [the nurse] was not there when I was with the doctor. Then she reports I waste the contrast that must be given. So I want to know: whose job is it to [draw] contrast, the nurses' or the radiographers'?"* [Nurse, Radiology, AH]

Nurses also expressed confusion about radiographers' expectations of their role during some of the specialized investigations such as fluoroscopic procedures. As a result, they raised concerns about the seemingly unwarranted radiation risk associated with merely being a bystander in the procedure.

> *"I think sometimes we are getting exposed to radiation unnecessarily. The patient is for the swallow. What is the duty of the nurse inside the screening room? Because the contrast, the radiographer is mixing it and the radiologist is giving it by mouth. Why do they want the nurse to be exposed to radiation? … Some of them, sometimes they do not call you because they know you are not needed there. You see tomorrow, if you are not there, then there is a complaint again. I feel that we are exposed unnecessarily."* [Nurse, Radiology, AH]

Further education needs. In this study nurses identified gaps in their knowledge at various levels of the tasks they were required to perform and the activities they were involved with. The three main needs expressed were the following: patient preparation; interpretation skills; and radiation risks and safety.

The adequate preparation of patients in terms of what to expect from and during specific types of imaging investigations requires knowledge of the different investigation types and processes involved. It also involves the skills required for making efficient judgment calls.

"You have to read the history of the patient. Like in the scan sometimes they ask scan for the pelvis to see. So if you don't know how does it begin and then end, you'll just tell the patient to sit there. Only to find that the patient should drink the contrast because he started here up to there and which is the chest abdomen and pelvis. You see sometimes you had to know and sometimes they don't teach you to ask if it is necessary for the patient to drink or what." [Ward nurse, AH]

Even though nurses are not expected or specifically trained to fully comprehend the intricacies of completing and interpreting a request form, or to interpret radiographic images, we found that nurses in our study often expressed a need for improving their interpretation skills − *"The patients come to us, not the doctors. Every time they come to us, so we have to get more information on reading the x-rays"* [Nurse, DH]. *"Because the doctor does not explain to the patient, the findings … I think we are going to be very effective to interpret it to the patient"* [Ward nurse, AH].

The nurses also expressed a need for improved skills in the interpretation of radiographs to aid them in compiling effective evidence-based nursing notes and to ensure that the requested examinations were appropriate and adequate.

"You see the old people, if they've done x-ray of the knee and then she says, 'The whole leg of mine.' So you don't know what you can write [in the nursing notes] and then you say, 'Mamma, let me see the x-rays.' And then when you check the x-ray, you only see it's the foot there. So you know how to write the story on the cardex." [Nurse, Patient 13]

A third important educational need of nurses was addressing their knowledge gaps regarding radiation risks and safety, specifically in terms of the effects of radiation on nurses and patients in the context of mobile units in the wards.

"We need to know why you must take that apron because of so, so, so. And if I myself have a[n] apron, so the patient, it won't affect him if the patient doesn't have an apron? ... We need to know those dangers of radiation for the patient and for the person who is doing that." [Ward nurse, AH]

"The one time I remember the mobile x-ray. They were going to take a particular x-ray for that patient and the radiographer told us to move away, even the other patients. So after the radiographer has gone out and that guy asked me, 'Why are they sending us away?', I didn't know what to tell him. For us women, I know why, because of the eggs if you are pregnant or not." [Nurse, DH]

Interprofessional Interactions – "We will always be standing at the back of the line"

Interprofessional relations and cooperation between the various health-professional role players are essential in achieving optimal patient care and high-quality imaging investigation services (Mørk, et al., 2008). Two sub-themes emerged from our study: hierarchies and power relations; and interprofessional communication and conflict.

Hierarchies and power relations. The radiology registrars in this study were of the opinion that nurses who had not been specifically assigned to work in radiology did not "*understand our role very well as the radiographers do, because they don't order the investigation; they don't see the investigation being done; they don't have to interpret the investigation"* [Radiology registrar, AH].

Radiographers working in the radiology department also regarded themselves as having more authority in relation to nurses. This often resulted in the clear demarcation of territorial boundaries that could, in turn, negatively affect patient care.

"They [the radiographers] have just called the patient inside the room. They want to do the x-rays. And the patient suddenly says, 'I want to go to the loo.' They will try for hours looking for the nurse. In that case I think it is unfair to the patient; when they find the nurse the patient has already wetted." [Nurse, Radiology, AH]

In terms of general nurse-radiographer interactions, we also found no significant interprofessional relationships either. A nurse at the district hospital described the situation as follows:

"*The radiographer does not feature … so much because we just send the patient to them and from there they [the patients] come with the x-ray and the doctors are the one to see the x-rays. We don't correlate; we don't communicate much."* [Nurse, DH]

Interprofessional communication and conflict. In our study there were clear indications of communication difficulties between the various health professionals working in the radiology department. The absence of effective interprofessional communication between radiology registrars and nurses regarding the coordination of imaging services had a negative effect on nurses' ability to prepare patients for certain diagnostic investigations.

"The radiologists will come at their own time. They will go and sit down and drink tea. [In front at reception] patients are waiting. So our doctors are not doing their part. You can't go in the tearoom and go and tell them, 'Doctor, come and do your work.' Because they know you are here for a service. So it's a problem. They will just come and shout at you, 'The patient is not on the bed!' And you have to run around because you want the patient like this." [Nurse, Radiology, AH]

The nurse participants indicated that they were involved in much more than just taking care of patients in the radiology department. However, despite their best efforts to assist in the procedures, where possible, they often experienced a sense of professional disrespect and disillusionment in their interactions with radiographers.

"You can see the patient when she comes in the door. I must escort her to the bed. But even if the radiographer makes you angry, with us we've got things like the nursing etiquette. I know how to react; you see, I cannot [explode] in front of the patient. But with them [radiographers] they … can just shout [at] you in front of the patient sometimes." [Nurse, Radiology, AH]

The nurse-radiographer interaction during imaging procedures was sometimes also complicated by discrepancies in nurses' knowledge regarding the requirements associated with specific investigations, which often were further strained by interprofessional hierarchical issues.

"I think the nurses think we [radiographers] are zero. … They think we don't know anything about our job; … they know better than us. I went to do a patient in ICU [intensive care unit] and the patient is intubated. She [the nurse] told me that I must do the patient seated. … I said, 'I know. But in this case I am not going to do the patient seated; that's why supine.' She is telling me, no, but she has twenty years' experience. I am like, 'Do you have twenty years' experience as a nurse or as a radiographer?'" [Radiographer, AH]

The quality of interprofessional communication between nurses, radiographers and doctors outside the radiology department had a clear influence on the request for a radiographic service. Communication gaps were often due to the focus on the mere performance of a specific task rather than having a holistic approach towards providing a quality service. This is how one radiographer at the academic hospital illustrated the situation:

"I went to ICU and the nurse gave me an x-ray form as I walked in and there was one [a duplicate] lying on the table. So the student is like, 'There is two x-ray forms.' I told her, 'Bring both of them.' Because if I do the x-ray now, two hours later they [other nurses] are going to phone, oh, they didn't take x-rays on this patient, because the form is still lying on the counter. They don't go and check whether the x-rays have been done. They just say, 'Here is another x-ray form.' So there is a real gap in communication, not only between the different doctors, but between the different staff as well." [Radiographer, AH]

In addition, medical providers outside the radiology department did not always adhere to the protocols related to the completion of request forms. As a result, service efficiency and timely delivery of services were negatively affected.

"The doctors do not fill the request forms. So we have to phone the doctor and find out from the ward who is the patient's doctor. We have to hash [speed dial] the doctor and find out what the patient is coming for. So it also takes our time." [Nurse, Radiology, AH]

DISCUSSION

Some studies have already described nurses' professional roles in interventional radiology, nuclear medicine, ultrasound, magnetic resonance imaging, computed tomography, bone densitometry and mammography (Goodhart & Page, 2007; Marques da Cruz & Gaidzinski, 2013). However, a gap remains in the literature with regard to clear and unambiguous indicators for gauging the role and performance of nurses working in diagnostic imaging departments (Marques da Cruz & Gaidzinski, 2013).

The current study aimed to provide a more holistic picture of nurses' roles and the professional space they occupy with regard to diagnostic imaging investigations in different sections of two South African public hospitals. Nurses form an integral part of health professional teams. In terms of diagnostic imaging, the study found their professional role to be particularly evident in the care of and communication with patients, in their specific scope of practice, and in a variety of interprofessional interactions. Unlike in some other countries, nurses were deployed at the radiology department of the academic hospital without any formal training in radiology nursing. However, through their experience they had acquired some knowledge and skills of dealing with radiology- or radiography-related issues. This is in contrast with the nurses at the district hospital and those working in the wards in the academic hospital who expressed a need for more education in a number of diagnostic imaging topics.

Nurses' professional role in radiography and radiology is multidimensional, especially from a continuity-of-care perspective. Some of the roles they fulfill in relation to patients are to be a supporter, translator, interpreter, nurturer, advocate, protector and witness. The collaborative role of the nurse in the radiology department is evident at many points, such as: preparing patients for investigations; assisting radiographers with patient manipulation during an investigation; and ensuring that the patient's information needs are addressed as the procedures proceed. In addition, nurses become the patients' voices when they cannot speak for themselves (Goodhart & Page, 2007).

In the South African context there is no formal scope of nursing practice in radiology- or radiography-specific specialties. This paucity has resulted in nurses engaging with the coordination of referring patients for diagnostic imaging investigations (Brown, 2012). In South Africa only medical providers are allowed to request these investigations, but similar to the findings of Patel, Celenza and Watters (2012) and McConnell, Slevin and Mcllfatrick (2013), nurses in our study also engaged in x-ray requests, mainly because of system pressures. We found that particularly nurses outside the radiology department tended to assist medical providers with the completion of request forms, sometimes even being these doctors' messengers for booking investigations. However, these actions often resulted in incorrect or unnecessary requests.

Several studies have shown evidence that nurses can interpret plain radiographic images through experiential learning (McConnell et al., 2013; Considine, Martin, Smit, Winter, & Jenkins, 2006; Coleman & Piper, 2009; Free, Lee, & Bystrzycki, 2009). The professional nurse participants in our study were keen to expand their scope of practice, specifically to include the interpretation of radiographs. Their desire to increase their practice was based on their wish to provide feedback to patients who are anxious or in transition and to compile evidence-based nursing notes.

Patient safety is an essential component of nursing care (Marques da Cruz & Gaidzinski, 2013). According to Ohno and Kaori (2011), an inherent nursing characteristic in taking optimal care for patients is effective communication and the ability to ensure one's own safety. From a diagnostic imaging perspective optimal care includes radiation safety. Our study found that nurses not only had a fear of occupational radiation exposure, but also acknowledged a lack of knowledge in this regard and were eager to gain more insight.

Nurses' communication roles with patients, radiographers and radiologists are multifaceted. Also, the communication interactions between these role players are mostly task related. Patient-initiated communication with nurses to seek answers regarding radiographic procedures and diagnoses was prominent in our study. Interprofessional communication was often fragmented as a result of the absence of clearly defined nursing

roles and responsibilities in the radiology department. This gap in communication created passive tensions between health care providers and in some instances even resulted in unprofessional and disrespectful interprofessional behavior that could compromise patient care.

Another pertinent observation in our study were the power relations and hierarchies inside the radiology department, where nurses were expected to interpret request forms without any formal training and to make judgments about preparation of patients for specialized investigations. This resulted in confusion for the nurses, as well as in compromised preparation of the patient and delayed or extended duration to provide the requested service. The power imbalance became visible in cases requiring the administration of a contrast medium, especially when nurses were expected by radiographers and/or radiologists to perform these tasks in contravention of their scope of practice. These nurses were regarded as subordinate to other medical professionals in the department and they had very little professional autonomy compared to professional nurses outside the radiology department (Pape, Thiessen, Jakobsen, & Hansen, 2013).

CONCLUSION

Although studies have already been conducted on the role of nurses in interventional radiology, this qualitative study is the first to specifically address nurses' roles in a multi-modality radiology department. It found that nurses performed the following significant activities: 'being there' for patients; filling the communication gap for patients; completing and interpreting request forms; and preparing patients for diagnostic imaging investigations. They also experienced specialized profession-related educational needs, the effect of interprofessional hierarchies and power relations, and conflict emanating from interprofessional communication. The most important issue requiring urgent further empirical investigation is the interprofessional relations, roles and scope of practice between nurses, radiographers and radiologists, especially since these professions report to different regulatory bodies in South Africa. With a view to developing and reviewing best-practice

guidelines (Brown, 2012), further investigations are also required on nurses' professional skills and abilities to make judgment calls on the justification of requests and to prepare patients for specialized radiographic investigations. Finally, formal needs assessments in South Africa and other countries without professional radiology nursing programs could be the first step to inform regulatory bodies on the possibility of developing appropriate national qualification programs.

Acknowledgement

The authors wish to thank all the colleagues and patients who contributed to the study and Barbara English (Office of the Deputy Dean: Research, Faculty of Health Sciences, University of Pretoria) who provided editorial support.

References

Alaamer, A.S. (2012). Radiography education and training in Saudi Arabia. *Open Journal of Radiology, 2*(4)*,* 134-140. (doi:10.4236/ojrad.2012.24025)

Brown, C.D. (2012). Improving patient care in the diagnostic imaging department: the role of the nurse navigator. *Journal of Radiology Nursing, 31*(3), 97-100.

Chow, M., Chan, L., Lo, B., Chu, W-P., Chan, T., & Lai, Y-M. (2013). Exploring the intention to use a clinical imaging portal for enhancing healthcare education. *Nurse Education Today, 33*(6), 655-662.

CNET (Center of Nursing Education and Testing, Inc), & RNCB (Radiologic Nursing Certification Board, Inc.). (2010). Practice analysis of radiology nursing. *Journal of Radiology Nursing, 29*(4), 109-128.

Coleman, L., & Piper, K. (2009). Radiographic interpretation of the appendicular skeleton: A comparison between casualty officers, nurse practitioners and radiographers. *Radiography, 15*(3), 196-202.

Considine, J., Martin, R., Smit De V., Winter, C., & Jenkins, J. (2006). Emergency nurse practitioner care and emergency department patient flow: Case-control study. *Emergency Medicine Australasia, 18*(4)*,* 385-390.

Cowling, C. (2008). A global overview of the changing roles of radiographers. *Radiography, 14*(1), 28-32.

Crane, J., & Delany, C. (2013). Physiotherapists in emergency departments: responsibilities, accountability and education. *Physiotherapy, 99*, 95-100.

Field, L.J., & Snaith, B.A. (2013). Developing radiographer roles in the context of advanced and consultant practice. *Journal of Medical Radiation Sciences, 60,* 11-15.

Free, B., Lee, G.A., & Bystrzycki, A. (2009). Literature review of studies on the effectiveness of nurse practitioners ability to order and interpret X-rays. *Australasian Emergency Nursing Journal, 12*(1)*,* 8-15.

Glicksman, P. (2008). Radiology nursing. *Journal of Radiology Nursing, 27*(1), 36.

Goodhart, J., & Page, J. (2007). Radiology nursing. *Orthopaedic Nursing, 26*(1)*,* 36-39.

Gray, T.A., West, J.R., & Nadolsky, N.A. (2013). Preanesthesia screening phone messages and rate of return based on the primary language of patient. *Journal of PeriAnesthesia Nursing*, *28*(1), 11-15.

Lundén, M., Lundgren, S.M., & Lepp, M. (2012). The nurse radiographers' experience of meeting with patients during interventional radiology. *Journal of Radiology Nursing*, *31*(2), 53-61.

Marques da Cruz, C.W., & Gaidzinski, R.R. (2013). Nursing time in a diagnostic imaging center: development of an instrument. *Acta Paulista de Enfermagem*, *26*(1), 79-85.

McConnell, D., Slevin, O.D., & Mcllfatrick, S. (2013). Emergency nurse practitioners' perceptions of their role and scope of practice: is it advanced practice? *International Emergency Nursing*, *21*(2), 76-83.

Mørk, B.E., Aanestad, M., Hanseth, O., & Grisot, M. (2008). Conflicting epistemic cultures and obstacles for learning across communities of practice. *Knowledge and Process Management, 15*(1)*,* 12-23.

Nursing Council of New Zealand. (2009). Competencies for the nurse practitioner scope of practice (Approved by Council September 2008). Wellington: Nursing Council of New Zealand. Retrieved from http://nursingcouncil.org.nz/Nurses/Scopes-of-practice/Nurse-practitioner. December 10, 2013.

Ohno, K., & Kaori, T. (2011). Effective education in radiation safety for nurses. *Radiation Protection Dosimetry*, *147*(1-2), 343-345.

Pape, B., Thiessen, P.S., Jakobsen, F., & Hansen, T.B. (2013). Interprofessional collaboration may pay off: introducing a collaborative approach in an orthopaedic ward. *Journal of Interprofessional Care*, [Epub ahead of print, June 27]. (doi:10.3109/13561820.2013.808611)

Patel, H., Celenza, A., & Watters, T. (2012). Effect of nurse initiated x-rays of the lower limb on patient transit time through the emergency department. *Australasia Emergency Nursing Journal*, *15*(4), 229-234.

Patton, M.Q. (2002). *Qualitative research and evaluation* (3rd ed). Thousand Oaks, CA: Sage.

Summers, A. (2005). Can nurses interpret X-rays safely without formal tuition? *Accident and Emergency Nursing*, *13*, 162-166.