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An analysis of the need for accredited training on the administration of intravenous contrast media by radiographers: results of an online survey

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Abstract

Role extension has been debated amongst South African radiographers for a number of years. However, the administration of contrast media still remains outside their scope of practice. The Society of Radiographers of South Africa (SORSA) has received anecdotal reports that radiographers are administering contrast media. This practice is a direct infringement of the rights of patients who are required to be treated and examined by health professionals who practice within their legal scope.

The aim of this survey was to investigate the views and opinions of South African radiographers regarding the injecting of contrast media and the type of training needed if it were included in the scope of practice of South African radiographers.

A questionnaire was sent to 845 radiographers using an online survey programme (SurveyMonkey). The questions related to biographical information, work experience, training and the medico-legal aspects of intravenous contrast media injection by radiographers. The response rate was 21% (n=177). Eighty-one percent (81%) were diagnostic radiographers. Seventy-three percent (73%) practice radiography in a major city. There was an equal representation of the public and private sector, namely 43% for both. Of those from the public sector 47% were from a tertiary healthcare facility. More than seventy-eight percent (>78%) practice radiography in a health facility that provides radiology services. Seventy-three percent (73%) were aware of mild to moderate adverse reactions to contrast media; 45% were aware of severe adverse reactions to contrast media in their workplace. Eighty-five percent (85%) thought that accredited training should include the administration of contrast media as well as resuscitation of a patient. Sixty-two percent (62%) thought the accredited training should include pharmacology and advanced resuscitation. Ninety-three percent (93%) thought the main advantage would be an increase in service delivery to patients; 85% thought the main disadvantage would be potential risk of criminal or civil litigation. Ninety-seven percent (97%) were of the opinion that radiographers who introduce contrast media to patients must have current malpractice insurance.

The results of this survey provide new information on the current status of contrast media administration to the patient whose safety and rights remain at the centre of our focus. It is recommended that the statutory body, namely the professional board for radiography and clinical technology (RCT) of the Health Professions Council of South Africa (HPCSA) takes cognizance of the outcome of this study and embarks on a more extensive survey to include a larger sample which would be more representative of the South African radiography population.

Keywords

Medicinal compounds, pharmacology, resuscitation, medico-legal, patient's rights

Introduction

Role extension has been well documented in the literature^[1-10]. In the United Kingdom (UK), Canada and the United States of America (USA) education programmes are already in place to equip radiographers with the required knowledge, skills and competencies to perform these additional roles, such as image interpretation^[1, 11] and injection of contrast medium^[12]. One aspect of role-extension within the South African context is that of injecting of contrast media by radiographers^[13] which is not within the radiographic scope of practice. The injection of radiopharmaceuticals is, however, in the nuclear medicine scope

of practice and is part of the training of a nuclear medicine radiographer.

The issue of injection of iodine-based contrast media by radiographers was published in the 2010 HPCSA newsletter of the Professional Board for Radiography and Clinical Technology (RCT)^[14]. This publication spelt out clearly that injecting is outside the scope of practice but that needle placement can be done after accredited training (as approved by the HPCSA). So although a needle may be placed in a patient's vein contrast may not be administered by a radiographer.

Since 2000 various practices have been reported and discussed at a variety of platforms facilitated by the Society of

Radiographers of South Africa (SORSA). Examples of these are papers on role extension, based on several models, presented at congresses hosted by SORSA as well as at the 16th ISRRT World Congress held in Durban in 2008^[15-20]. These debates however focussed on reporting on images by radiographers.

In order to address the issue of injection of contrast medium by radiographers a panel discussion on the introduction of contrast medium was included on the scientific programme at the SORSA-RSSA imaging congress in March 2011^[21]. Several recommendations arose during this panel discussion. One being that a needs analysis, which includes both the private

sector and public sector at all levels of service delivery, should be undertaken to obtain data for the way forward for the radiography profession in South Africa.

In April 2012 SORSA appointed a task team to explore this topic by means of a survey. The task team set about compiling a research tool to address the issue of intravenous (iv) administration of contrast media to patients by radiographers. The findings of the survey would then be submitted to the statutory body for the profession of radiography in South Africa (namely, the HPCSA-RCT) for consideration in terms of extending the scope through accredited courses. This 'burning issue' arises from the current regulation that defines the scope of the profession of diagnostic radiography^[22]. Regulation 3: medicine control states "...by which is understood assistance to the radiologist or medical practitioner in the control and administration of contrast media or medicines as required for such diagnostic procedures"^[22].

Although there is currently no training/courses on the injection of contrast medium accredited by the HPCSA-RCT the authors have received anecdotal reports that radiographers are injecting contrast media. Information from the HPCSA also indicates that there are radiographers administering contrast media to patients^[13]. Such practice is of concern as the medico-legal ramifications are self-evident particularly when considering patients' rights. For this reason questions on who would take responsibility for management of patients in the event of them suffering adverse reactions to contrast media were included in the survey.

The purpose of the survey was to determine the views of South African radiographers with regard to the administration of contrast media as well as the need for an accredited training course. The purpose was underpinned by nine broad objectives.

Objectives

1. To determine radiographers' willingness to administer contrast media.
2. To determine the need for an accredited course to improve service delivery to patients in both public and private sectors in major South Africa cities.
3. To determine the need for an accredited course to improve service delivery to patients in public sectors in all levels of health care facilities in South Africa.
4. To determine the extent of injection of contrast media to patients by radiographers in both the private and public sector.
5. To determine the need for an accredited course for injection of contrast media by radiographers where radiographers would not be responsible for resuscitation if a patient suffered an adverse reaction to the administered contrast medium.
6. To determine the need for an accredited course for administration of medical compounds where a radiographer who administers the contrast medium would be responsible for resuscitation of a patient in the event of an adverse reaction.
7. To determine the type of resuscitation training that would be required, if necessary.
8. To determine whether radiographers were of the opinion that constant updating of resuscitation competency would be necessary.
9. To establish biographical data of the participants in order to identify which age group/s, if any, support role extension that covers injection of contrast media or medicinal compounds by radiographers.

Methods and materials

In order to meet the study objectives a questionnaire, comprising 37 questions, was developed as the research tool for the survey. The tool was loosely based on that used in an Australian study^[23]. In this survey closed-questions were used to obtain quantitative data. A pretest (pilot) was undertaken to evaluate the competency of the questionnaire resulting in minor changes to the tool. Due to time and costs restraints an online software programme (SurveyMonkey) was used to capture and calculate the responses^[24].

In this survey the categories of questions were broadly linked to the nine objectives. The questions were related to training and the medico-legal aspects of intravenous contrast media injection by radiographers.

Purposive non-probability sampling was used^[25-26] since the survey focussed on role-extension for radiographers. The inclusion criteria were:

- radiographers in any category, namely diagnostic (D), nuclear medicine (NM), radiotherapy (RT) and ultrasound (US), registered with the HPCSA
- respondents with access to email and internet facilities to be able to access a hyperlink to the online questionnaire
- SORSA members
- non-members who consented to the use of their respective email addresses in the online survey.

Email addresses were sourced from the SORSA membership database. To include radiographers who were not members of SORSA an invitation to participate in the online survey was posted on SORSA's website, advertised at SORSA CPD activities at branch level and hard copies were distributed at several health facilities in South Africa. Email addresses of non-members who responded to the invitation to participate in the survey were included. The email addresses of potential participants were uploaded and e-invitations were sent to all the uploaded email addresses.

The researchers adhered to research ethics: respondents were informed that the information they provided would not be divulged to other persons. Furthermore, the privacy and anti-spam policies of SurveyMonkey^[27] were strictly adhered to. The email invitation message included an 'opt out' option (remove link field). Completion of the question-

Table 1: In which province do you practice radiography? (n=177)

Name of Province	Percentage of Responses
Western Cape	26%
Eastern Cape	5.8%
Northern Cape	0.6%
Gauteng	23.8%
Limpopo	2.9%
Free State	7.0%
KwaZulu-Natal	28.5%
Mpumalanga	1.7%
North West	2.9%

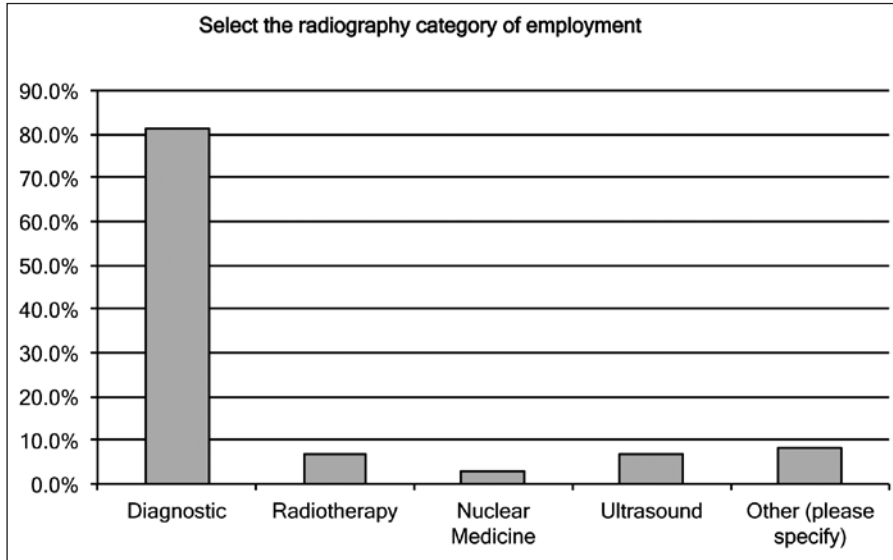


Figure 1: Radiographic categories (n=177)

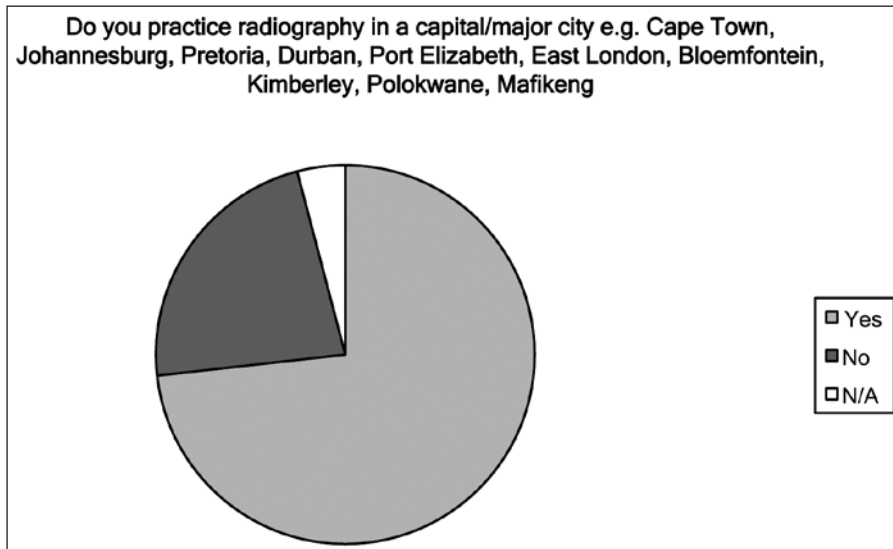


Figure 2: One hundred and twenty-six (73.3%) practice radiography in a major city in South Africa (n=177)

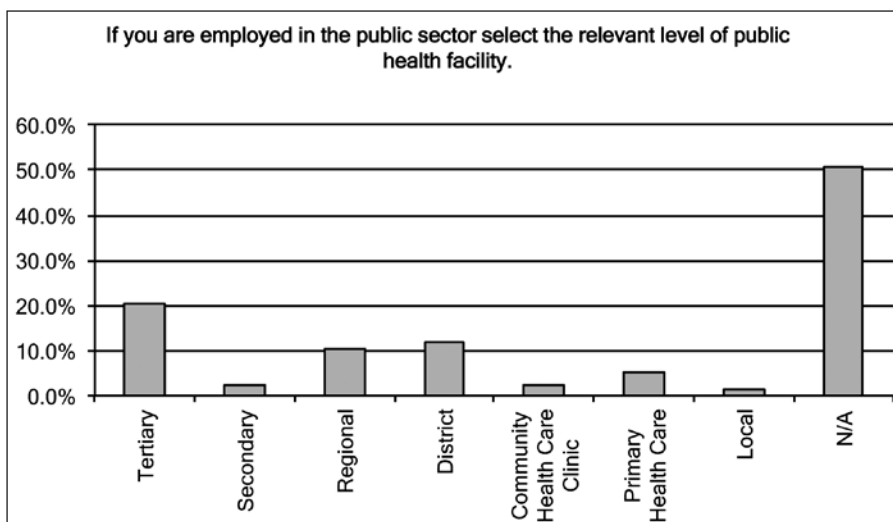


Figure 3: Employment : type of public health facility (n=177)

naire was assumed to be confirmation of consent. Respondents' identities were kept confidential. They were informed that the outcome of the survey would be published.

Eight hundred and fifty-four (n=854) invitations were sent out via emails using SurveyMonkey online software [24]. There was an online response deadline of three weeks which was extended by a further 10 days. All responses were captured online by means of SPSS statistics software of SurveyMonkey [24]. Descriptive statistics were used to analyse the data.

Results

One hundred and seventy-seven (n=177) online responses were received from all four categories of radiographers in the nine provinces (Table 1). There was a 21% response rate. (Note that in this paper decimal points are rounded off to the nearest figure).

The demographics of the respondents were as follows. Eighty-one percent (81%) were diagnostic radiographers (Figure 1). Seventy-three percent (73%) practice radiography in a major city (Figure 2). There was an equal representation of the public and private sector (43% for both). Of those from the public sector 47% were from a tertiary healthcare facility (Figure 3). Sixty-four percent (64%) have been practicing radiography for more than 15 years. Seventy-two percent (72%) were between 26 to 55 years old.

Most of the respondents (78%) practice radiography in a health facility that provides radiology services during normal working hours; 72% stated that after hours radiology services are also provided. Contrast media injection was part of their work duties according to 27% of the respondents (Table 2) and 22% had some in-house training in contrast media injection (Table 3). Table 4 presents the responses to the question: If you injected contrast media, which method of injection of contrast media did you use? Twenty-five (15%) respondents stated they had used an automatic injector intravenous method only; 27 (16%) stated they had used both automatic and manual injection intravenous methods; eight (5%) indicated they had used automatic injector intravenous and inter-arterial methods.

There was a 77% affirmative reply to the question: do you know of instances where a patient has had a mild to moderate reaction to contrast media at a public/

Table 2: Is injection of contrast media either part of your current normal duties or previous duties (e.g. previous place of employment)? (n=177)

Answer options	Response percent
Yes	27.3%
No	59.9%
N/A	12.8%

Table 3: Have you received in-house training to inject contrast media? (n=177)

Answer options	Response percent
Yes	21.5%
No	50.0%
N/A	28.5%

Table 4: If you injected contrast media, which method of injection of contrast media did you use? (n=177)

Answer options	Response percent
Automatic injector intravenous only	14.5%
Automatic injector intravenous and inter-arterial	4.7%
Mixed automatic and manual injection intravenous only	15.7%
Manual intravenous only	7.6%
N/A	64.5%

Table 5: Do you know whether any patient where you worked or are still working needed resuscitation following a reaction to contrast media? (n=177)

Answer options	Response percent
Yes	45.3%
No	48.3%
N/A	6.4%

Table 6: Indicate the distance to the nearest referral health facility that offers iv contrast media services to patients? (n=177)

Answer options	Response percent
Less than 20km	36.6%
20 km to 50 km	8.1%
50km to 80km	0.6%
80km to 110km	3.5%
More than 110km	4.1%
N/A	47.1%

private health facility where you worked or are still working? In terms of patients requiring resuscitation as a result of adverse reactions to contrast media 45% of the respondents replied in the affirmative (Table 5).

In terms of the needs analysis it was necessary to determine the distance to the nearest health facility that offers intravenous contrast media service to patients for those patients who do not reside in

major cities. The findings are presented in Table 6.

Responses pertaining to the need for an accredited training course were as follows. Eighty-five percent (85%) stated that a radiographer who has received accredited training in introduction of contrast media must also be competent to resuscitate a patient in the event of an allergic reaction. Sixty-two percent (62%) stated there is a need for accredited

training that includes pharmacology and advanced resuscitation. The respondents indicated that an accredited course on the introduction of medicinal compounds, including pharmacology and advanced resuscitation, should consist of 120 contact hours.

Thirty-eight percent (38%) were of the opinion that only radiographers with more than five years experience ought to be offered training for contrast media injection; 34% thought radiographers should have more than two years post community service experience. The majority of respondents were of the opinion that radiographers with accredited training to introduce contrast media to patients should be required to undergo a competency test in resuscitation: 52% thought it should be every year while 34% thought it should be every two years.

The respondents' views on the advantages and disadvantages of radiographers introducing intravenous contrast media to patients were: 93% thought the main advantage would be an increase in service delivery to patients (Figure 4); 85% thought the main disadvantage would be potential risk of criminal or civil litigation (Figure 5). Ninety-seven percent (97%) were of the opinion that radiographers who introduce contrast media to patients must have current malpractice insurance. There were two questions that specifically related to administration of contrast media in terms of who would take responsibility in the case of a patient adversely reacting to contrast media. The questions were as follows:

- Do you think there is a need for a training course for radiographers for injection of contrast media only? Note that this implies that someone else would be responsible for resuscitation if a patient has a reaction to the contrast media.
- Do you think there is a need for a training course for radiographers for injection of medical compounds which would include contrast media, and administration of drugs if required for mild to severe reactions to contrast media? Note that this implies a radiographer who administers the contrast medium would be responsible for resuscitation of a patient in the event of an adverse reaction.

The respective results for each question are presented in Tables 7 and 8.

Discussion

There was a poor response from radiographers working in rural areas. Within a South African context there is no agreed definition of rural ^[28] therefore for the purpose of this survey rural means predominantly farming regions or small towns or villages that are at least 60 kilometres from a major South African city. Rural radiographers' views on contrast media injections would have been useful as they mostly work without the support of a radiologist.

Of concern is that 27% of the respondents are currently administering contrast medium to patients, or did so in the past; some in-house training was undertaken by 22% of the respondents. These findings are important since the issue of injection of contrast media was addressed by the HPCSA in 2010 ^[14] and 2011 ^[13]. The stance of the statutory body has been well ventilated in terms of accredited training for needle placement. What is clear is that the rights of patients are not being taken into consideration by those radiographers who are administering contrast media. The reasons for radiographers performing tasks outside their scope of practice are unclear. Are they aware of the legal implications of performing tasks outside the scope of practice of the profession? In this survey 84% of the respondents were of the opinion that patients should be informed that a radiographer with appropriate accredited training would be administering the contrast media.

It is noteworthy that the majority of respondents acknowledged accredited training is required as well as competency in resuscitation. The respondents were requested to indicate the contact hours for such courses. According to the South African Qualifications Authority ^[29], the term 'contact hours' refers to the number of hours that a student spends in a classroom or practical laboratory receiving formal tuition. This is usually 40% of the total hours needed for a student to complete the outcomes of a course. The total hours needed is referred to as notional hours – i.e. total amount of time taken by an average student to meet the learning outcomes for a course. Notional hours include among others face-to-face contact time, structured learning in the workplace, assignments, research, studying for assessments ^[29]. The survey results showed that the contact hours needed should be 120, thus the remaining time

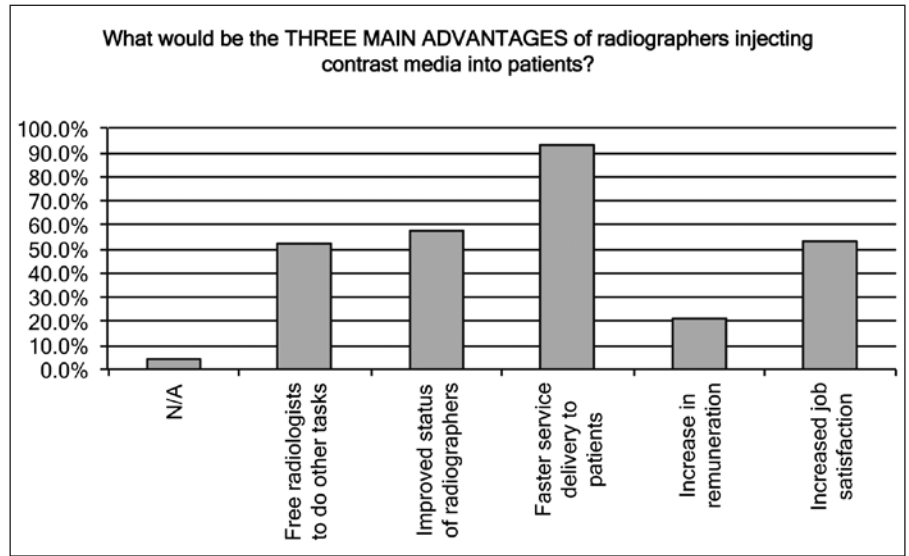


Figure 4: Advantages of injection of contrast media by radiographers (n=177)

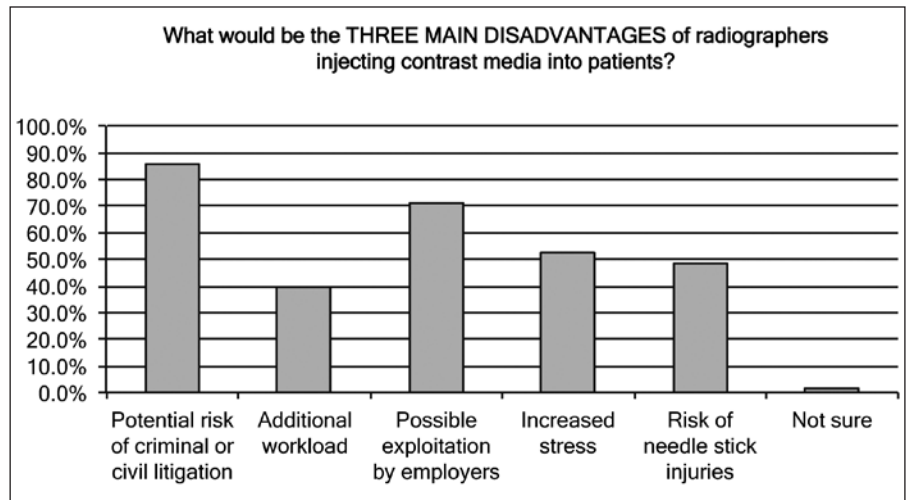


Figure 5: Disadvantages of radiographers injecting contrast media (n=177)

Table 7: Do you think there is a need for a training course for radiographers for injection of contrast media only? Note that this implies that someone else would be responsible for resuscitation if a patient has a reaction to the contrast media (n=177)

Answer options	Response percent
Yes	51.1%
No	35.5%
Not sure	13.4%

Table 8: Do you think there is a need for a training course for radiographers for injection of medical compounds which would include contrast media, and administration of drugs if required for mild to severe reactions to contrast media? Note that this implies a radiographer who administers the contrast medium would be responsible for resuscitation of a patient in the event of an adverse reaction (n=177)

Answer options	Response Percent
Yes	62.2%
No	34.9%
N/A	2.9%

needed would be 180 hours, giving a total of 300 notional hours. This would convert to 30 credits for the course where one (1) credit is equal to 10 hours of learning. Credits refer to the amount of learning contained in a course^[29]. When considering the required number of contact hours needed for a course on contrast injection that would include pharmacology and resuscitation the time spent being instructed on the practical aspects would need to be included. Also to be considered is the amount of time that a student would need to spend practising in order to become fully competent. This would need to be factored into the notional hours. This poses the question: will a 30 credits course be adequate? It is possible that some respondents did not understand the term 'contact hours' as can be seen by the distribution of answers to the question on contact hours. This aspect may be ascribed to the fact that radiographers in general are not always familiar with educational terminology. Although the number of notional hours and credits for an accredited course may be useful, the outcomes attained in the course will ultimately determine the credits and number of notional hours.

The results of the question: Are radiographers in SA prepared or ready to take the responsibility for a patient showing an adverse reaction to the contrast medium, indicate that two (2) to five (5) years of experience are required which means that experience is acknowledged as an important factor. In Canada for example after passing the theory of an accredited course, a radiographer has to observe a specific number of cases, then inject in the presence of a radiologist until the radiographer can be signed off as competent^[12]. Only then can such a Canadian radiographer work independently. After this an annual competency assessment is required in order to continue with injecting contrast media. The findings of this survey are similar in terms of competency assessments: 52% stated that resuscitation competency should be tested every year and 34% stated every second year if resuscitation training was included in a course.

In terms of the UK model's intravenous injection policy^[30] there should be safe and proper delegation of intravenous (iv) injection by a radiologist to a radiographer. This includes management of adverse reactions as the radiologist is responsible for managing adverse reac-

tions and if the reaction is deemed life threatening, the cardiac arrest team has to be immediately alerted. The policy also states that if a radiographer has two failed venepuncture attempts then assistance of the delegating radiologist should be sought. In New South Wales, Australia, radiologists must supervise contrast injection by radiographers. The radiologist thus remains responsible for any untoward outcomes and treats any reactions^[23]. On the other hand in the USA radiologist assistants do not administer iv contrast media^[11, 31]. It should be pointed out that according to the HPCSA an accredited course on needle placement means that the radiologist or medical practitioner remains the responsible person where iodine-based contrast media is administered as a patient may experience a serious allergic reaction^[14].

Currently in South Africa there are no guidelines in place for the administration of contrast media by radiographers as this is not within their scope. Guidelines would need to be drawn up by HPCSA-RCT in consultation with the relevant stakeholders: clinical health facilities, higher educational institutions offering radiography training, radiologists, SORSA, lawyers and other interested parties. It is interesting to note from the results of the survey that most respondents (61%) are willing to administer contrast media if they receive appropriate training and 51% indicated that someone else should take responsibility if a patient has adverse reactions to contrast media. However, 62% were of the opinion that with correct training, radiographers could take full responsibility for contrast reactions and resuscitation. This is in contrast to what is happening in the Australia and the UK, where the radiologist remains responsible for the patient^[23, 30]. It should be noted that 78% of the respondents in this study work in a facility where there are radiologists present. This therefore raises the question as to whether these same radiographers would respond in the same way if they were working in a remote hospital with no radiologist present.

Medico-legal implications were addressed in the survey since public sector radiographers in South Africa are responsible for payment of their malpractice insurance fees. Malpractice insurance for private sector employed radiographers is addressed in the legislation^[32]. The results of the survey revealed that 29% of the respondents have malpractice

insurance but 98% were of the opinion that it should be essential for radiographers who introduce contrast media into patients to have malpractice insurance. This clearly indicates that the respondents are fully aware of the potential risks of administering iv contrast media^[33]. The high response rate to the question regarding malpractice insurance could be explained by the fact that 77% of the respondents reported that they know of patients who suffered a mild to moderate reaction to contrast and 43% knew of patients who needed resuscitation after a contrast reaction.

According to the HPCSA's *General ethical guidelines*^[34] it is the responsibility of all health professionals to "Report violations and seek redress in circumstances where they have good or persuasive reason to believe that the rights of patients are being violated and/or where the conduct of the practitioner is unethical". This applies to any radiographer who is aware of another radiographer giving contrast media injections. Insurance policies will not protect a radiographer who has exceeded his/her scope of practice.

Careful consideration should therefore be given when debating the scope of a radiographer who injects contrast media – the role of the radiologist/medical practitioner should be interrogated thoroughly and wisely.

Limitations of the survey

As this survey was a SORSA initiative, ±95% of the study population (n=854) were SORSA members. The outcome of this study could thus be viewed as the views and opinions of predominantly SORSA members and should not be generalised to the radiography population of South Africa.

The response rate of 21% is a limitation of the study: the error level was 5.7% at 90% confidence interval; the acceptable statistical accuracy for a survey is 5% at 95% confidence interval^[35, 36]. To improve the statistical accuracy of this survey, it should be repeated with a sample drawn from the South African radiography population.

An important factor contributing to the low response rate was the use of email and internet for the survey. The online survey was selected as a cost-effective and time saving method compared to printing and mailing hard copies. Although many radiographers have

email addresses, many responded saying they access email via a smartphone and although they could access internet, they could not complete the survey via a smartphone. The online survey allowed one response per email address. At some work places radiographers share a work email address. Most workplaces, especially the state health facilities, do not have internet access and many radiographers do not have internet access at home. These obstacles of limited access to email and internet contributed to the low response rate.

Email survey response rate is known to be low, however it is still the most cost-effective and time saving method for a survey. Some authors propose various methods of improving the response rate: 'mixed mode strategy' using an online survey and mail survey [37]; personalising the survey by sending a pre-notification and follow-up letter or postcard [37, 38]. SMS messaging system should also be considered to improve the response rate.

Recommendations

- The survey should be repeated in collaboration with the HPCSA-RCT. The target population should be all HPCSA registered radiographers.
- The questionnaire should be used in another survey that includes a larger population (all HPCSA registered radiographers) to benchmark the results obtained. This would reach a wider population and ensure representativeness of all radiographers. It would also allow for a more statistically significant sample, thereby producing more reliable results that could be generalised.
- If a larger survey indicates the need for accredited training courses the statutory body should be requested to establish national guidelines, as well as an intravenous policy, in consultation with all relevant stakeholders (including radiologists). These guidelines could be used by higher education institutions to compile appropriate curricula for the training of radiographers to administer contrast. Having national guidelines such as those in Australia and the UK [23, 30] would enable all aspects to be monitored and controlled.

Conclusion

Role extension for radiographers to include the injection of contrast medium

into a patient may be a general fact in Canada and/or the UK. In these countries the scope of practice of radiographers has been addressed and a model for accredited training already exists. In South Africa the scope of practice of a radiographer only allows venepuncture (needle placement).

Information that a number of radiographers are practicing outside their scope of practice by injecting patients with contrast media has become available. Since such practices are illegal it was important for SORSA to establish current practices among radiographers. The overarching aim of the study therefore was to address recommendations that arose as a result of the panel discussion at the SORSA-RSSA 2011 imaging congress.

The study had nine objectives which were addressed in the closed-question survey. The findings indicated that radiographers are of the opinion that accredited courses should be offered: mainly to improve service delivery to patients. The respondents indicated an awareness of the potential risks of administering contrast media to patients hence there was an overwhelming support for malpractice insurance as well as regular assessments of the resuscitation competency of those radiographers who opt to undergo the relevant training. The survey purposefully addressed who would be responsible in the event of a patient experiencing adverse reactions to the contrast media. The respondents realised the potential medico-legal risks but also indicated the need for a course on pharmacology and advance resuscitation.

Based on these results SORSA submitted a request to the statutory body (HPCSA-RCT) in August 2012 to consider the findings in terms of extending the scope of practice for radiographers who would be interested in accredited training courses on the administration of contrast media to patients.

A further study should be undertaken to obtain the opinion from radiographers who are not members of SORSA. This current study was feasible since the email addresses of SORSA members were used for a SORSA initiative.

This is the first published survey on the administration of contrast media in South Africa hence adds to the body of knowledge and could be used to influence future policies.

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