MALAYSIAN RADIOGRAPHERS ADMINISTERING INTRAVENOUS CONTRAST MEDIA INJECTIONS: RADIOGRAPHERS' AND OTHER HEALTHCARE PRACTITIONERS' PERSPECTIVES

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by

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ABSTRAK

Pelaksanaan suntikan media kontras intravena (IVCM) oleh juru x-ray (JXR) merupakan suatu aspek yang dapat dicapai untuk meningkatkan kualiti perkhidmatan. Namun, JXR di Malaysia tidak boleh melakukan IVCM. Pemeriksaan yang memerlukan IVCM terpaksa ditunda sehingga pelaksanaannya dilakukan oleh anggota kesihatan lain yang layak melaksanakan tugas ini. Akibatnya, keadaan ini akan meningkatkan masa menunggu dan mungkin boleh mengganggu anggota kesihatan yang sedang menumpukan perhatian terhadap pemeriksaan lain pada ketika itu. Secara tidak langsung, ini akan menjejaskan kualiti penyampaian perkhidmatan. Justeru, kajian ini dijalankan bertujuan untuk menghasilkan dan mengesahkan borang kaji selidik yang dapat menilai faktor-faktor penghalang, kesan-kesan dan kemungkinan pada masa akan datang berkenaan dengan pelaksanaan IVCM oleh JXR di Malaysia. Tambahan, ia juga bertujuan untuk mengkaji punca-punca halangan dan kesan-kesan yang mungkin berlaku akibat daripada JXR di Malaysia melakukan IVCM, menentusah faktor penghubungkait hospital, jantina dan pekerjaan responden ke atas faktor-faktor penghalang dan kesan-kesannya, mengkaji persetujuan responden berkenaan dengan pengajaran IVCM dalam silibus pembelajaran JXR dan pendekatan Kementerian Kesihatan Malaysia menyediakan latihan IVCM kepada JXR di Malaysia berserta dengan hubungan antara dua pembolehubah ini. Di samping itu, ia bertujuan untuk menentusahkan samada

terdapat perbezaan signifikan antara skor min untuk kumpulan JXR dan anggota kesihatan lain berkaitan dengan pengajaran IVCM dalam silibus pembelajaran JXR dan pendekatan Kementerian Kesihatan Malaysia menyediakan latihan IVCM kepada JXR di Malaysia. Kajian ini adalah “cross sectional” dan kualitatif, menggunakan kaedah borang kaji selidik yang direkabentuk. Ia melibatkan tujuh ratus enam belas (716) responden yang terdiri daripada lima ratus dua puluh lima (525) JXR, lapan puluh (80) pakar radiologi, lima puluh lapan (58) pegawai perubatan dan lima puluh tiga (53) jururawat terlatih dari jabatan pengimejan diagnostik tiga belas (13) buah hospital kerajaan negeri yang utama di seluruh Malaysia. Kaedah pensampelan adalah secara tidak rawak menggunakan borang kaji selidik yang dihasilkan. “Content validity index” (CVI) bagi borang kaji selidik yang diedarkan kepada JXR dan anggota kesihatan lain ialah 0.968 dan 0.970. “Cronbach’s alpha” untuk “internal consistency” mempunyai julat 0.735 hingga 0.824. Data dianalisa mengunakan statistik diskriptif dan statistik inferensi. Daripada jumlah keseluruhan responden, 62.3% bersetuju bahawa pengajaran IVCM tidak terdapat dalam silibus pembelajaran JXR merupakan faktor utama menghalang mereka melakukan IVCM. 84.8% dan 69.0% bersependapat bahawa peningkatan ilmu pengetahuan dan kemahiran JXR serta pengurangan masa menunggu merupakan kesan-kesan penglibatan JXR dalam pelaksanaan IVCM. 84.4% responden bersetuju JXR di Malaysia melakukan IVCM. Keputusan “t-test” iaitu $p<0.001$, membuktikan terdapat perbezaan signifikan antara skor min untuk kumpulan JXR dan anggota kesihatan lain berkenaan dengan pengajaran IVCM dalam silibus pembelajaran JXR serta pendekatan Kementerian Kesihatan Malaysia menyediakan latihan IVCM kepada JXR di Malaysia dan membenarkan mereka melakukan IVCM. Kesimpulannya, kebanyakan responden bersetuju JXR di

Malaysia melakukan IVCM. Faktor penghalang yang utama adalah disebabkan pengajaran IVCM tidak terdapat dalam silibus pembelajaran JXR. Justeru, latihan yang sesuai berserta dengan pengiktirafan dari pihak berkuasa semestinya dipenuhi untuk menggalakkan JXR di Malaysia melakukan IVCM pada masa akan datang.

MALAYSIAN RADIOGRAPHERS ADMINISTERING INTRAVENOUS CONTRAST MEDIA INJECTIONS: RADIOGRAPHERS' AND OTHER HEALTHCARE PRACTITIONERS' PERSPECTIVES

ABSTRACT

Administration of intravenous contrast media (IVCM) injections by radiographers is one of the aspects that could be achieved to enhance patient care. However, Malaysian radiographers cannot perform IVCM injections. The examination requiring IVCM injections are delayed until authorized healthcare practitioners fulfil the task. Consequently, this results in the increment of waiting time and may incite distraction for those practitioners who were concentrating on the other procedures at the same time. Ultimately, it will negatively impact on patient care and service delivery. Therefore, this study was aimed to develop and validate questionnaires concerning obstacles, consequences and possibilities of Malaysian radiographers performing IVCM injections. Also. It was aimed to identify the perceived hindrances and consequences may result from Malaysian radiographers performing IVCM injections, to determine the associated factors of practicing hospital, gender and designation on perceived obstacles and consequences of participants, to determine participants' agreement on the inclusion of IVCM administration into radiographers' syllabus and provision of IVCM administration and role extension for radiographers by MOH, to examine correlation between participants' agreement on the inclusion of IVCM administration into radiographers' syllabus and provision of IVCM administration and role extension for radiographers by MOH and yet to determine any significant difference exist between means score for radiographers group and

other healthcare practitioners group on inclusion of IVCM administration into radiographers' syllabus and provision of IVCM administration and role extension for radiographers by MOH. Cross sectional and qualitative study was conducted using newly designed questionnaires involving seven hundred sixteen (716) participants for which constitute of five hundred twenty five (525) radiographers (R), eighty (80) radiologists (S), fifty eight (58) medical officers (MO) and fifty three (53) state registered nurses (SRN). They were drawn from diagnostic imaging department of thirteen (13) principal government hospitals in the Malaysia, with strategy of convenience sampling and were surveyed using questionnaires. The content validity index (CVI) for two (2) sets of developed tools for R and S, MO, SRN was 0.968 and 0.970 respectively. The reliability test (Cronbach's alpha) for internal consistency ranges from 0.735 to 0.824. Descriptive statistics and inferential statistics were used to analyse data. From the total number of participants, 62.3% agreed IVCM administration is not in the syllabus of radiographers training program. 84.8% of participants viewed improvement of radiographers' knowledge and skills whilst 69.0% conceded time reducing as the consequences. Overall, 84.4% were in favour of radiographers undertaking IVCM injections. T-test indicated significant difference between means score for radiographers group and other healthcare practitioners group on inclusion of IVCM administration into radiographers' syllabus and provision of IVCM administration and role extension for radiographers by Malaysian Ministry of Health (MOH), $p<0.001$. In conclusion, most of the participants were in favour for radiographers to undertake this role. The major obstacle was IVCM administration is not in syllabus of radiographers training program. An appropriate training concomitant with recognition through regulation for Malaysian

radiographers to undertake IVCM injections role therefore is imperative to support their extended role in this field.

CHAPTER 1

INTRODUCTION

1.1 RATIONALE OF STUDY

IVCM administration is often performs to visualize blood vessels and internal organs in human body during radiological procedures. However, Malaysian radiographers cannot inject contrast media (Ministry of Health, 1985). The examination requiring contrast media injections are delayed until the medical practitioners or other health care practitioners who are authorised to administer intravenous (IV) drugs fulfill the task. Consequently, this results in the increment of waiting time and may incite distraction for those practitioners who were concentrating on the other procedure at the same time. Ultimately, it will negatively impact on patient care and service delivery. Inevitably, according Milburn and Colyer (2008) this leads to persistent failures in delivering a seamless patient-centred service.

As health care industrial has changed tremendously, multi-skilling and the development of new roles within every health care profession including radiography is well documented and debated by many authors including Miller, et al. (2008), Smith, et al. (2008), Williams (2006), Buttress and Marangon (2008) and Price, et al. (2000). The level of development is distinctly varied in many countries as shown in the paper by Cowling (2008). To date, role development had been slow to develop in Malaysia and role extension for radiographers had been minimal, although May, et al. (2008) clearly indicated the establishment of advanced clinical role for radiographers in the United States of America has advanced, as well as the role of consultant practitioners within the United Kingdom (UK).

Therefore, it is an essential pre-requisite that this study is carried out to investigate the perceived obstacles, consequences and possibilities of Malaysian radiographers administering IVCM injections. The questionnaires developed through this study could be transposed to other hospitals and most importantly, it should contribute to future knowledge regarding IVCM injections by radiographers in the Malaysia and will act as a benchmark in further similar studies in this field. Specifically, the perceived obstacles and consequences identified through this study, could provide as the guidelines for Malaysian Ministry of Health (MOH) and statutory body to establish a substantive framework (e.g. guidelines and policy) that supports radiographers' extended role. Ultimately, it could enable highest professional standard of competency and improve service delivery as a whole.

1.2 OBJECTIVES

1.2.1 General objective

To explore the role extension of Malaysian radiographers in performing IVCM injections.

1.2.2 Specific objectives

1.2.2.1 To develope and validate questionnaires concerning obstacles, consequences and possibilities of Malaysian radiographers performing IVCM injections.

1.2.2.2 To identify the perceived obstacles that might impede radiographers in Malaysia from administering IVCM injections.

1.2.2.3 To identify the perceived consequences may result from the extended role of Malaysian radiographers performing IVCM injections.

1.2.2.4 To determine the associated factors of practicing hospital, gender and designation on perceived obstacles of participants.

1.2.2.5 To determine the associated factors of practicing hospital and designation on perceived consequences of participants.

1.2.2.6 To determine participants' agreement on the inclusion of IVCM administration into radiographers' syllabus.

1.2.2.7 To determine participants' agreement on provision of IVCM administration and role extension for radiographers by MOH.

1.2.2.8 To examine correlation between participants' agreement on the inclusion of IVCM administration into radiographers' syllabus and provision of IVCM administration and role extension for radiographers by MOH.

1.2.2.9 To determine any significant difference exist between means score for radiographers group and other healthcare practitioners group on inclusion of IVCM administration into radiographers' syllabus and provision of IVCM administration and role extension for radiographers by MOH.

1.3 HYPOTHESES

1.3.1 There is association between participants' practicing hospital and perceived obstacles of participants.

1.3.2 There is association between participants' gender and perceived obstacles of participants.

1.3.3 There is association between participants' designation and perceived obstacles of participants.

1.3.4 There is association between participants' practicing hospital and perceived consequences of participants.

1.3.5 There is association between participants' designation and perceived consequences of participants.

1.3.6 There is significant correlation between participants' agreement on the inclusion of IVCM administration into radiographers' syllabus and provision of IVCM administration and role extension for radiographers by MOH.

1.3.7 There is significant difference between means score for radiographers group and other healthcare practitioners group on inclusion of IVCM administration into radiographers' syllabus and provision of IVCM administration and role extension for radiographers by MOH.

CHAPTER 2

LITERATURE REVIEW

In recent years, there have been numerous discussions surrounding role extension of radiographers (Brady, 1995) around the world especially in developing countries. The pace of development has been different in each country. The discussions include a wide spectrum of development ranging from plain film radiography reporting to advanced imaging technologies reporting. This is particularly apparent in gastrointestinal radiology as described by several authors Culpan, et al. (2002), Nightingale and Hogg (2007), Judson and Nightingale (2009). In 2002, Culpan, et al. (2002) revealed a sensitivity of 90.6% for radiographer performed double contrast barium enema (DCBE) compared with 89.7% for radiologist performed DCBE of which supports the practice of radiographers in undertaking DCBE examination. Both studies by Nightingale and Hogg (2007) in barium swallows and meals; whilst Judson and Nightingale (2009) in DCBE examination also report a high standard of performance of barium procedures by radiographers. Cowling (2008) provided evidence of role extension in IV administration and this is supported by Toh, et al. (2007). Further evidence of the radiographers role extension is given by Kerr and Vinjamuri (2001) in the area of nuclear medicine as well as in mammography by Pauli, et al. (1996) and Duijm, et al. (2008). Within magnetic resonance imaging (MRI), Moller, et al. (2004) provided ample evidence of radiographer role progression. Increasingly, plain film radiographer reporting has been studied for various areas. Blakeley, et al. (2008), Smith and Baird (2007) and Brealey, et al. (2005) all provided evidence and examples of the radiographers ability in this field. Studies by Judson and Nightingale (2009) and Law, et al. (2008) provided evidence of role extension in the

area of barium studies; whilst Lo, et al. (2003) and Leslie, et al. (2000) demonstrated in their papers areas of role development within ultrasonography (US). Price, et al. (2009 cited in Smith and Reeves, 2009) demonstrated how radiographers have extended their role in computed tomography (CT) reporting of the head and Brandt, et al. (2007) showed how paediatric brain CT reporting in trauma setting is now radiographer led. Nuclear medicine and radionuclide imaging of the chest and heart are shown by Price, et al. (2009 cited in Smith and Reeves, 2009) to be part of the radiographers remit. They added MRI of the lumbar spine, knee and orbits is becoming an accepted part of the extended role of the specialist radiographer.

Indeed, role extension, advancement and development of radiographers (Hardy and Snaith, 2006) are extensively discussed in the literature. A literature review was performed to support this study, as to create a conceptual framework to link with other research and ideas on the topic (Holloway and Wheeler, 2002) that specifically relates to IV administration by radiographers. Several methods were used to search for the literature. The computer search was eclectic, with the keywords ‘intravenous injections’ and ‘radiographer’ was performed using the databases of MEDLINE 1995 to date, CINAHL 1995 to date, Cochrane, AMED, EMBASE and PUBMED. Subsequently, smart text searching was used to find similar results. The search was extended to the Malaysian MOH Virtual Library a collection of various knowledge providers from the MOH participating libraries’ and other health medical information resources. The keywords ‘radiography’, ‘intravenous injections’ and ‘radiographer’ was performed using the databases of Ovid, KARGER 1997 to date, platform of MD Consult and Open J-Gate. The Online Public Access Catalogue (OPAC), in-house databases and local publications were searched using the portal of Malaysian MOH Virtual Library. The research directory of web-based service of

Malaysian National Medical Research Register (NMRR), weblog of Malaysian MOH Radiology, as well as website of the Malaysian Society of Radiographers were searched using the keywords 'intravenous injections' and 'radiographer' thereafter. Furthermore, the searching was undertaken through the multidisciplinary open access online journal of Biomedical Imaging and Intervention Journal (biij) followed by the reference lists of relevant articles. A total of two hundred seventy seven (277) references were short-listed and read. On investigation, only seventeen (17) references were relevant to the extended role of radiographers in performing IV injections.

Paterson (1995 cited in Smith and Reeves, 2009) provided one of the first instances of IV injections performed by radiographers in the UK; a practice that had become widely established by 2008. This is evidenced in the review article by Smith and Reeves (2009), emphasising the extended role of diagnostic radiographer in administering IV injections over the period 1995-2009 within UK. Several studies by Price and Miller (Price, et al. 2002 cited in Miller, et al. 2008), (Price, et al. 2008), (Miller, et al. 2008) depicted the well-established practice of IV injections by radiographer. The study conducted by Miller, et al. (2008) revealed 100% of the managers of imaging departments surveyed reported that radiographers in their hospital administered IV injections, thus providing evidence of the wide spread nature of the extended role of radiographers in this field within the UK.

By contrast, despite of the statements which support the role extension of radiographers to perform IV injections such as those from the Division of Nursing and Health Sciences, College of Science, Technology and Applied Arts of Trinidad and Tobago (2006 cited in Cowling, 2008) and by Sim, et al. (2008), specific guidance and policies regarding IV administration must be developed as a strategic

initiative to advocate their extended role. Toh, et al. (2007) commented although The Australian Institute of Radiography (AIR, 2003 cited in Toh, et al. 2007) and the New South Wales Health Department (1995 cited in Toh, et al. 2007) have accepted radiographers to perform IV injections, however none of the comparable studies on IV injections were discussed in Australia during their literature search.

Other similar circumstance was found in the Malaysian Literature. Various resources searched including the research directory of Malaysian NMRR, weblog of Malaysian MOH Radiology, the website of the Malaysian Society of Radiographers and the Malaysian MOH Virtual Library found no published evidence to support IV injections by Malaysian radiographers. Sim, et al. (2008) stated:

"...intravenous contrast materials can be administered by radiographers…", and that *"…if the practice is in compliance with institutional regulations".*

In Malaysia, radiographers are encouraged to extend their professional role in CT, US and breast imaging by attending specific courses. Those courses constitute of Post Basic in CT (MOH, 2010) and Advanced Diploma in Breast Imaging (MOH, 2011) organized by Malaysian MOH; whilst Postgraduate Diploma of Medical US organized by a private college, namely Vision College (2011). In fact, the training course of Diploma in Radiography (MOH, 2008) encompasses imaging techniques for most of the contrast media studies of various systems (e.g. urinary, gastrointestinal, reproductive, cardiovascular, neurology, etc.). Administration of IV injections is not taught in all mentioned courses however. The paper by Smith, et al. (2008) revealed both the AIR (2006) and the Royal Australian and New Zealand College of Radiologists (RANZCR, 2006) proposed future extended roles should be underpinned by continuing education. They also suggested extended role should be recognised, formalised and legitimised. With respects to the scenario in Malaysia,

none of the training courses in IVCM administration were made available for radiographers and most importantly, indeed crucial, there are no guidelines or policy development documents formed by the government of Malaysia for radiographers to progress into the extended role of IV injections (MOH, 1985).

Within UK, in response to support the role extension of radiographers in the field of IV injections, specific courses of training, substantive framework (e.g. guidelines and policy) with respect to IV administering provides much support and guidance from professional bodies. The policy of IV administration by radiographers has been developed by The College of Radiographers (COR, 1996). The COR (2003) demonstrated the ability of radiographers in performing IV injections through different types of training (e.g. in-house courses, universities or colleges) undergone ever since 1996. Addition, the Royal College of Radiologists (RCR, 1999) has provided guidance on obtaining informed consent from the patients; as for risk management (RCR, 1996) due to contrast media reactions. The support from the RCR (1993) is well evidenced when specific policy on proper delegation of IV injections role by a radiologist to a radiographer is developed.

Of course, the extended role of radiographers in administering IVCM could impel great impact on the operational management of a department. Skill-mix and utilization of resources has become a mainstay for health care providers in an effort to reduce costs as well as increase efficiency in the America. Urden and Walston (2001 cited in Marquis and Huston, 2006) explained it was due to the restructuring and reengineering done. Similarly, the same paradigm was found in DOH (2000 cited in Hayes, 2005) of the UK whereas healthcare practitioners are to move outside of traditional boundaries by taking on tasks normally performed by others. Marquis and Huston (2006) from the America and the Audit Commission (1995 cited in

Hardy and Snaith, 2006) from the UK viewed the shortage of staff leads to skills mixing. Yet the demand for change in health care to deliver improved services to clients (McElroy, et al. 1996), (Department of Health, 2001 cited in Milburn and Colyer, 2008), (Department of Health, 2000 cited in Milburn and Colyer, 2008), (Eddy, 2008), (Towsley-Cook and Young, 2007) is now even more pressing suggesting that role extension is therefore a significant necessary investment to shape an appropriate improvement in the radiographic service.

Evidence from work by Cowling (2008) and Toh, et al. (2007) revealed the needs to extend the role of radiographers in administering IVCM injections. Keenan, et al. (2001) and Huston (2006) elucidated performance of IVCM injections by radiographers can improve resources allocation, motivation as well as career enhancement among the radiographers. Self-achievement, job satisfaction, prestige are seen by Fisher and Pankowski (1992 cited in Keenan, et al. 2001) as a means of motivating and providing progression (Palmer, 1994 cited in Keenan, et al. 2001) among radiographers and yet the impetus to improve their standing within the healthcare community. Additionally, it may reduce the completion times for specific procedures especially those requiring IVCM administration. It permits radiographers undertaking the particular examination to proceed with the task without asking for help from other staff members. Likewise, other health care practitioners eligible to perform IV injections will be able to concentrate conscientiously on their own tasks without distraction and as a consequent be more effective in many improved aspects of radiography. Loughran (1993), Gosling (1993) and the COR (2003) viewed role development for radiographers as a means of reducing times whilst Toh, et al. (2007) felt that it is an appropriate means of aiding the work flow through the department. Keenan, et al. (2001) conceded the benefits given to the radiology department of the

extended role of radiographers in performing IVCM injections could also prove to enhance not merely to the department alone, but to the staff and patients as well. Hafslund, et al. (2008) implied that this will improve quality and the quantity of works as a whole.

Despite of innumerable benefits may result from radiographers performing IVCM injections, all strategies to ensure the best outcome is of paramount importance. Although research proves patients are less likely to suffer for serious or fatal reactions to a contrast media (Rivero Paparoni, et al. 2014) since introduction of nonionic contrast media in 1984 (Bontrager, 2001), however local and/or systemic reactions may occur after IVCM injections. Bontrager and Lampignano (2014) delineate possible symptoms of local reactions and systemic reactions post IVCM administration. Both extravasation and phlebitis are categorized as local reactions and it could be found at or near the injection site if any local reaction is suspected. In contrary, systemic reactions refer to those affect the entire body or a specific organ system but not at the site of injection. Systemic reactions to contrast media can range from mild to severe and there are classified based on the degree of symptoms associated with the reaction (Kasivisvanathan, et al. 2015). The first type of systemic reaction, namely mild reaction or non-allergic reaction include symptoms of anxiety, lightheadedness, nausea and vomiting, metallic taste, mild erythema, itching, sneezing, warm flushed sensation during injection and mild urticaria. The second type of systemic reaction, the moderate one, is a true allergic reaction, also called anaphylactic reaction. The symptoms encompass moderate to severe urticaria, possible laryngeal swelling, bronchospasm, angioedema, hypotension and tachycardia; whilst the third type of systemic reaction, also known as vasovagal reaction, is a life threatening situation. Those symptoms involve hypotension,

bradycardia, cardiac or respiratory arrest, loss of consciousness, convulsions, laryngeal edema, cyanosis, difficulty in breathing and no detectable pulse. Commonly, most of the reactions to media contrast are mild (Li, et al. 2015), (Morcos, 2014), (Schabelman and Witting, 2010), and it requires no treatment other than support and verbal reassurance. Contrariwise, moderate reactions and severe ones may lead to a life threatening condition, thus it requires immediate and intensive treatment without delay. Bontrager and Lampignano (2014) emphasized that physician should be summoned immediately if any severe reaction is suspected, their statement was supported by Kasivisvanathan, et al. (2015) added that cardiac arrest team should be alerted if needed as delay and inappropriate treatment could result in patient's death. Vitally, it is recommended that high risk patients may be given pre-medication of corticosteroid and antihistamine (Andreucci, et al. 2014), (Bontrager and Lampignano, 2014) to reduce the severity of contrast media reactions prior to IVCM administration. Unarguably, IVCM administration demands high level of training, expertise and experience or may give rise to negligence action. There are consensus stressed that health and safety protocols should always be adhered (Williams, 2006), (Keenan, et al. 2001), (Connor, et al. 1997) throughout IVCM administration procedure. Disappointingly, the investigation by Suing and Davis (2009) disclosed the observed radiographers did not fully adhere to the IV administration guidelines during performance of IV injections, of which could lead to infection and further jeopardize patient's well-being. The finding of their study is found to be consistent with Connor, et al. (1997), they commented a low level of compliance to RCR guidelines and urged there is still much to be improved especially matters related to management of contrast media reactions. Kada (2009) endorsed the needs and challenges for radiographers to deliver proper care to the

patients. Likewise, Keenan, et al. (2001) and Suing and Davis (2009) also stressed that compliance to the proper guidelines is concomitant with the implementation of the IV administration by the radiographers somehow must be enforced to extenuate possible risks. Buttress and Marangon (2008) discussed the legal issues related to legal responsibility of extended roles of health professionals beyond their normal scope of practice. Truthfully, professional practice of radiographers is influenced by professional codes of conducts issued by the professional bodies (Brealey and Scally, 2008), (Lewis, et al. 2008), (MOH, 1985). Hence, it is imperative that extended role for radiographers is to be recognised, formalised and legitimised in order to inform vicarious liability according to Cowling (2008), or may leave radiographers vulnerable to medico-legal action.

Studies pertaining to the role development of radiographers in IV administration have been evaluated to prove the rationale for conducting this current study of the Malaysian radiographers performing IVCM injections, namely Keenan, et al. (2001) and Toh, et al. (2007). Studies by Keenan, et al. (2001) emphasized the benefits that resulted from the extended role of radiographer in the UK, particularly IV injections. Their paper also outlined that a proper framework of delegation to encompass the medico-legal aspects, policy guidelines and accreditation and performance monitoring provide evidence in response to minimize possible risks. Nonetheless, radiographers' perspectives related to their willingness to perform IV injections were not surveyed. Ideally, participation in role extension activities as seen by Williams (2006) should be on voluntary basis a principle. This is endorsed by Toh, et al. (2007) elucidated the radiographers who volunteer to undertake IVCM injections role could lead to higher standard of service delivery, exploration of

radiographers' perceptions is therefore imperative to maximize their full potential in task accomplishment.

In 2007, a survey was conducted by Toh, et al. (2007) to investigate radiographers' perceptions regarding IVCM administration in the Greater Sydney metropolitan area. The study focused on the possible outcome of departmental workflow, training with relation to IVCM injections, medico-legal aspects, workplace dynamics and the current status of IVCM administration among surveyed radiographers respectively. The strategy of cluster and simple random sampling was considered reasonable appropriate by Polit and Beck (2006) although the list of radiology centres that were included did not represent the actual comprehensive list of radiology centres in the Greater Sydney metropolitan area. However, the adequacy of questionnaire surveys according to Burns (1997), with the inclusion of open-ended as well as closed response format questions was identified and questioned. Polit and Beck (2006) and Polgar and Thomas (2008) discussed the usefulness of the questionnaire based on the overall structure of the questionnaire itself to obtain the desirable information in terms of its reliability and validity.

Both Polit and Beck (2006) and Polgar and Thomas (2008) considered the data analysis, the measurement of correlation coefficient between two variables with Pearson's r test using SPSS to be adequate. The interpretation of the findings and the limitations elicited throughout the study were presented reasonably well. However, despite the approval from the University of Sydney Human Research Ethics Committee the issue that pertains to the local approval from participating radiology centres was not addressed. Most importantly, although the survey investigated the possible changes to departmental workflow, other possible consequences that might impact on the radiographers performing IVCM injections were not surveyed. For

instances, what were the consequences of radiographers performing IVCM? Both positive and negative issues were not explored or recorded. The study of Toh, et al. (2007) explored merely the departmental workflow. Also, their survey did not investigate the obstacles that might impede radiographers from performing IVCM injections.

Despite of the establishment of advanced and consultant practitioners' radiographers roles discussed by Hardy, et al. (2008) in the UK, Cowling (2008) claimed that role extension has been minimal in the Malaysia. Malaysian radiographers are not permitted or eligible to perform IVCM injections at the present time; they may only operate an imaging modality after appropriate training such as Post Basic in CT (MOH, 2010), Advanced Diploma in Breast Imaging (MOH, 2011) and Postgraduate Diploma of Medical US (Vision College, 2011). To date no published research has been undertaken in Malaysia studying role extension of radiographers in IVCM administration from the perspectives of radiographers and other health care practitioners. This presents a unique and important opportunity, indeed crucial point to investigate if the opinions of radiographers are inextricably linked to their willingness to perform IVCM and to maximize their full potential by providing excellent healthcare services to the patients. These are endorsed by Toh, et al. (2007) and Smith and Lewis (2002 cited in Toh, et al. 2007), they cited unwillingness from the radiographers could negatively affect the quality of patient care. As contrast injections form a well-documented and common part of the imaging pathway performance of IVCM injections by radiographer would make a great impact upon the improvement of health service delivery. Nonetheless, the resultant consequences could be negative and catastrophic possibly, thus performance of this specific task by radiographers requires conscientious scrutiny.

Milburn (1997) claimed radiographers will perform roles within the domain of medical profession, importantly effective and more than safe practice. In view of this specific role is undertaken by other health care practitioners in the Malaysia currently, this study is therefore valid to explore Malaysian radiographers' and other health care practitioners' perceptions towards an extended role of radiographers in IVCM injections. This study is conducted to identify the perceived obstacles that might impede radiographers from administering IVCM injections and the perceived consequences may result from their extended role in performing IVCM injections. Also, it was aimed to explore the potential future role development, specifically IVCM injections and its possible application to the radiographer role in the Malaysia. The questionnaires developed through this study could be transposed to other hospitals and most importantly, it should contribute to future knowledge with regards to IVCM injections by radiographers in the Malaysia and will act as a benchmark in further similar studies in this field. Specifically, the perceived obstacles and consequences identified through this study could provide as the guidelines for Malaysian Ministry of Health (MOH) and statutory body to establish a substantive framework (e.g. guidelines and policy) that supports radiographers' extended role. Eventually, it could enable highest professional standard of competency and improve service delivery as a whole.

CHAPTER 3

MATERIALS AND METHODS

3.1 Study design

It was a cross sectional and qualitative study using newly designed questionnaires involving seven hundred sixteen (716) participants.

3.2 Study participants

Seven hundred sixteen (716) participants constitute of five hundred twenty five (525) radiographers (R), eighty (80) radiologists (S), fifty eight (58) medical officers (MO) and fifty three (53) state registered nurses (SRN) who worked at diagnostic imaging department of thirteen (13) principal government hospitals in the Malaysia.

3.3 Inclusion criteria

The radiographers, radiologists, medical officers and state registered nurses who have worked in their current department respectively for the period of more than two (2) months, had being included in the study, reasoning that they could have better understanding of departmental protocol.

3.4 Exclusion criteria

The participants whom posted from other department for clinical practice, regardless of their field of specialty had been excluded from the study though their posting lasted for months because of their area of posting concentrated on specific area only based on the objectives of their study. Thus, they might not understand the protocol of the department as it might be very different when compared with their

previous clinical area of practice. Yet, ten (10) participants who participated during pilot study had been excluded from actual study in order to prevent contamination of sample.

3.5 Study period

Data collection has been undertaken following full ethical clearance, specifically school and local on 25th April 2013. The recruitment period for actual study started on 28th April 2013 until 1st July 2013, of which took approximately three (3) months throughout thirteen (13) principal hospitals in the Malaysia. Subsequently, data analysis was done and followed by report written [approximately twelve (12) months]. The study is ready for submission within two (2) years.

3.6 Study location

The participants have been recruited from diagnostic imaging department of thirteen (13) state principal government hospitals in Malaysia.

3.7 Sample size calculation

Table 3.7.1 shown below displays the numbers of potential participants for each diagnostic imaging department throughout thirteen (13) principal government hospitals in Malaysia respectively.

Table 3.7.1 Potential participants for each diagnostic imaging department of each hospital

Discipline / Hospital	Radiographer (R)	Radiologist (S)	Medical Officer (MO)	State Registered Nurse (SRN)
HTF, Perlis	28	2	1	3
HSB, Kedah	46	6	7	5
HPP, Pulau Pinang	51	7	3	5
HRPB, Perak	54	7	5	5
HTAA, Pahang	40	7	6	2
HKL, Kuala Lumpur	135	18	2	12
HRPZII, Kelantan	30	6	1	3
HSNZ, Terengganu	44	9	2	4
HM, Melaka	40	6	5	5
HTJS, Seremban	48	7	5	3
HSA, Johor	77	11	3	3
HQE1, Sabah	47	6	4	3
HUS, Sarawak	71	6	7	7
Total	**711**	**98**	**51**	**60**

Raosoft sample size calculator was utilised to estimate sample size. From the entire target population of seven hundred eleven (711) radiographers, ninety eight (98) radiologists, fifty one (51) medical officers and sixty (60) state registered nurses, Raosoft sample size calculator with 95% of confidence level, 5% of margin of error and 50% of the response distribution set, recommended sample size for each disciplines of radiographer, radiologist, medical officer and state registererd nurse as two hundred fifty (250), seventy nine (79), forty six (46) and fifty three (53) respectively (Raosoft, Inc. 2004). However, five hundred twenty five (525), eighty (80), fifty eight (58) and fifty three (53) questionnaires returned from radiographers, radiologists, medical officers and state registered nurses respectively had been selected for this study.

3.8 Sampling method

The participants who fulfilled selection criteria and volunteer to participate in this study being selected with convenience sampling method.

3.9 Research tools

The questionnaires (consist of open-ended and closed response format) that pertain to the objectives of the study have been designed. There were developed based on extensive reading from eclectic literature. There are Smith and Reeves (2009), Miller, et al. (2008), Toh, et al. (2007), Smith, et al. (2008), AIR (2006), RANZCR (2006), Keenan, et al. (2001) and many more. With reference to the appropriateness of newly designed questionnaires, a review by peer (Appendix 1) with Master Degree in Health Science who is the President of Malaysian Society of Radiographers as well as experienced educator in Malaya University was sought to overcome the shortcomings in the questionnaires (Cummings and Hulley, 2007, p249-51). She was informed about the objectives of study and yet, to give comment on the developed tool. The earliest version of developed questionnaire could be found in Appendix 2 and the suggestions of improvement on the developed tool are highlighted in blue color.

Concomitantly, on-going guidance, feedback as well as support from the supervisors (Appendix 3) were sought throughout the study. Based on the comments from the peer, and ample information gained via extensive reading on the topic, all necessary changes were made during the process of revising. Thereafter, the first version of two (2) sets of questionnaires (Appendix 4-5) was ready for submission to the Malaysian Ministry of Health Medical Research and Ethics Committee (MREC) for approval before distribution.

In order to increase the reliability and validity of research tools, a pilot study was done soon after approval from the MREC. Yet, invitation of ten (10) experts (Appendix 6) in related field was accomplished to judge the content validity of designed instruments. Content Validity Index (CVI) for two (2) sets of questionnaires respectively was calculated. The CVI for developed questionnaires to R was 0.968; whilst questionnaires to other healthcare practitioners (S, MO, SRN) was 0.970 respectively. In addition, reliability test was performed to calculate Cronbach's alpha for question number eight (8) to question number fifteen (15) using Statistical Package for Social Sciences (SPSS) version 19.0. The internal consistency of Cronbach's alpha for question number eight (8), nine (9) and ten (10) to twelve (12) was 0.772, 0.735, and 0.824 respectively. Based on the feedback and comments from participants and experts, also the results from content validity as well as reliability tests, the final version of instruments (Appendix 7-8) were made available for submission to the MREC again for approval prior to distribution.

3.9.1 Content validity

The formula developed by Lawshe since 1975 was used to calculate the Content Validity Ratio (CVR) and CVI for developed tools. Lawshe methods is widely used for judgment of content validity. It is evident in the study by Tunuguntla and Subrahmanian (2012), Chen, et al. (2011), Raja Prasad and Reghunath (2010), Schmidt, et al. (2009) and many more. With regards to the evaluation of content validity for research tools developed in this study, ten (10) experts composed of persons knowledgeable about the job with disparity grade for which consist of five (5) radiographers, three (3) state registered nurses and two (2) postgraduate students for master in radiology who are incumbent MO were given the initial seventy eight

(78) and eighty one (81) items of two (2) sets of questionnaires respectively to evaluate its' content validity. The first set is used for other healthcare practitioners (S, MO, SRN) while the second set is to be distributed to radiographers. For each set of questionnaires, all items were numbered in sequence (textbox in purple color) and could be found in Appendix 4 and 5. Ten (10) experts who are the panelists were asked to rate each number of items independently by giving their respond either "essential", "useful but not essential", or "not necessary". Their responses were pooled and the number indicating "essential" for each individual item is determined. The formula used the total number of experts (N) and the number who rated the tools as essential (E):

$$CVR = [(E - (N / 2)) / (N / 2)]$$

Where CVR = content validity ratio, E = Number of experts indicating "essential", N = total number of panelists. This formula yields values range from +1 to -1; positive values indicate at least half the experts rated the item as essential.

For the content evaluation panel composed of ten (10) members, a minimum CVR of 0.62 is required to satisfy the 5% level (Table 3.9.1.1). Items with CVR values meeting minimum value of 0.62 are retained. On the other hand, the items with CVR less than 0.62 were rejected and deleted. For the questionnaires of seventy eight (78) items, eleven (11) items are rejected (Table 3.9.1.2). Likewise, out of eighty one (81) items of questionnaires to R, eleven (11) items are rejected too (Table 3.9.1.3). All rejected items are highlighted in yellow in Appendix 4 and 5. Thereafter, CVI, the mean of CVR values of the retained items for two (2) sets of questionnaires is computed respectively, whereby CVI for questionnaires to other healthcare practitioners (S, MO, SRN) was 0.970 whilst to R was 0.968 respectively.

Table 3.9.1.1 Number of panelists versus the acceptable CVR

No. of Panelists	Min. Value
5	.99
6	.99
7	.99
8	.75
9	.78
10	**.62**
11	.59
12	.56
13	.54
14	.51
15	49
20	.42
25	.37
30	33
35	.31
40	.29

(Lawshe, 1975, p568)

Table 3.9.1.2 Computed CVR for 78 items of questionnaires to other healthcare practitioners (S, MO, SRN)

Item No.	CVR
1-13, 15-26, 28, 30-2, 35-6, 38-9, 42-3, 46-7, 52-8, 60-5, 68-72, 74-8 (60 items)	**0.99**
14, 29, 48-9, 66-7, 73 (7 items)	**0.80**
50	0.40
40, 59	-0.40
44, 51	-0.60
27, 33-4, 45	-0.80
37, 41	-0.99

Therefore, CVI for this set of questionnaires is 65/67, that is **0.970**

Table 3.9.1.3 Computed CVR for 81 items of questionnaires to R

Item No.	CVR
1-13, 16-29, 31, 33-5, 38-9, 41-2, 45-6, 49-50, 55-61, 63-8, 71-5, 77-81 (62 items)	**0.99**
14-5, 32, 51-2, 69-70, 76 (8 items)	**0.80**
53	0.40
43, 62	-0.40
47, 54	-0.60
30, 36-7, 48	-0.80
40, 44	-0.99

Hence, CVI for this set of questionnaires is 67.78/70, is **0.968**

3.9.2 Reliability test

Data collected from the pilot study was utilized to evaluate the internal consistency and reliability of the tools. A reliability test was accomplished to calculate Cronbach's alpha (or coefficient alpha) using SPSS version 19.0. For the total number of fifteen (15) questions in the questionnaires of first version (Oct 2012), two (2) questions [number ten (10) and fifteen (15)] were deleted. The deleted questions are highlighted in red color of which attached in Appendix 4 and 5. The final version (Mac 2013) of the questionnaires composed of twelve (12) questions is illustrated in Appendix 7 and 8. Cronbach's alpha for each question number of eight (8) [Table 3.9.2.1], nine (9) [Table 3.9.2.2], and ten (10) to twelve (12) [Table 3.9.2.3] was 0.772, 0.735, and 0.824 respectively.