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Knowledge of nosocomial infection control practices among radiographers in Jordan

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ABSTRACT

Introduction: Nosocomial infections add health-related and financial burdens on health systems. This study aims to evaluate the radiographers' knowledge of nosocomial infection control practices in Jordan.
Methods: A cross-sectional questionnaire-based assessment was conducted. The main domains of the knowledge based test were the nature of nosocomial infections, standard precautions, and infection control practices specific to the radiology department. Comparison of knowledge among radiographers was assessed using the Student *t*-test and ANOVA. Multiple linear regression was used to find predictors of the knowledge score.
Results: The final analysis included 100 radiographers from educational, private, and public hospitals. Mean knowledge score was 66.2% (SD: 20.3%, range: 25.0–100%). Questions with the lowest correctly scored were about the main source of infections (17%), recapping used needles (27%), gloves use (27%), the necessity of using overshoes (26%) and a cap (26%) when there is a risk of biological fluid splashes, the necessity of using sterile gloves (7%) and protective masks (5%) during all invasive procedures, the manoeuvrability around a sterile field (54%), and the safety of passing the imaging plate to the scrub nurse in order to place it under the radiographer's direction (37%). Predictors of knowledge score were the academic degree and training status ($R^2 = 0.21$, $P < 0.001$).
Conclusion: Knowledge of infection control practices among Jordanian radiographers was moderate. Future training should focus on handling used needles, the use of protective barriers, and the manoeuvrability around sterile fields. Improved academic curriculum and on-site training could enhance knowledge in infection control practices.

Introduction

Nosocomial infections (NIs) are infections acquired in healthcare settings within 48 h postadmission, 3 days postdischarge, or 30 days postoperation.[1] NIs are most commonly of bacterial origin and can also be viral and fungal.[2] NI pathogens transmit through a variety of vehicles including contact, droplet, air, food, drink, and vectors (*e.g.*, rodents and insects).[3] NIs affect 3.5–12% of patients in the developed countries, whereas it is more prevalent in the developing countries, including Jordan, where it reaches 5.7–19.1%.[2]

The higher rate of NIs is associated with higher healthcare-related mortality rates, length-of-stay, cost, and increased microorganism resistance.[4–6] Therefore, it is crucial to investigate the potential determinants for the high NI rates in the developing countries.

More than one third of NIs can be prevented by applying appropriate infection-control measures.[7] In 2007, the Healthcare Infection Control Practices Advisory Committee in the Centres of Disease Control and Prevention Organization released guidelines for infection prevention measures that apply to all patients. These guidelines are built upon a series of isolation and infection prevention documents published since 1970, and commonly known as Standard Precautions (SPs).[8] SPs aim not only to prevent transmission of NIs, but also to protect healthcare workers (HCWs) from cross-infection.[9]

Hundreds of patients visit the radiology department every day. Each of them may be a source or susceptible to NIs. Furthermore,

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advances in diagnostic and interventional radiology over the last three decades have led to longer stays in the radiology department due to the increase in numbers of targeted patients and the complexity of the procedures.[10]

Patients have contact with a variety of radiographic equipment during their stay in the radiology department. Lead aprons, image receptors, and adhesive tape used to attach radiographic markers are few examples of fomites that have been proved to carry nosocomial pathogens.[11–13] Direct contact has also been raised as a major cause of cross-bacterial infection between patients and HCWs.[14] In addition, invasive procedures, including interventional radiology and operating theatre imaging, are leading cause for NIs.[15] For example, 4.9% risk of NI was reported for vascular angioplasty,[16] whereas the risk of bacteraemia was reported to be 13% after a transcutaneous intrahepatic portosystemic shunt.[17]

Radiographers are key members in the radiology department as far as NIs prevention is concerned. Within their role, they have direct and indirect contact with the patients. They work on different imaging modalities and are actively involved in interventional radiological procedures. In addition, radiographers travel among departments to perform tasks ranging from acquiring simple X-ray examinations to lengthy, invasive, sophisticated, and aseptic procedures under fluoroscopic guidance in the operating theatre.

Insufficient knowledge is recognised as a major contributor for poor compliance to the SPs.[18,19] Although guidelines and recommendations on SPs[8] and specific infection control practices[20] have been issued since the 1970s, no Jordanian study has ever assessed the knowledge of radiographers in infection-control practices. In fact, this issue is poorly covered in the literature worldwide. El-Gilany et al. (2012) measured the level of knowledge among Egyptian healthcare providers from different disciplines.[21] Among those, radiographers showed the lowest level of knowledge. Another study assessed the knowledge in NIs prevention and SPs among radiographers in Sri Lanka and described it as good.[22] However, none of the previous studies included infection control practices specific to the radiography profession in their assessment.

The aim of this study was to assess the knowledge level in standard precautions and specific nosocomial infection control practices among radiographers in Jordan and to identify factors associated with it.

Materials and methods

Study design

A questionnaire of 41 items was developed by the investigators based on previous studies[23–25] and text from contemporary evidence-based practice guidelines[20,26] to assess radiographers knowledge of the nature of NI (6 questions), SPs (23 questions), and infection control practices specific to the radiology department (12 questions). All questions contained 3 possible answers; “yes”, “no”, and “I don't know”. Demographic data were collected including gender, age, academic degree, type of hospital (educational/private/public), years of experience, interventional experience (yes/no), and prior on-site infection control training (yes/no).

The questionnaire was developed in consultation with a group of experts with questionnaire and infectious disease experience. The investigators and experts reached consensus on 39 items (out of 41) that were clinically relevant and evaluated reasonable expectations of knowledge on infection control. The questionnaire was piloted face-to-face with 10 radiographers in order to check comprehension and clarity of the questions. The reliability coefficient for the test (using Cronbach's alpha internal consistency coefficient) for the pilot was 0.778.

Sampling

The required sample size was calculated with the advice of a statistician. A sample of 88 participants was planned in order to estimate a proportional response in the region of 50% with a 95% CI of $\leq$10. Therefore, it was agreed to collect data from as close as possible to 88 participants. The resulting sample of 130 allowed the estimation of a proportional response for each group in the region of 50% with a 95% CI of 8.1.

Ethical approval for the study was obtained from the host University and hospitals Institutional Review Boards (IRB). Participants were recruited from 14 randomly selected hospitals from two major cities, Amman and Irbid. Data collection was over a three-month period from June to September 2014. A research assistant visited the radiology department in the selected hospitals during day time and outside meal breaks, and invited staff radiographers to fill up the questionnaire. The research assistant accompanied the participants while they were filling the test paper to ensure spontaneous answers, and to prevent consultation that may occur in self-reported surveys. The research assistant did not interfere with the process of filling the questionnaire.

All radiographers who worked during the shift at the time of the research assistant's visit and were present in the radiology department were invited to participate in the study. Student radiographers and part-timers who could have come from different type of hospitals were excluded from the study.

Data analysis

Correct answers were identified from the guidelines of the radiology department at Louisiana State University (LSU) Health Sciences Centre and from the literature.[23–26]

Means, standard deviations (SD), and proportions were calculated to describe data. The score was defined as the percentage of correct answers. The numerical value of the knowledge score has no direct meaning in practice. For example, a radiographer with a knowledge score of 100% is not necessarily twice as proficient as a radiographer with a score of 50%, or the radiographer with the lower score needs twice as much training as the radiographer with the higher score. Therefore, the 100 point scale was reduced to 3 levels Likert-type scale (weak/moderate/good) to make it more graspable. The levels “weak”, “moderate”, and “good” were assigned for the scores “<60”, “60–79”, and “$\geq$80”, respectively. In addition, this particular scale has been used to compare the “level” of knowledge for our participants with other studies.[21,25,27,28]

Although the “weak/moderate/good” scale does not have direct practical meaning, it clearly indicates that, for example, the radiographer with “good knowledge” is more knowledgeable than a radiographer with moderate knowledge and, therefore, more likely to comply and practice at higher standards. Therefore, the level of knowledge can be thought as an indirect surrogate for the level of compliance and quality of practice.

The differences in scores between groups of different gender, academic degree, interventional experience, and training were compared using independent sample Student *t*-test. One-way analysis of variance test (ANOVA) was performed to test differences in the scores between different hospitals. Spearman's rho test of correlation was used to test the relationship between age and experience and the SPs knowledge score.

Step-wise multiple linear regression analysis was performed. The output variable was the overall proportion of correct answers. All variables with a *P* value of less than 0.1 on univariate correlational analysis were employed in the regression model to explain the scores variance. The explanatory variables included in the model were the following: academic degree, type of hospital; and

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