

Review Article

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Radiation protection among health care workers: knowledge, attitude, practice, and clinical recommendations: a systematic review

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Keywords: health care workers; knowledge; radiation protection; systematic review.

Abstract

Objectives: This study was performed to determine the knowledge, attitude, and practice (KAP) of health care workers (HCWs) towards radiation protection.

Methods: In this systematic review study, three international databases (Web of Science, PubMed, Scopus) were searched for related published articles in the English language from 1 January 2000 to 1 February 2020. The quality of the included studies was evaluated using the Hoy et al. tool.

Results: Out of the 1,848 studies examined, 41 studies that were performed on 11,050 HCWs were included in the final stage. The results indicated that in most studies, more than half (50%) of the participants had average knowledge. Furthermore, 60% of the participants had a positive attitude, but in most studies, they had average practice regarding radiation protection. The most important recommendation for improving KAP among the participants was incorporating radiation protection standards in the student curriculum.

Conclusion: Considering the results of the study, further attention should be paid to proper education regarding radiation protection standards and improvement of HCW performance.

Introduction

Daily, healthcare workers (HCWs) are exposed to occupational contacts with various diagnostic and therapeutic radiology interventions [1]. The HCWs' exposure to various radiology waves results in acute complications (dermatitis, mucositis, and hair loss) as well as long-term complications (cataracts, skin problems, genetic problems, and cancer) through impairment in the normal DNA functioning [2–6].

Specifically, the HCWs exposed to radiation develop cancer by approximately more than 40% compared to patients and other groups [7]. To prevent the side effects of radiation, the International Radiation Protection Association (IRPA) has designed some guidelines to limit the dose received by the HCWs, and it is periodically reviewed [8, 9]. The most important method of proper radiation protection principle implementation is education [10]. Today, with the increase in the number of radiology procedures, all healthcare workers exposed to radiology waves should know how these procedures are performed and how they can better protect themselves [11, 12]. The extent of awareness of the healthcare workforce about radiation protection has a considerable impact on the proper attitude and performance regarding protection against radiology waves [13].

Current evidence suggests different results about the level of awareness, attitude, and performance of healthcare workers about radiation protection across different countries [14–16]. Further, many studies have shown that HCWs with good knowledge may lack a good attitude about radiation protection [17–19]. Also, many individual studies have found poor knowledge about radiation protection [14, 20, 21]. Precise determination of awareness, attitude, and performance of HCWs about radiation

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protection across different fields can help healthcare policymakers in the better management and improvement of awareness, attitude modification, and their performance. To the best of our knowledge, so far, no study has been performed in this regard and with this scope. Accordingly, this systematic review study was conducted to determine the knowledge, attitude, and practice (KAP) of healthcare workers towards radiation protection.

Materials and Methods

Design

This systematic review study was performed based on the Cochrane book and reported using preferred reporting items for systematic reviews and meta-analyses (PRISMA) checklist [22]. A prepared protocol was used to conducting the study but was not published in English. Protocol registration was not conducted. In this study, cross-sectional studies conducted to investigate the knowledge, attitude, or practice of healthcare workers about radiation protection published in the English language was included. Review studies, letter to the editor, qualitative, and poor quality studies performed before 2000 published in non-English language were excluded. The health care workers based on included studies were included: radiologists, dentists, radiographers, medical students, surgeons, nurses, cardiologists, and anesthesiologists.

Search strategy

In this study, three international databases (Web of Science, Scopus, and PubMed) were searched from 1 January 2000 until 1 February 2020. The PubMed search strategy used for search in other databases. To develop a search strategy, a librarian specialist with an experience of working in systematic review studies was employed. The keywords were determined based on Boolean operators (AND, OR, and NOT), Medical Subject Headings (MeSH), Emtree, and keywords in relevant studies. The keywords were: “Radiation protection”, “health care workers”, “knowledge”, “attitude”, “practice”, and “KAP”.

Selection of studies and data extraction

The search results across the databases were entered into Endnote. Next, the included studies were screened, and duplicate articles were removed. The title of the remaining studies was evaluated, and irrelevant cases were excluded. According to the inclusion criteria, the abstract of the studies was evaluated, and the relevant studies proceeded to the next stage. In the last stage, the full texts of the remaining studies were examined. Screening and selection of the studies were performed by two persons. Any disagreement between the authors was resolved by a third person. In some papers where the information was incomplete, their authors were contacted to acquire the necessary information. Extracted data items included: first author, year, country, sample size, participants, target population, age, gender, sampling method, method of data collection and risk of bias, outcome measures, knowledge, attitude, practice, and improvement recommendations.

Quality assessment

The quality studies were evaluated by Hoy et al. scale [23]. This scale included 10 items which checked the external and internal validity of studies. The quality of included studies was assessed by two researchers separately. The disagreement between researchers was resolved by the third researcher.

Results

Study selection

A total of 1,848 articles from initial searches were retrieved in three databases. Out of 1,471 non-duplicated studies in the title and abstract screening process, 1,406 studies were excluded. Out of 65 studies, 41 had eligibility criteria. Out of 24 excluded studies, four studies were reviews, six studies had no full text, seven studies were published in a non-English language, and three studies did not meet the minimum quality requirements for inclusion in the study, and four studies were qualitative (Figure 1).

Study characteristics

Forty-one studies conducted on 11050 HCWs were included, which had been performed from 2002 to 2019. All of the studies were cross-sectional. The most common method of sampling was convenience sampling ($n=19$). In more than 98% of studies ($n=40$), the instrument was a researcher-made tool. In all of the studies, the information had been collected as a self-report. Most studies had a low risk of bias ($n=36$). The mean age of the participants had been mentioned only in 11 studies. The age range of the participants was 29.4–45 years. The studies had been conducted in 22 countries. Most of the studies had been performed in the US ($n=5$) and Italy ($n=4$) (Table 1).

Main results

Instruments

In most studies ($n=40$), the researcher-made instrument had been used for data collection. Only one study had used a standard tool. In five studies, the number of questionnaire items used was not clear. The number of items in different questionnaires ranged from 5 to 63. The content of items was different from study to study. Nevertheless, overall they examined the KAP of HCWS regarding radiation protection.

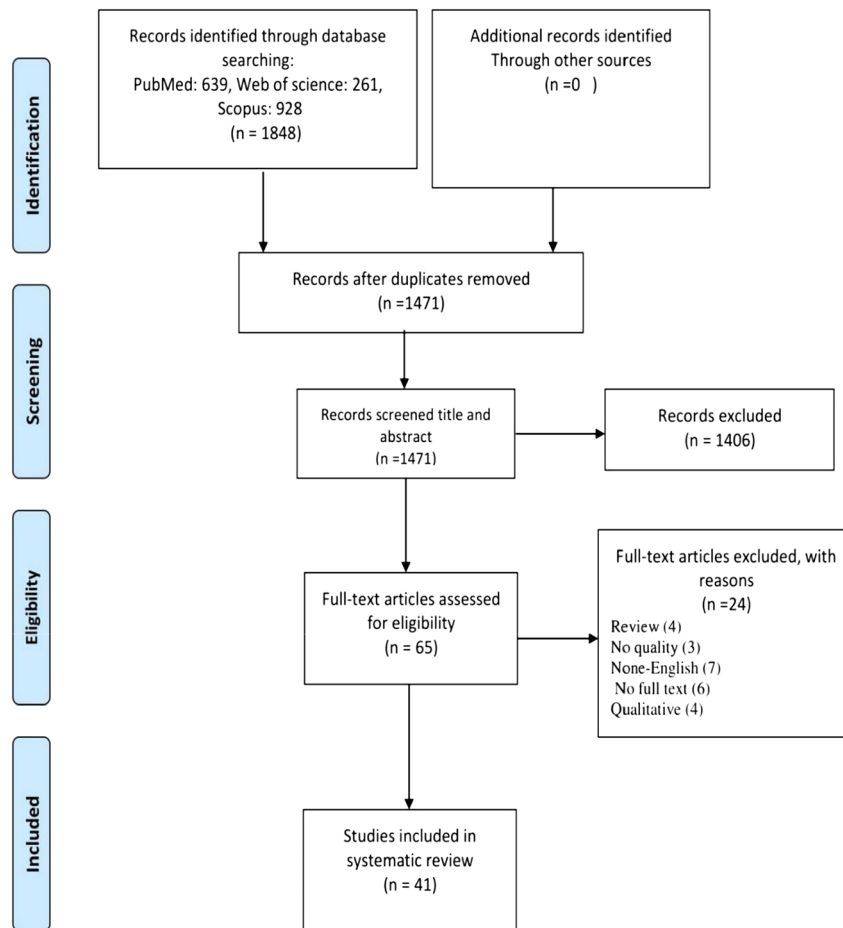


Figure 1: Study selection process.

Knowledge of HCWs towards radiation protection

Out of the 41 studies, most of them ($n=33$, 80.4%) had examined knowledge of HCWs about radiation protection. Knowledge in different studies had been measured with various numbers of items and about different protection tools. Moreover, knowledge had been classified as poor, average, and sufficient in most studies. In the present study, the level of sufficient knowledge in the included studies was reported. The minimum level of knowledge was 2%, while the maximum was 95%. More than 50% of the participants in most studies (18 out of 33) had sufficient knowledge of radiation protection. In some studies ($n=6$), the level of knowledge had been mentioned as average (5.6–12.1). The level of knowledge of radiation protection among the dentists was 39.1–75.98%. For the radiologists, it was 59–95%, and among the medical students was 10–94%.

Attitude, practice, and clinical recommendations of HCWs about radiation protection

Out of the 41 studies included, six studies had examined the attitude of HCWs about radiation protection. In four

studies, the level of awareness had been classified as negative and positive. The minimum level of positive attitude was 61.2%, while the maximum was 88%. The results indicated that more than 60% of the HCWs had a positive attitude about adhering to radiation protection precautions. In two studies, awareness had been reported as average (6–8.6). Out of 41 studies, 15 studies had examined the practice of HCWs about radiation protection. In 13 studies, the level of proper practice of HCWs had been mentioned. The practice in the studies had been classified as poor, average, and good, and is defined as the extent of applying protective equipment for radiation protection. The level of high practice across different studies was 14.3–99%. In most studies ($n=7$), HCWs had an average practice of radiation protection. In some studies, the mean score was 3.2–13.1. The most important recommendations in the included studies to enhance the KAP of HCWs regarding radiation protection were: including radiation protection topics in curricula ($n=13$), implementing periodic practical training course in hospitals ($n=12$), providing continuing education programs ($n=11$), and providing sufficient radiation protective devices ($n=8$) (Table 2).

Table 1: Knowledge, attitude, practice and recommendations for the practice among health care workers (HCWs) towards Radiation protection.

ID	Author (year)	Country	Study characteristics 1. Sampling method 2. Outcome 3. Risk of bias	Participants 1. Sample (sample/RR/ final sample) 2. Age (mean SD) 3. Gender (male/female) 4. Target population	Data collection 1. Instrument (type, items) 2. Method of data collection	Results 1. Knowledge 2. Attitude 3. Practice (N/%) or Means + SD
1	Abdelrahman (2018) [30]	Jordan	1. Convenience sampling 2. Practice 3. Low	1. 84/74%/62 2. 32.7 (5.8) 3. m 48/f 14 4. Radiologists	1. The researcher made, eight items 2. Self-report	1. NR 2. NR 3. 61 (98.4%)
2	Absi (2011) [31]	UK	1. Census 2. Knowledge 3. Moderate	1. 285/38.2%/109 2. NR 3. NR 4. Dentists	1. The researcher made, 16 items 2. Self-report	1. 42 (39.1%) 2. NR 3. NR
3	Adejumo (2012) [32]	Nigeria	1. Simple random 2. Knowledge 3. Low	1. 100/100%/100 2. NR 3. NR 4. Radiographers	1. The researcher made, 16 items 2. Self-report	1. 95 (95%) 2. NR 3. NR
4	Alahmari (2016) [33]	Australia, Saudi Arabia	1. Convenience sampling 2. Attitude 3. Low	1. 110/100%/257 2. NR 3. NR 4. HCWs	1. The researcher made, eight items 2. Self-report	1. NR 2. 97 (88%) 90 (61.2%) 88% 3. NR
5	Alavi (2016) [34]	Iran	1. Census 2. Knowledge, attitude, Practice 3. Low	1. 670/61.7%/413 2. NR 3. NR 4. HCWs	1. The researcher made, 32 items 2. Self-report	1. 7.20 + 3.4 2. 8.6 + 2.7 3. 13.1 + 3.3
6	Alobaysi (2019) [35]	Saudi Arabia	1. Simple Random 2. Knowledge 3. Moderate	1. 203/100%/203 2. NR 3. M 96 F 107 4. Students	1. The researcher made, 19 items 2. Self-report	1. 124 (61%) 2. NR 3. NR
7	An (2018) [36]	South Korea	1. Simple random 2. Knowledge, Attitude 3. Moderate	1. 207/100%/207 2. NR 3. NR 4. Dentists	1. The researcher made, 19 items 2. Self-report	1. 127 (61%) 2. 171 (83%) 3. NR
8	Awosan (2016) [37]	Nigeria	1. Convenience sampling 2. Knowledge 3. Low	1. 110/100%/110 2. 34.04 (8.83) 3. M 74/ F 36 4. HCWs	1. The researcher made, NR items 2. Self-report	1. 65 (59.1) 2. NR 3. NR
9	Babaloui (2018) [38]	Iran	1. Convenience sampling 2. Knowledge 3. Low	1. 85/97.6%/83 2. NR 3. M 24/F 59 4. Nurses	1. The researcher made, 22 items 2. Self-report	1. 12 + 2.77 2. NR 3. NR
10	Badawy (2016) [39]	Australia	1. Convenience sampling 2. Knowledge 3. Moderate	1. 200/73.5%/147 2. NR 3. NR 4. Nurses	1. The researcher made, 10 items 2. Self-report	1. 62 (42%) 2. NR 3. NR
11	Batista (2019) [40]	Brazil	1. Census 2. Knowledge, attitude 3. Low	1. 59/100%/59 2. 33.0 (7.2) 3. M 14/F 45 4. HCWs	1. The researcher made, 28 items 2. Self-report	1. 50 (85) 2. NR 3. 36 (60%)
12	Brun (2018) [41]	France	1. Census 2. Practices and knowledge 3. Low	1. 103/87.3%/90 2. 43.8(11.7) 3. M 51 F 39 4. HCWs	1. The researcher made, 23 items 2. Self-report	1. 5.6 + 16 2. NR 3. 3.2 + 7

Table 1: (continued)

ID	Author (year)	Country	Study characteristics 1. Sampling method 2. Outcome 3. Risk of bias	Participants 1. Sample (sample/RR/ final sample) 2. Age (mean SD) 3. Gender (male/female) 4. Target population	Data collection 1. Instrument (type, items) 2. Method of data collection	Results 1. Knowledge 2. Attitude 3. Practice (N/%) or Means + SD
13	Campanella (2017) [42]	Italy	1. Census 2. Knowledge 3. Low	1. 419/100%/419 2. 44.76 (12.33) 3. M 210/F 209 4. GP	1. The researcher made, 26 items 2. Self-report	1. 129 (62.2) 2. NR 3. NR
14	Carpeggiani (2012) [43]	Italy	1. Census 2. Knowledge 3. Low	1. 403/100%/403 2. 45 (6) 3. M 182/F 221 4. HCWs	1. The researcher made, 10 items 2. Self-report	1. 209 (52%)/ 31.5 + 3.7 2. NR 3. NR
15	Erkan (2019) [44]	Turkey	1. Convenience sampling 2. Knowledge 3. Moderate	1. 101/100%/101 2. NR 3. M 42/ F 59 4. HCWs	1. Researcher made, 20 items 2. Self-report	1. 26 (25.7%) 2. NR 3. NR
16	Faggioni (2017) [45]	Italy	1. Convenience sampling 2. Knowledge 3. Low	1. 159/100%/159 2. 29.4 3. M 71/F 88 4. Students	1. The researcher made, 16 items 2. Self-report	1. 100 (62.8%) 2. NR 3. NR
17	Famurewa (2014) [46]	Nigeria	1. Convenience sampling 2. Knowledge 3. Low	1. 250/64.8%/162 2. NR 3. NR 4. HCWs	1. The researcher made, 10 items 2. Self-report	1. 115 (71.2%) 2. NR 3. NR
18	Fan (2017) [47]	China	1. Convenience sampling 2. Knowledge 3. Low	1. 266/100%/266 2. 36/8 3. NR 4. Surgeon	1. The researcher made, five items 2. Self-report	1. 115 (43.2%) 2. NR 3. NR
19	Garg (2018) [48]	Nepal	1. Census 2. Knowledge 3. Low	1. 100/100%/100 2. NR 3. NR 4. Students	1. The researcher made, 20 items 2. Self-report	1. 85 (85%) 2. NR 3. NR
20	Haverkamp (2013) [49]	Germany	1. Census 2. Knowledge 3. Low	1. 1361/100%/1361 2. NR 3. NR 4. HCWs	1. The researcher made, nine items 2. Self-report	1. 721 (53%) 2. NR 3. NR
21	Hirvonen (2019) [50]	Finland	1. Stratified random sampling 2. Knowledge 3. Low	1. 252/100%/252 2. M 37 /F 215 3. NR 4. Nurses	1. The researcher made, 33 items 2. Self-report	1. 6.46 + 2.4 2. NR 3. NR
22	Ihle (2019) [18]	Australia	1. Convenience sampling 2. Knowledge, A, P 3. Low	1. 154/40.9%/63 2. NR 3. M 44/F 19 4. Dentists	1. The researcher made, 32 items 2. Self-report	1. 58.7–75.8% 2. NR 3. NR
23	Jentzsch (2015) [51]	Switzerland	1. Convenience sampling 2. Knowledge 3. Low	1. 83/100%/83 2. NR 3. NR 2. Operating room personnel	1. The researcher made, NR items 2. Self-report	1. 54 (65%) 2. NR 3. 45 (54%)
24	Jeong (2016) [52]	South Korea	1. Census 2. Knowledge 3. Low	1. 200/100%/200 2. NR 3. NR 4. Nurses	1. Standard, NR items 2. Self-report	1. 8.68 + 2.65 2. NR 3. 3.16 + 0.67

Table 1: (continued)

ID	Author (year)	Country	Study characteristics 1. Sampling method 2. Outcome 3. Risk of bias	Participants 1. Sample (sample/RR/ final sample) 2. Age (mean SD) 3. Gender (male/female) 4. Target population	Data collection 1. Instrument (type, items) 2. Method of data collection	Results 1. Knowledge 2. Attitude 3. Practice (N/%) or Means + SD
25	Kurtul (2018) [53]	Turkey	1. Census 2. Knowledge 3. Low	1. 443/99.5%/441 2. 30 3. M 207/F 234 4. HCWs	1. The researcher made, 23 items 2. Self-report	1. 67.7-93.2% 2. NR 3. NR
26	Lee (2017) [54]	Ireland	1. Convenience sampling 2. Knowledge 3. Low	1. 683/100%/683 2. NR 3. NR 4. Students	1. The researcher made, 13 items 2. Self-report	1. 22-94% 2. NR 3. NR
27	Livingstone (2018) [55]	India	1. Convenience sampling 2. Practice 3. Low	1. 91/100%/91 2. NR 3. NR 4. Radiologists	1. The researcher made, NR items 2. Self-report	1. NR 2. NR 3. 13 (14.3%)
28	Lynskey Iii (2013) [56]	USA	1. Convenience sampling 2. Practice 3. Low	1. 3158/15.9%/504 2. NR 3. NR 4. Radiologists	1. The researcher made, eight items 2. Self-report	1. NR 2. NR 3. 94-99%
29	Macia-Suarez (2018) [57]	Spain	1. Convenience sampling 2. Knowledge 3. Low	1. 63/100%/63 2. NR 3. NR 4. Radiologists	1. The researcher made, 14 items 2. Self-report	1. 1 (2%) 2. NR 3. NR
30	Masoumi (2018) [58]	Iran	1. Census 2. Knowledge, atti- tudes, and practice 3. Low	1. 553/100%/553 2. NR 3. M 249 F 304 4. Radiologists	1. The researcher made, 63 items 2. Self-report	1. 326 (59%) 2. 428 (77.5) 3. 254 (46%)
31	Mutyabule (2002) [59]	Uganda	1. Census 2. Knowledge, practice 3. Low	1. 74/100%/62 2. 34 3. NR 4. Dentists	1. The researcher made, 33 items 2. Self-report	1. 25 (40%) 2. NR 3. 45 (74%)
32	Paolicchi (2016) [60]	Italy	1. Census 2. Knowledge 3. Low	1. 780/100%/780 2. NR 3. NR 4. Radiologists	1. The researcher made, 22 items 2. Self-report	1. 741 (95%) 2. NR 3. NR
33	Rahman (2018) [61]	India	1. Census 2. Knowledge, attitude, and practice 3. Low	1. 200/100%/200 2. NR 3. NR 4. Students	1. The researcher made, 12 items 2. Self-report	1. 168 (84%) 2. NR 3. 52 (26%)
34	Rahman (2008) [21]	Pakistan	1. Census 2. Knowledge and practice 3. Low	1. 34/82.3%/28 2. NR 3. NR 4. Cardiologists	1. The researcher made, NR items 2. Self-report	1. 22 (79%) 2. NR 3. 25 (92)
35	Sadigh (2014) [62]	USA	1. Census 2. Knowledge 3. Low	1. 532/32.5%/173 2. NR 3. M 104/F 69 4. Students	1. The researcher made, NR items 2. Self-report	1. 17 (10%) 2. NR 3. NR
36	Sethi (2019) [63]	USA	1. Census 2. Practices 3. Low	1. 214/74.2%/159 2. NR 3. NR 4. Radiologists	1. The researcher made, 19 items 2. Self-report	1. NR 2. NR 3. 155 (98.1%)
37	Shin (2013) [64]	South Korea	1. Convenience sampling 2. Practice 3. Low	1. 78/100%/78 2. 34.6 (5.97) 3. 78 4. HCWs	1. The researcher made, 42 items 2. Self-report	1. NR 2. NR 3. 48 (61.9%)

Table 1: (continued)

ID	Author (year)	Country	Study characteristics 1. Sampling method 2. Outcome 3. Risk of bias	Participants 1. Sample (sample/RR/ final sample) 2. Age (mean SD) 3. Gender (male/female) 4. Target population	Data collection 1. Instrument (type, items) 2. Method of data collection	Results 1. Knowledge 2. Attitude 3. Practice (N/%) or Means + SD
38	Vidovich (2015) [65]	USA	1. Census 2. Attitude 3. Low	1. 5432/19.9%/1084 2. NR 3. NR 4. Cardiologists	1. The researcher made, 38 items 2. Self-report	1. NR 2. Mean + SD (6 + 3) 3. NR
39	Whitney (2019) [66]	USA	1. Convenience sampling 2. Practices 3. Low	1. 623/100%/623 2. NR 3. M 323/F 300 4. Anaesthesiologists	1. The researcher made, NR items 2. Self-report	1. NR 2. NS 3. 3.299 (48%)
40	Yunus (2014) [67]	Malaysia	1. Convenience sampling 2. Knowledge 3. Low	1. 27/100%/27 2. NR 3. NR 4. Nurses	1. The researcher made, 16 items 2. Self-report	1. Mean (7.26) 2. NR 3. NR
41	Yurt (2014) [68]	Turkey	1. Convenience sampling 2. Knowledge 3. Low	1. 92/100%/92 2. NR 3. M 46/F 46 4. HCWs	1. The researcher made, 42 items 2. Self-report	1. 20 (21.6%) 2. NR 3. NR

Discussion

The present study was performed to investigate the KAP as well as clinical recommendations of HCWs regarding radiation protection. A total of 41 studies performed on 11,050 individuals were entered into the final stage. The instrument utilized in most studies was researcher-made. The HCWs are the most relevant people dealing with daily exposure to radiology procedures. Thus, following safety rules and protection against radiation are crucial in HCWs. Regarding the knowledge, the study results showed that generally, the participants had average knowledge about radiation protection. The level of knowledge was 2–95%. Among the HCWs, radiologists had greater knowledge about standard precautions, which can be due to greater familiarity has given that they receive more education due to the nature of their profession, experience of the type of studied population, sample size as well as previous knowledge among radiologists who have more awareness in this regard. No previous study was found examining the KAP of HCWs about radiation protection using a systematic review. Nevertheless, individual studies on the general population have shown that only 24.7% of the participants had adequate knowledge about radiation protection [24], which was in contrast to the present study. This can be due to the differences in the target population, studied

sample size, and examined country. Having proper knowledge about radiation protection is vital given its short-term and long-term complications [25]. The essential principles in proper knowledge are knowing the duration, distance, and use of suitable personal equipment [26, 27].

Regarding attitude, the study results showed that in most studies, more than 60% of participants had a positive attitude to radiation protection. Positive attitude Development about radiation protection leads to motivation for enhancing the knowledge; hence, more proper practice. Developing a positive attitude is time-consuming, and mostly occurs over the long run and based on experience [18]. Regarding performance, most studies revealed an average performance of HCWs concerning radiation protection. The average practice can be due to differences in the methodology, sample size, type of the target population studied, and the country where the studies had been performed. Indeed, a different approach may exist in any country for training HCWs regarding radiation protection. Further, the content of educational courses held in different countries can have a different impact on their performance. The basis for creating a proper knowledge, positive attitude, and thus, the right practice is the use of the same approach with a standard content regarding radiation protection among HCWs. Clinical guidelines prepared by the IRPA [28], and the International Society of Radiology (ISR) [29] are the best sources. Besides, the study

Table 2: Practical recommendations to improve nurses' knowledge, attitude and practice towards radiation protection among health care workers (HCWs).

[illegible]

showed that the best methods for increasing awareness, attitude, and performance of HCWs about radiology protection were as follows: including radiation protection topics in curricula (n=13), implementing periodic practical training courses in hospitals (n=12), and providing continuing education programs (n=11).

These recommendations highlight the importance of systematic and step-by-step attention to enhance HCWs awareness from the studentship period. The creation of a standard curriculum based on international standards, which is also regularly updated, is essential for the students' curriculum. Also, after the studentship period, at the beginning of working in hospitals, again internship and practical as well as theoretical courses as in-service training are necessary to establish a proper performance atmosphere for them. It is because improper performance leads to many complications for HCWs and patients as well as increased costs incurred to the healthcare system.

Limitations and strengths

The most important limitations were as follows. All included studies were cross-sectional; thus, special limitations of these studies when interpreting the results should be considered. Also, the instruments in different studies examined special parts of precautions; thus, it was not possible to examine their awareness, attitude, and performance given the type of precaution adopted. As well as instruments had been researcher-made. Hence, it was not possible to do a meta-analysis. In some studies, the KAP had been stated in a general form. Consequently, it was not possible to examine them in terms of occupation, and only English published studies were included.

Despite the above limitations, this study had some strength as well. To the best of the authors' knowledge, this is the first study performed in this area. Also, the standard systematic review approach and Cochrane guidelines have been used for conducting and reporting of the study. In this study, in addition to awareness, attitude, and performance of HCWs, clinical recommendations were also examined to improve KAP.

Conclusion

This systematic review indicted that HCWs have average knowledge, positive attitude, and average awareness towards radiation protection, respectively. This study

suggests the importance of using standard clinical guidelines and approaches to prepare educational curriculum, internship education in hospitals, and educational courses in hospitals. The findings of this study can be used as a suitable guideline for HCWs especially radiology staff and healthcare policymakers.

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