



## Systematic Review

## Workplace violence in medical radiation science: A systematic review

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## ARTICLE INFO

## Article history:

Received 18 August 2023

Received in revised form

7 December 2023

Accepted 27 December 2023

## Keywords:

Bullying

Harassment

Medical sonography

Nuclear medicine

Radiation therapy

Radiography

## ABSTRACT

**Introduction:** According to World Health Organization (WHO), workplace violence (WPV) is a significant issue in healthcare. However, no systematic review on WPV in medical radiation science (MRS) has been published yet. The purpose of this paper is to systematically review prevalence of WPV in MRS and its risk factors.

**Methods:** Electronic scholarly publication databases, namely EBSCOhost/Cumulative Index of Nursing and Allied Health Literature Ultimate, PubMed/Medline, ScienceDirect, Scopus, and Wiley Online Library were used for literature search to identify articles about WPV in MRS published over last 10 years as per preferred reporting items for systematic reviews and meta-analyses guidelines. To facilitate comparisons of the WPV prevalence and relative importance of individual risk factors across the included studies, their reported absolute figures of findings were used to synthesize respective percentages (if not stated). **Results:** Twelve papers met the selection criteria and were included. This review shows that the WPV prevalence were 69.2–100 % (whole career) and 46.1–83.0 % (last 12 months) in diagnostic radiography, 63.0–84.0 % (whole career) in radiation therapy, 57.6 % in medical sonography (last 12 months), and 46.8 % (last 6 months) in nuclear medicine. The identified WPV risk factors included intoxicated patients, staff stress, feeling of inadequacy resulting in self-protection, more vulnerable practitioners (female, <40 years old and <5-year experience), working in radiation therapy treatment room, emergency department, examination room, general radiography, public hospital, and non-examination and waiting areas, long patient waiting time, night shift, overcrowding environment, unable to meet patients'/family members' expectations, miscommunication, patient handling, inadequate staff and security measures, interaction with colleagues, and lone working.

**Conclusion:** The WPV risk in diagnostic radiography and radiation therapy appears extremely high as a result of the aforementioned risk factors. Nevertheless, these study findings should be used with caution due to potential non-response bias.

**Implications for practice:** A WPV policy should be developed in every clinical workplace. Even if such policy is available, its enforcement including policy awareness boosting, and encouraging incident reporting and support seeking will be essential for reducing WPV. More survey studies based on WHO WPV questionnaire should be conducted for strengthening evidence base.

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## Introduction

According to World Health Organization (WHO), workplace violence (WPV) is a significant issue in healthcare. WPV can be defined as healthcare workers being abused, assaulted or threatened in work-related events which include but are not limited to

travelling to and from workplace, and implicit or explicit conflict affecting their health, safety or wellness.<sup>1</sup> Common examples of WPV in healthcare include aggression, bullying, physical assault, sexual harassment, and verbal abuse and threats initiated by perpetrators such as patients, visitors and co-workers. Affected healthcare workers can experience from unnoticeable effects to fatality. Usually, these WPV incidents result in healthcare worker burnout, sleep disorder and stress, leading to reduction of their work performance as well as commitment and satisfaction. Hence, the WPV not only affects individual healthcare workers but also impacts on healthcare quality which in turn becomes academic,

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clinical, professional, ethical, societal, political and government concerns.<sup>1–5</sup>

As a result of its significance, a number of systematic reviews about the WPV in healthcare have been published.<sup>2–5</sup> According to an umbrella review of meta-analyses covering 674,266 healthcare workers published in 2022, overall WPV prevalence was 58.7 % and commonest incidents were verbal abuse and threats (66.8 %), physical assault (20.8 %) and sexual harassment (10.5 %), respectively.<sup>2</sup> These findings are consistent with those of a previous systematic review and meta-analysis covering 331,544 healthcare workers published in 2019 (overall prevalence: 61.9 %, verbal abuse: 57.6 %, physical violence: 24.4 %, and sexual harassment: 12.4 %). However, it also highlighted that different countries and professions had variations of the WPV prevalence.<sup>3</sup> Hence, there are some literature reviews focussed on specific countries or regions, e.g. Africa,<sup>6</sup> Italy,<sup>7</sup> South-East Asian and Western Pacific Regions,<sup>8</sup> etc. and professions such as emergency medical services (EMS),<sup>9</sup> nursing<sup>8</sup> and pharmacy.<sup>10</sup>

To the best of our knowledge, no systematic review on WPV in medical radiation science (MRS) has been published yet. However, MRS is an indispensable part of modern healthcare.<sup>11</sup> Medical radiation practitioners (MRPs) including diagnostic radiographers, nuclear medicine technologists (NMTs), medical sonographers and radiation therapists work in various clinical areas such as radiology, nuclear medicine, emergency and radiation oncology departments, intensive care units and operating theatres.<sup>12–23</sup> As per the previous systematic reviews in healthcare, various clinical settings would have different risk levels. Common high risk areas that are related to MRS practice include emergency department (ED), evening shift work, and waiting room.<sup>3–5</sup> Although International Labour Office (ILO)/International Council of Nurses (ICN)/WHO/Public Services International (PSI) framework guidelines have provided suggested strategies to reduce the WPV in healthcare,<sup>1</sup> without understanding of the WPV prevalence and risk factors in MRS, effective strategies for reducing the incidents of WPV in this profession could not be determined.<sup>2,3</sup> Hence, it is timely to conduct a systematic review on the WPV in MRS. The purpose of this systematic review is to explore the published papers to answer the question “What was the prevalence of WPV in MRS and its risk factors?”

## Methods

Preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines were used for conducting this systematic review on the WPV in MRS.<sup>24</sup> Several major processes, namely literature search, article selection, and data extraction and synthesis, were involved.<sup>11,25–27</sup>

### Literature search

The electronic scholarly publication databases, namely EBSCOhost/Cumulative Index of Nursing and Allied Health Literature (CINAHL) Ultimate, PubMed/Medline, ScienceDirect, Scopus, and Wiley Online Library, were used for literature search on 21st April 2023 to identify papers about the WPV in MRS published over the last 10 years. The search statement, (“Workplace Violence” OR “Bullying” OR “Harassment”) AND (“Radiographer” OR “Radiation Therapist” OR “Nuclear Medicine Technologist” OR “Sonographer”) was used. The publication year range was used for ensuring findings of this review relevant to current situation.<sup>4,5</sup> The search keywords were based on the review focus and the previous systematic reviews in healthcare.<sup>2,3</sup>

### Article selection

Two reviewers (KAS and KKN) independently selected the articles with any discrepancy resolved through discussion.<sup>3,5</sup> Only peer-reviewed original research papers written in English and focused on the WPV in any settings of MRS (against diagnostic radiographers, NMTs, medical sonographers and radiation therapists) were included. Grey literature, conference abstracts, editorials, review, perspective, opinion, commentary, and non-peer-reviewed articles were excluded. This is because well-developed methodological guidelines for appropriate selection of the grey literature were unavailable. Also, complete study information was not given in the conference abstracts. The editorials, review, perspective, opinion, and commentary papers only provided secondary information. Unsubstantiated information was presented in the non-peer-reviewed papers.<sup>11,25–27</sup>

The article selection process is shown in Fig. 1. After duplicate articles were removed from the results of the database search, article titles, abstracts and full texts were assessed against the selection criteria subsequently. Each non-duplicate paper within the search results was kept unless a decision on its removal could be made. Additional, relevant papers were identified by checking references lists of the included articles.<sup>11,25–27</sup>

### Data extraction

Two systematic and one scoping reviews on the WPV in healthcare were used to devise a data extraction form (Table 1).<sup>4,6,7</sup> The data, namely author name and country, publication year, MRS division (diagnostic radiography, medical sonography, nuclear medicine or radiation therapy), study purpose and design, sample size and characteristics, and key findings, were extracted from the included papers.

### Data synthesis

To facilitate comparisons of the WPV prevalence and relative importance of individual risk factors across the included studies, their reported absolute figures of findings were used to synthesize respective percentages (if not stated) as per the PRISMA guidelines.<sup>24</sup> Quality assessment tool for studies with diverse designs (QATSDD) was used to determine quality percentage of each article with <50 %, 50–70 % and >70 % representing low, moderate and high study quality, respectively.<sup>11,25,27,28</sup> The study quality percentages are presented in Table 1 as well.

## Results

Twelve papers which met the selection criteria were included in this review. Table 1 shows the characteristics of these studies.<sup>12–23</sup> All but one study investigated the prevalence of WPV with the use of questionnaire,<sup>12,13,15–23</sup> and the only exception focused on the risk factors of WPV determined through a qualitative approach (interview).<sup>14</sup> Nonetheless, the WPV risk factors were also covered in all survey studies except the one by Trad and Johnson.<sup>12,13,15–23</sup> The included studies were mainly about the WPV situations in Africa ( $n = 4$ ),<sup>13–15,18</sup> and North America ( $n = 4$ ).<sup>12,19,21,23</sup> A quarter of them focused on the United States of America (USA) situation.<sup>12,21,23</sup> Two thirds of the included studies were published from 2019, indicating an increase of researchers' attention to the WPV issue recently.<sup>12–16,18,20,23</sup> Also, two thirds of them focussed on diagnostic radiography<sup>12–15,17,18,20,22</sup> with the others about radiation therapy,<sup>19,21</sup> medical sonography,<sup>16</sup> and nuclear medicine,<sup>23</sup> reflecting the typical characteristics of MRS.

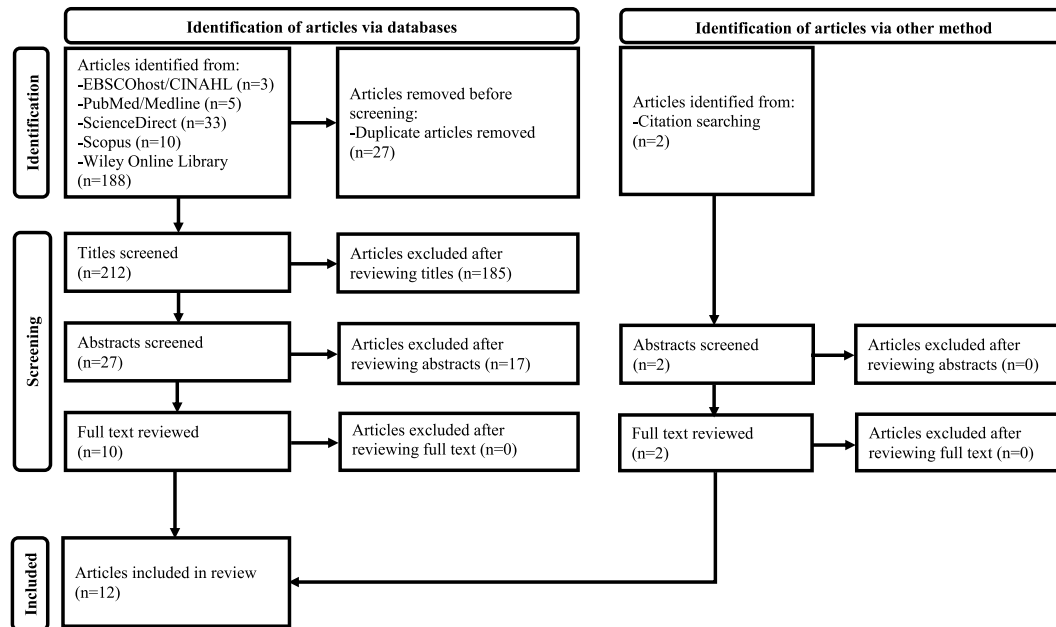


Figure 1. PRISMA flow diagram for systematic review of workplace violence in medical radiation science.

The overall WPV prevalence in diagnostic radiography was 69.2–100 % for radiographers' whole career<sup>12,15,18,20</sup> while it was 46.1–83.0 % for last 12 months.<sup>13,17,22</sup> For radiation therapy, 63.0–84.0 % of respondents experienced WPV in their career.<sup>19,21</sup> Similar prevalence percentages are noted in the medical sonography (57.6 % in last 12 months)<sup>16</sup> and nuclear medicine studies (46.8 % in last 6 months).<sup>23</sup> The prevalence of common WPV types were verbal abuse and threats (32.0–100 %),<sup>12,13,15–20,22,23</sup> sexual harassment (10.3–84.6 %),<sup>12,15,19,22</sup> and physical assault (3.0–51.0 %).<sup>12,13,15–19,22</sup> The WPV risk factors identified by the highest proportions of studies' participants included intoxicated patients (100 %),<sup>15</sup> staff stress (80.0 %), feeling of inadequacy resulting in self-protection (80.0 %),<sup>17</sup> more vulnerable MRPs (less than 40 years old [77.3 %]<sup>20</sup> and female [68.9 %]),<sup>23</sup> working in radiation therapy treatment room (68.0 %),<sup>19</sup> long patient waiting time (61.5 %),<sup>15</sup> working in ED (56.5 %), examination room (54.1 %), and general radiography (46.8 %),<sup>22</sup> less than 5-year work experience (46.4 %), night shift (43.6 %),<sup>20</sup> working in public hospital (39.4 %),<sup>16</sup> overcrowding environment (30.8 %),<sup>15</sup> working in non-examination and waiting area (23.9 %),<sup>22</sup> unable to meet patients'/family members' expectations (23.1 %),<sup>15</sup> miscommunication (21.0 %),<sup>22</sup> patient handling (14.0 %),<sup>18</sup> inadequate staff (14.0 %),<sup>22</sup> inadequate security measures (12.6 %),<sup>20</sup> interaction with colleagues (12.0 %),<sup>18</sup> and lone working (11.8 %).<sup>22</sup> Although the major focus of all included studies was the WPV prevalence and/or risk factors, some reported the WPV impacts such as more irritable (65.0 %), difficult to concentrate (63.0 %),<sup>21</sup> affecting patient care (57.3 %),<sup>23</sup> more forgetful (46.1 %),<sup>21</sup> anxiety and stress (26.4 %), work motivation reduction (25.2 %), lower energy level (21.0 %),<sup>22</sup> and decrease of self-worth (24.5 %),<sup>21</sup> and coping strategies, e.g., nothing (72.7 %),<sup>15</sup> experience sharing with colleagues and family members (27.3 %),<sup>15</sup> calming down perpetrators (19.1 %), seeking help from colleagues (13.6 %), self-defence (12.7 %), being angry (12.7 %), and legal action (9.1 %) as well.<sup>20</sup>

For the quality of included studies, all but two were at least moderate.<sup>12–23</sup> Excluding the qualitative study by Chinene et al.,<sup>14</sup> their sample sizes ranged between 13 and 870 with the median size of 100.<sup>12,13,15–23</sup> Also, a wide range of response rate, 1.9–100 % is noted.<sup>12,13,15,17–23</sup>

## Discussion

### WPV prevalence

To the best of our knowledge, this is the first systematic review on the WPV in MRS. When compared with the overall prevalence figures from the two systematic reviews on the WPV in healthcare published in 2022 (58.7 %)<sup>2</sup> and 2019 (61.9 %),<sup>3</sup> the WPV prevalence in diagnostic radiography (69.2–100 %) and radiation therapy (63.0–84.0 %) reported by the included studies seems concerning.<sup>12,15,18–21</sup> Although the WPV prevalence range for diagnostic radiography over the last 12 months (46.1–83.0 %) was lower and more comparable to those figures for healthcare in general, the WPV prevalence for diagnostic radiographers' whole career should not be ignored because the aforementioned systematic reviews combined the prevalence figures for the 12-month and whole career periods from individual studies to determine the overall WPV prevalence in healthcare.<sup>2,3,12,13,15,17,18,20,22</sup> Usually, the literature including ILO/ICN/WHO/PSI framework guidelines for addressing WPV in the health sector indicates that nurses encounter WPV more frequently than other healthcare professionals.<sup>1,3,5,8</sup> As per the ILO/ICN/WHO/PSI framework guidelines, both nurses and EMS responders are classified as extremely high risk professions with regard to the WPV.<sup>1</sup> However, Varghese et al.'s systematic review on the WPV in nursing which covered 13 countries with 42,222 participants published in 2022 showed that the overall prevalence was only 58 %,<sup>8</sup> matching the figures for the whole healthcare sector reported by Sahebi et al.<sup>2</sup> (58.7 %) and Liu et al. (61.9 %).<sup>3</sup> It is well known that nursing is the largest healthcare workforce.<sup>29–31</sup> Hence, the figures of WPV prevalence in healthcare would be more representative for this profession.<sup>2,3</sup> Nonetheless, the overall WPV prevalence in diagnostic radiography (69.2–100 %) and radiation therapy (63.0–84.0 %) appears more similar to the one reported in a systematic review on the WPV in EMS (57.0–93.0 %) published in 2020 which covered 104 articles.<sup>9</sup> Based on the ILO/ICN/WHO/PSI framework guidelines, the WPV risk in diagnostic radiography and radiation therapy should be considered extremely high.<sup>1</sup>

**Table 1**  
Characteristics of workplace violence (WPV) studies in medical radiation science (MRS).

Author, year and country	MRS division	Study purpose	Study design	Sample size and characteristics	Key findings	Quality
Beam et al. (2022)- United States of American (USA) <sup>12</sup>	Diagnostic radiography	Determination of prevalence of WPV	- Prospective - Cross-sectional - Questionnaire (unvalidated, not based on literature but with piloting)	- 193 out of 10,000 randomly selected radiographers in USA - Response rate: 1.9 %	- 69.2 % experienced WPV in their career - Prevalence of WPV types: verbal intimidation by patients (68 %) and physicians (60 %), insulted by visitors (56 %), sexual harassment by patients (55 %), and verbally intimidated by visitors (54 %), physical assault by patients (51 %), and threat by patients (47 %) - Risk factor: work environment (increased chance of insult by visitors in CT, adult ED and MRI)	High (71.4 %)
Chinene et al. (2022)- Zimbabwe <sup>13</sup>	Mainly diagnostic radiography but also covering medical sonography, nuclear medicine, and radiation therapy	Determination of risk factors of WPV	- Prospective - Cross-sectional - Questionnaire (unvalidated but based on established scale and literature with piloting)	- 100 out of 110 randomly selected radiographers of 3 central hospitals in Zimbabwe - Response rate: 91 %	- 83 % experienced WPV in last 12 months - Prevalence of WPV types: verbal abuse (81 %), sexual abuse (21 %), and physical abuse (4 %) - Risk factors (scale 1–5): poor working conditions leading to frustration ( $\bar{x}$ : 3.93), long patient waiting time ( $\bar{x}$ : 3.91), power imbalance ( $\bar{x}$ : 3.87), burnout/fatigue ( $\bar{x}$ : 3.79), narcissism ( $\bar{x}$ : 3.79), communication style difference ( $\bar{x}$ : 3.68), opinion difference ( $\bar{x}$ : 3.59), personal/family issues ( $\bar{x}$ : 3.57), inadequacy feeling leading to self-protection ( $\bar{x}$ : 3.42); poor workplace culture ( $\bar{x}$ : 3.38) and bias caused by culture/generation/gender difference ( $\bar{x}$ : 3.32)	Moderate (64.3 %)
Chinene et al. (2022)- Zimbabwe <sup>14</sup>	Diagnostic radiography	Determination of risk factors of WPV	- Prospective - Exploratory qualitative - Individual semi-structured interview (guide based on literature with piloting)	11 radiography managers purposively selected from 3 hospitals in Zimbabwe	Risk factors: work environment (lack of leadership trust, radiographers' burnout/fatigue and low salary), power hierarchy (feeling of superiority, inappropriate professional boundary crossing and inadequate radiographer representation in healthcare), and lack of reporting framework (protocol and culture)	High (76.2 %)
Hattingh et al. (2019)- Namibia <sup>15</sup>	Diagnostic radiography	Determination of prevalence of WPV and coping strategies	- Prospective - Cross-sectional - Questionnaire (unvalidated, not based on literature but with piloting)	13 out of 15 (all) night shift radiographers of 1 state radiology department in Namibia - Response rate: 86.7 %	- 100 % experienced WPV in their career - Prevalence of WPV types: verbal abuse (100 %) and threats (84.6 %), sexual harassment (84.6 %), and physical assault (46.2 %) - Risk factors: patients with intoxication (100 %), long patient waiting time (61.5 %), overcrowding environment (30.8 %) and unable to meet expectations of patients/ family members (23.1 %) - Coping strategies: Nothing (72.7 %), and experience sharing with colleagues and family members (27.3 %)	Low (42.9 %)
Lloyd–Jones et al. (2021)-Australia <sup>16</sup>	Medical sonography	Determination of prevalence of WPV	- Prospective - Cross-sectional - Questionnaire (unvalidated and without piloting but based on established questionnaire)	33 out of all Australasian Sonographers Association members	- 57.6 % experienced WPV in last 12 months - Prevalence of WPV types: verbal abuse (57.6 %), threatening behaviour (21.2 %), and physical violence (3 %) - Risk factors: work environment (public hospital) (39.4 %), >20-year experience (24.2 %), and 25–34 years old (15.2 %)	High (71.4 %)
Nyhsen et al. (2016)- United Kingdom <sup>17</sup>	Diagnostic radiography	Determination of prevalence of WPV	- Prospective - Cross-sectional	- 44 and 5 out of 51 general and 7 CT radiographers of 1	- 57 % experienced WPV initiated by junior doctors in last 12 months	Low (45.2 %)

(continued on next page)

Table 1 (continued)

Author, year and country	MRS division	Study purpose	Study design	Sample size and characteristics	Key findings	Quality
		initiated by junior doctors	- Questionnaire (unvalidated and without piloting but based on established questionnaire)	large acute hospital in United Kingdom, respectively - Response rate: 84.5 %	- Prevalence of WPV types: loud verbal abuse (57 %), verbal threat (51 %) and bullying (45 %), and physical threat (8 %) - Risk factors: stress (80 %) and inadequacy feeling leading to self-protection (80 %)	
Sethole et al. (2019)- South Africa <sup>18</sup>	Diagnostic radiography	Determination of prevalence of WPV	- Prospective - Cross-sectional - Questionnaire (unvalidated but based on established questionnaire with piloting)	- 37 of 65 (all) radiographers of 2 tertiary public hospitals in South Africa - Response rate: 57 %	- 73 % experienced WPV in the career - Prevalence of WPV types: verbal abuse (73 %), emotional abuse (46 %) and physical abuse (27 %) - Risk factors: patient handling for physical abuse (14 %), and interaction with co-workers for verbal (12 %) and emotional abuse (10 %)	Moderate (68.3 %)
Sperduti et al. (2018)- Canada <sup>19</sup>	Radiation therapy	Determination of prevalence of WPV, risk factors and impacts	- Prospective - Cross-sectional - Questionnaire (unvalidated but based on established questionnaire with piloting)	- 78 out of 165 (all) radiation therapists of 1 urban cancer centre in Canada - Response rate: 47 %	- 84 % experienced WPV in the career - Prevalence of WPV types: verbal abuse (76 %), harassment (59 %), verbal threat (32 %), and physical threatening (23 %) and assault (6 %) - Risk factors: work environment (treatment [68 %] and waiting areas [22 %]) - Impacts: anger, anxiety, depression, difficult to concentrate and sleep, fatigue, fear, flashback, frustration, headache, irritability, low self-esteem, nightmare, sadness, shame, and stress	High (76.2 %)
Tohidnia et al. (2019)- Iran <sup>20</sup>	Diagnostic radiography	Determination of prevalence of WPV and risk factors	- Prospective - Cross-sectional - Questionnaire (validated and based on established questionnaire with piloting)	- All (121) radiographers of 1 Iranian university's radiology department - Response rate: 100 %	- 72.7 % experienced WPV in the career - Common WPV type: verbal violence (77.3 %) - Risk factors: <40 years old (77.3 %), female (63.6 %), <5-year work experience (46.4 %), night shift (43.6 %), residents (42.7 %), overcrowding environment (21.0 %), inadequate security measures (12.6 %) and staff (11.7 %) - Coping strategies: calming down perpetrators (19.1 %), seeking help from colleagues (13.6 %), self-defence (12.7 %), being angry (12.7 %), legal action (9.1 %), and experience sharing with family (5.5 %)	Moderate (61.9 %)
Trad and Johnson (2014)-USA <sup>21</sup>	Radiation therapy	Determination of prevalence of WPV and impacts	- Prospective - Cross-sectional - Questionnaire (unvalidated but based on established questionnaire with piloting)	- 308 out of 665 radiation therapists of 48 radiation therapy centres in USA - Response rate: 46 %	- 63 % indicated WPV presented in current/previous centres - Impacts: more irritable (65.0 %), difficult to concentrate (63 %), more forgetful (46.1 %), and decrease of self-worth (24.5 %)	Moderate (66.7 %)
Tung et al. (2015)- Taiwan <sup>22</sup>	Mainly diagnostic radiography but also covering medical sonography, nuclear medicine, and radiation therapy	Determination of prevalence of WPV and risk factors	- Prospective - Cross-sectional - Questionnaire (unvalidated but based on established questionnaire and literature with piloting)	- 542 out of 4953 radiographers randomly selected in Taiwan - Response rate: 10.9 %	- 46.1 % experienced WPV in last 12 months - Prevalence of WPV types: verbal abuse (65.6 %), physical assault (21.8 %), and sexual harassment (10.3 %) - Risk factors: work environment (ED [56.5 %], examination room [54.1 %], general radiography [46.8 %], location other than examination room and waiting area [23.9 %], and waiting area [19.6 %]), long patient waiting time (21.6 %), miscommunication (21.0 %), influence of alcohol (19.7 %), lack of staff (14.0 %), and lone working (11.8 %) - Impacts: anxiety and stress (26.4 %), work motivation reduction (25.2 %), and lower energy level (21.0 %)	High (71.4 %)

Youngblood (2021)- USA <sup>23</sup>	Nuclear medicine	Determination of prevalence of WPV and risk factors, and awareness of WPV policy	<ul style="list-style-type: none"> <li>- Prospective</li> <li>- Cross-sectional</li> <li>- Questionnaire (unvalidated but based on established questionnaire with piloting)</li> </ul>	<ul style="list-style-type: none"> <li>- 870 out of 20,385 nuclear medicine technologists (NMTs) in USA</li> <li>- Response rate: 4.3 %</li> </ul>	<ul style="list-style-type: none"> <li>- 46.8 % experienced WPV in last 6 months</li> <li>- Prevalence of WPV types: ignorance (61.2 %), information withholding for affecting performance (57.2 %), highlighting mistakes/errors (57.0 %), rumour/gossip spreading (53.1 %), constant criticism (50.1 %), hostile response (47.1 %), insult (46.6 %), and loud verbal abuse (42.3 %)</li> <li>- Risk factors: female (68.9 %), position (NMTs more likely to experience WPV than other roles such as students [59.9 %]), and 36–45 years old (55.7 %)</li> <li>- Impacts: affecting patient care (57.3 %) and attention (39.6 %)</li> <li>- WPV policy awareness: NMTs (38.0 %) and students (25.0 %)</li> </ul>	High (76.2 %)
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CT, computed tomography; ED, emergency department; MRI, magnetic resonance imaging.

### Common WPV types

The most common WPV type noted in the included studies was verbal abuse and threats,<sup>12,13,15–20,22,23</sup> which is consistent with the findings from the systematics reviews in healthcare and nursing.<sup>2,3,8</sup> However, sexual harassment and physical assault were the second and third commonest WPV types in MRS.<sup>12,13,15–19,22</sup> In contrast, an opposite order of these two types is found in the whole healthcare and nursing sectors.<sup>2,3,8</sup> This could be attributed to lower awareness of sexual harassment of MRPs and perpetrators, resulting in more incidents in MRS.<sup>15</sup> Table 1 shows that four studies investigated the impacts of WPV on radiographers, NMTs and radiation therapists. All of them belong to psychological impacts,<sup>19,21–23</sup> and also match those stated in the systematic reviews on the WPV in healthcare, EMS, nursing and pharmacy because the verbal abuse and threats were the most common WPV type which could only cause the psychological impacts.<sup>3–10</sup>

According to a number of literature reviews on the WPV in healthcare and nursing, they highlighted that working in ED and with patients having mental health conditions were the major risk factors of WPV.<sup>3–8</sup> Although this review's findings reveal that working with intoxicated patients was the most important WPV risk factor in MRS,<sup>15</sup> ED is the major clinical area for managing these patients.<sup>32–34</sup> Also, mental health conditions are commonly associated with intoxication.<sup>33–35</sup> Hence, our findings of working with intoxicated patients as the most important WPV risk factor in MRS appear in line with the aforementioned literature reviews that working in ED and with patients having mental health conditions being the major risk factors.<sup>3–8</sup> Nonetheless, every WPV risk factor listed in Table 1 should not be ignored because the ILO/ICN/WHO/PSI indicated that the WPV has already spread from ED to all other areas of healthcare institutions. Also, all risk factors identified in this review are covered in their framework guidelines for addressing WPV in the health sector.<sup>1</sup>

### WPV coping strategies

For the WPV coping strategies, only two included studies investigated these.<sup>15,20</sup> The most common coping strategy was doing nothing which is concerning.<sup>15</sup> However, several systematic reviews on the WPV in healthcare, nursing and EMS showed that not reporting WPV incidents was common.<sup>6,8,9</sup> This could be attributed to the general perception of healthcare professionals that the WPV is an inherent element of healthcare and such incident reporting can imply their lack of competence in delivering patient care and performing routine duties.<sup>9</sup> Such phenomenon is also consistent with the findings of Youngblood's study that only about one third of their NMTs aware of existence of WPV policy in the clinical workplace.<sup>23</sup> Similarly, less than 30 % of participants of Hattingh et al.'s<sup>15</sup> and Tohidnia et al.'s<sup>20</sup> studies were able to apply appropriate strategies such as experience sharing with colleagues and family members, calming down perpetrators, seeking help from colleagues, self-defence, and legal action for coping with the WPV in MRS.<sup>1</sup>

As per the ILO/ICN/WHO/PSI framework guidelines for addressing WPV in the health sector, a range of strategies could be applied for addressing the WPV risk factors identified in this review as follows<sup>1</sup>:

1. Intoxicated patients, working in radiation therapy treatment room, ED, examination room, general radiography, public hospital, non-examination and waiting areas, patient handling, and inadequate security measures: Provision of security services at departments' main entrances, multiple area accesses for staff but limiting public access and separate area for managing

mentally unstable patients, and installation of video surveillance and alarm systems.

2. Staff stress and feeling of inadequacy resulting in self-protection: Avoidance of staff overload, provision of support workers, sufficient rest period, time for problem solving, experience sharing and consultation, recreational area, quiet space, flexible work arrangement and regular work time schedule if feasible.
3. Long patient waiting time, overcrowding environment, unable to meet patients'/family members' expectations and miscommunication: Improvement of patient flow and appointment scheduling, and timely information and comfortable waiting area provided to patients and their families (e.g., television, newspapers, magazines, healthcare service brochures, toys, etc.).
4. More vulnerable MRPs (female, <40-year-old and <5-year experience), night shift, inadequate staff and lone working: Provision of training for coping with WPV and arrangement for team working.
5. Interaction with colleagues: Development of person-centred workplace culture focussing on cooperation, dignity, equal opportunity, non-discrimination, safety and tolerance.

Nevertheless, the most important measure for addressing the WPV issue in MRS should be development and implementation of the WPV policy in the workplace which includes increasing the MRPs awareness of such policy and conducting regular WPV survey with them.<sup>1,36</sup> Table 1 reveals that all but one study used the questionnaire as the data collection tool which is in line with the ILO/ICN/WHO/PSI recommendation because many WPV incidents might not be reported and recorded, making incident report review become less reliable data collection approach.<sup>1,6,8,9,12,13,15–23</sup> It is noted that some included studies had less representative sample sizes (e.g., 13, etc.) and response rates (such as 1.9 %), indicating potential non-response bias and study quality issue.<sup>12,15,37</sup> However, the study quality of all but two were at least moderate.<sup>12–23</sup> Besides, the included studies had a large variation of survey designs such as the WPV reporting periods (whole career, last 12 or 6 months).<sup>12,13,15–23</sup> Nonetheless, according to the ILO/ICN/WHO/PSI WPV in the health sector country case studies research instruments–survey questionnaire, the preferable reporting period should be 12 months,<sup>38</sup> consistent with their recommendation of conducting regular WPV survey.<sup>1</sup>

There are several limitations in this systematic review. Only English articles were included. This might affect its comprehensiveness. For example, no study from non-English European, South-East Asian and South American countries was covered in this review. Furthermore, two thirds of the included studies were about Africa<sup>13–15,18</sup> and North America.<sup>12,19,21,23</sup> Besides, only articles published over the last 10 years were selected but this could ensure our findings more relevant to current clinical practice.<sup>39</sup> It is also noted that no included study was about WPV in academic setting of MRS.<sup>12–23</sup> Hence, our findings should be used with caution although this is the first systematic review on the WPV in MRS.

## Conclusion

As per the findings of the included studies, the WPV risk in diagnostic radiography and radiation therapy appears extremely high. Nevertheless, their findings should be used with caution due to the potential non-response bias. Hence, more studies based on the ILO/ICN/WHO/PSI WPV in the health sector country case studies research instruments–survey questionnaire should be conducted in all countries where there is limited WPV research for strengthening the evidence base in the future. Also, a WPV policy should be

developed in every clinical workplace. Even if such policy is available, its enforcement including policy awareness boosting, and encouraging incident reporting and support seeking will be essential for reducing the WPV in MRS.

## Conflict of interest statement

None.

## Acknowledgement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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