

# A literature review of healthcare workers compliance to, and knowledge of standard/universal precautions

## Abstract

**Introduction:** The Operating Room (OR) is considered one of the high-risk areas in hospital that encounter high rate of infection and mortality. Thus, Healthcare workers (HCW) Compliance and level of knowledge toward mechanisms to reduce this risk, Universal/Standard precautions (UP/SP), are significant and have a direct impact on the patient and HCW safety.

**Objective:** This work reviews the compliance rate of HCW and their level of knowledge toward UP/SP through research conducted in order to evaluate and measure HCW compliance and knowledge. It will hopefully improve the level of patient care provided and raise the HCW awareness toward UP/SP.

**Methodology:** A literature review was conducted using Cinahl, PubMed and Medline; 10 articles were used to identify the aspect and to answer the search question.

**Results:** Low rate of compliance and level of knowledge was the main outcome found and factors lead to this low rate is identified and discussed through the literature.

**Conclusion:** Health organisation must improve the level of knowledge and awareness of HCW in order to raise the HCW compliance rate. UP/SP guidelines should be followed to achieve the required patient care provided and decrease the infection and mortality rate in OR.

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**Abbreviations:** HCW, healthcare workers; UP/SP, universal/standard precautions; SP, standard precaution; CDC, center for disease control; SSI, surgical site infection; SCPE, standards of conduct, performance and ethics; HCPC, health and care professions council; ACORN, Australian college of operating room nurses; SPSS, software analysis package; WHO, world health organization

## Introduction

The discovery of microorganisms and disease transmission mechanisms highlighted the need for infection control.<sup>1</sup> Scientists have found that one of the causes of infection during operations is the patient's endogenous flora<sup>1,2</sup> as the natural barrier, the skin, is breached through incisions. However, other external factors were also found to be causing infection, because prior to the introduction of precautions, operations were frequently performed in fields crowded with people and unnecessary equipment.<sup>3</sup> This practice raised the risk of infection, leading to longer hospital stays and increasing the mortality rate.<sup>1</sup> This practice was continued until Semmelweis and Lister introduced antiseptics and sterile techniques; however, antiseptics and sterile techniques were not generally accepted and practiced until World War I.<sup>4</sup>

Healthcare workers (HCWs) play a significant role in patient safety. Thus, in response to the increased infection rate, the Center for Disease Control (CDC) introduced several precautions to be followed to prevent/reduce the infection rate.<sup>5</sup> In 1985, the CDC introduced Universal Precaution (UP), which stipulated guidelines to guarding

against blood-borne pathogens.<sup>6</sup> Later, Standard Precaution (SP) guidelines were introduced; these are methods that combine the UP guidelines concerning blood-borne pathogens with the guidelines that cover all body substances that might cause infection.<sup>7</sup> Precautions should be applied regardless of patient status (i.e., whether the patient is known to have an infection or not). The CDC guidelines are recommended to be followed and practiced by all HCWs in areas where direct contact with patients is required, thereby implementing patient safety requirements, especially in high-risk areas, such as the operating room (OR), while also protecting the HCW.<sup>7,8</sup>

The CDC guidelines impose several requirements on HCWs in order to reduce potential risks of infection and to improve the level of care provided; they include the use of protective tools, such as facemasks, eye shields and gloves.<sup>9,10</sup> The idea of wearing masks in the OR is first to protect the patients, by reducing the rate of air contamination from the HCWs, and second to protect the HCWs from blood or fluid splash during surgical operations.<sup>11</sup> Gloves are essential, and are recommended to be worn whenever direct contact with patients is required. In the OR gloves are of two types; unsterile for any contact with patients, and sterile as are required when establishing a sterile field.<sup>12</sup> The benefits of using gloves are to protect the patients from the transmission of microorganisms from the HCW's hand and arm, and to protect the HCWs from cross-infection from the patients.<sup>13</sup> However, in the OR of the author's department, it is still commonplace to debate whether double gloving should be worn for all procedures, or only with infected cases. Eye shields are used to protect the eyes of HCWs from splash.<sup>11</sup>

Despite the facts that guidelines have been in existence for a long time, and they have significant impact on the health of both patients and HCWs, the term UP and SP are still misunderstood and misinterpreted as a result. Nevertheless, surgical site infection (SSI) is still one of the reasons for the high mortality rate associated with surgery.<sup>14</sup>

From the author's experience in OR it is still common that many HCWs are not aware of the CDC guidelines, and argue about the effectiveness of practicing UP/SP recommendations. This should be considered poor practice because according to the standards of conduct, performance and ethics (SCPE) of the Health and Care Professions Council,<sup>15</sup> part of the healthcare professional practitioner's duty is to review and to be aware of any guidelines in place in order to update their knowledge and thus improve his/her practice.

Some incidents occurred in the OR where the author's works that can be attributed to not following the appropriate recommended guidelines. These incidents included an increased rate of infected patients coming to the OR, and especially an increased rate of infection in postoperative patients, an increased rate of disease transmission recorded in the hospital, and continuous incidents of cross-infection to HCWs. Moreover, a continuous argument among staff, surgeons and the anaesthetists concerning the usage of protective tools is common in the OR where the author works. These reasons motivated the author to conduct this literature review as the author felt an obligation, as part of the healthcare team, to increase patient safety and improve the quality of care provided through the benefits to be derived from this literature.

The objective of this literature review is to collect evidence based practice through exploring studies that were conducted to clarify and evaluate HCWs' compliance, and to measure the level of awareness and knowledge with regard to UP/SP in the OR. This review attempts to identify methods that would raise HCWs' knowledge and awareness, and result in effective recommendations in order to improve practice and knowledge, and thereby raise the level of safety for both patients and staff.

## Methodology

This review will focus on primary research conducted with regard to HCWs' compliance and the level of knowledge about UP/SP. A literature review was chosen because it is a simple way to use available evidence-based practice;<sup>16</sup> furthermore, because the author will use published reviews related to a particular subject, this does not require approval from a research ethics committee,<sup>16</sup> which could take a long time.

A literature review is a broad method for studying and understanding the literature connected to a specific subject.<sup>16</sup> Aveyard also<sup>16</sup> declares that researching and analysing related literature is an appropriate method for finding the answer to a research question.

This literature, according to Aveyard,<sup>16</sup> is classified as policy literature because it discusses the policies and guidelines that practitioners should follow combined with research literature because it includes the method used, results and discussion to answer a defined research question. Wallace & Wray<sup>17</sup> state that it is useful to identify the classification of literature in a review in order to clarify what the author is hoping to achieve.

Cardiff University Resources for Operating Department Practice were used to search for articles for this review. The databases searched

for relevant articles were CINAHL, PubMed and Medline via Ovid. The inclusion criteria were cross-sectional surveys, descriptive surveys, and descriptive correlation and self-developed questionnaires that focus on HCWs' compliance and knowledge. Crombie<sup>18</sup> mentioned that aiming to obtain evidence from surveys is principally weak because surveys are beneficial for revealing current practice, but do not apply if the purpose is discovering the reason behind a particular practice. However, most of the studies found that evaluated HCWs' compliance, and measured their awareness and knowledge, were surveys. Reports and review articles were excluded, because, as Brown<sup>19</sup> comments, it is better to use an original study for evidence-based practice than a secondary study that might have an unreliable bias. Books are also referred to for additional information. Parahoo<sup>20</sup> states that inclusion and exclusion criteria should be addressed in order to have a better appreciation of the scope of a literature review.

The search limitations specified articles published in the last decade, so as to get information on up-to-date evidence-based practice; articles were to be in the English language, as translation takes more time than was available, given the review deadline; while only studies on humans were appropriate, because all HCWs are humans.

The key terms used included "compliance", "awareness", and "knowledge", because the review objective was to estimate the compliance and knowledge of HCWs toward UP/SP. "Standard precautions", "standard precaution", "precautions" "universal precaution" and "universal precautions" were used because the literature evaluation was to be based around these terms. "Scrub nurses", "scrub nurse", "nurses", "staff" and "healthcare workers" were used because these are the factors the evaluation measurement hinges on. To link the literature with the author's experience, "operating theatre" and "operating room" were employed. The US spelling of "theater" was used because the UK spelling did not give any results. Moreover, "evidence-based practice", "survey", and "surgical site infection" were used to provide an expanded search. According to MacNaughton & Hughes,<sup>21</sup> the key terms must be chosen on the basis of two factors: first, the terms must be fundamental to the research topic; and second, they must be in general use by professionals working in the research context.

The search strategy was conducted in two stages in order to find studies for each theme covered in this literature. Different keywords were used in each stage, and a third phase was also conducted in the Cinahl and Medline database to expand the search, and to cover any similar studies presented.

Cinahl is a wide database offering several choices for searching; in addition to articles from journals, it includes those from dissertations and books, which are difficult to find in other databases.<sup>22</sup> PubMed is a search tool used to access literature citations and full-text articles from contributing journals.<sup>23</sup> Medline is one of the broadest databases that covers medicine and health studies and is available to be accessed from anywhere and at any time.<sup>24</sup> In addition, Medline provides free access online, and it can also be accessed via PubMed.<sup>24</sup>

Cinahl was searched in three stages; for the first theme using the keywords "Compliance", "scrub nurses" and "standard precautions". Keywords were combined by using "add" and resulted in 4 hits. After careful reading the titles and abstracts, three relevant articles were chosen for the first theme. The last one was excluded, because it was inappropriate to the review. The second stage of this search was conducted to search for articles on the second theme. Keywords used were "Awareness", "health care workers", and "universal precaution".

These words were used to conduct a broad search and find as many results as possible. The result was only one article, and after reading the abstract and scanning the article it was found to be suitable and was selected for inclusion in the review. The third search on Cinahl was conducted to provide wider results for the second theme, and the year limitation was also changed to (2002-2013), in order to give more results. Keywords used were “universal precautions”, “knowledge”, “compliance” and “nurses” and the result was eleven hits, but of these only one was found to be relevant.

PubMed was also searched for both themes. For the first theme, keywords were “compliance”, “scrub nurse”, “universal precaution” and “survey”. Limitation criteria were as before, and four results were obtained. Two of these results were the same as the one chosen from the search in the Cinahl database, and the other two were scanned and found relevant and were included in the review. The second search, with different keywords, was used to provide greater depth to the search after finding similar articles in both PubMed and Cinahl. PubMed was searched using the keywords “operating theater”, “evidence based practice”, “surgical site infection”. This search revealed six articles, but only one was selected and the others were considered irrelevant.

The Medline database was searched in three searches to find relevant articles; using the keywords “knowledge”, “staff”, “operating room”, and “precautions”. After combining keywords with “and”, the results brought three hits, but only one was relevant, a second was already chosen, and the third was not suitable. “Health care workers”, “nurses”, “standard precautions”, and “universal precautions” were then used as keywords to search for more articles in the Medline database, and resulted in seven hits, two of which were already chosen, and the rest unrelated. The third search on Medline included the keywords “healthcare workers”, “compliance” and “universal precautions”. This resulted in nine hits, from which one article was selected, the rest being considered not applicable to this review.

From all the databases the search generated ten relevant hits for this literature review see (Appendix 1).

Mixed critique tools were used to conduct a deeper analysis of the subject. The ten articles were critiqued based on a number of available critique tools, such as the STROBE<sup>25</sup> checklist for cross-sectional studies and Ingham-Broomfield’s<sup>26</sup> critique tool, “A nurses’ guide to the critical reading of research”. Several books that discuss methods for critiquing surveys were also used to offer guidance in using these tools, such as, Aveyard,<sup>16</sup> Crombie,<sup>18</sup> Parahoo,<sup>20</sup> and Polit & Beck.<sup>24</sup>

## Literature review

The compliance of HCWs in OR with UP/SP is significant for patient safety and quality of care. Studies suggest a compliance rate of less than 100% among HCWs, and several studies around the world have examined this issue. This literature review will discuss two themes. The first theme aims to reveal HCWs’ compliance rate through seven articles that studied this aspect in different countries. The second theme concerns the education level of HCWs; for this theme only three articles are considered as relatively few studies have evaluated this aspect compared to studies undertaken to evaluate staff compliance. Some of the studies had combined evaluating HCWs compliance and measuring their level of knowledge in their aim; this will be acknowledged during the discussion.

## Compliance

Seven articles on this theme are included. Three articles comprise a cross-sectional survey evaluating HCW compliance rates vis-à-vis UP/SP,<sup>27-29</sup> while the other four studies are mixed designs.<sup>30-33</sup> Cutter and Jordan conducted two studies in the area of HCWs compliance toward UP/SP, which makes their outcomes more convincing and trustworthy, as multiple studies by authors in the same area gives them greater expertise in the field.

**Ethical approval:** Ethical approval from relevant committees was obtained for all studies.<sup>21,24,28,30-33</sup> Ethical considerations are essential to the validity and variability of any study.<sup>34</sup> Obtaining informed consent from participants is not required with this design, because using a questionnaire is considered less intrusive in a participant’s life, and because anonymity can be assured with questionnaires.<sup>20</sup> However, if codes are used for participants in a questionnaire study, as in Cutter and Jordan’s<sup>27</sup> survey, the codes should be stored in a different computer to ensure the confidentiality of the participants, and should be destroyed at the end of the study, or soon afterwards.

Cutter & Jordan<sup>29</sup> included quotations of exactly what the participants said during the interviews conducted for their study, but maintained the confidentiality of participants, which is beneficial, because recorded interviews help to raise the reliability and validity of the study.<sup>35</sup>

**Study design:** The research design refers to the framework chosen for the collection and analysis of study data, and this includes detecting the links between variables.<sup>36</sup> A cross-sectional survey is the best design to follow if the aim is to evaluate current nurses’ practice.<sup>37</sup> According to Freeman and,<sup>38</sup> a cross-sectional survey is an easy research method to implement, and is useful for hypothesis generation. Therefore, the choice of cross-sectional design in the studies<sup>27-29</sup> is appropriate because all the studies were aiming to evaluate the HCWs’ practice, i.e. their compliance.

Overall, the authors of the three articles accomplished what is required of a good cross-sectional study. Clearly written and easily read, they made advantageous use of tables and diagrams to help present some significant details of their studies. Although they may have missed some points, which could reflect a weakness in their research, or may be due to limitations imposed in getting the articles published.

The other four articles evaluate the issue via a mixed study design: Osborne<sup>30</sup> conducted a descriptive correlation study, Demir<sup>31</sup> performed a prospective, cross-sectional descriptive survey, Nagao et al.,<sup>32</sup> conducted a retrospective review followed by a questionnaire survey, and Hosoglu et al.,<sup>33</sup> performed their study using an analytic, cross-sectional survey. The advantage of using a mixed design is that it provides a better chance of encompassing the full scope of the study, and the data collected are far richer, as there are fewer limitations.<sup>39</sup> Mixed designs are also beneficial for the study because if any one of the methods has a weakness in any area, it can be addressed through the strengths of the other study methods employed.

A descriptive design is useful for defining an issue, although not its cause, while survey research is the best method for detecting a population’s characteristics, such as views and performances, which makes it a method commonly used in the research of health professionals.<sup>40</sup> A disadvantage of a prospective study is that a large

sample size is needed in order to be able to analyse the data,<sup>41</sup> although using a mixed method addresses this weakness. This was the case in the Demir<sup>31</sup> survey, where the author had conducted a prospective, cross-sectional, descriptive survey, and by this mixed method Demir<sup>31</sup> was able to cover the weakness of the prospective study, which is the need for a large sample, through the strength associated with a cross-sectional study where a large number of participants can be included.<sup>35</sup>

Macnee et al.,<sup>42</sup> stated that a descriptive correlational design can be used to determine the relationships between variables as precisely as possible. It is a suitable design for this type of study, since descriptive studies are good for eliciting current behaviours, and the author's aim was to discover the staff's present compliance with UP/SP, although with correlational studies, there is a risk to the study validity from unknown variables.<sup>43</sup>

In Osborne's<sup>30</sup> study, the author used a health belief model (HBM) as a theoretical framework to obtain logical results as variables having significant effects on healthcare provider's behaviours. According to,<sup>36</sup> it is good to include a theoretical framework within a study because it offers a rationale for the research conducted, and this allows the results to be interpreted.

**Study sample:** The participant recruitment process, including the inclusion and exclusion criteria, is significant and should decrease the risk of study bias.<sup>44</sup> A cross-sectional recruitment method is usually easier because it involves a single data collection phase, and does not need a follow-up commitment.<sup>45</sup> This is probably the reason why the majority of the studies conducted to evaluate UP/SP are cross-sectional surveys.

Most of the studies include HCWs from different departments, including OR nurses and surgeons, in order to paint the most representative picture possible. However, in Jeong et al.,<sup>28</sup> study, recruitment was limited to OR nurses only, because the authors state that they work in a high-risk environment and are the ones most influenced by UP/SP compliance. However, the way of choosing participants was not made clear in the article by Jeong et al.,<sup>28</sup> nor was it stated whether there were any refusals, and this could affect the validity and reliability of the study. According to Parahoo,<sup>20</sup> when a study has unclear sample frame, like that of Jeong et al.,<sup>28</sup> it makes it hard to say that the study has a representative sample, making it difficult to generalize from the study outcomes.

In contrast in Cutter & Jordan's<sup>27</sup> study, participant selection is discussed very clearly and in detail, together with the inclusion and exclusion criteria that were followed. This was also the case with Cutter & Jordan<sup>29</sup> study sample. In cutter & Jordan<sup>27</sup> the study included only one hospital, however, in their 2012 study they expanded the study to include six hospitals. However, both studies excluded HCWs who did not perform exposure prone procedures, but the authors referred this exclusion to the unique nature of the other specialities, which could affect the generalisation of the findings.

The participants in Osborne's<sup>30</sup> study were chosen using a stratified random sampling method. This method is useful when comparing a population's individuals in order to generalize the study outcomes.<sup>46</sup> Although randomization is essential to maintain the rigour of a study and to minimize bias,<sup>47</sup> the stratified random method has the disadvantage that the study can end with a distorted representation of the population involved, as participants may be equal in the sample, but not in the population. Osborne<sup>30</sup> study sample was limited to OR nurses registered with Australian College of Operating Room Nurses (ACORN). The author does not mention how the sample was chosen to meet the population criteria, but does state that this

limitation on the sample was because ACORN is a professional organization representing OR nurses in Australia, which would limit the generalization of the study to all OR nurses in Australia, however, the author also recommended that future studies should include all OR nurses.

Demir's<sup>31</sup> study sample included 24 OR charge nurses from eleven public hospitals in Turkey. Private hospitals were excluded. However, Demir<sup>31</sup> did not mention the reason behind this exclusion and nor the limitation to charge nurses, which affects the generalisation of the study outcome.<sup>48</sup>

Hosoglu et al.,<sup>33</sup> study sample included multidisciplinary HCWs in thirty hospitals. However, the authors limited their participants to dayshift workers. Parahoo<sup>20</sup> mentioned that researchers might include smaller number of participants in order to collect more data in depth and because of the increased cost of large population; however, Hosoglu et al.,<sup>33</sup> have not explained the reason behind limiting their study to dayshift workers.

Nagao et al.,<sup>32</sup> study sample included only surgeons and scrub nurses after a retrospective review of the hospital injury record, however, the authors acknowledged this limitation and recommended further studies to include multidisciplinary HCWs.

**Data collection:** A research method is a way of collecting data by using one or more instruments, such as a self-completion questionnaire or structured interviews etc.<sup>49</sup> According to Hicks,<sup>50</sup> a good questionnaire has to reflect the aims of the study, and researchers must avoid questions that foster their own beliefs. Terry<sup>51</sup> states that a mixed questionnaire method is beneficial and will raise the response rate, as participants usually answer closed questions rapidly, and skip open questions for various reasons, such as being too time-consuming or being confused over the questions' goals. A self-administered questionnaire is an easy way to collect data and to get truthful answers to research questions from participants.<sup>52</sup> If the data collection time is short, a cross-sectional design is the best fit, according to Jackson.<sup>53</sup>

Using a self-reporting method affects study results because staff usually overestimates their performance/practice, as compared with results when staff are observed.<sup>54</sup> Osborne<sup>30</sup> acknowledges this as a limitation factor in generalising their outcomes.

Questionnaire in all studies included several closed questions. However, Demir,<sup>31</sup> Cutter & Jordan,<sup>29</sup> and Cutter & Jordan<sup>27</sup> included also limited open questions. Having a limited number of open questions is beneficial for a study, as Parahoo<sup>20</sup> explains that open questions are usually skipped by participants, because of the extra time taken to answer them, which eventually leads to a low answer rate, and affects the generalisation of the study findings.

A postal questionnaire was used in the surveys of Osborne,<sup>30</sup> Cutter & Jordan<sup>27</sup> and Nagao et al.<sup>32</sup> The data collection in Nagao et al.,<sup>32</sup> was divided into two parts; the first part was a retrospective review of the recorded exposure injuries in the OR in the targeted hospital. Nagao et al.,<sup>32</sup> mention that the hospital involved in the study encourages all HCWs to report any incidents that occur and this is the reason why the authors included the retrospective. The second part was a questionnaire about the last 12 months, and this method had the weakness that memories could not be entirely accurate, which might affect the data. The disadvantage of performing a retrospective review, i.e. a secondary analysis, is that the confidentiality of the individuals in the medical records might be exposed,<sup>55</sup> but Nagao et al.,<sup>32</sup> had obtained a consent form and followed the human experimentation guidelines, which eliminated this disadvantage.

Data collection in all studies was through questionnaires, except for Demir's<sup>31</sup> survey, which used face-to-face interviews and in Cutter & Jordan's<sup>29</sup> study researchers used face-to-face interviews in addition to a questionnaire. Face-to-face interviews, in Demir,<sup>23</sup> have a disadvantage in that the interviewer's presence can affect the answers given, as participants tend to omit bad practices.<sup>20</sup> However, the author did discuss this disadvantage of the interviews, and admits that it is considered a limitation of the study, and that it could affect the validity of the data. However, Korn & Graubard<sup>56</sup> state that this kind of interview helps ensure the accuracy of the data collected as it provides an opportunity to have direct contact with participants, and this can increase the rate of data collection because researchers can explain their research objectives, and this motivate people to become involved, thereby increasing the study's validity and reliability.

A questionnaire was distributed by the head nurses of the OR In Jeong et al.,<sup>28</sup> study while Infection control workers distributed the questionnaire in Hosoglu et al.,<sup>33</sup> study. Questionnaire distribution influences the quality of response and the rate of the data collection. Direct questionnaire distribution is more efficient at increasing the response rate than a mail questionnaire, because a large number of participants can be reached in a direct way, while some people tend not to respond to a mail questionnaire simply because it did not capture their interest.<sup>57</sup>

The questionnaire focused on the main influencing factors, and was piloted on members not included in the study. To increase a study's validity and reliability, researchers may use a pilot test, and then revise their questionnaire before distribution. This will strengthen a study, because, as Polgar & Thomas<sup>58</sup> state, a pilot test is an inexpensive way to classify and reduce potential barriers for an extensive study.

Amendments to a questionnaire are often made after a pilot test with the purpose of collecting the best quality data and to enhance validity. This procedure is also essential for a study to ensure that the study questions are answered, and thus achieve the study objectives.<sup>41</sup> In Osborne's<sup>30</sup> study, amendments to the questionnaire are explained well and the author uses Cronbach's alpha coefficient method to test the questionnaire. This test was also performed in Cutter & Jordan's,<sup>29</sup> which is beneficial because it makes the research more transparent.<sup>35</sup> Furthermore, this method is useful for increasing the reliability and validity of a questionnaire.<sup>57</sup>

According to Bryman<sup>36</sup> the response rate was noticeably unacceptable for two studies: for Osborne<sup>30</sup> it was 45%, and for Hosoglu et al.,<sup>33</sup> 40.7%. A low rate can affect the validity of a study, while an increase in the response rate will definitely positively affect the findings. However, Parahoo<sup>20</sup> states that, when using a questionnaire, it is likely that there will be a low response rate as its context may not suit all participants; besides, that some population may refuse to be involved in a study, and this rejection may be due to not having enough time, or even having difficulty in understanding the questions. A four-week time limit was set for participants to complete the questionnaire in the Osborne<sup>30</sup> survey, and although the response rate was low, there was no follow up, which could have explained whether the low response rate was because of the limited time, or because participants refused to be involved in the survey.

In Cutter & Jordan's<sup>29</sup> study, the questionnaire form was resent twice, to non-responders, which increased the response rate from 27.28% to 51.47% after the third attempt. The resending process is beneficial for studies as it increases response rates, which eventually will increase the chance of generalising the study outcome and is useful in improving the data quality of a study.<sup>59</sup> Moreover, Bowling<sup>35</sup>

states that the response rate to a survey questionnaire is higher when researchers resend the questionnaire form rather than just sending a reminder, as knowing that their involvement does matter will motivate participants to respond.

**Data analysis:** All the studies used a well-known computer software analysis package (SPSS) to analyse their data. A few studies also raised the validity of their data analysis by using an additional analysis process. In Cutter & Jordan's<sup>27</sup> study, the authors conducted content analysis on answers to their open question.

**Findings:** All the studies discussed the issue and answered the question posed.<sup>27-33</sup> The study results were presented as recommended by Crombie,<sup>18</sup> the authors illustrating findings with tables and graphs, and their discussion section was explained properly.

The generalization of study outcomes is influenced by the sample size used in the study.<sup>50</sup> With regard to generalization, the fact that study findings may only be generalized to the population included in the study sample is a factor authors have to consider.<sup>36</sup> In Osborne's<sup>30</sup> study, its generalization may be limited to members registered with ACORN. The outcome of the study by Jeong et al.,<sup>28</sup> is questionable, because the study sample was limited to hospitals with 500 hundred or more beds in only one region of South Korea. However, there are a number of potential errors that are frequently raised in relation to surveys, such as the fact that it is hard to end up with a representative sample in a survey, even if prospective sampling is used.<sup>36</sup>

In all studies the low rate was related to several factors impacting the HCWs' practice. Most results showed that surgeons were less compliant with UP/SP as compared to OR nurses.<sup>29,32</sup> One study also found that incident-reporting systems had a significant effect on staff compliance, and this was revealed by the low rate of incidents being reported in the OR, because most staff will not report an injury unless they know that the patient has been infected.<sup>32</sup> Studies also connected a low rate with staff claims of having insufficient time, or under involvement with the process of establishing policies.<sup>30,28</sup> These impacting factors will be discussed in depth, and linked to the individual findings of the studies in an attempt to analyse and answer the research question.

The internal factors noticed in Osborne's<sup>30</sup> survey that impacted upon HCWs' compliance, were lack of time, the HCWs' personal assumptions, including the belief that most patients are not infected, and being uncomfortable working with the protective tools. Nevertheless, Osborne<sup>30</sup> found that the availability of the protective tools in the departments was one of the external factors impacting on compliance. The size of the hospitals was also one of the external factors that had an impact on HCWs' compliance in Osborne's<sup>30</sup> study: the smaller the hospital the lower the measured compliance rate. However, Osborne<sup>30</sup> study states that this difference could be due to the level of the guidelines set in the small hospitals, and vice versa, with larger hospitals having more guidelines on infection control. However, as mentioned, the generalisation of Osborne's<sup>30</sup> findings may be limited, as the sample for the study included only OR nurses.

The study by Jeong et al.,<sup>28</sup> also found that HCWs' compliance is low. Nevertheless, Jeong et al.,<sup>28</sup> found that the lowest practice rate was for protective eyewear. However, they state that this could be due to the extensive and far broader attention paid to the usage of gloves, compared with the attention given to eye shield usage.

Moreover, Jeong et al.,<sup>28</sup> survey, states that HCWs' low compliance was related to a lack of time, as in the Osborne<sup>30</sup> survey; however, Jeong et al.,<sup>28</sup> found that most HCWs claimed that they were not

included in the establishment of the guidelines, which significantly increased the HCWs' low compliance. This was based on the belief that guidelines set in place could be unrealistic, or unachievable in some countries, and this led staff to refuse to follow them. Although most guidelines are international guidelines, and are translated in South Korea where Jeong et al.,<sup>28</sup> conducted their survey, the author suggests that if HCWs were included in the translation process, and any necessary changes were made to the guidelines to suit the country's policies, it would eventually increase the HCWs' compliance rate, because they would be more familiar with them, and this would encourage them to improve their compliance. Jeong et al.,<sup>28</sup> declared that their research was the first study conducted to evaluate HCWs' compliance in South Korea. Thus they compared their results with those of other international studies conducted on the evaluation of HCWs' compliance; two of the studies they used, as references are included in this review, these are the studies by Osborne<sup>30</sup> and Cutter & Jordan.<sup>27</sup> This is beneficial, as the advantage and disadvantages of both the Osborne<sup>30</sup> and Cutter & Jordan<sup>27</sup> studies are discussed and critiqued within the literature, which will help to evaluate the findings of the Jeong et al.<sup>28</sup> Nevertheless, as discussed before, the generalisation of the Jeong et al.,<sup>28</sup> study is not certain, and is limited to hospitals with more than five hundred beds.

In Cutter & Jordan,<sup>29</sup> the results are divided into three sections: persistent incidents, compliance with UP/SP, and the training and education levels of participants. The authors discuss each section very well, and the issues related to them, and also give the details of responder rates for each issue. However, the main findings of the Cutter & Jordan<sup>29</sup> study are that they found that most surgeons have their own standards, and make individual decisions when it comes to protection methods. Some surgeons used their own judgement regarding their compliance and practice with patients, while others stated that if there were no record stating that a patient was infected, they would apply fewer protection measures in practice. However, Cutter & Jordan<sup>29</sup> found that while this practice was strongly agreed upon by surgeons, the nurses did not agree with it, and tried to treat all patients armed with the facts about high-risk patients. The general reasons given in Cutter & Jordan<sup>29</sup> study were similar to the reasons in the Osborne<sup>30</sup> study, but with a few additional factors, such as the bad practice of senior HCWs, and the surgeons' belief that injuries are a normal part of the work risk.

The outcomes of the study by Nagao et al.,<sup>32</sup> support the fact that surgeons are recorded as having a lower compliance rate than nurses, as Cutter & Jordan<sup>29</sup> also declare. In addition, surgeons' accidents are more frequent than those of scrub nurses, and the study shows that reporting rates are still low among all staff. Therefore, based on this difference between surgeons' and nurses' accident rates, Nagao et al.,<sup>32</sup> recommended that there have to be different preventive methods, depending on the context of individuals and their job risks.

One the reasons for the low compliance rate in Demir<sup>31</sup> was that the guidelines were in English, and Turkish nurses generally have a poor understanding of foreign languages. In addition many hospitals do not offer facilities like computers for nurses to use to update their knowledge or practice.

Hosoglu et al.,<sup>33</sup> not only found low compliance, but also low knowledge levels, and a low awareness of precautions and guidelines among HCWs. Their study produced similar results to that of Jeong et al.,<sup>28</sup> making the point that the rate of wearing gloves among HCWs was high compared to the wearing of masks and eye shields.

Cutter & Jordan<sup>27</sup> found that the low compliance rate of staff to UP/SP was not only because of their beliefs, or level of awareness, it was also impacted by an external factor, the availability of the protective tools in the various departments, similar to Osborne's<sup>30</sup> findings. Having identified this factor, perhaps the low compliance rate could be reduced by solving this issue, and providing sufficient protection tools in each department.

Moreover, in various studies the authors identified several issues from the populations examined that might cause, or at least have a relationship with the HCWs' low rate of compliance. The studies searched for relationships between the low compliance rate and demographic characteristics, such as the age, religion or gender of the study participants, and some did find significant correlations.<sup>30,31,33</sup> However, others found that there was no relationship between the HCWs' characteristics and their compliance.<sup>27-29,32</sup>

Osborne<sup>30</sup> found a relationship between the low compliance rate and the participant's demographic characteristics. The age and years of experience of the nurses affected their compliance; new employees would be more compliant than those who had more than two years' experience. Thus, Osborne<sup>30</sup> recommended that further research should be conducted on older HCWs in order to evaluate the age factor further, and thereby to eventually improve their practice.

Apart from the HCWs' compliance issue, it has been found that one of the main causes for a low rate of compliance is the staff's level of knowledge and education,<sup>28-30</sup> all of which will be discussed in depth through the finding of the three studies<sup>60-62</sup> under the second theme.

## Knowledge

**Ethical approval:** Bowling<sup>35</sup> states that it is important to maintain the participants' confidentiality, and to protect the researchers' reputation in any study, and this is done by obtaining a signed consent form from each participant in the study. The authors of the Amoo et al.,<sup>60</sup> Chan et al.,<sup>61</sup> and Chan et al.,<sup>62</sup> surveys successfully accomplished this, thus all the studies were ethically approved.

**Study design:** Amoo et al.,<sup>60</sup> Chan et al.,<sup>61</sup> & Chan et al.,<sup>62</sup> conducted surveys to assess the awareness and knowledge of HCWs with regard to UP/SP. The authors' aims were to determine the factors that influence HCWs' behaviour, based on their level of education. Thus, Amoo et al.,<sup>60</sup> Chan et al.,<sup>61</sup> & Chan et al.,<sup>62</sup> mentioned the risks that HCWs run, because of the work environment and what could result from a lack of awareness, in their study introduction.

However, the survey of each one had a different design. Amoo et al.,<sup>60</sup> is a descriptive survey that fits well with the purpose of the study. The survey was conducted in order to evaluate the awareness of HCWs toward UP, and Bowling<sup>35</sup> recommended that a descriptive survey is useful for evaluating the knowledge level of a specific population. In Hong Kong, Chan et al.,<sup>61</sup> conducted a cross-sectional survey with the same aim, which is also beneficial, as a cross-sectional study is appropriate for evaluating HCWs' level of knowledge.<sup>37</sup> On the other hand, Chan et al.,<sup>62</sup> conducted a self-report survey in China, also with the aim of exploring HCWs' knowledge. However, the accuracy of the data obtained through self-report surveys is always questionable, as participants might hide the truth from the researcher.<sup>55</sup>

**Study sample:** The study by Amoo et al.,<sup>60</sup> included 200 HCWs, working in four hospitals in Nigeria, including several departments, such as OR, wards, and the outpatient department. Chan et al.,<sup>61</sup> survey included 306 participants, but Chan et al.,<sup>61</sup> survey included

only nurses and ward managers from one hospital, which makes the sample of Amoo et al.,<sup>60</sup> more representative, and eventually its outcome could be more generalizable. However, Chan et al.,<sup>62</sup> study participants were 113 HCWs in OR, but again it is hard to say that this study has a representative sample, because it was conducted in one public hospital. However, this study was more appropriate to this literature review as it is concentrated on OR HCWs.

The selection criteria for a study sample has a significant impact on the study's findings, and has to be discussed fairly in order to see if the study findings are worth generalising.<sup>18</sup> The inclusion and exclusion criteria for the population involved in the Amoo et al.,<sup>60</sup> study are appropriately discussed and explained by the authors, as it is important to include how the population was recruited in order to assess the sample's eligibility.<sup>18,63</sup>

Amoo et al.,<sup>60</sup> sample was selected using an accidental sampling method by collecting data from accidental respondents who agreed to participate and completed a questionnaire; therefore, the study sample was limited to the participants available at the time of the survey. Using this sampling method could affect the reliability of a study, as it is hard to generalize the results due to the risk of having an unrepresentative sample.<sup>64</sup> However, the Amoo et al.,<sup>60</sup> sample included multidisciplinary HCWs, which might raise the representative dimension of the study sample. Although the sample had different percentages of the participants' characteristics, because of the sampling method the participants could not be guaranteed to have equal demographic characteristics.<sup>18</sup>

In Chan et al.,<sup>61</sup> study the sample was randomly selected. This is a good way to reduce study bias, because, according to Parahoo,<sup>20</sup> each one of the target populations has an equal chance of participating. However, the authors do not mention the details of the recruitment process which, makes it difficult to determine if the study has a representative sample and thus eventually makes it difficult to generalise the study outcomes.<sup>65</sup>

In Chan et al.,<sup>62</sup> survey, the method for participant recruitment i.e. the inclusion and exclusion criteria, was based on other previous studies that had conducted surveys with a similar aim. This affects the validity and reliability of the study findings as the selected studies may be at risk for bias.<sup>18</sup>

**Data collection:** Data in Amoo et al.,<sup>60</sup> study was collected through a self-developed questionnaire. The structure of the questionnaire included closed-ended questions, and Likert's five-point scale questions. Closed questions have limited answers, which means that the respondents cannot give alternative answers.<sup>53</sup> A Likert's scale raises a similar issue, because it tends to provide a specific answer scale.<sup>20</sup> Thus, by using these two methods the data collected are influenced, as participants may give a wrong answer because they have limited answers available. However, because Amoo et al.,<sup>60</sup> used a self-developed questionnaire, the content was tested and necessary amendments were made. With this testing Amoo et al.,<sup>60</sup> were confident that the questions were clear and understandable, which increases the validity of the study and eventually raises the response rate, as explained by Bowling.<sup>35</sup>

On the other hand, data collection in Chan et al.,<sup>61</sup> was conducted using a self-administered questionnaire. They also assessed the validity of the content with experts, who were excluded from the study sample. The questionnaire was piloted, and the reliability coefficient of the knowledge test was 0.60 using the Kuder-Richardson reliability, and for the compliance section it was 0.72 using the Cronbach alpha

internal consistency coefficient. Those test results were proof of how reliable the questionnaire was, as LoBiondo-Wood & Haber<sup>55</sup> mentioned that the closer the coefficient is to 1, the more reliable is the questionnaire.

The data in Chan et al.,<sup>62</sup> were collected using a self-report questionnaire. This is a common method for collecting data on variables that are hard to observe.<sup>55</sup> However, the issue with the self-report questionnaire is that there is a risk that participants might not complete answering the questionnaire if it is long, or if the questions are difficult.<sup>55</sup> However, Chan et al.,<sup>62</sup> solved this issue by personally distributing their questionnaires, giving them the opportunity to explain the objectives, and participants the opportunity to ask questions to clarify matters, and to be assured of the value of their response as being beneficial for increasing the response rate of the study.<sup>20</sup> Chan et al.,<sup>62</sup> study had also tested the questionnaire content before distribution, which is considered one of the best ways to raise the validity and reliability of a study.<sup>20</sup>

If a study has a high response rate, it will have less risk of bias, and so the study findings may be considered more generalizable.<sup>66</sup> Overall, the response rate in three studies was high. In Amoo et al.,<sup>60</sup> the response rate was 100%, which could be due to the method of sampling, as participants were voluntarily recruited, and the researchers distributed the questionnaire themselves, which raises the response rate as discussed above. In Chan et al.,<sup>61</sup> the response rate was 70%, which is still considered to be in the range of an acceptable response rate,<sup>36</sup> while in Chan et al.,<sup>61</sup> the response rate was 85%, which is also considered good.

However, none of three articles Amoo et al.,<sup>60</sup> Chan et al.,<sup>61</sup> or Chan et al.,<sup>62</sup> mentioned why they used a self-report or self-administered questionnaire. Although Polit & Beck<sup>67</sup> state that there are other methods superior to both questionnaire methods, such as face-to-face interviews, and that they may have a higher response rate, which would be beneficial in raising a study's validity. However, the disadvantage of using face-to-face interviews is that it needs more time to conduct them and researchers have to gather the information and then analyse it, which also takes a long time that the researchers may not have.<sup>48</sup>

**Data analysis:** According to Houser,<sup>63</sup> a chi-square test is a suitable method of analysis if the study sample has different characteristics. This is appropriate for Amoo et al.,<sup>60</sup> survey, because the study includes different sample categories with different characteristics, such as religion and gender. The analysis method in Chan et al.,<sup>61</sup> was different, as Chan et al.,<sup>61</sup> used the Pearson correlation coefficient. The Pearson correlation coefficient is also appropriate and beneficial when discussing probability.<sup>55</sup> However, Chan et al.,<sup>62</sup> used the well-known SPSS analysis package, together with a cluster-analysis in order to divide the study sample into two groups and analyse their variables.

**Findings:** Data were represented using tables and graphs, both useful methods for summarizing data and showing the variables included in the study.<sup>63</sup> In Amoo et al.,<sup>60</sup> a descriptive statistic was used to support the study reliability. In Chan et al.,<sup>61</sup> graphs were used to clarify the knowledge variability scores. In Chan et al.,<sup>62</sup> several tables were used to represent participant characteristics, part of the questions included in the questionnaire, and the results of the study, which helped to clarify the study process.

Amoo et al.,<sup>60</sup> found that most HCWs who participated had a high level of awareness regarding UP/SP. However, the low percentage of awareness measured was found to come from cleaners and a few

laboratory HCWs, and this was due to two factors: an insufficient number of cleaners to cover their job, and extended working hours by the HCWs. Amoo et al.,<sup>60</sup> said that these two factors influenced the level of education that the HCWs might have, as cleaners cannot attend workshops or training lectures about UP/SP because of their short-staffing, and how other HCWs might refuse to attend because they are tired from the extra duty hours. However, the generalisation of Amoo et al.,<sup>60</sup> is questionable, because of their sampling method.

Chan et al.,<sup>61</sup> had a reverse finding to that of the Amoo et al.,<sup>60</sup> Chan et al.,<sup>61</sup> found a low level of awareness in their study. However, the low rate differed in certain aspects, as HCWs had good knowledge and understanding with regard to areas such as hand washing. Chan et al.,<sup>61</sup> also found that there is no follow up system in the hospital targeted in their study, as there is no check-up system to evaluate and refresh the HCWs' level of knowledge regarding UP/SP. Thus Chan et al.,<sup>61</sup> recommended the establishment of a continuous mandatory training programme, in all health organisations, to refresh and update the HCWs' knowledge.

Chan et al.,<sup>62</sup> had two opposing outcomes: The first group that had more female HCWs revealed a higher level of knowledge and awareness toward UP/SP, while, the second group, which included more male HCWs, showed a low level of awareness. Chan et al.,<sup>62</sup> declared that this difference was because the female HCWs included in the study were senior or registered nurses who had higher education certificates, and were employed permanently in their jobs, whilst the male HCWs were only partly employed, and had lower educational certificates.

## Discussion

Due to the risks involved in the OR it is essential that all HCWs are aware of the precautions in place, and to involve them in their daily practice to ensure quality patient care, protecting patients and themselves from any associated risk.<sup>68</sup> It has been widely documented that UP/SP guidelines are effective in reducing cross infection between patients and HCWs, and also help to reduce SSI.<sup>69,70</sup> Therefore it is necessary to identify the factors influencing HCWs' compliance, and to measure their knowledge level to enable a plan to improve practice and increase compliance rate.

Unfortunately, the overall outcome of the studies included in the review revealed low practice rates and low knowledge levels of UP/SP among HCWs,<sup>18,27,29-33,61,62</sup> except Amoo et al.,<sup>60</sup> who found high level of awareness.

These studies were conducted in different countries around the world, producing similar results, with a low compliance rate being their main outcome. Compliance and the quality of care provided varied, depending on the level of income and country's stage of development, which is considered a barrier or limitation in terms of providing sufficient education, and having sufficient awareness about the protocols established to prevent/reduce infection rates within hospitals. According to the World Health Organisation,<sup>71</sup> around three million HCWs are exposed yearly to blood-borne viruses, the majority in low-income countries<sup>71</sup> Osborne<sup>30</sup> and Amoo et al.,<sup>60</sup> acknowledged this issue.

Although UP/SP have been in place for many years and many studies have been conducted to evaluate, discuss and resolve the low rate of compliance issue, it still occurs widely. Therefore, an assumption can be made, based on the results that the majority of the authors found that as result of the low rate of compliance and low knowledge level of HCWs, around the world patients undergoing

surgical procedures are facing similar risks with regard to getting infections in OR; furthermore HCWs are facing the risk of being exposed to infections as a result of their lack of knowledge and awareness, and because of not following the guidelines.

Based on the author's personal experience, several factors affect the low rate of compliance in OR. These include the fact that several surgeons do not practice the guidelines, thinking that they are not essential, and they are not convinced that the guidelines have much impact on the patients' or on their own health. This issue causes several daily arguments between staff and surgeons in the OR. This issue was brought several times to the attention of the head of the surgeons by the OR manager. However, it was not given the attention it deserved, as the author works in a military hospital and most managers here are military soldiers, who do not realize that this a huge problem, and that it has a significant impact on patient safety. Consequently, this issue was not evaluated in the author's hospital, so the main reasons behind the surgeons' poor practice remain unknown. However, it was raised in Cutter & Jordan's<sup>29</sup> study, and they related the low compliance rate among surgeons to their personal judgments on patients. In Osborne's study (2003) the author found that the surgeon's believed that injuries are a normal part of the job risk encountered when working in hospitals. In order to resolve this issue and change and improve the surgeons practice several meetings should be conducted, however, several barriers might be encountered such as surgeons thought that they are always right so they would not listen to others, surgeons ego which might prevent them from recognising and admitting their own wrong practice, and the resistance to the change as a result of not recognising the rationale for the change. However, this could be solved hopefully through the meetings to convince surgeons with the sense of urgency and the rationale to change, because<sup>72</sup> state that people have to recognise the need for the change in order to motivate them to accept and implement the change. However, in order to manage and implement the change successfully the leadership style of the head of the OR must be suitable and include the needed skills such as effective communication throughout the change process and engaging the surgeons in the decision, which will achieve the change in short-term and encourage surgeons to change.

In addition, the author advises hospital managers to establish a plan to improve staff practices and to detect factors that could lead to non-compliance, so as to be able to solve it. The plan could include having more workshops, seminars and training sessions, and the inclusion of all HCWs, regardless of their place on the hierarchy scale, would be beneficial; as, having multidisciplinary education would improve the quality of the care provided, and would also be beneficial in increasing the level of HCWs' knowledge and eventually their compliance rate.<sup>73</sup> In order to apply this successfully, sufficient time should be provided to allow HCWs to attend workshops and training programmes. Moreover, assessments of staff during the training program would also be useful; to assure if programs are beneficial.<sup>74</sup> However, those recommendations might need long time to be arranged and be implemented so simple changes could be implemented first to encourage the HCWs, and to get their attention about the current issues. This could be done through putting up posters about the recommended guidelines in department corridors. Moreover, arranging meetings to discuss issues regarding the setting and applying of guidelines, or amendments needed to make them more suitable and appropriate for employees to practice. Thus communication between HCWs and the head of the OR is recommended. Communication is significant in developing and improving any practice.<sup>73</sup> This would hopefully encourage HCWs to comply and implement the guidelines during their practice.

Moreover, since HCWs are usually trained in regard to the technical aspects of their job, and usually do not receive any human factors training.<sup>75</sup> This lack of awareness about human factors could be the reason behind several incidents, which are usually linked to lack of communication and teamwork failure.<sup>75</sup> Thus, improving communication and teamwork training among HCWs is beneficial and significant to improve patient care provided.<sup>76</sup>

Protective tools should be readily available, and be sufficient for all HCWs as recommended by the guidelines – as the availability of these tools has direct correlation with the low compliance rate. This issue was noticed in the author's OR, but was also connected to the HCWs' claim that they assume that patients are not infected from their own judgment on patient appearance, and that this is a reason behind their not using the protective tools regularly. This was also acknowledged in Osborne<sup>30</sup> study. The author recommends the usage of these tools as a daily routine as recommended by the WHO.<sup>77</sup> However, to encourage HCWs to use the protective tools, their level of awareness about the importance of these tools must raise. Therefore having training programmes and assessments are significant and would solve this issue too. Moreover, the author advises lectures about the significance of using equally all kinds of protective tools are to be given by the infection control members in the hospital, as they are the professionals in the infection control area.<sup>78</sup>

Involving staff in the policy process is also recommended, as employee engagement is beneficial in motivating staff to follow the guidelines.<sup>79</sup> However, in practice this could be challenging as resetting international guidelines is difficult, but effective teamwork is helpful and would improve patient care safety.<sup>80</sup>

Most HCWs in the OR where the author works complain of not having enough time to practice the recommended guidelines between cases. This was also mentioned in the outcomes of Osborne<sup>30</sup> and Jeong et al.<sup>28</sup> However, in the OR where the author works this issue was raised and was discussed in several meetings to reveal the reasons behind the time deficiency. After discussion it was revealed that the time deficiency is due to the staff shortage in theatres. Increasing the number of staff in each theatre would be beneficial for infection control, and would solve the time deficiency issue. However, this might have the disadvantage of increasing the working hours of the HCWs. In addition, managers might argue with this solution, as it will have an impact on the hospital finance because it will raise the overtime cost paid to staff.

One of the theories is that the guidelines are provided only in the English language, and although English is used during the study period of HCWs, they still have difficulty in fully understanding the English guidelines. This issue was also acknowledged in the Demir<sup>31</sup> study. However, the author suggests that the guidelines should be provided in both English and the local (Arabic) languages, as there are native English speakers who work in OR, alongside Arabic staff, which would increase the HCWs level of knowledge, and eventually raise their compliance rate.

Moreover, facilities for HCWs to check the guidelines are not readily available, as there are insufficient computers in the OR where the author works, and there are only two printed guidelines: one is in the reception area and the other one is in the manager's office. This problem was also raised in Demir's<sup>31</sup> study, and was considered to be one of the barriers against the HCWs' updating their knowledge. However, the provision of an updated, bi-lingual printed copy of the guidelines in each theatre would solve this issue, so staff can check and update their knowledge.

## Conclusion

Health organisations must educate their staff to increase the level of awareness toward UP/SP, and increase the quality of patient care. Moreover, if the awareness of HCWs is improved, it will hopefully reduce the existing negative attitude toward the implementation of UP/SP, as the level of knowledge and compliance to UP/SP are reciprocally related.

Looking to the future, organisations need to involve employees in the establishment of policies, and consider having a mandatory program for HCWs with time allowed to accomplish it effectively.

Increasing HCWs' awareness and acknowledgment of risk factors in their work place, and the impact of their poor practice on both themselves and on patients is significant, and especially if they do not follow the guidelines. This change can be achieved through communication, which is another important aspect that impacts HCWs' compliance. Thus, having regular meetings with all HCWs would reduce related practical issues, and highlight positive perceptions that would eventually increase and motivate HCWs to follow the guidelines.

However all of those factors depend mainly on the organisation, as organisations have to provide the protective tools for their employees, and make sure the tools are suitable, effective and fit for purpose, furthermore they must be comfortable and easy to use. Therefore, the responsibility rests not only on HCWs as employees, but also on managers and leaders; part of their duty is to keep updating and evaluating the HCWs' knowledge of UP/SP.

Hopefully, after applying these recommendations, the HCWs' compliance and knowledge levels will be raised. This will result in improved quality of patient care.

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## Conflict of interest

The author declares no conflict of interest.

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