

Factors associated with the compliance of standard precaution; review article

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Abstract

Compliance with standard precautions is very important for healthcare workers because studies have shown that it helps in minimising the transmission of infectious diseases and healthcare-associated infections which is directly proportional to the patient cost and stay of the patient in hospitals. As healthcare associated infections increase, the cost and the stay of the patient will increase. Researchers suggest that all healthcare workers need to follow the standard precautions guideline and it can be possible with the help of health education, training, provision of equipment and supervision by the management. Barriers to the compliance identified are lack of education, heavy workload, unavailability of equipment, lack of resources and lack of access to supplies. The lack of education and heavy workload are the major factors faced by the nurses.

Keywords: Healthcare workers, Universal precautions, Standard precautions.

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Introduction

Standard precautions (SPs) are helpful in preventing the transmission of infections and reducing the rate of healthcare associated infections (HCAIs) which will ultimately reduce the cost of the patients and hospital stay. In healthcare settings, registered nurses and doctors play important roles in policy-making and implementation for infection control. The current review was planned to assess literature in this area.

Search strategy

Search engines Pub-Med, Science Direct and Google Scholar were used to retrieve relevant articles. The key words used for the search were "Knowledge and Practice of SPs among healthcare workers", "Universal Precautions among healthcare workers", "Factors affecting the compliance of Standard Precautions" and "Barriers to compliance of Standard Precautions". The search resulted in 70,300 articles. After applying time filter from 2009 to

2019, the search narrowed down to 881(1.25%) articles. This was further shortlisted based on the title, availability of the article, English language, and availability of abstract. Finally, 51(5.8%) articles were selected for the current review, and 22(43%) of them were found to be eligible for in-depth review.

Definition and components of SPs

According to the studies shortlisted, the increasing spread of HAIs has made it extremely important for healthcare workers (HCWs) to practise SPs, which, in short, include wearing personal protective equipment (PPE), taking care to protect themselves while handling all types of patients, including contact precautions and airborne precautions, taking specific care when treating high-risk individuals, increasing awareness about personal hygiene amongst patients, proper disposal of waste, safe injection practices as well as the procedure in case of needle-prick injury and ensuring not only the availability of the required equipment and hospital infrastructure, but also regularly monitoring the compliance of HCWs with SP guideline. Moreover, the studies have used the definition of the Centres for Disease Control and Prevention (CDC)¹⁻¹⁴ (Table).

SP Guidelines

The CDC is working on SPs to reduce the rate of HAIs all over the world because HAIs are the infections patients get with the treatment from HCWs, which is a major problem, but is also preventable with the help of SP practices. SPs guidelines control the rate of infection in healthcare settings to reduce the risk of blood-borne and other pathogens as well as it can also reduce the rate of HAIs. It had also been analysed that among the males needle-stick injury reporting was significantly higher than the female ($p < 0.01$) and the staff nurses were more compliant with SPs compared to nursing students ($p < 0.001$).^{5,15} As per CDC guideline, all HCWs need to assume that all the patients are possibly infected or can transmit infections in a healthcare setting. Therefore, the HCWs need to apply the SPs while attending all the patients either infected or not. For compliance with SPs, all HCWs need proper hand hygiene, use of PPEs, such as gloves, gown, mask, face and eye shield, according to the risk assessment and predicted contact, such as respiratory hygiene and cough etiquette, needle-stick injury prevention, medical equipment handling, proper disposal of waste and sharp objects, environmental cleaning and proper transport

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Table: The definition and components of Standard Precautions (SPs).

Article	Definition of Standard Precautions	Components of Standard Precaution
\Compliance with standard precautions: Results of a French national audit (1)	The Centers for Disease Control and Prevention (CDC) is a federal agency that conducts and supports health promotion, prevention, and preparedness activities in the United States with the goal of improving overall public health.	1.Wearing and changing gloves while providing bedside care to the patients and between the patient care activities, appropriate needle recapping and hand-detaching soiled needles, taking care of hygiene (hand washing with hydrochloric acid, liquid soaps and disinfectants, cleaning hands with sanitizer, etc.). 2.Using a single-use mask and goggles in the event of risk for blood or body fluid splattering/vapourising, and appropriate way to of waste disposal.
Factors affecting performance of hospital control infection in Japan (2)	The definition will be same as above.	1.Availability of sufficient well trained full time Infection Control(IC) staff, development and maintenance of hospital infrastructure (such as proper ventilation system, Air conditioners, keeping check of temperature and humidity level etc.). 1.Hand hygiene reinforced before and after handling the patient and reinforced the use of gloves, gown and isolated room for contact precautions patient and proper waste disposal which mentioned that the waste of the patient having air borne infection should be disposed of in red container or bag separated from other waste. 2.Gowns and goggles should be worn for the procedures and activities which have chances of splashes and sprays of blood or body fluids. 3.Nurses who have a respiratory infection are advised to avoid direct patient contact or wear a surgical mask, especially with high-risk patients. 4.Patients with airborne precautions are preferred to be in negative-pressure isolation rooms.
Knowledge and practices of isolation precautions among nurses in Jordan(3)	The definition will be same as above.	1.Use of protection equipment such as eye shields, protective masks, and quarantine clothes while practicing hand washing and sterilization. Presence of a sharps disposal box in the department is important. 1.SP's include performance of hand hygiene using personal protective equipment (PPE), such as gloves, gowns, masks, face eye shields, goggles, apron and guided risk assessment manuals. Including recapping needle technique, sharp disposal and water proof wound dressing. Moreover, all these equipment should be discarded in red bag after use. 1.Using good handwashing methods (using effective antiseptics, quick drying hand disinfectants etc.). 2.The six step hand washing method described in the "Standard for hand hygiene for healthcare workers in healthcare settings" should be strictly administered.
Factors impacting compliance with standard precautions in nursing, China(4)	The definition will be same as above.	1.Availability of personal protective equipment and its correct use (such as gloves, gown, goggles, disposal of medical waste, and effective needle disposal systems).
Validity and reliability assessment of the Compliance with Standard Precautions Scale Arabic version in Saudi nursing students(5)	The definition will be same as above.	1.Hand hygiene and personal health hygiene of the patient was considered to be very important for: Prior to meals, after using the toilet or bedpan, prior to touching dressings and incisions, after returning from testing or a procedure, before and after having visitors. 2.Availability of bedside pre-packaged alcohol wipes, soap and hand hygiene facility (using wet and dry paper towels etc.).
Experimental study on disinfection effect of different dose of rapid hand disinfectant(6)	The definition will be same as above.	1.Use of alcohol based hand sanitizer immediately before touching a patient, before performing an aseptic task (e.g., placing an indwelling device) or handling invasive medical devices, and after contact with blood, body fluids or contaminated surfaces. 2.Wash with soap and water when hands are visibly soiled, and after known or suspected exposure to spores (e.g. B. anthracis, C difficile outbreaks). Wear gloves when contact with blood or other potentially infectious materials could occur, change gloves between two patients and perform hand hygiene during patient care.
Knowledge, Practice, and Attitude Among Iranian Nurses, Midwives, and Students Regarding Standard Isolation Precautions(7)	The definition will be same as above.	1.Environmental control, hand hygiene, universal precautions such as personal protective equipment (PPE), decontamination of patient care equipment, specimen handling, personal hygiene and appropriate disposal of syringes, needles and sharps etc. 2.Nurses should avoid recapping syringes and should empty a sharp box only when half-full. When exposed to accidental needle-stick injury (NSI) they should wash the injured site with water and soap and take the post-exposure prophylaxis.
Can improving patient hand hygiene impact Clostridium difficile infection events at an academic medical center?(8)	The definition will be same as above.	1.Nurses should also maintain hand hygiene by washing hands. 2.Availability of online curriculum for infection control.
Clean Hands Count for Healthcare Providers(9)	The definition will be same as above.	
Impact of an infection-control program on nurses' knowledge and attitude in pediatric intensive care units at Cairo University hospitals(10)	The definition will be same as above.	
Improving knowledge and compliance with infection control Standard	The definition will be same as above.	

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Article	Definition of Standard Precautions	Components of Standard Precaution
Precautions among undergraduate nursing students in Jordan (11)		3.Compliance with the use of personal protective equipment, disposal of sharp objects and other biological wastes, decontamination of spills and used articles, and prevention of cross-infection is also essential. 4. Availability of resources such as masks, gloves, sinks, water, and paper hand towels.
Injection Safety (12)	The definition will be same as above.	1.Proper use of syringes, needles, and medication vials during routine healthcare procedures, such as administering injections.
Respiratory Hygiene/Cough Etiquette in Healthcare Settings (13)	The definition will be same as above.	1.All individuals having respiratory infection should take care of cough etiquette and should dispose off the tissue after use, and should perform hand hygiene. 2.Nurses should wear a surgical or procedure mask when examining such patients.
The ethical and pedagogical effects of modelling "not-so-universal" precautions (14)	The definition will be same as above.	1.Use universal precautions when exposed to other patients' blood and other bodily fluids. Wear goggles and change gloves after every patients and change gloves between two patients.

and processing of the linen used by patients.¹⁶ A pre- and post-test interventional study in 2018 analysed significance difference post-test. In pre-test, more than half of the participants (57%) showed inadequate knowledge, while in the post-test, only 2% reported inadequate knowledge and low compliance to SPs. Therefore, the study recommended making online infection control programme mandatory for all HCWs.¹¹ One of the elements of SPs includes hand hygiene and the statement is supported by CDC that HCWs clean their hands less than 50% of the time they need to. WHO and CDC recommended using alcohol-based hand rubs (ABHRs) for hand hygiene because of its effectiveness against broad-spectrum microorganisms, being less time-consuming and it can be kept at patient's bed-side which can be easily accessible.¹⁷ Another study reported that patient's hand hygiene decreased clostridium difficile events which were occurring most frequently before initiating patient hand hygiene. The study reported significant results post-intervention.⁸ PPE use is the second element of SPs and refers to the use of gloves, gown, mask, face and eye shield. A study in Jordan reported that 90% of the nurses had good knowledge about the SPs, but they have limited knowledge based on specific isolation precautions in which only 42.2% had correct knowledge regarding the contact isolation, and 40.7% had correct knowledge about the air-borne isolation. In this study, they also identified some factors leading to non-compliance of SPs including lack of supplies, organisational factors and heavy workload. The study recommended more health education programmes, proper monitoring and supervision of infection-control practices.³ The CDC mentioned that respiratory hygiene and cough etiquettes are also the part of SP guideline in which they mentioned that every personnel needed to cover his/her mouth and nose with a tissue paper while coughing or sneezing, and the person who is coughing/sneezing needs to sit 3 feet away from other people, if possible. The CDC also recommended that HCWs should wear surgical mask when

assessing patients with droplets or any respiratory infection.¹³

According to CDC, safe injection is the part of SPs because unsafe injection is risky for both patients and HCWs. The CDC stated that unsafe practice could lead to multiple HAIs. Numbers reported from different part of the United States included 18 cases of hepatitis C infections associated with a surgical technician at a Colorado hospital in 2009, 25 cases of gram-negative bacteraemia associated with a nurse at a Minnesota hospital, 25 cases of hepatitis C infections associated with radiology technician reported from New Hampshire, Kansas and Maryland in 2012.¹² According to CDC, a heating, ventilation and air conditioning (HVAC) system is a basic and essential system needed in all healthcare settings to remove contaminated air, maintain the temperature and humidity at the patient's comfort level, and to minimise the risk of microorganism spreading from infected patients. An HVAC includes air inlet or intake from outside, its filtration and humidity modification accordingly, heating and cooling equipment, and grilles for air distribution. Decreased performance of HVAC system in a healthcare facility can contribute to HAIs.¹⁶ According to CDC guideline, all reusable equipment or devices must be cleaned or sterilised as per instructions to prevent the transmission of infections.¹⁶ One study on infections related to medical devices reported ventilator-associated pneumonia (VAP) rates high in both medical and surgical intensive care unit (ICU). The range of VAP in 5 groups was analysed. In groups 1-4 it ranged from 0.9 to 51.6 per 1000, while one group had VAP rate of 186.5 per 1000.¹⁸ Another study showed there were one-third ICU infections which could have been prevented by adopting the recommended preventive measures. The study mentioned that HCWs needed more precautions other than the SPs that are isolated precautions, such as droplet, contact and air-borne precautions. It also mentioned another strategy for

preventing water-borne infections that entailed boiling the water before use, regular cleaning and regular maintenance of the water-tank.¹⁹

A hospital setup needs proper disposal of the waste because hospital waste can cause various diseases in the community. A 2016 study in India showed that due to exposure with certain waste, various health problems were recognised such as diarrhoea, malaria, skin and respiratory infections.²⁰

Knowledge and Practice of SPs for Reducing HCAs

A study conducted in China reported that only half of the nurses had received training and had knowledge regarding SPs, while the remaining half had not even heard about the word "SPs". The study indicated that knowledge was positively correlated with the compliance of SPs ($r=0.24$) which suggested that greater knowledge would lead to better SP compliance. Another factor identified in the study was that the nurses who had received training on SPs had greater compliance with SPs than those who had not received training.⁴ An experimental study in China compared two groups with the usage of hand rub disinfectant. The possible analysis of the explanation for the low compliance with hand hygiene was lack of knowledge regarding the use of hand hygiene and its effect on their health, insufficient equipment that is unavailability, less resources, skin irritation, and damage to skin with the use of the disinfectant. It recommended that for reducing HCAs, the HCWs need to be more compliant with SPs. It will only be possible with the help of regular skill-based training, continuing education session, and frequent monitoring of the HCWs following the SP guidelines.⁶ A pre-post interventional study, done to check the impact of an infection control programme on nurses, reported that the knowledge regarding SPs before the infection control programme was 51.2% while post-intervention it was 87.2%. The study found that education regarding infection control improved knowledge regarding SPs. Thus, more infection control training programmes were needed for reducing the HCAs with the help of improvement in the knowledge regarding SPs and to reduce the cost of the patients due to increased stay of the patient diagnosed with HCAs.¹⁰ Moreover, a study observed that the practice of SPs relied on overall hospital quality. It revealed that the ease and availability of PPE had an important role in compliance with SPs. It observed that HCWs from a small hospital were not good in practising SPs, and mentioned some other reasons that included lack of infrastructure, and the absence of an infection control department.² The study also suggested that SPs should be followed for every patient, and not for specific patients, such as those with human immunodeficiency virus (HIV) or acquired immunodeficiency syndrome (AIDS),

because it created social stigma for the patients and their families. SPs are more important than isolation precautions, because no one knows the patient diagnosis without any laboratory investigations. Therefore, it is important to follow SPs and take every patient as infected.²

Overall, the studies reviewed have shown that HCWs have a lack of knowledge regarding SPs and that is why the practice of SPs is not upto the mark which can be improved with proper training. However, there are multiple factors affecting SP compliance.²¹

Factors affecting SP compliance

Multiple factors can affect the practice of SPs, such as knowledge, training, refresher course, supervision by the management, ongoing education session and working environment. SPs are important elements for infection control, and every organisation has its own policy regarding infection control, but the studies cited above have shown high rates of HCAs. The factors associated with low level of knowledge and practices are many more. Some of them are interpersonal, others are departmental, while some of them are organisational. Studies have stated that more than 80% of the HCWs did not previously receive any educational session on SPs and that more than 80% wanted to be trained regarding SPs.⁷ Another study with a large sample in France identified some factors which needed to be improved for enhancing the compliance with SPs, like promoting use of gloves use while having blood contact risk, use of PPE, changing gloves and hand hygiene as well as avoiding recapping of the needle.¹ One qualitative study using in-depth interviews of nurses in Uganda explored the low compliance with SPs.²² During the interviews most of the participants commented that they tried their best to practise SPs based on their knowledge, but the reason behind low compliance was lack of resources unable to fulfil the demand, policy issues and patient overflow. However, the nurses also shared their strategies for preventing infections which were departmental and personal approach. They suggested that the units needed to be designed to avoid congestion for minimising the risk of infection to HCWs and cross-infection among patients. Another suggestion was for adequate ventilation which can compensate for the overflow of the patients. The study also showed that the nurses working in resource-limited settings had difficulties in practising SPs owing to limited resources, maintenance issues for inadequate ventilation, lack of information and overcrowding. For such a setting, the nurses frequently balanced the available resources to minimise risk to patients and themselves. The study showed that the nurses were overburdened and had limited resources. To overcome these challenges the nurses demonstrated their resilience and decided to practice SPs on isolation-based precaution.²²

However, studies have suggested that treating the patient on the basis of their disease, which is isolation-based precaution, is an ethical issue because HCWs shall treat all patients equally by practising SPs to avoid stigmatisation of certain patients. Moreover, it has also been recommended that provision of safe, respectful and non-discriminatory care is essential with the help of practising SPs to reduce the labelling of a patient with specific infectious disease, which is very important for reducing the stigmatisation.^{14,21}

Conclusion

As reviewed, literature indicates that primary HCWs, comprising doctors and registered nurses, are less sensitive regarding the SP compliance. Therefore, it is necessary for them to be encouraged by the management to follow SP guidelines which is only possible through health education, training and provision of facilities. However, hospital managements also need to take care of associated factors that might be responsible for SP non-compliance, like heavy workload, lack of education and training, unavailability of PPE, lack of resources and supplies etc.

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References

- Giard M, Laprugne-Garcia E, Caillat-Vallet E, Russell I, Verjat-Trannoy D, Ertzscheid MA, et al. Compliance with standard precautions: Results of a French national audit. *Am J Infect Control*. 2016; 44:8-13.
- Sekimoto M, Imanaka Y, Kobayashi H, Okubo T, Kizu J, Kobuse H, et al. Factors affecting performance of hospital infection control in Japan. *Am J Infect Control*. 2009; 37:136-42.
- Suliman M, Aloush S, Aljezawi M, AlBashtawy M. Knowledge and practices of isolation precautions among nurses in Jordan. *Am J Infect Control*. 2018; 46:680-4.
- Luo Y, He GP, Zhou JW, Luo Y. Factors impacting compliance with standard precautions in nursing, China. *Int J Infect Dis*. 2010; 14:e1106-14.
- Cruz JP, Colet PC, Al-otaibi JH, Soriano SS, Cacho GM, Cruz CP. Validity and reliability assessment of the Compliance with Standard Precautions Scale Arabic version in Saudi nursing students. *J Infect Public Health*. 2016; 9:645-53.
- Li X, Xu CJ, Zhao SJ. Experimental study on disinfection effect of different dose of rapid hand disinfectant. *Int J Nurs Sci*. 2014; 1:212-4.
- Askarian M, Memish ZA, Khan AA. Knowledge, practice, and attitude among Iranian nurses, midwives, and students regarding standard isolation precautions. *Infect Control Hosp Epidemiol*. 2007; 28:241-4.
- Pokrywka M, Buraczewski M, Frank D, Dixon H, Ferrelli J, Shutt K, et al. Can improving patient hand hygiene impact *Clostridium difficile* infection events at an academic medical center? *Am J Infect Control*. 2017; 45:959-63.
- Control CFD, Prevention. Clean hands count for healthcare providers, 2017.
- Galal YS, Labib JR, Abouelhamd WA. Impact of an infection-control program on nurses' knowledge and attitude in pediatric intensive care units at Cairo University hospitals. *J Egypt Public Health Assoc*. 2014; 89:22-8.
- Hassan ZM. Improving knowledge and compliance with infection control Standard Precautions among undergraduate nursing students in Jordan. *Am J Infect Control*. 2018; 46:297-302.
- CDC. Centre of Disease control and Prevention 1600 Clifton Road Atlanta, GA 30329-4027 USA USA Government; 2011 [updated 30th August, 2016]. Information for providers.[Online] [Cited 2018 December 20]. Available from: URL: <https://www.cdc.gov/injectionsafety/providers.html>.
- CDC. Centre of Disease control and Prevention 1600 Clifton Road Atlanta, GA 30329-4027 USA USA Government; 2012 [updated 27th February, 2012]. Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). [Online] [Cited 2018 December 22]. Available from: URL: <https://www.cdc.gov/flu/professionals/infectioncontrol/resphygien e.html>
- Aultman JM, Borges NJ. The ethical and pedagogical effects of modeling "not-so-universal" precautions. *Med Teach*. 2011; 33:e43-e9.
- CDC. Centre of Disease Control and Prevention 1600 Clifton Road Atlanta, GA 30329-4027 USA U.S. Department of Health & Human Services; 2018. National Center for Emerging and Zoonotic Infectious Diseases (NCEZID), Division of Healthcare Quality Promotion (DHQP). [Online] [Cited 2018 December 22]. Available from: URL: <https://www.cdc.gov/hai/data/index.html>.
- CDC. Guidelines for Environmental Infection Control in Health-Care Facilities Atlanta, GA 30329. Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC).[Online] [Cited 2017 February 15]. Available from: URL: <https://www.cdc.gov/infectioncontrol/guidelines/environmental/index.html>
- CDC. Centre of Disease control and Prevention 1600 Clifton Road Atlanta, GA 30329-4027 USA USA Government; 2016. Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC).[Online] [Cited 2018 May 03]. Available from: URL: <https://www.cdc.gov/handhygiene/providers/index.html> accessed on December 22,2018.
- Gaid E, Assiri A, McNabb S, Banjar W. Device-associated nosocomial infection in general hospitals, Kingdom of Saudi Arabia, 2013–2016. *J Epidemiol Glob Health*. 2018; 7:S35-S40.
- Mohapatra S. Sterilization and disinfection. *Essentials of Neuroanesthesia*: Elsevier. 2017; 929-44.
- De S, Debnath B. Prevalence of health hazards associated with solid waste disposal-a case study of Kolkata, India. *Procedia Env Sci*. 2016; 35:201-8.
- Mill JE, Edwards N, Jackson RC, MacLean L, Chaw-Kant J. Stigmatization as a social control mechanism for persons living with HIV and AIDS. *Qual Health Res*. 2010; 20:1469-83.
- Nderitu EW, Mill J, Richter S. The experience of Ugandan nurses in the practice of universal precautions. *J Assoc Nurses AIDS Care*. 2015; 26:625-38.