

## An Overview Influence of Nursing in Compliance to Infection Control

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### Abstract

*This review was conducted through searching the literature via electronic databases; Medline, Embase, and PubMed, for all relevant studies that were published up to the middle of 2021. With susceptible residents sharing sources of air, food, water, and health care within an institutional setting, the nursing home environment is highly conducive to infection acquisition and spread. An educational program should be implemented to help improve nursing knowledge and attitudes toward infection prevention.*

**Keywords:** *Nursing, Infection control.*

### Introduction

Nosocomial infections happen during the course of treatment and contribute to patient mortality and morbidity [1]. In developing countries, infection rates may exceed 25% [2]. The primary causes of nosocomial infections are poor hand hygiene among health care providers and failure to follow infection prevention precautions when providing care [3]. These infections have a significant impact on health care services and patient care in the United Kingdom, costing an estimated £1 billion per year. Nurses are the health care providers who have the most direct contact with patients and provide the most direct patient care [4]. As a result, nurses' compliance with infection prevention precautions would have a significant impact on lowering nosocomial infection rates. However, Chan et al [5] reported that in terms of applying precautions inappropriately and insufficiently, nurses' knowledge of standard precautions was inadequate. An examination of incident reports submitted by nursing students revealed that 25.4% were related to infection

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prevention practices [6]. Nurses' compliance with infection prevention precautions is known to vary; for example, reported hand hygiene compliance rates in the United States are 46.7%-57.4%, 63.8% in Jordanian nurses, and 86.6% in Hong Kong nurses [7,8]. Nursing students have an unavoidable impact on the prevalence and frequency of nosocomial infections [9]. According to one survey, 52% of nursing students were dissatisfied with the content of their infection prevention course [9]. Many studies have found that nursing students have less than the required level of knowledge about infection prevention precautions. Most Healthcare-associated infections (HAIs) are preventable and in a recent national survey of NHs, considerable variation in resources and practices for infection control (IC) activities was found such as time dedicated to IC, staff knowledge on IC practices, and environmental decontamination practices [10,11]. Furthermore, infection rates differ between facilities [12]. This suggests that HAIs are important quality indicators [13]. CMS has published quality measures (QMs) for both long-stay and short-stay NH residents on Nursing Home Compare since 2002, an online tool that allows consumers to distinguish between higher and lower quality NHs [14]. Several QMs, such as the percentage of residents with a urinary tract infection (UTI) or an indwelling urinary catheter, are related to infection control and prevention. These QMs related to infection are used to calculate overall 5-star ratings for NHs [14].

## **DISCUSSION:**

NHs that conducted staff training at both new employee orientation and when outbreaks occurred had better quality related to urinary catheter use. While prior research has assessed the role of IC professional training on NH quality, to our knowledge none have examined the impact of IC training of other NH staff. Furthermore, a NH with IC training at both orientation and when an outbreak occurred may have a more robust IC program. Our results support existing evidence that a tailored and continuous training program was better than a single intervention in reducing HAIs [15,16].

Direct patient care staff are responsible for the identification, assessment, and reporting of residents with infections. These responsibilities require sufficient understanding of IC practices and are vital to the proper implementation of IC processes. Our results indicate that more intensive training may improve staff knowledge of IC processes, an important step towards improving overall quality of care. Moreover, urinary catheter use is strongly associated with development of catheter-associated UTIs in NHs, suggesting that reinforcement of prevention and control processes through timely staff training may be one way to decrease infection rates in NHs, though additional research is warranted [17,18].

Since many hospitals report high MRSA colonisation rates among elderly patients, and because it has been shown that *S. aureus* colonisation increases with advancing age, there are concerns about the introduction of MRSA into nursing homes by MRSA-positive patients discharged from hospital. Once introduced, the subsequent spread of MRSA between patients would create a reservoir of MRSA within a nursing home, providing the potential for an outbreak and further hospital outbreaks when affected nursing home residents require hospital treatment [18,19]. Nursing homes provide an ideal environment for the acquisition and spread of MRSA, since residents have an increased risk of colonisation due to chronic illness and debilitation, multiple exposures to antimicrobial agents, and the presence of pressure ulcers and indwelling devices [20]. MRSA colonisation is also a marker of mortality risk amongst nursing home residents [20].

It is likely that the prevalence of Meticillin- or methicillin- (the United States Approved Name) resistant *Staphylococcus aureus* (MRSA) within nursing homes is increasing as a result of the increased prevalence of MRSA within hospitals, which may have been compounded by the considerable movement of patients from long-stay hospitals to community-based nursing homes. A 1994 study in Birmingham reported a prevalence of

17% amongst 191 residents in 10 nursing homes [21,22]. Interestingly, phage-typing of the strains revealed similarities with those circulating in Birmingham hospitals, suggesting direct transfer from hospital to nursing home. A 1999 study in Northamptonshire reported a prevalence of 4.7% amongst 275 residents in 17 nursing homes, with six of the 17 homes having colonised residents [23]. Similar studies in other countries have reported MRSA prevalence rates in nursing homes ranging from 1.1% in Germany, to 4.9% in Belgium [19], 6.2% in Israel, 8.6% in Ireland and 22.7% in the USA, though why there is this range is unclear. More recent studies have confirmed continued high MRSA prevalence rates in nursing homes [24,25,26]. Little attention has been given to infection prevention and control in nursing homes with respect to MRSA, unlike the situation in the hospital setting.

There has been much debate about how best to prevent and control the transmission of MRSA. The general consensus is that more appropriate and prudent use of antibiotics would help to address the rise in resistant bacteria [27]. It is also recognised that infection prevention and control procedures have a part to play in preventing and controlling the transmission of MRSA [27].

Universal precautions (UPs) are a set of interventions and procedures performed to reduce the risk of acquiring occupational infections from both known and unknown sources in the health care setting. The main objectives of UPs are to protect personnel from percutaneous injuries and to prevent transmission of nosocomial infections. Health care students are at high risk of being exposed to nosocomial and blood-borne pathogens. This high risk can be attributed to poor compliance with universal infection control practices, limited clinical experience, or insufficient protective supplies available to them [28,29,30]. Research suggests that medical and health care students are not fully compliant with hand-washing recommendation before and after examining patients. The Centers for Disease Control and Prevention<sup>8</sup> guideline for infection prevention asserts that periodical assessment of knowledge and compliance of health care workers with infection control guidelines is a priority strategy to prevent infections. Various international research studies have assessed the knowledge and compliance of nursing students [31,32]. Across different countries, great variations in the knowledge of infection control and the compliance of nursing students have been observed. For example, compliance rate was 56.1% among nursing students in Hong Kong. On the other hand, in Jordan, 51.3% of nursing students were rated as “excellent” in their knowledge of UPs, 39.6% were rated as “satisfactory,” and 9.1% were classified as “weak.” Also the students' UP practices were rated as the following: “unsafe” (4.1%), “weak” (27.1%), and “competent” (68.8%) [32]. Close results were also demonstrated by Darawad and AlHussami, [34] who reported a mean knowledge score about UPs of 12.3 of 25 in a sample of Jordanian nursing students. The problem of poor knowledge of UPs was also reported in developed countries such as Italy and Australia and in developing countries such as Namibia [35] and Ghana. [36] Improvements in the knowledge of infection control and practices after implementing educational programs are well documented in the literature. For example, in an observational study, Naderi et al [35] examined the effect of an educational program on compliance with hand hygiene and the incidence rate of nosocomial infections. The study was conducted over 4 years and involved nursing and medical staff who followed a problem-based educational program on hand hygiene.

Wu et al [37] investigated Taiwanese nursing students' knowledge, application, and confidence in infection prevention precautions, and recommended a comprehensive foundation course in infection prevention for nursing students before entering clinical practice. There were gaps in nursing students' hand hygiene knowledge, and their compliance with hand hygiene measures was inadequate [37]. Celik and Koçasli [38] proposed revising hand hygiene education measures in response. This lack of knowledge could be attributed to deficiencies in infection prevention education provided to nursing students in nursing schools, which frequently leaves students perplexed and unsure about which practices are appropriate. Given that approximately 33% of nosocomial infections

are preventable, nursing schools are thought to play an important role in educating nursing students on infection prevention precautions and the importance of following those precautions in clinical practice [39,40]. Many studies have suggested emphasizing hand hygiene in the undergraduate curriculum through frequent hand hygiene education and assessment. Other suggestions include revising the nurse training curriculum to include standard infection prevention precautions and keeping students' infection prevention knowledge up to date during clinical application. Despite the fact that such educational programs could improve nurses' hand hygiene practices, infection prevention practices, and infection prevention knowledge, there is a lack of research studies focusing on educating nursing students on infection prevention precautions. In Jordan, infection prevention precautions are not taught in special courses in nursing schools [38,40].

## CONCLUSION:

It is recommended that efforts be directed toward hand hygiene with antiseptic agents and water, rather than simply soap and water, to prevent transmission via skin. All healthcare workers in any setting should have easy access to antiseptic agents. In the absence of adequate handwashing facilities, an antiseptic product that does not require water should be used. Environmental infection prevention and control includes environmental hygiene of work areas, including work surfaces in healthcare settings, as well as the cleanliness of equipment and the disposal of items that may have come into contact with colonised/infected patients.

## References

1. Nobile C, Montouri P, Diaco E, Villari P. Healthcare personnel and hand decontamination in intensive care units: knowledge, attitudes, and behaviors in Italy. *J Hosp Infect* 2002;51:226-32.
2. Pittet D, Allegranzi B, Storr J, Donaldson L. Clean Care Is Safer Care: The Global Patient Safety Challenge, 2005-2006. *Int J Infect Dis* 2006;10:419-24.
3. Centers for Disease Control and Prevention. Guideline for hand hygiene in healthcare settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *Morb Mortal Recomm Rep* 2002;51(RR 16):1-48.
4. Al-Hazmi A. Knowledge, attitudes, and practice of medical students regarding occupational risks of hepatitis B virus in college of medicine, Aljouf University. *Ann Med Health Sci Res* 2015;5(1):13-19.
5. CDC (2014). Guide to Infection Prevention for Outpatient Settings: Minimum Expectations for Safe Care. <http://www.cdc.gov/HAI/pdfs/guidelines/Outpatient-Care-Guide-withChecklist.pdf>. Accessed September 9, 2017.
6. Bello AI, Asiedu EN, Adegoke BO, Quartey JN, Appiah-Kubi KO, Owusu-Ansah B. Nosocomial infections: knowledge and source of information among clinical health care students in Ghana. *Int J Gen Med* 2011;4:571-574.
7. D'Alessandro D, Agodi A, Auxilia F, et al. Prevention of healthcare associated infections: medical and nursing students' knowledge in Italy. *Nurse Educ Today* 2014;34(2):191-195.
8. Darawad MW, Al-Hussami M. Jordanian nursing students' knowledge of, attitudes towards, and compliance with infection control precautions. *Nurse Educ Today* 2013;33(6):580-3.
9. Mitchell BG, Say R, Wells A, Wilson F, Cloete L, Matheson L. Australian graduating nurses' knowledge, intentions and beliefs on infection prevention and control: a cross-sectional study. *BMC Nurs* 2014;13(1):43.
10. Richards CL., Jr. Infection control in long-term care facilities. *J Am Med Dir Assoc* 2007;8:S18– S25.

11. Smith PW, Bennett G, Bradley S, et al. SHEA/APIC guideline: infection prevention and control in the long-term care facility, July 2008. *Infect Control Hosp Epidemiol.* 2008;29:785–814.
12. Richards CL, Jr, Steele L. Antimicrobial-resistant bacteria in long-term care facilities: infection control considerations. *J Am Med Dir Assoc.* 2003;4:S110–S114.
13. Bradley SF. Staphylococcus aureus infections and antibiotic resistance in older adults. *Clin Infect Dis.* 2002;34:211–216. z
14. Raghavendran K, Mylotte JM, Scannapieco FA. Nursing home-associated pneumonia, hospital acquired pneumonia and ventilator-associated pneumonia: the contribution of dental biofilms and periodontal inflammation. *Periodontol* 2000. 2007;44:164–177.
15. Stevens V, Dumyati G, Fine LS, Fisher SG, van Wijngaarden E. Cumulative antibiotic exposures over time and the risk of Clostridium difficile infection. *Clin Infect Dis.* 2011;53:42–48.
16. U.S. Department of Health and Human Services; Revisions to Appendix PP -"Interpretive Guidelines for Long-Term Care Facilities, Tag F 441". 2009 [https://www.cms.gov/Regulations and Guidance/Guidance/Transmittals/downloads/r51\\_soma.pdf](https://www.cms.gov/Regulations%20and%20Guidance/Guidance/Transmittals/downloads/r51_soma.pdf).
17. Siegel JD, Rhinehart E, Jackson M, Chiarello L Healthcare Infection Control Practices Advisory Committee. Management of Multidrug-Resistant Organisms in Healthcare Settings.2006 [http://www.cdc.gov/hicpac/mdro/mdro\\_toc.html](http://www.cdc.gov/hicpac/mdro/mdro_toc.html). [PubMed]
18. Siegel JD, Rhinehart E, Jackson M, Chiarello L Healthcare Infection Control Practices Advisory Committee. Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings. 2007 <http://www.cdc.gov/hicpac/2007IP/2007isolationPrecautions.html>.
19. Hoefnagels-Schuermans A, Niclaes L, Buntinx F, Suetens C, Jans B, Verhaegen J, et al. Molecular epidemiology of methicillin-resistant Staphylococcus aureus in nursing homes: a cross-sectional study. *Infection Control and Hospital Epidemiology* 2002;23:546-9.
20. Cox RA, Bowie PE. Methicillin-resistant Staphylococcus aureus colonization in nursing home residents: a prevalence study in Northamptonshire. *Journal of Hospital Infection* 1999;43:115-22.
21. Trick WE, Weinstein RA, DeMarais P, Kuehnert MJ, Tomaska W, Nathan C, et al. Colonization of skilled-care facility residents with antimicrobial-resistant pathogens. *Journal of the American Geriatrics Society* 2001;49(3):270-6.
22. Fraise AP, Mitchell K, O'Brien SJ, Oldfield K, Wise R. Methicillin-resistant Staphylococcus aureus (MRSA) in nursing homes in a major UK city: an anonymized point prevalence survey. *Epidemiology and Infection* 1997;118(1):1-5.
23. Cox RA, Bowie PE. Methicillin-resistant Staphylococcus aureus colonization in nursing home residents: a prevalence study in Northamptonshire. *Journal of Hospital Infection* 1999;43:115-22.
24. Mendelson G, Yearmack Y, Granot E, Ben-Israel J, Colodner R, Raz R. Staphylococcus aureus carrier state among elderly residents of a long-term care facility. *Journal of the American Medical Directors' Association* 2003;4(3):125-7.
25. Baldwin NS, Gilpin DF, Hughes CM, Kearney MP, Gardiner DA, Cardwell C, et al. Prevalence of methicillin-resistant Staphylococcus aureus (MRSA) colonization among residents and staff in nursing homes in Northern Ireland. *Journal of the American Geriatrics Society* 2009;57(4):620- 6.
26. Smith CS, Parnell P, Hodgson G, Darby B, Barr B, Tompkins D, et al. Are methicillin-resistant Staphylococcus aureus that produce Pantone- Valentine leucocidin (PVL) found among residents of care homes?. *Journal of Antimicrobial Chemotherapy* 2008;62:968-72.
27. Gopal RG, Michalczyk P, Nayeem N, Walker G, Wigmore L. Prevalence and risk factors for methicillin-resistant Staphylococcus aureus in adult emergency admissions-a case for screening all patients?. *Journal of Hospital Infection* 2007; Vol. 66, issue 1:15-21.
28. Pittet D, Allegranzi B, Storr J, Donaldson L. Clean Care Is Safer Care: The Global Patient Safety Challenge, 2005-2006. *Int J Infect Dis* 2006;10:419-24.

29. Centers for Disease Control and Prevention. Guideline for hand hygiene in healthcare settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *Morb Mortal Recomm Rep* 2002;51(RR 16):1-48.
30. Plowman R. The socio-economic burden of hospital-acquired infection. London [UK]: Public Health Laboratory Service; 1999.
31. Cole M. Exploring the hand hygiene competence of student nurses: a case of flawed self assessment. *Nurse Educ Today* 2009;29:380-8.
32. French G, Friedman C. Infection control: basic concept and training. 2nd ed. Portadown [North Ireland]: International Federation of Infection Control; 2003. pp. 25e35.
33. Chan R, Alexander M, Chan E, Chan V, Ho B, Lai C, et al. Nurses' knowledge of and compliance with universal precautions in an acute care hospital. *Int J Nurs Stud* 2002;39:157-63.
34. Al-Hussami MO, Darawad MW, Almheirat I. Predictors of compliance hand washing practice among healthcare professionals. *Healthc Infect* 2011;16:79-84.
35. Naderi HR, Sheybani F, Mostafavi I, Khosravi N. Compliance with hand hygiene and glove change in a general hospital, Mashhad, Iran: an observational study. *Am J Infect Control*. 2012;40(6): e221-e223.
36. Bello AI, Asiedu EN, Adegoke BO, Quartey JN, Appiah-Kubi KO, Owusu-Ansah B. Nosocomial infections: knowledge and source of information among clinical health care students in Ghana. *Int J Gen Med*. 2011;4:571-574.
37. Wu CJ, Gardner G, Chang AM. Taiwanese nursing students' knowledge, application and confidence with standard and additional precautions in infection control. *J Clin Nurs* 2009;18:1105-12.
38. Celik S, Koçasli S. Hygienic hand washing among nursing students in Turkey. *Appl Nurs Res* 2008;21:207-11.
39. Ward DJ. The infection control education needs of nursing students: an interview study with students and mentors. *Nurse Educ Today* 2011;31: 819-24.
40. Reime MH, Harris A, Asknes J, Mikkelsen J. The most successful method in teaching nursing students infection control, E-learning or lecture? *Nurse Educ Today* 2008;28:798-806.