



Abstract

Personnel in contact with patients or equipment and textiles should always use the hospital's work attire. It includes anyone handling food, medicines, textile, waste or cleaning tools. By caring, treating, examining and transporting patients, there will be direct contact between own work clothes and the patient's cloths/bedding or skin. The same is true when working with used patient equipment such as bedpans, toilet chairs, beds and other aids and working in patient rooms, toilets and bathrooms or when handling bedding and bandages, giving physiotherapy, etc. The work uniform is particularly exposed to organic matter and microbes, for example, in ambulances, in emergency services, in restless and anxious patients and children, during sampling and examination/treatment, etc. In acute wards, the staff is often exposed to splashes from patients, especially blood but also vomit, sputum, pus, faeces and urine. This chapter is focused on practical measures to prevent transmission of infections via contaminated staff uniforms.

Keywords

Staff uniforms · White coats · Gowns · Healthcare worker's uniforms · Attire · Transmission of microbes · Contamination · Infection control · Hygiene

6.1 Purpose

Healthcare worker's uniforms protect them against the spread of infections. The hospital uniform signifies a professional identity that ensures professional patient safety and infection protection.

6.2 Comprise

All employees who are in contact with patients, equipment, textiles, medicines and food (food, water, beverages) or who treat contaminants and waste [1–7].

6.3 Responsibility

The hospital management should ensure conditions and resources where all employees receive adapted uniforms, training and follow-up with regard to personal hygiene and the use of the hospital’s uniform. This includes good and clean wardrobe conditions.

Department management should ensure training, information and control of all employees, including temporary workers and extra help, and that they follow the hospital’s procedures with regard to the work attire. All staff should have lockers for private clothes and shoes in clean and well-kept wardrobes.

All employees have a personal responsibility to follow hospital policy with regard to the use of work attire and for personal hygiene and infection control.

6.4 Practical Measures

- The hospital work uniform and attire replaces the use of private clothes [1–7].
- The hospital work clothing should only be used in hospital or in service.
- Shift work suit daily or by local codes [8, 9].
- In direct contact with the patient, clean or unclean equipment or textiles in the health care; change work uniform daily or more often if contaminated. This also applies to work with psychiatric patients.
- Hospital shoes, for own use, are used only in the hospital. Change to hospital shoes and place private one in the locker when arriving the hospital.
- Use the hospital’s socks, especially if not shoe cover heel and toe.
- It is *not* allowed to use jewellery at all work with patients or equipment (finger rings, bracelets, necklaces, all kinds of earrings and all other jewellery). Piercing is not allowed. Jewellery leads to increased bacterial growth [10, 11].
- It is not allowed to use the wristwatch at point of care or work with equipment as it increases the bacterial load on the hands [12].
- Nails should be short and clean. Artificial nails are not allowed [10, 11].
- Long hair is collected and secured. There can often be large amounts of bacteria in the hair.
- If covering the hair for religious reasons: use the hospital fabrics (hijab). The use of own hijab or headscarf is not allowed. The head restraints are changed daily and connected in such a way that the “snaps” do not hang down the front of the uniform and contaminate.
- Shift work clothes if contaminated with biological material.

- Surgical personnel and anaesthesiologists have a particular responsibility to follow the hospital's uniform routines—see the surgical department.
- Work clothes should be of sturdy yet dense material resistant to washing at 85 °C for at least 10 min and to disinfectants and frequent washing. All washing of outfits and other fabrics must be done in approved laundries for hospital textiles.
- Work attire should *not* be taken home and washed there because of the risk of spreading disease.
- Work attire should be comfortable and not trigger allergies.
- By care of patients, use care coat with long sleeves and cuff. These may be used in a blue or other specific colour and be patient bound.
- Use cover coat or disposable plastic aprons at work where there is danger of soiling of the ordinary work clothes.
- By care of infectious isolated patients, use yellow infection coats with long sleeves, cuffs at the wrist without pockets and with closing behind.
- Infection coats and care coats must be replaced daily or immediately if visible soiling or soaking. *An advantage in work with infectious cases is the use of yellow, disposable coats changed after each use.*
- Clean work clothes to prevent the spread of infection and to reduce bacterial load on the hands [13].

6.5 Background Information

In hospitals, there is an accumulation of infectious agents. Bacteria are often more antibiotic resistant than those detected outside hospitals. Contaminated work clothes pose a high risk of infection in a hospital environment [14–24].

Personnel with direct contact with patients or with clean and unclean equipment and textiles should always use the hospital's work attire. It includes anyone handling food, medicines, textiles, waste or cleaning tools. By caring, treating, examining and transporting patients, there will be direct contact between your own work clothes and the patient's cloths/bedding or skin. The same is true when working with used patient equipment such as bedpans, toilet chairs, beds and other aids and working in patient rooms, toilets and bathrooms or when handling bedding and bandages, giving physiotherapy, etc.

The work uniform is particularly exposed to organic matter and microbes, for example, in ambulances, in emergency services, in restless and anxious patients and children, during sampling and examination/treatment, etc. In acute wards, the staff is often exposed to splashes from patients, especially blood but also vomit, sputum, pus, faeces and urine [25].

In hospitals, the workout will be an alternating exposure for the work uniform to contaminated and clean material, for example, to go from nursing of a patient to storage rooms for sterile equipment or clean textiles. Competence and knowledge in infection control reduce the cross-contamination to other patients and the environment.

Change of attire daily. An additional certainty is that the outfit is changed daily or more often when needed. Bacteria, viruses and fungi live on textiles for up to several days and can pose a significant risk of infection [26–29]. During the SARS outbreak in 2003, a laundry employee in Taiwan was infected and caused a large outbreak through the washed and contaminated laundry sent out to the departments.

The work wear quickly becomes contaminated already after 8 h, partly from own skin and microbes, and partly from patients, personnel and the environment [30, 31]. Up to 60% of uniforms may be colonized with pathogenic microbes [15, 24]. In endemic areas of MRSA, the uniform may be contaminated with MRSA in 30–80% of cases [16, 32]. The bacteria are sitting for long periods on the sleeves and pockets and are risk to patients and other employees, particularly when hands are contaminated by own working clothes [32]. The more contaminated the outfit is, the more microbes are detected on the hands. From there, the road is not long to the mouth and to other parts of the face [13, 33]. The use of stethoscope, tourniquet, telephone, intercom systems, etc. in the coat pocket or around your neck increases the burden of microbes on the uniform, especially if the stethoscope and hands are not disinfected between patients and activities [34].

Good housekeeping in a department contributes to reduced infection pressure on the hands and the work wear [35]. Handwash must be carried out in such a way that the uniform is not contaminated with splashes and bacteria from the washbasin [36].

Do not wash the work wear at home. The washing of work clothes transferred to the user is justified by the fact that “home washing is as good as professional washing with regard to the cleanliness of the laundry” [8, 37]. This is not recommended and not true. Hospital-associated microbes should not be introduced to the home environment [9]. Both the Norwegian and the European occupation health and safety (2000/54/EU) highlight that workers like healthcare professionals and their families should not be subjected to unnecessary infection [7].

The patient’s view on uniforms. Patients feel greater security and communicate more easily with personnel and special doctors, formally dressed in the institution’s attire [38]. Doctors of “white coats” are perceived as being more hygienic, professional, authoritative and skilled [38]. Medical student’s white coats show high bacterial contamination on the sleeves and pockets [20, 39]. Similar observation is done among 100 doctors at a hospital in England where the white coat was changed once a week [19]. Staphylococci (*S. aureus*) were isolated from one of four coats and more frequent from surgeons than from internists [19].

Wardrobes and storeroom for uniforms must have a high standard with regard to cleaning and maintenance to eliminate the risk of cross-contamination. The wardrobe should have a handwash and hand disinfectant. The textile store must be clean and always have the door closed. If the door is open, clean clothes are usually contaminated by air currents from the corridor [23].

Laundries should be approved, accredited and quality assured [1–3, 6]. Laundering of textiles may be a weak link in the treatment of hospital textiles which may contain pathogenic bacteria [40, 41].

References

1. Dufseth IS, Andersen BM. Textiles. In: Handbook of hygiene and infection control. Oslo: Ullevaal University Hospital; 2008. p. 604–9.
2. Department of textile supply, Ullevål Hospital, has set the standard for quality (ISO 9002 standard) within laundry, storing of textiles, dressmaking.
3. Regulations concerning work suit. Ullevål Hospital; 1999.
4. Infection control program for Ullevål University, 2006–2011.
5. Andersen BM. Hospital attire. In: Handbook in hygiene and infection control. Oslo: Ullevaal University Hospital; 2008. p. 184–5.
6. State Board of Health, IK-1941. Hygiene guidelines; treatment of textiles used in health institutions. Oslo: The Norwegian Public Health Authority; 1994.
7. Occupational Health Department. Regulations on protection against exposure to biological factors (bacteria, viruses, fungi and more) in the workplace. Oslo: Occupational Health Department; 1997. nr.1322.
8. Bearman G, Bryant K, Leekha S, et al. Healthcare personnel attire in non-operating-room settings. *Infect Control Hosp Epidemiol.* 2014;35:107–21.
9. Dancer SJ. Pants, policies of and paranoia. *J Hosp Infect.* 2010;74:10–5.
10. Boyce JM, Pittet D. Guideline for hand hygiene in health-care settings. *MMWR Recomm Rep.* 2002;51:1–45.
11. WHO guidelines on hand hygiene in health care. Geneva: WHO; 2009. p. 1–270.
12. Jeans AR, Moore J, Nicol C, Bates C, Read RC. Wristwatch use and hospital-acquired infection. *J Hosp Infect.* 2010;74:16–21.
13. Munoz-Price LS, Arheart CL, Mills JP, et al. Associations between bacterial contamination of health care workers' hands and contamination of white coats and scrubs. *Am J Infect Control.* 2013;41:565–7.
14. Banu A, Anand M, Nagi N. White coats as a vehicle for bacterial dissemination. *J Clin Diagn Res.* 2012;6:1381–4.
15. Pinon A, Gachet J, Alexandre V, Decherf S, Vialette M. Microbiological contamination of bed linen and staff uniforms in a hospital. *Adv Microbiol.* 2013;3:51–519.
16. Treacle A, Thom KA, Furuno JP, et al. Bacterial contamination of health care workers' white coats. *Am J Infect Control.* 2009;37:101–5.
17. Zachary KC, Bayne PS, Morrison VJ, Ford DS, Silver LC, Hooper DC. Contamination of gowns, gloves, and stethoscopes with vancomycin-resistant enterococci. *Infect Control Hosp Epidemiol.* 2001;22:560–4.
18. Neely AN, Maley MP. Survival of enterococci and staphylococci on hospital fabrics and plastic. *J Clin Microbiol.* 2000;38:724–6.
19. Wong D, New K, Hollis P. The microbial flora on doctor's white coats. *Br Med J.* 1991;303:21–8.
20. Muhadi SA, Aznamshah NA, Jahanfar S. A cross sectional study on the microbial contamination of the medical student's white coats. *Malays J Microbiol.* 2007;3(1):35–8.
21. Varghese D, Patel H. Hand washing: stethoscopes and white coats are the sources of nosocomial infections. *Br Med J.* 1999;319:519.
22. Chacko L, Jose S, Issac A, Bhat KG. Survival of nosocomial bacteria on hospital fabrics. *Indian J Med Microbiol.* 2003;21(4):291.
23. Hambraeus A. Transfer of *Staphylococcus aureus* via nurses' uniforms. *J Hyg.* 1973;71:799–814.
24. Wiener-Well Y, Galuty M, Rudensky B, Schlesinger Y, Attias D, Yinnon AM. Nursing and physician attire as possible source of nosocomial infections. *Am J Infect Control.* 2011;39:555–9.
25. Littlechild P, Macmillan A, White MM, Steedman DJ. Contamination of skin and clothing of accident and emergency personnel. *BJM.* 1992;305:156–7.
26. Kramer A, Schwebke I, Kampf G. How long do nosocomial pathogens persist on inanimate surfaces? A systematic review. *BMC Infect Dis.* 2006;6:130.
27. Perry C, Marshall R, Jones E. Bacterial contamination of uniforms. *J Hosp Infect.* 2001;48:238–41.

28. Scott E, Bloomfield SF. The survival and transfer of microbial contamination via cloths, hands and utensils. *J Appl Bacteriol.* 1990;68:271–8.
29. Fijan S, Turk SS. Hospital textiles, are they a possible vehicle for healthcare-associated infections? *Int J Environ Res Public Health.* 2012;9:3330–43.
30. Burden M, Keniston A, Frank M, et al. Bacterial contamination of healthcare workers' uniforms: a randomized controlled trial of antimicrobial scrubs. *J Hosp Med.* 2013;8:380–5. <https://doi.org/10.1002/jhm.2051>.
31. Callewert C, de Maeseeneire E, Kerckhof F-M, Verliefde A, Van de Wiele T, Boon N. Microbial odour profile of polyester and cotton clothes after fitness session. *Appl Environ Microbiol.* 2014; <https://doi.org/10.1128/AEM.01422-14>.
32. Gaspard P, Eschbach E, Gunther D, Gayet S, Bertrand X, Talon D. Methicillin-resistant *Staphylococcus aureus* contamination of healthcare workers' uniforms in long-term care facilities. *J Hosp Infect.* 2009;71:170–5.
33. Rusin P, Maxwell S, Gerba C. Comparative surface -to-hand and fingertip-to-mouth transfer efficiency of gram-positive bacteria, gram-negative bacteria, and phage. *J Appl Microbiol.* 2002;93:585–92.
34. Longtind Y, Schneider A, Tschopp C, et al. Contamination of stethoscopes and physicians' hands after physical examination. *Mayo Clin Proc.* 2014;89:291–9.
35. Hess A, Shardell M, Johnson JK, et al. A randomized, controlled trial of enhanced cleaning to reduce contamination of healthcare workers gowns and gloves with multidrug resistant bacteria. *Infect Control Hosp Epidemiol.* 2013;34:487–93.
36. Best IU, Fawley WN, Parnell P, et al. The potential for airborne dispersal of *Clostridium difficile* from symptomatic patients. *Clin Infect Dis.* 2010;50:1450–7.
37. Wilson JA, Loveday HP, Hoffman PN, Pratt RJ. Uniform: an evidence review of the microbiological significance of uniforms and uniform policies in the prevention and control of healthcare-related infections. Report to the Department of Health (England). *J Hosp Infect.* 2007;66:301–7.
38. Gooden BR, Smith MJ, Tattersall SJ, Stockl MR. Hospitalized patients' views on doctors and white coats. *Med J Aust.* 2001;20:219–22.
39. Loh W, Ng VV, Holton J. Bacterial flora on the white coat of medical students. *J Hosp Infect.* 2000;45:65–8.
40. Bloomfield SF, Exner M, Signorelli C, Nath KJ, Scott EA. The infection risk associated with clothing and household linens in home and everyday life settings, and the role of laundry. International Scientific Forum on Home Hygiene. 2011. <http://www.ifh.homehygiene.org>.
41. Munoz-Price LS, Arheart KL, Lubarsky DA, Birnbach DJ. Differential laundering practices of white coats and scrubs among health care professionals. *Am J Infect Control.* 2013;41:565–7.