

Research Article

Compliance of Cypriot nurses with Standard Precautions to avoid exposure to pathogens

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Abstract

Standard Precautions have been introduced as a means to protect health professionals from exposure to pathogens. This study examines the extent of Cypriot nurses' compliance with the main aspects of Standard Precautions and explores the possible associations with the nurses' characteristics. Self-completed questionnaires that examined the frequency of the implementation of Standard Precautions were distributed to a convenience sample of 668 nurses. The response rate was 89.37%. The results showed inadequate compliance with Standard Precautions. Full compliance with all the main aspects of Standard Precautions was reported by only 9.1% of the participants. Male nurses and those who had not been exposed previously to pathogens reported better compliance, in comparison to female nurses and those who had been exposed previously. Nurses who had participated previously in an educational program about Standard Precautions reported a higher frequency of implementing them than those who had not participated. The nurses' age and frequency of the implementation of Standard Precautions were found to be significantly and positively correlated. The results can be used to enhance nurses' safety by focusing on areas of non-compliance.

Key words

compliance, exposure, nurses, pathogens, safety, Standard Precautions.

INTRODUCTION

In the hospital environment, many microorganisms can cause serious or even lethal infections to healthcare professionals, due to occupational exposure. The greatest concern centers on the Hepatitis B virus, Hepatitis C virus, and HIV (Konte *et al.*, 2007). This issue has particularly affected nurses, who are the largest group of workers within the healthcare system (WHO, 2008). Nurses are likely to be exposed to microorganisms during their daily practice due to the very close (and frequently direct) contact that they need to have with patients in order to provide nursing care (Maltezou *et al.*, 2008). The Centers for Disease Control and Prevention (CDC) in the USA acknowledged the importance of occupational exposure to microorganisms and, in 1996, issued a set of guidelines (Garner, 1996) that were recently updated by Siegel *et al.* (2007). These guidelines, which are known as Standard Precautions, aim to protect both healthcare professionals and patients from exposure to microorganisms (Ganczak & Szych, 2007).

LITERATURE REVIEW**Standard Precautions**

In the 1970s, the CDC recognized the issue of occupational exposure to microorganisms among healthcare professionals as a problem that potentially could have serious effects on their health. For this reason, the CDC issued the first guidelines to help healthcare professionals protect both themselves and their patients from the transmission of infectious microorganisms. In 1983, these guidelines were revised; in 1987, Universal Precautions were released, which required healthcare professionals to treat every patient as potentially infectious. In 1990, Body Substance Isolation Practice was outlined (Lynch *et al.*, 1990), which required the use of protective equipment (similar to that described by Universal Precautions) for healthcare professionals in all cases when exposure was anticipated. The main difference was that the use of protection was required when contact was anticipated with any body fluid (whereas, Universal Precautions required the use of protection only when contact was anticipated with certain defined body fluids). In 1996, the CDC, in order to clarify the different instructions (which, in some cases, seemed to confuse healthcare professionals), issued Standard Precautions, combining the main principles of Universal Precautions and Body Substance Isolation Practice (Garner,

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1996). Recently, Standard Precautions have been updated and expanded to correspond to recent changes in health care (Siegel *et al.*, 2007). Standard Precautions (Appendix I) have been reported as an effective means of providing protection, both to healthcare professionals and to patients, by controlling the spread of infections, but only when they are systematically and fully implemented (Cullen *et al.*, 2006).

Compliance

Compliance has been defined by Haynes *et al.* (1979) as the extent to which a certain behavior is carried out in accordance with medical orders or healthcare advice. Similarly, non-compliance is defined as the extent to which a certain behavior is not in accordance with the aspects mentioned above, either partially or in total (Playle & Keeley, 1998). Non-compliance can be an intentional action (whereby individuals choose to adopt a certain behavior and to avoid another) or an unintentional action (whereby individuals do not follow a certain behavior because they cannot understand its content) (Hussey & Gilliland, 1989). Compliance or non-compliance can be influenced by a variety of factors, such as the culture, economic and social factors, a lack of knowledge or means, or an unwillingness to participate. Guidelines that direct individuals' behavior exist in a variety of settings (including healthcare settings). Nevertheless, individuals do not always use or comply with them.

Compliance with Standard Precautions

Although Standard Precautions are simple to understand and implement, there is a marked reluctance among healthcare professionals to comply with them fully. Compliance with Standard Precautions among healthcare professionals (including nurses) was reported to be inadequate with regard to eye protection (Madan *et al.*, 2001; 2002; Chan *et al.*, 2002; Kermod *et al.*, 2005; Ganczak & Szych, 2007), avoidance of needle recapping (Chan *et al.*, 2002; Osborne, 2003; Kermod *et al.*, 2005), glove use when required (Knight & Bodsworth, 1998; Chan *et al.*, 2002; Stein *et al.*, 2003; Kermod *et al.*, 2005; Zhang *et al.*, 2009), washing hands before and after patient contact (Chan *et al.*, 2002; Stein *et al.*, 2003), use of face masks (Madan *et al.*, 2002), avoidance of a used needle that is disassembled from a syringe (Godin *et al.*, 2000; Zhang *et al.*, 2009), and the implementation of precautions for all patients (Godin *et al.*, 2000).

Factors leading to non-compliance

Many researchers have focused on the factors that influence nurses to not comply with Standard Precautions. The reported factors include a lack of means (Sax *et al.*, 2005; Oliveira *et al.*, 2010), a lack of time to implement the precautions (Kelen *et al.*, 1990; Tait *et al.*, 2000; Madan *et al.*, 2002; Sax *et al.*, 2005), a lack of knowledge about the use of the preventive equipment (Sax *et al.*, 2005; Oliveira *et al.*, 2010), forgetfulness (Sax *et al.*, 2005; Oliveira *et al.*, 2010), a negative impact on nursing skills (Kelen *et al.*, 1990; Tait *et al.*, 2000; Stein *et al.*, 2003), skin irritation (Oliveira *et al.*, 2010), a lack

of training (Gershon *et al.*, 1995), conflict between the need to provide care and protection (Gershon *et al.*, 1995), and distance from the necessary facilities or equipment (Oliveira *et al.*, 2010).

AIM OF THE STUDY

This study aimed to examine Cypriot nurses' compliance with the main aspects of Standard Precautions and to explore the possible relationships or associations with the nurses' demographic characteristics.

METHODS

A cross-sectional survey was used with a 10 item, structured questionnaire on the implementation of Standard Precautions, developed by the authors.

Questionnaire development

Phase one

The instructions of the CDC concerning Standard Precautions were examined (Garner, 1996; Siegel *et al.*, 2007). Most of the important issues were extracted and reviewed for inclusion in the first version of the questionnaire.

Phase two

In order to test the face and content validity, six experts on infection control examined the content and format of the first version. Following their suggestions, a second version was designed by eliminating those questions that were described as irrelevant to the study. Others were added.

Phase three

The second version of the questionnaire was pilot-tested on 30 clinical nurses in order to further test its content validity. They evaluated the clarity of the instructions and its content. Further amendments followed.

Phase four

The final questionnaire consisted of 10 questions. Nine of them used a six-point Likert-type response scale and each question required the respondents to assess the frequency of their performance of certain requirements of Standard Precautions (never, seldom, sometimes, often, usually, and always). The last question used a "yes" or "no" response format (Table 1).

Ethical considerations

The study was approved by the Cyprus National Bioethics Committee and the relevant committee of the Ministry of Health of Cyprus. As this project was a part of a PhD thesis, the protocol was reviewed, evaluated, and approved by a supervisory committee. The participants were free to

Table 1. The study's questionnaire

	Never	Seldom	Sometimes	Often	Usually	Always
1. I provide nursing care considering all patients as potentially contagious						
2. I wash my hands after the removal of gloves						
3. I avoid placing foreign objects on my hands						
4. I wear gloves when exposure of my hands to body fluids is anticipated						
5. I avoid needle recapping						
6. I avoid the disassembling of a used needle from a syringe						
7. I use a face mask when exposure to air-transmitted pathogens is anticipated						
8. I wash my hands after the provision of care						
9. I discard used sharp materials into sharps containers						
10. Have you been vaccinated against HBV?					Yes	No

HBV, Hepatitis B virus.

participate in or withdraw from the study, the anonymity of the data was preserved, and the data that emerged were kept safely. The completion of the questionnaires was considered as informed consent for participation. A cover letter with information on the aim of the study accompanied the questionnaires.

Sample size

The *g**Power statistical program (Faul *et al.*, 2007) was used to estimate the necessary sample size. A minimum of 278 completed questionnaires was required in order for this study to have acceptable power (power = 80%, $\alpha = 0.05$, effect size = 0.04) (Merkouris, 2008). The post-hoc analysis demonstrated that this study, based on the final recruited sample of 577 participants, achieved a power of >95% ($\alpha = 0.05$, effect size = 0.04).

Data collection

The questionnaires were distributed from March to May 2010 by a member of the research team to a convenience sample of 668 nurses who were working at the five main hospitals in the Republic of Cyprus, participating in an upgrade program from the diploma level to the bachelor level of nursing ($n = 2898$). The questionnaires were collected during the same day in order to achieve a higher response rate. The inclusion criteria were: (i) to be a registered nurse; (ii) to have direct contact with patients; and (iii) to have a willingness to participate in the study. A total of 597 questionnaires was returned (response rate: 89.37%) and 577 were usable.

Data analysis

The data were analyzed by using SPSS 17.0 for Windows (SPSS, Chicago, IL, USA). Descriptive statistics, such as percentages, means, and standard deviations (SDs), were computed for the demographic data and percentages and sums were calculated for the ordinal data. For finding the sums of the ordinal data, a value was assigned to each point on the

Likert-type scale (1 = "never", 2 = "seldom", 3 = "sometimes", 4 = "often", 5 = "usually", and 6 = "always") and a sum of the answers of each respondent was calculated (the highest possible score was 54 and the lowest possible score was nine). The higher the score, the more compliant the participant was considered to be. Comparisons were carried out by using the χ^2 -test for the categorical data and the Mann-Whitney *U*-test for the numerical data. Correlations were carried out by using the Spearman's Rank correlation coefficient. The use of non-parametric tests (Mann-Whitney *U*-test and Spearman's Rank correlation coefficient) was selected because the variables did not follow a normal distribution (Merkouris, 2008).

RESULTS

Reliability of the questionnaire

The Cronbach's alpha was determined by using the responses to the nine questions using the Likert-type response format. It was found to be 0.713, evidence that the questionnaire had an acceptable level of internal consistency (Bowling, 2009). If deleted, none of the questions contributed to a better Cronbach's alpha score. The test-retest reliability was carried out among 46 nurses, to whom the questionnaire was distributed twice with a 1 month interval (Merkouris, 2008). The Spearman's correlation coefficient for the two administrations was 0.765 ($P < 0.01$), showing a high stability of the questionnaire over time (Polit *et al.*, 2001).

Demographics

The mean age of the nurses was 36.32 years (SD = 9.89, minimum = 21, maximum = 61) and the mean amount of clinical experience was 13.57 years (SD = 9.74, minimum = 1, maximum = 40). Most (80.9%) of the participants were female. Almost half (48%) of them had been exposed previously to microorganisms in some way (e.g. sharps injury, air transmission) and three-quarters (75.6%) of the nurses had participated previously in a program concerning the prevention of exposure to microorganisms.

Nurses' behavior

Only 9.1% of the respondents replied that they always implemented all the main principles of Standard Precautions (replying "always" to all questions), as mandated by the guidelines. Full compliance with Standard Precautions on individual aspects of the guidelines ranged from 30.2% to 95.7%. The two behaviors that were reported with the lowest frequency of "always" implemented were: "I provide nursing care considering all patients as potentially contagious" (30.2% reported that they always do) and "I avoid the disassembling of a used needle from a syringe" (45.8% reported that they always avoid this). The two behaviors that were reported with the highest frequency of "always" implemented were: "I wash my hands after the provision of care" (84.4% reported that they always do) and "I discard used sharp materials into sharps containers" (95.7% reported that they always do) (Table 2). Most (91.5%) of the nurses said that they had been vaccinated against the Hepatitis B virus.

The responses to the Likert-type questions were combined into three categories (A = never + seldom + sometimes,

B = often + usually, and C = always) in order to explore how the nurses behaved with regard to certain aspects of Standard Precautions. Category A was considered as negative behavior (unsystematic use), category B as relatively positive, but not satisfactory, behavior (aspects of systematic use, but not always), and category C was considered as satisfactory behavior (systematic use). The analysis showed that, in some aspects of Standard Precautions, the nurses tended to show a notable amount of negative behavior (category A), ranging from 10.8% to 26.8%. An additional positive, but not satisfactory, behavior (category B), ranging from 19.3% to 43.2%, also was reported (Table 3).

Significant differences and relationships

For reasons of comparison, the sample was divided into two groups: those who did not fully comply with all the main aspects of Standard Precautions (responses 1–5 on the Likert-type scale) and those who did (response 6 on the Likert-type scale). A χ^2 -test showed that more male (17.3%) than female (8%) nurses reported full compliance with Standard Precautions ($P < 0.01$) and that more nurses who had not been occupationally exposed to microorganisms previously (13.4%) than nurses who had been exposed previously (6.5%) reported full compliance with all the main aspects of Standard Precautions ($P < 0.01$). A Mann–Whitney U -test showed that the nurses who had participated previously in an educational program concerning Standard Precautions reported a higher frequency of implementing the guidelines than those who had not participated ($P < 0.01$). The Spearman's correlation coefficient showed a small, positive significant relationship between the age and frequency of the reported compliance with Standard Precautions ($\rho = 0.185$, $P < 0.01$).

DISCUSSION

It is clearly evident from the results of this study that an overall suboptimal compliance by the Cypriot nurses with the main requirements of Standard Precautions exists. Only 9.1% of the respondents reported that they always implemented all the main principles of Standard Precautions.

Table 2. Full compliance (always implemented) with the main aspects of Standard Precautions ($n = 577$)

Behavior	Always implemented N (%)
1. I provide nursing care considering all patients as potentially contagious	174 (30.2)
2. I wash my hands after the removal of gloves	454 (78.7)
3. I avoid placing foreign objects on my hands	357 (61.9)
4. I wear gloves when exposure of my hands to body fluids is anticipated	381 (66.2)
5. I avoid needle recapping	325 (56.3)
6. I avoid the disassembling of a used needle from a syringe	264 (45.8)
7. I use a face mask when exposure to air-transmitted pathogens is anticipated	331 (57.4)
8. I wash my hands after the provision of care	487 (84.4)
9. I discard used sharp materials into sharps containers	552 (95.7)

Table 3. The reported compliance level by category ($n = 577$)

Behavior	Category A: Never + seldom + sometimes N (%)	Category B: Often + usually N (%)	Category C: Always N (%)
1. I provide nursing care considering all patients as potentially contagious	155 (26.8)	249 (43.2)	173 (30.0)
2. I wash my hands after the removal of gloves	12 (2.1)	111 (19.3)	454 (78.6)
3. I avoid placing foreign objects on my hands	62 (10.8)	158 (27.4)	357 (61.8)
4. I wear gloves when exposure of my hands to body fluids is anticipated	17 (2.9)	178 (30.8)	382 (66.3)
5. I avoid needle recapping	70 (12.2)	182 (31.5)	325 (56.3)
6. I avoid the disassembling of a used needle from a syringe	117 (20.3)	197 (34.1)	263 (45.6)
7. I use a face mask when exposure to air-transmitted pathogens is anticipated	53 (9.2)	193 (33.5)	331 (57.3)
8. I wash my hands after the provision of care	5 (0.8)	85 (14.8)	487 (84.4)
9. I discard used sharp materials into sharps containers	10 (1.7)	15 (2.6)	552 (95.7)

These findings are similar to those that were reported by Kermodé *et al.* (2005), who found only 11% full compliance for all the components of the precautions. The majority of the respondents acknowledged less-frequent implementation, failing to appreciate the protection that these guidelines can offer (Kim *et al.*, 2003). This suboptimal behavior can lead to an increased hazard of being contaminated and the lack of use of the precautions can leave the nurses unprotected.

A remarkable proportion (69.2%) of the respondents did not provide nursing care considering all patients as potential disease-carriers. Standard Precautions require that all patients should be treated as potentially infectious and protective measures should be applied every time that exposure to microorganisms is anticipated (Siegel *et al.*, 2007), irrespective of the patients' sex, age, or other characteristics. Many infected patients and carriers of serious diseases (e.g. AIDS) might not have specific clinical symptoms. These diseases can be transmitted if proper protective measures are not implemented (Raftopoulos *et al.*, 2008).

Hand hygiene is considered as the main means of infection control (Siegel *et al.*, 2007). In this study, 21.3% of the respondents admitted that they did not always wash their hands after removing gloves and 15.6% did not always wash their hands after the provision of nursing care. These results are higher than those that were reported in a review by Gammon *et al.* (2008), where the mean compliance rate with hand hygiene was 52% (ranging from 28% to 86%). Hand-washing always should be carried out before and after the provision of care as it reduces the count of microorganisms on one's hands, protecting both healthcare professionals and patients from the spread of infection (Apostolopoulou *et al.*, 2010).

More than one-third (38.1%) of the respondents mentioned that they had rings or artificial nails on their hands. Similar findings were reported by Kennedy *et al.* (2004), who found that 61% of the healthcare workers in a neonatal intensive care unit wore at least one ring at work. Wearing rings increases the total bacterial colonization of the hands and reduces the success of alcohol-based hand disinfection (Yildirim *et al.*, 2008). It also has been shown that wearing a wedding ring is no better, in terms of hand colonization, than wearing a ring with a stone (Yildirim *et al.*, 2008). Therefore, the current practice of allowing wedding rings to be worn should change. Similarly, long or artificial nails can increase the count of microorganisms on one's hands and makes the removal of microorganisms, even with proper hand-washing, more difficult (Lin *et al.*, 2003).

According to the guidelines, gloves always should be used when the exposure to body fluids is anticipated. Body fluids can contain pathogenic microorganisms (e.g. HIV or Hepatitis B virus in blood) that can transmit serious diseases (e.g. AIDS, Hepatitis B). Gloves serve as a barrier between the hands and body fluids, preventing microorganisms from contaminating one's hands. One-third (33.8%) of the participants reported that they did not always wear gloves when exposure was likely to happen (e.g. during the drawing of blood), increasing the danger of being exposed. Unfortunately, similar findings of inadequate compliance on glove use are frequently reported in the literature (Knight & Bod-

sworth, 1998; Chan *et al.*, 2002; Stein *et al.*, 2003; Kermodé *et al.*, 2005; Ganczak & Szych, 2007).

It has been estimated that ~ 66 000 infections of Hepatitis B virus, 16 000 infections of Hepatitis C virus, and 200–5000 infections of HIV among healthcare professionals are due to percutaneous injuries (Kermodé *et al.*, 2005). Recapping a used needle poses a serious danger of needle-stick injury (Schmid *et al.*, 2007). Therefore, used needles never should be recapped, as this could lead to a needle-stick injury. The needles always should be discarded without removing them from the syringe and placed in a sharps container in one piece. In this study, 43.7% of the respondents admitted that they did not always avoid recapping a used needle before they discarded it. This finding is in accordance with other studies (Chan *et al.*, 2002; Osborne, 2003; Kermodé *et al.*, 2005). In addition, more than half (54.2%) of the respondents admitted some kind of manipulation of the needle after it has been used. More specifically, the respondents said that they often tried to disconnect a used needle from a syringe before discarding it. Such a manipulation can lead to a needle-stick injury or blood spillage.

Face masks can prevent the inhalation of air-transmitted microorganisms and they are highly recommended when the exposure to such microorganisms is anticipated (Siegel *et al.*, 2007). Unfortunately, 42.6% of the participants said that they did not always use a face mask when needed, putting them at risk of acquiring an air-transmitted infection. The majority (95.7%) of the respondents answered that they always discarded used sharp objects into a sharps container. This behavior is in accordance with the requirements of Standard Precautions, which requires that, for the safety of all healthcare workers, used sharp objects should not be discarded as common waste (e.g. in waste bins), as this poses a danger of injury. Alternatively, they should be put, after their use, into a puncture-resistant sharps container and discarded according to the requirements of the local policy.

Most (91.5%) of the respondents stated that they had been vaccinated against the Hepatitis B virus. Vaccination against the Hepatitis B virus provides a very good level of protection against the disease (WHO, 2008) and should be encouraged among healthcare professionals.

The analysis showed that the Cypriot nurses tended to not be fully compliant (always in need of implementation) with the main principles of Standard Precautions (they demonstrated negative or occasionally positive, but not satisfactory, behavior). Interventional programs for improving nurses' current behavior should focus mainly on these aspects (e.g. provision of care considering all patients as potentially contagious, avoidance of used-needle disassembly) in order to enhance the overall compliance rate with the guidelines. More effort will be needed to fulfill those principles so that nurses can avoid non-compliant behavior.

Overall, the Cypriot nurses did not follow Standard Precautions in the required way, although they did choose to implement some procedures satisfactorily (e.g. discarding sharp materials into sharps containers). This behavior puts them into great danger of acquiring a disease following exposure to pathogens during their daily clinical practice.

Significant differences and relationships

The male nurses showed a significantly more-frequent full compliance with the main requirements of Standard Precautions than did the female nurses, which shows a gender influence on compliance that needs more investigation. This finding does not support previous studies (Gershon *et al.*, 1999; Parmeggiani *et al.*, 2010), where no difference in the use of Standard Precautions was noted in relation to the participants' age. It should be stated, however, that these studies' samples included a variety of healthcare workers (e.g. physicians and student nurses), not just nurses. The results also do not support the reports of previous studies in other disciplines (e.g. sexual compliance, compliance with antihypertensive therapy), which suggested that women were more likely to be compliant, compared to men, or that no relationship between compliance and gender existed (Impett & Peplau, 2003).

The nurses who had not been exposed previously to pathogens reported better full compliance with Standard Precautions than those who had been exposed. This was an unexpected finding because it would have been more sensible to expect that those nurses who had experienced exposure in the past would be more careful and would implement Standard Precautions fully in the future. This difference could be attributed to a more risky attitude or an unwillingness to comply with the regulations that the exposed group might have developed. Further study of the characteristics of the two groups is needed in order to explain the observed difference.

As expected, the nurses who had participated in an educational program concerning Standard Precautions in the past showed more frequent use of Standard Precautions, compared with those who had not participated in such a program. This demonstrates that educational programs can influence nurses' compliance level and persuade them to use Standard Precautions more frequently. These findings are in accordance with those of a review by Gammon *et al.* (2008), which examined the compliance of healthcare professionals (including nurses) with Standard Precautions and showed that educational interventions could improve their compliance with precautions, although this compliance might not be permanent or long-term.

Age was found to be a determinant of the frequency of compliance with Standard Precautions. The older the nurse, the more frequently the nurse would follow Standard Precautions. Although this relationship was small, it was significant, showing that to some extent, age is a determinant of practice. An explanation for this is that the experience that nurses gain over the years makes them more willing to follow the precautions.

Limitations of the study

This study used a convenience-sampling method for easier recruitment and the achievement of a significant response rate. However, this method is lacking in terms of external validity (Bowling, 2009), which might have affected the possibility of generalizing the results to the whole population of

nurses. Furthermore, the use of a self-completed questionnaire might have been associated with self-report bias, leading to the assumption that the rate of compliance might have been even lower than that which has been reported.

CONCLUSIONS

The study demonstrated that Cypriot nurses do not follow Standard Precautions in the way that is required and that they choose to implement only selected aspects in a satisfactory manner (e.g. discarding sharp materials in sharps containers). This behavior puts them at risk of acquiring diseases following their exposure to pathogens during their daily clinical practice and might have contributed to the previously observed high rate of occupational exposure to microorganisms. This determination of the extent to which aspects of the nurses' behavior is inadequate should encourage nurse managers and healthcare policy-makers to develop educational programs that are specifically tailored to the problematic areas in order to promote the use of Standard Precautions, thus greatly enhancing nurses' safety. Furthermore, it is vital to examine which factors might influence nurses' compliance with Standard Precautions in order to promote those that will lead to the universal adoption of these precautions and to eliminate those that prevent their full implementation. Future studies, using qualitative and quantitative methods, would be useful in determining the nature of such factors.

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APPENDIX I

Basic principles of Standard Precautions

- 1 The provision of care considering all patients as potentially contagious.
- 2 Hand-washing before and after the provision of care to a patient.
- 3 Hand-washing after glove removal.
- 4 The use of gloves when hand exposure to body fluids is anticipated.
- 5 Avoidance of recapping a used needle.
- 6 Avoidance of disassembling a used needle from a syringe.
- 7 The use of a face mask when exposure to air-transmitted microorganisms is anticipated.
- 8 The use of face goggles when the splashing of body fluids in the face is anticipated.
- 9 The safe discarding of sharp materials to puncture-resistant sharps containers.
- 10 Avoidance of placing foreign objects (e.g. rings) on one's hands.
- 11 Vaccination against Hepatitis B virus.