Infection control in Indonesian Hospitals

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Chapter

6

PREVENTING NOSOCOMIAL INFECTIONS: IMPROVING COMPLIANCE WITH STANDARD PRECAUTIONS IN AN INDONESIAN TEACHING HOSPITAL

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ABSTRACT

Standard precautions can prevent transmission of microorganisms. We investigated hand hygiene, handling of needles and use of personal protective equipment in an Indonesian teaching hospital and performed a multifaceted intervention study to improve compliance.

We performed an intervention in the Departments of Internal Medicine and Paediatrics, consisting of development of a protocol for standard precautions, installation of washstands, educational activities and performance feedback. Before, during and after the intervention, observers monitored compliance with hand hygiene, safe handling of needles and use of gloves, gowns and masks. A gynaecology ward served as control. Unobtrusive observations were performed to check for an influence of the observers on the overt observations.

A total of 7160 activities was observed. Compliance with hand hygiene increased from 46% to 77% in Internal Medicine and from 22% to 62% in Paediatrics. Before the intervention, no safe recapping was recorded in either department. After the intervention, 20% of needles were recapped safely. Inappropriate gown use decreased in Internal Medicine. There were no significant changes in use of gloves and masks. There may have been an effect of the overt observations in the Paediatric Department but none in the Internal Medicine Department. There were no significant changes in the control ward, except for a decrease in use of gloves.

Compliance with hand hygiene procedures improved significantly due to an intervention project focused on education and improved facilities. Compliance with safe handling of needles improved slightly due to introduction of the one-hand method for safe recapping of used needles.

INTRODUCTION

Prevention of transmission of pathogens in hospitals is based primarily on standard precautions. According to the principle that every patient is a potential source of pathogens, precautions should be taken whenever contact with a patient or patient's materials may result in transmission. Standard precautions combine measures to prevent healthcare-associated infections in patients and job-related infections in healthcare workers (HCW). Among the standard precautions are hand hygiene, personal hygiene of HCW and patients, safe handling of sharp objects and the use of personal protective equipment (PPE) such as gloves, gowns and masks.[1]

Improving adherence to standard precautions has been the aim of many intervention studies published in recent years.[2-16] Most of these studies focus on changing behaviour of HCW towards stricter observance of hand hygiene protocols.

Low adherence to guidelines is considered a problem of attitude and behaviour. However, in developing countries HCW face other problems in compliance with standard precautions.[17 18] Our experience in Indonesia is that in many public hospitals facilities for infection control are limited. Often, clinical wards have few handwashing facilities, sometimes without soap or towels. Sufficient water pressure to assure a continuous supply of water is not always guaranteed. Sometimes there is no running water and washbasins filled with cleaning solutions (chlorhexidine-cetrimide) are used instead. Alcohol-based handrubs are not widely available. There is often a shortage of gloves, gowns and masks. In many hospitals, single-use gloves are sterilized and re-used. Containers for safe disposal of sharp objects are often absent.

Given the essential role of standard precautions, we performed an intervention study in the Dr. Kariadi Hospital, Semarang, Indonesia, taking into account the problems described above and behavioural aspects to improve adherence to hand hygiene, safe handling of needles and the use of personal protective equipment.

METHODS

Setting

The study was conducted in a paediatric and an internal medicine ward of the Dr. Kariadi Hospital, Semarang, Indonesia. A gynaecology ward served as control.

The internal medicine ward has 66 beds: eight large rooms and four two-bed rooms, three of which are used for isolation. The paediatric ward is a 45-bed unit , which has nine rooms, one of which is used for protective isolation and two for source isolation. The gynaecology ward is a 66-bed unit with seven large rooms.

At the start of the study, there were two washstands with running water, soap and either a cotton towel or no towel in Internal Medicine. In the paediatric ward there were three trolleys with two bowls, one filled with a chlorhexidine/cetrimide solution, the other filled with water.

Empty plastic bottles were used as needle containers in both study wards. Needles were usually resheathed first and then discarded into these bottles. In both wards, there was a shortage of gloves. Disposable latex gloves were sterilized and re-used. Cotton gowns and masks were in limited supply.

Design

The study consisted of several periods:
1. Pre-intervention baseline observation period. HCW were not informed about the actual goal of the observations.
2. Consensus period. Observations were continued and members of the local infection control committee, researchers and representatives of medical and nursing personnel developed department protocols for hand hygiene, use of PPE and safe handling of needles during a series of consensus discussions.
3. Intervention period. Intervention activities were carried out and observations were continued.
4. Post-measurement and feedback period. Observations were continued and feedback was given once or several times.

Intervention

At the start of the intervention period, three more washstands were installed in the internal medicine ward. In the paediatric ward, the washbasins were replaced by three washstands.
A month after installation of the washstands, a 3-week campaign was started, consisting of a lecture on standard precautions, practical sessions in small groups and written information. The practical sessions were given frequently, to ensure that all medical and nursing personnel and students could attend. In the first week, HCW learned and practised correct handwashing and use of handrub, the second week safe handling of needles and the third week use of PPE. Because no budget was available for designated needle containers, we chose to teach recapping by the one-hand method as the only correct way of handling used needles.[19 20] Each attendant received a summary of the protocol and a small bottle of alcohol-based handrub. At the same time, handrub was placed in all rooms in the wards. Alcohol-based handrub was produced locally by the Hospital Pharmacy Department (one pocket bottle contained 100 ml ethanol 70% plus 2 ml glycerin). Feedback on compliance with hand hygiene during baseline and consensus periods was given orally and on charts hung near washstands. Those attending the practical sessions on safe recapping received a small gift: a pocket calculator with statements on infection control. Brightly coloured posters depicting the procedures were hung in nurse's rooms.
After the campaign, feedback on compliance with hand hygiene protocols was given once in the paediatric ward and three times in the internal medicine ward.

Measurements

Adherence to guidelines was measured by overt observations of HCW by the researchers (H.F. and D.O.D.) and trained observers. To check whether compliance was influenced by the presence of the observers, observation was also done unobtrusively by trained ward personnel while doing their work. An observation schedule ensured that all rooms were observed equally. Per observation, half of the patient rooms were studied. Overt observations were done from 7.00-8.30 a.m., unobtrusive observations between 7.30 and 8.30 a.m.
All activities that, according to the protocol, required hand hygiene or use of PPE were recorded. At the same time, other observers counted the number of handwashings. Because there were only two to four handwashing facilities per ward, all handwashings in the ward were recorded. Use of handrub was only counted in the rooms under observation.

We recorded every time a HCW carried out any activity while wearing gloves, a gown or a mask, or handled needles. Handling of needles was classified as unsafe when used needles were either not recapped by the one-hand method or taken from the room without resheathing.

Outcome measures

Compliance with hand hygiene: observed hand hygiene as percentage of maximum hand hygiene indicated by the department protocol.
Compliance with personal protective equipment: observed use of gloves, masks and gowns as percentage of maximal use indicated by the department protocol.
Safe handling of needles: percentage cases of handling needles followed by recapping by the one-hand method.

Calculations and statistical analysis

Compliance with hand hygiene was calculated as follows:

$$\frac{a+(b*(c/d))}{((e_t * f_t)+(e_2 * f_2) \ldots+(e_n * f_n)) * (c/d)} * 100$$

in which *a* represents the number of times handwashing is observed for the whole ward, *b* is the number of times use of alcohol-based handrub is observed in the observed rooms, *c* is the number of patients present in the ward, *d* is the number of patients present in the observed rooms, *e* is an activity carried out by a HCW in an observed room and *f* represents the number of times hand hygiene should be applied for activity *e* according to the consensus protocol.
Population characteristics and compliance were analysed by using the statistical package SPSS. First, compliance was calculated per observation period. Regression lines and ANOVA were used to detect significant changes in compliance within observation periods. When there were no significant changes in compliance per observation period, mean compliance for these periods was calculated. Next, significant differences between all periods were analysed with ANOVA and Post-Hoc tests. Significant differences between overt and unobtrusive observation were determined with the Independent Samples T-test.
For statistical analysis, the post-measurement period was divided into several periods because feedback was given repeatedly in the Internal Medicine Department. The post-measurement data for Paediatrics were divided into periods paralleling the periods in Internal Medicine, so the difference between measurements alone and feedback plus measurements could be analyzed.

RESULTS

Observations were performed from July 21, 2003 to June 26, 2004. During 81 overt observations per department, 3126 activities were observed in Internal Medicine and 1879 in Paediatrics (Table 1).

Hand hygiene

There were no significant trends in compliance within periods in either of the departments. Therefore, mean compliance in the baseline period was compared to mean compliances in the other periods.

In Internal Medicine (Figure 1a, Table 1), compliance increased significantly from baseline to the intervention period (difference 38%, CI-95 13 to 64) and remained increased until the end. Overall, there was a 67% increase from baseline to the last observation period (difference 31%, CI-95 1 to 62).
In Paediatrics (Figure 1b, Table 1), there was a significant increase in compliance from baseline to the intervention period (difference 74%, CI-95 40 to 108). In the last period, after six weeks without any activities, there was a non-significant decrease in compliance (difference 34%, CI-95 -73 to 4). Overall, there was a 182% increase from baseline to the last observation period (difference 40%, CI-95 4 to 76).

Handling of needles

In Internal Medicine, handling of needles was recorded 693 times, with hardly any safe handling in the baseline and consensus periods and a non-significant increase in the intervention period (Table 1). Compliance was highest in the last observation period (difference 53%, CI-95 39 to 74).
In Paediatrics, handling of needles was observed 158 times. The majority of needles was handled unsafely in all periods (Table 1).

Use of personal protective equipment

Neither ward exhibited significant differences in compliance with use of personal protective equipment (PPE, Table 1).
In Internal Medicine, use of gloves was observed 45 times in the baseline period, while there were 103 indications for use. After the intervention, use of gloves was observed 113 times, while there were 197 indications for use. Compliance did not change significantly throughout the study. Indications for use of gowns were observed twenty times in the baseline period, while gown use was observed 418 times. After the intervention, use of gowns was observed 216 times, while there were three indications for use. Overuse of gowns decreased significantly from 27 gowns per observation in the baseline period to 2 in the last period (difference 25, CI-95 -18 to -31). Mask use was observed 59 times throughout the study period, while there were two indications for use. Compliance with gown and mask use could not be calculated, because the indications were very few.
In Paediatrics, use of gloves was observed three times in the baseline period, and indications for use were twenty times. After the intervention, use of gloves was observed fourteen times, while there were 37 indications for use. In total, mask use was observed 15 times, while there were six indications for use, and gown use was observed 12 times, with five indications according to standard precautions. Because of these small numbers, compliance with use of gloves, gowns and masks could not be calculated.

Unobtrusive observations

Unobtrusive observations were performed 21 times in Internal Medicine and 16 times in Paediatrics from the intervention to the last observation period (Figure 1a and 1b).
There was no significant difference between the two types of observations. However, inspection of the boxplots suggests that there may have been a difference for Paediatrics, at least during the intervention period, which failed to reach significance due to the small sample size.

Control ward

In the gynaecology ward, 2155 activities were observed during the consensus, intervention and post intervention periods.
There was no significant change in compliance with hand hygiene during the observation period, neither within nor between periods. Use of alcohol-based handrub was never observed. All needles were handled unsafely, in all periods.
Compliance with use of gloves decreased significantly from the consensus period to the post intervention period. Use of gloves was observed 121 times, while there were 84 indications for use. Compliance with the use of gowns and masks could not be calculated, because, although gowns were worn 40 times and masks 25 times, there were no indications according to standard precautions. Gowns were worn while handling cytostatic drugs.

DISCUSSION

Our intervention procedure, combining instalment of washstands, teaching activities and feedback on performance, resulted in a significant and sustainable improvement in hand hygiene. Safe handling of needles by applying the one-hand method for resheathing used needles was introduced with some success in the Internal Medicine Department, but failed in the Paediatric Department. With the exception of a strong decrease in overuse of gowns in Internal Medicine, the use of gloves, masks and gowns did not change despite instruction to HCW and consensus about indications for use.
For the assessment of compliance with the hand hygiene protocol, observations of handwashing and care activities were performed separately. The advantage of this method was that observers did not need to follow HCW closely. The disadvantage was that compliance had to be calculated with the assumption that the number and type of activities in the observed rooms were the same as in the whole ward, because observations of handwashing at washstands concerned the whole department whereas activities could be measured for a part of the department only. By calculating mean adherence per period, individual variations were levelled out and reliable estimations of adherence were possible.
The fact that HCW were observed from a distance decreased observer bias. The hypothesis that people improve their behaviour when they know they are being observed could not be confirmed by comparing compliances measured with overt and unobtrusive observations. In Paediatrics there may have been a temporary influence of observation on HCW's compliance during the intervention. At this point in the study, HCW were aware of the goal of the observations, since they received feedback on their compliance in the baseline and consensus periods. Indeed several times HCW started washing their hand en masse when they spotted the observers. This effect appeared to dissipate after a few weeks.
The intervention on hand hygiene was the most successful. During and shortly after the intervention period, there was an enthusiastic response of personnel, especially in Paediatrics. In this ward, before the intervention, there were no washstands with running water. Several senior nurses on the paediatric ward felt frustrated by the lack of facilities in their ward and saw the study as an opportunity to tackle the problems of hand hygiene. During the study, they often reminded HCW of the importance of hand hygiene. The initial response in Internal Medicine was weaker, but six months after intervention, compliance was still significantly higher than at baseline. After the

newly appointed head nurse of this department was settled into her new job, she too regularly reminded HCW during educational meetings.

Although overall compliance with hand hygiene improved significantly, alcohol-based handrub did not become an accepted alternative to handwashing. Acceptance of handrub could facilitate compliance greatly.[5 8 12 21] One pocket-sized bottle with 100 ml of locally produced alcohol-based handrub currently costs Rp 1,375 (Euro 0.14), consisting of Rp 325 for the bottle and Rp 1,050 for the contents. In practice the price of a bottle is slightly lower, because the bottles are re-used.

Introduction of handrub might have failed for several reasons. During the consensus discussions and practical sessions, we noticed that there were misconceptions regarding indications, effectiveness, unfavourable effects and correct use of handrub. Fear that handrub would dry the skin played a role, a logical concern given the fact that alcohol-based solutions, often without skin protection, were present in the wards before the study and occasionally used for hand hygiene. Many HCW questioned the effectiveness of handrub alone, which might be caused by a common perception that water is the only effective means of hand hygiene. In a predominantly Muslim society, people learn to wash their hands frequently with water from early childhood. Alcohol drinking is forbidden, *haram.* Islam permits the use of alcohol as a medicinal agent, and indeed most HCW did not object to using alcohol-based handrubs. However, occasionally HCW remarked that alcohol was not a desirable agent for them to use.

With regard to handling of needles, disposal of unsheathed needles in designated needle containers is superior to resheathing, even by a safe method. Unfortunately containers were not available. Therefore we chose to teach recapping by the one-hand method. In the current low-budget situation, this method could make HCW's work much safer.

Although there was some effect of our intervention, unsafe handling of needles was still often observed at the end of the study. Proper attention by the hospital management to bloodborne diseases by creating facilities for correct disposal of sharp objects might enhance HCW’s awareness of and compliance with safe handling of needles. A system for vaccination of HCW and post-exposure prophylaxis should also become part of the hospital infection control system.

Compliance with use of gloves appears to be reasonable, although many HCW did not know that hand hygiene should be carried out after removing gloves. Because of a shortage of gloves, used gloves were washed and re-used. We chose not to prioritize an adequate supply of gloves, gowns and masks, given the few indications for use and a limited budget. However, a marked improvement in quantity and quality of the use of PPE might require improvements in facilities. The overuse of gowns in Internal Medicine can be explained by the habit of several nurses to wear gowns as part of their daily dress, which was discontinued after learning the indications for use of gowns.

We measured compliance up to six months after the end of the campaign. Continuing observations, repeated feedback and further improvements in facilities might help to sustain the effects of the intervention. In many hospitals in Western countries, teaching and reminding HCW about the importance of infection control measures are tasks of the infection control personnel. In Dr. Kariadi Hospital, there are no infection control professionals, but in each department, one or two nurses are responsible for infection control in addition to patient care. In our study they proved enthusiastic and authoritative opinion leaders. Appointment and training of professionals with

infection control as a single task might help to maintain the effects of intervention projects, such as that presented here.
Influencing HCW's behaviour with respect to infection control is difficult, but is best achieved by intervention procedures that combine several methods, such as educational activities and feedback.[5 12 22-25] In countries with limited healthcare resources, such as Indonesia, such interventions will probably only be successful when they incorporate improvements in facilities.
Further studies are needed to determine whether appointing dedicated, trained infection control personnel will support adherence to hand hygiene and improve compliance with personal protective equipment and safe handling of needles. Better facilities, such as designated needle containers, may also stimulate better compliance. In the current low-budget situation, priority should be given to hand hygiene and safe handling of needles. Reasons for limited concern with bloodborne diseases and acceptance of alcohol-based handrub should be explored further.

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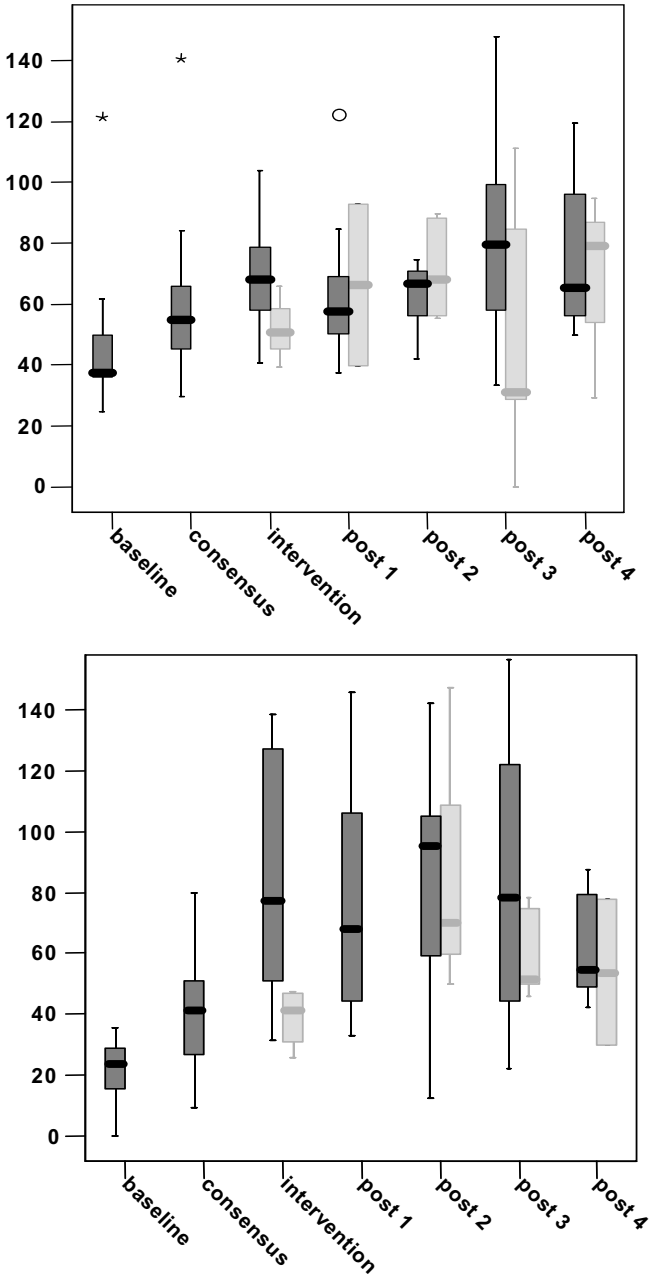
Figure 1: Compliance with hand hygiene protocols



These boxplots represent compliance in the internal medicine ward (top) and the paediatric ward (bottom).
The dark grey bars represent compliance with hand hygiene protocols (interquartile range) measured by overt observations, while the light grey bars represent compliance measured by unobtrusive observations.
The horizontal lines represent median compliance per period, while the asterisks and circles represent outliers.

Table 1: demographic data

	baseline	*consensus*	*intervention*	*post 1*	*post 2*	*post 3*	*post 4*
Internal Medicine							
number of overt observations	15	14	12	11	8	14	7
patients on ward *	27 (5)	35 (7)	40 (10)	46 (6)	45 (8)	32 (9)	25 (5)
patients observed #	49 (11)	52 (11)	50 (12)	47 (11)	46 (14)	52 (14)	51 (17)
number of activities †	42 (14)	42 (17)	41 (21)	45 (14)	44 (15)	29 (15)	23 (9)
hand washing **	44 (8)	52 (12)	61 (21)	55 (13)	58 (16)	44 (14)	35 (14)
handrub use ##	11 (7)	9 (9)	9 (11)	27 (13)	27 (13)	17 (10)	14 (13)
compliance hand hygiene ††	37, 46 (23)	55, 61 (27)	68, 84 (63)	58, 63 (24)	67, 63 (11)	80, 79 (30)	65, 77 (27)
safe recapping	1 (3)	0 (0)	8 (16)	18 (21)	33 (26)	13 (18)	57 (42)
compliance gloves use	44 (31)	57 (32)	47 (34)	49 (39)	64 (39)	52 (41)	77 (32)
compliance gown use	100	100	-	100	-	-	100
compliance mask use	-	0	-	-	-	0	-
Paediatrics							
number of overt observations	15	14	10	11	12	11	8
patients on ward*	22 (4)	25 (6)	23 (6)	28 (6)	23 (5)	26 (3)	19 (4)
patients observed #	54 (21)	57 (20)	54 (9)	57 (10)	48 (11)	50 (19)	53 (20)
number of activities †	22 (10)	33 (16)	21 (9)	32 (14)	18 (7)	17 (10)	17 (6)
hand washing **	13 (5)	19 (7)	33 (11)	34 (12)	31 (16)	28 (7)	25 (9)
handrub use ##	1 (5)	12 (15)	8 (14)	14 (10)	19 (28)	8 (9)	10 (9)
compliance hand hygiene ††	24, 22 (10)	41, 40 (19)	77, 96 (70)	68, 88 (63)	95, 85 (35)	78, 84 (44)	55, 62 (18)
safe recapping	0 (0)	2 (6)	13 (35)	22 (37)	0 (0)	25 (46)	0 (0)
compliance gloves use	18 (41)	4 (12)	17 (37)	17 (41)	8 (17)	0 (0)	45 (37)
compliance gown use	33 (58)	-	0	-	-	-	-
compliance mask use	33 (58)	-	100	-	0	-	-
Gynaecology							
number of overt observations		19	12	9			
patients on ward *		57 (4)	53 (6)	47 (5)			
patients observed #		52 (6)	50 (6)	47 (10)			
number of activities †		60 (10)	55 (14)	40 (9)			
hand washing **		17 (7)	19 (8)	16 (8)			
handrub use ##		0 0	0 0	0 0			
compliance hand hygiene ††		14, 14 (5)	17, 17 (8)	17, 17 (6)			
safe recapping		0 0	0 0	0 0			
compliance gloves use		85 (31)	64 (48)	25 (20)			
compliance gown use		-	-	-			

The numbers given are mean percentages (standard deviation), unless otherwise indicated.
* Is the number of patients present in the ward, at the start of a 90 minutes observation. # Represents the percentage patients observed (number of patients present in observed rooms / number of patients present in ward), during 90 minutes of observation. † represents the number of activities carried out by ward personnel, observed per 90 minutes of observation. ** Is the number of times handwashing was observed in the ward, per 90 minutes of observation. ## Represents the use of handrub as percentage of total hand hygiene (handwashing + use of handrub), per 90 minutes observation. †† Median, mean (standard deviation).