

# A Tool to Assess Knowledge, Attitude and Behavior of Indonesian Health Care Workers Regarding Infection Control

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## ABSTRAK

**Tujuan:** untuk meneliti pengetahuan, sikap dan perilaku tentang pengendalian infeksi di dua rumah sakit pendidikan di pulau Jawa dengan menggunakan kuesioner dan untuk menilai penggunaan kuesioner tersebut sebagai suatu alat bantu. **Metode:** dilakukan penelitian mengenai pengetahuan, sikap dan perilaku tentang pengendalian infeksi di dua rumah sakit pendidikan di pulau Jawa dengan menggunakan kuesioner untuk mengidentifikasi lingkup masalah, hambatan dan hal-hal yang mempermudah. Targetnya adalah mengikutsertakan setidaknya 50% dari seluruh pekerja layanan kesehatan (dokter, perawat, asisten perawat dan perawat pengendali infeksi) di setiap rumah sakit, departemen dan lingkup profesional. Wawancara dengan para pekerja layanan kesehatan dimaksudkan untuk memperjelas hasil yang masih belum dipahami oleh para peneliti. Perbedaan variabel demografik serta skor antara pertanyaan individual dan pertanyaan kelompok dibandingkan dengan menggunakan uji statistik chi-square dan analisis varian. Nilai rho Spearman digunakan untuk menguji korelasi antara pengetahuan, sikap, perilaku yang dilaporkan sendiri dan hambatan yang dirasakan. **Hasil:** lebih dari separuh pekerja layanan kesehatan dari departemen yang berpartisipasi mengisi kuesioner dengan lengkap. Dari 1036 responden (44% perawat, 37% dokter dan 19% asisten perawat), 34% telah divaksinasi hepatitis B, 77% pernah mengalami kecelakaan jarum suntik dan 93% telah mendapatkan pelatihan mengenai pengendalian infeksi. Nilai rerata jawaban benar terhadap pertanyaan mengenai pengetahuan adalah 44%; jawaban terhadap pertanyaan sikap adalah 67% dan sesuai dengan sikap yang benar; hambatan kepatuhan terhadap petunjuk pengendalian infeksi didapatkan pada 30% pertanyaan dan nilai rata-rata kepatuhan yang dilaporkan sendiri adalah 63%. Ditemukan korelasi positif yang bermakna antara pengetahuan, sikap, perilaku yang dilaporkan sendiri dan hambatan yang dirasakan. **Kesimpulan:** kuesioner dalam penelitian ini bersama-sama dengan kunjungan dan wawancara merupakan alat bantu yang berharga untuk mengenali titik masalah di rumah sakit dan dapat menentukan kendala dan dukungan yang harus diubah ketika merencanakan intervensi. Intervensi yang berhasil baik selayaknya meliputi intervensi pada manajemen rumah sakit, pengaturan pengendalian infeksi serta para pekerja layanan kesehatan di bangsal.

**Kata kunci:** pengendalian infeksi, Indonesia, kuesioner, pekerja layanan kesehatan.

## ABSTRACT

**Aim:** to investigate knowledge, attitude and behaviour toward infection control in two teaching hospitals on the island of Java by means of a questionnaire and to evaluate the use of the questionnaire as a tool. **Methods:** we investigated knowledge, attitude and behaviour toward infection control in two teaching hospitals on the island of Java by means of a questionnaire to identify problem areas, barriers and facilitators. The target was to include at least 50% of all health care workers (physicians, nurses, assistant nurses and infection control nurses) in each hospital, department and profession. Differences between demographic variables and scores for individual questions and groups of questions were compared using the chi-square statistic and analysis of variance and Spearman's rho was used to test for correlations between knowledge, attitude, self-reported behaviour and perceived obstacles. **Results:** more than half of the health care workers of the participating departments completed the questionnaire. Of the 1036 respondents (44% nurses, 37% physicians and 19% assistant nurses), 34% were vaccinated against hepatitis B, 77% had experienced needle stick accidents and 93% had been instructed about infection control. The mean of the correct answers to the knowledge questions was 44%; of the answers to the attitude questions 67% were in agreement with the correct attitude; obstacles to compliance with infection control guidelines were perceived in 30% of the questions and the mean self-reported compliance was 63%. Safe handling of sharps, hand hygiene and the use of personal protective equipment were identified as the most important aspects for interventions. Significant positive correlations were found between knowledge, attitude, self-reported behaviour and perceived obstacles. **Conclusion:** the questionnaire in conjunction with site visits and interviews was a valuable strategy to identify trouble spots in the hospitals and to determine barriers to facilitators of change that should be taken into account when planning interventions. Successful interventions should cover hospital management, the infection control team, as well as the health care workers on the wards.

**Key words:** infection control, Indonesia, questionnaire, healthcare workers.

## INTRODUCTION

Despite all the efforts of infection control professionals, infections remain a major unwanted side effect of health care, often causing serious harm to patients. The statement of Johan Peter Frank, director of the General Hospital in Vienna around 1800, does not belong only in the past: 'Can there be a greater contradiction than a hospital disease: an evil that one acquires where one hopes to lose one's own disease?' The biggest problem is not the lack of effective precautions and evidence-based guidelines, but the fact that health care workers apply these measures insufficiently.<sup>1,2</sup> Improving this negligent behaviour of health care workers is a main aspect of infection control in health care.

Human behaviour is a complex process determined among others by knowledge about and attitude towards the behaviour, perceived social standards and self-efficacy.<sup>3,4</sup> A first step in the development of interventions aimed at improving adherence to infection control measures is a careful evaluation of barriers to and facilitators of behaviour change. Both the

knowledge and attitude of individual health care workers should be assessed. Similarly, self-reported behaviour is important: people who are convinced that their own behaviour is correct may not be willing to change their behaviour. Several studies have investigated the knowledge, attitude and behaviour of health care workers in relation to infection control.<sup>1,5-13</sup> All studies except two come from high-income countries.<sup>5,9</sup>

Our study aimed at, firstly, assessing the current situation in our institutions with respect to infection control and, secondly, to develop tools with which other health care institutions in Indonesia could make the same assessment for their own situation.

We investigated the knowledge, attitude and self-reported behaviour with respect to infection control of physicians, nurses and assistant nurses in two teaching hospitals on the island of Java, Indonesia, by means of a questionnaire to detect problem areas, barriers and facilitators. We hypothesised that, firstly, the better the knowledge of health care workers about infection control, the more problems they

perceive in complying with infection control guidelines; secondly, that health care workers with better knowledge about infection control will be more realistic about their own behaviour and thus report worse compliance than those with less knowledge; thirdly and finally, that knowledge and attitude will show strong positive correlations.

## METHODS

The study was conducted in two general hospitals on the Indonesian island of Java: Dr. Soetomo hospital in Surabaya and Dr. Kariadi hospital in Semarang.

Both hospitals are government hospitals that provide subsidised services for lower socioeconomic patients. Up to 86% of patients have no health insurance and have to pay cash for their hospital stay, medicines, laboratory tests and dressings.<sup>14,15</sup> In Surabaya, an annual mean of 41,095 patients was admitted in 2003-2004 and in Semarang 21,451. Both hospitals provide nursing and medical care in class I, II and III. The highest standard of comfort is provided in the more expensive class I, the lowest in class III. In this study, health care workers from the Departments of Internal Medicine, Surgery, Obstetrics & Gynaecology, Paediatrics and Intensive Care participated and in Dr. Kariadi hospital the class department also participated.

In both hospitals, an infection control committee and an infection control team have been introduced. There are no infection control practitioners who can dedicate themselves full-time to infection control tasks. Responsibility for infection control on nursing wards lies on senior nurses, who have received some infection control training and are called 'infection control nurses'. Their position is comparable to that of 'link nurses' in some European hospitals<sup>16,17</sup> and their experience varies.

### Design of the Study

Information about knowledge, attitude and behaviour of health care workers was collected through a questionnaire. The questionnaire was designed by the researchers and a Dutch medical psychologist. It was translated into Indonesian and, after a pilot study, adapted

by Indonesian physicians, infection control nurses and a medical psychologist. The target was to include at least 50% of all health care workers (physicians, nurses, assistant nurses and infection control nurses) in each hospital, department and profession. Representatives of each department were in charge of distribution of the questionnaires. Participants completed the questionnaire during sessions at which a researcher or infection control nurse was present to supervise and to answer questions. Before health care workers started completing the questionnaire, the goal of the questionnaire was explained, individual completion was required and anonymous analysis of the results was guaranteed. A case number, through which profession and department of the respondent could be identified, was written on the form directly before or after a respondent completed the form. The number on the form could not be traced to individual respondents, except when only one respondent with a given profession in a given department participated in the study.

After completion of the questionnaire, site visits and unstructured interviews with health care workers were undertaken when necessary to clarify results that were not understood by the researchers.

### Design of the Questionnaire

Data on population characteristics and knowledge, attitude and self-reported behaviour with respect to hand hygiene, prevention of blood-borne diseases, personal hygiene and use of personal protective equipment, urinary catheterisation, intravenous catheterisation and care of surgical wounds were collected by means of closed questions. Department, profession, years of experience, instruction about infection control, hepatitis B vaccination status and needle stick accidents experienced were the population characteristics that were required (**Online Appendix**, [www.inaactamedica.org/archives/2013/appendix/duerink\\_vol45-p.206.pdf](http://www.inaactamedica.org/archives/2013/appendix/duerink_vol45-p.206.pdf)). Whether needle stick accidents occurred and which action was taken after needle stick accidents was considered to reflect behaviour. The results of these questions are therefore presented together with the other self-reported behaviour questions.

The attitude of health care workers toward infection control was investigated in two ways: by questions about their opinion of statements about infection control (further called 'attitude') and by asking whether they perceived obstacles in complying with infection control guidelines (further called 'perceived obstacles').

The answers could be ticked in pre-printed boxes: 'true', 'false', or 'don't know' for the knowledge questions; 'yes', 'no', or 'do not know' for the attitude statements; 'yes' or 'no' for the questions about behaviour and 'agree', 'do not agree', or 'do not know' for the questions about perceived obstacles.

The questionnaire comprised of 21 questions about knowledge, 39 about attitude, 39 about perceived obstacles and 23 about self-reported behaviour. All questions had obviously high levels of construct validity.

### Statistical Analysis

For the questions about attitude and behaviour, the desired attitude or behaviour was labelled as 'correct'. For analysis, correct answers regarding knowledge, attitude and behaviour were analysed as 'correct'; incorrect answers, missing values and 'do not know' were all categorised as 'incorrect'. For the questions about perceived obstacles; 'no', missing values and 'do not know' were all interpreted as 'not perceiving an obstacle'. Scores for the individual questions of each category (knowledge, attitude, perceived obstacles and behaviour) were pooled, which yielded total scores per category for each respondent.

Because the number of infection control nurses was small, results of regular nurses and infection control nurses are presented together. Only when there is a significant difference are the results given separately.

The statistical package SPSS (SPSS version 14.0, SPSS inc., Chicago, Illinois) was used for analysis. Differences between demographic variables and scores for individual questions and groups of questions were compared using the chi-square statistic and analysis of variance.  $p$  values  $<0.05$  were considered statistically significant (NS). Non-significant values are denoted by "NS".

To test our three main hypotheses, Spearman's rho was used for correlations between scores for knowledge, attitude, self-reported behaviour and perceived obstacles, both total scores and scores per separate item. As a surrogate marker for reliability, the internal consistency of the questionnaire was assessed with Cronbach's Alpha. Values above 0.700 were considered to reflect reliable measurements of a homogeneous domain.

## RESULTS

### Demographics

In Surabaya, 55% of health care workers in the targeted departments completed the questionnaire, ranging from 18% of nurses in the ICU to 98% of physicians in Surgery (**Table 1**). In Semarang, 60% of nurses and 93% of physicians in the participating departments completed the questionnaire (**Table 1**). According to hospital statistics, only four assistant nurses worked in the participating departments, while 59 respondents in Semarang ticked the box 'assistant nurse'. Apparently the definitions of 'assistant nurse' among respondents was broader than that of hospital management. It is likely that the majority of participating physicians were residents, because 77% in Surabaya and 67% in Semarang had less than ten years of experience in their profession.

### Vaccination Hepatitis B

In Surabaya, 41% of the respondents were vaccinated against hepatitis B, in Semarang 31% ( $p=0.001$ , online appendix). Doctors were vaccinated more often (Surabaya 56%, Semarang 54%, NS) than nurses (Surabaya 25%, Semarang 17%, NS) and assistant nurses (Surabaya 45%, Semarang 7%,  $p<0.001$ ). The shorter health care workers worked in their current profession, the higher the percentage vaccinated, ranging from 44% of health care workers with less than 5 years of experience to 26% of health care workers with 20 or more years of experience ( $p=0.002$ ). No significant differences were found between the departments.

**Table 1.** Response rates for the questionnaire

Department		Nurse <sup>1)</sup>		Physician		AN <sup>2)</sup>		Total
Surabaya	Internal Medicine	58	(88)	53	(39)	32	(65)	143
	Surgery	73	(54)	78	(98)	49	(43)	200
	Obstetrics & Gynaecology	32	(65)	28	(30)	17	(45)	77
	Paediatrics	71	(82)	26	(27)	40	(66)	137
	ICU/others <sup>3)</sup>	17	(18)	0	(0)	3	(60)	20
	total	251	(60)	185	(46)	141	(53)	577
Semarang	Internal Medicine	33	(69)	52	(99)	9	<sup>5)</sup>	94
	Surgery	39	(100 <sup>*</sup> )	58	(100 <sup>4)</sup> )	12	<sup>5)</sup>	109
	Obstetrics & Gynaecology	42	(56)	28	(67)	12	<sup>5)</sup>	82
	Paediatrics	25	(52)	57	(1004))	12	<sup>5)</sup>	94
	ICU/others <sup>3)</sup>	66	(51)	0	(0)	14	<sup>5)</sup>	80
	total	205	(61)	195	(100 <sup>4)</sup> )	59	<sup>5)</sup>	459
Total Surabaya + Semarang		456		380		200		1036

1) The category nurse includes infection control nurses (9 in Surabaya and 12 in Semarang) and nursing managers (4 in Surabaya); 2) AN means assistant nurse; 3) ICU/others represents the intensive care units (ICU), the class department (Semarang) and the nursing management department (Surabaya); 4) the number of respondents who completed the questionnaire exceeded the official number of personnel in this specific profession and department; 5) the total number of personnel in this specific profession and department is unknown.

### Instructions Regarding Infection Control

Most health care workers had been instructed in the importance of infection control (Surabaya 97%, Semarang 91%,  $p < 0.001$ ) and hospital guidelines for infection control (Surabaya 88%, Semarang 74%,  $p < 0.001$ ). Instructions to report when they showed symptoms of an infectious disease were given to 62% of respondents in Surabaya and 44% in Semarang ( $p < 0.001$ ). Information about which professionals were responsible for infection control was given to 66% in Surabaya and 41% in Semarang ( $p < 0.001$ ).

The proportion who were instructed in the importance of infection control varied from 99% in Obstetrics & Gynaecology (of the two hospitals combined) to 82% in the class department ( $p < 0.001$ ). The proportion who had been instructed about which professionals were responsible for infection control varied from 94% in Obstetrics & Gynaecology to 67% in the intensive care units ( $p < 0.001$ ).

Fifty-six percent of the respondents from Surabaya had been instructed in what to do after a needle stick accident and 38% in Semarang ( $p < 0.001$ ). Nurses in both hospitals were instructed more often than doctors and assistant nurses ( $p < 0.001$ ). In Surabaya, no significant

differences were observed among departments. In Semarang, the proportion instructed was highest in Obstetrics & Gynaecology (54%) and lowest in Paediatrics (21%,  $p = 0.001$ ).

### Knowledge

The mean percentage correctly answered knowledge questions for all health care workers combined was 44% (**Online Appendix**, [www.inaactamedica.org/archives/2013/appendix/duerink\\_vol45-p.206.pdf](http://www.inaactamedica.org/archives/2013/appendix/duerink_vol45-p.206.pdf)). Knowledge about the prevention of blood-borne diseases and infections of intravenous catheters and surgical wounds was unsatisfactory with three out of four, three out of three and two out of three questions respectively scoring below 40%. The knowledge of physicians was significantly better than that of nurses and assistant nurses ( $p < 0.001$ ). All departments except the ICU scored better than the class department ( $p < 0.005$ ). Total scores for knowledge of less experienced health care workers were slightly higher than those of more experienced health care workers, with the exception of the group with 15 to 19 years of experience, which had the lowest scores of all groups ( $p < 0.001$ ). No significant differences were observed between the two hospitals.

## Attitude

**Agreement with attitude statements.** The mean score of the answers to all attitude questions that were in agreement with the preferred attitude was 67% (**Online Appendix**, [www.inaactamedica.org/archives/2013/appendix/duerink\\_vol45-p.206.pdf](http://www.inaactamedica.org/archives/2013/appendix/duerink_vol45-p.206.pdf)). Agreement was unsatisfactory for personal hygiene and the use of personal protective equipment; five out of nine statements scored below an agreement level of 40%. Doctor's and nurses attitudes were significantly better than those of assistant nurses ( $p < 0.001$ ). Less experienced health care workers had slightly higher scores than more experienced ones, with the group with 15 to 19 years of experience having the lowest score ( $p < 0.001$  for both scores). No significant differences were observed between the two hospitals or the departments.

**Perceived obstacles to complying with infection control guidelines.** Obstacles to complying with infection control guidelines were perceived for 30% of the items raised in the questionnaire (**Online Appendix**, [www.inaactamedica.org/archives/2013/appendix/duerink\\_vol45-p.206.pdf](http://www.inaactamedica.org/archives/2013/appendix/duerink_vol45-p.206.pdf)). Most obstacles were perceived to complying with guidelines for the prevention of blood-borne diseases; for three out of five statements more than 40% of respondents perceived problems. Doctors perceived more obstacles than nurses ( $p = 0.025$ ) and assistant nurses ( $p = 0.019$ ). Health care workers in Internal Medicine and Surgery perceived more obstacles than those from Obstetrics & Gynaecology ( $p = 0.028$  and  $0.023$ , respectively), Paediatrics ( $p = 0.049$  and  $0.041$ ) and the class department ( $p = 0.029$  and  $0.027$ ). No significant differences were observed between the hospitals or years of experience.

## Self-reported Behaviour

**Compliance with precautions.** The mean self-reported compliance with precautions was 63% (Appendix A). Self-reported behaviour was unsatisfactory for personal hygiene and the use of personal protective equipment; for two out of three statements less than 40% of the respondents behaved in accordance with the norm. Nurses reported significantly better compliance than doctors and assistant nurses ( $p < 0.001$ ). No

significant differences were observed between the two hospitals, the departments or more and less experienced health care workers.

**Needle stick accidents and action after needle stick accidents.** In Surabaya, 76% of health care workers experienced needle stick accidents, in Semarang 88% ( $p < 0.001$ , **Online Appendix**, [www.inaactamedica.org/archives/2013/appendix/duerink\\_vol45-p.206.pdf](http://www.inaactamedica.org/archives/2013/appendix/duerink_vol45-p.206.pdf)). No significant differences were found between the professions and years of experience. In Surabaya, fewer needle stick accidents were reported in the Department of Internal Medicine than in the other departments ( $p < 0.001$ ); no significant differences were found between the departments in Semarang.

In both cities, the majority of personnel (96%) who experienced needle stick accidents reported to have washed or rubbed with alcohol afterwards, while 22% (Surabaya) and 14% (Semarang,  $p = 0.003$ ) told a supervisor or an infection control nurse. Assistant nurses reported their needle stick accidents most frequently (Surabaya 39%, Semarang 32%) and doctors least frequently (Surabaya 7%, Semarang 6%,  $p < 0.001$ ). More experienced health care workers and especially the group with 15 to 19 years of experience reported their needle stick accident to a supervisor or infection control nurse more often than less experienced health care workers ( $p < 0.001$ ).

## Correlations Between Knowledge, Attitude and Behaviour

Significant positive correlations were found between knowledge, attitude, self-reported behaviour and perceived obstacles (**Table 2**), confirming all three hypotheses. The greater health care workers' knowledge, the more they

**Table 2.** Correlations between knowledge, attitude and behaviour

	Spearman's rho			
	knowledge	attitude	obstacles	behaviour
knowledge	1	0.272*	0.102*	0.246*
attitude	0.272*	1	0.134*	0.365*
obstacles	0.102*	0.134*	1	0.031
behaviour	0.246*	0.365*	0.031	1

\* Indicates that the correlation is significant at the  $p < 0.001$  level.

showed the preferred attitude, the more obstacles they perceived and the better their self-reported behaviour.

### Internal Consistency of the Questionnaire

The Cronbach's Alpha score for instructions for infection control was 0.634, total knowledge 0.448, agreement with attitude statements 0.761, perceived obstacles 0.610 and self-reported behaviour 0.921.

## DISCUSSION

The present survey of knowledge, attitude and self-reported behaviour of health care workers with respect to infection control in two Indonesian hospitals revealed problems in the use of personal protective equipment and in the prevention of blood-borne diseases, as was reported in another Indonesian study.<sup>18</sup>

Most health care workers did not know the correct answers to the questions on the risk of transmission of HIV and HCV in needle stick accidents and were not aware of the value of post-exposure prophylaxis for HIV infection after such accidents. Main perceived obstacles to adherence to the guideline for safe handling of sharps were the fact that it takes too much time, it makes patient care too technical, and that there are not enough sharps containers. Resheathing of used needles is common practice, explaining the high agreement with the statement that 'needles should be resheathed to avoid needle stick accidents' and the low self-reported behaviour for the statement 'I never resheath needles'. Interpretation of these facts should take into account the low level of hepatitis B vaccination, the endemicity of hepatitis B in Indonesia<sup>18,19</sup> and the small percentage of health care workers who had been instructed how to deal with needle stick accidents. Observations on the wards and interviews with personnel revealed that designated hard plastic sharps containers were lacking and empty plastic water bottles were used instead.<sup>20</sup> Unsheathed needles could easily puncture the thin plastic of these bottles and therefore health care workers were taught to resheath used needles to prevent needle stick accidents. The majority of health care workers experienced needle stick accidents, probably

largely as a result of these incorrect instructions. Guidelines for handling needle stick accidents and the role of the infection control organisation in this respect were apparently lacking. Proper attention by the hospital management to blood-borne diseases by creating facilities for correct disposal of sharp objects might enhance awareness and compliance of health care workers with safe handling of needles. Ideally, a system for vaccination of health care workers and post-exposure prophylaxis should also be part of the hospital infection control system. We do realise that the hospital management must prioritise the allocation of limited resources. The implementation of a safe method to resheath used needles would, in our opinion, be an acceptable alternative to purchasing proper sharps containers.<sup>21,22</sup> Although not ideal, the work of health care workers would become much safer if needles would consistently be resheathed safely.

The inquiry revealed that health care workers did not agree with statements about the use of sterile and non-sterile gloves and from their self-reported behaviour it appeared that they did not use gloves and aprons according to the principles of standard precautions. As obstacles to applying the rules, insufficient supplies of gloves and aprons was mentioned. The distinction between sterile and non-sterile gloves was not clear to most health care workers. Observations revealed that there indeed was no distinction between sterile and non-sterile gloves in the hospitals we studied.<sup>20</sup> Disposable latex gloves were in short supply and used gloves were washed, powdered and re-used as 'sterile' gloves. Ideally, interventions would include ensuring the continuous supply of sufficient amounts of disposable gloves and other personal protective equipment. We feel that, in the current low-budget situation, this should not be the first priority. Primarily, the promotion of good hand hygiene after removing gloves should be chosen, because gloves might become permeable for viruses after 're-sterilisation'. Additionally, currently used guidelines should be adapted for use in this setting, especially limiting the use of gloves and other personal protective equipment to situations where it is most crucial.

In a paediatric ICU in Jakarta, Indonesia, it was shown that adaptation of certain infection control guidelines of the Centers for Disease Control and Prevention improved compliance with infection control guidelines in a limited-resources setting similar to the hospitals described here.<sup>21</sup>

The results of the questionnaire seem to suggest that there are no problems concerning hand hygiene in the two hospitals. Although knowledge about hand hygiene appeared reasonable, there were inconsistencies in the answers with respect to knowledge, attitude and self-reported behaviour. And, although self-reported compliance was as high as 70%, other studies showed that compliance with hand hygiene rarely exceeds 50% and health care workers in general tend to overestimate their own compliance.<sup>22-24</sup>

Observations in the Departments of Paediatrics and Internal Medicine in Semarang, performed after the results of this questionnaire were known, revealed a striking shortage of hand washing facilities: four wash basins for 104 patient beds. Actual compliance with hand hygiene was much lower than reported by the respondents in the current study: 22% and 46%, respectively.<sup>20</sup> No data are available regarding compliance in Surabaya, but observations showed that the number of wash basins was only slightly higher than in Semarang. The combination of factors that compromise hand hygiene, namely shortage of facilities, insufficient knowledge about evidence of the benefit of hand hygiene, and the favourable self-image of compliance with hand hygiene rules, mean that it will take considerable effort to bring about any improvements in hand hygiene.

As far as care of surgical wounds and urinary and intravenous catheterisation were concerned, knowledge was frequently outdated: only a minority of the respondents knew that shaving before surgery does not protect against surgical site infections,<sup>25</sup> or that the use of antimicrobial soap or cream is not indicated for the prevention of urinary tract infections, surgical site infections and catheter-related infections.

Our hypothesis that better knowledge would correspond with a better attitude and perceiving more obstacles was confirmed. Especially

infection control nurses and physicians, who were the most knowledgeable health care workers, tended to perceive more obstacles than other health care workers. Our expectation that people with better knowledge would be more realistic about their own behaviour and thus report worse compliance than those with less knowledge proved wrong. The better health care workers' knowledge, and especially their attitude, the better behaviour they reported.

The inquiry identified potential barriers to and facilitators for change. Possible barriers are the favourable self-images our respondents tended to have of their compliance with the precautions, the limited facilities like wash basins, gloves and sharps containers, the few obstacles reported by the respondents, the ignorance of the respondents about the shortages of facilities and an infection control organisation that needs reinforcement. Possible facilitators included the generally positive attitude towards infection control and the fact that, although knowledge was sometimes outdated and measures improvised, the health care workers were quite aware of the importance of infection control, including the prevention of blood-borne diseases. The few perceived obstacles should be explored further, preferably with focus group discussions or unstructured interviews.

The results of this questionnaire can be regarded as representative for the health care workers in these hospitals, since the majority of the health care workers of the involved departments completed the questionnaire. Scores for the internal consistency of the questionnaire were rather low for questions about knowledge, reasonable for instructions about infection control and perceived obstacles and rather high for attitude and self-reported behaviour. Apparently knowledge is a more heterogeneous domain and knowledge within certain subdomains may not correlate closely with that in other subdomains. A substantially larger number of questions than we used is needed for a reliable assessment of the level of knowledge. It appears that the majority of the health care workers completed the questionnaire carefully, although some politically correct answering might have occurred, even though anonymous analysis of the results was



guaranteed to the participants. Observations and interviews that were performed in the wards after completion of the questionnaire confirmed most of the results of the questionnaire and clarified results that appeared strange or inconsistent.

Both the questionnaire and the observations were performed several years ago (2001-2004). Since then, infection control has been a topic of continuous interest in both hospitals and has become part of the hospital accreditation program in Indonesia. Alcohol-based hand disinfectant is currently present at each patient room in both hospitals. In Semarang, gloves are still re-used in nursing wards, but not in operating theatres; in Surabaya gloves are no longer re-used. Infection control practitioners that can dedicate themselves fully to infection control are now appointed in both hospitals and are occasionally consulted by HCW's.

## CONCLUSION

The questionnaire in conjunction with site visits and interviews was a valuable strategy to identify trouble spots in the hospitals and barriers to and facilitators of change which should be into account when interventions are planned. The safe handling of sharps, hand hygiene and the use of personal protective equipment were identified as the most important aspects for interventions. For successful implementation of changes barriers should be removed at the level of hospital management which should provide the facilities. The infection control organisation should be strengthened by the employment of full-time, well-trained infection control professionals, and the wards where health care workers should be educated and trained in evidence-based precautions.

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