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Original Article

The evaluation of a multimodal hand hygiene improvement strategy in Cambodian hospitals

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Abstract

Introduction: Hand hygiene is the most effective method of preventing healthcare-associated infections. Healthcare-associated infections are considered serious in developing countries, and there are few reports on the hand-hygiene status of these countries. Thus, we evaluated hand-hygiene status in eight hospitals in Cambodia to understand and identify factors hindering effective infection control.

Methodology: Eight infection-management instructors working in one of the eight Cambodian government hospitals in a large city were interviewed with the WHO Hand Hygiene Self-Assessment Framework.

Results: The mean Hand Hygiene Self-Assessment Framework score across the eight hospitals was 177.81 ± 56.73. The overall level of compliance with the multimodal hand hygiene improvement strategy across these eight hospitals was basic-two hospitals scored inadequate and six hospitals scored basic. The scores for the 5 factors of the Hand Hygiene Self-Assessment Framework were as follows: 45.63 ± 15.45 for system change, 33.13 ± 16.89 for education and training, 27.81 ± 21.65 for evaluation and feedback, 58.13 ± 5.30 for reminders in the workplace, and 13.13 ± 11.00 for institutional safety climate for hand hygiene

Conclusions: The promotion of hand hygiene compliance requires the establishment of a basic infrastructure, reinforcement of the hand hygiene education system, and provision of diverse educational materials, as well as the fostering of a professional workforce for education. Hospitals should also bolster their management systems for hand hygiene compliance.

Key words: Hand hygiene; hand washing; healthcare-associated infection; infection control.

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Introduction

Healthcare-associated infections (HAIs) can lead to numerous problems, including unnecessarily prolonged hospital stay, disability, and mortality [1]. They have inordinately affected developing countries: for instance, the incidence rates of HAIs in developed and developing countries are about 7.6 and 10.1 cases per 100 patients, respectively, while the incidence of HAIs in the intensive care units (ICU) of developing countries is roughly two to three times that in developed countries [2]. Developing countries have particularly inadequate resources and poor environmental standards for preventing and managing HAIs. Unlike developed countries, they lack a monitoring system and governmental guidelines for infection prevention and infrastructure establishment; they also tend to use guidelines developed in more advanced countries without adaptation and lack infection management experts, adequate resources, and a sufficient workforce [3-5].

The simplest and most effective way to reduce HAIs is to maintain good hand hygiene. However, hand hygiene compliance is low worldwide, ranging between 40% and 50% [6]. It is particularly low in developing countries, with compliance rate of 32.1% in Rwanda [7], 25.7% in Vietnam [8], 21.1% in sub-Saharan African Countries [9], and 26.0% in Cambodia [10].

In an attempt to promote hand hygiene compliance in healthcare institutions throughout the world, the WHO devised the multimodal hand hygiene improvement strategy (MHHIS) [11], which consists of five components: system change, training and education, observation and feedback, reminders in the workplace, and institutional safety climate. The WHO has stressed the importance of simultaneous and interactive application of these key components [11]. Multiple studies have used the MHHIS and reported successful outcomes [11-13].

Cambodia is classified as the poorest country among the countries receiving official development assistance (ODA) from the Organization for Economic Co-operation and Development (OECD). As many hospitals have been founded gradually with foreign aid, there is more chance to be exposure to risk of HAIs than

it did before. In 2009, the Cambodian Ministry of Health (MOH) established the National Infection Control Policy and, a year later, launched the Infection Prevention and Control Guideline for Health Care Facilities in an attempt to improve HAIs management. Nevertheless, the overall lack of infrastructure has hampered maintenance of even the most fundamental hygiene practices, let alone allowed for the application of HAIs policies and guidelines in clinical setting [14].

There are no studies, to our knowledge, that have investigated the current state of hand hygiene, which is key for HAIs management, in Cambodia. Moreover, considering the recent situation caused by Corona virus disease-19 pandemic, provision of health care is one important problem [15], and it is important to understand the current status of hand hygiene in Cambodia.

Therefore, we evaluated the hand-hygiene status of hospitals in Cambodia based on the five components of WHO's MHHIS to understand and identify factors that undermine hand-hygiene compliance. These findings are expected to be useful for devising effective hand hygiene strategies tailored to developing countries, such as Cambodia, to be used by healthcare-related staff and experts for HAIs prevention and management.

Methodology

Design

For this quantitative study, we used a cross-sectional design to analyze the current state of hand hygiene among hospitals in Cambodia using surveys, interviews, and observational methods.

Participants

We selected participants using convenience-sampling methods. Participants were eight infection-management instructors (infection management team staff or nursing director) working in eight Complementary Packages of Activities (CPA) Level 3 hospitals in a large city of Cambodia with a high density of large government hospitals.

CPA level 3 hospitals provide the highest quality of care among all government hospitals in Cambodia. Compared to CPA level 1 or 2 hospitals, they provide the widest range of highly skilled medical services and have a relatively well-established human resources and material infrastructure, allowing them to perform a pivotal role in Cambodia's medical service. They have 100–250 beds, perform major surgeries and provide obstetric care, emergency care, and special medical services, including blood transfusions [16]. We chose CPA level 3 hospitals for this study because it seemed best to establish and settle the hand hygiene promotion activities in them first, after which they can be expanded to CPA level 1 and 2 hospitals. Considering that Cambodia's healthcare system is centered around public healthcare institutions and that government hospitals differ from private hospitals in terms of their facilities and management systems, we focused on eight CPA level 3 government hospitals in one large city for this study.

Instrument

For data collection, we used the Hand Hygiene Self-Assessment Framework (HHSAF) [17], a standardized instrument developed by the WHO. This instrument consists of five domains and a total of 51 items. The total score for each domains is 100 points, and the total HHSAF score is 500 points, attained by adding the scores of the five domains. We evaluated the hand-hygiene level of the hospital, obtaining a total score of HHSAF: a score of 0–125 is an inappropriate level, 126–250 is the basic level, 251–375 is an intermediate level, and 376–500 defined the advanced level.

Data Collection Methods

We interviewed eight participants, and observed each hospital using HHSAF to collect the data. HHSAF is a structured instrument to quantify hand-hygiene status through interview or observation. The data accrued over 5 days.

Interview

Data were collected from each hospital by using the HHSAF to interview an infection management instructor who tend to be well aware of the hand hygiene status within the hospital. We visited each hospital to conduct the interview, and each interview took about one hour on average. Using the data collected during the interview, the hospital was scored based on the HHSAF scoring criteria, and the reasons that items received low scores were identified.

Observation. After collecting the interview data, we conducted observations simultaneously in five consenting hospitals to enhance the accuracy of the data. Three hospitals did not consent to observation for safety and security reasons, so we analyzed only the interview data in these hospitals. We specifically examined the presence of five items in the system change subscale of the HHSAF (1.1, 1.2, 1.3, 1.4, 1.5) and one item in the reminders in the workplace subscale (4.1), as these were the only items for which objective data could be collected via observation. If the interviewee's response differed from our observation,

the scoring was based on the observation. Based on the total score of HHSAF, the hospitals received a grade on one of four levels of hand hygiene: inadequate, basic, intermediate, and advanced. This study granted ethical approval from the Institutional Review Board of researchers' affiliation.

Results

Table 1 shows the results of the HHSAF scores computed based on the interviews and observations. Two hospitals received a rating indicating an inadequate level, while the remaining six were rated with basic level of hand hygiene. The mean score for all eight hospitals was 177.81 ± 56.73, which is equivalent to the basic level. Among the five subscales, reminders in the workplace had the highest score (58.13 ± 5.30), while institutional safety climate for hand hygiene had the lowest score (13.13 ± 11.00). The specific interview and observation results for each of the five HHSAF subscales were as follows. Detailed comments on each questionnaire on five subscales are described in Supplementary Table 1.

System Change

The mean score for system change was 45.63 ± 15.45, minimum of 25, and maximum of 70. All hospitals stated that they did not provide alcohol-based hand rub (ABHR) throughout the facility with a continuous supply at each point. However, three hospitals did continuously supply ABHR facility-wide and provided ABHR in the majority of wards at points of care. The most common reasons for hospitals not providing ABHR facility-wide at each point of care were financial problems and patients' wasteful use of hand sanitizers. The ABHR was either purchased or self-formulated by the hospital using materials obtained from the Cambodian MOH.

The sink-to-bed ratio exceeded 1:10 in most wards in six hospitals, and a 1:1 ratio was not achieved in either the isolation room or ICU. Clean water was supplied through the sink in all eight hospitals, but only five hospitals placed soap in the sink. Hospitals noted that their inability to supply soap was primarily the result of financial problems; when they could not place soap in all the sinks, hospitals preferentially supplied soap in the critical care units. None of the hospitals placed single-use towels near the sink for drying hands after washing due to financial problems, although three hospitals used a regular reusable towel.

Six hospitals had a budget for hand hygiene products, but the budget was insufficient. Three hospitals claimed to have practical plans for improving their medical infrastructure and noted that they were receiving foreign aid to improve their infrastructure.

Training and Education

The mean score for training and education was 33.13 ± 16.89, minimum of 0, and maximum of 55. None of the hospitals provided mandatory hand hygiene education for all professions on hiring or regular annual refresher education. While five hospitals claimed to provide at least one regular hand hygiene education session annually, only two of them monitored staff's completion of this education.

Medical staff tended to have low accessibility to hand-hygiene-related information. One hospital claimed to have the Cambodia-MOH-equivalent of the WHO's guidelines called the "Infection Prevention and Control Guidelines for Health Care Facilities". Two hospitals were equipped with a brochure titled "Hand Hygiene: Why, How and When", and claimed that these could be easily accessed by general medical staff. The "Glove Use Information" leaflet was not available in any of the hospitals. These hand-hygiene-related documents were not easily accessible by the general medical staff because they were placed only in managers' offices.

Six hospitals reported having an expert who can provide hand hygiene education. In hospitals that performed infection management improvement

Table 1. Hand Hygiene Self-Assessment Framework Scores in Hospitals of Cambodia (N = 8).

Domains	CPA* level 3 hospitals								Mean±SD
	A	B	C	D	E	F	G	H	
System Change	55	60	45	25	35	45	30	70	45.63±15.45
Training and Education	40	35	30	0	45	55	20	40	33.13±16.89
Evaluation and Feedback	27.5	62.5	32.5	10	20	15	0	55	27.81±21.65
Reminders in the Workplace	60	60	65	50	60	60	50	60	58.13±5.30
Institutional Safety Climate for Hand Hygiene	15	10	15	0	15	35	0	15	13.13±11.00
Total Score	197.5	227.5	187.5	85	175	210	100	240	177.81±56.73
Level	Basic	Basic	Basic	Inadequate	Basic	Basic	Inadequate	Basic	Basic

* CPA: Complementary Package of Activities.

activities in collaboration with foreign institutions in Australia, France, Switzerland, etc., hand hygiene education for the hospital staff was provided by either an external expert from the corresponding foreign country or hospital staff who had completed the infection management education provided by the Cambodian MOH. Only one hospital was equipped with an education system for hand hygiene monitoring staff, and four hospitals claimed to have a budget for hand hygiene education.

Evaluation and Feedback

The mean score for evaluation and feedback was 27.81 ± 21.65, minimum of 0, and maximum of 62.5. Seven hospitals performed inspections for hygiene-related products; these inspections were regularly performed by each ward in 1-week to 1-month intervals. With regard to measuring staff members' hand hygiene knowledge, none of the hospitals assessed knowledge of the indications for hand hygiene, and only one hospital performed an annual assessment of appropriate hand hygiene methods.

As an indirect assessment of hand hygiene compliance, one hospital claimed to measure ABHR usage and another hospital claimed to measure soap usage at least once every three months. However, we were unable to objectively verify these hospitals' ABHR usage. Three hospitals did directly assess hand hygiene compliance at least once annually on a regular basis, while one hospital assessed it annually on an irregular basis. Two out of the eight hospitals claimed to have a hand hygiene compliance rate exceeding 81%; the remaining six hospitals did not know their hand hygiene compliance rate (as such, these hospitals were given a score of 0 for this item).

None of the hospitals provided immediate feedback on hand hygiene compliance after observation. Three hospitals, however, provided systematic feedback (by sharing hand hygiene results), although it was only to managers.

Reminders in the Workplace

The mean score for reminders in the workplace was 58.13 ± 5.30, minimum of 50, and maximum of 60. All eight hospitals put up the posters displaying the appropriate time and method for hand hygiene supplied by the Cambodian MOH within the hospitals. These posters were placed on the walls near the sink and ABHR in order to be available for reference for all staff and patients when engaging in hand hygiene practice. Only one hospital regularly inspected these posters for damage, doing so every 2–3 months. None of the eight hospitals engaged in additional hand hygiene promotion activities, such as updating poster content, placing hand hygiene leaflets in the wards, distributing hand-hygiene-related fliers, and employing reminders such as screensavers or stickers. The greatest reason for not performing these practices was financial problems.

Institutional Safety Climate for Hand Hygiene

The mean score for institutional safety climate for hand hygiene was 13.13 ± 11.00, minimum of 0, and maximum of 35. Six hospitals had an infection management team that was in charge of infection management within the hospital (including hand hygiene improvement activities) that held regular meetings. Of these hospitals, three of them allocated time to perform hand hygiene improvement activities. Only one hospital specified the specific role of the infection management team staff in such activities, and in that case only the role of the chief executive officer and medical director was defined.

None of the eight hospitals performed diverse hand hygiene activities, such as organizing hand hygiene improvement activities on Hand Hygiene Day (5 May) or identifying staff and leaders that demonstrated excellent compliance with hand hygiene as an attempt to foster a hand hygiene culture. Furthermore, only one hospital organized activities to increase awareness of hand hygiene among patients and provided hand hygiene education for patients.

Regarding initiatives to support continuous improvement of hand hygiene, only one hospital set an institutional target for hand hygiene compliance to be achieved each year.

Discussion

The mean HHSAF score for the eight selected hospitals in one large city of Cambodia was 177.81 ± 56.73. Although we cannot compare this result to those of other developing countries due to a lack of studies using HHSAF, it is exceedingly low when compared to the mean score of 373 among 91 countries, 10% of which are low-income countries [18].

Based on the WHO's general action plan for healthcare institutions with a basic level of MHHIS, we can point to the following problems as the most pressing to be resolved in Cambodian hospitals in relation to the five components of the MHHIS. With regard to system change, hospitals lacked basic hand hygiene products. Insufficient infrastructure is also a common problem in other developing countries [7,19,20], the low accessibility to hand hygiene products during workflow hinders the medical staff's

hand hygiene compliance [4,9,21]. Thus, support is needed to increase the availability of the supply of soap, disposable hand towels, sinks, and ABHRs. In particular, ABHRs are easy to use and economical, and they do not require additional infrastructure such as a sink, soap, or disposable towels; hence, they are beneficial in being able to easily improve medical staff's access to hand hygiene. ABHRs are also recommended in institutions with limited number of sinks or low access to sinks [11]. Currently, the eight hospitals had a limited number of sinks and not all of them provided disposable towels—these can both increase the risk of cross-contamination [22], which further emphasizes the need for supplying ABHRs.

The key problem with training and education in the eight Cambodian hospitals was that they could not provide systematic education and assessment. Education is a critical success factor and cornerstone of hand hygiene improvement [1]. Education is highly cost-effective, and previous studies in developing countries reported that interventions that included education were effective for promoting hand hygiene [8,10,23]. To improve the effectiveness of education, a systematic monitoring system that keeps track of medical staff's completion of education programs should be established, and hand-hygiene-related educational materials should be provided in each ward to give all medical staff easy access to such information. Furthermore, hand hygiene should be monitored accurately, and a program that fosters professional hand hygiene monitoring staff should be developed to support this evaluation and feedback system.

For evaluation and feedback, they key problems were low hand hygiene monitoring activity, a lack of accurate monitoring assessment, and no systematic feedback system. Hand hygiene compliance monitoring provides important data to assess the effectiveness of hand hygiene improvement programs [1], and feedback for hand hygiene compliance is effective for promoting hand hygiene [24-26]. Indirect monitoring using measurements of ABHR and soap consumption can provide an overall measure of use, which has the advantage of reducing selection bias compared to direct observation [27]. Therefore, performing both indirect and direct monitoring can provide practical information about hand hygiene compliance in the hospital. Thus, hospitals should devise plans to implement both monitoring methods to enable more systematic monitoring and share the results of this monitoring to general medical staff as well create a hospital environment that promotes hand hygiene throughout the entire hospital.

The reminders in the workplace score was higher than the scores of the other components because hospitals showed good compliance with poster display requirements. By putting up posters distributed by the Cambodian MOH in their wards, they satisfied the basic implementation criteria suggested by the WHO; however, due to financial difficulties, many of the posters were damaged or out of date, and promotional materials other than posters were not used. Reminders play an important role because they continuously remind medical staff about the importance and method of hand hygiene while also teaching patients and caregivers about the importance of hand hygiene [1]. Therefore, promotional materials should be well distributed in workplaces to medical staff as well as patients and caregivers, and existing promotional materials should be continually managed.

The institutional safety climate for hand hygiene score was the lowest among all components. The key problems identified for this component were a lack of competent infection management experts and a lack of diverse activities that foster hand hygiene culture within the hospital. Building a safety climate fosters a foundation for launching and continuing hand hygiene improvement activities while simultaneously motivating staff to comply with hand hygiene [1].

Table 2. Major Issues on five components of multimodal hand hygiene improvement strategies.

Domains	Major Issues
System Change	Foster a basic hand-hygiene-promoting environment by supplying basic hand hygiene products, including ABHRs, and establish a monitoring system.
Training and Education	Establish an education monitoring system to follow-up on medical staff's completion of hand hygiene education.
	Provide hand-hygiene-related data that can be accessed by all medical staff.
	Develop an education program that fosters a professional workforce for monitoring hand hygiene.
Evaluation and Feedback	Establish plans for direct and indirect monitoring and should share the monitoring results with all medical staff in the hospital.
Reminders in the Workplace	Print and manage appropriate promotional materials to continuously provide information
Institutional Safety Climate for Hand Hygiene	Clarify the roles of facility leadership and devise measures for fostering a safety climate

Furthermore, it plays a central role in HAI prevention and healthcare worker safety [28]. Infection control programs and a positive safety climate also require adequate facility leadership [27]; accordingly, facilities should clearly allocate leadership roles for this purpose.

A major strength of this study is its mainly objective assessment of hand hygiene compliance in CPA level 3 government hospitals in Cambodia using the assessment framework suggested by the WHO. Based on our analysis, issues identified as the most pressing are described in Table 2. We expect that these findings will benefit HAI management and hand hygiene improvement throughout Cambodia and potentially other Southeast Asian countries.

This study has several limitations. First, this study was conducted on eight CPA level 3 government hospitals in only one large city in Cambodia. CPA level 3 hospitals might differ in some respects depending on their location, so this must be taken into consideration when interpreting the results. Second, although we strove to collect objective data by performing direct observations, we could not observe all hospitals because some did not allow it. As a result, there is a possibility of response bias.

Conclusions

We found that the average hand-hygiene status of hospitals in Cambodia were at the basic level, but hospitals differed depending on their financial situation; therefore, the status of hand washing continues to need support.

We suggest that agents aiming to provide hand hygiene and infection management support to Southeast Asian countries, including Cambodia, should refer to our findings in order to hone in on the key problems that must be addressed in the corresponding country. Instead of providing temporary support based on donor-centered or project-performance-centered approaches, recipient-tailored, hand hygiene improvement measures should be developed in consideration of the recipient's sustainability.

Authors' contributions

Bomi An worked for conception and design, data collection, analysis and interpretation of data, writing the manuscript, and critical revision of the manuscript. Sook Ja Yang worked for conception and design, analysis and interpretation of data, writing the manuscript, and critical revision of the manuscript.

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Annex – Supplementary items

Supplementary Table 1. Evaluation of Hand Hygiene in Hospitals of Cambodia Using Hand Hygiene Self-Assessment Framework.

1. System Change				
Question	**Answer**	**Score**	**N (%)**	**Comments**
1.1 How easily available is alcohol-based handrub in your health-care facility?	Not available	0	0 (0)	Reckless Waste by patients in addition of financial problems Alcohol-based hand sanitizers are self-formulated or purchased The raw materials for formulating hand sanitizers are provided by Cambodia's Ministry of Health
	Available, but efficacy and tolerability have not been proven	0	0 (0)	
	Available only in some wards or in discontinuous supply(with efficacy and tolerability proven)	5	2 (25.0)	
	Available facility-wide with continuous supply(with efficacy and tolerability proven)	10	3 (37.5)	
	Available facility-wide with continuous supply, and at the point of care in the majority of wards (with efficacy and tolerability proven)	30	3 (37.5)	
	Available facility-wide with continuous supply at each point of care (with efficacy and tolerability proven)	50	0 (0)	
1.2 What is the sink:bed ratio?	Less than 1:10	0	2 (25.0)	This is scheduled to be expanded in two hospitals through foreign aid
	At least 1:10 in most wards	5	6 (75.0)	
	At least 1:10 facility-wide and 1:1 in isolation rooms and in intensive care units	10	0 (0)	
1.3 Is there a continuous supply of clean, running water?	No	0	0 (0)	
	Yes	10	8 (100)	
1.4 Is soap available at each sink?	No	0	3 (37.5)	Soap is preferentially placed in critical care units
	Yes	10	5 (62.5)	
1.5 Are single-use towels available at each sink?	No	0	8 (100)	Towels are re-used in three hospitals
	Yes	10	0 (0)	
1.6 Is there dedicated/available budget for the continuous procurement of hand hygiene products (e.g. alcohol-based handrubs)?	No	0	2 (25.0)	There's only a tight budget
	Yes	10	6 (75.0)	
1.7* Is there realistic plan in place to improve the infrastructure in your health-care facility?	No	0	5 (62.5)	Systematic activities performed in three institutions through foreign aid
	Yes	5	3 (37.5)	
Mean ± SD			**45.63±15.45**	

* 1.7 was answered when the hospital was scored less than 100 for question 1.1 to 1.6

2. Training and Education

Question	Answer	Score	N (%)	Comments
2.1 Regarding training of health-care workers in your facility:				
2.1.a How frequently do your health-care workers receive training regarding hand hygiene in your facility?	Never	0	1 (12.5)	
	At least once	5	2 (25.0)	
	Regular training for medical and nursing staff, or all professional categories(at least annually)	10	5 (62.5)	
	Mandatory training for all professional categories at commencement of employment, then ongoing regular training(at least annually)	20	0 (0)	
2.1.b Is a process in place to confirm that all health-care workers complete this training?	No	0	6 (75.0)	
	Yes	20	2 (25.0)	
2.2 Are the following WHO documents, or similar local adaptations, easily available to all health-care workers?				
2.2.a The WHO 'Guideline on Hand Hygiene in Health-care: A Summary'	No	0	7 (87.5)	Similar document: Cambodian Ministry of Health 'Infection Prevention and Control Guidelines for Health Care Facilities' Low accessibility by regular medical staff because it is only available in managers' offices
	Yes	5	1 (12.5)	
2.2.b The WHO 'Hand Hygiene Technical Reference Manual'	No	0	7 (87.5)	
	Yes	5	1 (12.5)	
2.2.c The WHO 'Hand Hygiene: Why, How and When' Brochure	No	0	6 (75.0)	
	Yes	5	2 (25.0)	
2.2.d The WHO 'Glove Use Information' Leaflet	No	0	8 (100)	
	Yes	5	0 (0)	
2.3 Is a professional with adequate skills to serve as trainer for hand hygiene educational programs active within the health-care facility?	No	0	2 (25.0)	Performed by an external expert or medical professional who completed the hand hygiene education provided by the Cambodian Ministry of Health
	Yes	15	6 (75.0)	
2.4 Is system in place for training and validation of hand hygiene compliance observers?	No	0	7 (87.5)	
	Yes	15	1 (12.5)	
2.5 Is there a dedicated budget that allows for hand hygiene training?	No	0	4 (50.0)	
	Yes	10	4 (50.0)	
		Mean ± SD	**33.13±16.89**	

3. Evaluation and Feedback				
Question	**Answer**	**Score**	**N (%)**	**Comments**
3.1 Are regular (at lease annual) ward-based audits undertaken to assess the availability of handrub, soap, single use towels and other hand hygiene resources?	No	0	1 (12.5)	Performed every 1 week-1 month
	Yes	10	7 (87.5)	
3.2 Is health care worker knowledge of the following topics assessed at least annually (e.g. after education sessions)?				
3.2.a The indications for hand hygiene	No	0	8 (100)	
	Yes	5	0 (0)	
3.2.b The correct technique for hand hygiene	No	0	7 (87.5)	
	Yes	5	1 (12.5)	
3.3 Indirect Monitoring of Hand Hygiene Compliance				
3.3.a Is consumption of alcohol-based handrub monitored regularly (at least every 3 months)?	No	0	7 (87.5)	No information on the consumption by a single hospital conducting indirect monitoring
	Yes	5	1 (12.5)	
3.3.b Is consumption of soap monitored regularly (at least every 3 months)?	No	0	7 (87.5)	
	Yes	5	1 (12.5)	
3.3.c Is alcohol based handrub consumption at least 20L per 1000 patient-days?	No (or not measured)	0	8 (100)	
	Yes	5	0 (0)	
3.4 Direct Monitoring of Hand hygiene Compliance				
3.4.a How frequently is direct observation of hand hygiene compliance performed using the WHO Hand hygiene Observation tools (or similar technique)?	Never	0	4 (50.0)	No information on compliance in two out of four hospitals performing monitoring
	Irregularly	5	1 (12.5)	
	Annually	10	3 (37.5)	
	Every 3 months or more often	15	0 (0)	
3.4.b What is the overall hand hygiene compliance rate according to the WHO Hand Hygiene Observation tool (or similar technique) in your facility?	≤30	0	6 (75.0)	
	31-40%	5	0 (0)	
	41-50%	10	0 (0)	
	51-60%	15	0 (0)	
	61-71%	20	0 (0)	
	71-80%	25	0 (0)	
	≥ 81%	30	2 (25.0)	
3.5 Feedback				
3.5.a Immediate Feedback Is immediate feedback given to health-care workers at the end of each hand hygiene compliance observation session?	No	0	8 (100)	
	Yes	5	0 (0)	
3.5.b Systematic feedback Is regular (at least 6 monthly) feedback of data related to hand hygiene indicators with demonstration of the trend over time given to:				
3.5.b.i Health-care workers?	No	0	8 (100)	
	Yes	7.5	0 (0)	
3.5.b.ii Facility leadership?	No	0	5 (62.5)	
	Yes	7.5	3 (37.5)	
		Mean ± SD	**27.81±21.65**	

4. Reminders in the Workplace				
Question	**Answer**	**Score**	**N (%)**	**Comments**
4.1 Are the following posters (or locally produced equivalent with similar contents) displayed?				
4.1.a Poster explaining the indications for hand hygiene	Not displayed	0	0 (0)	Distributed by the Cambodian Ministry of Health Posters are hung on the wall near the sink or hand sanitizer
	Displayed in some wards/treatment areas	15	0 (0)	
	Displayed in most wards/treatment areas	20	0 (0)	
	Displayed in all wards/treatment areas	25	8 (100)	
4.1.b Poster explaining the correct use of handrub	Not displayed	0	0 (0)	
	Displayed in some wards/treatment areas	5	0 (0)	
	Displayed in most wards/treatment areas	10	0 (0)	
	Displayed in all wards/treatment areas	15	8 (100)	
4.1.c Poster explaining correct hand-washing technique	Not displayed	0	0 (0)	
	Displayed in some wards/treatment areas	5	0 (0)	
	Displayed in most wards/treatment areas	7.5	0 (0)	
	Displayed at every sink in all wards/treatment areas	10	8 (100)	
4.2 How frequently does a systematic audit of all posters for evidence of damaged occur, with replacement as required?	Never	0	2 (25.0)	Financial problem
	At least annually	10	5 (62.5)	
	Every 2-3 months	15	1 (12.5)	
4.3 Is hand hygiene promotion undertaken by displaying and regularly updating posters other than those mentioned above?	No	0	8 (100)	Financial problem
	Yes	10	0 (0)	
4.4 Are hand hygiene information leaflets available on wards?	No	0	8 (100)	Financial problem
	Yes	10	0 (0)	
4.5 Are other workplace reminders located throughout the facility? (e.g. hand hygiene campaign screensavers badges, stickers, etc)	No	0	8 (100)	Financial problem
	Yes	15	0 (0)	
		Mean ± SD	**58.13±5.30**	

5. Institutional Safety Climate for Hand Hygiene				
Question	**Answer**	**Score**	**N (%)**	**Comments**
5.1 With regard to a hand hygiene team that is dedicated to the promotion and implementation of optimal hand hygiene practice in your facility:				The infection management team also manages hand hygiene improvement activities
5.1.a Is such a team established?	No	0	2 (25.0)	
	Yes	5	6 (75.0)	
5.1.b Does this team meet on a regular basis (at least annually)?	No	0	2 (25.0)	
	Yes	5	6 (75.0)	
5.1.c Does this team have dedicated time to conduct hand hygiene promotion?	No	0	5 (62.5)	
	Yes	5	3 (37.5)	
5.2 Have the following members of the facility leadership made a clear commitment to support hand hygiene improvement?				
5.2.a Chief executive officer	No	0	7 (87.5)	
	Yes	10	1 (12.5)	
5.2.b Medical director	No	0	7 (87.5)	
	Yes	5	1 (12.5)	
5.2.c Director of nursing	No	0	8 (100)	
	Yes	5	0 (0)	
5.3 Has a clear plan for the promotion of hand hygiene throughout the entire facility for the 5 May(Save Lives Clean Your Hands Annual Initiative) been established?	No	0	8 (100)	
	Yes	10	0 (0)	
5.4 Are systems for identification of Hand Hygiene Leaders from all disciplines in place?				
5.4.a A system for designation of Hand Hygiene champions	No	0	8 (100)	
	Yes	5	0 (0)	
5.4.b A system for recognition and utilization of Hand Hygiene role models	No	0	8 (100)	
	Yes	5	0 (0)	
5.5 Regarding patient involvement in hand hygiene promotion:				
5.5.a Are patients informed about the importance of hand hygiene?	No	0	7 (87.5)	
	Yes	5	1 (12.5)	
5.5.b Has a formalized program of patient engagement been undertaken?	No	0	7 (87.5)	
	Yes	10	1 (12.5)	
5.6 Are initiatives to support local continuous improvement being applied in your facility, for example:				
5.6.a Hand hygiene E-learning tools	No	0	8 (100)	
	Yes	5	0 (0)	
5.6.b A hand hygiene institutional target to be achieved each year	No	0	7 (87.5)	
	Yes	5	1 (12.5)	
5.6.c A system for infra-institutional sharing of reliable and tested local innovations	No	0	8 (100)	
	Yes	5	0 (0)	
5.6.d Communications that regularly mention hand hygiene(e.g. facility newsletter, clinical meetings)	No	0	8 (100)	
	Yes	5	0 (0)	
5.6.e System for personal accountability	No	0	8 (100)	
	Yes	5	0 (0)	
5.6.f A Buddy system for new employees	No	0	8 (100)	
	Yes	5	0 (0)	
		Mean ± SD	**13.13±11.00**	