Infection Prevention and Control Practices as Reported by Registered Nurses and Nurse Midwives in 13 Government Hospitals in Cambodia

by

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Infection Prevention and Control Practice in 13 Government Hospitals in Cambodia

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Abstract

Background: Although infectious diseases are becoming less of a threat to health in low and middle income countries, infection prevention and control (IPC) programs that include quality assurance monitoring continue to be needed to improve care in middle income countries such as Cambodia.
Purpose: The purpose of this study was to report nurses' and midwives' perceptions of regarding the implementation and use of IPC guidelines provided by the Ministry of Health in Cambodia and whether there are differences based on the type of hospital (CPA-1 [hospital with minimal services], CPA-2 [emergency department available with some surgical services], CPA-3 [emergency department, surgical services and specialty services], and national).
Methods: This descriptive cross-sectional study used a Center for Disease Control infection control instrument adapted for use in Cambodian hospitals that was translated using a translation and back-translation process described by the World Health Organization. The sample consisted of 275 respondents including 174 (63.3%) nurses and 99 (36.0%) midwives from either one CPA-1 hospital (n=10, 3.6%), 6 CPA-2 hospitals (n=76, 27.6%), 4 CPA-3 hospitals (n=132, 48.0%) and 2 national hospitals (n=57, 20.7%). Aspects of infection control programs measured included fiscal and human resources for IPC, hand hygiene, use of personal protective equipment, care of the patient with a urinary catheter, prevention of surgical site infection and environmental cleaning. Responses by hospital type were compared using the Chi-Square test of independence or the Fisher's Exact Test.
Results: Nurses and midwives in the CPA-1 hospitals reported less fiscal and human support (20%) for maintaining an IPC program when compared to other classifications of hospitals (75% for CPA-2, 87% for CPA-3, and 82% for national) ($p < 0.05$). Differences by hospital type were also present for aspects of IPC including hand hygiene, personal protective equipment and environmental cleaning.
Conclusions: IPC is improving considerably in Cambodian hospitals, but more resources need to be allocated to the CPA-1 and CPA-2 hospitals that provide basic levels of care in the more rural areas of Cambodia.

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Preface

The basis of my research was from a larger project with the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ, funding agency) working on quality control in Cambodia. My particular interest in this topic was heightened during my visit to Siem Reap province of Cambodia. During that time, I was able to see first-hand the work being done to assist the Kingdom of Cambodia in their healthcare reform. First, I would like to thank my thesis advisor, Dr. Richard Henker who I began working with during my sophomore year. I am so glad he showed me the importance of global health for allowed me to be a part of this project along with the rest of my project team. I will always be grateful for his constant support and guidance on this project. I am especially thankful for the time he devoted to this project and encouraging my travels and presentations. I would like to thank Dr. Susan Sereika for helping me with my statistical analysis and for allowing me so much time to decipher statistics. Without her help, my analysis would have been lack luster and I would not have understood much of it. I would also like to thank Dr. Hiroko Henker for her support and contributions with the collection of data for this project. Additionally, I would like to thank Dr. Virya Koy for his contributions to this project as well as the larger GIZ project alongside Manila Prak. I appreciate Dr. Koy's support with my defense and agreeing to be my external examiner, although travels were cancelled due to COVID-19. I would also like to thank my defense committee for supporting me through this process through virtual-meetings. Lastly, I would like to thank the GIZ for funding this research project. I would also like to thank the University of Pittsburgh Honors College, Student Government Board and Asian Studies Office for helping me fund my trip to Singapore to present this research at the International Council of Nurses Congress this past summer (2019).

1.0 Introduction

Infection prevention and control (IPC) is understood to be the primary method to decrease nosocomial infections and thus improve patient outcomes. According to the Centers for Disease Control (CDC), one in 31 hospitalized patients will acquire a nosocomial infection, also known as hospital-acquired infections (HAIs) (CDC, 2017). Nosocomial infections are a major complication for healthcare and a leading cause of death in low-middle income countries such as Cambodia. A study done by Thi Anh Thu and colleagues (2015) showed that implementing infection control programs in Vietnam reduced HAIs by 36%. Investigators concluded that all hospitals in low-middle income countries, especially those with less fiscal support, would benefit through the implementation and continued use of infection prevention programs (Thi Anh Thu et al., 2015). Theories, including the one proposed by Donabedian, suggest that through examining services implemented in hospitals, investigators can determine quality of care. As hospital practices advance, patient outcomes improve (Donabedian, 1966). To evaluate HAIs, the World Health Organization (WHO) works to provide hospitals and healthcare workers globally with outlined plans to improve IPC, which includes knowledge and understanding of nosocomial infections. The WHO conducted a study regarding implementation and evaluation of infection control programs (Haley et al., 1985). Investigators found that with strict infection control programs, infection rates declined dramatically.

1.1 Background

Along with the economic growth, health in Cambodia has significantly improved in the past twenty years. Initiatives that have contributed to an improvement in health status in Cambodia include a series of health reforms implemented by the Ministry of Health (MoH) since 1993. Although there has been significant improvement in healthcare in Cambodia, there is still a need for support and implementation of MoH guidelines. The MoH has established health strategic plans to provide direction to the development of the health sector and a framework for stakeholders to improve the health of Cambodians. The Ministry of Health's strategic approach (Health Sector Strategic Plan 2003-2007) has contributed to this improvement by increasing the quantity of providers. However, Cambodia still faces many challenges in healthcare services. In the most recent strategic plan (Health Strategic Plan 2016-2020 HSP3), the Ministry of Health has identified gaps between established quality standards and clinical guidelines, and quality of health care services. In the current strategic plan, HSP3, the MoH intends to evaluate infection control programs, strategies and patient outcomes. The HSP3 shows the MoH's commitment to achieving the United Nation's Sustainable Development Goals by 2030.

The MoH developed the National Guidelines on IPC for healthcare facilities in 2010 and updated them in 2017. The purpose of these guidelines was to provide healthcare managers and workers with knowledge and practice of IPC in healthcare settings (MoH, 2017). The guidelines, which were introduced in all healthcare facilities at both the national and sub-national levels, regardless of public or private settings, are to be used in all aspects of the IPC programs, including healthcare waste management. The MoH called on all healthcare workers to strictly follow these guidelines and to use them as the basis for developing various educational policies in their respective healthcare facilities.

One of the goals of the MoH is to offer equal access to healthcare. The Ministry of Health provides healthcare at two levels: Minimum Package of Activity (MPA) and Complementary Package of Activity (CPA). MPA is given at the health centers whereas CPA occurs at referral hospitals. There are also national hospitals which provide the most complex care and are the largest (WHO, 2012).

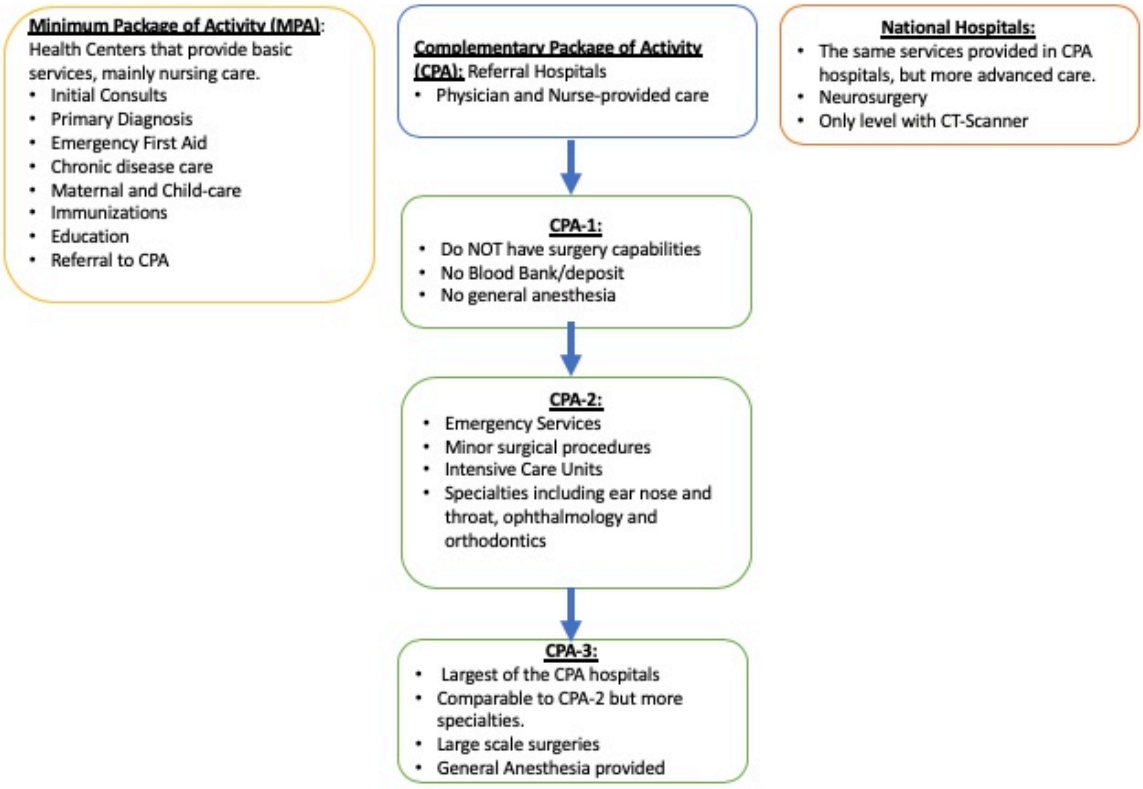

Figure 1: Healthcare in Cambodia is divided into 3 levels. Minimum Package of Activity (MPA), Complementary Package of Activity (CPA) and National Hospitals. This shows each hospital type and level based on clinical activities provided at each (Minahan, 2020).

The purpose of this study was to describe nurses' and midwives' perceptions regarding the implementation and use of IPC guidelines provided by the Ministry of Health in Cambodia and to explore whether there are differences in effectiveness of IPC based on the type of hospital (CPA-1 and CPA-2, versus CPA-3 and National).

2.0 Methods

2.1 Design

A descriptive, cross-sectional design was used to evaluate the implementation of infection control guidelines in thirteen hospitals in Cambodia.

2.2 Setting and Sample

The sample included nurses and midwives who were employed at hospitals in five provinces (Kampoung Spoeu, Kampot, Kep, Kampoung Thom and Phnom Penh) and also national hospitals in Phnom Penh. The population of registered nurses (RN) and registered midwives (RM) in these provinces and national hospitals was 2,320. See Table 1 for the number of participants from each hospital and the classification of their hospital as CPA-1, CPA-2, CPA-3 or national.

Systematic sampling was applied in Kampoung Spoeu, Kampot, Kep and Kampoung Thom. The hospitals that were used for this study were chosen by the GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) based on prior research projects with these hospitals.

Table 1: Hospital Type, Name, Location and Number of Participants

Grouping Variable	Hospital Level	Hospital Name	Number of Participants (n)
CPA-1 & CPA-2	CPA1	Kep	10
	CPA2	Kampoung Trach	17
	CPA2	Angkor Chey	15
	CPA2	Kong Pisey	15
	CPA2	Stung	10
CPA-3 & National Hospitals	CPA3	Kampot	31
	CPA3	Kamgpoung Speur	34
	CPA3	Kampoung Thom	17
	CPA3	Phnom Penh Municipal	50
	National	Khmer-Soviet Friendship	35
	National	Kossomak	22

2.3 Measurement

To measure the perceived extent of implementation of IPC, the study team selected an instrument that was publicly available through the Center of Disease Control (CDC) – the Infection Prevention and Control Assessment Tool (IPCAT) (2017). Prior to using the instrument, it was

modified to be appropriate for the participants in the study (i.e., nurses and midwives in Cambodia) and the setting of the study (i.e., hospitals in Cambodia). The instrument was translated from English to Khmer in accordance with the WHO Process of translation and adaptation of instruments (WHO, 2019). The translation was based on concepts and not a word-for-word method. Two experts performed a forward translation of the instrument from English to Khmer. A panel of three experts on nursing care in Cambodia were brought together to evaluate the translated instrument to determine if the expression in Khmer was appropriate.

After the expert panel reviewed and revised the instrument, a back translation from Khmer to English was conducted by a third translator. Investigators (Koy, V & Prak, M) reviewed the back translation and found two items that were not precise versions of the initial items and revised the items in Khmer and made adjustments as appropriate.

2.4 Ethical Considerations

Approval of use of human subjects for this project was obtained from the National Ethics Committee for Health Research and supported by hospital directors (Approved no. 019 NECHR) and the University of Pittsburgh Human Research Protection Office (PRO18020192). All invited participants were informed of risks and benefits of the study; participation was voluntary, and participants had the ability to freely withdraw from the study at any time. Participants were also guaranteed that their responses would remain anonymous. Both researchers and participants agreed to the conditions of the study using a consent form that was signed prior to data collection.

2.5 Statistical Analysis

IBM® SPSS® Statistics for Windows Version 26 (IBM Corp., Armonk, N.Y., USA) released in 2019 was used for all data analyses. Descriptive statistics were used to summarize the characteristics of the total sample and by type of hospital. For the comparison based on type of hospital, the nurses and midwives from CPA-1 and CPA-2 hospitals were combined into one group and those from CPA-3 and national hospitals were combined into a second group for analysis. The characteristics of CPA 1 and 2 were comparable. The chi-square test of independence or Fisher exact test, if sparse cells were encountered, were used as appropriate for comparisons between the collapsed two types of hospitals. The level of statistical significance was set at 0.05 for two-sided hypothesis testing. Odds ratios with 95% confidence intervals were reported to summarize the measure of association.

3.0 Results

Thirteen hospitals were included in the analysis. One hospital was a CPA-1, six hospitals were CPA-2, four hospitals were CPA-3 and two were national hospitals. Of the 275 nurses and midwives who responded, ten respondents (3.6%) were from CPA-1 hospitals, 76 (27.6%) were from CPA-2 hospitals, 132 (48.0%) were from CPA-3 hospitals and 57 (20.7%) were from national hospitals.

3.1 Demographic Characteristics of the Sample

Table 2: Demographic Characteristics of Study Participants

Characteristic	**CPA-1 & CPA-2** Mean±SD **or** **n (%)**	**CPA-3 & National** Mean±SD **or** **n (%)**	**Total** Mean±SD **or** **n (%)**	**Test Statistic, p-value**
Gender				
Male	40 (38)	66 (62)	106 (39)	3.35, 0.082
Female, n (%)	46 (27)	123 (72)	169 (61)	
Age (years)*				
Age (years)	39±12	36±10	38±11	2.51, 0.013

Nursing experience (years)*				
	16±13	13±36	15±15	2.17, 0.031
Level of Degree				
Associates Degree Nurse	37 (27)	102 (73)	139 (51)	7.30, 0.100
Associates Degree Midwife	35 (36)	63 (64)	98 (36)	
Bachelor of Science in Nursing	12 (34)	23 (66)	35 (13)	
Bachelor of Science in Midwifery	0 (0)	1 (100)	1 (0.4)	
Doctorate (PhD)	0 (0)	2 (100)	2 (0.7)	
Type of Ward*				
Surgical	10 (22)	39 (78)	45 (16)	17.59, 0.023
Medicine	17 (30)	39 (69)	56 (20)	
ICU	4 (20)	16 (80)	20 (7)	
Maternal	24 (41)	25 (42)	59 (14)	
Pediatric	5 (28)	13 (72)	18 (7)	
Outpatient Department	13 (33)	26 (67)	39 (14)	
Tuberculosis	11 (61)	7 (39)	18 (7)	
Sexually-Transmitted Disease	2 (14)	12 (86)	14 (5)	
Cancer	0 (0)	6 (100)	6 (2)	

* indicates $p < 0.05$

One-hundred-and-seventy-four participants (63.7%) were nurses and ninety-nine (36.3%) were midwives. Two (0.7%) participants obtained a doctorate (PhD) in nursing. Most (n=139, 50%) had an associate's degree in nursing.

Over 90% of participants worked 24-hour shifts. Twenty percent of participants indicated that they were the only nurse on the ward. This occurred mostly in the CPA-1 and CPA-2 hospitals. The mean number of patients cared for during each shift was lowest for the participants working in the CPA-1 and CPA-2 hospitals, with a mean of 4.4 (SD=2.4) and 12.8 (SD=15.8), respectively. The mean number of patients cared for during each shift in the national hospital was the highest at 34.9 (SD=24.1).

3.2 Program and Infrastructure

Most study participants recognized (80.4%) an active infection control program that included fiscal, human resource support and policies. Two of the CPA-2 hospitals and one CPA-1 hospital reported a lack of support and infrastructure for their infection control programs (Table 3).The smaller, rural hospitals (CPA-1 and CPA-2) have significant differences in infection control programs when compared to CPA-3 and national hospitals.

Table 3: Survey Question and Statistical Results Based on Reponse

Question	**Type of Hospital**			**Odds Ratio, 95% CI (LL, UL)**	**Test Statistic (p-value)**
	CPA-1 & CPA-2 (n=86) n (%)	**CPA-3 and National (n=189) n (%)**	**Total (n=275) n (%)**		
1. Hospital provides fiscal and human resource support for maintaining the infection prevention and control program.	59 (68.6)	162 (85.7)	221 (80.4)	2.75 (1.49, 5.06)	10.96 (0.001)
2. The person (s) charged with directing the infection prevention and control program at the hospital are qualified and trained in infection control.	62 (72.1)	176 (93.1)	238 (86.5)	5.24 (2.51, 10.92)	22.45 (<0.001)
3. Written infection control policies and procedures are available, current, and based on evidence-based guidelines (e.g. MoH), regulations, or standards.	74 (86.0)	183 (96.8)	257 (93.5)	4.95 (1.79, 13.67)	11.23 (0.002)
4. Infection prevention and control program provides infection prevention education to	66 (76.7)	166 (87.8)	232 (84.4)	2.19 (1.13, 4.25)	5.51 (0.021)

patients, family members, and other caregivers.					

CI=confidence interval; LL=lower limit of the CI; UL=upper limit of the CI

3.3 Hand Hygiene

Hand hygiene policies, programs and supplies were present in all levels of hospitals (90.9%). Significant differences were found in monitoring and feedback from hospitals about hand hygiene, which were less likely to occur in CPA-1 and CPA-2 hospitals. Furthermore, CPA-1 and CPA-2 hospitals reported less availability of supplies for adherence of hand hygiene (Table 4).

Table 4: Results for Hand Hyiene Questionnaire Subdomain by Hospital Type

Question	**Type of Hospital**			**Odds Ratio, 95%CI (LL,UL)**	**Test Statistic (p-value)**
	CPA-1 & CPA-2 (n=86) n (%)	**CPA-3 and National (n=189) n (%)**	**Total (n=275) n (%)**		
1. Hospital has a competency-based training program for hand hygiene.	73 (84.9)	177 (93.7)	250 (90.9)	2.63 (1.15, 6.01)	5.50 (0.024)

2. Hospital routinely audits (monitor and documents) adherence to hand hygiene.	46 (53.5)	167 (88.4)	213 (77.5)	6.60 (3.57, 12.20)	41.16 (<0.001)
3. Hospital provides feedback from audits to personnel regarding their hand hygiene performance.	42 (48.8)	154 (81.5)	196 (71.3)	4.61 (2.63, 8.07)	30.76 (<0.001)
4. Supplies necessary for adherence to hand hygiene (e.g., soap, water, paper towels, alcohol-based hand rub) are readily accessible inpatient care areas.	67 (77.9)	169 (89.4)	236 (85.8)	2.40 (1.20, 4.77)	6.44 (0.011)
5. Hand hygiene policies promote preferential use of alcohol-based hand rub (ABHR) over soap and water in most clinical situations.	73 (84.9)	158 (83.6)	231 (84.0)	0.91 (0.45, 1.84)	0.07 (0.860)

CI=confidence interval; LL=lower limit of the CI; UL=upper limit of the CI

3.4 Personal Protective Equipment

A competency-based program for the use of personal protective equipment (PPE) was reported by more than 70% of all participants. Audits and feedback were less likely to occur regarding PPE in CPA-1 and CPA-2 hospitals. There were significant differences between CPA-1 and CPA-2 versus CPA-3 and national hospitals regarding availability of PPE supplies (gloves,

gowns, mouth, nose and face protection) ($p<0.05$). CPA-1 and CPA-2 hospitals also acknowledged less availability of respiratory protection equipment for airborne agents (Table 5).

Table 5: Results for Personal Protectie Equipment Questionnaire Subdomain by Hospital Type

Question	**Type of Hospital**			**Odds Ratio, 95%CI (LL,UL)**	**Test Statistic (p-value)**
	CPA-1 & CPA-2 (n=86) n(%)	**CPA-3 and National (n=189) n(%)**	**Total (n=275) n (%)**		
1. Hospital has a competency-based training program for use of personal protective equipment (PPE).	48 (55.8)	147 (77.8)	195 (70.9)	2.77 (1.60, 4.79)	13.82 (<0.001)
2. Hospital routinely audits (monitors and documents) adherence to proper PPE selection and use, including donning and doffing.	46 (53.5)	137 (72.5)	183 (66.5)	2.29 (1.35, 3.89)	9.58 (0.002)
3.Hospital provides feedback to personnel regarding their performance with selection and use of PPE.	47 (54.7)	133 (70.4)	180 (65.5)	1.97 (1.16, 3.34)	6.46 (0.008)

4. Supplies necessary for adherence to personal protective equipment recommendations specified under Standard and Transmission-based Precautions (e.g., gloves, gowns, mouth, eye, nose, and face protection) are available and located near point of use.	55 (64.0)	153 (81.0)	208 (75.6)	2.40 (1.35, 4.24)	9.27(0.003)
5. The facility respiratory protection program provides employees protection from recognized hazards.	44 (51.2)	113 (59.8)	157 (57.1)	1.42 (0.85, 2.37)	1.80 (0.191)

CI=confidence interval; LL=lower limit of the CI; UL=upper limit of the CI

3.5 Surgical Site Infection

Sixty-five percent of participants identified a surgical site infection (SSI) program in their hospital. Surgeries were least likely to be performed in CPA-1 and CPA-2 hospitals where surgical site infection programs were less comprehensive. Audits and feedback were also less likely to occur in rural CPA-1 and CPA-2 hospitals when compared to urban CPA-3 and national hospitals. CPA-1 and CPA-2 hospitals reported less SSI data collection and feedback to providers than CPA-3 and national, although percentages were overall low (Table 6).

Table 6: Results for Surgical Site Infection Questionnaire Subdomain by Hospital Type

Question	Type of Hospital			Odds Ratio, 95%CI (LL,UL)	Test Statistic (p-value)
	CPA-1 & CPA-2 (n=86) n(%)	CPA-3 and National (n=189) n(%)	Total (n=275) n (%)		
1. Hospital has a program to improve surgical care	37 (43.0)	138 (73.0)	175 (63.6)	3.58 (2.10, 6.11)	22.98 (<0.001)
2. Hospital routinely audits (monitoring and document) adherence to elements of program to improve surgical care	33 (38.4)	121 (64.0)	154 (56.0)	2.86 (1.69, 4.34)	15.781 (<0.001)
3. Hospital provides feedback from audits to personnel regarding to elements of program to improve surgical care	35 (40.7)	116 (61.4)	151 (54.9)	2.32 (1.38, 3.90)	10.207 (0.001)
4. Hospital routinely audits (monitoring and document) adherence to recommended infection control practices SSI prevention	41 (47.7)	130 (68.8)	171 (62.2)	2.42 (1.43, 4.08)	11.199 (0.001)

5. Hospital provides feedback from audits to personnel regarding their adherence to surgical infection control practices	40 (46.5)	133 (70.4)	173 (62.9)	2.73 (1.61, 4.62)	14.419 (<0.001)
6. Hospital monitors SSI data and uses it to direct prevention activities	39 (45.3)	118 (62.4)	157 (57.1)	2.00 (1.20, 3.36)	7.043 (0.009)
7. Hospital provides feedback of SSI data to surgeons and other surgical personnel	36 (41.9)	131 (69.3)	167 (60.7)	3.14 (1.85, 5.32)	18.676 (<0.001)

CI=confidence interval; LL=lower limit of the CI; UL=upper limit of the CI

3.6 Environmental Cleaning

Eighty-two percent of participants confirmed that their hospital has competency-based environmental cleaning program. Seventy-seven percent identified that they have clear policies for cleaning of equipment (Table 7). Participants from CPA-1 and CPA-2 hospitals noted significantly less protocols to identify equipment that has already been cleaned. Audits regarding environmental cleaning were conveyed less in CPA-1 and CPA-2 hospitals than in CPA-3 and national hospitals. According to 70.5% of participants, feedback from audits occurred (Table 7).

Table 7: Results for Environmental Cleaning Questionnaire Subdomain by Hospital Type

Question	Type of Hospital			Odds Ratio, 95%CI (LL,UL)	Test Statistic (p-value)
	CPA-1 & CPA-2 (n=86) n (%)	CPA-3 & National (n=189) n (%)	Total (n=275) n (%)		
1. Hospital has a competency-based training program for environmental cleaning	64 (74.4)	160 (84.7)	224 (81.5)	1.90 (1.02, 3.55)	4.101 (0.046)
2. Hospital has policies that clearly define responsibilities for cleaning and disinfection of non-critical equipment, mobile devices, and other electronic (e.g., ICU monitoring, ventilator, airway boxes)	60 (69.8)	151 (79.9)	211 (76.7)	1.72 (0.96, 3.08)	3.394 (0.47)
3. Hospital has protocols to ensure that healthcare personnel can readily identify equipment that has been properly cleaned and disinfected and is ready for patient use	61 (70.9)	160 (84.7)	221 (80.4)	2.261 (1.23, 4.17)	7.056 (0.007)

4. Hospital routinely audits (monitors and documents) adherence to cleaning and disinfection procedures, including use of products in accordance with manufactures' instruction	40 (46.5)	134 (70.9)	174 (63.3)	2.80 (1.65, 4.75)	15.128 (<0.001)
5. Hospital provides feedback from audits to personnel regarding their adherence to cleaning and disinfection procedures.	49 (57.0)	145 (76.7)	194 (70.5)	2.49 (1.44, 4.29)	11.087 (0.001)

CI=confidence interval; LL=lower limit of the CI; UL=upper limit of the CI

4.0 Discussion

This cross-sectional descriptive study was conducted to determine the gaps in infection prevention and control program implementation across different levels of hospitals in Cambodia as reported by nurses and midwives. Preventing and controlling infection is a pivotal component of safe and high-quality healthcare. The WHO provides support to develop and implement infection prevention and control guidelines, training materials, assessment tools and healthcare worker training, and to prepare for surveillance of healthcare-associated infection in selected healthcare facilities (WHO, 2018). With such support, the Cambodian MoH has promoted the implementation of core components for the infection prevention and control program at national and all CPA-1, CPA-2 and CPA-3 levels.

Initially, the MoH implemented IPC programs in CPA-3 and national hospitals. After roughly seven years, IPC programs were introduced in CPA-1 and CPA-2 hospitals; this gap in time significantly contributes to the disparities in the reporting by CPA-1 and CPA-2. In Cambodia, CPA-1 and CPA-2 hospitals are typically smaller and located in rural areas where access to basic supplies is often limited. CPA-3 and national hospitals have more fiscal support and better and more comprehensive infection control programs. This discrepancy also emerges when comparing smaller, rural hospitals in the United States to larger ones. Community hospitals in the U.S. have more difficulty providing the same quality of care compared to that given by larger academic hospitals and often struggle to maintain adequate infection control programs (Reese, et al., 2014).

Inconsistencies often arise from the lack of personnel, supplies and time devoted to providing quality infection control when compared to larger hospitals that have a greater number

of staff and more fiscal support. Infection control programs in high income countries compared to those in low-middle income countries show large disparities in resources, funding and personnel (Desai et al., 2019).

4.1 Infection Prevention and Control (IPC) Program and Infrastructure

More than 80% of study participants acknowledged an active infection control program in their hospitals. This result is consistent with the IPC program implemented by the Hospital Services Department of MoH. Since 2010, this program has been introduced and disseminated to healthcare facilities in Cambodia. The IPC training program was provided by a MoH team to all provincial hospitals (CPA-3), but it was not implemented as consistently in district-level hospitals, i.e., CPA-1 and CPA-2 hospitals. In 2017, the IPC guidelines were updated, and the MoH team continued to provide IPC training to all public hospitals. The result is reflected by the nurses and midwives who are now aware of the importance of an IPC program in promoting the quality of care for patients.

Infrastructure for IPC was noted by 80% of nurses and midwives. The four main aspects of the IPC program included human resource support and infrastructure, training and education for all personnel, policies and procedures, and education to patients and families or other caregivers. However, as evidenced by a study by Sok & Koum, the lack of fiscal aid, resources and limited staff capacity has contributed to limitations of the IPC programs at some hospitals, such as CPA-1 or -2 hospitals (2013a). The researchers mentioned that IPC continues to suffer from poor staff capacity and commitment, limited educational maintenance and financial shortages (Sok et al. 2013b). This finding is comparable to rural and urban hospitals in Colorado where a similar study

was conducted to review discrepancies in IPC (Reese, et al. 2014). Reese and colleagues found that nurses in smaller hospitals had more responsibilities and less support to maintain high quality IPC programs. Their study demonstrated that although infection rates were improving, more supplies, fiscal support and personnel were required to achieve a more sophisticated IPC program (Reese et al., 2014).

4.2 Hand Hygiene

Hand hygiene is accepted as the most important factor when trying to prevent infections (Burke, 2003). More than 70% of nurses and midwives found hand hygiene policies, programs and supplies at all levels of hospitals. However, In CPA-1 and CPA-2 hospitals, the monitoring and feedback about hand hygiene were less likely to occur. CPA-1 and CPA-2 hospitals are the district-level hospitals that have limited IPC training program and resources from the MoH. Loftus and colleagues found that alcohol-based hand rub was the most feasible and reliable tool to prevent nosocomial infections in low-middle income countries (2019). Alcohol-based hand rub has reliable outcomes to prevent nosocomial infections and is a relatively affordable adjunct to soap and water.

In hospitals with limited assets, allocation of funding and supplies for practices such as hand hygiene can be difficult. A common misconception is that it is not practical to implement pristine hand hygiene programs in low-middle income countries. A study done by Song et al. (2013) reports that when hand hygiene program compliance increased, MRSA acquisition rates decreased by 48 percent and, therefore, saved the hospital roughly $66,000 annually. According to a study conducted in a Vietnamese hospital, it is realistic to implement hand hygiene procedures

in hospitals with less monetary support. The team found that hand hygiene programs reduced HAIs by 36% and spending by roughly $1,131 (Thi Anh Thu et al., 2015).

Sansam and colleagues (2016) suggested that education and surveillance conducted by the MoH and the infection committee of the hospital may be effective for reducing healthcare-associated infections in developing countries with a limited budget and resources (Sansam et al., 2016). Hand hygiene compliance improved during the first year after the implementation of the education program but the average hand hygiene compliance at two years decreased compared to one year (Sansam et al., 2016). An increased budget and resources with the training support by the MoH and health partners would contribute to better hand hygiene compliance practice in all healthcare facilities. Therefore, it is necessary to apply and maintain adequate hand hygiene programs in all levels of hospitals. Hospitals must monitor hand hygiene practice as well as offer brush-up training if needed to improve nosocomial infection rates.

4.3 Personal Protective Equipment

Using PPE reduces the risk of acquiring and transmitting infections, by erecting a barrier between pathogens and port of entry and exit of the host. It is important that PPE is used effectively, correctly and consistently where contact with blood and bodily fluids of patients may occur. Continuous availability of PPE and adequate training for its proper use are essential (MoH, 2017).

Seventy percent of all participants reported that there was sufficient PPE in CPA-3 and national hospitals. On the other hand, the participants from the CPA-2 hospitals acknowledged a lack of monitoring and feedback as well as supplies for the use of PPEs. In addition, the results

indicated that the CPA-1 and CPA-2 hospitals are in a situation where they received limited training and IPC supplies compared to CPA-3 and national hospitals. Smaller hospitals in the United States often lack supplies and support to maintain PPE protocols (Reese et al., 2014). The IPC team at the MoH has been coordinating and guiding IPC teams in most CPA-3 hospitals and asking Provincial Health Departments to add more to their budget in their annual operating plan for IPC activities (Sok & Kuom, 2013a). To promote higher quality of care for all and prevent nosocomial infections, PPE programs must be maintained.

4.4 Surgical Site Infection

The SSI is a common nosocomial infection. The incidence of SSIs varies and depends on several aspects of practice. These practices include: pre-operation preparation of the site of an incision, use of sterile equipment/ instruments, the type and length of operation, technique and experience of the surgical team, use of antibiotic prophylaxis, and the presence of foreign bodies including a drainage tube (MoH, 2017).

Overall, 63% of participants reported an SSI program was available in their hospitals. This percentage was much higher in national hospitals (84%) than in other hospitals (68% in CPA-3, 46% in CPA-2 and 20% in CPA-1). To factors explain this situation. First, because surgical care is not frequent in CPA-1 and CPA-2 hospitals, the priority of SSI training can be low in these hospitals. Second, because the IPC core team from the MoH is still facing a challenge to reach all levels of hospitals, SSI training programs are limited in CPA-1 and CPA-2 hospitals. Surgical site infection practices are included in the IPC program provided by the MoH. When the IPC program is implemented, there is an improvement in infection control at that site. Surveillance of

healthcare-associated infections in a setting with limited resources is challenging but feasible (Sok et al, 2013b).

4.5 Limitations

Even though our study results were strong, there were some limitations to this study to note. First, the sampling technique was weak. Hospital directors invited participants rather than selecting participants randomly with the hospital. Second, the participants did not represent the entire country. The study only included four provinces and two national hospitals. It only had one CPA-1 hospital with ten respondents; in the future, more CPA -1 hospitals and respondents should be included in the sample. When this study was conducted, it was part of a larger study by the GIZ. The larger study included four surveys. Therefore, the use of four questionnaires about 15 pages in length may have been too burdensome for the respondents to complete. The infection control portion of the project was only one of the four surveys participants had to complete. These surveys could cause participants lose interest in answering the questions. Future research should consider the use of a shorter questionnaire survey.

5.0 Conclusion

This study demonstrates the participants' perceptions of the current state of infection control policy in Cambodia. Although healthcare is improving, there is much room for growth. Prior to HSP3, hospitals in Cambodia were working to increase the quantity of healthcare providers. Now, the MoH is working to improve quality of care, but IPC continues to suffer from poor staff capacity and commitment. In addition, CPA-1 and CPA-2 hospitals suffer from financial shortages. The Kingdom of Cambodia is aware of the disparities based on the levels of hospitals. As a result, the MoH will ensure IPC by the staff of the hospitals through continuous professional development. These findings provide useful foundational information for the development of future intervention packages and improvements of IPC at all levels of hospitals in the healthcare system in Cambodia.

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