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Current practices and barriers to the use of facemasks and respirators among hospital-based health care workers in Vietnam

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Low- and middle-income countries**Background:** This study aimed to examine the knowledge, attitudes, and practices towards the use of facemasks among hospital-based health care workers (HCWs) in Hanoi, Vietnam.**Methods:** A qualitative study incorporating 20 focus groups was conducted between August 2010 and May 2011. HCWs from 7 hospitals in Vietnam were invited to participate.**Results:** Issues associated with the availability of facemasks (medical and cloth masks) and respirators was the strongest theme to emerge from the discussion. Participants reported that it is not unusual for some types of facemasks to be unavailable during nonemergency periods. It was highlighted that the use of facemasks and respirators is not continuous, but rather is limited to selected situations, locations, and patients. Reuse of facemasks and respirators is also common in some settings. Finally, some participants reported believing that the reuse of facemasks, particularly cloth masks, is safe, whereas others believed that the reuse of masks put staff at risk of infection.**Conclusions:** In low and middle-income countries, access to appropriate levels of personal protective equipment may be restricted owing to competing demands for funding in hospital settings. It is important that issues around reuse and extended use of medical masks/respirators and decontamination of cloth masks are addressed in policy documents to minimize the risk of infection.Copyright © 2015 by the Association for Professionals in Infection Control and Epidemiology, Inc.
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Protection of health care workers (HCWs) from communicable/respiratory infections is essential to promote the health and safety of staff and to maintain the functioning and capacity of the health workforce during outbreaks of emerging infections, such as pandemic influenza, Middle East respiratory syndrome coronavirus (MERS-CoV), and ebola virus.¹⁻³ Infection prevention and control in health care settings involves, among other measures, the use of personal protective equipment (PPE), which encompasses all of the specialized equipment worn by HCWs for protection against health and safety hazards, including gloves, eye protection, head and shoe coverings, and respirators/facemasks.^{4,5}In low-resource settings, where the incidence of infectious disease is high and the hospital environmental conditions are often poor, hospitals may rely heavily on PPE to protect staff. The use of facemasks (including medical and cloth masks) and respirators is strongly recommended by the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) as a standard for transmission-based precaution.^{4,5} But even though this practice is highly recommended, actual policies and practices

regarding the use of facemasks and respirators vary.⁶ For example, whereas the WHO and CDC have the same policy on the use of facemasks/respirators for seasonal influenza, tuberculosis, and ebola virus infection,^{4,7–11} they have different recommendations for pandemic influenza and MERS-CoV.^{4,12,13} Low- and middle-income countries generally adopt policies and guidelines of the WHO and/or the CDC.⁶ The problem is that low-resource countries might not have the ability or finances to adopt infection control policies and respiratory protection guidelines equivalent to those originating from high-resource countries. Therefore, many nonstandardized practices, such as the extended use and reuse of facemasks, are common in low-resource countries; data on these practices are limited, however. Moreover, cloth masks are commonly used in low-resource countries, they are rarely mentioned in infection control policies and guidelines.¹⁴

The appropriate use of facemasks and respirators is important to provide the desired level of protection; however, it requires knowledge, training, and supervision. Compared with other types of PPE, adherence with facemask and respirator use is traditionally low, despite expert recommendations.¹⁵ During a sustained national/international outbreak of a novel viral respiratory infection, health systems may be overwhelmed and existing infection control plans undermined. In 2011, the Institute of Medicine of the US National Academy of Sciences recommended further research into the effectiveness of facemasks/respirators and the factors affecting individuals' willingness and ability to comply with recommendations regarding PPE use.¹⁶

The present study aimed to examine knowledge, attitudes, risk perceptions, and practices regarding the use of facemasks and respirators and barriers to compliance among hospital-based HCWs in Hanoi, Vietnam.

METHODS

Study design

A qualitative study incorporating 20 focus groups was conducted in Hanoi between August 2010 and May 2011. Ethical approval was obtained from the National Institute for National Institute of Hygiene and Epidemiology in Vietnam and the University of New South Wales in Australia. Seven hospitals were purposively selected based on their location and size. Both central (funded nationally) and city (funded by the city of Hanoi) hospitals were included. HCWs (physicians and nurses) from selected departments within these hospitals in Hanoi were invited through advertisements and snowball technique. Purposive samples were obtained from physicians and nurses from various departments to ensure diversity. Departments were selected on the basis of the risk of repeated and multiple staff exposures to viral respiratory infections.

A total of 20 focus groups with 10–12 participants per group were conducted. Separate focus groups were arranged for physicians (10 focus groups) and nurses (10 focus groups) to avoid bias owing to dominant participation and professional influence.¹⁷ All focus groups were of mixed sex and were fairly homogenous with respect to the age. Three focus groups were conducted by a different facilitator and were excluded, whereas the remaining 17 focus groups conducted by the same facilitator were included in the analysis. Each participant was provided with a modest incentive in the amount of US\$5 to compensate for time.

Data collection

An interview guide was developed collaboratively by study researchers from Vietnam and Australia during an in-country workshop. Questions were designed to cover key areas of interest,

including personal risk perceptions, perceptions of the importance and effectiveness of different infection control measures, current practices regarding the use of PPE (with a focus on facemask/respirator use), factors affecting compliance, and organizational practices and support around infection control practices. Before the workshops, an information sheet was provided and participants were asked to provide written informed consent. The focus group sessions ranged in duration from 60 to 90 minutes and were conducted in Vietnamese language. During the sessions, the moderator's interaction with the group consisted primarily of delivering the main open questions, ensuring that the discussions remained relevant to the aim of the study, and encouraging all participants' involvement in the discussions. Group sessions were digitally recorded and transcribed in Vietnamese using standard word processing software, then translated into English.

Analysis

Thematic analysis was carried out, and a group approach was taken to analyze transcripts to reduce bias and ensure data rigor. Initially, 2 investigators (A.A.C. and H.S.) developed a code list of themes after a preliminary analysis of one-quarter of the transcripts. An agreed-upon thematic framework (consisting of main issues related to facemask use) was then applied to another subsample of transcripts and modified further. Identical themes were grouped into 4 major thematic categories. Using this final framework, 1 researcher (A.A.C.) coded and analyzed all 17 transcripts. Coded text was organized within the identified themes of the developed framework. NVivo software (Pty Ltd. Version 10, 2012, QSR International, Melbourne, Australia) was used to facilitate data management and analysis. Themes were described, and variations in opinions were discussed. Anonymous quotes were narrated to describe the chosen themes.

RESULTS

Best protection method

Facemasks and respirators were considered an effective approach of preventing respiratory infections. Most participants described facemasks/respirators as the "only" and the "best protection" method available to protect HCWs from respiratory infections. Participants had mixed views on the level of protection afforded by the various types of products available, however. N95 respirators were considered the most effective, although most nurses emphasized that they had never used N95 respirators in their workplace, whereas some doctors remarked that N95 respirators were only available during emergencies. Both medical and cloth masks were described as being "comfortable" and "easy to breathe through." Medical masks were associated with being "safe," "effective," "airy," and "clean," whereas cloth masks were "soft" and "cheap." Some of the negative aspects associated with medical masks included that they are "expensive" and can be "saturated with sweat," whereas cloth masks are "difficult to tie" and "dirty." There is a perception that medical masks are of better quality than cloth masks, despite the fact that medical masks are not subject to regulatory standards in Vietnam.

"I think medical masks protect more than cloth masks because they are made according to medical standards" (physician).

Wearing multiple facemasks was reportedly a common practice among HCWs. Participants reported that wearing 2 or 3 medical masks together (on top of one another) is not unusual. However, this practice is dependent on the type and availability of facemasks

on the ward. Perceived thickness of the layer of facemask protection appeared to be an important factor.

"Medical masks are costly, so they are often used limitedly. If the hospital can supply you with 5 fabric (cloth) masks a day, would you like them more than the disposable ones?" (nurse).

"I prefer medical mask because it makes me easy to breathe. If I need to use cloth mask for a long time in the emergency case, I feel very uncomfortable" (nurse).

"I feel that N95 respirator is too stuffy. Sometimes, I am afraid of infection from the patients so I have to wear two facemasks together but then I feel stuffy" (physician).

Issues around the type and availability of facemasks

"Availability" of facemasks in the hospitals was the strongest theme to emerge from the focus group sessions. Participants emphasized that it is not unusual for some types of facemasks to be unavailable during nonemergency periods. A shortage of facemasks was reported in many hospitals by both physicians and nurses. The type of product used is extremely dependent on what is provided by the hospital. Medical masks are not always available, and in some instances only cloth masks are supplied to HCWs. At some sites, participants spoke of receiving only 3 cloth masks per year, with staff members responsible for "decontaminating" them after each use.

"The hospital now stops providing medical mask. Sometimes, we ask, but they don't provide" (physician).

"The facemask is not enough for the staff, especially in the morning that is crowded of patients" (nurse).

"When the medical masks are finished, I use cloth masks" (nurse).

It was reported that N95 respirators are not routinely supplied in most hospitals or are provided to HCWs only in emergency department (ED) and intensive care units (ICUs) or in limited quantities during outbreaks and epidemics.

"N95 masks are in limited supply, so we seldom use them. We can't afford to change several N95 respirators a day. Because of inadequate supply, we aren't really interested in using them, except those who are very much conscious of their health and safety, so they are wearing N95s most of the time" (physician).

"Self-purchase" was an important subtheme related to facemask availability. In some settings, owing to the limited supplies of facemasks provided by hospitals, staff members reported buying their own supplies from local stores. Medical masks were the most common type reportedly purchased by HCWs, whereas extra cloth masks were purchased by some. In some instances, HCWs reported being unable to afford to buy extra facemasks themselves owing to low salaries and they need to rely on what was provided by the hospitals. Some participants mentioned pharmaceutical companies as another source of facemasks and respirators.

"We want to wear facemasks regularly, but the quantity is not enough so we have to buy with our own money" (physician).

"Cloth masks are provided by hospital, while we buy medical masks with our own money" (nurse).

Patients, locations and situations: factors associated with facemask use

Participants highlighted that the use of facemasks/respirators is not continuous, but rather is limited to select situations, locations,

and patients. Facemasks were commonly used while in contact with patients or items in the patient's room and during high-risk situations or with some categories of patients (ie, "doing procedures," "changing transfusions," and "examining new patients that I haven't known before"). Exposure to patients perceived to be highly infectious (eg, those with tuberculosis or pandemic influenza) was another factor influencing facemask use. The number of facemasks used per day also varied among participants and depended on the type of facemasks used and their availability. HCWs reported typically using 1 or 2 medical masks per day; however, this number varied depending on the ward/department.

"In the department of infectious diseases, we use the facemask all day during an epidemic because the diseases are easily transmitted through respiratory system. When there is no epidemic, we have no feeling of disease transmission, so we just use facemask with tuberculosis patients" (physician).

"The risk is lower in the gastroenterology department, because few patients have a cough. For example, there are many viral and respiratory diseases in the infectious diseases department, so they must wear the facemasks. The medical staff must wear them in the emergency department and intensive care unit during working hours" (nurse).

Participants reported that facemasks and respirators are not generally worn while in the administration section or staff office or when walking the corridors.

"But when I move to work in the intensive care unit, and if I know there is a child with acute respiratory infection, meningitis or epidemic of influenza or H1N1, I certainly have to use facemask, and sometimes I walk stealthily into the room. It means that depends on specific characteristics of work, I think so. How I can wear facemask when treating a diabetic patient" (physician).

Interestingly, participants also emphasized that facemasks and respirators generally are not worn in the pediatric wards owing to staff concerns about frightening children.

"Another example, a crying child comes to the clinic and sees a doctor wearing a facemask, he or she is likely to be more scared and cry louder. Thus, adherence to wearing a facemask is not always done, although I know I am exposed to respiratory infections" (physician).

"You must wear the facemask in the surgical ward and the intensive care unit, but it's unnecessary to wear in the pediatric ward because the adults with the masks and the glasses will make the children nervous" (nurse).

Participants also suggested that facemasks are also not typically worn when talking with patients' family members and caregivers, as these people are considered healthy, and there is a concern that facemask use may "hurt their feelings." A few participants even felt that it was "unfriendly" to wear a facemask while having a short conversation on the ward with patients, because patients may feel "discriminated against" and become "hostile."

"It would be impolite to use a facemask while giving instructions to patients or answering their questions" (physician).

"For example, after going out the office, the patient comes and asks questions from me; it is not good to put the facemask on. If I put the facemask on, the patient will feel that I am unfriendly. He will think that I'm scared of being infected" (nurse).

Facemask use as "source control" (ie, used on a sick patient) was reported as well. One participant reported using a facemask when

ill, to avoid transmitting infections to colleagues and children, whereas others reported that patients and/or their family members commonly use facemasks. Some participants believe that facemask use by patients is more important than by HCWs. Higher compliance by patients relative to HCWs was reported.

“Doctors are wearing facemasks while examining patients, but they don’t wear facemasks when coming back to their offices. Patients and their family members are wearing facemasks most of the time” (physician).

“In my ward, all patients must wear a facemask, but the doctors do not have to wear one” (physician).

Participants characterized facemask/respirator use as “instinctive,” “habitual,” or “routine” practice. Several pointed out that facemask use increases significantly during outbreaks, pandemics, and other high-risk situations. This theme was reported more frequently in the nurse focus groups compared with the physician focus groups.

“Certainly, it becomes instinctive. We are obligated to wear a facemask before coming to a patient’s room. If a patient calls while we are eating, we must wear a facemask to go to the patient. It’s compulsory for all nurses here. Sometimes, patients call while we are sitting in the office, we would take the facemask from a pocket immediately as a quick response” (nurse).

“Because it is the infectious hospital, it has become a habit to wear a facemask when entering patient rooms. Nobody enters a room without a facemask” (nurse).

Reuse of facemasks

Views were mixed regarding the reuse of facemasks and respirators. Some participants considered the practice safe (mostly nurses), whereas others believed that reuse placed them at risk of contracting an infection (mostly physicians). Reasons given for not supporting reuse included participants considering it “unsafe,” “unreliable,” and “time-consuming.” Nonetheless, reuse was reported as a common practice by nurses and doctors in all wards/departments and across all hospitals.

“I often wear the medical masks and never wear the cotton masks because the cotton mask is not up to the standard. I am afraid of washing and then drying them because it wastes time. Moreover, the water may contain *E. coli*, so washing masks is unreliable” (physician).

Some participants (mainly physicians) highlighted that they would support the reuse of cloth masks if they did not have to be responsible for cleaning them.

“The only inconvenience I found in cloth masks is they have to be washed. Just think how many times a week I can wash it, how many times I have to take it off, and then reapply it within a work day. Moreover, I have to wash it at the end of the day and hang it out to dry; not to mention, if it rains. I won’t have a facemask for the next day. Too much for me” (physician).

“If there is one person (staff member) who washes and sterilizes cloth mask, we would prefer the use of a cloth mask” (nurse).

Cloth masks were the most commonly reused type; however, participants also reported that medical masks and respirators are reused after “washing.” Participants emphasized that they preferred using a washed N95 respirator over a medical or cloth mask. Different approaches to cleaning cloth masks were reported, including handwashing in a basin, washing in the hospital laundry,

and “sterilization” by autoclaving or UV light exposure. Some participants also reported taking their masks home and washing them with their domestic laundry.

“I wash by myself. After washing, I put all masks in a box and send them to the infection control department for sterilization” (nurse).

“A washed and reused N95 respirator is better and more effective than a medical mask” (physician).

DISCUSSION

Our data reveal mixed practices regarding the selection and use of facemasks and respirators by HCWs in hospitals in Hanoi, determined primarily by the type of products available in the hospitals. Perceived risks associated with working in a particular ward or with dealing with particular patients were the primary factors influencing facemask use. The main factors reported as barriers to facemask use appeared to be social (ie, not wanting to offend patients or their family members) and attitudinal (ie, not wanting to frighten children). The literature indicates that HCWs’ compliance with facemask use is influenced by individual (risk perception and presence of adverse events) and organizational factors (availability, education, and policies).^{18,19} Providing feedback on HCWs’ adherence to precautions and regular communication has been identified as important factors in facilitating their compliance with infection control practices.¹⁸

Ensuring the availability of facemasks and respirators is essential to maximizing compliance. Of the issues raised by participants, the availability of medical masks and respirators was the most frequently identified issue. Participants spoke of inadequate supplies of medical masks and respirators, resulting in staff having to reuse facemasks over 1 or more days. Finally, the use of cloth masks was also reported as routine practice, and in some settings as the sole type provided by the hospital. In some hospitals, reportedly only 3 or 4 new cloth masks are provided to staff each year and it is the HCWs’ responsibility to maintain their own supply of facemasks. This situation is of concern, given that previous studies have identified an association between adherence to respiratory protection and the availability of facemasks in hospital settings.¹⁸

The need for HCWs to purchase their own facemasks from local stores was another issue of concern identified by our participants. Generally, facemasks are bought from local stalls or shops that surround the hospital and are manufactured locally. These products may be of inferior quality and may provide a false sense of protection. The ability of facemasks to filter particles varies significantly depending on the materials used for facemask construction. In the United States, the Food and Drug Administration (FDA) oversees the sale and marketing of medical devices, including medical masks, and recommends that “manufacturers demonstrate medical mask performance in 4 areas: fluid resistance, filter efficiency, differential pressure, and flammability.”²⁰ At present, there are no data on the performance of locally purchased facemasks in these 4 areas. Samples of medical and cloth masks collected from Vietnamese hospitals during a recent survey demonstrated wide variations in filtration performance (data not shown).

Generally, masks are recommended to protect HCWs from splashes or sprays of blood and body fluids and from droplet infections, such as influenza. Respirators are designed for respiratory protection, and properly fitted respirators provide better protection than masks.^{21,22} The direct costs of buying respirators and indirect costs of certification, training, and fit testing are high, however our data suggest that most hospitals do not use respirators. Estimates show that for a pandemic with an approximate estimated duration

of 120 days, each HCW would need a total of 480 respirators. This would equate to an estimated cost of \$302 per staff member (estimated cost of \$0.63 per N95 respirator for products manufactured by a leading international company), or \$151,000 per hospital (for 500 physicians/nurses working in high-risk wards/departments).²³ Although these are hypothetical calculations and do not take into account local pricing/discounts, it is unlikely that hospitals in low-resource settings would have the capability of supplying the required quantities of facemasks during a pandemic or extended outbreak.

Our data indicate that the use of cloth masks is common among HCWs in hospitals in Hanoi. Moreover, some participants expressed a preference for cloth masks because of perceived superior protection associated with thicker material than in the commonly available medical masks and the option of cleaning them with simple decontamination methods. There is a lack of data on the efficacy of cloth masks, as well as on such practices as double-masking.¹⁴ Regulatory standards require that masks should not permit blood or other potentially infectious fluids to pass through to or reach the wearer's skin, mouth, or other mucous membranes under normal conditions and for the duration of PPE use.²⁴ In a report by a National Institutes of Health committee on the development of reusable facemasks for use during an influenza pandemic, the members were hesitant to discourage the use of cloth masks, but suggested caution with their use.²⁴

Our data also indicate that commercially available medical masks and respirators are currently being used for extended periods and/or are being reused over multiple days. Medical masks and respirators have a limited life span. Once worn, they can become damaged or deformed, or develop intolerable levels of breathing resistance from moisture buildup. If worn in an environment with a high probability of exposure to infectious agents, they can become contaminated, especially if worn in a room with any type of aerosol-generating procedure.²⁴ Commercially available disposable medical masks and respirators are not designed for reuse, and there is nearly universal agreement that reuse, even by a single user, should be discouraged except in the most extreme circumstances.

Health care facilities may be able to extend the use of medical masks and respirators by training personnel to wear them during serial patient encounters without removing or redonning between encounters. The CDC cautiously recommends the extended use and reuse of facemasks in cases of high demand and/or unavailability of masks/respirators, taking into account the severity of infection, transmission mode, spread of disease, and risk of self-contamination.²⁵ The precise balance between the risk of contact transmission and the benefit of extended use is unknown, although the risk is minimized if HCWs perform hand hygiene before and after touching the respirator.

Various approaches to cleaning disposable medical masks and respirators were reported, including autoclaving, isopropyl alcohol, bleach, hydrogen peroxide, microwave, soap and water, UV radiation, and dry heat. The effectiveness of these decontamination measures is uncertain, and no single technique is recommended by either the WHO or the CDC. Any method of decontaminating a facemask must remove the viral threat, be harmless to the user, and should not compromise the integrity of the various elements of the facemask (eg, tear or deform the filter, stretch the elastic attachments, bend the nose clip).²⁴ More research is needed to ascertain whether any of the methods can be used, given that the material of commercially available medical masks and respirators is not suitable for reuse after standard methods of decontamination.²⁴

Considering the limited resources in low- and middle-income countries, the issues surrounding the use of cloth masks and extended use and decontamination of facemasks need to be

addressed to inform pandemic preparedness. Current guidelines underlying effective control programs have been produced by high-income countries for their own social, economic, and health environments.⁶ Low- and middle-income countries might not have the ability to adopt these principles using the same methods and materials. As highlighted by Zimmerman in 2007, there is a need for the development of infection control and prevention guidelines based on evidence but adapted to the specific needs of HCWs in low-resource settings.²⁶ For example, recent WHO infection control guidelines discuss the level of evidence and also briefly address the use of cloth masks.⁴ Further studies are needed to examine the efficacy of various decontamination techniques, and HCWs should be educated about these practices.

The use of focus groups is a strength of the present study, allowing a significant depth of exploration into the behavioral aspects of a research area dominated by quantitative analyses of facemask efficacy and filtration capacity. The study also has several limitations, however. Member checking of themes was not undertaken. The fact that focus groups were conducted in Vietnamese language and then translated into English might have jeopardized the interpretation and completeness of data. This was a small study, and the study's qualitative nature restricts the generalizability of our results. Facemask use varies among countries, and a study in one country might not be applicable to rest of the world. Interviews were only undertaken with a select group of participants, so the possibility of other important themes emerging cannot be ruled out. Finally, participants may have overreported compliance with infection control measures to avoid judgment resulting in social desirability bias.

In summary, this study has identified considerable variation in the selection and use of facemasks by hospital HCWs, along with various reuse practices. It will be important to gather evidence from other settings on the use of nonstandard practices by HCWs identified here to enable the updating of guidelines to address common practices in low-income settings. Policies and guidelines should address critical areas, such as duration of facemask use, extended use, and decontamination methods. Future research on the cost-effectiveness of providing PPE to HCWs in low-income settings will be important as well.

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