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## Healthcare worker safety: a vital component of surgical capacity development in low-resource settings

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### Abstract

**Introduction**—A disparate number of occupational exposures to bloodborne pathogens occur in low-income countries where disease prevalence is high and healthcare provider–per-population ratios are low.

**Methods**—In an effort to highlight the important role of healthcare worker safety in surgical capacity building in Rwanda, we measured self-reported presence of safety materials and compliance with personal protective equipment in the operating theatre as part of a nationwide survey to characterize emergency and essential surgical capacity in all government hospitals.

**Results**—We surveyed 44 hospitals. While staff report general availability of safe disposal of sharps and hazardous waste, presence of and compliance with eye protection was lacking. Staff were cognizant of prevention measures such as double-gloving and ‘safe receptacles’, as well as hospital policies for post-exposure prophylaxis for HIV following needlesticks, but there was little awareness of hepatitis exposure.

**Conclusions**—Healthcare worker safety should be a key component of hospital-level surgical capacity.

### Keywords

Africa; Surgery; Healthcare worker safety; Health personnel; Operating room safety; Occupational health; Bloodborne pathogens

### Introduction

The World Health Organization (WHO) estimates that 9% of healthcare workers globally experience percutaneous exposure to bloodborne pathogens each year. Of these three million

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individuals, 90% live in low-income countries.<sup>1</sup> In the year 2000, contaminated sharps exposure resulted in approximately 16 000 hepatitis C virus (HCV), 66 000 hepatitis B virus (HBV), and 1000 human immunodeficiency virus (HIV) infections worldwide. Half of the associated premature deaths from these exposures (estimated at 1100) will occur in sub-Saharan Africa.<sup>2</sup>

Healthcare worker safety in the operating room should be a global priority in all settings. Yet, it is particularly important to address in regions where disease prevalence is high and healthcare provider–per-population ratios are low. In most regions of Africa, for example, there are 100-fold fewer surgeons per capita than in the United States and Europe.<sup>3</sup> Over 230 million surgical procedures are estimated to be performed worldwide each year, but 70% of countries have no data on the frequency and type of surgical procedures.<sup>4</sup> Even fewer nations have data on surgical safety measures, including occupational exposure of healthcare workers in the operating room. Not unexpectedly, most documented infections from occupational exposure occur in industrialized countries that have established standards and procedures for monitoring and reporting.<sup>5</sup>

In high-income countries, the use of personal protective equipment (PPE) such as eye shields, fluid resistant gowns, and wearing two sets of gloves have been shown to be effective in reducing operating room occupational exposure.<sup>6,7</sup> Similarly, hepatitis B vaccination of healthcare workers in the United States has decreased occupational transmission of the virus compared to high rates of transmission in unvaccinated personnel in other countries.<sup>8,9</sup> Recently, there has been increased attention to reducing exposure risks in low-resource settings around the world, where the prevalence of bloodborne pathogens is higher. A survey of surgeons in sub-Saharan Africa revealed a low rate of hepatitis B vaccination.<sup>10</sup>

Surgery has been regarded as the ‘neglected stepchild of global health’,<sup>11</sup> a phenomenon likely due to the high costs of training surgeons and for infrastructure and materials necessary for safe surgery. Given the time and financial investments required to train a surgeon in resource-limited settings, reducing occupational exposure to bloodborne pathogens should be paramount. Therefore, as part of a larger study to characterize emergency and essential surgical capacity in Rwanda, we measured self-reported presence of safety materials and compliance with personal protective equipment in the operating theatre. Our goal was to create a baseline of surgical safety knowledge and practice in Rwanda, highlight surgeons’ risks of bloodborne pathogen transmission, and identify targets to reduce occupational risks, with the expectation that these data could be used to advocate at the local and international level.

## Background

Rwanda is a landlocked country in sub-Saharan Africa with a population of over 10 million and the highest population density on the African continent. Following the genocide of 1994, HIV prevalence was high (10% in 2003).<sup>12</sup> Over the past 15 years, aggressive programs targeted at HIV/AIDS prevention and treatment has shown excellent results; Demographic and Health Survey HIV prevalence at the community level was 3% in 2010.<sup>13</sup>

Reliable national prevalence data for HBV and HCV are not currently available at the population level. The Ministry of Health Annual Report estimates HBV prevalence to be around 5–10% (infection versus antibody is not specified) but does not identify a source of information.<sup>12</sup> The only available general population prevalence data is available in blood donors. The National Centre for Blood Transfusion, which reported a 1.63% prevalence of HBsAg, 1.06% HCV prevalence, and 0.48% HIV prevalence in blood donations for 2009–2010, suggesting at least a higher prevalence of HBV and HCV in the community than HIV.<sup>12</sup>

## Methods

We utilized a locally-adapted WHO situational analysis tool to survey emergency surgical capacity at every government-supported hospital in Rwanda ( $n=44$ ).<sup>14</sup> The tool evaluates surgical capacity in five areas: infrastructure, human resources, interventions, emergency equipment and supplies, and personal protection. Full survey results have been previously reported.<sup>15</sup> This study focuses on the emergency equipment and supplies and personal protection practices as they relate to occupational exposure to bloodborne pathogens.

In November 2010, site visits were made to 44 hospitals, including 41 district hospitals and three referral hospitals. One of the authors administered surveys via personal interview with hospital staff including a data manager and at least two of the following: hospital director or administrator, theatre nurse, anesthetist, and physician performing surgery. Results were reported anonymously by hospital-specific interviewee role was not linked to the survey.

Respondents were asked whether materials the WHO recommends be present at the district hospitals were available. Specifically, we selected eight PPE or safe waste disposal items from the WHO list of 72 items for further evaluation: apron, eye protection, face masks, waste disposal, plastic sheeting, sharps disposal, exam gloves, and sterile gloves. Respondents were asked to identify if the item was ‘always available’, ‘sometimes available with frequent shortages’, ‘or never available/absent’. Responses were then grouped into two categories: ‘always available’ or ‘frequent shortages or unavailable’. Simple descriptive statistics were used to summarize the data.

In addition, we administered a qualitative survey on the use of PPE. Occupational exposure questions asked how often surgeons and assistants wear eye protection and two sets of gloves during an operation. It also queried clinical respondents if they disposed of scalpels and needles in safe receptacles. Administrators were asked whether the general practice of the hospital was to dispose of scalpels and needles in safe receptacles. All respondents were asked if a guideline was in place and followed for needle-sticks experienced by the staff. Possible responses included: ‘always’, ‘most of the time with rare exceptions’, ‘sometimes but use is not consistent’, or ‘never’. Responses were stratified into two groups: ‘always or most of the time’ and ‘sometimes or never’. Simple descriptive statistics were used to summarize the data. An open-ended discussion with the interviewer following the structured survey allowed respondents to expound on the specific guidelines, post-exposure prophylaxis available, HIV and hepatitis screening and awareness of staff as well as to explore perceived barriers to the use of personal protective equipment and other methods of

decreasing occupational exposure. Specific questions regarding hepatitis screening/exposure were only asked during the open-ended discussion. The results and anonymous recommendations were provided to the Ministry of Health following the survey.

## Results

A total of 44 composite surveys were collected, one from each of the 44 government hospitals (41 district hospitals and 3 referral hospitals) that provide procedural services. Figure 1 shows the reported availability at all hospitals of PPE and waste disposal materials related to healthcare worker safety. Safe sharps disposal and hazardous materials disposal were reported to be available greater than 95% of the time. PPE materials are generally available. Eye protection was the least available, with 36% of hospitals reporting frequent shortages or general unavailability.

Reported PPE use prevalence is detailed in Fig. 2. Respondents reported nearly universal use of double gloving but poor use of eye protection. Of hospitals, 88.6% reported that needles and scalpels were disposed of in safe receptacles. Of all hospitals, 81.8% reported having needlestick guidelines in place for staff with sharps injuries. In general, respondents reported hospital procedures included post-exposure prophylaxis and testing for HIV, but no hospitals were able to provide a written guideline to the interviewer. During open-ended staff discussion, it was evident that awareness of and testing for hepatitis following sharps exposure was insufficient.

## Discussion

With the significant human resource scarcity in Africa, preventing occupational exposures to healthcare workers should be paramount to healthcare development. Sub-Saharan Africa carries 68% of the world's HIV/AIDS burden but has only 3% of healthcare workers worldwide and 1% of financial resources for health.<sup>16,17</sup> Surgical disparities are even more profound, and Rwanda is no exception, with less than 0.5 total surgeons per 100 000 persons.<sup>15</sup> Given the scarcity of surgical personnel in Rwanda, healthcare worker safety should be a priority. By utilizing the WHO tool for assessment of hospital-based surgical capacity, we specifically aimed to highlight the important role of healthcare worker safety in surgical capacity building and provide feedback to the healthcare administrators and policy makers.

Rwanda is not alone amongst low- and middle-income countries in regards to healthcare worker safety and the availability of PPE. A review of published WHO capacity surveys in eight low-income nations revealed shocking disparities in PPE availability, particularly eye protection but even including sterile gloves.<sup>18</sup> In Sierra Leone, a recent capacity survey showed poor compliance with generally accepted practices of universal precautions, including the use of PPE — on this basis, the authors issued an advocacy call for prevention of occupational exposure to HIV in the operating room.<sup>19</sup> Zafar and colleagues report a significant decrease in reported needlestick injuries following the introduction of a quality improvement education project to reduce sharps injuries.<sup>20</sup> A cross-sectional survey of healthcare workers in Nigeria who experienced an occupational exposure found poor

adherence to and knowledge of universal precautions as well as inadequate or erroneous knowledge of HIV transmission.<sup>21</sup> A recall survey of Tanzanian health workers revealed at least five needlestick accidents and nine splashes per health worker per year, showing the elevated occupational risk of African healthcare workers. Furthermore, due to limited funding for surgical supplies, quality is not always a priority, with surgeons in the survey recalling one perforated glove every ten operations.<sup>22</sup> A survey of injection practices in Mongolia found that health-care workers were less likely to report needlestick injuries if they adhered to universal precautions.<sup>23</sup>

Insufficient availability of materials is consistently cited in the literature as contributing both to the poor compliance with universal precautions and inadequate knowledge regarding occupational exposure to blood-borne pathogens; providing the necessary safety devices is essential to increasing awareness of universal precautions in an operating room setting.<sup>24–28</sup>

In Rwanda, we found that PPE was generally reported to be available with the exception of eye protection. Utilization of proper eye protection is an easy and important safety measure to implement if affordable eye protection is made available.<sup>29</sup>

A limit of our study is that our utilization of the WHO tool does not provide standard definitions of such things as ‘safe disposal’ but relies rather on perception and self-reported utilization of such equipment. Further surveys, follow-up and advocacy with clear definitions of proper safety equipment should be conducted. Because surveys were compiled as composite responses by hospital, we were not able to compare responses by job type (i.e. administrator versus surgeon or theatre nurse). This would be a useful comparison to evaluate policies and implementation in the future. Further, the open discussion identified issues that could be more systematically analyzed in a future study; this includes the availability of HBV vaccination, and the type and utilization of post-exposure prophylaxis.

Rwandan staff who were interviewed for this publication were generally cognizant of common prevention measures such as double-gloving and ‘safe receptacles’ as well as hospital policies for post-exposure prophylaxis for HIV following needlesticks. Staff were generally reported ease and availability of HIV testing during normal working hours and access to post-exposure prophylaxis. However, none of the hospitals was readily able to provide a written guideline to be followed by staff in the event of an occupational exposure in the operating theatre. Clinical staff reported that they ‘should’ get an HIV test if experiencing a needlestick but had difficulty determining how to obtain tests after-hours or on weekends, for example. They further reported anecdotal poor compliance with post-exposure testing and prophylaxis. In general during the open-ended discussion, we found little awareness of hepatitis exposure amongst clinical workers. We did not originally include questions regarding HBV in the formal questionnaire; nor does it exist in the WHO survey. After an administrator at one of the first hospitals asked if the survey was asking about HBV and stressed his concern that it was neglected, we routinely asked specifically about HBV exposure and vaccination policies. On further exploration, we found that national hepatitis prevalence data is severely lacking in Rwanda. Only one referral hospital provided hepatitis vaccination for healthcare workers, which was not yet fully routine for

staff and did not include rotating medical and postgraduate students. Hospital administrators, in particular, expressed a desire to provide hepatitis vaccination to their staff.

Globally, viral hepatitis affects greater than 10 times the number of people affected by HIV/AIDS each year, and hepatitis exposure awareness is vitally important in the surgical population.<sup>30</sup> Studies suggest that 15–60% of the African population may have positive serologic markers of Hepatitis B infection.<sup>31</sup> A recent survey of healthcare workers in Zambia found that 88% reported availability of PEP but only 8% were fully vaccinated against HBV.<sup>32</sup> To fully protect health care workers, HIV awareness is not enough. Further awareness and prevention of hepatitis, including access to HBV vaccination for healthcare workers, is of paramount importance.

Promotion of the development of surgical capacity in resource-poor settings should emphasize healthcare worker safety. Development approaches underway and in planning stages should take place side-by-side with other surgical development activities, involving adequate provision of PPE materials, improved education regarding universal precautions, standard guidelines and policies for occupational exposures, and vaccination against bloodborne pathogens such as hepatitis where available.

## Conclusions

Healthcare worker safety should be a key component of hospital-level surgical capacity in Rwanda and elsewhere. As efforts are made to increase capacity, concurrent promulgation of accepted healthcare worker safety practices should be prioritized to prevent loss of valuable human resources to infectious disease acquired as a result of occupational exposures.

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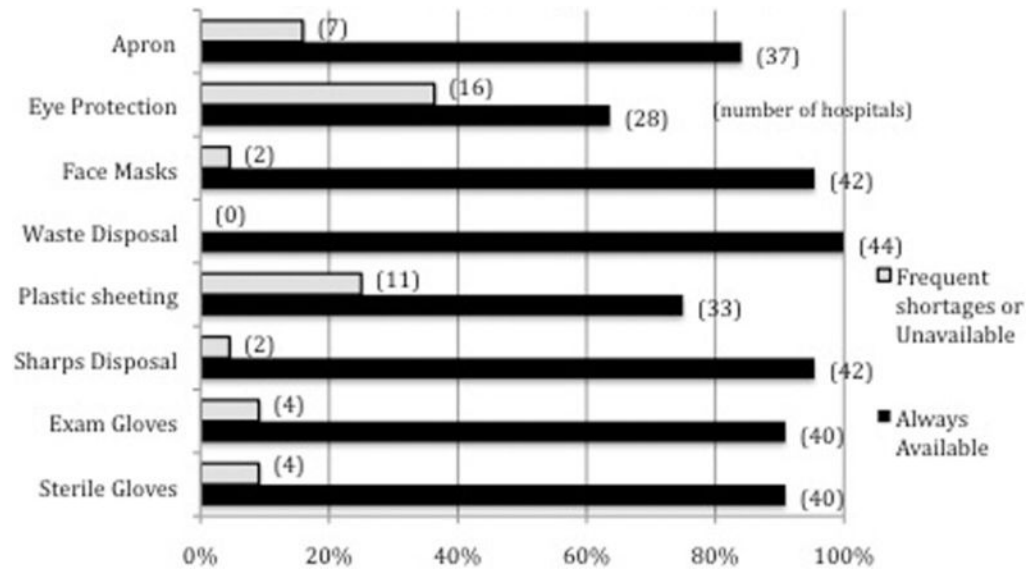
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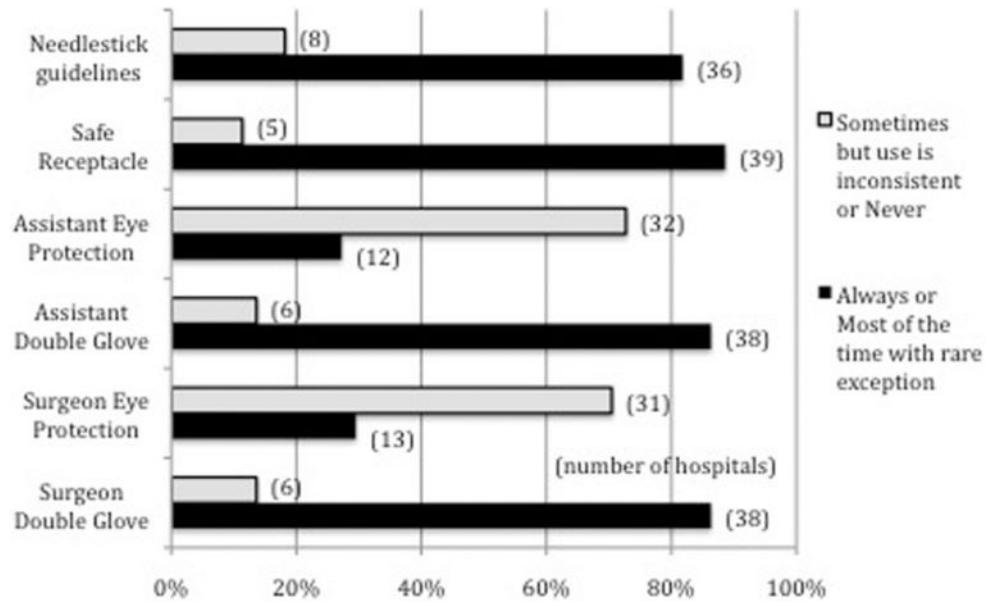
**Figure 1.**  
Availability of materials.

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**Figure 2.**  
Compliance with personal protective equipment and safety.

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