Healthcare workers (HCWs) have increased risks due to continued exposure to patients with infectious diseases, particularly tuberculosis and hepatitis B. This study assessed workplace conditions and practices regarding air- and blood-borne infections in public hospitals in the Free State. Workplace audits were conducted in intensive care, medical wards and casualty departments at three Free State public hospitals. A questionnaire survey was also administered to a targeted 20% stratified quota sample at these facilities. Of the 513 HCWs surveyed, 21.2% reported needle-stick injuries and other body fluid exposure and 19.1% were not adequately protected against hepatitis B. Additionally, 68.3% were never screened for tuberculosis, 54.8% did not wear N95® respirators when needed, only 28.5% washed their gloves and 19.8% did not always wash their hands between caring for different patients. Physicians were at highest risk of needle-stick injuries, were less compliant with hand hygiene, and associated with lower rates of tuberculosis screening, reporting spills and wearing N95® respirators. A significant association was also found between training and screening for tuberculosis, and the use of N95® respirators. The workplace audits highlighted infection control hazards, including the improper use of N95® respirators, a lack of available soap and inadequate availability of sharps containers. There is an urgent need to protect HCWs from workplace hazards. Considerable attention is needed to improve infection control practices by HCWs, and especially physicians. Guidelines and legal frameworks exist. It is time to implement the needed measures.

“My experience in getting tuberculosis was horrible, and I know other doctors who have had it much worse (full-blown multidrug-resistant tuberculosis). The system has to do much more to protect us if there are going to be people to provide health care in this country.” – Young doctor with rifampicin-resistant tuberculosis, Free State (February 2013)

Introduction

Healthcare workers (HCWs) are at risk of numerous instances of biological exposure in healthcare settings. This is largely owing to close contact with patients with infectious diseases, particularly tuberculosis and hepatitis B. This study assessed workplace conditions and practices regarding air- and blood-borne infections in public hospitals in the Free State. Workplace audits were conducted in intensive care, medical wards and casualty departments at three Free State public hospitals. A questionnaire survey was also administered to a targeted 20% stratified quota sample at these facilities. Of the 513 HCWs surveyed, 21.2% reported needle-stick injuries and other body fluid exposure and 19.1% were not adequately protected against hepatitis B. Additionally, 68.3% were never screened for tuberculosis, 54.8% did not wear N95® respirators when needed, only 28.5% washed their gloves and 19.8% did not always wash their hands between caring for different patients. Physicians were at highest risk of needle-stick injuries, were less compliant with hand hygiene, and associated with lower rates of tuberculosis screening, reporting spills and wearing N95® respirators. A significant association was also found between training and screening for tuberculosis, and the use of N95® respirators. The workplace audits highlighted infection control hazards, including the improper use of N95® respirators, a lack of available soap and inadequate availability of sharps containers. There is an urgent need to protect HCWs from workplace hazards. Considerable attention is needed to improve infection control practices by HCWs, and especially physicians. Guidelines and legal frameworks exist. It is time to implement the needed measures.

“My experience in getting tuberculosis was horrible, and I know other doctors who have had it much worse (full-blown multidrug-resistant tuberculosis). The system has to do much more to protect us if there are going to be people to provide health care in this country.” – Young doctor with rifampicin-resistant tuberculosis, Free State (February 2013)

Introduction

Healthcare workers (HCWs) are at risk of numerous instances of biological exposure in healthcare settings. This is largely owing to close contact with patients with infectious diseases, particularly tuberculosis and hepatitis B. This study assessed workplace conditions and practices regarding air- and blood-borne infections in public hospitals in the Free State. Workplace audits were conducted in intensive care, medical wards and casualty departments at three Free State public hospitals. A questionnaire survey was also administered to a targeted 20% stratified quota sample at these facilities. Of the 513 HCWs surveyed, 21.2% reported needle-stick injuries and other body fluid exposure and 19.1% were not adequately protected against hepatitis B. Additionally, 68.3% were never screened for tuberculosis, 54.8% did not wear N95® respirators when needed, only 28.5% washed their gloves and 19.8% did not always wash their hands between caring for different patients. Physicians were at highest risk of needle-stick injuries, were less compliant with hand hygiene, and associated with lower rates of tuberculosis screening, reporting spills and wearing N95® respirators. A significant association was also found between training and screening for tuberculosis, and the use of N95® respirators. The workplace audits highlighted infection control hazards, including the improper use of N95® respirators, a lack of available soap and inadequate availability of sharps containers. There is an urgent need to protect HCWs from workplace hazards. Considerable attention is needed to improve infection control practices by HCWs, and especially physicians. Guidelines and legal frameworks exist. It is time to implement the needed measures.

“My experience in getting tuberculosis was horrible, and I know other doctors who have had it much worse (full-blown multidrug-resistant tuberculosis). The system has to do much more to protect us if there are going to be people to provide health care in this country.” – Young doctor with rifampicin-resistant tuberculosis, Free State (February 2013)

Introduction

Healthcare workers (HCWs) are at risk of numerous instances of biological exposure in healthcare settings. This is largely owing to close contact with patients with infectious diseases, particularly tuberculosis and hepatitis B. This study assessed workplace conditions and practices regarding air- and blood-borne infections in public hospitals in the Free State. Workplace audits were conducted in intensive care, medical wards and casualty departments at three Free State public hospitals. A questionnaire survey was also administered to a targeted 20% stratified quota sample at these facilities. Of the 513 HCWs surveyed, 21.2% reported needle-stick injuries and other body fluid exposure and 19.1% were not adequately protected against hepatitis B. Additionally, 68.3% were never screened for tuberculosis, 54.8% did not wear N95® respirators when needed, only 28.5% washed their gloves and 19.8% did not always wash their hands between caring for different patients. Physicians were at highest risk of needle-stick injuries, were less compliant with hand hygiene, and associated with lower rates of tuberculosis screening, reporting spills and wearing N95® respirators. A significant association was also found between training and screening for tuberculosis, and the use of N95® respirators. The workplace audits highlighted infection control hazards, including the improper use of N95® respirators, a lack of available soap and inadequate availability of sharps containers. There is an urgent need to protect HCWs from workplace hazards. Considerable attention is needed to improve infection control practices by HCWs, and especially physicians. Guidelines and legal frameworks exist. It is time to implement the needed measures.

“My experience in getting tuberculosis was horrible, and I know other doctors who have had it much worse (full-blown multidrug-resistant tuberculosis). The system has to do much more to protect us if there are going to be people to provide health care in this country.” – Young doctor with rifampicin-resistant tuberculosis, Free State (February 2013)
estimated 14 000 deaths annually in the country, and increasing the risk of occupational exposure. Although the South African National Department of Health recommends that, where necessary, HCWs should be vaccinated for hepatitis B, a study conducted in Gauteng province in 2009 found that 67.9% of HCWs had received only one dose of the hepatitis B vaccine and only 19.9% were fully vaccinated.

It is widely agreed that exposure is generally preventable by rapidly identifying and isolating infectious patients; using appropriate personal protective equipment (PPE), such as respiratory and eye protection, gowns and gloves; cleaning up the spills of body fluids immediately, and correctly disposing of contaminated sharps and biomedical waste. In addition, routine immunisation against hepatitis B is required. Among other advisories, the joint WHO, International Labour Organisation and Joint United Nations Programme on HIV/AIDS policy guidelines on improving healthcare workers’ access to HIV and tuberculosis prevention, treatment, care and support emphasise the importance of developing and strengthening infection control programmes and ensuring a safe working environment for HCWs. Given the shortage of HCWs in South Africa (49% of medical practitioner posts and 46.3% of professional nurse posts were vacant in the public sector in 2010), together with the elevated infection risks faced by them, the need to promote a healthier and safer work environment in health care is now critical.

Thus, this study aimed to ascertain the current health and safety status, as well as infection control practices, specifically with regard to the prevention of blood- and air-borne infectious diseases at three public hospitals in the Free State. An attempt was also made to ascertain any differences between occupation, years of service, age, race and gender to determine if future interventions should take these variables into account.

Method

This study was part of a larger research programme that focused on making the healthcare sector a healthier place in which to work, and included an examination of the implementation of an occupational health and safety information system (OHASIS) to systematically collect better occupational health and infection control data. This research programme was pursued by a collaboration of teams from South Africa and Canada.

Setting and design

Three large public hospitals (one tertiary and two regional) in Free State province with professional staff components, i.e. staff working directly in patient care [doctors (1 318), nurses (989) and allied health (497)], were included in this study. The three hospitals were purposively selected in consultation with the Free State Department of Health as pilot sites for the implementation of the OHASIS system and the collection of baseline occupational health and safety, as well as infection control, data. Workplace audits and a cross-sectional survey of HCWs were conducted from November 2011 to February 2012 at the hospitals.

Sampling and data collection

The workplace audit, focusing on workplace hazards for the transmission of tuberculosis and blood-borne infectious diseases, was conducted by a team of experts from Canada and South Africa, in addition to occupational health and infection control professionals at each facility. A workplace audit tool, adapted for this purpose from previous studies conducted in other countries by the team, was utilised. Audits were conducted in the intensive care unit (ICU), casualty and a medical ward at two of the hospitals; and in the ICU, casualty and paediatric gastroenteritis unit in the third hospital. These clinical areas were purposely selected so that high-risk areas in the hospital could be included.

Self-administered questionnaires that investigated health and safety practices, as well as a cover letter that explained the research and which requested consent, were distributed to approximately 1 120 staff in the designated units for the survey. This was a targeted 20% stratified sample designed to reflect the composition of the workforce. To achieve this, an a priori sampling frame was created using hospital employment data from the The Personal and Salary System (PERSAL) database to determine the number of HCWs from each occupational category who would need to be surveyed in order to achieve a 20% sample of HCWs. A target sample size of 20% of HCWs was selected, based on what the primary investigators determined would be achievable in terms of the recruitment process described herein. The target sample size was calculated to be more than large enough to serve as a valid representation of the various outcomes of interest in the study population. In order to achieve a representative 20% sample, almost double the number of required questionnaires were distributed to potential respondents. The self-administered questionnaire comprised open- and closed-ended questions. It was pilot tested and the final version was made available in English and Sesotho, the language spoken predominantly in Free State province.

Data analysis

Observed infection control and occupational health hazards and model practices identified by the audits were tallied and presented as counts for each hospital. Editing and quality control ensured that the survey questionnaires were fully completed. Data were coded, captured and analysed using Statistical Package for the Social Sciences. Frequencies and percentages were calculated to describe the categorical variables. Pearson’s chi-square test was used to determine statistical significance with respect to the observed associations.

Authorisation and ethical approval

Authorisation for the study was obtained from the Free State Department of Health and ethical approval from the Ethics Committee at the Faculty of Health Sciences, University of the Free State, as well as the University of British Columbia’s Research Ethics Board.

Results

Workplace audits

The workplace audits identified infection control hazards in all three hospitals (Table I). It was observed that sharps containers were either not available at point of use or were overflowing in 8/9 audited units, N95® respirators were not used correctly in six units, there were few or no N95® respirators in five units and there were no disposal towels, and/or the soap dispensers were empty or clogged, in five of the units.

However, model infection control practices were also documented. Posters encouraging proper hand hygiene were prominently displayed.
in most areas in all three hospitals (7/9 units). Similarly, occupational health and safety policies, guidelines and forms were accessible to staff in most areas in all three hospitals (7/9 units).

Survey

Survey respondents

An 18.3% sample was achieved, closely approximating the targeted 20% representative quota sample sought. Of the 513 HCWs who responded to the survey at the three hospitals, the majority were female (86.0%) and 59.1% were 40 years of age or older. Three quarters were nurses (75.4%), including nursing services managers, professional nurses, staff nurses and nursing assistants; 14.4% were allied health professionals, including social workers, physiotherapists, radiographers and dietitians; and 10.1% were doctors, including registrars and specialists. Respondents had worked an average of 12.6 years at the respective hospitals. The sample was a good reflection of the workforce as a whole, and did not differ significantly with regard to the race and sex of the hospital workforce population.

Blood and body fluid exposure, tuberculosis screening and vaccinations

In the two years prior to the study, one in five HCWs (21.1%) reported having experienced a needle-stick injury or other exposure to body fluids. Slightly more than two thirds of the HCWs were never screened for tuberculosis (68.3%), and approximately one fifth (22.9%) were possibly unprotected against hepatitis B as 9.2% reported that they had not been vaccinated against hepatitis B, 9% had not received all three doses of the hepatitis B vaccination and 4.7% were uncertain as to whether or not they had ever been vaccinated against hepatitis B.

Table I: Workplace audit findings at hospitals A, B and C

<table>
<thead>
<tr>
<th>Unit or area</th>
<th>Casualty</th>
<th>Medical ward</th>
<th>ICU</th>
<th>Paediatric gastroenteritis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>A</td>
</tr>
<tr>
<td>Infection control hazards</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biohazardous materials are splashed when the bedpans are emptied</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Cloth hand towels are used</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Soap dispensers are empty or clogged</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Non-latex gloves are not readily available</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Sharps disposal containers are not available at point of use</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Sharps containers are overflowing or full</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>A common urine bucket is used to empty catheter bags, and facial protection is not worn in the process</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>There are no or few available N95® respirators</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>N95® respirators are not used correctly when the situation demanded it</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Spill kits are unavailable or not used</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Safety-engineered needles are not available</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>3</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>Model practices</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The unit is clean and free of clutter</td>
<td>✓</td>
<td>-</td>
<td>-</td>
<td>✓</td>
</tr>
<tr>
<td>A hand hygiene signage is prominently displayed</td>
<td>-</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>All occupational health safety guidelines, policies and forms are readily available</td>
<td>-</td>
<td>✓</td>
<td>-</td>
<td>✓</td>
</tr>
<tr>
<td>Alcohol hand rub is available at each bedside</td>
<td>✓</td>
<td>-</td>
<td>-</td>
<td>✓</td>
</tr>
<tr>
<td>Windows are open to encourage natural air flow</td>
<td>-</td>
<td>✓</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

ICU: intensive care unit
X: Hazard (a negative finding) observed and documented
✓: Model practice (a positive finding) observed and documented
-: Hazard or model practice not observed at the time of the audit
Health and safety practices to prevent exposure to infectious diseases

Numerous risky health and safety practices were reported. More than half of the respondents (54.8%) did not wear N95® respirators to protect against tuberculosis infection, even when they knew that the situation called for this practice. This may relate to the lack of availability of N95® respirators, observed during the workplace audits. Further unsafe practices included more than half of the respondents (57.2%) reporting that they recapped needles, 28.5% washed their gloves after use and 19.8% did not always wash their hands with soap and water between caring for different patients.

There was a significant association between HCWs who protected themselves (i.e. wore N95® respirators, when indicated) and those who followed basic infection control practices to protect patients, measured by hand washing (p-value < 0.05). Many health and safety practices protect both patients and staff, e.g. screening staff for tuberculosis is both for the benefit of the health professional and his or her co-workers and families, as well as the patients.

Health and safety training to prevent infections

Training in relation to the prevention of air- and blood-borne infections was lacking for a number of HCWs. In particular, one fifth of the respondents reported having received no training on isolation procedures (28.4%), the use of PPE (24.4%) and how to prevent the acquisition of needle-stick injuries (21.1%). More than one third of the HCWs had received no training on tuberculosis infection control measures (35%). The importance of training was evident from the significant association observed between training and screening for tuberculosis, and use of N95® respirators. Of the HCWs who had been screened for tuberculosis, 81.2% had also received training on tuberculosis infection control (p-value < 0.05). Similarly, of the HCWs who always wore N95® respirators when the situation demanded it, 76.8% were also trained on tuberculosis infection control and 91.4% were trained on the use of PPE (p-value < 0.05).

Demographics and occupation

Significant differences were not observed with respect to any of the age, race or sex parameters in the survey. A significant association was found between length of employment and having ever been screened for tuberculosis (p-value < 0.05). The highest percentage of HCWs who had ever been screened (53.7%) were those employed for more than 25 years. When the data were analysed according to occupation (Table II), it was found that physicians were at highest risk of acquiring needle-stick injuries, and had the poorest record with regard to complying with hand washing, undergoing tuberculosis screening and reporting spills, as well as wearing N95® respirators.

Trust in management to maintain a safe workplace

There was a significant association between following safe practices (i.e. wearing N95® respirators, reporting spills, being free of needle-stick injuries) and trust in management to provide a safe environment (p-value < 0.05). Significant differences in the occupational groups were also found with regard to trust. Seventy-five per cent of the doctors versus 42% of the nurses and 47.3% of the allied health professionals expressed a lack of trust in managers with regard to keeping their workplace safe (p-value < 0.05).

Discussion

To our knowledge, this is the largest hospital survey conducted to date of both air- and blood-borne infection control practices by South African healthcare professionals, and the first to be accompanied by an objective workplace audit to verify the self-reported findings. The non-random quota sampling method employed was designed to ensure that the sample reflected the HCW population at the hospitals in question. Although the sample incorporated almost 20% of the workforce, and was therefore adequately large and well constructed to ensure representativeness of the workforce with respect to demographics (age group, department, sex and race), it was not a random sample. Thus, some volunteer bias may have been present. However, the authors’ view is that any influence of volunteer bias was more likely to have led to an underestimate of the true extent of the hazards and safety problems, rather than an overestimate. Thus, the results presented here may actually minimise the true extent of the need to better protect healthcare workers from air- and blood-borne diseases.

Specifically, this study demonstrated that healthcare professionals, especially doctors, frequently fail to protect themselves by not wearing...
N95® respirators, when necessary, perhaps owing to the lack of availability of N95® respirators in some units. They also frequently recap needles, which may link to the observation during the audit that there was a deficiency in sharps containers, and do not wash their hands between caring for different patients, possibly because of the absence of soap observed during the audit. This situation places them at risk of acquiring air- and blood-borne infectious diseases.

International guidelines on how to protect HCWs from acquiring infectious diseases via occupational exposure are well developed and widely embraced. Such measures feature in the Draft National Infection Prevention and Control Policy for TB, MDRTB and XDR-TB,26 the National Infection Prevention and Control Policy & Strategy,27 and the South African National Strategic Plan on HIV, STIs and TB 2012-2016.28 Furthermore, the South African Health and Safety Act29 entitles all workers, including health workers, to a safe working environment without risk to their health. Despite the availability of policies and guidelines, these are often poorly implemented because the health system is under pressure with respect to human resource limitations, poor infrastructure and resources, as well as related budgetary constraints, all of which are exacerbated by the HIV/tuberculosis co-epidemic.29

Despite the elevated risk that HCWs face in developing hepatitis B, and universal recommendations for hepatitis B vaccination, HCWs are not always adequately immunised, even after experiencing a needle-stick injury or other occupational exposure.2 Our findings indicated that while hepatitis B immunisation in the Free State seemed to be more extensive than that previously reported in other South African provinces,7 protection against blood-borne infections still requires attention. The deficit in empty sharps containers at point of use, as well as the practice of recappping needles, highlights this ongoing need.

Our finding that 64.8% of the HCWs reported never having been screened for tuberculosis was concerning. This is astounding in a country with such a high prevalence of tuberculosis and the knowledge that HCWs are a high-risk population because of occupational exposure. As international and national guidelines clearly indicate that HCWs should be regularly screened for tuberculosis, this situation clearly needs attention. A recent study found that the diagnosis of tuberculosis in medical doctors in KwaZulu-Natal was often delayed, further stressing the need for improved tuberculosis screening, as well as infection control training.16

In addition, our workplace audit revealed that N95® respirators were not used appropriately and were not always available, confirming the survey results found. Furthermore, the importance of training in safe practices is clear from the significant observed association between training and screening for tuberculosis and the use of N95® respirators. This is supported by the findings of a study at a South African hospital whereby HCWs with greater knowledge were more likely to use respirators and to practise cough hygiene.30

The finding that the poorest record of compliance with good infection control practices was held by physicians is consistent with observations that have been noted by other researchers.31 This is particularly disappointing as these professionals are often regarded as mentors or practice leaders. Even during the 2009 H1N1 influenza pandemic, when the risk of disease acquisition was perceived as higher in many jurisdictions, physicians were less likely to comply with wearing N95® respirators and gloves for non-aerosol-generating procedures than other HCWs.31 Lower adherence by physicians to hand hygiene has been consistently observed in hand hygiene audits. We found that soap and disposable towels were not always readily available in this study, and this may have been a contributing factor to the inconsistent observation of good hand hygiene practices.

Recommendations

Specific recommendations arising from the results of our audit include:

- Encouraging staff to change gloves between patients (when glove use is appropriate).
- Educating staff on how and when to use N95® respirators.
- Providing protective barriers and PPE for staff when they have to dispose of bedpan contents in soiled utility rooms.
- Replacing cloth towels with single-use paper towels.
- Encouraging the cleaning staff to check each soap dispenser daily in the morning.
- Ensuring that sharps containers are available at each patient’s bedside and emptied frequently.
- Minimising cross-contamination by cleaning the equipment between patients.

Conclusion

There is an urgent need to protect the health workforce currently employed in the public healthcare sector, especially in high-burden, high-demand areas, such as South Africa. Attention to providing a safe working environment is essential to restore the trust of HCWs in the healthcare systems in which they work. Our study documented that considerable attention is needed to improve the infection control practices by HCWs, especially physicians. The guidelines and legal frameworks exist. It is time to implement the required measures to comply therewith.

Declaration

The authors gratefully acknowledge the Canadian Institutes of Health Research for funding this study.

Acknowledgement

We thank our colleagues and staff at the University of British Columbia and University of Free State who contributed to this research programme. Appreciation is extended to the HCWs who participated in the survey, the infection control and occupational health practitioners who participated in the workplace audits, and the health and safety committee members who offered their comments. We especially thank and commend the managers at the provincial health department and the three hospitals, including the chief executive officers, who are working hard to remedy the deficiencies noted, despite the resource-strained situation.

Information pertaining to this study was presented at the joint conference of the Public Health Association of South Africa and the Rural Doctors Association of South Africa in Bloemfontein from 5–7 September 2012.
Conflict of interest

The authors do not have a commercial or other association which may have posed a conflict of interest.

References