Occupational hazards among laboratory hub riders in selected health centres in central region of Uganda

Article *in* The Open Public Health Journal · January 2021

CITATIONS
0

READS
37

4 authors:

Sandra Agondeze
War Child Holland
3 PUBLICATIONS **0** CITATIONS
SEE PROFILE

Kiiza Stephen
Bugema University (BU)
3 PUBLICATIONS **0** CITATIONS
SEE PROFILE

Peter Vuzi
Makerere University
18 PUBLICATIONS **22** CITATIONS
SEE PROFILE

Christopher Ddamulira
Mildmay Institute of Health Sciences
11 PUBLICATIONS **7** CITATIONS
SEE PROFILE

Direct RESEARCH JOURNALS

Direct Research Journal of Public Health and Environmental Technology
Vol. 6, Pp. 6-20, 2021
ISSN: 2734-2182
https://doi.org/10.26765/DRJPHET13099316
Article Number: DRJPHET13099316

https://directresearchpublisher.org/drjphet

Full Length Research Paper

Occupational hazards among laboratory hub riders in selected health centres in central region of Uganda

Sandra Agondeze[2], Stephen S. Kizza[3], Peter Vuzi[3], and Christopher Ddamulira [1]*

[1]Mildmay Institute of Health Sciences, P.O. Box 24985, Kampala, Uganda.
[2]Makerere University- John Hopkins University (MU-JHU) Research Collaboration, Mulago Hill, Kampala- Uganda.
[3]Lecturer at the School of Graduate Studies, Bugema University.
*Corresponding Author E-mail: chris_ddamulira@yahoo.co.uk

Received 15 January 2021; Accepted 20 February, 2021

ABSTRACT: Laboratory hub riders (LHRs) are motorcycle riders employed by health centres to handle, package, and transport biological samples within and between different health centres. Their nature of work exposes them to infectious microorganisms through accidental splash exposure or sharps injuries. The study was carried out in selected health centres in Central region, Uganda. The objective was to assess the factors influencing Occupational hazards. The population of the study was 140 LHRs proportionately allocated in selected Health centres in central region of Uganda, with a sample size of 103 LHRs. It was a cross sectional study using both quantitative and qualitative methods. Data were analysed using descriptive statistics to derive means, frequencies and standard deviations as well as inferential statistics to derive odds ratios and significances using logistic regression and multivariate analysis. The study revealed that majority of the LHRs was youths, aged 20-35 years, with Ordinary level certificate as their highest level of education. About 63.7% reported occupational exposure occurrences to management, and were knowledgeable about risks and hazards at work place. Majority 92.2% viewed their jobs as high risk and used Personal Protective Equipment (PPE) 85.4%, to reduce occupational hazards. Very few 12.3 % of the LHRs received training before commencing with their duties as new recruits. The prevalence of occupational hazards was quite low with 36.9% reported having experienced splash exposures, and 7.8% reported having experienced sharps injuries in the past 12 months. Job specific training was found to be the influential factor for occupational hazards in regard to splash exposure (Adjusted Odds Ratio (AOR) = 0.33, 95% Confidence Interval (CI) = 0.12 - 0.93, p-value (p) = 0.04) and sharps injuries (AOR = 0.56, 95% CI = 0.73 - 0.66, p = 0.01). There is need for health centres to incorporate job specific training such as safety precautions on infection prevention and control for newly recruited LHRs before they commence with their duties.

Keywords: Occupational hazards, laboratory hub riders, health centres, Uganda

INTRODUCTION

Laboratory Hub Riders (LHRs) are motorcycle riders employed by health centres to handle, package, and transport biological samples within and between different health centres (Kiyaga et al., 2013). Laboratory Hub Riders who transport Laboratory samples or specimens between clinical laboratories encounter occupational hazards through exposure to and transmission of blood-borne infectious diseases among (Karmon et al., 2013). Other occupational hazards include; sharps injuries such as cuts, needle pricks and splash exposures to body fluids from patients such as blood, urine, stool, Cerebral Spinal Fluid (CSF) as well as from pathological specimens.

Several scholars have put forward the factors that are responsible for occupational hazards among health care providers including Laboratory Hub Riders. According to WHO (2011), it is estimated that in resource constrained countries, 40% to 65% of occupational hazards among

workers in healthcare are attributed to sharps injuries and splash exposure to infectious patients' fluids. The magnitude of exposure varies from mild to fatal. Rahul et al. (2010) identifies personal factors that contribute to the prevalence of these hazards such as poor reporting habits of occupational exposures, lack of training of workers regarding safety practices and lack of knowledge about the risk are considered as the major risk factors to blood and body fluids exposures and sharps related injuries. They contribute to the prevalence of these hazards among workers because they hinder implementation of occupational health programs. Amoran (2013), tried to relate occupational hazards and its factors emphasizing that personal factors such as age, knowledge about the risk, and perception of the risk in his study, occupational exposure, risk perception and access to HIV post exposure prophylaxis among health care workers in Northern Nigeria. But he restricted his research on sharps injuries, where when studying occupational hazards, splash exposures need to be addressed as well. Ndejjo et al. (2014) in a cross sectional study to assess occupational health hazards faced by Healthcare workers in Kampala, Uganda. They urged out that 50% of respondents reported experiencing an occupational health hazard. This study tried to address factors associated with occupational hazards among HCWs such as lack of PPE, working overtime, lack of safety training, work experience as well as working in multiple centres. However, it left out Laboratory Hub Riders and couriers.

In Uganda, the UNAIDS (2014) developed a large scale program to scale up infectious diseases management and treatment such as HIV, Malaria and Tuberculosis (TB) through the SUSTAIN projects. These projects introduced the concept of Laboratory Hub Riders and Hub network system as one way of strengthening the health systems at Regional Referral Hospitals (RRH). Under arrangement of the project, laboratory samples at lower level healthcare centres are collected by Laboratory Hub Riders using motorcycles to transport them to higher level RRH laboratory for analysis and the test results are then returned to those healthcare centres to aid diagnosis. The new system has reduced the cost of transporting laboratory samples by 62% (Kiyaga et al., 2013), infectious diseases diagnosis and care has been scaled up because there has been reduced turnaround time (TAT) for results reporting to clinicians, laboratory samples or specimens tested has increased dramatically in public reference laboratories, private and NGOs in Uganda.

Majority of Laboratory Hub riders recruited in Central Uganda Region are Ordinary Level (UCE) leavers recruited basing on their ability to ride a motor cycle. However, there is limited information on their prior training and sensitization about the hazards involved while handling, packaging and transporting laboratory samples or specimens and hospital safety precautions, since they access clinical laboratories and most times, handle and package laboratory specimens or samples due to limited human resource for health in most health centres in Uganda (Kiyaga et al., 2013). The NIOSH (2011) recommends that Laboratory Hub Riders, Medical couriers sample transporters recruited should be trained and made aware of the hazards they can be exposed to while carrying out their duties. The study therefore, focuses on factors influencing occupational hazards among Laboratory Hub Riders in selected Health Centres in Central Region, Uganda.

Ministry of Health report (2015), reported that 14% of the Laboratory Hub Riders recruited in Central Uganda reported to have contracted Hepatitis B and TB while on duty. Transporting Laboratory specimens or samples in improvised containers such as unsealed containers, in plastic bags, in clothes or pockets with bare hands on motorcycles, poses serious occupational health risk to the transporters as well as the entire communities (Riders for Health, 2014)

Despite the efforts by Ministry of Health to prevent occupational hazards among Laboratory Hub Riders and couriers, such as Bio-safety management training basic track 1and scaling up Hepatitis B vaccination for Laboratory Hub Riders, the prevalence of occupational hazards still remains a serious health problem among Laboratory hub riders. Yet the occupational hazards, injuries and illness cause a great human suffering and acquire high costs, both for those affected and the society in general (Ndejjo et al., 2014). The general objective of the study was to assess factors (personal; health facility related) influencing occupational hazards among laboratory hub riders in selected health centres in Central Region, Uganda.

Objectives

(i) To identify personal factors of Laboratory Hub Riders in selected Health Centres in Central Uganda.
(ii) To assess health facility related factors of Laboratory Hub Riders in selected Health Centres in Central Uganda.
(iii) To determine the prevalence of occupational hazards among Laboratory Hub Riders in selected Health Centres in Central Uganda.
(iv) To establish whether there is a significant influence of personal and health facility related factors on the prevalence of occupational hazards among Laboratory Hub Riders in selected Health Centres in Central Uganda.

METHODOLOGY

The study was conducted in the selected Health Centres in Central Region of Uganda employing Laboratory Hub

Riders. These included; Kayunga Hospital in Kayunga District, Mukono H/CIV and Nagalama Hospital in Mukono District. Central Public Health Laboratories under Ministry of Health, Mulago National Referral Hospital, Ebenezer clinical Labs, Lancet laboratories, MBN laboratories, Baylor Uganda, Makerere University-John Hopkins University, Joint Clinical Research Center, and Infectious Disease Institute Labs in Kampala City, Uganda Virus Research Institute Mild-may Uganda NGO, and Wakiso H/CIV in Wakiso District. The three districts share boundaries and neighbor to each other. These districts were selected because they have the highest number of health centres and referral labs as compared to other areas in the country. The population of the study was 140 Laboratory hub riders, according to Health Centres Staff employed by the Health Centres in the selected Health Centres in Central Uganda who meet the inclusion criteria (Table 1).

The study adopted both descriptive cross sectional and correlational research design with mix methods approach. The study employed both purposive and simple random sampling strategies to identify respondents. The sampling frame was constructed with the help of officials from the selected health centres. An appropriate sample of 103 Laboratory hub riders was determined using Krejicie and Morgan (1970). Additionally, this sample had to conform to four aspects of the inclusion criteria, namely: i) Laboratory hub riders employed by Health Centres in Central Uganda, ii) those who had worked at the sampled health centres as Laboratory Hub Riders for six months before the time of the study was done, iii) those who had direct contact with patient's blood or body fluid and sharps injuries, and iv) those willing to consent.

In the study, two (2) instruments were employed. They included questionnaire and Key Informant Interview Guide (KIIG). Questionnaire data were collected using a researcher administered standard semi-structured questionnaire adopted from Centre for Disease Control and Prevention workbook for designing sharps prevention program (CDC, 2008). Each Laboratory Hub Riders was asked to fill a questionnaire at a time. Those who preferred to be interviewed were interviewed based on the content of the questionnaire. Face to face interview with Key informants was used with laboratory managers and supervisors on the account of their knowledge and experience. KIIG had questions on number of sharps injuries and splash exposures reported by Laboratory Hub Riders monthly. Information on exposure to patients' body fluids and sharps injury prevention provided at orientation, occupational hazards prevention and control measures discussed by upper management, and circumstances leading to occupational exposure and injuries. A pilot study was done on 15 respondents in the selected health centres employing Laboratory Hub Riders in Central Uganda. Ethical approval was obtained from TASO Uganda Research and Ethics Committee, the administrators of the centres that the study was proposed to take place. In this study, quantitative raw data obtained using a questionnaire was sorted, edited, cleaned and fed into computer and analyzed using Statistical Packages for Social Scientists (SPSS) version 20.0 for windows. Both descriptive and inferential statistical methods were used. Chi-square (χ^2) and Logistic linear regression was used. Qualitative data were organized into coherent categories to summarize the data, and then analyzed by the use of content analysis to find meaningful information to this study. Instruments, methods of data collection and analysis were triangulated.

RESULTS AND DISCUSSION

Personal factors of laboratory hub riders

The study found that majority of Laboratory Hub Riders (LHRs) were aged between 26-40 years, and majority had Ordinary level as their highest level of education. About 63.6% report occupational exposure occurrences to authorities and are knowledgeable about risks and hazards at the work place (86.4%). A majority (92.2%) perceived their jobs as high risk therefore practiced safety measures (83.7%) and use PPE (85.4%), to reduce occupational hazards. Very few 12.3 % of the LHRs receive training before commencing with their duties as new recruits, and majority were working in government aided centres.

Work experience

According to the results in (Table 2), 43 (41.7%) of the LHRs have worked for less than 2 years as LHRs with a mean and SD of 3.3 ± 2 years. The little work experience of 3 years is because the concept of LHRs and Hub Network system is a recently introduced innovation to strengthening the health systems in public sector Uganda, especially Laboratory diagnoses (UNAIDS, 2014). The LHRs interviewed in this study were recruited at the inception of the program.

Reporting culture

Study results in (Table 2), reveal that a sixth of the LHRs (63.6%) were good at reporting occupational hazards in regard to splash exposures and sharps injuries. This is possibly because most of them have attended safety training.

Knowledge about the risk

Study results in (Table 2), majority of the LHRs 89 (86.4%) have good knowledge about the risks associated with occupational hazards in regard to splash exposures

Table 1: Study population and sample size

Health Centres	Population of the Category	Sample of the Category
Kayunga Government Hospital	02	01
Mukono H/CIV	05	04
Nagalama PNFP Hospital	03	02
Central Public Health Labs	54	40
Makerere University-John Hopkins University	05	04
Mulago National Referral Hospital	04	03
Ebenezer clinical Labs	10	07
Lancet laboratories	14	10
MBN laboratories	08	06
Baylor Uganda	07	05
Joint Clinical Research Center	03	02
Infectious Disease Institute Labs	10	07
Uganda Virus Research Institute	03	02
Wakiso health centre IV	02	01
Mild-may Uganda NGO	12	09
Total	N =140	n = 103

Source: Selected Health facility staff list (2016).

Table 2: Personal factors of laboratory hub riders.

Factor	Frequency (n = 103)	Percent
Age bracket (years)		
20 – 25	10	9.7
26 – 30	36	35.0
31- 35	23	22.3
36 – 40	24	23.3
41- 50	10	9.7
mean =32.7, SD =5.97, range = 30		
Highest educational level attained		
Below ordinary level	8	7.8
Ordinary level	51	49.5
Advanced level	15	14.6
Tertiary level	29	28.1
Work Experience (years)		
Less than 2	43	41.7
3 – 4	37	35.9
5 – 10	23	22.4
mean =3.32, SD =1.93, range = 9.5		
Reporting culture		
Poor	24	63.6
Good	42	36.4
Knowledge about the Risk		
Poor	14	13.6
Good	89	86.4
Perception of the Risk		
Poor	8	7.8
Good	95	92.2
Observe safety practices		
Yes	77	83.7
No	15	16.3

and sharps related injuries.

Perception of the risk

Study results in (Table 2) shows that an overwhelmingly majority 95 (92.2%) of LHRs perceive occupational hazards in regard to splash exposure and sharps related injuries as high risk.

Safety practices

Results in (Figure 1), shows that most 77 (83.7%) of the respondents observe safety practices to prevent or

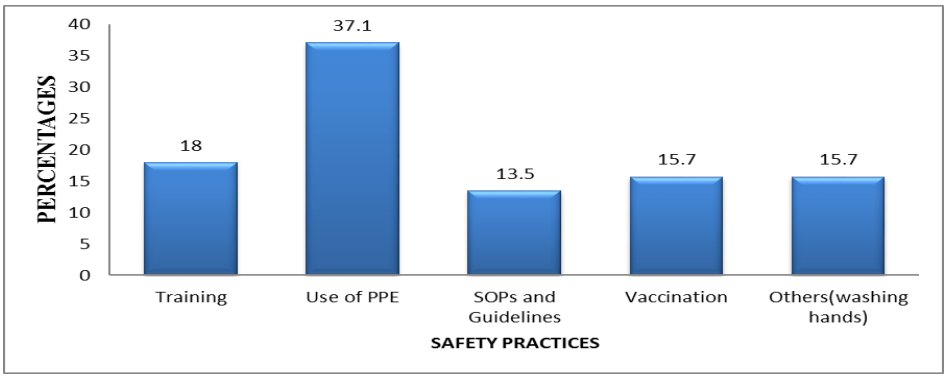

Figure 1: Safety practices used by the LHRs for preventing occupational hazards.

control occupational hazards. The safety practices include; washing hands after handling patients' samples, use of PPE, undergoing safety training and vaccination. 37.1% of the LHRs mentioned use of Personal Protective Equipment (PPE). This is explained by the big number of respondents (83.7%) who observe safety practices while handling, packaging and transporting of Laboratory specimens or samples. Similar findings were reported by studies done in Nigeria and India by Akinboro et al. (2012) and Hansa et al. (2005), where, 98.6 % and 96.6% respectively, of workers practiced safety measures by using PPE. Compliance with safety precautions by appropriate use of PPE whenever there is a possibility of occupational exposure is always recommended for all workers in order to reduce the risks of occupational hazards (Figure 1).

Health centres related factors of laboratory hub riders

In (Table 3), the study describes the Health facility related factors of Laboratory Hub Riders such as; Job specific training, working hours, work guidelines or SOPs, type or category of the facility and provision of Personal Protective Equipment (PPE). Based on the results in (Table 3), the majority 73 (70.9%) of the LHRs received job specific training. The specific training entails safety precautions, occupational health hazards, control measures to prevent occupational hazards, use of PPE, packaging, and shipments of biological infectious samples. Ideally, very few of LHRs (12.3%) received training before commencement with their duties as new recruits. The low numbers of before commencement trainings implies that the managers of the health centres do not fully comply with the recommendations by NIOSH (2011) that all LHRs, medical couriers, and biological specimen should be trained and made aware of safety measures and precautions of controlling occupational exposures and different hazards before commencing with their duties as new recruits. This was supplemented by a response from a supervisor from MOH, who stated that,

"Normally, safety and infection control trainings in this facility are conducted every year, and they involve all clinical and non-clinical staff including Laboratory Hub Riders, however, there are no specific trainings conducted before they commence with their duties apart from orientation." (KII 2, 2017).

Working hours

Results in (Table 3) shows that, majority 73 (70.9%) of the LHRs work between 5-8 hours per day, with a mean and SD of 8.2±1.14 and range of 7. This implies that the LHRs work within the normal working hours as per The Uganda Public Service Standing Orders (2010), which recommends working hours for all public service workers as eight (8) hours. Dembe et al. (2012) in their study on the impact of overtime and long work hours on occupational injuries and illnesses among HCWs, reported that working for more than 8 hours per day was associated with a 37% increased hazard rate, and concluded that people who worked longer hours spent more time at risk or are exposed to more work related hazards than workers who had shorter work schedules. This was complemented by a statement from a laboratory hub rider manager from MOH, who said:

"Normally, Laboratory Hub riders work for 6 to 8 hours, unless when they have to ride longer distances, which is not on a daily basis, because we usually employ back up Laboratory Hub Riders who cover extra hours in case the work load has increased and they also stand in, on circumstances when other LHRs have to take their annual leave." (KII 4, 2017).

From the KII response, LHRs work for 6 to 8 hours. On days when they are required to work over time, an earlier communication is made and another person takes over, thus reducing on the incidences of occupational hazards occurring due to fatigue and work overload.

Table 3: Health centres related factors of laboratory hub riders

Factors	Frequency (n=103)	Percent
Job specific training		
Yes	73	70.9
No	30	29.1
Work load (average hours/day)		
5 – 8	73	70.9
9 – 12	30	29.1
mean = 8.2, SD =1.14, range = 7		
Presence of work guidelines or SOPs		
Yes	90	87.4
No	13	12.6
Type/category of the health facility		
Private	21	20.4
NGO	32	31.1
Public	50	48.5
Provision of PPE		
Yes	88	85.4
No	15	14.6

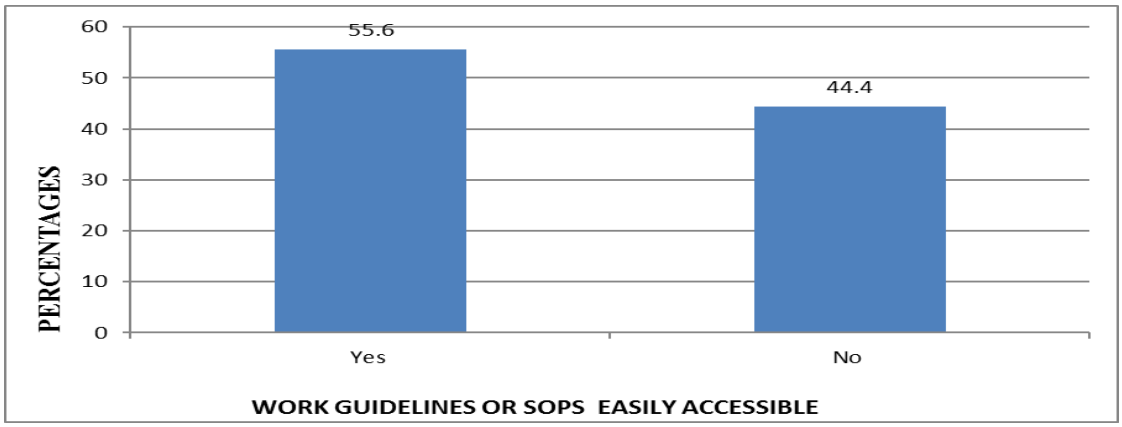

Figure 2: Accessibilty of workguidelines or SOPs

Work guidelines or standard operating procedures (SOPs)

As shown in Table 3, the results show that 90 (87.4%) of the LHRs have work guidelines or SOPs in their centres. This is because during training and orientation of workers, health centres are tasked to develop work guidelines and SOPs for the different work procedures in their work stations. Similar findings were reported by Mill et al., (2013) in their study among HCWs in Uganda where, about 93.8% of respondents reported that work guidelines or SOPs were available in their work departments, although often inaccessible to most workers. Work guidelines and SOPs are key in any occupational hazards prevention program, and training workers on the use and application of the developed guidelines, therefore, most health centres had work guidelines and SOPs in place (Figure 2). In the study, LHRs who reported that they had working guidelines or SOPs in place, close to half 44.4% reported that LHRs could not easily understand and access these working guidelines or SOPs. This is explained by the nature of some health centres where most work guidelines or SOPs are kept in a lockable cabinet, and workers are not trained. This contradicts the recommended guidelines by CDC (2012), that all health care centres' work processes involve biological and hazardous materials, therefore, there is need to institute work guidelines and SOPs for all work processes and procedures which should be easy to understand and easily accessible by all employees as well as ensuring that all staffs are trained on their use.

Type or category of the health centres

Results in (Table 3), shows that close to half 50 (48.5%) of the LHRs work in public aided health centres. Being a new innovation under the MOH, it is likely that

Table 4: Prevalence of occupational hazards among laboratory hub riders,

Item	Frequency	Percent
Splash exposure		
Yes	38	36.9
No	65	63.1
No of incidents of Splash Exposure (n = 38)		
1-3	24	63.1
4-6	14	36.9
mean =2.92, SD =1.63, range = 5		
Sharps injuries		
Yes	8	07.8
No	95	92.2
No. of times with sharps injuries (n = 08)		
1	5	62.5
2	3	37.5
mean =.38, SD = 0.58		

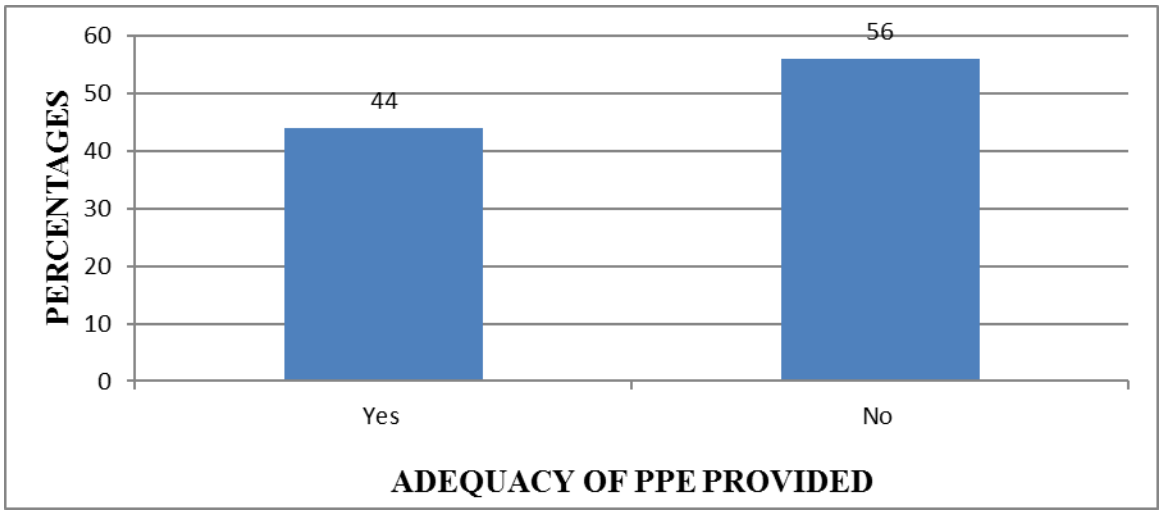

Figure 3: Adequacy of PPE provided

government and government aided health centres are the ones implementing this program. This is backed up by Kiyaga et al. (2013), where the of use LHRs to collect Laboratory samples or specimens from lower level healthcare centres to higher level regional Referral Hospitals (RRH) laboratories for analysis is a new innovation by MOH to scale up infectious disease management.

Provision of personal protective equipment *(PPE)*

Results in Table 3 shows that majority 88 (85.4%) of the LHRs are provided with PPE like gloves, gumboots, goggles and overcoats. This is explained by the big number of respondents (86.4%) who have good knowledge about the risk posed while handling, packaging and transporting biological specimens. In the study, LHRs were asked whether the PPE provided are adequate or constantly supplied (Figure 3). In the study, 56% of the LHRs reported there is inconsistent supply of the PPE to LHRs, possibly because the priority is given to other categories of health care workers like nurses, doctors, etc. The study results are consistent with results from a study conducted among Laboratory workers in Saudi Arabia (Akhter et. al., 2011), where 62% of respondents reported inconsistence supply of gloves therefore would handle blood and blood products with bare hands; 22% did not have goggles and face shields when handling body fluids, reasons given were lack of availability (30%) of the required PPE due to inconsistent supply by management.

Prevalence of occupational hazards among laboratory hub riders

Objective 3 of the study was to determine the prevalence

of occupational hazards among Laboratory Hub Riders. In the study, the LHRs were asked to recall whether they have ever suffered from splash exposure with patients' body fluids and sharps injuries or not, and the number of times such incidences happened to them in the past 12 months at the time of the study. Descriptive statistics using frequency and percentages were used as presented in (Table 4).

Splash exposure

Table 4, shows that 65 (63.1%) of LHRs reported not experiencing any Splash exposure in the last 12 months. This implies that the prevalence of splash exposure as an occupational hazard is low probably because of interventions done such as safety training to increase knowledge and observe safety practices. However, 36.9% of LHRs reported having had splash exposure in the past 12 months. On average the occurrence of incidences of splash exposures was at the rate of 2.9 per person per year. The reported prevalence of splash exposure is because in Africa including Uganda, Laboratory specimens or samples are often packaged in improvised containers such as unsealed plastic bags, gloves, syringes with needles, clothes or pockets using bare hands, and transported on motor cycles or passenger service vehicles, and later also unpacked by the LHR because of limited staff (Riders for Health, 2014). The study findings are supported by a statement from a LHR's manager from Mild may Uganda, who said:

"The nature of our work exposes us to splash exposures in the eyes, mouth, broken skin, because some of us are not well trained on how to handle laboratory/biological specimens and in some instances, we package them ourselves. When we are called to pick samples from the labs, we just find a note saying the samples are in the refrigerator plus their accompanying forms. In most cases those sample containers are loosely tightened, hence the samples may end up pouring in your face, or on your clothes and hands or in the sample courier bags." (KII 5, 2017).

Such information explains that splash exposures are bound to happen given the circumstances explained, such as loosely tightened containers, poorly capped needles, and poor storage and packaging of biological samples or specimens, however, the severity of exposure varies given the level of training. Prevalence of splash exposure in this study are similar to that reported by other studies among generalized categories of HCWs in Uganda, Kenya, and Nigeria, where the proportion of splash exposures in the past twelve months was 50.0%, 32.2% and 44.7% respectively (Ndejjo et al., 2014; Manyele et al., 2010; Ogoina et al., 2014). This implies that occupational hazards are bound to happen in health care settings during procedures which involve one from getting in close contact with patients' contaminated body fluids through accidental exposure such as loosely tightened containers, poorly capped needles, and poor storage and packaging of biological samples or specimens.

Sharps injuries

Results in (Table 4), shows that majority 95 (92.2%) of LHRs reported not having had any sharps injuries in the last 12 months. This suggests that the prevalence of sharps injuries was low possibly because of the interventions done such as safety training, knowledge to increase knowledge about the risk and observing safety practices, as well as given the nature of their work; they are less likely to sustain sharps injuries as compared to other categories of HCWs. However, a few 7.8% of LHRs reported having had sharps injuries. The occurrence or incidences of sharps injuries on average is at the rate of 1.4 per person per year. The study findings are supported by a statement by a laboratory manager from Baylor Uganda, who said:

Unlike laboratory workers who obtain blood from patients using sharps like needles, carpels and surgical blades, LHRs rarely work with such instruments because in most cases, samples or specimens are dispensed in plastic containers apart from a few cases where samples have to be carried in a syringe and glass slides" (KII 6, 2017).

From the response above, it implies that occurrences of sharps injuries are few given the fact that exposure to such incidences is minimal, plus the training and knowledge about the risk exhibited by LHRs.

Factors influencing occupational hazards among LHRs

Objective 4 of the study was to establish the influence of personal and health facility related factors on the prevalence of occupational hazards among LHRs. To achieve this, the related variables were subjected to Pearson Chi square (χ^2) tests as in (Table 5, 6, 7 and 8).

Splash exposures

Results in (Table 5), shows that basing on Chi-square (χ^2) analysis, there is no significant association between personal factors and prevalence of occupational hazards in regard to splash exposure among LHRs in the study area ($p > 0.05$). This is seen from the majority of the LHRs who reported that they had not experienced any splash exposures in the past twelve months, and thus,

Table 5: Personal factors associated with occupational hazards in regard to splash exposure.

Personal Factors	Prevalence		χ^2	Df	p-value
	Yes (%)	No (%)			
Age bracket (years)					
20 – 25	03 (30.0)	07 (70.0)			
26 – 30	17 (47.2)	19 (52.8)			
31- 35	06 (26.1)	17 (73.9)	3.18	4	0.54
36 – 40	08 (33.3)	16 (66.7)			
41- 50	04 (40.0)	06 (60.0)			
Educational Level					
Less than ordinary level	02 (25.0)	06 (75.0)			
Ordinary level	22 (43.1)	29 (56.9)	2.48	3	0.48
Advanced level	06 (40.0)	09 (60.0)			
Tertiary level	08 (27.6)	21 (72.4)			
Work Experience (years)					
Less than 2	19 (44.2)	24 (55.8)			
3 – 4	08 (21.6)	29 (78.4)	5.87	2	0.06
5 – 10	11 (47.8)	12 (52.2)			
Reporting culture					
Poor	14 (33.3)	28 (66.7)	0.12	1	0.73
Good	07 (29.2)	17 (70.8)			
Knowledge about the risk					
Poor	08 (57.1)	06 (42.9)	2.85	1	0.09
Good	30 (33.7)	59 (66.3)			
Perception of the risk					
Poor	05 (52.5)	03 (37.5)	2.44	1	0.12
Good	33 (34.7)	62 (65.3)			
Aware of Safety practices					
Yes	22 (28.6)	55 (71.4)	1.90	1	0.17
No	07 (46.7)	08 (53.3)			

$p > 0.05$

they are less influenced by the above factors.

Sharps injuries

Results in (Table 6), shows that basing on Chi-square (χ^2) analysis, there is no significant association between personal factors and prevalence of occupational hazards in regard to sharps injuries among LHRs in the study area ($p > 0.05$). This is seen from the majority of the LHRs who reported that they had not experienced any sharps injuries in the past twelve months, and thus, they are less influenced by the above factors.

Results in (Table 7), shows that basing on Chi-square (χ^2) analysis, there is a significant relationship between health centres related factors such as job specific training, work guidelines or SOPs, type or category of the health facility, and provision of PPE, and prevalence of splash exposures among LHRs in the study area ($p < 0.05$). However, there is no significant relationship between work hours or overload and prevalence of splash exposures ($p > 0.05$)

Results in (Table 8), shows that basing on Chi-square (χ^2) analysis, there is a significant relationship between health centres related factors such as job specific training, work guidelines or SOPs, and provision of PPE, and prevalence of splash exposures among LHRs in the study area ($p < 0.05$). However, there is no significant relationship between work hours or overload, type or category of the health facility, and prevalence of splash exposures ($p > 0.05$).

Factors influencing occupational hazards in regard to splash exposure and sharps injuries

The prevalence of splash exposure as an occupational hazard was quite low (36.9%), the prevalence of sharps injuries was as well, very low (7.8%). Job specific training was found to be the influential factor for occupational hazards in regard to splash exposure (AOR = 0.33, 95% CI = 0.12 - 0.93, p = 0.04) and sharps injuries (AOR = 0.56, 95% CI = 0.73 - 0.66, p = 0.01) at multivariate analysis. Those variables which showed significant influences in chi-square were subjected to Logistic linear regression to obtain Crude Odds Ratios (COR) and corresponding 95% Confidence Intervals (CI) as presented in (Table 9). The significant variables after Logistic linear regression were further subjected to

Table 6: Personal factors associated with occupational hazards in regard to sharps injuries.

Health Facility Factors	Prevalence		χ^2	Df	p-value
	Yes (%)	No (%)			
Age bracket (years)					
20 – 25	01 (10)	09 (90.0)			
26 – 30	03 (8.3)	33 (91.7)			
31- 35	02 (8.7)	21 (91.3)	0.97	4	0.92
36 – 40	02 (8.3)	22 (91.7)			
41- 50	00 (0.0)	10 (100)			
Formal Educational					
Less than ordinary level	01 (12.5)	07 (87.5)			
Ordinary level	04 (7.8)	47 (92.2)	0.31	3	0.96
Advanced level	01 (6.7)	14 (93.3)			
Tertiary level	02 (6.9)	27 (93.1)			
Work Experience (years)					
Less than 2	04 (9.3)	39 (90.7)			
3 – 4	02 (5.4)	35 (94.6)	0.46	2	0.80
5 – 10	02 (8.7)	21 (91.3)			
Reporting culture					
Poor	02 (4.8)	40 (95.2)	2.85	1	0.91
Good	01 (4.2)	23 (95.8)			
Knowledge about the risk					
Poor	02 (14.3)	12 (85.7)	0.96	1	0.33
Good	06 (6.7)	83 (93.3)			
Perception of the risk					
Poor	02 (25.0)	06 (75.0)	3.60	1	0.06
Good	06 (6.3)	89 (93.7)			
Aware of Safety practices					
Yes	03 (3.9)	74 (96.1)	2.18	1	0.14
No	02 (13.3)	13 (86.7)			

p > 0.05

Table 7: Health facility related factors associated with occupational hazards in regard to splash exposure.

Factors	Prevalence		χ^2	Df	p-value
	Yes (%)	No (%)			
Job specific training					
Yes	20 (27.4)	53 (72.6))	9.71	1	0.002**
No	18 (60.0)	12 (40.0)			
Working hours (Work load)					
5 – 8	24 (32.9)	49 (64.1)	1.74	1	0.19
9 – 12	14 (46.7)	16 (53.3)			
Work guidelines or SOPs					
Yes	29 (32.2)	61 (67.8)	6.68	1	0.01*
No	09 (69.2)	4 (30.8)			
Type/category of the health facility					
Private	11 (53.4)	10 (47.6)	7.25	2	0.03*
NGO	06 (18.8)	26 (81.2)			
Public	21 (42.0)	29 (58.0)			
Provision of PPE					
Yes	29 (33.0)	59 (67.0)	4.03	1	0.05*
No	09 (60.0)	06 (40.0)			

*p < 0.05 **p < 0.01

multivariate analysis to get the Adjusted Odds Ratios (AOR) and corresponding 95% CI.

Splash exposures

Job specific training

According to results in (Table 9), Job specific training is significantly associated with the prevalence of occupational hazards in regard to splash exposures (COR = 0.25, 95% CI = 0.10 - 0.62, p = 0.002). This implies that LHRs who received training were 4 times less likely to incur occupational hazards in regard to

Table 8: Health facility related factors associated with occupational hazards in regard to sharps injuries.

Factors	Prevalence		χ^2	df	p-value
	Yes (%)	No (%)			
Job training					
Yes	03 (4.1)	70 (95.9)	4.68	1	0.03*
No	05 (16.7)	25 (83.3)			
Working hours (work load)					
5 – 8	05 (6.8)	68 (93.2)	0.30	1	0.59
9 – 12	03 (10.0)	27 (90.0)			
Presence of work guidelines or SOPs					
Yes	04 (4.4)	86 (95.6)	11.00	1	0.01*
No	04 (30.8)	09 (69.2)			
Type/category of the health facility					
Private	01 (4.8)	20 (95.2)	0.38	2	0.83
NGO	03 (9.4)	29 (90.6)			
Public	04 (8.0	46 (92.0)			
Provision of PPE					
Yes	05 (5.7)	83 (94.3)	3.67	1	0.05*
No	03 (20)	12 (80.0)			

*p < 0.05 **p < 0.01

Table 9: Factors influencing occupational hazards in regard to splash exposure and sharps injuries.

Variables	Prevalence		COR (CI; 95%)	AOR (CI; 95%)
	Yes (%)	No (%)		
Splash exposure				
Job specific training				
Yes	20 (27.4)	53 (72.6)	0.25 (0.10 - 0.62)**	0.33 (0.12 - 0.93)*
No	18 (60.0)	12 (40.0)	1	
Work guidelines/ SOPs				
Yes	29 (32.2)	61 (67.8)	0.21 (0.06 - 0.74)*	0.51 (0.12 - 2.25)
No	09 (69.2)	4 (30.8)	1	
Provision of PPE				
Yes	29 (33.0)	59 (67.0)	0.33 (0.11 - 1.01)*	0.37 (0.11 - 1.23)
No	09 (60.0)	06 (40.0)	1	
Sharps injuries				
Job specific training				
Yes	29 (33.0)	59 (67.0)	0.21 (0.05 - 0.96)*	0.56 (0.07 - 0.66)*
No	09 (60.0)	06 (40.0)	1	
Work guidelines or SOPs				
Yes	04 (4.4)	86 (95.6)	0.11 (0.02 - 0.49)**	0.16 (0.02 - 1.49)
No	04 (30.8)	09 (69.2)	1	

*p < 0.05 **p < 0.01 RC = 1

splash exposures than those who have not been trained. This is because when one has not been trained on job, they may lack skills and knowledge on the basic prevention and control measures of occupational hazards in regard to splash exposures. These findings are in line with a cross sectional study done in Tanzania and Uganda (Mbaisi et al., 2013 and Ziraba et al., 2010) among health care providers where, training on job was a key factor for any worker involved with patients and patients' blood and biological fluids. This was supplemented by an administrator from MBN laboratories, who said,

"Incidences of splash exposures are more common among staff who are not well trained and oriented in safety trainings, they keep on reporting incidences of blood splashing in their eyes, and mouths all the time, because we document all the incidences reported, so

when you check in their personnel file, you find that they had never attended any training or drill related to their work procedures."(KII 9, 2017).

Such information implies that training enhances safety of workers; it creates awareness, motivation and vigilance for employees to perform their duties, thus, promoting personal and patient safety in the work environment. However, when workers do not receive appropriate training on occupational hazards, they are more likely to experience occupational hazards.

Also when subjected to a multivariate analysis, Job specific training was still significantly associated (AOR = 0.33, 95% CI = 0.12 - 0.93, p = 0.04). This implies that when other factors in the model are controlled, the likelihood of encountering splash exposures reduces 3 times. The findings are in line with studies done in Ethiopia and Canada by Beyene and Tadesse (2014) and Yassi et al. (2007), where it was reported that lack of training on infection prevention and safety was associated, [(AOR: 3.3, 95% CI: 1.6-5.8, p = 0.001)] and [(AOR: 12.3, 95% CI: 7.6-1 5.1, p = 0.000)] respectively, with increased prevalence of occupational exposures among health care providers. This explains that training of workers in occupational prevention measures is very essential because untrained workers are more likely to experience occupational exposures than the trained workers.

Work guidelines or SOPs

According to results in (Table 9) above, work guidelines or SOPs was significantly associated with the prevalence of occupational hazards in regard to splash exposures (COR = 0.21, 95%CI = 0.06 - 0.74, p = 0.02). This implies that LHRs who were provided with work guidelines or SOPs were about 5 times less likely to incur occupational hazards in regard to splash exposure than those who have not been provided with work guidelines or SOPs. This is because when health centres do not develop appropriate work guidelines or SOPs for the different work procedures according to the approved protocols, workers may end up doing things differently hence end up experiencing occupational hazards in regard to splash exposures. No similar studies are however reported in this regard. According an administrator from Ebenezer clinical Laboratories.

"We normally develop work guidelines and SOPs, but you find that in most cases, LHRs do not utilize and adhere to the developed guidelines and they end up doing their own things, leading them to be splash exposures and injuries."(KII 7, 2017).

Such information implies that all workers are supposed to be trained and oriented through the developed work guidelines and SOPs addressing all work practices and procedures in Health care settings, as well as involving them in developing the required guidelines, however, failure to involve and train workers on the guidelines and SOPs, adherence of the recommended guidelines and practices remains poor.

However, when subjected to multivariate analysis, work guidelines or SOPs was not a predictor for occupational hazards in regard to splash exposures (AOR = 0.16, 95%CI = 0.02 - 1.49, p = 0.38). This could be attributed to the fact that LHRs may not be trained on how to utilize those work guidelines or SOPs in place, which makes them of less in importance. These findings are in line with a study done in Ethiopia by Kaweti and Abegaz (2016) where, results indicated that following standard procedures and precautions was not associated with prevalence of occupational exposures among health care providers, [(AOR: 1.25, and 95%CI= 0.88-1.79)].

Provision of PPE

According to results in (Table 9), provision of PPE was significantly associated with prevalence of occupational hazards in regard to splash exposures (COR = 0.33, 95%CI = 0.11 - 1.01, p = 0.05). This implies that LHRs from health centres which provided PPE were about 3 times less likely to incur occupational hazards in regard to splash exposure than LHRs from health centres which do not provide appropriate PPE. This is because use of Personal Protective Equipment (PPE) such as gloves, face masks, gumboots, goggles, and over coats at all times protect one from splash exposures. These findings are in line with a cross sectional study done in India by Hansa et al. (2003) among health Laboratory workers, where provision and use of PPE was a key factor for protective workers against occupational exposures. However, when subjected to multivariate analysis, provision of PPE was not significantly associated (AOR = 0.37, 95%CI = 0.11 - 1.23, p = 0.12). This could be attributed to the fact that LHR may not be trained on how to utilize those PPE provided, which makes them of less importance. No similar studies are however reported in this regard.

Sharps injuries

Job specific training

According to results in Table 9, Job specific training is significantly associated with the prevalence of occupational hazards in regard to Sharps injuries (COR=0.21, 95%CI=0.05 - 0.96, p= 0.04). This implies that LHRs who received training were 5 times less likely to incur occupational hazards in regard to sharps related injuries than those who have not been trained. This is because when one has not been trained on job, they may lack skills and knowledge on the basic prevention and control measures of occupational hazards in regard to sharps injuries. These findings are in line with a study

Table 10: LHR recommendations to reduce prevalence of occupational hazards.

Recommendation	Frequency	Percentage	Ranking
Conduct safety Trainings annually	29	42.3	1
Providing PPE like gloves, face shields, masks, eye protection gumboots and aprons	12	17.6	2
Facility managers to provide sample carrier bags recommended by WHO	11	14.7	3
Managers to provide hand washing centres easily accessible by LHRs	08	11.8	4
Facility managers to develop work guidelines or SOPS addressing work procedures	04	5.9	5
Regular meetings involving LHR and laboratory personnel	04	5.9	6

done in Ethiopia by Bekele et al. (2015) where training on job was reported as key factor for any worker involved with patients and patients' blood and biological fluids. Job specific training was still significantly associated (AOR= 0.56, 95% CI=0.73 - 0.66, p = 0.01). This implies that when other factors in the model are controlled, the likelihood of encountering sharps injuries reduces 2 times. This could be attributed to the fact that more training meant less sharps injuries. Contrary to these findings are previous findings by Lulie et al., (2013) where it was urged out that training for health workers seem to be not necessarily brought about protection from occupational hazards in regard to sharps injuries because the knowledge gained may not necessarily be transferred into practice of preventive measures or knowledge received may not be sufficient and that the provided training may be more of theoretical than practical.

Work guidelines or SOPs

According to results in Table 9, work guidelines or SOPs was significantly associated with the prevalence of occupational hazards in regard to sharps injuries (COR=0.11, 95%CI= 0.02 -0.49, p=0.004). This implies that LHRs who were provided with work guidelines or SOPs were about 11 times less likely to incur occupational hazards in regard to splash exposure than those who have not been provided with work guidelines or SOPs. This was supplemented by one Laboratory in charge from Kayunga hospital, who said,

"Usually, we develop work guidelines and SOPs, addressing LHRs work, and put these guidelines on every Laboratory and their offices such that they can be able to perform work procedures appropriately. We ensure LHRs are trained and understand the guidelines developed. ."(KII 10, 2017).

This is because when health centres do not develop appropriate work guidelines or SOPs for the different work procedures according to the approved protocols, workers may end up doing things differently hence end up experiencing occupational hazards in regard to splash exposures. LHRs need to be involved developing the required guidelines, because failure to involve and train workers on the guidelines and SOPs, adherence of the recommended guidelines and practices remains poor. However, when subjected to multivariate analysis, work guidelines or SOPs was not a predictor for occupational hazards in regard to splash exposures (AOR = 0.51, 95%CI = 0.12 - 2.25, p = 0.11). This could be attributed to the fact that LHR may not be trained on how to utilize those work guidelines or SOP s in place, which makes them of less importance. No similar studies are however reported in this regard.

Hypothesis testing

There is no significant influence between age, level of education, working experience, and reporting culture, knowledge about the risk, risk perception and occupational hazards among Laboratory Hub Riders ($p > 0.05$). The null hypothesis was accepted. There is a significant influence between job specific training, work guidelines, type or category of the health facility, provision of PPE, and occupational hazards among Laboratory Hub Riders ($p < 0.05$). The null hypothesis was rejected. The alternative hypothesis allows the study to conclude that occupational hazards are significantly influenced by Health Facility.

Related factors

LHRs recommendations to reduce prevalence of occupational hazards

During the study, respondents were asked to make recommendations on the measures or strategies that would be made to improve or reduce occupational hazards among LHRs in Uganda. Data was analyzed using Descriptive statistics. The findings are presented in frequencies and percentages in (Table 10). Table 10 shows that majority of LHRs in the study recommended conducting training on safety measures annually by their

managers 29 (42.3 %,). This is explained by the percentage of respondents who are knowledgeable about the risk and good perception of the risk (Table 2), and how safety training is associated with occupational hazards, thus, important in any occupational hazards prevention program. The above findings are supported by results from a study done in Uganda by Ziraba et al. (2010) among Health Care Providers where, most (78%) of the respondents recommended training in infection prevention and control as one way to reduce occupational diseases like Hepatitis B among health care providers. The findings may mean that majority of LHR believe when one has been trained on safety and occupational hazards prevention measures, he is able to acquire knowledge that can be apply to prevent and control occupational hazards.

Conclusion and recommendations

Laboratory Hub Riders (LHRs) were relatively younger with less working experience, and with ordinary level as their highest level of education. The prevalence of occupational hazards in regards to splash exposure and sharps injuries was quite low. Job specific training was influential in occupational hazards among LHRs. This means that there is need for the Health centres as well as ministry of health to establish policies that will help raise awareness on the importance of job specific or safety training in order to reduce on the prevalence occupational among LHRs in Uganda. Health facility managers need to incorporate job specific training such as safety precautions on infection prevention and control for newly recruited LHRs before they commence with their duties. There is need for health centres to avail all the necessary PPE like gumboots, aprons, respirators, goggles and gloves constant supply. Health facility managers need to develop work guidelines addressing all work procedures and processes for example SOPS for disinfection, guidelines for sample packaging, guidelines for first aid and Post Exposure Prophylaxis policy and procedure, and make them easily accessible to LHRs at all times. Equally, strategies and guidelines recommended by WHO and IATA for packaging and transporting laboratory specimens or samples and institute follow up and accountability mechanisms need to be followed. Further Research should employ qualitative studies, and factors like distance travelled per day need to be explored in future studies.

REFERENCES

Akhter J, Sameera AJ, Loulwah H, Khalid AZ (2011). Laboratory Work Practices and Occupational Hazards among Laboratory Health Care Workers. A Healthand Safety Survey. *Journal of Pharmaceutical and Biomedical Sciences.*9 (04): pp 2230 – 7885.

Akinboro AA, Adejumo PO, Onibokun AO, Olowokere AE (2012). Community health care workers' risk perception and practices of occupational exposure to HIV in Ibadan, South-west Nigeria. *African Journal of Primary Health Care Family Medicine* 4(1): pp. 338-347.

Amoran OE (2013). Occupational exposure, risk perception and access tp prophylaxis for HIV/AIDS infection among HCWs in Northern Nigeria. *British Journal of medicine& Medical Research*; No. 1. pp;32 - 34.

Bekele T, Gebremariam A, Kaso1 M, Kamol A, (2015). Factors Associated with Occupational Needle Stick and Sharps Injuries among Hospital Healthcare workers in Bale Zone, Southeast Ethiopia, Department of Public Health. *Journal pone.* 10(10):

Beyene T,Tadesse S (2014). Predictors of occupational exposure to HIV infection among healthcare workers in southern Ethiopia. *International Journal of Infection Control*; 10 (13)

CDC (2012). Morbidity and mortality weekly report and recommendations. Updated Center for Disease Control and prevention (CDC) recommendations for the management of Hepatitis B virus-infected health-care providers and students; 61(3):1-16.

CDC (2008). Work book for Designing, Implementing and Evaluating a Sharps Injury Prevention Program.US.CDC.2nd edition.

Dembe A, Wickizer T, Sieck C, Partridge J, Balchick R (2012). Opioid use and dosing in the workers' compensation setting. A comparative review and new data from Ohio. *American journal of industrial medicine*, *55*(4), 313-324.

Hansa M, Goswami I, Sumeeta TS, Sachin MP, Mitesh KP (2005). Knowledge, attitude and practice of laboratory safety measures among paramedical staff in Gujarat medical college, India. Department of Preventive & Social Medicine, *British Journal of Medicine;*10 (2). Pp. 234-255.

Karmon SL, Mehta SA, Brehm A (2013). Occupational exposure to Blood Borne Pathogens. New york. Ceuf fast.

Kaweti G, Teferi A (2014). Prevalence of percutaneous injuries and associated factors among health care workers in Hawassa referral and adare District hospitals, Hawassa, Ethiopia. *BMC Public Health; 16(8).*

Kiyaga C, SendagireH, Eleanor Grosz J, McConnell J , Narayan V, Esiru G, Elyanu P, Akol Z, Kirungi W, Musinguzi J, Opio A (2013). Uganda's New National Laboratory Sample Transport System: "A Successful Model for Improving Access to Diagnostic Services", MOH, Kampala, Uganda. *Journal of Public Health Policy;*36(2).pp 153–169.

Krejicie R, Morgan DW (1970). Determining sample size for research activities. Educational and psychological measurement.

Lulie W, Emebet A, Medihanit T, Hanna F, Dereje B (2012). Factors associated with needle stick and sharp injuries, among healthcare workers in Felege Hiwot Referral Hospital. College of Medicine & Health Sciences, Ethiopia.

Manyele SV, Ngonyani HAM, Eliakimu E (2008). The status of occupational safety among health service providers in hospitals in Tanzania. Health Service Inspectorate Unit, Ministry of Health & Social Welfare (MOHSW):10 (3): pp. 109-200.

Mbaisi EM, Ng'ang'a Z, Wanzala P, Omolo J (2010). Prevalence and factors associated with percutaneous injuries and splash exposures among health-care workers in a provincial hospital, Kenya. *Pan African Medical Journal;3(2), pp.22-43.*

MillJ, Nderitu E, Richter S (2013). Post-exposure prophylaxis among Ugandan nurses: ''Accidents do happen''. *International Journal of Africa Nursing Sciences*; 4(1); pp. 11–17.

Ministry of Health (MOH)/ Central Public Health Laboratories (CPHL) report. (2015). Capacity building and health systems strengthening program in Uganda; Hub Network and Hub riders' annual Report.

Ndejjo R, Musinguzi G, Yu X, Buregyeya E, Musoke D, Wang J, Halage AA,Whalen C Bazeyo W, Williams P, Ssempebwa J (2014). Occupational Hazards among HCWs in Kampala. *Journal of Environmental and Public Health.*Vol.2, Article ID 913741.http://dx.doi.org/10.1155/2015/913741

NIOSH (2011). National Institute for Occupational Safety and health report. Exposure to stress and Occupational hazards in hospitals; 136.

Ogoina D, Pondei K, Adetunji B, Chima G,Isichei C, IdadoS (2014). Prevalence and determinants of occupational exposures to blood and body fluids among health workers in two tertiary hospitals in

Nigeria. *African Journal of Infectious Diseases;* 8(2): pp. 50 – 54.
Rahul S, Rasania SK, Anita V, Saudan S (2010). Study of prevalence and response to needle stick injuries among health care workers in a tertiary care hospital in Delhi, India. *Indian Journal of Community Medicine*; 35(1):74-77.
Riders for health report. (2014). Health systems strengthening and Social impact. http://www.changemakers/sites/default/files/riders-for-health-health systems strengthening.pdf.
The Uganda Public Service Standing Orders. (2010). Ministry of Public Service; www.ministryofpublicservice/uganda/ps.
UNAIDS (2014). An ambitious treatment target to help end the AIDS epidemic, Switzerland. http// sustainuganda.org/sites/ success stories/hubrider.pdf.
WHO (2011). Global framework for national occupational health programs for health workers: http://www.who.int/occupational_health/global_framework_for_hcws.
Yassi A, Lockhart K, Copes R, Kerr M, Corbiere M, Bryce E, Danyluk Q, Keen D, Yu S,Kidd C (2007). Severe acute respiratory syndrome Study Team. Determinants of healthcare workers' compliance with infection Control procedures. *Public Health Journal;* 10(1): pp. 44-52.
Ziraba AK, Bwogi J, Namale A, Wainaina C, Mayanja KH (2010). Sero-Prevalence and risk factors for hepatitis B virus infection among health care workers in a tertiary hospital in Uganda. *BMC Infectious Diseases:*10(1): pp.191.