Factors affecting compliance with infection prevention and control standard precautions among healthcare workers in Songwe region, Tanzania

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SUMMARY

Background: Compliance with infection prevention and control standard precautions (IPCSPs) remains a major challenge in many countries including Tanzania. Lack of compliance exposes healthcare workers (HCWs) and patients to a high risk of developing healthcare-associated infections (HAI) including antimicrobial-resistant microorganisms which can contribute to the spread of antimicrobial resistance (AMR). This study investigated compliance with IPCSPs and associated factors among HCWs in public healthcare facilities (HFs) in Songwe Region, Tanzania between January and March 2021.

Methods: A cross-sectional study was conducted in all 5 districts in Songwe Region, involved 400 HCWs from difference healthcare facilities (HFs) including dispensaries, health centres and hospitals. The Compliance with Standard Precautions scale (CSPS) tool developed by WHO was used. Descriptive and modified Poisson regression analysis was done. A P-value of less than 0.05 indicated statistical significance.

Results: Only 22.5% (90/400) of HCWs had high compliance (above 80%) to IPCSPs. The majority of HCWs reported highest compliance on discarding used needles/sharps into sharps containers (94%), the lowest IPCSPs compliance was for the correct handling of spills, taking a shower after extensive splashing and not re-using disposable masks, 8%, 28.5% and 34% respectively. Attending IPC training or an IPC seminar in the previous year (ARR= 2.97 [1.87–4.72] P<0.001), the number of years of work experience (ARR= 2.08 [1.22–3.54] P=0.007), and having experienced a needlestick injury (ARR=0.62 [0.40–0.95] P=0.028), were identified as predictors of HCWs compliance with IPCSPs.

Conclusion: The majority of HCWs in Songwe region had low compliance with IPCSPs according to national standards. IPC training and the number of years of work experience predicted high compliance with IPCSPs. Capacity building initiatives, mentorship and supportive supervision should be emphasised for all HCWs in all HFs.
Background

Exposure to blood-borne pathogens in the 1970s led to the spread of hepatitis infections among HCWs in healthcare facilities (HFs). Infection prevention and control (IPC) initiatives have been introduced to protect healthcare workers (HCWs) especially from hepatitis B virus (HBV) and human immunodeficiency virus (HIV) infections [1]. Infection prevention and control standard precautions (IPCSPs) are a set of activities designed to prevent the transmission of organisms between patients/staff for the prevention of health care-associated infection (HAIs) [2].

Implementation of IPC is a universally relevant component of all healthcare systems and affects the health and safety of both people who use healthcare services and those who provide them [3]. Infection Control Africa Network (ICAN) has reported that attitude and behaviour practices by HCWs continue to fuel transmission of HAIs in Africa [1,4,5]. Emerging diseases like Ebola virus disease (EVD) and Coronavirus disease 2019 (COVID-19) have underlined the need for strengthening IPC with the objective of having resilient healthcare systems, both at the national and facility level [6,7].

Compliance with IPCSPs has remained a challenge in Tanzania [1,8]. Poor IPC practices through contaminated hands of HCWs, equipment (e.g., stethoscopes, blood pressure machines, thermometers), healthcare interventions (such as surgery, diagnostic testing or invasive procedures) and via the environment lead to the exposure of patients to a high risk of developing HAIs mainly via direct contact [4,8,9]. A systematic review reported the burden of HAIs in Tanzania to be 14.8%, which is much higher than in developed countries [7]. National guidelines to enhance IPC practices for HCWs in HFs have been developed by WHO was used [8]. The scale has 20 items which were responded using a four-point Likert scale (never, seldom, sometimes and always). Items 2, 4, 6, 15 and 20 were negatively stated. A score of 1 was given to an “always” response in positively worded statements and the “never” option in negatively worded statements, while 0 for the other responses, giving a total possible range score of 0—20 and was expressed in terms of percentages.

Dependent variable was compliance with IPCSPs which was dichotomous. A compliance score of 80% and above was categorized as high compliance and a compliance score of below 80% as low compliance. This is in accordance with Tanzania national guidelines for the recognition of implementation status of quality improvement initiatives in HFs including IPC improvement initiatives, that HCWs compliance rate of at least 80% is considered the desired level of compliance [11]. Compliance to IPCSPs examined adherence to personal protective equipment (PPE), disposal of sharps and waste products, decontamination and prevention of cross-infection between patients by observational methods. Social demographic variables and duration of work experience was done by self-reporting and information. For example, motivation was investigated by demonstrating HCWs had obtained a certificate of appreciation or other incentives such as competition in performing IPC interventions. Supportive supervision (SS) was investigated by recording if HCWs had received on job mentorship by supervisors from the same HFs or from external HFs.

Methods

This was a cross-sectional study, which included 400 HCWs regardless of discipline, working in public healthcare facilities (HFs) in all three levels of primary healthcare: dispensaries (the lowest level which provide outpatient services only), health centres (which provide both outpatient and inpatient services including some surgical services), and level one hospitals in all five districts of Songwe region from January to March 2021. The region had 1,026 HCWs, where 374 were working in hospitals, 212 in health centres and 440 in dispensaries. Sample size estimation was calculated using Kish Leslie’s formula for cross sectional studies at 95% confidence interval and marginal error of 5% with consideration of 10% non-respondent rate by using median compliance to IPC principles 57% [8]. HCWs included from each HFs level were obtained by stratified sampling technique where the proportion to size was calculated and simple random sampling technique was done to each level by using electronic numbers. Medical students, interns or volunteers were excluded from the study.

Data collection tool and technique

The Compliance with Standard Precautions Scale (CSPS) tool developed by WHO was used [8]. The scale has 20 items which were responded using a four-point Likert scale (never, seldom, sometimes and always). Items 2, 4, 6, 15 and 20 were negatively stated. A score of 1 was given to an “always” response in positively worded statements and the “never” option in negatively worded statements, while 0 for the other responses, giving a total possible range score of 0—20 and was expressed in terms of percentages.

Data management and analysis

Data were analysed in Stata version 15.0. Frequency distribution was compared using the Chi-square test entered in to bivariate modified Poisson regression model as outcome for this study was more than 15%. Factors included in the model were, profession, level of HF, working years’ experience, IPC training in the previous year, needlestick injury (NSI) experience, blood/body fluid splash, hepatitis B vaccination status and IPC SS. Variables with P-value < 0.2 in bivariate modified Poisson regression analysis were added to multivariate modified Poisson regression model using forward selection. The model used
to identify factors associated significantly with high compliance to IPCSPs at P-value < 0.05.

**Ethical approval**

Study was approved by MUHAS Ethical Review Committee on 18/11/2020 with Ethical Approval Number MUHAS-REC-11-2020-426. Informed consent was obtained from study participant and form signed after agreeing to participate to the study. Confidentiality of study subjects was ensured through the use of ID codes to conceal their identity.

**Results**

**Demographic characteristics of the study respondents**

Table I shows the demographic characteristics of the respondents. The total number of respondents was 400 (96% response rate). Respondents had a median age of 32 years with interquartile range (IQR) of 10 (29, 39). The majority of the respondents were: females (64.0%), nurses (38.5%), diploma level (35.3%), from hospital level HF (37.5%), and working in an outpatient department (40.5%).

| Variable                      | Frequency (N=400) | Percent (%) |
|-------------------------------|-------------------|-------------|
| **Age**                       |                   |             |
| 21 to 30                      | 146               | 36.5        |
| 31 to 40                      | 163               | 40.8        |
| 41 and above                  | 91                | 22.7        |
| **Sex**                       |                   |             |
| Female                        | 256               | 64.0        |
| Male                          | 144               | 36.0        |
| **Professions**               |                   |             |
| Clinicians                    | 110               | 27.5        |
| Nurses                        | 154               | 38.5        |
| Medical Attendants            | 92                | 23.0        |
| Others                        | 44                | 11.0        |
| **Education level**           |                   |             |
| Degree                        | 41                | 10.3        |
| Diploma                       | 141               | 35.3        |
| Certificates                  | 134               | 33.5        |
| Secondary                     | 55                | 13.7        |
| Primary                       | 29                | 7.2         |
| **Healthcare Facility level** |                   |             |
| Hospital                      | 150               | 37.5        |
| Health centre                 | 109               | 27.3        |
| Dispensary                    | 141               | 35.2        |
| **Working department**        |                   |             |
| Outpatient dep.               | 184               | 46.0        |
| Reproductive and child health | 57                | 14.3        |
| Labour ward                   | 55                | 13.7        |
| Medical ward                  | 29                | 7.2         |
| Surgical ward                 | 17                | 4.2         |
| Paediatric ward               | 14                | 3.5         |
| Other                         | 44                | 11.0        |

**Infection prevention and control (IPC) experiences of the study respondents**

Table II shows the respondents working experience where majority had been working in healthcare service delivery in less than 6 years (42.3%). In addition, majority of HCWs 46.3% and 71.3% had experienced NSI and blood/body fluid splash respectively, while 67.5% had not been vaccinated against hepatitis B. On IPC experiences, 79.3%, 79.3% and 40.8% had not received IPC training, did not receive any motivation on IPC initiatives in their working unit, and did not attend any IPC meeting at their working unit for the past one year of working respectively. 47.0% did not receive any IPC SS for the past one year.

| Variable                        | Frequency (N=400) | Percent (%) |
|---------------------------------|-------------------|-------------|
| **Working experience (years)**  |                   |             |
| Less than 6                     | 169               | 42.3        |
| 6 to 10                         | 146               | 36.5        |
| 11 to 15                        | 27                | 6.7         |
| 16 and above                    | 58                | 14.5        |
| **Experience of needlestick injury** |             |             |
| Yes                             | 185               | 46.3        |
| No                              | 215               | 53.7        |
| **Experience of blood/body fluid exposure** |   |             |
| Yes                             | 285               | 71.3        |
| No                              | 115               | 28.7        |
| **Hepatitis B vaccination**     |                   |             |
| Yes                             | 130               | 32.5        |
| No                              | 270               | 67.5        |
| **IPC training < 1 year**       |                   |             |
| None                            | 317               | 79.3        |
| Once                            | 69                | 17.2        |
| Two and above                   | 14                | 3.5         |
| **Motivation**                  |                   |             |
| No motivation                   | 322               | 80.5        |
| Annually                        | 25                | 6.3         |
| Quarterly                       | 25                | 6.2         |
| Monthly                         | 28                | 7.0         |
| **IPC meetings attended**       |                   |             |
| Never                           | 163               | 40.7        |
| Monthly                         | 91                | 22.7        |
| Rarely                          | 74                | 18.5        |
| Weekly                          | 32                | 8.0         |
| Quarterly                       | 31                | 7.8         |
| Annually                        | 9                 | 2.3         |
| **Supportive supervision (SS) given** |        |             |
| No supervision                  | 188               | 47.0        |
| Annually                        | 27                | 6.7         |
| Quarterly                       | 185               | 46.2        |

**Compliance with infection prevention and control standard precautions (IPCSPs)**

The overall average compliance of the HCWs to IPCSPs in Songwe Region was 66% where only 22.5% HCWs had high compliance to IPCSPs of greater than 80%. The majority HCWs
(94%) reported the highest compliance with proper disposal of used sharp items into sharps boxes, while only 8% HCWs were correctly handling spills of blood/body fluid on surfaces by cleaning first. HCWs reported suboptimal compliances to the following IPCSPs: 71.5% did not shower after extensive splashing, 66% re-used disposable masks in working areas, 60.0% disposed of sharps boxes while full, and 26.5% recapped needles. For hand hygiene practices, 24.0% of HCWs did not wash their hands between each patient contact, while 41.5% did not use alcohol hand rub as an alternative when hands are not visibly soiled, and 47.0% used only water for hand washing (Table III).

Demographic and working experience factors affecting compliance with infection prevention and control standard precautions

The findings of this study showed statistically significant differences between respondents working in dispensaries, health centres and hospitals in the compliance with IPCSPs \((P=0.008)\). A high proportion (33.0%) of HCWs at health centres had a high compliance with IPCSPs compared to those working at hospitals and dispensaries. Furthermore, compliance with IPCSPs was found to be statistically significant in the number of years of working experience \((P=0.026)\); Working experience of 11–15 years had the highest proportion (44.4%) of high compliance with IPC SPs compared to those with less than 6 years of working experience (18.3%)

Additionally, the findings observed a statistically significant difference between respondents who had received IPC training in previous 1 year \((P<0.001)\). Respondents who had received two or more IPC training sessions in the previous year had a higher proportion (64.3%) of high compliance with IPCSPs compared to those with none. Nevertheless, the findings showed statistically significant difference in NSI exposures \((P=0.005)\) whereby those with no exposure to NSI had high proportion (27.9%) of high compliance with IPCSPs compared to those with NSI exposure.

Furthermore, there was a statistically significant difference between respondents who received IPC SS at their working unit \((P=0.004)\). Respondents who had at least one IPC SS per year had higher proportion (44.4%) of high compliance with IPCSPs and those who did not receive any IPC SS at their working unit (17.0%). Lastly, findings showed no statistically significant difference in age, sex, professional disciplines and IPC motivation in compliance with IPCSPs (Table IV).

Table III

Compliance with IPC standard precautions of HCWs (N=400) in Songwe region from January to March, 2021 with Standard Precautions (SP) based on the WHO Compliance with Standard Precautions scale (CSPS)

| SP No. | IPC standard precaution | Compliance (N=400) | Percentage (%) |
|-------|-------------------------|--------------------|----------------|
| 5     | I put used sharp articles into sharps boxes | 376 | 94.0 |
| 19    | I wear gloves to decontaminate used equipment with visible soils | 373 | 93.0 |
| 9     | I cover my wound(s) or lesion(s) with waterproof dressing before patient contacts | 362 | 90.5 |
| 10    | I wear gloves when I am exposed to body fluids, blood products, and any excretion of patients | 361 | 90.0 |
| 17    | Waste contaminated with blood, body fluids, secretion, and excretion are placed in red plastic bags irrespective of patient’s infective status | 353 | 88.0 |
| 18    | I decontaminate surfaces and equipment after use | 350 | 87.5 |
| 12    | I decontaminate my hands immediately after removal of gloves | 331 | 83.0 |
| 11    | I change gloves between each patient contact | 319 | 80.0 |
| 16    | I wear a gown or apron when exposed to blood, body fluids, or any patient excretions | 309 | 77.0 |
| 1     | I wash my hands between patient contacts | 303 | 76.0 |
| 4     | I recap used needles after giving an injection* | 292 | 73.5 |
| 14    | My mouth and nose are covered when I wear a mask | 293 | 73.0 |
| 7     | I remove PPE in a designated area | 256 | 64.0 |
| 2     | I only use water for hand washing* | 213 | 53.0 |
| 13    | I wear a surgical mask alone or in combination with goggles, face shield, and apron whenever there is a possibility of a splash or splatter | 184 | 46.0 |
| 3     | I use alcohol hand rubs as an alternative if my hands are not visibly soiled | 166 | 41.5 |
| 6     | The sharps box is only disposed when it is full* | 161 | 40.0 |
| 15    | I reuse surgical mask or disposable PPE* | 137 | 34.0 |
| 8     | I take a shower in case of extensive splashing even after I have put on PPE | 114 | 28.5 |
| 20    | I clean up spillage of blood or other body fluid immediately with disinfectants* | 32 | 8.0 |

Scale items were arranged from the highest to lowest compliance rate; * Reverse scored items.
was not statistically significant. Lastly, those with working experience of 6–10 years were 1.29 times more likely to be compliant with IPCSPs at a high level though it was not statistically significant.

HCWs who had received one training session on IPC in a previous year were 1.88 times more likely to comply with IPCSPs at a high level compared to those who had no training in a previous year (P=0.002). While those who had two or more training sessions on IPC in the previous year were 3 times more likely to comply with IPCSPs at a high level compared to those with no training in a previous one year (P<0.001). However, HCWs who had exposure to NSI were 0.62 times less likely to comply with IPCSPs at a higher level compared to those with no history of exposure (P=0.028). HCWs who received one SS per year on IPC were two times more likely to comply with IPCSPs at a high level compared to those who did not receive any SS (APR=2.09 [1.25–3.50] P=0.005). There was no significant association between other factors such as blood/body fluid exposure history, hepatitis B vaccination status and compliance with IPCSPs.

**Discussion**

This study demonstrated low compliance with IPCSPs among HCWs at Songwe region as per national standards. In addition,
the study showed that the majority of HCWs do not always wear surgical masks, eye protection, waterproof aprons, and that they tend to re-use disposable masks. Furthermore, the study found being a nurse, having received IPC training, had a longer duration of work experience, having received IPC supportive supervision, the healthcare facility level, lack of NSI exposure as associated factors with high compliance with IPCSPs. Low compliance with IPCSPs presents a risk for patient safety and HCWs safety as well as reducing the quality of healthcare services in general.

The study identified that few HCWs always wear surgical masks, do not reuse disposable surgical masks and one-third of HCWs still recap needles. This low compliance with IPCSPs findings are consistent with other studies which showed that the majority of HCWs were non-compliant [12,13]. These poor practices are due to carelessness, attitude, lack of motivation, inadequate knowledge on IPCSPs among HCWs, and inadequate equipment and supplies in HFs [14–17]. The findings showed that hand hygiene practice between patients was high compared with findings from a study done previously in Tanzania which reported low hand hygiene compliance [3]. The improvement in this current study could be due to the ongoing high profile of IPC and the distribution of hand washing facilities as part of the COVID-19 pandemic response interventions which include hand hygiene.

This study reported that nurses were more likely to comply with IPCSPs at a high level compared to other clinicians, medical attendants and other healthcare professions. This is consistent with a study done in Jordan which showed that nurses’ scores for compliance were higher compared to other clinicians [3]. This could be due to presence of IPC clinical education in their curriculum at nursing school compared to other healthcare professions in which IPC is not included. This seems to have a positive effect on nurses’ compliance with IPCSPs at work.

Furthermore, HFs level was associated with compliance with IPCSPs at a high level. Interestingly, HCWs working at health centers are more likely to comply with IPCSPs at high level compared to those working at hospitals. This finding correlated with another study done previously in Tanzania, which reported HFs from higher service levels (Hospitals) had a relatively higher proportion of IPC scores at baseline. However, during reassessment, lower-level HFs (Health Centers and Dispensaries) in Tanzania had higher improvements in scores compared with those from higher service level HFs to the extent that there was no statistically significant difference between low and high level facilities after the intervention [18]. This could be due to training, supportive supervision (SS) and assessment modalities which were taking place in all facility levels.

The number of years of work experience was associated with compliance to IPCSPs. HCWs who had been at work for 11–15 years were more likely to comply with IPCSPs compared with those who had worked for less than six years. This is consistent with a study done in Jordan which reported length of clinical experience had positive impact on compliance with IPCSPs [3]. This result may be because of experience obtained from many years’ training, mentorship and supportive supervision (SS) on IPC at work during employment. The number of IPC training sessions was also associated with compliance with IPCSPs at a high level. HCWs who had received at least two training sessions were more likely to comply with IPCSPs compared to those who received one training session or those who did not receive any training in the previous year. This is supported by multiple studies which reported IPC trainings as the factor that most affected IPC compliance [19–21]. This can be explained by the fact that IPC training provides current evidence updates on IPC for HCWs and patient safety from lessons learnt from outbreaks that happened including Ebola and COVID-19 and therefore contributing to higher compliance with IPCSPs.

SS was another factor associated with high compliance with IPCSPs. HCWs who did not receive any SS on IPC in a year had low compliance with IPCSPs compared to those who received at least one episode of SS in a year. This finding is consistent with a study done in Liberia which revealed the improvement of IPC compliance when comparing before and after SS [22]. This could be due to SS providing onsite coaching, self-assessment and feedback. The WHO recommended that HCWs are provided with SS in IPC in order to improve their skills, raise job motivation and satisfaction, and to improve performance through technical advice provided on the spot [23]. HCWs with no history of NSI exposure had higher compliance to IPCSPs compared to those exposed to NSI. This finding is similar to study done in China which showed exposure to NSI significant contributed to poor compliance to IPCSPs [24]. This could be explained by inappropriate behaviour and poor adherence to standard operating procedures for the correct handling sharps and for safe injection which may result in NSI [23].

There are some limitations in this study which should be acknowledged. These include Hawthorne effect whereby HCWs changed their health care delivery behaviours while being observed for IPCSPs compliance. However, the study methodology was likely to be more reliable than self-reported behaviour. In addition, because it involved observation over a period of time, the HCWs tended to demonstrate their normal practice. Another limitation is the possible effect of the availability of infrastructure and supplies to HFs on compliance with IPCSPs as the study did not investigate these issues as factors for compliance with IPCSPs. Lastly, the compliance tool used in the study was originally developed and validated to assess self-reported compliance with standard precautions and not as an observation check list tool for compliance with standard precautions. However, we believe that the observation was the best way to ensure real compliance of HCWs. It has been reported in one study that there is a difference between what is reported by HCWs and actual findings [25]. As the study was mainly based on HCWs factors rather than healthcare system factors, we recommend other studies to be conducted on healthcare system factors affecting the compliance with IPCSPs among HCWs.

**Conclusion**

The majority of HCWs in Songwe region had low compliance to IPCSPs. This compliance level is below national level standards to guarantee safety of HCWs and patients especially in this era of emerging and re-emerging infections including the ongoing COVID-19 pandemic. Being a nurse, IPC training, the number of years of work experience, IPC supportive supervision, working in a health centre, lack of NSI exposure were all associated with high compliance to IPCSPs.

Based on these findings, it is recommended that all HCWs regardless of discipline in Songwe region should comply with all
IPCs including hand hygiene, wearing appropriate PPEs, proper waste disposal and decontamination of surfaces. Also, HCWs should be aware of and read available national IPC guidelines, standards and standard operating procedures in order to gain more knowledge and skills in IPC. Furthermore, HCWs should engage with facility and working unit IPC meetings and on the job training to expand knowledge and performance. Healthcare management teams from regional, council and facility level should encourage capacity building in IPC through workshops and cascade training to all HCWs; should intensify IPC SS in different working units to help HCWs improve IPCSS compliance and should ensure patient and HCWs safety and enhance the quality of healthcare services.

The Ministry of Health (MoH) is recommended to invest in more resources and research in IPC implementation and HAIs surveillance. This will enable the MoH to observe any improvements from interventions which are conducted nationally by building HCW capacity and providing evidence-based information for decision making, especially during the ongoing COVID-19 pandemic. Furthermore, there is a need for additional resources for the continuity and intensification of SS and refresher training for all HCWs. Lastly, consideration should be put on inclusion of IPC in curriculum for all healthcare disciplines where IPC is not currently part of the curriculum to promote effective and high quality healthcare services especially in this era of emerging and reemerging diseases.

Credit authors statement

Radenta P. Bahegwa: Conceptualization, writing original draft, data collection, analysis and editing. Ally K. Hussein, Eliudi Eliakimu and Billy Ngasala: conceptualization, review, editing and supervision. Joseph Hokororo, Chrissogne German, Rogath Kishimba and Ruth Ngowi: commented on multiple drafts of the manuscript and approved the final manuscript to be submitted for publication.

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Conflict of interest

Authors declare no competing interests.

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