

Health Facilities Readiness to Implement Standard Precautions for Infection Prevention and Control in Tanzania: Lesson Learnt from SARA Reports

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Abstract

Introduction: Standard Precautions are a set of measures applied in the care of all individuals/patients regardless of their infectious status aiming at preventing healthcare workers and patients from infections, preventing environmental contamination and spread of infections to the community. Many health facilities have not implemented them to an acceptable level. The purpose of the study is to report progress of improvement in health facilities readiness to implement standard precautions for infection prevention and control based on SARA reports. **Methods:** We generated mean scores of all standard precautions each year and calculated their standard deviations, variances and confidence intervals. One-way ANOVA was used to determine if the mean scores were equal. Finally, the trend of improvement in health facilities readiness to implement the standard precautions was generated. **Results:** A total of nine standard precautions were reported in SARA reports for 2012, 2017 and 2020. The mean scores of the standard precautions were 52.22% in 2012, 64.55% in 2017 and 69.66% in 2020. The overall trend showed an increase in health facilities readiness to implement standard precautions, although the mean scores were not statistically different (p -value 0.3217). **Conclusion:** SARA surveys conducted in Tanzania in 2012, 2017 and 2020 have

shown an overall increase in health facilities readiness to implement standard precautions. Safe final waste disposal was being done in fewest facilities while single-use or auto-disable syringes were in most facilities that were sampled in all years. SARA surveys may be a useful way to evaluate Infection Prevention and Control adherence in health facilities.

Keywords

Infection Prevention and Control, Standard Precautions, Health Facilities Readiness, Safe Waste Disposal, Implementation of Standard Precautions

1. Introduction

Standard Precautions are a set of measures applied in the care of all individuals/patients regardless of their infectious status with the aim of preventing health care workers and patients from infections as well as preventing environmental contamination and spread of infections to the community. The key elements of standard precautions are: performing hand hygiene; using personal protective equipment; following respiratory hygiene/cough etiquette principles; ensuring appropriate patient placement; cleaning and disinfecting patient care equipment, instruments/devices and the environment; appropriate linen processing; following safe injection practices; and ensuring healthcare worker safety including proper handling of needles and other sharps [1].

The Service Availability and Readiness Assessment (SARA) surveys in the area of standard precautions cover nine indicators which can be grouped into six categories as follows: waste management (sharps and infectious waste); availability of disinfectant; availability of single-use syringe; availability of soap and running water or alcohol-based hand rub; availability of latex gloves; and availability of guidelines [2]. Tanzania has made many strides in the area of implementation of standard precautions since the inception of the United States President Emergency Plan for AIDS Relief (PEPFAR) in 2003, which provided funding for the prevention of Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS) to 14 countries in Africa and the Caribbean including Tanzania [3]. Key milestones achieved in Tanzania, which aimed at strengthening the implementation of standard precautions are summarized in **Table 1** [3]-[11].

Efforts to improve waste management in health facilities in Tanzania started in 2003 when there was a nationwide health-care waste management-training program that was implemented from 2003 to 2005. During that time, an assessment of facilities found that the methods used for waste disposal were mainly open pit burning (50%) and burying (30%), with a low capacity for incineration in hospitals [4]. The Making Medical Injections Safer (MMIS) Project, which was implemented by John Snow Inc., supported the Ministry of Health in Tanzania to address issues of injection safety and health care waste management using

Table 1. Infection prevention and control—summary of key milestones in Tanzania (2003–April, 2021).

Year	Milestone (Information Source)
2003	Infection Prevention and Control—Injection Safety (IPC-IS) Programme started to be implemented with funding from PEPFAR that was provided as part of the wider HIV/AIDS funding [3].
2003–2005	Nationwide health care waste management training [4].
2004	First National Infection Prevention and Control Guidelines for Healthcare Services was developed [5].
2004	Making Medical Injections Safer (MMIS) project, a five years project (2004–2009) implementation was started with funding support from PEPFAR through the Centers for Disease Control and Prevention [6].
2009	Quality Improvement - Infection Prevention and Control Orientation Guide for Participants was developed (supported by the United States' Agency for International Development [USAID] through the ACCESS program and PEPFAR) with the aim of providing healthcare workers with <i>readable and user-friendly basics of Quality Improvement concepts, IPC practices and logistics management, while incorporating behavior change and communication, to improve quality in health care</i> [7].
2010	Implementation of IPC Standards for Hospitals using the Standard Based Management and Recognition (SBM-R) approach was started [8].
2012	National Communication Strategy for IPC was developed which addresses key social and behavior change communication issues for IPC and outline strategic actions that can help to move people toward the intended behavioral outcomes [9].
2014	Star Rating Assessment initiative was developed and implemented as part of a wider Government of Tanzania effort called Big Results Now in which one of the service areas assessed was IPC. Analysis of its baseline data (2015–16) and reassessment (2017–2018) has revealed improvement in adherence to IPC principles [10].
2015	National IPC Standards for Health Centres and National IPC Standards for Dispensaries were developed [8].
2015	PEPFAR support for IPC ended in 2015.
2018	The National Infection Prevention and Control Guidelines for Healthcare Services of 2004 were revised to produce a 2018 edition [8].
2020	The IPC Standards for Hospitals, Health Centres, and Dispensaries were revised coupled with development of Standard Operating Procedures [8].
2019 to April, 2021	On-going dissemination of the guidelines, standards and standard operating procedures accompanied with IPC standards compliance assessment using SBM-R tool [11].

adapted strategies designed by the World Health Organization's Safe Injection Global Network including: “*Capacity building and training; commodity management and procurement; behavior change communication and advocacy; es-*

establishing standardized systems for safe health care waste management; establishing policy environment which supports injection safety and health care waste management; increasing health care workers safety; and monitoring and evaluation” [6]. Its baseline data collected in 2004 indicated that injection safety practices in Tanzania were poor, as noted in the following indicators: handling without washing hands was 50%; poor disposal of sharps immediately after use was 54.2%; recapped needles was 45.8%, and did not use safety boxes was 50.0% [12].

Compliance with standard precautions is key for healthcare workers’ protection. If those are not well adhered to, it leads to exposure of healthcare workers and eventually the community at large to infections. In a study conducted in 14 hospitals (district, regional and zonal referral) in 2006, “*Needlestick injuries accounted for the largest part of the most common accidents (52.9%) among health care workers, followed by splash of blood from patients (21.7%), burn injury from chemicals (10.6%), and slippery floors (5.9%)*” [13].

Also, a study by Chalya, *et al.* (2015) which was conducted in zonal referral hospital (Bugando Medical Centre) in Nyamagana Council in Mwanza found that out of 436 healthcare workers who participated in the study, 212 (48.6%) reported incidents of needlestick injuries and splash exposures within the previous 12 months. Needlestick injuries were reported by 65.1% (n = 138) and splash exposures by 27.4% (n = 58). Sixteen (7.5%) respondents had both needlestick injuries and splash exposures (which means total needlestick injuries were equal to 16 + 138 = 154/436), making the prevalence of needlestick injuries in the past 12 months to be 35.32. In addition, the majority of healthcare workers, 185 (87.3%), were not adequately immunized for hepatitis B virus and only 17 (8.0%) were fully vaccinated, having received three doses of the vaccine. Only 16.7% of exposed healthcare workers received post-exposure prophylaxis for HIV; and subsequent six-month follow-up for HIV showed zero seroconversion [14].

Despite the challenges of unsafe disposal and reuse of contaminated syringes, which affect safe injection practices in low- and middle-income countries [15]; the trend of unsafe injections in sub-Saharan Africa was shown to improve between 2000 and 2010 whereby on average people received only 0.04 - 0.05 unsafe injections per year [16]. Also, Hayashi and colleagues, in the analysis of demographic and health survey data of 2011-2015, for Tanzania, the frequency (defined as the number of health care injections per person per year) was 0.90 (n = 16,780) and the safety of injections as measured by “*use of an unopened syringe or needle*” was 97.6% (n = 4786) [17]. This indicates that the efforts that were put in place by the Ministry of Health in collaboration with stakeholders with funding support from US—PEPFAR since 2003 have helped to improve injection safety practices in Tanzania. Also, the introduction and implementation of the 5S-(sort, set, shine, standardize and sustain)-KAIZEN-Total Quality Management approach [18] [19] has complemented the efforts to improve health care waste management, especially during this error of emerging and re-emerging infectious diseases [20].

The increasing burden of emerging and re-emerging infectious diseases has

highlighted the need for more focus on the implementation of standard precautions for IPC in health facilities in order to protect the health care workers and users. One of the key elements of standard precautions—preventing needle stick injuries is still an issue that requires at most attention. In a recent review by Mengistu and colleagues, (2021), which “*Aimed to determine the career time and previous one-year global pooled prevalence of occupational exposure to needle stick injury among healthcare workers*”, they found that the “*Worldwide pooled prevalence of needle stick injuries among healthcare workers during career time and previous one year was 56.2% (95% CI: 47.1, 64.9) and 32.4% (95% CI: 22.0, 44.8), respectively*” [21]. For Tanzania, the *prevalence of needle stick injuries among healthcare workers in the previous one year is 35.32* [14] [21]. Also, the government has constructed, renovated and or upgraded health facilities in the past five years (2015-2020) in various councils countrywide; therefore, there is a need to understand if the new facilities are ready to implement standard precautions [22].

In that context, studying the “Service Availability and Readiness Assessment (SARA)” data for 2012, 2017 and 2020 will help to inform the Ministries responsible for health issues in Tanzania (Ministry of Health; and President’s Office Regional Administration and Local Government) and all Partners on the trend of facilities readiness and provide some recommendations to address the situation on standard precautions implementation in general. Therefore, the objective of the study is to report on: the progress of improvement in health facilities readiness to implement standard precautions for IPC; and scores attained by health facilities based on SARA survey reports of 2012, 2017 and 2020.

2. Methods

In 2012 the SARA survey was conducted in a nationally-representative sample of 27 districts, with a target sample of 1908 health facilities and a final sample of 1297 health facilities, representing more than 18% of all health facilities in the country. The sample comprised non-government as well as government-owned health facilities. Field work for the survey was conducted in three rounds: the first in May-June, the second in July-August 2012 and the final round in December 2012. Data analysis and report preparation commenced in September 2012. A final round of data analysis and report editing was conducted in January-February 2013.

The 2017 SARA survey in Tanzania was conducted to assist the health sector in assessing and monitoring service availability and readiness and capacity at the district and national levels. The survey was conducted from 2nd to 21st October 2017 by the Ifakara Health Institute in collaboration with the then Ministry of Health, Community Development, Gender, Elderly and Children’s (MoHCDCGEC) through the Monitoring and Evaluation Section in the Policy and Planning Division (*from January 2022, the MoHCDCGEC has been renamed back to Ministry of Health*), and Khulisa Management Services (Khulisa), a South African consultancy company hired by The Global Fund. This was the second SARA survey

to be conducted. Data for the study were collected from a sample of 26 districts and 540 health facilities to provide a representative portrayal of health services in Mainland Tanzania.

In 2020, the data collection for the 2020 SARA survey was conducted from 23rd June to 14th July 2020 by the Ifakara Health Institute in collaboration with the Monitoring and Evaluation Section in the Policy and Planning Division of the then MoHCDGEC. Twenty-six districts, one from each of the 26 regions were selected in which a total of 612 health facilities were selected.

In all three years, the SARA reports do not show how the facilities were sampled. Hence, we can't report the methodology of sampling which was used. However, all levels of health facilities were included based on the health system of Tanzania, that is, primary facilities (Dispensaries, Health Centers and Level one Hospitals) and referral hospitals (levels two, three and four hospitals) [8]. The data were collected by the then MoHCDGEC's Division of Policy and Planning – Monitoring and Evaluation Section in collaboration with partners and consultants. The data were collected using a standard questionnaire instrument and indicators developed by the World Health Organization (WHO).

2.1. Study Variables

The standard precautions items assessed as study variables in the SARA report were as follows: safe final disposal of sharps; safe final disposal of infectious waste; appropriate storage of sharps waste; appropriate storage of infectious waste; disinfectant; single-use-standard disposable or auto-disable syringes; soap and running water or alcohol-based hand rub; latex gloves; and guidelines for standard precautions [2].

2.2. Outcome

The outcome of the study is the mean scores of standard precautions for IPC.

2.3. Data Analysis

We performed secondary data analysis of SARA reports of 2012, 2017 and 2020 and were informed by the literature on the situation of some of the key components of standard precautions as listed on the study variables above. The scores of the SARA report were categorized using the categories used by the WHO IPC Assessment Framework (IPCAF), which is an international tool to score adherence to IPC; in which the scores 0 - 200 maximum 25% is considered inadequate, 201 - 400 maximum 50% is considered as basic, 401 - 600 maximum 75% intermediate and 601 - 800 maximum 100% as advanced [23]. The mean scores of all standard precautions in each year were generated, and their standard deviations, variances and confidence intervals were calculated. One-way ANOVA was used to determine if the mean scores were equal. Finally, the trend of improvement in health facilities readiness to adhere to standard precautions was generated.

3. Results

The scores show percentages of health facilities that had had those elements of standard precautions in their health facilities. The safe final infectious waste disposal was being done in only 11% and single-use-standard disposable or auto-disable syringes were available in 87% of all facilities that were sampled in 2012. The safe infectious final waste disposal was done in only 30% and single-use-standard disposable or auto-disable syringes were available in all facilities (100%) that were sampled in 2017. The safe final waste disposal was done in only 23% and single-use-standard disposable or auto-disable syringes were available in 99% of all facilities that were sampled in 2020. The mean score of the facilities was 52.22% in 2012, 64.55% in 2017 and 69.66% in 2020. The mean scores were not different statistically with $p = 0.3217$. The summary of the percentage scores obtained during the surveys conducted in 2012, 2017 and 2020 is shown in **Table 2**.

The trend of mean scores of health facilities with Standard Precautions compliance

There has been improvement in terms of more health facilities that have the requirements necessary for complying with standard precautions for IPC while providing health care. There has been linear progress from 2012 to 2020 as far as the standard precautions are concerned in health facilities in Tanzania based on SARA reports, even though the mean scores are not statistically different. The linear trend is shown in **Figure 1**.

4. Discussion

In the SARA surveys conducted in Tanzania in 2012, 2017 and 2020, there was an overall increase of health facilities that were ready to comply with the implementation of standard precautions. The scores increased from 52.22% in 2012 to 69.66% in 2020. The survey was in keeping with a study conducted by Abera Beyamo in public health institutions of Dawuro zone, southwest Ethiopia, in

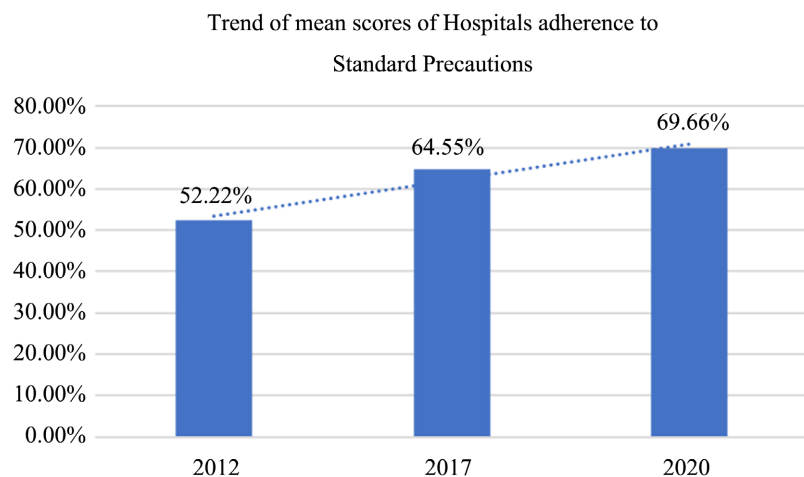


Figure 1. Trend of increase in health facilities with standard precautions.

Table 2. Category based on IPCAF tool showing scores obtained in 2012, 2017 and 2020.

SN	Tracer indicator assessed	% Score in 2012	IPCAF category	Score in 2017	IPCAF category	% Score in 2020	IPCAF Score
1	Safe final disposal of sharps	30	basic	51	intermediate	28	basic
2	Safe final disposal of infectious waste	11	inadequate	30	basic	23	inadequate
3	Appropriate storage of sharps waste	67	intermediate	69	intermediate	80	advanced
4	Appropriate storage of infectious waste	46	basic	62	intermediate	80	advanced
5	Disinfectant	77	advanced	96	advanced	98	advanced
6	Single use—standard disposable or auto-disable syringes	87	advanced	100	Advanced	99	advanced
7	Soap and running water or alcohol-based hand rub	50	basic	60	intermediate	78	advanced
8	Latex gloves	64	intermediate	68	intermediate	76	advanced
9	Guidelines for standard precautions	38	basic	45	basic	65	intermediate
	Total score Σx	470		581		627	
	Mean score \bar{x}	52.22	intermediate	64.55	intermediate	69.66	intermediate
	95% Confidence Interval	52.22 \pm 15.7		64.5556 \pm 14.726		69.66 \pm 17.776	
	Standard Deviation, s:	24.03		22.54		27.21	
	Variance S^2	577.44		508.03		740.25	

The *F*-ratio value is 1.18936. The *p*-value is 0.3217. The result is *not* significant at $p > 0.05$. Hence the mean scores are not different.

2016, who found 65% of health workers had complied with standard precautions [24]. The difference between these two studies is that the SARA surveys looked at the percentage of health facilities that generally comply with the standard precautions while Abera Beyamo *et al.* looked at the percentage of healthcare workers who complied with standard precautions.

The SARA surveys in all three years have found that safe waste disposal in terms of both sharps and infectious waste was very low. At the time when the survey was lastly conducted in 2020, safe disposal was 28%, while that of infectious waste was 23%. The survey is consistent with the study that was conducted by Manyele and Mujuni in 2010 at 135 lower-level facilities (103 dispensaries, 13 clinics, 11 laboratories, and 8 health centers of Dar es Salaam, Ilala Municipality, which showed that only about 39.3% of the facilities utilized on-site single-chamber incinerators for sharps waste treatment, which were of poor design and quality [25]. Also, about 59% of the facilities improvised sharps waste containers, sharps waste was transported by hands in 77% of the facilities, and most facilities stored sharps waste for about 72 hours (before treatment), which is beyond the recommended maximum storage time of 24 hours [4]. The storage practice differs from what SARA surveys had found out; the survey had found

about 80% by 2020, store waste both sharps and infectious waste appropriately. The difference might be due to the duration between the two studies which one was conducted in 2006 and the other one in 2020. There might be a lot of improvements happened in the storage of medical waste in the time interval of about 14 years (2006-2020).

During the surveys, it was realized that the majority of health facilities in the country had disinfectants. In the last survey that was conducted in 2020, it was found that 98% of the facilities had disinfectants. The finding of the presence of disinfectant contradicts the study conducted by Gon and colleagues, who noted that the cleaning and disinfection of health facilities were not at the recommended standard. They found that the proportion of cleanliness ($ACC < 2.5 \text{ cfu/cm}^2$) was only 19.1% during the pre-training period and 40.7% when using microbiological cleanliness (ACC and *S. aureus*) during the post-training period [26]. The finding of the availability of disinfectants to be 98% in the sampled health facilities could be due to the non-utilization of those disinfectants to the maximum potential.

The availability of soap and running water in Tanzanian health facilities were up to 78%, as shown by the SARA report of 2020. The survey differs from the survey conducted by Malebo *et al.* in health facilities of Tanzania that found 60.4% were not connected with piped water supply, but only a few hospitals 16.7% are not connected with piped water supply. However, it was alarming that more than 50% of health centres and dispensaries lacked connectivity with piped water supply. Regarding water availability and access in healthcare facilities visited, 46% reported inadequacies in the water supply. Thirty-two of the visited health facilities (34%) they reported irregular supply and that they experienced water shortages for at least one day in a week, whereas 12 healthcare facilities (12.5%) obtain water only seasonally. Availability of handwashing stations with soap/alcohol-based hand rubs within the facility was also a challenge, 44% of consultation rooms and 42% of delivery rooms in the surveyed healthcare facilities didn't have functional hand washing facilities and some had been replaced by plastic water containers without drainage. Soap for hand washing was present in 51% of consultation rooms and 79% of delivery rooms. As for antiseptic hand rub only 9% and 12% of the health facilities surveyed had antiseptic hand rubs present at hand washing points in consultation rooms and delivery rooms respectively [27]. The difference might be explained by the sharp improvement of infrastructures of the water system in Tanzania as the country reached a lower mid-level economy. The availability of personal protective equipment including gloves, as well as availability of guidelines and standard operating procedures in health facilities also generally improved.

5. Conclusions

The study has demonstrated that in Tanzania, there was an overall increase in health facilities readiness to implement standard precautions for IPC based on the trend from the SARA surveys conducted in 2012, 2017 and 2020. The SARA

surveys in all three years have found that: safe waste disposal in terms of both sharps and infectious waste was very low; availability of soap and running water in Tanzanian health facilities increased to 78% in 2020 from 50% in 2012, and availability of latex gloves increased from 64% in 2012 to 76% in 2020. The availability of soap and running water in Tanzanian health facilities of 78% in 2020 indicates an improvement compared to the study by Kanyangarara *et al.* 2021 on “*access to water, sanitation and hygiene services in health facilities in 18 countries in sub-Saharan Africa 2013-2018*” (including Tanzania), in which they have reported that 74 % of health facilities in all the countries had soap and running water or alcohol-based hand rub [28].

The finding that safe waste disposal in terms of both sharps and infectious waste was very low points to an urgent need for further improvement of health care waste management practices in our facilities given the large volume of the wastes being generated [29] [30]. The availability of soap and running water in Tanzanian health facilities of 78% in 2020 has an implication in the current time when globally and in Tanzania, we are struggling with controlling the coronavirus disease of 2019 (COVID-19) pandemic, in which hand washing is a key preventive measure [28]. As a way forward, the two Ministries: The Ministry of Health; and the President’s Office—Regional Administration and Local Government, need to intensify efforts to improve the availability of soap and running water in health facilities, as well as improve sharps and infectious water management in health facilities. Such efforts should also include behavior change interventions to enable the maintenance of individual handwashing behavior [31].

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Author Contributions

All authors conceptualized the manuscript and contributed to the literature search; All authors drafted the background, discussion and conclusion; JCH, ESE, MH and AM contributed to the Data analysis and drafting of the methodology section; and JCH drafted the results section. All authors read, edited and approved the final manuscript.

Conflicts of Interest

We declare that there are no any competing interests.

Disclaimer

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References

- [1] Centers for Disease Control and Prevention. National Center for Emerging and Zoonotic Infectious Diseases (NCEZID)—Division of Healthcare Quality Promotion (DHQP). <https://www.cdc.gov/infectioncontrol/basics/standard-precautions.html>
- [2] World Health Organization (2015) Service Availability and Readiness Assessment (SARA): An Annual Monitoring System for Service Delivery. Reference Manual, Version 2.2. 2015. World Health Organization, Geneva.
- [3] Fauci, A.S. and Eisinger, R.W. (2018) PEPFAR—15 Years and Counting the Lives Saved. *The New England Journal of Medicine*, **378**, 314-316. <https://doi.org/10.1056/NEJMp1714773>
- [4] Manyele, S. and Anicetus, H. (2006) Management of Medical Waste in Tanzania Hospitals. *Tanzania Journal of Health Research*, **8**, 177-182. <https://doi.org/10.4314/thrb.v8i3.45117>
- [5] Ministry of Health (MoH) (2004) National Infection Prevention and Control Guidelines for Healthcare Services in Tanzania. MoH, Dar es Salaam.
- [6] Making Medical Injections Safer (MMIS) Project—John Snow Inc. (2010) Reducing Unsafe and Unnecessary Injections in Africa and Haiti. The Making Medical Injections Safer Life of Project Report. March 2004 to September, 2010. MMIS, Arlington.
- [7] Ministry of Health and Social Welfare (MoHSW) (2009) Quality Improvement—Infection Prevention and Control Orientation Guide for Participants. MoHSW, Dar es Salaam.
- [8] Hokororo, J., Eliakimu, E., Ngowi, R., German, C., Bahegwa, R., Msigwa, Y., *et al.* (2021) Report of Trend for Compliance of Infection Prevention and Control Standards in Tanzania from 2010 to 2017 in Tanzania Mainland. *Microbiology & Infectious Diseases*, **5**, 1-10. <https://doi.org/10.33425/2639-9458.1118>
- [9] Ministry of Health and Social Welfare (MoHSW) (2012) National Communication Strategy for Infection Prevention and Control 2012-2017. MoHSW, Dar es Salaam.
- [10] Kinyenje, E., Hokororo, J., Eliakimu, E., Yahya, T., Mbwele, B., Mohamed, M.A., *et al.* (2020) Status of Infection Prevention and Control in Tanzanian Primary Health Care Facilities: Learning from Star Rating Assessment. *Infection Prevention in Practice*, **2**, Article ID: 1000712. <https://doi.org/10.1016/j.infpip.2020.100071>
- [11] Hokororo, J., Mohamed, H., Ngowi, R., German, C., Bahegwa, R., Msigwa, Y., *et al.* (2021) Evaluation of Infection Prevention and Control Compliance in Six Referral Hospitals in Tanzania Using National and World Health Organization Standard Checklists. *Preventive Medicine, Epidemiology and Public Health*, **2**, 1-9. <https://doi.org/10.31038/PEP.2021232>
- [12] Ministry of Health and Social Welfare (MoHSW) (2006) DO NO HARM: Injection Safety in the Context of Infection Prevention and Control—Participants' Manual. Draft 4. MoHSW, Dar es Salaam.
- [13] Manyele, S.V., Ngonyani, H.A. and Eliakimu, E. (2008) The Status of Occupational Safety among Health Service Providers in Hospitals in Tanzania. *Tanzania Journal of Health Research*, **10**, 159-165. <https://doi.org/10.4314/thrb.v10i3.14356>
- [14] Chalya, P.L., Seni, J., Mushi, M.F., Mirambo, M.M., Jaka, H., Rambau, P.F., *et al.* (2015) Needle-Stick Injuries and Splash Exposures among Health-Care Workers at

- a Tertiary Care Hospital in North-Western Tanzania. *Tanzania Journal of Health Research*, **17**, 1-15.
- [15] Gyawali, S., Rathore, D.S., Shankar, P.R. and Kumar, K.V. (2013) Strategies and Challenges for Safe Injection Practice in Developing Countries. *Journal of Pharmacology and Pharmacotherapeutics*, **4**, 8-12. <https://doi.org/10.4103/0976-500X.107634>
- [16] Pépin, J., Abou Chakra, C.N., Pépin, E. and Nault, V. (2013) Evolution of the Global Use of Unsafe Medical Injections, 2000-2010. *PLOS ONE*, **8**, e80948. <https://doi.org/10.1371/journal.pone.0080948>
- [17] Hayashi, T., Hutin, Y.J.-F., Bulterys, M., Altaf, A. and Allegranzi, B. (2019) Injection Practices in 2011-2015: A Review Using Data from the Demographic and Health Surveys (DHS). *BMC Health Services Research*, **19**, Article No. 600. <https://doi.org/10.1186/s12913-019-4366-9>
- [18] Ministry of Health and Social Welfare (MoHSW) (2009) Implementation Guideline for 5S-CQI-TQM Approaches in Tanzania. Foundation of All Quality Improvement Programme. MoHSW, Dar es Salaam.
- [19] Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC) (2019) Implementation Guideline on 5S-KAIZEN-TQM Approach in Tanzania. The Path to Total Quality Managed Hospital. 4th Edition, MoHCDGEC, Dodoma.
- [20] Ishijima, H., Miyamoto, N., Masaule, F. and John, R. (2021) Improvements to Healthcare Waste Management at Regional Referral Hospitals in Tanzania Using the KAIZEN Approach. *The TQM Journal*. <https://doi.org/10.1108/TQM-10-2020-0254>
- [21] Mengistu, D.A., Tolera, S.T. and Demmu, Y.M. (2021) Worldwide Prevalence of Occupational Exposure to Needle Stick Injury among Healthcare Workers: A Systematic Review and Meta-Analysis. *Canadian Journal of Infectious Diseases and Medical Microbiology*, **2021**, Article ID: 9019534. <https://doi.org/10.1155/2021/9019534>
- [22] Kapologwe, N.A., Meara, J.G., Kengia, J.T., Sonda, Y., Gwajima, D., Alidina, S., *et al.* (2020) Development and Upgrading of Public Primary Healthcare Facilities with Essential Surgical Services Infrastructure: A Strategy towards Achieving Universal Health Coverage in Tanzania. *BMC Health Services Research*, **20**, Article No. 218. <https://doi.org/10.1186/s12913-020-5057-2>
- [23] World Health Organization (2018) Infection Prevention and Control Assessment Framework at the Facility Level. World Health Organization, Geneva.
- [24] Beyamo, A., Dodicho, T. and Facha, W. (2019) Compliance with Standard Precaution Practices and Associated Factors among Health Care Workers in Dawuro Zone, South West Ethiopia, Cross Sectional Study. *BMC Health Services Research*, **19**, Article No. 381. <https://doi.org/10.1186/s12913-019-4172-4>
- [25] Manyele, S.V. and Mujuni, C.M. (2010) Current Status of Sharps Waste Management in the Lower-Level Health Facilities in Tanzania. *Tanzania Journal of Health Research*, **12**, 257-264. <https://doi.org/10.4314/thrb.v12i4.53362>
- [26] Gon, G., Kabanywanyi, A.M., Blinkhoff, P., Cousens, S., Dancer, S.J., Graham, W.J., *et al.* (2021) The Clean Pilot Study: Evaluation of an Environmental Hygiene Intervention Bundle in Three Tanzanian Hospitals. *Antimicrob Resist Infect Control*, **10**, Article No. 8. <https://doi.org/10.1186/s13756-020-00866-8>
- [27] Malebo, H.M., Njee, R.M., Sosovele, E., Makundi, E.A., Mubyazi, G., Mremi, I., *et al.* (2016) Water, Sanitation and Hygiene Situation in Health Care Facilities in Tan-

- zania Mainland and Way Forward. National Institute for Medical Research, Tanzania.
- [28] Kanyangarara, M., Allen, S., Jiwani, S.S. and Fuente, D. (2021) Access to Water, Sanitation and Hygiene Services in Health Facilities in Sub-Saharan Africa 2013-2018: Results of Health Facility Surveys and Implications for COVID-19 Transmission. *BMC Health Services Research*, **21**, Article No. 601.
<https://doi.org/10.1186/s12913-021-06515-z>
- [29] Kagonji, I.S. and Manyele, S.V. (2011) Analysis of the Measured Medical Waste Generation Rate in Tanzanian District Hospitals Using Statistical Methods. *African Journal of Environmental Science and Technology*, **5**, 815-833.
- [30] Kuchibanda, K. and Mayo, A.W. (2015) Public Health Risks from Mismanagement of Healthcare Wastes in Shinyanga Municipality Health Facilities, Tanzania. *The Scientific World Journal*, **2015**, Article ID: 981756.
<https://doi.org/10.1155/2015/981756>
- [31] Shao, M., Mushi, V., Mwelange, L. and Mwakitalima, A. (2021) The Improvement of Functional Handwashing Facilities during COVID-19: The Perspective of Tanzania. *Tropical Medicine and Health*, **49**, Article No. 46.
<https://doi.org/10.1186/s41182-021-00334-y>