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Designing a Framework for Enhancing the Implementation of Syndromic Surveillance of Surgical Site Infections in Health Facilities: Learning from Tanzania

Joseph C. Hokororo[1,5*], Arup Chakrabartty[4], Erick S. Kinyenje[1], Eliudi S. Eliakimu[1], Akili Mawazo[3], Bruno Sunguya[2],

[1]Health Quality Assurance Unit, Ministry of Health, Dodoma, Tanzania

[2]School of Public Health and Social Sciences, Muhimbili University of Health and Allied Sciences, Tanzania

[3]Department of Microbiology and Immunology, Muhimbili University of Health and Allied Sciences, Tanzania

[4]Department of Public Health, Texila University, India

[5]Central University of Nicaragua (UCN) in association with Texila International Marketing Management

Abstract

The ability to use data to improve infection prevention and control (IPC) measures is essential to the provision of high-quality healthcare. In low- and middle-income countries, there is no reliable data for healthcare associated infections due to either absent or inadequate surveillance framework. To address this challenge of no reliable data of healthcare-associated infections from its healthcare facilities, Tanzania has developed and is putting into use a syndromic surveillance framework. This study aims at providing an overview of essential procedures for setting up a syndromic surveillance framework for surgical site infections. The set-up was done to help Tanzanian healthcare facilities improve their IPC practices. This study originated from a thorough review of reports on the development of the framework for implementation of syndromic surveillance in Tanzania, covering IPC situation analyses, policy guideline development, training, mentorship, supervision, assessments, the creation of the IPC page in District Health Information System 2 (DHIS 2), and data quality evaluations. To improve IPC within local health facilities and across all authorities throughout the health system, this report illustrates the essential milestones associated with designing the framework for implementing syndromic surveillance to comprehend the burden of surgical site infections.

Keywords: *Framework Development, Healthcare-Associated Infections, Infection Prevention and Control, Surgical Site Infections, Syndromic Surveillance, Tanzania.*

Introduction

Syndromic surveillance is concerned with continuous monitoring of public health-related information sources and early detection of adverse disease events. In order to effectively prevent, diagnose, and control infectious disease outbreaks whether they are the result of natural causes or bioterrorism attacks frameworks are also being deployed [1]. Specifically, individuals who are ill may show behavioral patterns, symptoms, indicators, or laboratory findings that can be monitored using a range of data sources, even before an infectious disease is confirmed in the laboratory. Frameworks for syndromic surveillance are being developed at the local, regional, and national levels. The primary focus of syndromic surveillance is to aid in the

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****Corresponding Author: drhokororo@gmail.com***

early identification of a disease to inform research, clinical care, general public health, quality improvement, and patient safety [2].

Syndromic surveillance is a useful early warning system for epidemic diseases and in the tracking of the burden of diseases so as to up with counter measures that may help to control the epidemic or any burden of diseases. Low and middle-income countries (LMICs) either lack or have inadequate syndromic surveillance frameworks in place. In this era marked with emerging and reemerging of infectious diseases, antimicrobial resistance (AMR) and other Health care Associated Infections (HAIs), it is critical that syndromic surveillance frameworks are put in place for the early identification of their potential occurrences, burden and health consequences [3].

One of the unfavorable outcomes of providing healthcare is HAIs to patients and healthcare workers. In developing nations with insufficient resources, their burden is high. HAIs are infections that are contracted during the provision of healthcare in any context, including ambulatory care, home care, and at healthcare facilities [4]. HAIs have an impact on health facilities and the health of the general public. Infections at the surgical site referred as Surgical Site Infection (SSI) are one of the main categories of HAIs. SSI was again the third most common HAI, accounting for 15.7% of reported infections in the point prevalence survey of inpatients in England [5].

The SSIs must occur within 30 days of surgery unless a foreign body is left in situ. In the case of implanted foreign material, one year must elapse before surgery can be excluded as causative. SSIs are subdivided in three types based on depth of tissue involvement into three clinically relevant categories as: Superficial incisional SSIs involve only the skin and subcutaneous tissue; Deep incisional SSIs involve deep soft tissue layers, such as fascial or muscle layers of the incision and Organ space SSIs involve any anatomic structure opened or manipulated during the operative procedure [6]. Some of the risk factors for SSIs include the following: demographic features Sex, Age, American Society of Anesthesia (ASA) score of 3 or more, wound classification, non-use of World Health Organization (WHO) safe surgery checklist during surgery, operative time, low level of compliance with Infection Prevention and Control (IPC) by health care workers of the health facility.

These unexpected infections that arise after surgical therapy have the potential to significantly increase patient morbidity and mortality as well as necessitate further diagnostic and therapeutic procedures, which are expensive [7]. Every SSI that happens during medical surgical procedures needs to be followed up on and find out what is the root cause of that SSI so as the counter measure is established. Inadequate and uncomprehensive data reporting methods in many healthcare facilities are among the shortcomings Tanzania face. Tanzania has therefore established a Syndromic Surveillance for SSI framework to address that problem.

Tanzania through program of IPC of the Ministry of Health (MoH), designed syndromic surveillance framework in collaboration with various stakeholders. It started by updating policy guidelines of IPC and latter followed up with development of IPC syndromic surveillance framework. From the framework, registers and summary forms were developed. Furthermore, the data set from the summary forms were developed in the District Health Information System 2 (DHIS2). The entire process took place from 2018 to 2021.

When the process of designing and development was done, the first batch to be trained was regional referral hospitals. It was in November 2021 when the first batch of referral hospitals started to report in the DHIS2. The training process continued in phases and as of October 2024 a total of 148

health facilities are reporting SSIs in the DHIS2. Hence, the aim of this study is to describe the details of milestones of Designing of framework for Syndromic Surveillance of SSIs.

Rationale for Designing of Syndromic Surveillance Framework

Introduction of IPC core components by the WHO required countries to conduct HAIs surveillance to determine the burden of HAIs and come up with interventions that would mitigate the consequences of HAIs as well as on economy of patients, health facility, community and the country at large. In addition, Tanzania had made significant investments in the last five years to expand basic health services, particularly surgical treatments throughout the nation especially at the level of Primary Health Care (PHC) with intention to meet Universal Health Coverage (UHC). Documentation of the implementation of syndromic surveillance of SSIs had not been done.

The SSI surveillance framework provides the systematic steps of documentation and reporting of the SSIs occurrences from the patients who underwent surgeries. Tanzania was not documenting and reporting SSIs, hence the burden of it was not known. In order to determine the burden of SSIs, the framework was designed to help the healthcare workers to systematically document and report SSIs. Hence the aim of this study is to describe and share the milestones of designing a framework of a syndromic surveillance of SSIs for IPC improvement in Tanzania.

General Objective

The objective of this study is to describe the designing milestones of setting up a syndromic surveillance framework of SSIs for IPC improvement in Tanzania Health Facilities.

Standardization of Syndromic Surveillance

Tanzania has designed traditional HAI surveillance framework, where patient charts are manually reviewed by applying standardized case definitions to detect incident HAIs. This manual surveillance is time consuming and prone to error and subjective interpretation. Surveillance and feedback of infection rates to clinicians and other stakeholders has been a cornerstone of quality improvement in HAI prevention programs [2]. However, use of the same case definition, same data set, same indicators provide standardization of the surveillance. In addition, the trained members of quality improvement teams and IPC coordinator provide standardized surveillance methodology.

Aggregate data from participating health facilities, councils and regions provide benchmarking information for health facilities in the councils, councils in the region and regions at national level. Also, feedback to facilitate caregivers, health facilities, health management teams at the council and region as well as at MoH and the President's Office - Regional Administration and Local Government (PO-RALG) in the interpretation of HAI rates from accurate and reproducible data.

Successful quality improvement programs require accurate and reproducible data regarding the occurrence of HAIs and tools to assess the effect of interventions. Hence, measuring the incidence of HAIs provides essential data for action, and surveillance registers, summary forms and DHIS2 serve as a valuable structure for collecting and interpreting the data. Successful use of DHIS2 in surveillance using data stored in server has been successful for various data of HAIs, including SSIs. In addition, the use of DHIS2 SSI surveillance has facilitated monitoring every month and quarter at any level of administration because once data is uploaded

can be instantly seen at all levels. The potential advantage of the use of framework has facilitated the development of syndromic surveillance through DHIS2 in Tanzania (Figure 1).

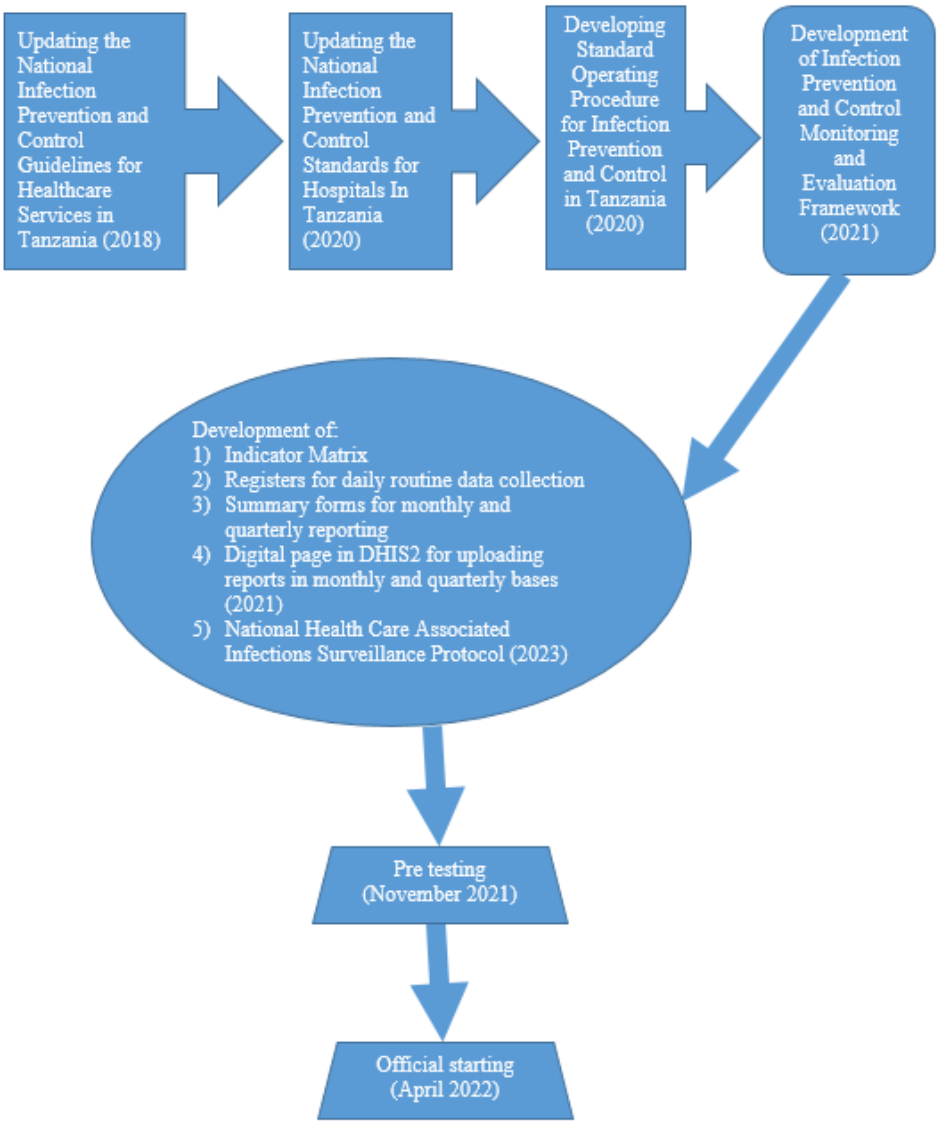

Figure 1: Conceptual Framework of Milestones of Setting up Syndromic Surveillance of Surgical Site Infections

Syndromic Surveillance Milestones

Designing Phase

Situation Analysis of IPC in Tanzania

There were the following gaps in IPC area, according to star-rating evaluations of Tanzanian healthcare facilities conducted between 2015/2016 and 2017/2028 [8]: Failure to follow protocols and standard operating procedures (SOPs). Healthcare workers and other service providers failed to sufficiently follow IPC guidelines and standards, in spite of their availability. Healthcare personnel lacked the necessary information and abilities to do IPC basic tasks, particularly those employed by lower-level facilities. Materials and equipment were also lacking. Gloves, goggles, plastic aprons, boots, and other personal protective equipment (PPE) were not provided in sufficient quantities. The lack of PPE increased the risk of occupational infections among healthcare workers and clients. In recent years, there had been a

progressive decline in providing equipment and materials to prevent infection. Additionally, it was found that, there was inadequate supportive supervision to the health facilities. There was a shortage of qualified supportive supervisory staff; a lack of supportive supervision had been identified at all levels of health care service delivery. Furthermore, there was lack of renovation and maintenance of infrastructure. Systems, such as electrical, water, and drainage were often not fully functional, and facility conditions were often overcrowded. These problems were due to a lack of awareness, inadequately qualified human resources, financial constraints, and the lack of involving frontline healthcare workers in planning.

Updating the National IPC Guidelines for Healthcare Services in Tanzania (2018)

The situation analysis above and some other challenges led to the updating of these IPC guidelines: Despite several changes over the past 20 years brought about by the emergence and reemerging of illnesses like Ebola, HIV/AIDS, and influenza, the IPC guidelines lacked these new information and recommendations from the WHO and United Republic of America-Center for Disease Control and Prevention (USA-CDC). In addition, people have the right to safe and quality health, which necessitates a safe environment for both patients and healthcare professionals, as well as the availability of fresh scientific information that makes it easier to give safe and effective preventive and control measures. HIV/AIDS epidemic, which has increased the risk of transmitting infections in health care settings because of the various procedures conducted in these facilities and increased awareness of how risky of getting infection it is to work in health facilities. Also, increase of AMR in the country and globally. All these together with results of situation analysis necessitated the revising of the IPC guidelines developed in 2004 to incorporate strategies to address all of them in 2018.

Updating the National IPC Standards for Health Facilities in Tanzania (2020)

In the late 1990s, the MoH started IPC activities through a variety of programs in collaboration with development partners, that contributed to the development of the document called "*National Norms, Guidelines, and Standards on Cross Cutting Issues for Health Care Practice in Tanzania; February 2003*". In 2004, more concerted efforts to carry out IPC began when the Health Services Inspectorate Unit (HSIU) developed the National Infection Prevention and Control Guidelines for Health Care Services in Tanzania (2004). Experience gathered over two decades of program implementation demonstrated some progress of IPC practices within health care facilities, though the improvement was not to the expected level [8, 9, 10]. The MoH decided to develop and implement National IPC Standards to add the impetus of improvement of health facilities such that they will: contribute to the delivery of safe health care and social care services; promote a multidisciplinary approach to IPC, provide an environment that drives improvement in quality, safety and accountability; encourage all staff involved in the delivery of health and social care to accept responsibility for their role in preventing and controlling infection; promote continuous quality improvement through regular monitoring and evaluation of IPC services as well as encourage attainment of best practices.

Developing SOPs for IPC in Tanzania (2020)

When handling medical procedures that have a high potential to spread infections among patients, healthcare workers, the general public, and environmental contamination, these SOPs for IPC were created to assist health service providers in

healthcare facilities in operating with guidance. The highest standards of IPC and transmission-based precautions were to be followed when performing medical procedures. This implies that in the process of providing health services, healthcare professionals will be required to adhere to established SOPs. Failure to do so could result in the infection of healthcare professionals, patients, communities, and the surrounding area. The Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC) emphasized the need for health professionals to be safe while providing care in order to guarantee high-quality care at all levels.

Development of IPC M&E Framework (2021)

The National Framework for M&E of IPC was created to offer helpful direction to all parties engaged in the execution of M&E of Tanzania's health sector IPC intervention. In order to provide pertinent information to programmers and managers for the successful implementation of protecting healthcare workers and clients against HAIs, it was intended to coordinate and synergize national efforts to ensure effective M&E of the IPC strategy for decision-making.

Implementing Quality Improvement requires a crucial component of M&E of the IPC activities. M&E are necessary to control and account for resources, enhance service delivery, and finally determine the effectiveness of interventions. Implementers can pinpoint issues and improve, correct, or modify techniques with the help of M&E. M&E was designed to give policy makers information on the sustainability and cost-effectiveness of programs; it was also meant to enable implementers and donors to monitor the IPC among healthcare workers and evaluate the degree to which interventions are being carried out and goals met. Additionally, M&E and surveillance would all contribute to the improvement of data to support trend analysis in the IPC and create connections between resources and intervention efforts.

Also, an M&E framework was designed specifically to track the advancement of IPC implementation. Important national and international metrics that will be used to offer details regarding the extent, caliber, and effects of IPC initiatives were laid out in the framework. The framework also outlines the various techniques that will be used to measure the frequency of each indicator. These techniques involve regular data collection and reporting of services rendered at medical facilities, which in turn would enable national surveys, surveys of medical facilities, modeling, and surveillance.

Implementation Phase

When the entire preparatory phase was done such that all tools were developed in terms of data collection registers, summary forms for reporting and the digital page, the task which followed was preparation of human resources who will use the tools and the digital page system. Preparation of the human resource was basically in terms of training them. The training was done in cascading manner from national trainers to the implementors.

Training of the Trainers

Training of the national trainers was key for the implementation stage. About 35 IPC national trainers were trained as the national trainers for M&E. These national trainers were multi-disciplinary and were coming from referral hospitals (regional, zonal and national hospitals). The training was on indicator matrix, how to fill the registers, how to fill the summary form and how to navigate in the DHIS2 in terms of data entry, sending report and how to find the reports in the system. The training was for one week to cover everything (theory and hands) on for DHIS2. This training took place in 2021.

Training of the Regional Team and Implementers at Referral Hospitals

Two individuals were trained at the regional level (i.e., from the Regional Health Management Team (RHMT)): a Regional Quality Assurance Focal Person and a Regional Health Management Information System (HMIS) Focal Person. We also included five healthcare professionals from all public referral hospitals in the area: the data manager, the theater nurse, the IPC focal person, the hospital's matron/patron, and the hospital quality assurance focal person. There are multiple referral hospitals in some areas. For example, in the same region, there are national, zonal, and regional hospitals. We took into account all of the local referral hospitals in this scenario. In order to complete all of the regions, we worked in groups of regions according to the number of referral hospitals in each region. We ensured that no more than 45 people participated in each training. In November 2021, the first training batches began to report in DHIS2. The training process was repeated until 38 public referral hospitals were trained, at which point they are all required to report to the DHIS2.

Training of the Council Team and the Implementers at PHC Facilities

Similarly, at the council level we trained two people from the Council Health Management Team (CHMT) namely council Health Management Information System (HMIS) Focal Person and Council Quality Assurance Focal Person). We also, included five healthcare workers' representatives namely Hospital Quality Assurance Focal Person, IPC Focal Person, Theater nurse, Matron/Patron and Data Manager of the hospital from all public council hospitals in the region. Some councils don't have hospitals, so the health center which is used as an alternative of the council hospital was included. Some councils have more than one hospital together with hospitals owned by non-government organizations, however, the government has share with them through application of service agreements [11, 12]. In such scenario we included all those hospitals from the council. We did sequentially one region per session where by all hospitals at council level were included. We still made sure the number of participants did not exceed 45 participants per training.

Pretesting and Official Reporting of the Data in the DHIS2

The process started as a pretest with 33 healthcare facilities, mostly referral hospitals. Enrolling of health facilities was done sequentially from November 2021 to March 2022 to report in DHIS2. The challenges and gaps in the registers, summary forms, and DHIS2 that were reported were all examined, and the ones that made sense were added to the tools for development. With the team's approval and everything finished, the surveillance framework was formally launched. A total of 54 healthcare facilities started to formally report in April 2022 as soon as the system was finished. As of February 2024, 117 healthcare facilities reported implementing the IPC, which includes SSI syndromic surveillance indicators. Out of nine regions that are reporting, 30 are referral hospitals and 87 are PHC facilities that is hospitals at council level and health centers have been trained and hence, started to report in DHIS2 in November 2021. The cascade is ongoing till we finish all 26 regions to be trained and report in the DHIS2.

Current SSIs Syndromic Surveillance Framework

Tanzania has a semiautomated surveillance system to monitor SSIs. To keep track of every client having surgery, we use a denominator register or form. This form collects preoperative data such as patient biodata, surgical team participation, operation details, and risk index score. A small percentage of

patients who have had surgery could develop SSIs. Syndromic surveillance of SSIs involves using a case definition to identify patients who have a high risk of developing SSI based on signs and symptoms such as fever, heat, and pain, as well as redness, purulent drainage or material, incision intentionally opened or drained, abscess, tenderness, sinus tract, wound spontaneously dehiscing, and localized swelling. The patient selection focuses on high sensitivity to detect possible SSIs to be confirmed by bundles of syndromes. Stakeholders reached a consensus regarding these symptoms and indicators. The patient is added to the SSI numerator register or form once the case definition is satisfied. The summary of those who developed SSI among those who did not is completed and recorded into the summary form at the end of each month. The disaggregation is carried out according to age, sex, wound type, patient risk score prior to surgery, and kind of SSI (superficial or deep within an organ/space). This is the summary that is uploaded to the DHIS2. Figure 2 depicts the process. Any authority within Tanzania's health system has access to this summary.

Figure 2. Current process in SSIs Syndromic Surveillance Framework in Tanzania.

Conducting Mentorship and Supportive Supervision

The national facilitators provide regular mentorship and supportive supervision to all facilities where the reporting team has received training and begun reporting. Checklists for supportive supervision and mentorship are used to guarantee uniformity throughout medical facilities for standardization. This is being done in order to emphasize to the reporting team and other staff members at the medical facility how important it is to record and report in the DHIS2. In addition, supportive supervision and mentorship to provide clarification on the spot for any topics that were unclear during the theoretical training. Furthermore, we take advantage of this chance to highlight the facilities' need to perform a basic analysis of the data in order to use the evidence to solve the shortcomings associated with IPC implementation and adherence. Likewise, in order to improve the framework overall, the national team received feedback from the implementation team regarding the difficulties and deficiencies in the registers, summary forms, and DHIS2.

Conducting Data Quality Assurance

High-quality data is required for all facilities reporting in the DHIS2. We initially established a system at the facility level to guarantee that, prior to the data being uploaded, at least two persons have verified the accuracy and completeness of the data in order for the reported data to reach high quality. Second, frequent assessment by the national team to ensure the quality of the data are required. To guarantee standardization, the data quality assurance checklist was created. Using the checklist, one can verify whether the information obtained from registers matches that found in the summary forms and DHIS2. It is also used to determine whether the data are relevant to the reporting facility in terms of

the number of patients and healthcare staff it serves each month as well as whether the data are consistent with other facility data.

Data Analysis and Feedback

Four stages of data analysis are intended for the SSIs surveillance and other M&E indicators, with the lower levels receiving input at each stage. The first level of analysis takes place at the facility level, where the quality assurance team is responsible for conducting the analysis and reporting the findings to the management of the health facility as well as the medical staff. This allows for the collaborative development of countermeasures to address the gaps and challenges identified.

The second level of analysis is done at the council level, where the CHMT under coordination of the quality assurance focal person, must analyze data for every facility in the council and develop interventions and support plans for the facilities they oversee. The third level of analysis is at the regional level, where the RHMT, coordinated by the quality assurance focal person, is responsible for conducting data analysis for all the facilities in their region. Also, in collaboration with council level, are supposed to develop interventions and support plans for the facilities they oversee.

Under the coordination of the IPC Sub-Unit of the Quality Assurance Unit of the MoH, analysis at the national level, which is the final and fourth level, is required for all facilities reporting in the DHIS2. The analysis and report are intended to be sent as feedback to all health facilities. The Sub-Unit is in charge of directing the creation of policies, guidelines, standards, and SOPs; providing instructions, training, mentorship, and supportive supervision on behalf of the national level (MoH). Conversely, the execution is being supervised by the PO-RALG. Therefore, in order to support all healthcare facilities nationwide, the MoH and PO-RALG are collaborating to develop the national IPC interventions.

Development of the National HAIs Surveillance Protocol (2023)

It is imperative that all health care workers be capable of applying evidence-based IPC procedures. HAIs are also a concerning issue on a global scale. However, the burden of HAIs may be even greater in developing nations without surveillance frameworks, like Tanzania. Therefore, in order to overcome the lack of a HAI surveillance framework, the MoH has created a national protocol for HAI surveillance in partnership with stakeholders. SSIs, catheter-associated urinary tract infections (CAUTI), central line-associated bloodstream infections (CLABSI), and ventilator-associated pneumonia (VAP) are the only four HAIs that are initially taken into consideration in this protocol. The creation of this protocol will aid in demonstrating the scope, seriousness, and preventative actions of HAIs. The National HAIs Surveillance Protocol offers evidence-based guidance on how to conduct surveillance properly. Indicator Matrix has been incorporated in the protocol which contains 21 IPC performance indicators. Out of the 21 indicators, 3 are involved with SSIs surveillance.

Development of Syndromic Surveillance Tools for Daily Data Collection

The daily routine data collection registers were established so that data may be routinely collected for reporting. Healthcare professionals utilize these registers to record any actions taken to apply and comply with IPC at the facility level. At the conclusion of every month and quarter, the documented data are summarized using monthly and quarterly reporting summary forms. Out of the 21 reported indicators, 13 are reported on a monthly basis, while the rest are reported on a quarterly basis. Data from the register are summarized using the summary forms before

uploading in the digital system. The summary forms and the digital page which is used for reporting are copies of each other. The digital page in DHIS2 for uploading reports in monthly and quarterly bases was also developed in 2021.

Is Syndromic Surveillance Sole Solution for Improving Infection Prevention and Control?

There are other ways to improve IPC both at national level and in healthcare settings outside syndromic surveillance. To enhance IPC at healthcare facilities and at the central level, various interventions are required. Given their interdependence, these many interventions must be bundled in a thorough and cohesive manner. The WHO presented the interventions and identified them as core elements of the IPC. Monitoring the HAIs through surveillance is one of these strategies. The following apply to each core component at the national and acute healthcare facility levels.

Core Component 1: IPC Programs

One element of providing safe health care is the present of IPC program. A 2015 WHO global survey found significant deficiencies in national IPC capacity. Just 54 (41%) of the 133 countries that responded have a national IPC program in place. In order to avoid HAIs and battle AMR using IPC best practices, the panel suggests that every acute healthcare facility implement an IPC program with a team of committed, trained healthcare workers. The panel also is in favor of creating an independent, operational national IPC program with well-defined goals, roles, and actions in order to use IPC best practices to prevent HAIs and fight AMR. Professional associations and other pertinent national programs ought to be connected to the national IPC program. [13]. Also, the 2022 WHO IPC Global Report has shown that for Tanzania: "*a national IPC programme and operational plan are available and national guidelines for health care IPC are available and disseminated. Selected health facilities are implementing the guidelines, with monitoring and feedback in place*" which still indicates sub-optimal implementation [14].

Core Component 2: IPC Guidelines

A key component of providing high-quality healthcare is utilizing the best available data, and reliable clinical practice guidelines are a crucial resource for informing evidence-based practices. The evidence that has been aggregated and transformed into specific, practice-oriented recommendations forms the basis of guidelines. Governments and professional associations have encouraged and supported the creation of guidelines as a means of minimizing differences in practice. Numerous nations have national or regional infrastructure devoted to synthesizing research and creating guidelines, as well as incentives intended to promote actions informed by the most recent suggestions of guidelines. Technical recommendations that are in line with the available data are necessary to establish a strong foundation that will encourage the application of best practices. It is noteworthy that the mere existence of guidelines does not guarantee their adoption; rather, the principles and findings of implementation science make it abundantly evident that local adaptation is a necessary condition for the successful adoption of guidelines. The panel suggests that in order to lower HAI and AMR, evidence-based guidelines be created and put into practice. To ensure successful implementation, it is necessary to evaluate adherence to guideline recommendations and provide education and training to pertinent health care workers [15]. This has a potential to inform on which strategy/strategies can better improve adherence, as many factors have been shown to influence implementation of clinical guidelines including "*organizational culture,*

educational sessions, reminders, and audit and feedback" [16].

Core Component 3: IPC Education and Training

The panel recommends that IPC education be implemented for all health workers through the use of participatory team- and task-based strategies, as well as bedside and simulation training to lower the risk of HAIs and AMR. The national IPC program should support the education and training of the health workforce as one of its core functions. This includes a robust health care worker education and training component with the aim of reducing specific types of infections, such as SSIs. Additionally, health care worker training is essential component for effective guideline implementation (see Core component 2) [17].

Core Component 4: HAI Surveillance

It is commonly known that monitoring systems make it possible to assess the local burden of AMR and HAIs and help identify new AMR patterns, such as clusters and outbreaks, as well as early detection of AMR and HAIs.In accordance with IPC guidelines and the local HAIs situation, IPC actions ought to be tailored to the specific requirements of the healthcare facility. For these reasons, AMR patterns and other HAIs surveillance frameworks are crucial parts of national and facility IPC initiatives. The development of general public health capability and the reinforcement of fundamental public health functions are further benefits of national IPC surveillance frameworks. The panel suggests conducting facility-based HAIs surveillance to direct IPC activities and identify outbreaks, including AMR surveillance. Results should be promptly communicated to stakeholders and healthcare professionals via national networks. The panel suggests that in order to lower HAIs and AMR, national HAIs surveillance programs and networks be established. These programs and networks should include methods for timely data feedback and have the potential to be utilized for benchmarking. However, study by Anna Deryabina and colleagues in Georgia found that, of the 41 hospitals, twenty-one (76%) reported doing HAIs surveillance. All WHO-recommended components of HAIs surveillance, such as a list of priority HAIs, established case definitions, standardized data collection and review procedures, and clearly defined roles and duties, were not reported to be present in any of the hospitals' systems [18]. This also, reflects the global situation in which in 2017-2018, HAIs surveillance was reported by 46.6% of countries [19].

Core Component 5: Multimodal Strategies

Studies in implementation research and IPC over the last ten years have shown that deploying many interventions/approaches integrated in a multimodal strategy yields the highest results for best practice interventions [20]. Fundamentally, a multimodal implementation strategy aids in the application of guidelines and evidence to healthcare practices in an effort to modify the behavior of healthcare professionals [21]. A multimodal approach is made up of multiple components or pieces (three or more, generally five) that are applied in a coordinated way. It contains resources created by interdisciplinary teams that take into consideration regional characteristics, like checklists and packages. The top five most typical elements consist of: (i) system change (improving equipment availability and infrastructure at the point of care) to facilitate best practice; (ii) education and training of health care workers and key stakeholders (e.g., managers and hospital administrators); (iii) monitoring of practices, processes, and outcomes and providing timely feedback; (iv) improved communication (e.g., reminders in the workplace or videos); and (v) culture change by fostering a safety climate. It is commonly acknowledged that concentrating solely on one strategy (component) will not

result in or maintain behavior change. It is acknowledged that, in comparison to regional initiatives alone, a national strategy to the execution of multimodal IPC enhancement activities offers significant advantages. The term "national" was used in this work to refer to both national and/or subnational (such as state-wide) activity. In order to enhance procedures and lower HAIs and AMR, the panel suggests putting IPC activities into practice utilizing multimodal methodologies. The panel suggests that the national IPC program should assist and coordinate the national or subnational execution of IPC activities using multimodal methodologies [22].

Core Component 6: Monitoring/Audit of IPC Practices and Feedback

Preventive measures like hand and respiratory hygiene, the use of surgical antimicrobial prophylaxis, the aseptic manipulation of invasive equipment, and many more must be consistently practiced in order to successfully use IPC interventions. The behavior of each healthcare professional as well as the accessibility of infrastructures and resources determine how appropriate these treatments are carried out. Standardized audits, indication monitoring, and feedback are required to regularly analyze working processes in order to find requirements deviations and to enhance performance and compliance [23]. The efficacy of national policies and initiatives can be tracked through the M&E of national programs, which also provides vital information to aid in implementation, future development, and improvement. To prevent and control HAIs and AMR at the facility level, the panel advises doing routine monitoring/audits and prompt feedback of health care procedures in accordance with IPC standards. All audited individuals as well as pertinent staff members should receive feedback. The panel suggests creating a national IPC M&E program to gauge how well standards are being fulfilled and how well activities are being carried out in accordance with the goals and objectives of the program [13]. At the national level, hand hygiene monitoring with feedback ought to be taken into account as a key performance measure [24].

Core Component 7: Workload, Staffing and Bed Occupancy

It is acknowledged that overcrowding in medical facilities is a public health concern linked to the spread of disease. The patient-to-bed and health care worker-to-patient ratios should be determined by taking into account a number of variables, such as patient acuity, the demand for healthcare, and the availability of a skilled staff. Overcrowding thus appears to be simply defined as the imbalance between the constant increase in healthcare demand and the lack of resources to meet those demands [25]. These elements might make it more difficult to provide the ideal staff-to-patient ratio, which could result in higher rates of HAIs and the spread of AMR. The panel suggests that in order to lower the risk of HAIs and the transmission of AMR, the following guidelines should be followed: (i) the number of beds occupied should not be beyond the facility's maximum capacity; (ii) the number of health care workers should be appropriately assigned based on the workload of patients [13].

Core Component 8. Built Environment, Materials and Equipment for IPC at the Facility Level

For the health and safety of patients as well as healthcare professionals, safe and efficient performance in the daily provision of patient care and treatment is essential to achieving the best possible results. A work system that facilitates the efficient application of IPC practices should be prioritized in order to optimize the health care environment and assist the promotion of standardized and effective clinical practice in compliance with

standards. Hand hygiene is regarded as the cornerstone of clinical treatment and is necessary to stop the development of AMR and HAIs [26]. The globally recognized method for bringing about a behavioral shift in hand hygiene practices is a multimodal strategy (component 5). The work system in which hand hygiene is practiced, or an environment with materials and infrastructure that support compliance at the point of care, is one of the five components of the WHO hand hygiene improvement plan. General rule: when performing patient care activities, all facets of the water, sanitation and hygiene (WASH) infrastructure and services, the availability of suitable IPC materials, and the cleanliness and/or hygienic conditions that support practices related to the prevention and control of HAI and AMR should be taken into account. Human factors engineering, or ergonomics, recognizes that providing enough materials, objects, and equipment in relation to WASH services and arranging them in the best possible way are essential components that support appropriate use and promote adherence to best practices. In the end, this helps achieve the intended behavior to promote IPC and facilitate its effective deployment. IPC has concerns over a number of environmental issues [27]. The interventions that address specific aspects of the building's planning and WASH-related situations in the medical facility are the most pertinent. The panel determined that a fundamental element of a successful IPC program in healthcare facilities is the description of the proper WASH services, atmosphere, and materials and equipment for IPC. Therefore, the panel agreed to create a good practice statement outlining the most pertinent components for a safe environment supporting appropriate IPC procedures, even in the lack of specific studies testing the efficacy of these crucial characteristics as interventions to minimize HAIs and AMR. The panel suggests that at the point of care, supplies and tools needed to practice proper hand hygiene should be easily accessible [13].

Discussion

We have designed a framework for implementation of a semiautomated surveillance in Tanzania in order to improve the country's IPC. At the facility level, we have created daily documentation registers together with monthly and quarterly summary forms. At the end of each month and quarter, the IPC Focal Person at the health facility compiles information for eight indicators that are reported monthly and thirteen indicators that are reported quarterly. The information from the paper registers and summary forms is then input into the digital platform DHIS2. According to Maaike S. M. van Mourik et al.,[28], in semiautomated surveillance, patients with a high risk of HAIs are chosen by an algorithm using information manually entered into summary forms and registries. Without laboratory evidence, patients with a clinical probability of infection are presumed not to have developed HAIs. However, in completely automated systems, all accessible electronic data is used to apply a uniform definition; no manual assessment is performed. Tanzania is employing the former model [28].

WHO recommends through core components to monitor and report data on HAIs, including SSIs [17]. Standardized definitions, procedures, forms, and instruments are provided by surveillance frameworks. Additionally, it enables benchmarking and comparison amongst hospitals. The WHO also provides information and guidelines for HAIs including SSIs prevention and control. Validating SSIs surveillance is crucial, according to the USA-CDC and WHO, since it aids in determining the scope of the disease and evaluating the effectiveness of any interventions aimed at prevention or mitigation. It also provides feedback to physicians and other health care providers and allows accurate comparison of infection rates

across different environments. To verify SSIs surveillance, uniform definitions, data collection forms, and reporting guidelines are employed. Comparing the surveillance data with information from other sources, such as Central University of Nicaragua (UCN) in association with Texila International Marketing Management test findings, post-discharge questionnaires, or patient records, may also be necessary. It may also entail carrying out a proactive risk assessment to determine and rank the areas that require improvement [29].

Tanzania buys these recommendations from WHO and USA-CDC in that, by establishing surveillance will help in preparedness and response of emerging and reemerging outbreaks, that is, HAIs surveillance will make preparedness and response plans easier to implement and helps detect any impending outbreaks. Surveillance is an essential part of a successful HAIs infection control program, as evidenced by the Study on the Efficacy of HAIs Infection Control (SENIC) and the experience with surveillance of surgical wound infections. Furthermore, a well-run monitoring and IPC program that provided surgeons with feedback on infection rates was linked to a notable decrease in HAIs. A number of HAIs surveillance techniques have lately been released as substitutes for thorough or hospital-wide surveillance [30].

Health facilities that use syndromic surveillance should be able to determine the number of SSIs that are present in their health facilities. The health facility is therefore able to plan or reinforce IPC interventions that will lessen the burden once the burden is understood. Unlike health facilities, regions, or nations that do not conduct surveillance, achieving optimal prevention of HAIs necessitates surveillance establishment [28]. Currently, Tanzania's Mainland has made significant progress in implementing HAIs surveillance. Syndromic surveillance techniques for HAIs specifically SSIs have been created and widely used. Across the nation, all public referral hospitals and some district hospitals have started to implement. The HAIs surveillance protocol which has taken into account four common HAIs to start with (SSIs, CAUTI, CLABSI, and VAP) is an essential guide to achieve HAIs surveillance. In Vietnam, due to scarce resources, they chose to start a “standardized HAIs surveillance framework for BSI and urinary tract infections” [20].

Despite the successful implementation of the surveillance, there are challenges that hinder the implementation of it especially in LMICs like Tanzania. Main challenges of Tanzania to implement syndromic surveillance across the country are inadequate knowledge of healthcare workers on the importance of data for planning and improvement, inadequate human resources for health who are already overburdened with healthcare provision, inadequate resources to cater for registers, summary forms and computers at facility level especially at PHC Facilities. These challenges facing Tanzania are in keeping with the study by Mehtar et al.[31] identified in the meta analysis which they did. Two major obstacles to IPC implementation in LMICs include a lack of adequate funding and insufficient human resources. It's possible that certain acute care facilities in LMICs don't have any IPC programs at all, and that there are staff members who lack the necessary training to carry out follow-up IPC initiatives and broad-based surveillance. Systematic reviews also exhibit these issues. The majority of individual reports in LMIC environments are biased toward larger, more prestigious hospitals with operational microbiological labs. IPC activity and staff awareness of IPC programs are more common in institutions of this size. In contrast, smaller hospitals—generally speaking, first-level hospitals with between 50 and 200 beds that serve populations of 50,000 and 200,000 people, like PHC Facilities in Tanzania—acquire the

majority of patient care. Numerous of these institutions lack both microbiological labs and efficient IPC initiatives, like SSIs surveillance and hand hygiene campaigns [31].

Furthermore, there may be issues with the quality of the data, especially when working with PHC Facilities and other lower-level healthcare facilities. For infectious diseases, syndromic surveillance provides several notable examples. For example, Google Flu Trends, a tracking tool designed to predict influenza, was heralded as a success before it was revealed to have major issues and was discontinued. The usage of such extensive query data may be the cause of Google Flu Trend's problem, which is known as a "feature selection" issue. Due to this issue, people must assume that looking up "influenza" online signifies a medical issue rather than something else, such a school report [3].

Way Forward

All of core components must be reinforced and put into practice both in referral hospitals and in PHC facilities. Even while surveillance is a fundamental element, it won't be enough to enhance IPC at the facility and national levels. Surveillance, however, is essential for gathering data that could be applied to the effective implementation of other core components and other IPC measures. Therefore, it may be argued that syndromic surveillance is an evidence-based strategy for enhancing IPC and other core components.

Tanzania uses syndromic surveillance, but moving from syndromic models to laboratory-based methods will advance the field toward improved surveillance frameworks. This is especially true if a clear decision is made about the culture, sensitivity, and ultimately isolation of the microorganism is made. AMR can be fought with the use of laboratory-based surveillance of SSIs, which will also help with better SSIs management through the identification and isolation of microorganisms and their susceptibility to antimicrobial agents. Laboratory based surveillance will also help the healthcare workers create an antibiogram specifically for their health facilities. Furthermore, the quality of care for infectious patients will be greatly improved by having an antibiogram performed by the health facilities. The patients will receive prescriptions for medications that are sensitive to the microorganisms causing the infection.

Last but not least we plan to move from semi-autonomous to full autonomous surveillance. It will be achieved through digitalization of all tools used in surveillance. The tools that are not yet digitalized are registers and summary forms. When these tools will be digitalized, the healthcare workers will not use long time in the process of documentation. Different systems will be linked so as to make the data full automated.

Conclusion

We acknowledge that syndromic surveillance for SSIs can be challenging for healthcare workers who perform it because the signs and symptoms used to diagnose SSIs are not always consistent with what is listed in the case definition, particularly when a small group of symptoms is used. These symptoms can vary from person to person, from time to time, from place to place, and sometimes significantly. Moreover, the follow-up mechanisms necessitate thorough preparation, a commitment of time and resources, and careful facilitation of frequent discussions among healthcare workers help to achieve the syndromic surveillance as planned. Nonetheless, when put into practice and developed over time by supportive supervision and mentoring, health care personnel can be instilled with a culture that can lead to engendering a commitment to follow up with all surgery patients and detect those who develop SSIs. Utilizing data for improvement can also help teams identify areas for progress, draw lessons from past mistakes, and make adjustments to optimize results and effect

when applied in the spirit of continuous improvement. One could argue that, in the long term, syndromic monitoring may prove cost-effective since it prevents SSIs, which can be expensive for the patient, healthcare facility, community, and nation as a whole. This is true even though carefully designing, planning, implementing, and facilitating the system can be labor-intensive.

Ethical Consideration

Permission to develop a documentary review was sought from National Institute for Medical Research Tanzania (NIMR), Health Research Ethics Committee of Tanzania and permission from MoH through Health Quality Assurance Unit.

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Author Contributions

The Principal Investigator, Dr Joseph C. Hokororo led the overall design, implementation, conceptualization and writing the article. Professor Bruno Fokas Sunguya, guided to the writing, review, and editing of the article. All co-authors reviewed and approved the final version of the article.

Competing Interests

None declared.

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