

Establishing a Sustainable Operations Management System for Maternal, Child Health and Infection Prevention and Control Using Quality Improvement Approaches: Learning from Chanika Health Centre, Tanzania (2021-2024)

Joseph C Hokororo^{1*}, Jackline Makupa², Rashid Mfaume², Sangmoon Shin³, Sangmi Lee³, Pius Kagoma², Radenta Bahegwe¹, Ruth Ngowi¹, Yohannes Msigwa¹, Erick Kinyenje¹, Syabo Mwaisengela¹, Omary Nassoro¹, Chrisogone German¹, Laura Marandu¹, Mbwana M Degeh¹, Mohamed Mangu'una⁴, Clara Mwita⁴, Agnes Mgaya⁶, Semeni Ssegellah⁵, Sophia Ntomola⁵, Anence Kamasho⁵, Omary Mwasi⁵, Pascal Nkii⁶, Grace Milanzi⁶, Joyce Mwampyate⁶, Meshack Ayoub⁶, Bakari Mahadhi³, Dasol Choe³ and Eliudi S Eliakimu¹

¹Ministry of Health, Health Quality Assurance Unit, Dodoma, Tanzania.

²President's Office-Regional Administration and Local Government, Dodoma, Tanzania.

³Medipeace, Tanzania Office, Dar es Salaam, Tanzania.

⁴Regional Health Management Team, Dar es Salaam Tanzania.

⁵Dar es Salaam City Council Health Management Team, Dar es Salaam.

⁶Chanika Health Centre, Dar es Salaam, Tanzania.

ABSTRACT

Chanika Health Center was established in 1975 as dispensary and upgraded to Health Centre after construction of several buildings including Maternity wing, OPD, Obstetric, Operating Theatre, Laboratory, Radiology and Imaging, CSSU, Laundry, and 3 story Staff houses buildings with the aid from the Republic of Korea through Korea International Cooperation Agency (KOICA) and it was inaugurated in August, 2017. In around 2021 the health Centre had increased number of patients attending the facility; therefore, it faced some challenges in terms of inadequate of staff, inadequate operations management skills, inadequate infection prevention and control (IPC) level, maintenance of facilities and equipment provided by KOICA. Limited knowledge and low community awareness on maternal and child health (MCH). Following the gaps above Medipeace in collaboration with KOICA supported the project on "Establishing a Sustainable Operations Management System for Maternal and Child Health and Infection Prevention and Control in Chanika Health Centre," Tanzania (2021-2024). Needs assessment was conducted at facility level and the discussion with Dar es Salaam Regional Health Management Team (RHMT) and Dar es salaam Council Health Management Team (CHMT). Key health worker at different departments/units/wards were also interviewed on needs required to have a sustainable operations management system for quality services provision and adherence to IPC standards. Some of the gaps identified were: limited equipment and consumables for the health delivery, inadequate water, sanitation and hygiene (WASH) infrastructures, salt water supply, inadequate health care workers (HCWs)' knowledge and skills, as well as inadequate facility health technology management. Led to unsatisfactory customer care, where 35% of the customers were not satisfied with the health providers and services. After identification of those gaps, quality improvement approaches started to be implemented. The approaches involved the following: capacity building on IPC and WASH infrastructure and trainings; IPC & WASH monitoring, Health facility planning, monitoring and evaluation (M&E) trainings, customer care training, provision of Health technology, WASH facilities and IPC equipment, and dissemination of IPC guidelines and Standard Operating Procedures. Capacity on community health workers and supporting their community activities for MCH.

Keywords

Maternal and Child Health, Infection Prevention and Control, Standard Operating Procedures.

Corresponding Author Information

Joseph C Hokororo, Ministry of Health, Health Quality Assurance Unit, Dodoma, Tanzania.

Received: June 10, 2025; **Accepted:** July 18, 2025; **Published:** July 28, 2025

Copyright: © 2025 Hokororo JC. This is an openaccess article distributed under the terms of the Creative Commons Attribution 4.0 International license.

Citation: Hokororo JC, Makupa J, Mfaume R. Establishing a Sustainable Operations Management System for Maternal, Child Health and Infection Prevention and Control Using Quality Improvement Approaches: Learning from Chanika Health Centre, Tanzania (2021-2024). *Advances Infect Diseases Therapy*. 2025;2(2):1-12.

Key Findings

The Quality Improvement Initiatives implemented in Chanika Health Center addressed challenges in availability of Personal Protective Equipment (PPE), availability of hand hygiene supplies, facilities for waste segregation and cleaning buckets (triple bucket mopping systems). Hence Medipeace supported this area of equipment's provision to improve area of Maternal, Child Health and Infection Prevention and Control (IPC).

The initiative found that, there was only 30% of health care workers (HCW) who were trained on basic knowledge on IPC practices. Hence, Medipeace supported this area of capacity building with more emphasis on awareness and knowledge creation on standard and transmission-based precautions for IPC. The result shows that, the number of HCWs who attained training on IPC increased from 30% to 81%. The acquired knowledge by HCWs improved the adherence of IPC standards during provision of services especially for the Maternal, Child Health services.

There were infrastructure barriers, such as limited access to clean and soft water, sanitation facilities, waste disposing facilities. Before the Chanika project, the facility used hard water that led to damage of equipment all over the facility, and there were limited technologies in waste disposal whereby local burning chamber were used. Hence, Medipeace supported the linkage construction of water supply system from Dar es Salaam Water Supply and Sanitation Authority (DAWASA) system to enable Chanika Health Centre to get soft water, moreover construction of high-tech incinerator and hand wash facilities.

The initiatives assisted in monitoring of Surgical Site Infection (SSI) as well as neonatal infection through monitoring and evaluation. Both infections were high, 83 cases for SSI out of 13,799 Caesarean Section conducted and seven cases for neonatal sepsis out of 45,208 live Birth) before the quality improvement initiatives in the year 2022 but improved after the interventions to 55 SSI out of 14,192 CS conducted and 4 cases of neonatal sepsis from 42,485 live birth latter in 2024.

Key Implication

Other health facilities may benefit by learning from the experience gained by Chanika Health Centre by implementation of these quality improvement initiatives. The adherence scores for IPC improved from 42% in the year 2022 to 86.12% in 2024.

Introduction and Background

Chanika Health Centre started as a dispensary, thereafter was upgraded from dispensary driven by the need to address the healthcare challenges faced by the rapidly growing population, among the challenges being Maternal and Child Health (MCH) Services. Supporting the upgrading the services, construction of additional buildings with the aid from the Republic of Korea through Korea International Cooperation Agency (KOICA) and it was inaugurated in August, 2017. In 2021 a need arose on post

management of the previous KOICA funded project in Chanika Health Center. Since the project was completed, the facility had increased number of patients, and hence started to face some challenges including lack of staff, lack of operational management skills, low infection prevention and control (IPC) level, maintenance of facilities and equipment provided by KOICA, low IPC knowledge and low community awareness on maternal and child health (MCH). Following the gap noted above, Medipeace in collaboration with KOICA supported the project on “*Establishing a Sustainable Operations Management System for Maternal and Child Health and Infection Prevention and Control in Chanika Health Centre, Tanzania (2021-2024)*”.

The aim was to strengthen capacity on sustainable quality improvement on MCH and IPC in Chanika Health Center and raise community awareness on MCH within Chanika area. Using quality improvement approaches grounded on IPC as a key component of health systems and affects the health and safety of both users and providers of health services. Water, sanitation and hygiene (WASH) infrastructure also was a key for IPC performance [1]. Effective IPC programs are the foundation for reducing endemic health-care-associated infections (HAIs), curbing the spread of antimicrobial resistance (AMR), and strengthening the containment of emerging pathogens [2]. It also contributes to the reduction of neonatal and maternal death [3]. An infection contracted at a hospital or other healthcare institution is referred to as a hospital-acquired infection, or nosocomial infection [4]. It is occasionally referred to as a HAI to highlight both hospital and nonhospital settings [5]. A hospital, nursing home, rehabilitation center, outpatient clinic, diagnostic lab, or other therapeutic settings can all be the source of this type of infection. Operating rooms and other nosocomial settings can get contaminated due to a variety of dynamic processes [6].

There are several ways that an infection can spread to a susceptible patient in a healthcare setting. In addition to contaminated equipment, bed linens, or air droplets, healthcare personnel can potentially transmit infections. The source of the infection may be unknown, but it might also come from the external environment, another patient [7] or perhaps contaminated healthcare workers (HCWs) [8,9]. After surgery or other operations that weaken the skin's protective layer, the microbe may become opportunistic and arise from the patient's own skin microbiota. Since the illness occurs in a medical facility, it is still regarded as nosocomial even if the patient may have got it from their own skin [10]. When there is no proof that the infection was existing when the patient arrived at the medical facility, it is referred to as a nosocomial infection. This means that the illness was either acquired or developed after the patient was admitted.

The burden of HAIs in Tanzania is estimated to be 14.8% making it one of the highly affected Low- and Middle-Income Countries (LMICs) [11]. However, HAIs are avoidable if effective IPC interventions are implemented [12]. Various stakeholders have been supporting IPC in the country. One of those stakeholders is Medipeace who have been supporting implementation of IPC

interventions in Dar es Salaam health facilities through the project called “Establishing Sustainable Operations Management System for Maternal and Child Health and IPC from 2021 to 2024”. The main areas of focus were strengthening the functionality IPC and adherence of basic IPC standards, surveillance and data quality management. Strengthen services, Other areas of focus included improve WASH infrastructure, improve facility operations management and program for Community Health Workers CHW on raising community awareness on MCH services.

Chanika Situation Before Project

Needs assessment was conducted at facility level and the discussion with Dar es Salaam Regional Health Management Team (RHMT) and Dar es salaam Council Health Management Team (CHMT). Key health worker at different department/wards were also interviewed on needs required to have a sustainable operations management system for MCH and IPC. The gaps identified during assessment were on the areas of:

- **Equipment and Consumables:** limited and out of services of some of basic equipment and consumables to support effective MCH services and for the IPC practice was observed. Study by Yilma et al. found that many equipment of health facility is not repaired. It was reported further that sanitation facilities such as water pipes, handwashing basins, latrine fixtures, incinerators, laundry equipment, and sterilizers were not repaired properly or regularly [13].



- **WASH infrastructures:** most of the WASH infrastructure were worn out and un functioning due to salt water available, including taps, toilets and hand wash facilities, wash machines and equipment. There were neither enough water storage tanks nor water supply from public suppliers DAWASA. Re - occurrence of regular maintenance and purchases of new instruments and machines were observed, there were no disposal facilities for waste management and areas for client hand wash especially the outpatient clients. There was no access to public water supply.



The pictures show Impact of salt water to the facility infrastructures

- **Health Care Workers’ knowledge and:** inadequate knowledge on IPC and noncompliance to the IPC standards and procedures, only 2.5% of HCWs were trained on a IPC practices, this is in contrary with the National targets that require at least 80% of HCWs to be trained on IPC. Lack of knowledge on the WASH and to 0% on WASH FIT monitoring Tool, useful for monitoring and evaluation of WASH infrastructure. Without appropriately trained HCWs, IPC cannot be implemented according to set standards [14]. Furthermore, gaps were observed on knowledge and skills on the areas of operation and management especially work improvement team.
- Knowledge on equipment maintenance especially first line maintenance was not known to most of the workers and there were inadequate use and operation of the equipment, no updating on the use of equipment or new installed equipment contributing to ineffective services provision. In the medical field, to ensure the use of large medical equipment, it is necessary to carry out regular maintenance on large medical equipment. In the process of maintenance and maintenance of large-scale medical equipment, most medical personnel have not established a corresponding quality management system, neglecting daily maintenance and maintenance, resulting in many hidden dangers of medical accidents.
- **Unsatisfactory customer care:** 35% of the customers were not satisfied with the health providers, services provided and hospital environment. Some of the reason were unavailable service due to equipment/machines ‘faults, limited communication with client, un-function some of toilets, salt water, and no areas for waiting for visiting inpatient client. Assuring good communication and quality of the provided services is essential for the fulfillment of patients’ expectations and needs which may ultimatel lead to customer’s satisfaction [15].
- **Facility planning:** out of 24 HCW participated on planning training only 8 HCW were are with the guideline for planning, 50% were not involved in planning on their operational units, there were no feedback after receive of maximum fund. most of the heads were not aware on the key issue on planning. The planning process at facility were not participatory and only few people were aware of the activities to be implemented. The facility monitoring of data was not effectively linked to the planning; data management was fairly good.
- **IPC performance:** before the project, the Chanika health centre scored 42% in early 2022 according to IPC assessment tools (national Standard-Based Management and Recognition (SBMR) and the World Health Organization (WHO) IPC Assessment Framework IPCAF, Studies highlighted that, there was general improvement of IPC standards adherence by HCWs though not to the expected level, the improvements differ at different levels of health care delivery [16]. The pace of improvement is higher in upper levels that is from regional

referral to national referral hospitals while it was slower in lower facilities namely from dispensaries to district hospitals with high number on infection rate and surgical site infections (SSIs) [16]. There was no facility newsletter for community education on common health issues at Chanika health center and awareness on the outbreak or emerging diseases occurring in the region or outside for community precaution and prevention measures. Furthermore, there was no internal monitoring of IPC interventions at the facility nor reporting of the implementation status of IPC interventions to DHIS2 as per requirements.

- **IPC supportive supervisions:** there was insufficient IPC supportive supervision at least once a year from RHMT and CHMT and this was due to larger number of facilities in Dar es Salaam region, internal supervision and external supervision was lacking at this level of health care facility. There were no mentorship and on job training for IPC due to limited funding. Supportive supervision activities are associated with improved availability of the core components of IPC at health facilities [17].

- **Forum for discussion and sharing facility progress:** There were no established quarterly joint meeting on IPC, limited sharing of the results of supportive supervisions conducted by CHMT or RHMT. There was a need to learn from those good performing facilities on IPC practice at least around Chanika Ward. There were no sharing of the human resource or attachment for learning good IPC practice or laboratory, environmental monitoring.
- **Human resource for health:** regular reallocation of staffs, shortage of staffs and some who are on temporary work contributed to reduced consistence on IPC practice and effective quality of service provision.
- **CHWs at Chanika ward:** on the eight streets of Chanika Ward there were 13 CHWs trained and they were allocated with a ratio of 1: 1. The allocation was not enough for the effective execution of the community health awareness and follow up of health interventions including MCH interventions within the community. They were not working regularly, however they worked where there is a specific issue and mainly, they worked



Figure 1: Chanika Health Centre project overview.

for MCH services. Additionally, CHWs they were neither motivated nor given working tools.

Project Description

The project title was “*Establishing a Sustainable Operations Management System for Maternal and Child Health and Infection Prevention and Control in Chanika Health Centre, Tanzania (2021-2024)*”. The goal is to improve the standards of MCH in Dar es Salaam City Council. Mainly, the focus was on strengthening sustainable MCH services and IPC standards adherence at the facility and raise awareness of community on health at Chanika Ward. Figure gives the project overview.

Project Site/Area: Chanika Health Centre, Chanika Ward, Ilala,

Project Period: Three (3) years from December 2021 – December 2024

Main areas of support: IPC, MCH services, WASH, CHWs and Community awareness and health centre operations.

Funder: The funding was from KOICA 80%, and Medipeace 20%.

Beneficiaries

130 HCWs, 24 CHWs and 188,633 community members from from eight streets within the Chanika Ward namely: Tungini, Vikongoro, Yongwe, Ngwale, Nguvu mpya, Virobo, Kidugalo na Lukooni. Also, Chanika Health Centre provides services to patients from nearby wards.

Method and Approached

Project area

Chanika Health Centre is a maternity facility, located at Chanika Ward, 32 kilometers from City Centre. It is among 3 public health facilities and one of four government Health Centers in Dar es Salaam City Council. The service catchment population of Chanika Health Centre is 106,663 people from Chanika, Zingiziwa, Msongola, and Buyuni Wards. Also, it serves referrals from 13 public health facilities and 50 private health facilities. Services offered by the facility include outpatient department (OPD) services, Laboratory services, Antenatal care (ANC) services, Postnatal services, Labor and delivery services, Care and treatment clinic (CTC) services and, Prevention of mother to child transmission (PMTCT) Services, Radiology and Imaging, Social Welfare services. Also the facility links with Community Health Care Workers in provision of community services including MCH.

Project Implementation Methods

During the implementation of the project several activities were conducted that include but not limited to: capacity building; assessments; provision of equipment and supplies; renovation/building of infrastructure as well as printing and dissemination of guidelines, SOPs and job aids on the areas of IPC and MCH Services.

Capacity building IPC

According to WHO, IPC is a scientific approach and practical solution designed to prevent harm caused by infection to patients and HCWs. It is grounded in infectious diseases, epidemiology, social science and health system strengthening. IPC occupies a unique position in the field of patient safety and quality towards universal health coverage (UHC), since it is relevant to health workers and patients at every single health-care encounter [18]. Poor WASH and IPC lead to HAIs, transmission of diseases from health facilities to communities and increased use of antibiotics and exacerbate outbreak and spread of infections.

Using quality improvement approaches grounded on IPC - WASH as a key component of health systems, capacity building on HCWs knowledge was fundamental. Therefore, IPC training was conducted to establish the facility capacity for IPC. The trainers were from Ministry of Health (MoH) headquarter and others were identified from other institutions/health facilities from the pool of National trainers on IPC. The training was categorised into the following: IPC training of trainers (ToT) training at beginning of the project (1st year), followed by HCWs training on IPC basic training (2nd year) and IPC Advance training and mentorship (3rd year). In each year the ToT were required to continue to conduct on job training at facility level for untrained HCWs, new employees and orient student(s) on field work.

IPC Monitoring

Enhancement of IPC monitoring at different level, internal, inter facilities and external assessment was conducted, the result was shared and used to improve IPC practices. There were also sport check by supervisors in the various departments/wards. SBMR tool for health centers and the WHO IPCAF checklist were used for external and or internal assessment. Furthermore, for Data Quality Assessment (DQA) assessment was done by using Data Verification and System Assessment checklist. The good performer on IPC per department and individual personnel were awarded by the facility. Awards included provision of a certificate for appreciation and display of picture of the personnel.

WASH & WASH FIT train

It is important to note that IPC and WASH cannot be separated. The later providing the basis for adequate IPC implementation. It important that, a potential increase patient influx, the demand for WASH services might be higher than the available offer and that it will be essential to support the gap to avoid health service to be disrupted. So, in supporting the facility it was also important to conduct training on WASH in collaboration with MoH on the 2nd and 3rd year of project implementation, to update the HCWs on basic WASH knowledge and enable to monitor and evaluate WASH services for improvement and planning.

Other Training to Facilitate the Effective Project Implementation

Planning Monitoring and Evaluation trainings

Following the assessment, HCWS knowledge on planning was low and they were required to conduct planning regarding operation of facility activities. A training was conducted to all heads of the department and their assistants on planning, monitoring and evaluation in the 1st and 2nd year. The aim was to have effective planning, monitoring and evaluation on health centre operations, service provision in general and further equip the facility on adequate use of monitoring data for the facility planning. Training was conducted by facilitators from MoH Policy and Planning Division and CHMT. MoH guideline for planning, monitoring and evaluation were used and disseminated to the facility.

Customer Care Training

On the 2nd year customer care training was conducted to improve quality of care and improve client dignity and satisfaction in general. After this training s customer satisfaction monitoring was conducted after six months. A routine exit interview was conducted by CHW allocated to work at facility.

Provision of Equipment and Supplies

During the project implementation, the equipment and supplies for implementation of IPC and WASH interventions were provided. In addition, equipment for improving MCH services were procured, including ultrasound, autoclave, monitoring equipment such as patient monitor, doppler and waste management facilities (waste bins and high-tech incinerator). With the new equipment and facilities installed the need for the user training was important. In collaboration with national hospital, zonal and regional referral hospital, health workers were trained on how to use equipment and maintenance. The aim to equip health care workers with the skills of equipment use and maintenance to enhance equipment durability, quality service and sustainability.

WASH Infrastructure Improvement

Aim was to improve water supply and availability, by connecting facility to public water supply. Additional procure waste collection bins, cleaning triple buckets, trolley, machine for binding bin liner, and PPE for waste management; plumbing and renovation, hand hygiene facilities and sanitation.

Development of document

Raising awareness to the community on MCHservices, promotion and education materials for community use were developed and printed for dissemination. CHWs were used to disseminate during house to house visit in the community. Other documents developed included, standard operating procedures (SOPs) for equipment maintenance and management, newsletters, digital education materials, CHWs training video and community education video for health facility use. The education materials were also used for conducting campaign in the community for MCH services, community meetings and bonanza and to the institution such as schools.

Project Results

Implementation of IPC program at Chanika Health Centre

Resources Issue

There were availability PPE, availability of hand hygiene supplies but limited resources for waste segregation facilities and cleaning buckets (triple bucket mopping systems). Hence, Medipeace supported this area of equipment's provision to improve area of MCH by IPC at Chanika Health Centre.



- Some of the supported waste management equipment

Staff training level

There was only 30% of HCWs who were trained on basic knowledge on IPC practices. Hence, Medipeace supported this area of capacity building with more emphasis on awareness and knowledge creation on standards precautions on IPC (see Table 1). As the result, the number of HCWs attained training on IPC increased to 81%.

Table 1: Implemented training during the project period is as follows;

S/N	Duration	Training Title	Training Type	Number of attained staff	Number of training days
1	1st Year	IPC	Offsite training	14	5
2		IPC	On job training	75	3
3		Planned preventive maintenance (PPM)	On job training	14	5
4		M&E	Offsite training	14	5
5		IPC data management	Offsite training	14	5
6	2nd Year	PPM	On job training	14	5
7		IPC	Offsite training	14	5
8		IPC	On job training	30	3
9		WASH FIT	Offsite training	14	4
10		Customer care training	Offsite training	97	5
11	3rd Year	Equipment user training	On job training	17	4
		Planning and monitoring	Offsite training	14	5
11		PPM	On job training	5	5
11		M&E	Offsite training	10	5
12		Incinerator Operation	Offsite training	1	14
13		Surveillance for neonatal infection prevention SNIP	Offsite training	12	5
		Planning and monitoring	Offsite training	15	5
14		WASH FIT	Offsite training	12	5

WASH Infrastructure Issue

There were infrastructure barriers, such as limited access to clean and soft water. Sanitation facilities, waste disposing facilities. Before

Chanika project, the facility used hard water that led to damage of equipment all over the facility, there was limited technologies for waste disposal whereby local burning chamber were used. Hence, Medipeace supported the linkage construction of DAWASA water system and construction of high-tech incinerator and hand washing facilities for the visitors and client. Figure 2 shows performance of the WASH infrastructure. The hygiene indicator before was 100% it was during COVID -19, however after the pandemic the hygiene indicator decrease.



IPC and M&E of IPC indicators

Before the project, there wasn't monitoring of IPC indicator such as monitoring of SSIs, neonatal sepsis, environmental sterility, and waste segregation. Hence, through the project, the facility planned the M&E for IPC and implemented. Based on conducted external assessment in 2024, results showed that the highest performing department scored 95.97%, the lowest performing department scored 77.05%, and the overall performance was 86.12%. According to the Tanzania IPC SBMR tool and the recognition guideline for quality improvement intervention implementation MoH guideline 2014, Chanika was awarded a recognition by MoH. The percentage score for all departments/units after assessment by using National IPC Standards (SBMR Tool) was as shown in Table 2.

Through continued follow up, supervision and mentorship, IPC consumables supply and use of IPC standards, the figure 3 shows the trend from the start of the project to the end year 2024 external assessment score. The assessment was conducted with expertise from MoH in collaboration with RHMT and CHMT as the main supervisor for the facility.

In order to ensure sustainable monitoring of the IPC system in the facility, the project used the available system for quality improvement. Therefore, quality improvement team (QIT), IPC focal person and work improvement teams (WITs) in departments were available to ensure the following: - they conduct in-service training on IPC; setting standards and monitor staff performance; enhancing consistent support by all hospital administrators,

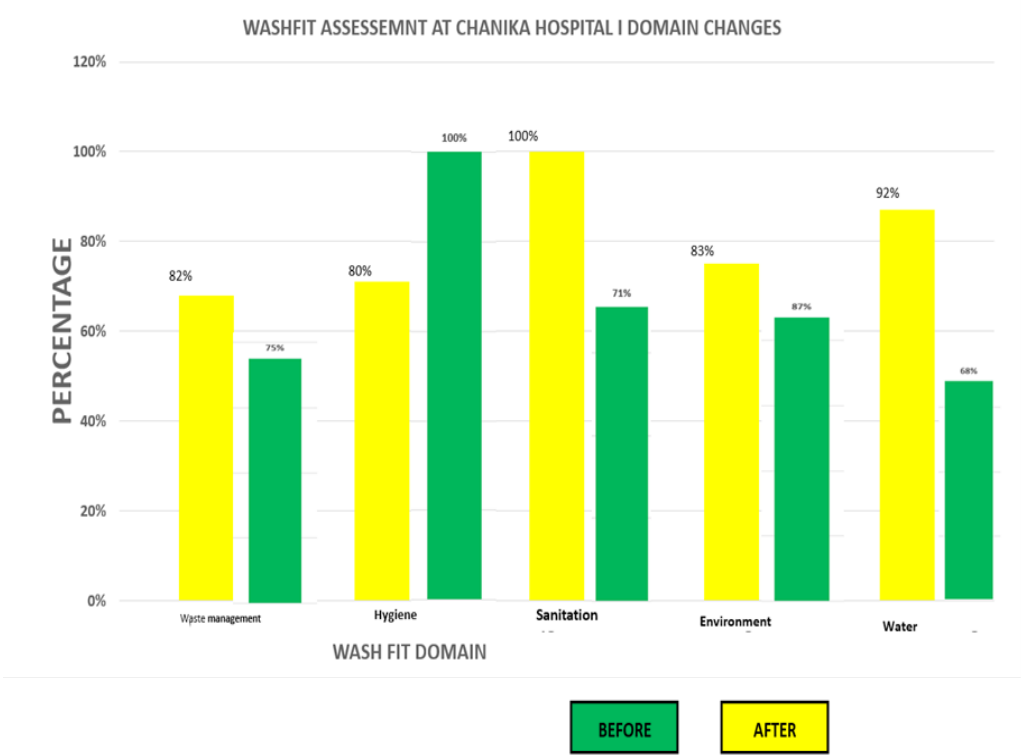


Figure 2: WASH FIT performance.

Table 2: Project end IPC evaluation.

Legend Set Definition: Color Representation				
0 - 59.99 Poor Performance	60 - 79.99 Moderate Performance	80 - 100 Excellent Performance		
Highest Performance		95.97%		
Lowest Performance		77.05%		
Overall Performance		86.12%		
Section			% Score	Points Scored/Maximum Points
Obstetrics and Gynecology Theatre			90.59	11.78/13
Central Sterilization and Supply Unit (CSSU)			91.42	9.14/10
Emergency Medical Department (EMD)			90.68	12.70/14
Outpatients Department (OPD)			77.05	10.02/13
Dental Unit			79.50	10.33/13
Eye Unit			79.05	13.44/17
Pharmacy & Store			82.66	9.92/12
Laboratory			92.22	11.07/12
Radiology Department			77.78	10.89/14
Labour Ward			94.08	12.23/13
Postnatal Ward			87.35	9.61/11
RMNCAH			84.05	8.40/10
Care and Treatment Centre (CTC)			83.79	10.05/12
Laundry			95.97	10.56/11
Healthcare Waste Management (HCWM)			85.67	5.14/6
Administration			86.04	6.88/8

RMNCAH = Reproductive, Maternal, Newborn, Child and Adolescent Health.

managers and staff; providing regular feedback and reward appropriate behavior; and encouraging senior staff and health facility management to be role models for recommended IPC practices. The project also used the trained ToTs in each department to continue orientation, mentorship of untrained staffs and carry out daily sport check. The use of ToTs has been shown to be effective ensuring continuity of interventions in Tanzania even in emergency situations Hokororo et al., 2023. The QIT also worked closely with the health centre management to guide and support the use of recommended practices and review and resolve related IPC problems that may arise.

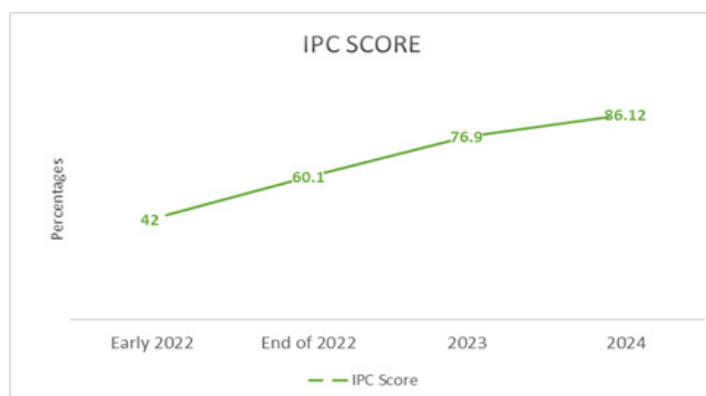


Figure 3: Showing trend on IPC improvement.

For monitoring the IPC performance, the surveillance for SSI and follow up and document infections especially neonatal infection were carried out and figure 4 shows the result of follow up on SSIs.

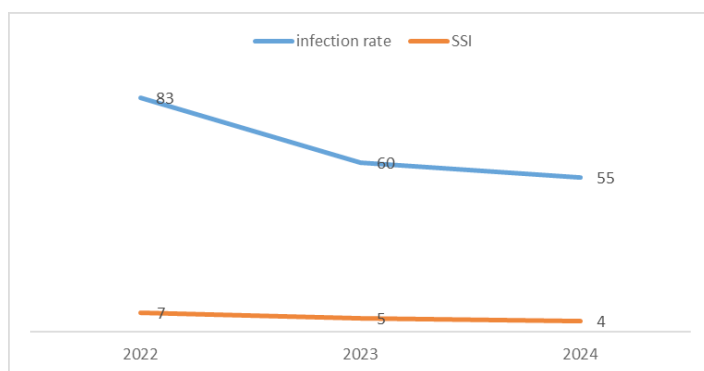


Figure 4: Showing infection rates.

Health operations and Customer Care M&E

M&E was conducted on health centre operations, focusing a customer care. Following the M&E implementation, it was noted that a total of 97 HCWs from different department were trained on customer care in the second year 2023 of project implementation. The following skills were impacted to the attendees: who is a customer, principles in provision of customer care, organization behavior in relations to customer service and mental wellbeing in provision of customer care. This skill helped the workers to build a good facility culture, translated into facility vision and mission provision of quality and equitable services to all. It also helped to spot bottlenecks and to determine the type of customers that are saved, determine the prices and motivate the customers and the service providers. On baseline the customer satisfaction with the HCWs was 75% while satisfied customers at the end of project

increased to 78%. Table 3 shows the end line evaluation.

Table 3: End line evaluation of level of customer satisfaction by department.

Level of satisfaction	Departments and operation areas						
	Reception Services	Environment Cleanliness	Nurses Services	Doctors Services	Pharmacy Services	Laboratory Services	Cost of Services
Satisfied	159 (79.5%)	140 (70%)	120 (60%)	140 (70%)	175 (87.5%)	192 (96%)	172 (86%)
Not satisfied	36 (18%)	53 (26.5%)	77 (38.5%)	54 (27%)	21 (10.5%)	8 (4%)	25 (12.5%)
No answer	5 (2.5%)	7 (3.5 %)	3 (1.5%)	6 (3%)	4(2%)	0 (0%)	3(1.5%)
TOTAL	200	200	200	200	200	200	200

Application and Management of Medical Equipment

HCWs were also equipped with the knowledge on the use and application of Healthcare Technology (HCT) and oriented to the first line maintenance of HCT to ensure that all equipment required for service provision is operating at 100% efficiency at all times. After the evaluation, the results showed an improvement in the knowledge and skills of most users regarding the use of medical equipment, with an average of **81%** good performance Table 4.

It was also observed that, some specific areas of expertise had an 100% performance including the radiology and laboratory department. However, the findings also highlight that some workers require further education as they demonstrated a substandard use of certain equipment (19% poor performance) that can cause harm to the clients.

Table 4: Percentage of equipment use performance per operational areas.

S/N	Location (operation area)	Percentage of good practice
1	X-ray room	100%
2	Ultrasound room	93%
3	Antenatal Ward	93%
4	Laboratory	100%
5	Operating theatre	93%
6	OPD	93%
7	Neonatal unit	80%
8	EMD	67%
9	Observation rooms	93%
10-	CSSD	80%

The score points reflect how well an individual adhered to the evaluation criteria set for the purpose of assessing their knowledge and skills in equipment use. Most of the respondents were knowledgeable on the use in their respective sections regarding the equipment available except for the few workers.

Raising community awareness on MCH and community campaign

In order to decrease community weakness to MCH and other

determinants, community campaigns were conducted. Various educational materials were developed and used in the community campaign/community health education materials yearly. Some of education materials were brochures, leaflets, video clips and booklet. Awareness campaigns were conducted by CHWs under supervision of the facility and house to house visit were conducted with CHW. Additional 11 CHWs were recruited following Medipeace intervention to fill the gap making a total of 24 CHWs; with ratio of three per street. The CHWs were intensively trained twice to equip them with knowledge and skills in community engagement and MCH. Furthermore, they were strengthened to conduct campaigns for raising community awareness on MCH, provide health education in the community, visits to pregnant women, infants, and elderly people.

Table 5: Percentage score of participants' knowledge according to the evaluation statement.

	Evaluation Statement	Average score (%)
1	Ability to know main parts and accessories of the equipment	85%
2	Ability to ensure the equipment starts up correctly	87%
3	Capability to prepare and operate the equipment	95%
4	Ability on how to adjust settings like alarm limits, display options, and waveforms.	50%
5	Capability to check for working performance of the equipment	87%
6	Understand the different alarms (e.g., physiological, technical).	71%
7	How alarms are handled and the protocols for responding to alerts.	67%
8	Skill on how to placement of accessories of the equipment	79%
9	Ability to observe how to check for good signal quality and troubleshoot poor readings.	94%
10	Knowledge on how equipment is cleaned, disinfected and maintained.	90%
11	Knowledge to disinfect equipment accessories	90%
12	Ability to identify and troubleshoot common problems with the Equipment.	90%
13	Ability to know safety precautions and note for the equipment.	90%
Average (%)		83%

Following the community activities conducted with CHWs under the supervision of the Chanika Health Centre, MCH data showed at the end of project that ANC attendance on four visits was 82% while on baseline it was 55.5%. which is 29.5% increase following community intervention. Table 6 shows the increase in number of ANC visit in relation to number of deliveries in the facility. Also, there were changes in the ANC attendance in the government facilities in the Chanika Ward (see Table 7).

Household visits and number of people reached in the community with education information material, MCH information, vaccination, nutrition, gender-based violence (GBV) increased.

There was a total of 21,391 household reached. Number of people reached given a health education material, have a health talk by CHW during house-to-house visit were 60,894 females and 28,853 males. Identified pregnant mother with less than 12weeks were 177 and community referral were 200 cases, of whom 70% completed the referral.

Table 6: Annual Antenatal attendance in relation to number of deliveries.

Years	4> ANC Visit	Hospital delivery	%
2022	4,814	8,671	55.5
2023	5,278	9,302	56.7
2024	6, 025	7,348	82.0

Table 7: Impact of CHW to other government facilities.

	2022	2023	2024			
Government FACILITY	ANC	PNC	ANC	PNC	ANC	PNC
Chanika	4,814	2,076	5,278	2,486	15,389	10,524
Yongwe	631	70	976	127	1,139	14
Lochie Dispensary	42	12	55	14	166	32

Discussion

We have designed an initiative for improving MCH and IPC in Tanzania. The initiative is called Sustainable Operations Management System for MCH and IPC. The initiative ensured the availability of supplies like PPE, hand washing facilities, waste bins and bin liners, cleaning buckets (triple bucket mopping systems and others). This is because one of the ways to improve IPC is by having supplies and equipment that facilitate compliance to HCWs. WHO Core component (CC) number eight recommends that patient care activities should be undertaken in a clean and/or hygienic environment that facilitates practices related to the prevention and control of HAIs, as well as AMR, including all elements around the WASH infrastructure and services and the availability of appropriate IPC materials and equipment. The panel recommended that materials and equipment to perform appropriate hand hygiene should be readily available at the point of care [19].

Building capacity of HCWs is another area where the initiative had focused in order to improve health provision to MCH and IPC. HCWs if well trained and capacitated to comply with IPC standards and transmission-based precautions, have the ability to deliver safe health services and protect themselves, patients, environment and the community [14]. Also, WHO core components recommends the need of building capacity to HCWs. IPC education spans all domains of health service delivery and is relevant to all HCWs, ranging from frontline workers to administrative management. Effective IPC education and training is predicated on employing the right educational method to achieve maximal learning and behaviour change. Education and training must be pertinent and relevant to the tasks that each worker is required to perform [19].

The initiative improved the WASH infrastructure by taking on into consideration that WASH is a critical component of IPC. To improve MCH and IPC, it is needed to make sure WASH is also improved. Unsafe care is often caused by poor IPC practices; lack of support for WASH; and inadequate waste management. WHO core components number eight also insists need of having environment that supports IPC. It emphasizes that, one of the five core elements of the WHO hand hygiene improvement strategy relates to the work system within which hand hygiene takes place, that is, an environment including infrastructure and materials that facilitate compliance at the point of care.

The initiative also conducted regular check of the implementation to monitor if the set goals are achievable. For IPC measures to be achieved, the effort to make regular follow up is needed. The study by Wood R et al. reported that, monitoring (i.e., WHO IPC CC6) as an important step in organizing an IPC programme, and the use of feedback (i.e., from monitoring or observation) to facilitate behaviour change was a reoccurring theme in plenary discussions. This reflects the WHO recommendations that monitoring and feedback are essential ways to support behaviour and system change [19,20]. In the course of monitoring, the trend showed there were gradual improvement which was in keeping with the study by Hokororo J et al., 2021 where it demonstrated that, there was general improvement of IPC standards adherence by HCWs though not to the expected level. The improvements differed at different levels of health care delivery. The pace of improvement was higher in upper levels that was from regional referral to national referral hospitals while it was slower in lower facilities namely from dispensaries to district/council level hospitals [16].

The impact of the initiative has shown the decline of the SSIs and the neonatal sepsis. Surveillance of HAIs is the recommendation of WHO through the IPC CC but also it is the way to monitor closely the IPC measures in the health facilities. HAIs surveillance of IPC programs, has been helping to identify outbreaks, track transmission routes, and guide interventions to reduce HAIs, while IPC encompasses all practices and policies aimed at preventing infections in healthcare settings. Infection surveillance is one of the cornerstones of IPC. Measurement of process metrics and clinical outcomes, such as detection of HAIs, can be used to support continuous quality improvement. HAIs metrics are reported as part of the accreditation for Hospital-Acquired Conditions Program, and they influence facility reputation and financial outcomes [21].

The facilities are supposed to provide quality healthcare services to their clients and one of the considerations in the components is safety. IPC is one area that if complied by HCWs provides safety which ultimately led to quality of services. IPC affects all aspects of health care, including hand hygiene, SSIs, injection safety, AMR and how hospitals operate during and outside of emergencies. IPC is a universally relevant component of all health systems and affects the health and safety of both people who use health services and those who provide them. HAIs are one of the most common adverse events in care delivery and both the endemic

burden and epidemics are a major public health problem [1]. In addition to provision of quality health services due to improved IPC, the initiative conducted customer care training to the HCWs so as to more improve quality of health services in a way that meets their expectations and needs is a form of patient-centred care [22]. In healthcare, strong customer care and high-quality services are intertwined, with excellent service leading to better patient outcomes and satisfaction, and vice versa. This includes everything from compassionate staff interactions to efficient processes and effective communication. Customer care service has become important in many ways for most organizations which had led to quality management and patient satisfaction with services [23].

Improvement of health services require competence in the use of sophisticated equipment which also require skills in their maintenance based on the technology. Technological advancements can help healthcare organizations identify and eliminate wasteful practices, streamline processes, and increase efficiency, leading to cost savings and better resource utilization. Technological advancements hold immense promise for improving healthcare quality and efficiency. A balanced approach that prioritizes patient safety, equity, and ethical considerations is essential to harness the full potential of technology in healthcare. Health technologies are also a form of quality improvement and allow organizations to improve the quality and safety of services while reducing opportunities for medical errors to occur [24,25].

Community engagement for improvement of MCH and IPC is key during this era when we are striving to meet UHC. The UHC is essential for improving MCH by ensuring equitable access to quality health services, including ANC and PNC, child immunization, and reproductive health services, without financial hardship. In this aspect Tanzania is using CHWs to meet those who need healthcare at the community. In this initiative we used CHWs to raise awareness to community so as they seek healthcare service especially for MCH to the health facilities. UHC is considered a strategic component of the Sustainable Development Goals specifically for goal 3 which seeks to ensure healthy lives and promote well-being for all, where all individuals and communities have equal access to key promotive, preventive, curative, and rehabilitative health interventions without financial constraints [26].

Conclusion

Sustainable Operations Management System for MCH and IPC using quality improvement approaches is being implemented by enforcing the MoH's guidelines. We had inclusive careful planning, dedicated time and resources, and careful facilitation of frequent discussions mainly with RHMT of Dar es Salaam Region and CHMT of Ilala City Council. Sometimes the higher levels of MoH and PO-RALG were involved. Also, when implemented over time, the feedback to different levels were done regularly. The implementation was in the spirit of continuous quality improvement and client centered. Despite being somewhat labor-intensive to thoughtfully design, plan, implement, and facilitate, the

initiative may prove cost-effective in the long run by "*Establishing a Sustainable Operations Management System for MCH and IPC Using Quality Improvement Approaches*" to all levels of health system in Tanzania and perhaps across the world.

Acknowledgments

We would like to acknowledge and thank all the stakeholders and participants during the implementation of Sustainable Operations Management System for Maternal, Child Health and Infection Prevention and Control Using Quality Improvement Approaches. We also thank the KOIKA through Medipeace-Tanzania. In addition, we thank Ministry of Health through Health Quality Assurance Unit and President's Office-Regional Administration and Local Government for their coordination and leadership during the implementation of the initiative. We are grateful to RHMT, CHMT, Chanika Health Centre Management Team and all HCWs for their generous support of this project.

Funding

Implementation of Sustainable Operations Management System for Maternal, Child Health and Infection Prevention and Control Using Quality Improvement Approaches by the MoH, PO-RALG Tanzania had funding from KOIKA through Medipeace Program. However, development of this article had no any financial support.

References

1. Storr J, Twyman A, Zingg W, Damani N, Kilpatrick C, et al. WHO Guidelines Development Group. Core components for effective infection prevention and control programmes: new WHO evidence-based recommendations. *Antimicrobial Resist Infect Control*. 2017; 6: 6.
2. Tartari E, Tomczyk S, Pires D, Zayed B, Coutinho Rehse AP, et al. Implementation of the infection prevention and control core components at the national level: a global situational analysis. *Journal of Hospital Infection*. 2021; 108: 94-103.
3. Sequeira Dmello B, John TW, Housseine N, Meyrowitsch DW, Roosmalen JV, et al. Incidence and determinants of perinatal mortality in five urban hospitals in Dar es Salaam, Tanzania: a cohort study with an embedded case-control analysis. *BMC Pregnancy Childbirth*. 2024; 24: 1-15.
4. Aiesh BM, Qashou R, Shemmessian G, Swaileh MW, Abutaha SA, et al. Nosocomial infections in the surgical intensive care unit: an observational retrospective study from a large tertiary hospital in Palestine. *BMC Infect Dis*. 2023; 23: 686.
5. Kwon JH, Advani SD, Branch-Elliman W, Braun BI, Cheng VC, et al. A call to action: the SHEA research agenda to combat healthcare-associated infections. *Infection Control Hospital Epidemiology*. 2024; 45: 1023-1040.
6. Yezli S, Barbut F, Otter JA. Surface contamination in operating rooms: a risk for transmission of pathogens?. *Surg Infect*. 2014; 15: 694-699.

7. Manyahi J, Majigo M, Kibwana U, Kamori D, Lyamuya EF. Colonization of Extended-spectrum β -lactamase producing Enterobacterales and meticillin-resistant *S. aureus* in the intensive care unit at a tertiary hospital in Tanzania: Implications for Infection control and prevention. *Infection prevention in practice*. 2022; 4: 100212.
8. Moremi N, Claus H, Vogel U, Mshana SE. The role of patients and healthcare workers *Staphylococcus aureus* nasal colonization in occurrence of surgical site infection among patients admitted in two centers in Tanzania. *Antimicrobial resistance and infection control*. 2019; 8: 102.
9. Joachim A, Moyo SJ, Nkinda L, Majigo M, Rugarabamu S, et al. Nasal Carriage of Methicillin-Resistant *Staphylococcus aureus* among Health Care Workers in Tertiary and Regional Hospitals in Dar es Salam, Tanzania. *International journal of microbiology*. 2018; 5058390.
10. Oni O, Orok E, Lawal Z, Ojo T, Oluwadare T, et al. Knowledge and perception of nosocomial infections among patients in a Nigerian hospital. *Sci Rep*. 2023; 13: 20204.
11. Erick Kinyenje, Joseph Hokororo, Eliudi Eliakimu, Talhiya Yahya, Bernard Mbwele, et al. Status of Infection Prevention and Control in Tanzanian Primary Health Care Facilities: Learning From Star Rating Assessment. *Infection Prevention in Practice*. 2020; 2: 100071.
12. Schreiber PW, Sax H, Wolfensberger A, Clack L, Kuster SP, et al. The preventable proportion of healthcare-associated infections 2005-2016: Systematic review and meta-analysis. *Infect Control Hosp Epidemiol*. 2018; 39: 1277-1295.
13. Yilma M, Taye G, Tefera M, Berhan Tassew, Atalay Mulu Fentie, et al. Exploring barriers to and facilitators of infection prevention and control practices in the Pediatrics and Child Health Department of Tikur Anbessa Specialized Hospital, Ethiopia. *Antimicrobial Resistance & Infection Control*. 2024; 13: 121.
14. Hokororo J, Marandu L, Ngowi R, Bahegwa R, Msigwa Y, et al. Training of Infection Prevention and Control to Healthcare Workers of Mining Health Facilities: A Shared Responsibility for Improving Safety of Mining Communities. *Occupational Diseases and Environmental Medicine*. 2024; 12: 243-264.
15. Ferreira DC, Vieira I, Pedro MI, Caldas P, Varela M. Patient Satisfaction with Healthcare Services and the Techniques Used for its Assessment: A Systematic Literature Review and a Bibliometric Analysis. *Healthcare (Basel)*. 2023; 11: 639.
16. Hokororo J, Eliakimu E, Ngowi R, German C, Bahegwa R, et al. Report of Trend for Compliance of Infection Prevention and Control Standards in Tanzania from 2010 to 2017 in Tanzania Mainland. *Microbiol Infection Disease*. 2021; 5: 1-10.
17. Gwaikolo C, Bodo B, Nabawanuka D, Mukiibi M, Seremba E, et al. Impact of supportive supervision visits on the availability of World Health Organization infection prevention and control core components in health facilities in Southwestern Uganda. *Infect Prev Pract*. 2024; 6: 100355.
18. Storr J, Kilpatrick C, Allegranzi B, Syed SB. Redefining infection prevention and control in the new era of quality universal health coverage. *Journal of Research in Nursing*. 2016; 21: 39-52.
19. <https://iris.who.int/bitstream/handle/10665/311259/9789241550512-eng.pdf>
20. Wood R, Tembele W, Hema A, Somé A, Kinganda-Lusamaki E, et al. Implementation of the WHO core components of an infection prevention and control programme in two sub-saharan African acute health-care facilities: a mixed methods study. *Antimicrob Resistant Infection Control*. 2024; 13: 2-14.
21. Sreeramoju PV, Palmore TN, Lee GM, Edmond MB, Patterson JE, et al. Institutional quality and patient safety programs: An overview for the healthcare epidemiologist. *Infect Control Hospital Epidemiol*. 2021; 42: 6-17.
22. Okeny PK, Pittalis C, Monaghan CF, Brugha R, Gajewski J. Dimensions of patient-centred care from the perspective of patients and healthcare workers in hospital settings in sub-Saharan Africa: A qualitative evidence synthesis. *PLoS ONE*. 2024; 19: e0299627.
23. Félicité N, Joseph M, Samson H, Sylvie K, Marlaine M, et al. Customer Care Practice and Its Effects in Burundian Private Hospitals. *Modern Economy*. 2024; 14: 886-898.
24. Borycki EM, Kushniruk AW. Health technology, quality and safety in a learning health system. *Healthc Manage Forum*. 2023; 36: 79-85.
25. Alowais SA, Alghamdi SS, Alsuehaby N, Tariq Alqahtani, Alshaya AI, et al. Revolutionizing healthcare: the role of artificial intelligence in clinical practice. *BMC Medical Education*. 2023; 23: 689.
26. Dowou RK, Amu H, Saah FI, Oluwafemi Adeagbo, Luchuo Engelbert Bain. Increased investment in Universal Health Coverage in Sub-Saharan Africa is crucial to attain the Sustainable Development Goal 3 targets on maternal and child health. *Arch Public Health*. 2023; 81: 34.