

## Assessing the Capacity of Quality Improvement Teams on Health Data Use for Improvement of Health Service Delivery in Council Hospitals in Tanzania

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### Abstract

#### Introduction

The ability of health workers in data use is pivotal in the healthcare system; it helps to facilitate effective data use to improve healthcare services in health settings. This study aimed to assess the capacity of hospital Quality Improvement Teams members to utilize health data in selected council hospitals in Tanzania.

#### Methods

We conducted a cross-sectional study involving 12 council hospitals in six regions. Data were collected from 203 members of Quality Improvement Teams using a self-administered questionnaire. We utilized Smart PLS 3 and conducted a bootstrapping analysis to assess the formulated hypotheses.

#### Results

The results show that most of the respondents have limited knowledge and skills in data visualization and sharing through dashboards (37.4%), data dissemination through notice boards (38.9%), and data review and interpretations through quarterly quality improvement team meetings (40.9%). Additionally, the majority of respondents indicated low knowledge and skills in ordering essential health commodities (50.3%), allocating hospital staff (45.3%), and preparing hospital plans and budgets based on existing data systems (50.7%).

#### Conclusion

Members of Quality Improvement Teams demonstrate a lack of proficiency in utilizing data, which has had a significant impact on the delivery of health services. Accordingly, it is imperative to focus on enhancing the capabilities of all personnel within health settings to comprehend and effectively apply techniques for data analysis, interpretation, data visualization, and sharing.

**Keywords:** *Capacity of Quality Improvement Teams, Health data use, Improvement of health service delivery, council hospitals, Tanzania*

## INTRODUCTION

Data use is crucial in a well-functioning healthcare system, as it helps develop evidence-based plans and decisions that improve health service delivery. With the global expansion of health services and the increasing outbreaks of diseases, health data remain critical for the improvement of health services in health settings and public health in general (WHO, 2016). Improving health services is the ultimate goal of any healthcare system, which involves several outcome indicators (Rendell et al., 2020) such as the availability of essential health commodities, skilled workforces, supportive infrastructures, and good governance (World Bank, 2017). The improvement of health service delivery mainly depends on evidence-based plans and responsive decisions that are delivered timely, accurately, and effectively in health settings (World Bank., 2015).

Health data use is the process that involves access to quality data and data application for planning and decision-making (Nutley and Li, 2018; Arenth et al., 2018; Li, Ddumba-Nyanzi and Nutrey and Li, 2018). Access to such data can be measured in terms of data visualization, data sharing via dashboards, dissemination of data through notice boards, and data review and interpretation (Nutley and Li, 2018). While data application for planning and decision-making primarily is measured in terms of ordering essential health commodities via existing data systems, allocating skilled hospital staff based on patient load, and preparing health facility plans and budget allocation using existing data systems (Ally, 2019; Mboera et al., 2021).

Attaining adequate health data use is a function of associated factors such as users' capacity, organization environment, and health information technology factors (Anasel et al., 2019; PATH and Vital Wave, 2016; Ho et al., 2020). In the context of the users' capacity, this can significantly impact the proper use of health data while simultaneously improving healthcare service delivery in facilities. Users' capacity refers to the level of knowledge, skills, commitment, and experience of health staff in accessing and utilizing high-quality health data for planning and decision-making purposes (Nurhayati and Mulyani, 2015).

Globally, there is a trend of inadequate use of health data by decision-makers, including QITs, due to low capacity in terms of knowledge, skills, commitment, and experiences in data use in some health facilities (Viberg Johansson et al., 2021). Various literatures have indicated that healthcare workers have minimal capacity in terms of knowledge, skills, commitment, and experiences about access to quality data through existing data systems and the use of health data for planning and decision-making, especially at the primary health facility level (Huber et al., 2018; Nutley et al., 2014; Nurhayati and Arbi, 2020).

In sub-Saharan countries, some scholars, including Tanzania, have highlighted the significant impact on the capacity of health workers in terms of knowledge, skills, employee commitment, and experience on health data utilization, consequently compromising quality of health service delivery (Asiimwe, 2015; Karuri et al., 2014; Njoka, 2015; Anasel et al., 2029). Additionally, in Africa, both frequently of poor quality data and underutilization of data are due to a lack of capacity of health staff in data analysis and interpretations through existing data systems in health facility settings (Musa et al., 2023). The Global Summit on Measurement and Accountability (GSMA) for Health advocates for enhancing data analysis capacity and utilizing information for evidence-based decision-making and planning. It has emphasized the imperative for all nations to establish health data use processes that involve analysis and information utilization in order to enhance health service delivery within healthcare settings (World Bank., 2015).

In response to these challenges, the Tanzanian government launched the Health Care Quality Improvement Framework through the Ministry of Health in 2011. The framework's objective was to improve the capacity and performance of healthcare providers in utilizing health data to enhance the quality of health settings. One key strategy to achieve this goal was using Quality Improvement (QI) teams to collect and analyze performance data systematically. By doing so, they could identify shortcomings and introduce remedial actions to improve healthcare quality.

Some scholars have indicated that there were positive effects that QI teams in health facilities in Tanzania have done (Kacholi et al., 2021; Kimiya et al., 2017). The reported effects of QI teams included improved patient care management, reduced patient waiting time, improved report generation, and quality of data in existing data systems (Ishijima and Eliakimu, 2016). Despite the identified positive changes in QITs, still, there are significant challenges in the capacity of health workers to access quality data and the use of health for planning and decision-making, especially in primary health facilities (MOHCDGEC, 2019). Therefore, this study aimed to evaluate hospital QIT members' capacity to use health data to improve healthcare delivery in selected council hospitals in Tanzania.

## METHODS

### Study design

We conducted a cross-sectional study across six regions, encompassing 12 council hospitals. The council hospitals included Mbalizi Council Designated Hospital and Chunya District Council in Mbeya Region, Mjimwema Municipal Council and Peramiho Council Designated Hospital in Ruvuma Region, Hai and Same District Councils in Kilimanjaro Region, Magu and Nyamagana District

Councils in Mwanza Region, and Bunda and Tarime Town Councils in Mara Region. The selection was based on hospitals with 3-star ratings and above and hospitals with ratings below three stars (MOHCDGEC, 2018).

### Sample size and sampling techniques

A total of 218 hospital QIT members were enrolled in the study using the Yamane formula Yamane (1967). The study sample was calculated at a 95% confidence level, and  $P = 0.5$  were considered in this formula as follows:

$$n = N / (1 + N(e)^2)$$

Whereas:

$n$  is the sample size

$N$  is the population size (i.e., the total number of members of quality improvement teams in the selected council hospitals).

$e$  is the level of precision = 0.05.

$$n = 480 / (1 + 480(0.05)^2) = 218$$

The study utilized a multistage sampling technique to select the regions and council hospitals for the survey. The choice of regions was predicated on the performance ratings of the council hospitals, specifically targeting high and low-performing facilities. Through a lottery method, three regions from each category were selected via simple random sampling. The high-performing regions included Mbeya, Kilimanjaro, and Mwanza, while Songwe, Ruvuma, and Mara were chosen from the low-performing category (MOHCDGEC, 2018).

After that, a stratified sampling approach was employed to classify council hospitals into two groups based on their performance. The delineation included high-performing council hospitals, those attaining 3-star plus scores of 60% or more, and low-performing council hospitals, categorized by 3-star plus scores of 59% or less within specified regions. Subsequently, a simple random sampling technique, akin to a lottery method, was utilized to select six council hospitals from both the high-performing and low-performing categories. The selection criteria were contingent upon the hospitals' designation as either high-performing or low-performing based on their health facility performance as evaluated during the technical review meeting (MOHCDGEC, 2018).

We used simple random sampling to select members for quality improvement teams from 12 council hospitals. First, we created a list of all QIT members from each hospital to establish a sampling frame. Then, we used random numbers to pick members for the questionnaire survey. We employed proportion sampling to determine how many QIT members to select from each hospital. These members were chosen because they are department and unit heads responsible for overseeing the design, implementation, and monitoring of quality improvement activities, including data collection, analysis, and decision-making (MoHSW, 2011).

### Data collection

A self-administered questionnaire was employed to gather comprehensive data from members of QITs within hospital settings. The study focused on the independent variable of QIT members' capacity, including their knowledge, skills,

experience, and commitment. Health data use acted as a mediating variable, assessing the accessibility and utilization of health data for planning and decision-making. The dependent variable intricately evaluated the accessibility of health information technologies, availability of essential health commodities, presence of skilled staff, and evidence-based plans and budget allocation. The following hypotheses were formulated: Hypothesis 1: Enhanced capacity of quality improvement teams will positively and significantly impact the availability of quality data within council hospitals. Hypothesis 2: Increased access to quality data will positively and significantly influence its utilization for planning and decision-making processes in council hospitals. Hypothesis 3: Effective data use for planning and decision-making will positively and significantly contribute to improved health service delivery in council hospitals.

Internal reliability was ascertained using Cronbach's alpha ( $\alpha = 0.73$ ), while convergent validity was assessed based on the average variance extracted (AVE = 0.5) across all indicators (Hair et al., 2018).

### Data Analysis

We reviewed the gathered data daily for accuracy and completeness. Then, we cleaned, edited, grouped, and analyzed the data using Statistical Package for the Social Sciences (SPSS) version 26. We used descriptive analysis to determine the frequency, proportion, and mean of the responses regarding using health data. We further used Smart PLS 3 through bootstrapping analysis to analyze the relationship between the capacity of Quality Improvement Teams (QITs) and the use of health data to enhance health service delivery. Results were considered statistically significant if the p-value was less than 0.05.

### Ethical Approval

The study was approved by the National Institute for Medical Research Tanzania under reference number NIMR/HQ/R.8a/Vol.IX/4251 and by the Postgraduate Technical Committee at Mzumbe University in Tanzania under reference number MU/PhD/SOPAM/MZC/040/T.2020. Additionally, relevant local government authorities obtained permission to conduct the study. Each participant provided signed informed consent after receiving an explanation of the study's purpose, benefits, and risks. Participation was voluntary, and participants were free to withdraw at any time without providing a reason.

## RESULTS

### Socio-demographic characteristics of respondents

Most respondents (50.7%) fall within the 31-40 age group. The least represented age group is >60 years (1.0%). There is a slight majority of females (56.2%) compared to males (43.8%). Most respondents are married (83.3%), followed by single (14.8%) and widowed (1.5%). The highest level of education is a Certificate or diploma (77.3%), followed by a bachelor's degree (20.7%) and a Master's PhD Degree (2.0%). The majority of the respondents hold clinical titles (82.3%) compared to non-clinical titles (17.7%) (Table 1).

**Table 1: Socio-demographic characteristics of respondents (N=203)**

Variable	Response	Frequency	Percentage (%)
Age	21-30 years	28	13.8
	31-40 years	103	50.7
	41-50 years	54	26.6
	51-60 years	16	7.9
	> 60 years	2	1.0
Sex	Female	114	56.2
	Male	89	43.8
Marital status	Married	169	83.3
	Separated	1	0.5
	Single	30	14.8
	Widow	3	1.5
Educational Qualifications	Certificate/Diploma	157	77.3
	Bachelor's degree	42	20.7
	Masters/PhD Degree	4	2.0
Title	Clinical	167	82.3
	Non-clinical	36	17.7

### Capacity of QI teams on health data use

The survey results reveal that most respondents, 37.4%, have low knowledge and skills in data visualization and sharing through dashboards. In contrast, a large proportion, 38.9 %, reported having a high level of knowledge and skills in data analysis and interpretations for data dissemination through notice boards. Additionally, 41.0% of respondents reported having low knowledge and skills in data review and interpretation through quarterly QIT meetings. The overall score indicates that 35.5% of respondents reported having low knowledge and skills in accessing data from existing data systems.

**Table 2: Items analysis for users' capacity for health data use (N=203)**

Variable	Lowest level n (%)	Low level n (%)	Neutral n (%)	High level n (%)	Highest level n (%)	Mean ±SD
Level of knowledge and skills in data visualization and sharing through dashboards	2(1.0)	76(37.4)	49(24.1)	73(36.0)	3(1.5)	3.00±0.91
Level of knowledge and skills in data analysis and data dissemination through notice boards	2(1.0)	67(33.0)	52(25.6)	79(38.9)	3(1.5)	3.07±0.90
Level of knowledge and skills in data review and interpretation through quarterly QI team meetings	11(5.4)	83(40.9)	45(22.2)	62(30.5)	2(1.0)	2.81±0.97
<b>Overall capacity to access health data</b>	<b>2(1.0)</b>	<b>72(35.5)</b>	<b>57(28.1)</b>	<b>69(34.0)</b>	<b>3(1.5)</b>	<b>3.00±0.89</b>
Level of knowledge and skills in ordering of essential health commodities based on existing data systems	5(2.5)	102(50.3)	42(20.7)	54(26.6)	0(0.0)	2.71±0.89
Level of knowledge and skills in allocating hospital staff based on patient load and staffing level guidelines	3(1.5)	92(45.3)	49(24.1)	59(29.1)	0(0.0)	2.81±0.88
Level of knowledge and skills in preparing hospital plans and budget allocation based on existing data systems	15(7.4)	103(50.7)	41(20.2)	44(21.7)	0(0.0)	2.56±0.91
Level of commitment to hospital on health data use	0(0.0)	12(5.9)	46(22.7)	138(68.0)	7(3.5)	3.69±0.63
Experience of members of QITs on health data use	94(46.3)	86(42.4)	20(9.9)	2(1.0)	1(0.5)	1.67±0.73
<b>Overall capacity to use data for planning and decision-making</b>	<b>2(1.0)</b>	<b>96(47.3)</b>	<b>61(30.1)</b>	<b>44(21.7)</b>	<b>0(0.0)</b>	<b>2.72±0.81</b>

The results also show that a significant proportion of 50.3% of the respondents had a low level of expertise in ordering essential health commodities through existing data systems. Furthermore, 45.3% of the respondents reported low knowledge and skills in allocating hospital staff based on patient load. The findings also reveal that 50.7% of the respondents had a low level of knowledge and skills in preparing hospital plans and budget allocation based on existing data systems. However, a considerable proportion of 68.0% of the respondents showed a high commitment to utilizing health data for hospital purposes. Regarding QIT

members' experience using data, a significant proportion of the respondents rated it at the lowest level (46.3%). As a result, 47.3% of respondents had a low overall capacity for utilizing health data for planning and decision-making.

### Capacity of QI Teams on data use for better services

The study results reveal a strong positive correlation between the capacity of QITs and the accessibility of high-quality data. Moreover, improved data accessibility significantly enhances data utilization for planning and decision-making. Ultimately, this leads to a significant improvement in primary healthcare service delivery. These findings support hypotheses H1 ( $\beta=0.702$ ,  $p<0.001$ ,  $CI=0.629-0.758$ ), H2 ( $\beta=0.857$ ,  $p<0.001$ ,  $CI=0.820-0.887$ ), and H3 ( $\beta=0.678$ ,  $p<0.001$ ) (Table 3).

**Table 3: Hypotheses testing- relationship among constructs**

Hypothesis	Structural model Paths	Path coefficient ( $\beta$ )	Statistically significant (p-value)	Results
H1	QI teams' capacity -> Access to health data	0.702	$p<0.001$	Supported
H2	Access to health data -> data used for planning and decision-making	0.857	$p<0.001$	Supported
H3	Data use for planning and decision making -> Improvement of primary health services delivery	0.678	$p<0.001$	Supported

## DISCUSSION

The study reveals a significant challenge in utilizing health data within Tanzania Mainland Council hospitals. Many respondents reported difficulties accessing and translating available health data into actionable plans. This indicates a widespread capacity gap among QIT members in terms of effectively employing data to improve healthcare services. These findings suggest that addressing these data-related issues is crucial for enhancing the region's healthcare delivery quality. The study highlights that while health data might be collected, its accessibility and usability are significant hurdles preventing its effective utilization to improve healthcare services.

The study findings suggest a moderate confidence level among respondents in their ability to analyze, interpret, and disseminate health data through monthly notice boards. While this indicates a certain level of competence, it also implies room for improvement in enhancing data analysis and communication skills within the healthcare setting. While nearly half of the respondents feel confident in these tasks, the remaining half may require additional training or support to improve their data-handling capabilities. These findings echo those by Anasel et al. (2019), indicating similarly low competency levels in data analysis and interpretation among respondents and displaying charts and graphs through notice boards. Mboera et al. (2021) revealed that less than 10% of facilities in Tanzania conduct proper analysis, interpretation, and display of disease burden via notice boards. This is not surprising as Karuri et al. (2014) revealed that only 33% of health workers are experienced in data analysis and sharing via notice boards, which affects evidence-based decision-making in public health facilities.

The findings indicate a substantial gap in data utilization during crucial quality improvement team meetings. Nearly half of the respondents expressed limited proficiency in reviewing, interpreting, and presenting data within this critical forum. This suggests that QIT members may not be equipped with the necessary skills to use data to drive improvements in healthcare delivery effectively. In essence, the study highlights a significant challenge in translating data into actionable insights within QIT meetings, which could hinder the overall effectiveness of quality improvement initiatives and affect the quality of services. These findings support Braa and Heywood's (2012) observation that regular data review meetings correlate with gradual health service improvements. Studies by Oliveira and Martins (2010) and Combs et al. (2006) highlight how employees' experiences significantly affect their ability to access quality data.

The findings of this study align with the following: a significant number of respondents (49.3%) reported low experiences in data visualization, and (57.1%) reported low experiences in sharing data through dashboards and disseminating data via notice boards. Interestingly, despite these low skills and experiences, a considerable portion (54.2%) showed a high commitment to data visualization practices. This indicates a potential for improvement through targeted training. In data-driven decision-making, challenges persist in procuring medicines and medical supplies at the departmental level due to insufficient capacity in integrated logistics management, as indicated by MOHSW (2015a). This observation is consistent with the study's findings, which highlight that a significant majority (50.3%) lack the requisite knowledge and skills to utilize HMIS tools and GOTHOMIS to procure essential health commodities, thereby contributing to shortages in health facilities. Mboera et al. (2021) revealed that only 37% of respondents reported an ability to analyze data and determine the needs of medicines and medical supplies using the existing data systems.

The findings of this study align with previous research indicating challenges in allocating health staff based on patient load. Similar to the MOHCDGEC report (2019), many respondents reported low proficiency in utilizing workload indicators and staffing level guidelines, resulting in suboptimal staffing levels. Furthermore, the study revealed substantial deficiencies in preparing hospital plans and budgets, corroborating the findings of Maluka and Chitama (2017) regarding incomplete health plans attributed to inadequate data analysis. These results are further supported by Ally (2019), who emphasizes the negative impact of unreliable data and weak data analysis on effective priority-setting during planning processes. These findings underscore insufficient training in HMIS tools and weak data utilization capabilities as critical barriers to optimal human resource allocation and strategic planning within the healthcare sector.

Despite these challenges, a neutral stance on commitment towards ordering essential health commodities (54.2%) and allocating hospital staff based on patient load and staffing

level guidelines (60.1%) suggest varied levels of engagement among health workers, impacting data-driven decision-making processes. Moreover, Anasel et al. (2019) posit that employee tenure positively correlates with a culture of health data utilization and improved service delivery. However, this study's findings diverge from this perspective, as a significant proportion of respondents reported limited experience in critical areas such as ordering essential commodities, staff allocation, and planning and budgeting. This discrepancy is partially reconciled by Moussa and El-Arbi (2020), who suggest that while experience can facilitate rapid information assimilation, the effectiveness of data utilization is contingent on access to quality data and robust data user capacity. Users' proficiency in knowledge, skills, commitment, and experience significantly influences their ability to access high-quality data and utilize it for planning and decision-making purposes.

Enhanced capacity among health personnel in data visualization, dissemination, review, and interpretation improves access to quality data through established systems by frameworks such as the Integrated Management Competence Model. Studies exemplified by Nurhayati and Mulyani (2015) affirm the positive impact of IT proficiency and employee experience on data access, thus highlighting the potential for heightened data quality and utilization with increased user experience. Furthermore, the study illustrates a positive correlation between access to quality data and its utilization for planning and decision-making, aligning with the research findings conducted by [insert study name]. This underscores the instrumental role of data visualization tools in enhancing decision-making processes.

#### LIMITATIONS OF THE STUDY

The study specifically focused on QITs and did not include other teams, which could have provided more detailed information on using health data in council hospitals. Additionally, the study findings may only apply to the Tanzanian context and other countries with a similar approach to health information systems. Lastly, the study only examined council hospitals, neglecting dispensaries, health centers, regional referrals, and national and specialized hospitals. This has created an information gap regarding whether the observed situation in council hospitals concerning the use of health data for decision-making differs and offers lessons that can be learned.

#### CONCLUSION AND RECOMMENDATIONS

The findings of this study underscore the critical gap in data utilization capacity among QIT in Tanzania's council hospitals. Limited access to quality data coupled with insufficient data analysis, interpretation, and visualization skills hinders effective decision-making and ultimately impacts the quality of healthcare services. To address these challenges, a comprehensive and sustained capacity-building program focused on data literacy and utilization is imperative for all healthcare personnel.

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### Conflicts of interest

The authors declare no financial or personal interests influencing the study.

### Authors` contributions

CRM contributed to the study`s conception, design, and data collection and analysis. HAM and MGA contributed to the critical review and editing of the manuscript. All authors have read and approved the final version of the manuscript.

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