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Curricular Limitations on Data Systems and Data Use Competencies for Health Related Programs in Tanzania

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Abstract:-

Background: Despite the fact that a lot of data is generated regularly and through periodic surveys, utilizing data for decision-making processes in the Tanzanian health sector remains a significant problem. One of the biggest issues with data use for decision-making in the delivery of health services is a lack of analytical and interpretive skills.

Objective: to assess how data use and data systems aspects are reflected in the health-related curricula given in Tanzanian health training institutes, as well as the degree to which they are.

Methods: The assessment was carried out between December 2018 and March 2019. The primary approaches for gathering data were participant observation, casual phone and in-person interviews, and document examination. Both qualitative and quantitative methods of analysis were used to examine the results.

Findings: Numerous elements related to data use and data systems are already present in the examined curriculum. However, it was noted that both data analysis and use lacked certain skills. Additionally, there wasn't enough emphasis in the existing curricula on leveraging real-world data from healthcare facilities to put theoretical lessons about data use into reality. The study discovered that even though these systems are the most widely used at various levels of health service delivery, they receive very little attention in classroom sessions. These systems include District Health Information System (DHIS2), Facility Financing Accounting and Reporting System (FFARS), Government of Tanzania Hospital Management Information System (GoT-HoMIS), Human Resource for Health Information System (HRHIS), and electronic Logistic Management Information System (eLMIS).

Conclusions: In Tanzania's health-related pre-service training curriculum, there exist gaps regarding data utilization and data systems. As a result, there is a skills gap among healthcare professionals about their ability to assess and understand data for decisions that are supported by evidence. The study advises the government to establish crucial data systems and data use policies, which must be followed in the development of both clinical and non-clinical curriculum, through the ministry of health (MoH).

Keywords: *Data use skills, Data system skills, Health training curricular, Decision making, Capacity Building Consortium.*

I. INTRODUCTION

Sound and reliable information is the foundation of evidence based decision-making across all health system building blocks, and is essential for health system policy development and implementation, governance and regulation, health research, human resources development, health education and training, service delivery and financing (WHO, 2008). Consequently, recognition of the importance of health information systems capable of generating reliable data is growing. In many countries, health sector reform and decentralization have brought about shifts in functions between the central and peripheral levels and generated new information needs with changing requirements for data collection, processing, analysis and dissemination. Health sector reforms also magnify the need for standardization and quality of information (ibid).

Recognizing that, the Tanzanian Government has been backing health information system with appropriate financial and staff investments. Notable efforts include: implementation and use of electronic medical record systems in some health facilities, adoption of DHIS2 as a standard to manage aggregated data at administrative levels (district, regional and national levels), development and rollout of eIDSR[1] to 17 regions.

However, if important information isn't leveraged for making evidence-based decisions, simply gathering and managing it won't help healthcare organizations (Pellakuri and Rao, 2014). It is crucial for health managers to use data to pinpoint problems, find solutions, assess performance, and allocate resources in order to improve health systems and health outcomes. In the same way, healthcare professionals should use data to follow clients, keep tabs on

[1]electronic disease surveillance system

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resource usage, analyze revenue, keep tabs on supply consumption, support clinical judgments, and deliver services effectively.

The main elements and requirements of a nation's health information system are identified by the Health Metrics Network (HMN) Framework (HMN, 2008). Resources, indicators, data sources, data management, information products, dissemination, and usage are the terms used by the Framework to characterize health information system components. In order to evaluate the components of health information systems in 14 sub-Saharan African nations, including Tanzania, HMN performed a questionnaire-based survey. The findings showed that there is little correlation between data output and data use, and that information gathering receives greater emphasis than information analysis and utilization (Mbondiji et al, 2014).

Inadequate abilities to analyze, interpret, and use data to make evidence-based decisions is one of the factors contributing to the weak relationship between data generation and poor data usage. Additionally, there is wasteful utilization of available experts in data analysis (such as statisticians and data scientists) (URT, 2017).

The Tanzanian government created the Data Use Partnership (DUP) to aid in the implementation of Tanzania's Digital Health Investment Road Map (Tanzania Digital Health Roadmap 2017–2023), which builds on the 2013–2018 e–Health Strategy, in response to data use challenges (URT, 2017). The Road Map presents 17 investment recommendations for enhancing health services and outcomes through data. DUP anticipates that these initiatives will lead to enhanced knowledge, enthusiasm, and behaviors related to the use of data and the institutionalization of data. The goal is to Institute Data Use Practices and Capacity. One of 17 investments, is to establish data use practices and increase capacity for utilizing data for decision-making through the use of toolkits, training, outreach, and mentorship of data use champions.

The Capacity Building Consortium (CBC) was established to help health professionals develop their capacity in data use methods for decision-making. Particularly those working in primary health care levels, CBC seeks to institute data use practices to both pre-service and in-service health workers.

II. METHODS

The assessment was done between December 2018 and March 2019. It used a variety of data collection strategies to generate the knowledge it believed was required to support the analysis. The methods used to obtain the data specifically were participant observation, informal phone and in-person interviews, and document examination. The team was made up of members from Muhimbili University of Health and Allied Sciences (MUHAS), Mzumbe University, and University of Dodoma (UDOM).

A. Document Review

Four steps were taken to complete the review. Phase one of the research consists finding and cataloging every institution that offers master's and degree programs in fields connected to health. The Tanzania Commission for Universities (TCU) admission requirements for 2018–19, university websites, and university prospectuses were among the documents examined in order to complete this assignment.

In phase two, we reviewed the training curricula at various institutions of higher learning with a focus on health and carefully examined the course/module contents to determine whether they address the issues of data systems and data utilization. However, for master's degree programs, the desk review was limited to those that relied on coursework and dissertations.

When curricula were not available, the team went to internet websites of higher education institutions and looked up a list of undergraduate and master's degree programs offered in faculties or schools that were either related to health or the sciences. The review team skimmed the prospectuses and course matrices to see if any titles for courses or modules specifically addressed data systems and data use. University of Dodoma (UDOM), Mzumbe University (MU), International Medical and Technological University (IMTU), Hubert Kairuki Memorial University (HKMU), ST. John's University of Tanzania (SJUT), and Catholic University of Health and Allied Sciences are among the institutions whose prospectuses have been reviewed (CUHAS).Additionally, we have access to the course matrices for the UDSM and the Eastern Africa Statistical Training Centre (EASTEC). The prospectus and curriculum covered the academic years 2015–2016 through 2018–2019.

B. Interview

We conducted a few informal face-to-face and telephone interviews with a variety of possible stakeholders who we believed could offer in-depth information about the curricula we obtained from their institutions. We also spoke with a variety of people who oversee these training courses or who have graduated from medical schools. The choice of informants was deliberate and based on how convenient they would be for the study.

Five trainers were among the key informants contacted in person (2 nurses, 3 doctors, 1 statistician). The purpose of interviewing the trainers was to learn more about their opinions regarding how the data use and data systems were covered in their institution's curricula. Additionally, we spoke with two graduates of the nursing and medical doctor (MD) programs who were employed as data managers over the phone. The purpose of interviewing alumni was to learn more about their perceptions of the quality of the abilities they acquired throughout their studies compared to the real skills required in their present employment contexts.

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C. Participant Observation

Some of the results were produced using reviewers' expertise and practical knowledge from their roles as educators, managers, and curriculum designers.

D. Data Analysis

The review team spent five days working together to analyze and interpret the results after conducting a thorough study and gathering enough materials. Both quantitative and qualitative analysis were performed. In order to compare degree programs with similar or relevant specializations, the degree programs were divided into clinical and non-clinical categories. When providing healthcare services, clinical healthcare professionals are the ones who interact directly with patients. The only healthcare workers who don't directly treat patients are non-clinical ones (e.g. health secretaries, researchers, public health specialists, and data managers).

In order to identify the presence of data systems and data use competencies, a review of degree programs was undertaken using 15 data system or data use criteria. The group performed a descriptive statistical analysis to gauge the prevalence of courses or modules that cover data use and data system-related topics. The qualitative analysis was conducted after the quantitative analysis by scanning the course or module name and program-learning outcomes using the content analysis technique. Tables and narratives were used to present the analyzed data.

III. RESULTS

A. Higher learning institutions and their respective programs

The analysis identified 17 higher learning institutions[2] that deliver a total of 146 health and allied sciences programs[3]. Among these programs, 46(32.0%) were undergraduate and 100 (68%) were postgraduate.

SN	Name of Institution	Type	Region/City	State	Undergraduate	Postgraduate	%Bachelor	%Masters
1	Catholic University of Health and Allied Sciences (CUHAS)	University	Mwanza	Tanzania Mainland	5	4	11	4
2	University of Dodoma (UDOM)	University	Dodoma	Tanzania Mainland	5	12	11	12
3	Muhimbili University of Health and Allied Sciences (MUHAS)	University	Dar Es Salaam	Tanzania Mainland	12	60	26	60
4	ST. Francis University	University	Morogoro	Tanzania Mainland	1	0	2	0
5	International Medical and Technological University (IMTU)	University	Dar Es Salaam	Tanzania Mainland	2	3	4	3
6	Kampala International University of Tanzania	University	Dar Es Salaam	Tanzania Mainland	3	0	7	0
7	ST. John' University of Tanzania (SJUT)	University	Dodoma	Tanzania Mainland	2	1	4	1
8	Mzumbe University (MU)	University	Dar Es Salaam	Tanzania Mainland	1	2	2	2
9	Kilimanjaro Christian Medical University College (KCMUCO)	University	Kilimanjaro	Tanzania Mainland	6	7	13	7

[2] The review has included some institutions that have been barred by TCU to enroll new students in recent years since they had produced health workforce which is existing in Tanzanian health sector

[3]For detail overview of each program offered within each identified higher learning institution, find the excel sheet named List of Universities and their programmes'

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10	Hubert Kairuki Memorial University (HKMU)	University	Dar Es Salaam	Tanzania Mainland	2	3	4	3
11	The Aga Khan University (AKU)	University	Dar Es Salaam	Tanzania Mainland	1	0	2	0
12	Eastern Africa Statistical Training Centre (EASTEC)	Non-University	Dar Es Salaam	Tanzania Mainland	1	2	2	2
13	Zanzibar University (ZU)	University	Unguja	Zanzibar	1	0	2	0
14	IHI & Nelson Mandela Institute of Science and Technology (NMIST)	University	Arusha	Tanzania Mainland	0	1	0	1
15	State University of Zanzibar (SUZA)	University	Unguja	Zanzibar	2	0	4	0
16	University of Dar-Es-Salaam (UDSM)	University	Dar Es Salaam	Tanzania Mainland	2	4	4	4
17	Sebastian Kolowa Memorial University (SEKOMU)	University	Tanga	Tanzania Mainland	0	1	0	1
Total					46	100	32%	68%

Table 1: Higher learning institutions and their respective programs

6(35%) of institutions out of 17 institutions were purely focusing on health-related programs while the rest (65%) institutions' focus was wider than health. Among those 17 institutions, 16 (94%) were universities and 1 (6%) was non-University. Furthermore 15 (88%) institutions were located in Tanzanian Mainland while 2 (12%) were located in Zanzibar. 47% of institutions located in Tanzania Mainland were geographically located in the Dar Es Salaam City. Due to the focus of the study only undergraduate and postgraduate/masters programs were retrieved from each institution and doctorate programs were left out.

The highest number of programs (61%) is found in four institutions: MUHAS (12 undergraduates and 60 postgraduate), KCMC (6 undergraduates and 2 postgraduate), CUHAS (5 undergraduate and 7 postgraduate) and UDOM (5undergraduate and 12 postgraduate).

B. Health degree curricular

The study team had access to curricular from 10 institutions. The team managed to get a total of 50 curricular in which23 were for undergraduate and 27were of masters. Table 3 below shows the list of curricular reviewed and their respective institutions.

C. Clinical Programs analysis

The assessment found that, majority of the courses (82%) were clinically related. Furthermore, it was noted that some of the offered clinical degree programs had different naming due to the specialization. For example, MUHAS' Bachelor of Medical Laboratory Sciences has sub-specializations such as Haematology and Blood Transfusion, Parasitology and Medical Entomology, Clinical Chemistry, and Histotechnology. Also, nursing bachelor programs at MUHAS, CUHAS and KCMC has different specialization such as BSc Nursing, BSc Nursing (Management), BSc Midwifery, and BSc Nursing Education. Likewise, Master of Medicine (MMed) programmeswere offered under different specializations such as Anaesthesiology (MMedAnaesthesiology), Anatomical Pathology (MMedAnat Path), Clinical Oncology(MMed Clinical Oncology), Emergency Medicine (MMed Emergency Medicine), Haematology and Blood Transfusion (MMedHaemat and BT), Internal Medicine (MMed Internal Medicine), Microbiology and Immunology (MMed Micro/ Immuno), Obstetrics and Gynaecology (MMedObs and Gyn), Ophthalmology (MMed Ophthalmology), Orthopaedics and Traumatology (MMed O/T), Otorhinolaryngology (MMed ORL), Paediatrics and Child Health (MMedPaed and Child Health), and Psychiatry and Mental Health (MMed Psych and Ment Health). However, these programmes have similar basic/supporting courses. In order to analyze their focus on data use and data systems

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competencies the team decided to categorize them into major categories of health related programsas shown in Table.

S/N	Clinical Program	Undergraduate	Masters	Total
1	Doctor of Medicine	9	41	50
2	Nursing	12	9	21
3	Pharmacy	4	7	11
4	Medical laboratory	9	0	9
5	Dental	1	5	6
6	Physiotherapy	1	0	1
7	Radiology	1	1	2
8	Optometry	1	0	1
9	Other Clinical Programs[4]	2	17	20
	Total	40	80	120

Table 2: List of Clinical Programs Identified

Were therefore found 40 bachelor's and 80 master's clinical programs in total. Medical Doctor (MD), Clinical Dentistry, Nursing and Midwifery, Medical Laboratory Sciences, Dental Sciences, and Pharmaceutical Sciences were among the frequent clinical programs that were reviewed since they were directly tied to clinical practice in primary health care settings. Curriculum and prospectuses for six MD, one clinical dentistry, six nursing, two medical laboratory sciences, and three pharmaceutical degree programs were available to us.

The evaluation showed that data systems and data use are already covered in university curricula for both bachelor's and master's programs. As an illustration, all universities (100%) offer a variety of courses and modules that give students training in quantitative and qualitative research, data analysis, interpretation, and linking data to action. This is proven by the fact that all clinical master's programs include modules or courses on introduction to research methodologies, monitoring and evaluating health programs, using data analytic tools, and interpreting data.

Furthermore, there was a lack of sophisticated data analysis courses (such as geographical data analysis and data analytics), with 0% of bachelor clinical programs providing their applicants with such training. However, via interviews and reflection on our experiences, we have found that bachelor students informally acquire data systems skills while undertaking clinical rotations and fieldwork in wards or health administration offices. Additionally, reviewers mentioned seminars and sessions that expose candidates to DHIS2 and GIS concepts. The review discovered that there were few fundamental ICT courses, data systems, HIS, GIS, and data analytics in master's programs, similar to bachelor clinical programs.

The study also found that compared to other clinical programs, nursing professional cadre's bachelor degrees contain more information on data use and data systems. Additionally, it was discovered that just 33% of MD students receive training in fundamental computer skills. In other universities, MD programs do not include any specialized modules or courses that target ICT capabilities. Instead, interested candidates can enroll in orientation sessions or paid computer classes. Table 3 and Table 4 for the bachelor's and master's clinical programs, respectively, describe the findings.

[4]In this review,'other clinical programs' refers to the clinical programs such asClinical Research,Medical Microbiology, Immunology with Molecular Biology,Medical Parasitology and Entomology, etc.

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	N=6		N=6		N=2		N=3		N=1
Data use and Data Systems Aspects	**# MD**	**%**	**Nursing**	**%**	**Laboratory**	**%**	**Pharmacy**	**%**	**Dental**
Basic computer skills	2	33%	5	83%	2	100%	2	100%	Yes
Quantitative methods	6	100%	6	100%	2	100%	2	100%	Yes
Qualitative methods	6	100%	6	100%	0	0%	0	0%	Yes
Introduction to research methods	6	100%	6	100%	2	100%	2	100%	Yes
Health management information systems DHIS2,	1	17%	4	67%	1	50%	1	50%	No
Data Systems e.g. FFARS, GoT-HOMIS	1	17%	3	50%	1	50%	1	50%	No
Linking data to action/Community Medicine/outreach/field/ Health profiles	6	100%	6	100%	2	50%	2	100%	Yes
Health Planning/Budgeting/Management	0	0%	3	50%	1	50%	2	100%	Yes
Data visualization	0	0%	0	0%	0	0%	0	0%	No
Dissemination/Knowledge translation	0	0%	0	0%	0	0%	0	0%	No
Data analysis tools (DV)	6	100%	6	100%	2	50%	2	100%	Yes
Geographical Information Systems (GIS)	0	0%	0	0%	0	0%	0	0%	No
Data Analytics	0	0%	0	0%	0	0%	0	0%	No
Data Interpretation	6	100%	6	100%	2	50%	2	100%	Yes
Health Program Monitoring And Evaluation	0	0%	6	100%	0	0%	2	100%	No

Table 3: Analysis of clinical bachelor programs

Data use and Data Systems Aspects	**MMED =30**		**MSc N=8**		**N=7**		**N=5**	
	# MMED	%	# MSc Nursing	%	# PHARMACY	%	# DENTAL	%
Basic computer skills	12	40%	0	0%	0	0%	0	0%
Quantitative methods	30	100%	8	100%	7	100%	5	100%
Qualitative methods	30	100%	8	100%	7	100%	5	100%
Introduction to research methods	30	100%	8	100%	7	100%	5	100%
Health management information systems DHIS2	0	0%	0	0%	0	0%	0	0%
Data Systems e.g. FFARS, GoT-HOMIS	0	0%	0	0%	7	100%	0	100%
Linking data to action/Community Medicine/outreach/field/ Health profiles/	30	100%	8	100%	7	100%	5	100%
Health Planning/Budgeting/Management	12	100%	8	100%	7	100%	5	100%
Data visualization	0	0%	0	0%	0	0%	0	0%
Dissemination/Knowledge translation	30	100%	8	0%	7	0%	5	0%
Data analysis tools	30	100%	8	100%	7	100%	5	100%
Geographical Information Systems	0	0%	0	0%	0	0%	0	0%
Data Analytics	0	0%	0	0%	0	0%	0	0%
Data Interpretation	30	100%	8	100%	7	100%	5	100%
Health Program Monitoring And Evaluation	30	100%	8	100%	7	100%	5	100%

Table 4: Analysis of clinical masters'program

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D. Non- Clinical programs analysis

18% of health degrees, according to the analysis, had no clinical relevance. The review did point out that several of the non-clinical degree programs available had distinct names because of their focus. For instance, the name of the master's degree in health systems management can be either health policy and management or health system management. The team chose to group them into key categories of non-clinical health-related programs, as shown in Table 5, to enable comparisons of similar or related specialties in their focus on data use and data systems competencies.

S. No.	**Non Clinical Programs**	**Bachelor**	**Masters**	**Total**
1	Health Informatics	1	3	4
2	Health systems management	1	2	3
3	Public/Community Health	1	7	7
4	Epidemiology	0	3	3
5	Monitoring and Evaluation	0	1	1
6	Statistics	3	3	6
7	Data Science	0	1	1
	Total	6	20	26

Table 5: Analysis of non-clinical programs categorized into health related programs

Five bachelor's degree and twenty master's degree non-clinical programs were found, and five bachelor's degree and twelve master's degree non-clinical curricula were analyzed.

It was found that the identified non-clinical bachelor degree courses were more comprehensive in terms of data systems and data use than clinical programs. All non-clinical bachelor's and master's degree programs were found to include training in fundamental computer skills, quantitative and qualitative research techniques, and skills in data processing and interpretation. Additionally, the research discovered that modules or courses teaching health information system and health management information system were offered in 40% of bachelor's and 67% of all master's programs (HMIS). Additionally, the review found that GIS and data analytics skills were present in non-clinical programs but they were absent in clinical ones.

However, the majority of non-clinical curriculum only give the most basic knowledge of data systems, GIS, and data analytics. For instance, data systems courses like DHIS2, FFARS, and GoT-HOMIS are offered in 40% of bachelor's and 33% of master's programs. Similarly, 17% of master's degrees and 40% of bachelor's programs offered GIS-related abilities. Additionally, because the curricula lack modules that explain how data may be utilized to drive health policies, interventions, and programs, health planning and linking data to action skills were low in several programs. As indicated in Table 6 below, the review also revealed areas of strength and deficiencies in the matrix of gathered curricula/courses.

Data use and Data Systems Aspects	**Number of degrees offering (0ut of 5)**	**Percentages**
Basic computer skills	5	100%
Quantitative methods	5	100%
Qualitative methods	3	60%
Introduction to research methods	5	100%
Health management information systems DHIS2,	2	40%
Data Systems e.g. FFARS, GoT-HOMIS	2	40%
Linking data to action/Community Medicine/outreach/field/ Health profiles/	4	80%
Health Planning/Budgeting/Management	2	40%
Data visualization	4	80%
Dissemination/Knowledge translation	5	100%
Data analysis tools (DV)	3	60%
Geographical Information Systems (GIS)	2	40%
Data Analytics	2	40%
Data Interpretation	2	40%
Health Program Monitoring and Evaluation	2	40%

Table 6: Analysis of data use and data systems variables in bachelor programs

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Data use aspect	Number of master's degree (Out of 12)	Percentages
Basic computer skills	5	42%
Quantitative methods	12	100%
Qualitative methods	12	10%
Introduction to research methods	12	100%
HIS/HMIS	8	67%
Data Systems e.g. DHIS2, FFARS, GoT-HOMIS	4	33%
Linking data to action/Community Medicine/outreach/field/ Health profiles/	4	33%
Health Planning/Budgeting/Management	7	58%
Data visualization	8	67%
Dissemination/Knowledge translation	12	100%
Data analysis tools	8	67%
Geographical Information Systems	2	17%
Data Analytics	2	17%
Data Interpretation	12	100%
Health Program Monitoring and Evaluation	10	83%

Table 7: Analysis of data use and data systems variables in masters' programs

IV. DISCUSSION

According to the assessment, both undergraduate and graduate programs at universities already cover topics related to data systems and data use, including fundamental computer skills, data collection and analysis, data analysis tools, qualitative and quantitative methods, and health management information systems.

Impressively, the evaluation revealed that both clinical and non-clinical curricula effectively addressed the skills and competencies necessary for data collection, analysis, and presentation. However, the review discovered that clinical programs place less of a focus on data systems and use competencies than non-clinical programs do. This suggests that clinical programs should include information about data systems and data use in their curricula, such as DHIS2, FFARS, GoT-HoMIS, HRHIS, and e-LMIS, as well as information about using data to identify and address problems related to public health. Similarly, modules in non-clinical programs focus on gathering data rather than how to link it to action.This suggests that non-clinical courses should emphasize data use skills more, such as linking or integrating generated data with applications of models from epidemiologic, economic, behavioral, and cultural perspectives to encourage the social changes necessary for improving the health of Tanzanian populations.

ICT skills is also offered sparingly for clinical courses. In light of the fact that administrative, monitoring, and supervisory employees use a wide range of data systems and train their younger staff members in healthcare unit settings, Kleinau (2000) argues that these staff members should have advanced ICT skills or rigorous computer training.

The assessment revealed that while data analysis modules were included in almost all clinical and non-clinical programs, there was a severe lack of advanced data analysis courses, especially those for geographic information systems and data analytics. Tanzania, meantime, has a large amount of data produced by existing data systems (such DHIS and Jeeva), necessitating the use of sophisticated data analysis tools, techniques, and procedures. This suggests that training in GIS and data analytics is required for health workers at all levels in order for them to analyse and comprehend regional trends and patterns of disease and resource distributions.

The culture of not using data for evidence-based decision-making is apparent in Tanzania. This was noted from the evaluated curriculum, where it was discovered that there was less coverage of data use-related topics. According to Sauerborn (2000), the "cultural" gap between data people and action people/decision makers is one of the obstacles to the effective use of information in the healthcare system. The study found that the lack of comprehensive coverage of data use issues in curricula design is the root of the culture of bad data use. Therefore, any intervention created to address data use issues should emphasize culture because curriculum design.

V. CONCLUSION

Study limitations: The majority of institutions' websites visited by participants lacked prospectuses that could be read. Additionally, there was a dearth of information, such as the names of the degree programs. Some universities' online prospectuses either supplied insufficient information on the courses they offered or information from their websites and prospectuses did not match. For instance, despite the university's claims to provide the Bachelor of Science in Medical Laboratory Technology (BSc MLT), the prospectus that was downloaded did not contain a course matrix. For fear of their competitors stealing their programs, some institutions were hesitant to publish their curricula. The reviewers were unable to access some curriculum as a result of this action.

Based on the findings, we advise higher education institutions to include courses about data systems and data use in their curricula. Similar to this, all clinical and non-clinical programs should be required to take fundamental ICT skills modules or courses. The learning outcomes of programs at higher education institutions should also include aspects related to data use and data systems.

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ABBREVIATIONS

- DHIS2: District Health Information System
- FFARS: Facility Financing Accounting and Reporting System,
- GoT-HoMIS: Government of Tanzania Hospital Management Information System,
- HRHIS: Human Resource for Health Information System,
- eLMIS: electronic Logistic Management Information System
- HIS: Health Information Systems
- GIS: Geographical Information Systems

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