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Analysing inhibitors of integrating and routinizing Health Information Systems for Universal Health Coverage: the case of Cameroon

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Background and Purpose: The purpose of this paper is to describe the state of HMIS in Cameroon, with particular emphasizes on the organisational factors affect integration, routinization and use of information for decision-making for the achievement of UHC goals.

Methods: This paper is based on an interpretative case study on the implementation of electronic data-based in Cameroon. Data was collected through interviews conducted with District Health Managers, Facility Information Officers, and Matron-In-charge of healthcare facilities from December 2015, to January and July 2016. Document review was used as secondary data collection. Multiple variation sampling technique was used to select interviewees.

Results: Though there is a "general expectation that as electronic IS (DHIS) has been implemented, computers and Internet dongles provided to district and facilities information managers, the quality of information generated will certainly become of good quality and could be used for decision making". This assumption neither concurs with the perspective of ICTs for development nor ICT as an agent for institutional change. According to advocates for ICT as an agent for changes IS is an institution and in order for it to bring about change, all aspects (human and non-human, social, cultural and political factors) have to be given equal attention.

This paper analysed inhibitors of HMIS integration in Cameroon. Factors that affect effective routinizing, integrating and use of HMIS are; multiple data collecting tools, centralized information management, inadequate information system infrastructure, lack of IT specialist and basic computer skills and non-culture of information use.

Conclusions: HMIS offers a remarkable potential for improving the efficacy and effectiveness for healthcare and also for achieving the goal of UHC. However, its integration, routinization and use are quite variable depending on the context.

1   Introduction

Universal Health Coverage (UHC) promotes equity in health by ensuring that all the people of the world have access to, and obtain health services they need without suffering financial hardship when paying for the services (WHO 2010, Sachs 2012). UHC is the world's political agenda for the next 15 years (2015 – 2030) on health system strengthening. To achieve these goals, WHO-World Health Report (WHR) (2008), states that the Primary Health Care (PHC) basket of services has to be expanded to include the following; cases of morbidity, common non-communicable diseases (NCDs) such as obesity, hypertension, cancer and blindness (WHR 2010; Sahay & Sundararaman 2015). Consequently, governments of lower and middle-income countries (LMICs) are called to scale-up activities and services to accelerate access to affordable and quality healthcare services.

The expansion of PHC services would affect information needs of healthcare providers and managers. Managers would need more information, from multiple information systems, from across public and private care providers and across different levels of care, to make decision, track, and monitor and allocate resource.

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Today, countries are implementing information systems (IS) in the healthcare sector, aimed at improving health information. A case at hand is the introduction of Web-DHIS in Cameroon. Like in many other LMICs, electronic database DHIS was introduced and implemented to address the information needs of managers and policy makers. Upon implementation of the database, we observed that technology is considered as a "black box", where its introduction will inevitably improve information. As articulated by one of the national directors: "*We have just introduced to you web-based DHIS. All district managers have been provided with computers and internet dongle. Same goes with hospital information managers. Data for internet will be sent to you on your dongle monthly. No more complains. You should go ahead and start submitting facility data without further complains*" (July 2016). Upon listening to these statements, I felt there is a general expectation that by implementing electronic information system, providing computers and Internet dongles to district and facilities information managers, the quality of data generated will certainly become good and will be used for decision making.

Information technologies have great potentials to support planning, monitoring health services and to communicate more effectively across organisational hierarchies (Bhatnagar, 1992). For example, the implementation of IT-based HMIS will provide health programmes, service providers with reliable and relevant health information to optimally allocate resources, improve quality of health services (Braa and Blobel 2003). However, the literature explains that the implementation and adoption of IT does not imply the provision of technology. The literature explains that if emphasis is laid on the technology alone, it (technology) fails to capture the rich and multifaceted nature of ICT (see, for instance, Kling 2000; Orlikowski & Iacono 2001). Doherty and King (2001) explain that by concentrating much on the technical issues is at the expense of the organisational once. This is what the authors call failure to a universal problem (Doherty, et al 2001). Aanestad (2002) added that when implementing ICT such as IS, there are two elements to it; human and non-human. These elements are related and interwoven. Therefore, in order to integrate, routinize and use IS both elements should be given equal attention (Aanestad 2002). In a similar vein, Heeks (2002) points out that in the case of development countries implementing IS, what is transferred is not only machines and software, but also attitude and values of the system, together with the social, political and cultural structures. While it could be relatively easier to transfer technology, socio-cultural settings have to be cultivated and technological learnings have to be ensured (Hanseth, 2002).

The purpose of this paper is to analyse the state of HMIS in Cameroon, with particular emphasizes on the organisational factors that would affect the integration, routinization and use of information for decision making. Considering the unexplored domain of HMIS for UHC, this paper focuses on the following research questions: What factors would affect the integration, routinization and use of health information to monitor and track activities of UHC goals.

2   Related Literature

Universal Health Coverage (UHC) is a foundational element of health strengthening efforts. UHC discourse emphasized the development of health systems that will enable all people to have access to services without suffering financial hardship when paying for them (WHO-WHR 2010). According to the WHO-World Health Report (WHR) (2008), Primary Health Care (PHC) is the vehicle to achieve UHC through financial risk protection. This will require that the PHC baskets of services are expanded.

The expansion of PHC services would impact on the information needs of health care providers, managers, and policy makers. Information from multiple systems will be needed, such as civil registration and vital statistics, including unique identifiers (UID), and community health services (WHO-WHR 2010; MA4Health 2015). They will also need information to support continuity of clinical care across public and private providers and across different levels of care. Financial information will be required to track out-of-pocket payment (OOP). Health Management Information System (HMIS) would be expected to communicate with these multiple systems across public and private providers and across different levels of care, to support the extraction and processing of information on health indicators, health systems performance and health status of the population. HMIS would be expected to provide increased access to reliable information, increase transparency and allow government to better understand the challenges of improving health. It should also be able to support the evaluation of health programs and inform policies

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(Mutale & Chintu, et al. 2013). The system should be capable of capturing a broad range of data on both patient-based and aggregated data, for both private and public healthcare facilities (Fichman, et al 2011), thus the importance of HIS in strengthening health system.

In Lower and Middle Income countries (LMICs), the traditional HMIS have been described as weak, inadequate, fragmented data collection processes, with centralized information management, and inadequate infrastructures (Lippeveld 2001; Heeks 2006; Chilundo and Aanestad 2004; Braa et al 2007; Nielsen, et al 2016). The quality of data generated is not of good quality and cannot be used for decision-making. Other factors facing IS include high organisational costs involved in managing, planning and maintaining ICTs (Heeks & Kenny 2002). There are also problems due to the political nature of the systems; (see, for instance, Schmidt and Werle 1998, Bunduchi, et al 2005). Silva and Figuerao (2002) highlight the issue of power exercised by international agencies implementing ICT in LMICs, and also issues relating to the socio-political nature of HMIS (Walsham, et al 1988, Orlikowski and Baroudi 1991, Avgerou 2002, Kimaro and Sahay 2007).

3   Context, settings and methods

The empirical setting within which the study was conducted is Cameroon. It is a low-income country, situated in the sub-Saharan Africa (SSA) region. It has an estimated population of 20.6 million (Chen, et al 2004). Healthcare services are being delivered in a context of severe resource constraints. Basic public and social amenities for the vulnerable are either absent or inadequate. Nationally, 29.7 percent of the population does not have access to safe drinking water and 66.9 percent lack adequate sanitation, resulting in regular outbreaks of cholera and other water-related diseases (UNICEF 2015). Healthcare services are not available to all due to physical distance and cost. Public health care is not free. Fees charged at health facilities are often higher and the burden of healthcare financing is born largely by households through out-of-pocket payments (OOP). The government of Cameroon spends an average of USD 61 as per capita per person on health. Out of this amount, only USD 17 paid by the state, USD 8 comes from international donors, and USD 36 is OOP (Cameroon Economic Update 2013). Seeking health is often not the first option; patients have often approached traditional health first or attempted self-treatment. For example, first-line malaria drugs are available through pharmacies and on the black market. Malaria is endemic and accounts for more than 40 percent of all deaths in children under 5 (UNICEF 2015). Mortality rate for children under 5 is 148 per 1000 live births, ranking Cameroon as 18th amongst 20 countries in the world with the highest mortality rate. Only 13 percent of children under the age of five sleep under insecticide-treated nets, in a country where malaria accounts for more than 40 percent of all deaths in this age group. Maternal mortality rate is alarmingly high, 670 per 100,000 births as compared to 546 per 100,000 live births in SSA. In addition, many women and girls have limited access to, and utilization of, prevention-of-mother-to-child transmission (PMTCT) services, resulting in HIV infection transfer to children (UNICEF 2015).

In Cameroon, the healthcare system adheres to the district health approach, organised in three levels: the operational level, corresponding to district health care; the intermediate level which is responsible for technical support, while the central level deals with the development of health policies. Different programmes operate at all three levels, engaged in the provision of specialised services such as maternal and child health, malaria, HIV/AIDS, TB, and are supported by different donor agencies.

The health system suffers from shortage of qualified healthcare personnel, lack of technical and managerial expertise. In 2009, the ratio of physician per inhabitants was 1 to 12,000 and nurses and other healthcare cadre was 0.5 to 1000 people. The distribution of health professionals is highly urban-focused and varies significantly by regions (MoPH 2011).

In 2014, MoPH introduced an electronic database; District Health Information System (DHIS) was adopted as the main platform for the management of health information nation-wide. DHIS is open source software developed for public health management information system. In Cameroon, DHIS is presently used at the healthcare facilities (General, Central, Regional and district) hospitals as the main tool for data collection. Data is captured manually at the Integrated Health Centres (IHC) and sent to the District offices, where it is captured electronically.

The study is drawn from an interpretative strand (Walsham, 1995). Interpretive studies attempt to understand phenomena via the meaning people assign to them. Different people's interpretations of the

same situation differ, and the aim is thus not an objective account but rather a more relativistic but shared understanding of what is happening (Orlikowski and Baroudi 1991). In this study, the purpose was to understand HMIS within the context of Cameroon, what factors affect its integration and routinizing in relation to achieving the goals of UHC.

Data was collected by the first author from January to September 2016. Multiple data sources were used; interviews, participant observation and document review. Three interviews were conducted with the DHIS core team in Yaoundé, 5 district information managers, 3 hospital information managers, 3 district program managers and 3 matron-in-charge of data management in wards, and Sister-in-charge of Integrated Health Centres. The interviews took place within the health facility surroundings, mostly in health workers' offices as they needed to continue their daily activities. Participant observation and informal talks were used to gather an impression of the working conditions in the health facility to understand health workers' working practices in depth and detail. The documents analysed include National HIS strategy document and program reports.

Purposive sampling technique was used to select participants to be interviewed. This technique is used to achieve a homogeneous sample. That is a sample of cases who share the same characteristics e.g. background or occupation (Creswell 2007). In this study, the participants were all involved in a particular activity; data management at their respective facilities. An interview guide with broad themes around HIS and data management in Cameroon was developed. Permission to conduct the study was obtained from the Office of Regional Health delegate of each region and signed informed consent was obtained from each participant. At the start of every discussion, permission to audio record the interviews was also obtained. The principle of data saturation was applied. That is interviews were stopped when further probing was not adding new information.

Data analysis was driven by interpretive process. Content analysis was used to analyse the data (Elo, et al 2008). The interviews were transcribed verbatim. The interviews were read through several times to obtain a sense of the whole. While reading the transcripts, headings were grouped to formulate a general description of the purpose of the research. Understanding from these various sources of research data were developed following the principle of triangulation.

4   Results

The Ministry of Public health in Cameroon achieved its major milestone in 2014 when it opted to implement electronic databases; District Health Information System (DHIS) web-based. This declaration led to the creation of the department for data management, also known as the "Cellular National d'Information Sanitaires" (CNIS). It is situated at the Ministry of Public Health (MoPH), charged with the responsibilities to manage data within the health care system; national, provincial, and district levels, for decision-making. CNIS main responsibilities are to gather, capture, process, analyse and disseminate data and information within the health systems to support decision-making of healthcare providers and policy-makers. Data is collected at health facilities, and reported upward through health districts to the national level in Yaoundé, the capital city. Over the years, web-based DHIS was only used at the central level; National Department of Health in Yaoundé. In June 2015, CNIS decided to up-scale DHIS nationally and created a data collection tool MRA which is similar to the manual data collection tool. This tool was up-loaded electronically on web-based DHIS. Thereafter, there was a nation-wide training on how to capture data directly online on the electronic version of MRA. In the process of routinizing MRA and integrating DHIS as the main platform for the management of HIS in Cameroon, the following were identified:

Cameroon as a well-established information system, but the manner and culture of collecting and submitting data leaves little to desire. It could be said that information management has become an institutionalized routine that must be performed as a part of their jobs and not because the healthcare providers realized the importance of the data they collect. This could be attributed to the following factors:

Centralization of information management: HMIS is planned and managed centrally. Data collection tools and reporting forms are designed at the central level with no input from the district. We also observed that there is a disconnection between the central office and the district health office, in

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terms of communication and support provided between these levels of the health system. The District Information Managers explain "We meet with the CNIS people in Yaoundé only when there is training. These trainings happen once in a while. Apart from such training, we at the district do not have any working relation with them [CNIS]. Even when we have some challenges on the database, we do know whom to talk to for assistance. We report the matter to the regional office, it takes ages for them to come back to us because they also seem to be having problems communication with CNIS" (July 2016).

When asked the Regional Office why they cannot provide support on DHIS to the district office, one of the regional managers had this to say "*we have been given positions without any support tool. Look at my office, I do not have a computer what sort of assistance can I offer. On DHIS, everything is controlled at the national level*" July 2016.

Inadequate information system infrastructure: Working on electronic database requires constant connections to the Internet. In the public sector in Cameroon, access to and use of the Internet is limited which hampers effective usage and management of the system. Fixed broadband internet connection is limited at the ministry and within the country as a whole. For example, 0.1% per 100 inhabitants and fixed telephone is none existence (Alliance for Affordable Internet 2014). Healthcare facilities do not have regular Internet access. District and facilities information offices have been given mobile Internet dongles with a certain quantity of data to capture and submit data on a monthly basis.

It was observed that most of the dongles are not functional and in some cases the Internet Service Provider (ISP) does not top-up the dongle regularly. As a result, the MRA forms are often submitted late. The situation is even worse at health facilities in the rural areas. In addition to the lack of internet connection, some of these facilities face frequent black out due to the lack of electricity.

Though computers have been introduced at the district levels, It is observed that most are either functional or cannot be used on the network. A Facility Data manager had this to say regarding the type of computers they have: "*there are so many computers in this hospital but I do not have a computer. At my health facility; the regional hospital, data is collection manually on the forms and sent to the delegation to be captured there. Presently, I have decided to use my personal computer but it seems as if the Internet dongle is not functional. I have informed the district office. So far nothing has been done*" (Facility Information Manager, July 2016)."

We realized a lack of basic HIS supplies such as printers, ink cartridges, and paper were often out of stock. Data Manager at a Regional Hospital explains: "*there are some computers others do not meet the required standards to be used over a network whiles others are faulty and cannot be repaired*" (Manager Central level, July 2016).

Another problem that has affecting data management is the lack of resources. For example, sending of data from one level to another is often done late due to lack of transportation. Since there is no transportation, data from periphery arrives is brought to the district by a clinic manager when s/he goes to the district for a meeting. Data are often submitted late.

It was also observed that the English version of MRA is not yet available. Facilities in the English speaking regions of the country had to record data on forms or exercise books which might get misplaced.

Data collation and collection Processes: Healthcare providers focused primarily on the patients. Due to the shortage of staff, the work burden on care giver is extremely high as a result, data reporting and collection is perceived to be a secondary task. Nurses are faced with a dilemma of seeing patients, registering and reporting of data in the various registers. Nurses, have multiple responsibilities, including primary clinical responsibilities, which may interfere with the time they have allocated for data collection. It was observed that nurses have attached more importance to patients' care which has adversely impact on data management as data is recorded many days after the event has occurred. One facility manager explain: "*Nurses often think of registering and reporting data towards the end of the month when the facility information manager comes around to inform them that he will be coming to collect the MRA. As they take long time before recording the figures, some of them do forget and at the end they start to guess numbers and record*" (Facility Information Manager, September 2016).

Data quality Review.

No data quality checks are done either before or after data are submitted. Whenever data is submitted, no feedback is provided to the lower facilities as a result. A district manager explains that due to the lack of feedback, data clerks have developed the habit of data falsification.

During a data review meeting on maternal health data for 2015, a Provincial coordinator explained: "*while I was going through Maternal Health data for last year [2015] from one of the districts in the central province, a facility recorded 85 maternal deaths in September 2015. I raised this issue with my subordinates; it did not mean anything to them. I asked myself, if this is true or cooked data? If this figure is correct, why issue was never raised at any of our meetings*" (Provincial Program Coordinator July 2016).

Handling and Storing of Registers.

Hospital registers of should be properly stored as evident that a services was offered. Proper care should be taken when writing in these registers and should be properly stored. We observed that pagers of registers were dirty and the edges of some pagers had been ripped off. This reinforced the widespread attitude that information is being collected mainly to satisfy the needs of those in Yaoundé. In general, there seems to be no time for data reporting and registering. Data collection has become an institutionalized routine that must be performed as a part of the job and not because the healthcare providers realized the importance of the data they collect.

Use of information.

The centralized nature of information management also means centralized used of information and decision making. In Cameroon though health systems are decentralised, data management is still very centralized. It was observed that there is a no culture of information use and a feeling of "laissez-faire" when it comes to issues relating to data. Data is collected not to be used for decision-making but an institutionalized routine that must be performed as part of the job to meet the needs of managers at the Central office in Yaoundé. The culture of using information for decision making by manager is practised minimally. Managers often refer to data or statistics as often referred to towards the end of the month or quarter, when preparing monthly reports. A facility Manager explains "*managers at her facility start completing the MRA around the 25th of the month after he must have gone around informing them that he will be coming to collect the forms*" (July 2016)

A Provincial HIV/AIDS Regional Coordinator added that: "as a priority program, at the beginning of the year targets are set in Yaoundé [the capital in Cameroon]. For example: "*Treatment coverage among HIV/AIDS positive pregnant women*". At the end of the month, based on the data submitted from the health facilities, I calculate the indicator and submit the report to the next level." (District Program Manager, September 2016). And a program director at the national level confirms "*districts are not involved in decision-making. Decisions are made at the central level and that is where data is used. Though at the central level information is mostly used to comply reports as well*" (National Program Director, September 2016).

Shortage of human resources and lack of basic computing skills: There is an acute shortage of IT professionals in the public sector and at the MoPH in particular. There is a lack of qualified IT staff, healthcare providers lack basic computer skills. At the regional and district level, those who manage data lack basic data management skills.

At the Ministry of Public Health, IT professionals are a rare profession. Most of these graduates prefer to work in the private sector or non-governmental organisations (NGOs) who offer better working conditions and better pay.

5   Discussion

The purpose of this paper was to analyse organisational factors that would affect the integration, routinization and use of HMIS in Cameroon for the purpose of achieving the goals of UHC. This was in relation to the implementation of web-DHIS, the electronic database. This study found that factors

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affecting HMIS in Cameroon are of multiply levels, ranging from centralized, inadequate information system infrastructure such as computer and internet connection, lack of human resources and no basic computer skills, and none use of information for decision making. This finding coincides with similar studies from (Bhatnagar 1992; Ashraf, et al 2007).

The general expectation that by implementing electronic information system, providing computers and Internet dongles to district and facilities information managers, the quality of data generated will certainly become good and will be used for decision making could only be met if these factors are attended to.

HMIS is the backbone of every healthcare system. In order for DHIS to achieve optimum performance, both the human and non-human factors should be considered (Aanestad 2002). In a similar vein Aquil (2009) articulate that to integrate an IS the following factors should be considered; behavioural, organisational and technical.

The organisational factors are the structure, resources, and support services which are to be used to develop and manage the system. The lack of these elements would crucially affect the performance of the system (Kamadjeu, et al 2005). Behavioural factors include elements of confidence and competence that users need to perform their tasks freely and comfortably. Limited knowledge on the usefulness of data by healthcare providers is a major factor and could lead to poor data quality and none use of information for decision-making (Rotich, et al (2003, Aquil 2009). Knowledge on how to manage the system should also be provided to district health managers. The absence of either of these elements will potentially affect the performance of IS. For example, if indicators are irrelevant, and data collection forms are too complex, will affect the confidence level of the data capturers and Matron in-charge to record data correctly. Also, when the software does not generate data timeously and of good quality, decision-makers will not use it (Odhiambo-Otieno 2005). The technical factors are the specialised knowledge and technology skills required to properly develop and manage the system efficiently (Nsubuga et al 2002). These factors; behavioural, organisational and technical are related and intertwined. Callon and Law argued that "a distinction between technology, context and society is a simplification obscuring the complex processes where technology and human actors jointly take part in forming socio-technical entities" (Callon and Law 1989).

It is undeniable that HMIS is uniquely positioned to capture process and communicate timely information for decision-makers for better monitoring of UHC goals. However, to achieve this aim, there is need to consider all factors of the systems instead of concentrating on technology only as in the case of Cameroon.

6   Conclusion

IT-based HMIS have potentials of improving the quality and use of information in the healthcare system. That is to provide health system and healthcare providers, quality information to monitor and track activities relating to UHC goals will variable depend on the context of the organization. Reasons being the technology and context are related and intertwined. Thus, to optimize the effectiveness and efficiency of the information system both aspects should be given equal attention. This study extends research in Cameroon on HMIS.

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