ZNPHI
ZAMBIA NATIONAL
PUBLIC HEALTH INSTITUTE

The Health Press

ISSN 2520-4378

VOL. 02
ISSUE 12
31 DECEMBER 2018

ZAMBIA'S JOURNAL ON PUBLIC HEALTH, DISEASE SURVEILLANCE, PREVENTION AND CONTROL

The Health Press - Zambia is published by Zambia National Public Health Institute, Ministry of Health Zambia since Jan 31, 2017.

Address: Plot 13, Reedbuck Road, Kabulonga, Lusaka.

Email: editor.heathpress@znphi.co.zm
Website: http://znphi.co.zm/thehealthpress/
Suggested Citation:
[Author Surname, Initial].[Article title].Health Press Zambia Bull 2018;02(12):[inclusive page numbers].

TABLE OF CONTENTS

HEALTH AND DISABILITY

Editorial

By ML Mazaba

Zambia National Public Health Institute, Lusaka, Zambia.

Correspondence: Mazyanga Lucy Mazaba (mazyanga.mazaba@znphi.co.zm)

Citation style for this article: Mazaba ML . Health And Disability. Health Press Zambia Bull. 2018;2(12); pp 1-2.

We also provide a commentary on the progress the Zambia National Public Health Institute, the intelligence technical wing of the health systems in Zambia, has made in improving data collection, collation, analysis and usability.

The editorial focuses on health and disabilities in celebration of the International Day of Persons with Disabilities awareness day.

Wishing you a pleasant end of year and looking forward to a continued association in 2019 and beyond.

Health and Disabilities

December 3rd observed by the United Nations as International Day of Persons with Disabilities (IDPD) since 1992 is aimed at supporting persons with disabilities and in 2018 the theme was "Empowering persons with disabilities and ensuring inclusiveness and equality" envisaged in the 2030 Agenda for Sustainable Development [3]. The World Health Organisation utilises this occasion to support governments and civil society to remove barriers to health facilities, expanding the scope of rehabilitation and supporting development of community-based rehabilitation.

Disabilities are a public health issue with some health associated conditions leading to poor health and wide-ranging health needs. Among the objectives of this important awareness day in 2018, the health related ones included [3,4]:

- Help persons with disabilities to attain the highest standard of healthcare, without discrimination;
- Train health professionals to ensure persons with disabilities haveaccess to appropriate healthcare;
- Refer children with disabilities to specialized medical and rehabilitation services to reduce morbidity and mortality; and
- Support women with disabilities to access maternal health services

These objectives are well appreciated as important because of the one billion people with disabilities; 200 million of who are children, and half who cannot afford health care [3].

The Zambia Agency for Persons with Disabilities (ZAPD), a quasi-Government Institution established by an Act of Parliament, under the Persons with Disabilities Act No. 06 of 2012 of the Laws of Zambia envisions "a fully rehabilitated or enlightened, economically empowered and socially integrated disabled persons with full access to information / public facilities and enjoying equal rights with other members of the society" [5]. The ZAPD seeks to support the improvement of the social wellbeing of people with disabilities through access to health services and facilities and alleviation of health related problems

The Health Press endorses the drive to ensure equity and inclusion of persons with disabilities in decision making, access to amenities and empowering of persons with disabilities in line with the Agenda for Sustainable Development theme of **'Leaving no one behind'.**

LIST OF REFERENCES

1. Mutale W, Chintu N, Amoriso C, Awoonor-Williams K, Phillips J, Baynes C et. al. Improving health information systems for decision making across five sub-Saharan African countries: Implementation strategies from the African Health Initiative. BMC Public Health Services 2013, 13(Suppl 2):S9-20
2. Mandyata CB, Olowski LK, Mutale W. Challenges of implementing the integrated disease surveillance and response strategy in Zambia: a health worker perspective. BMC Public Health. 2017;17(1):746-757.
3. Department of Economic and Social Affairs, United Nations. URL: https://www.un.org/development/desa/disabilities/international-day-of-persons-with-disabilities-3-december/idpd18.html
4. Ministry of Health, Saudi Arabia. URL: https://www.moh.gov.sa/en/HealthAwareness/healthDay/2018/Pages/HealthDay-2018-12-03.aspx
5. Zambia Agency for Persons with Disabilities. URL: http://www.zapd.org.zm

ELECTRONIC INTEGRATED DISEASE SURVEILLANCE AND RESPONSE SYSTEM TOOLS FOR DISEASE SURVEILLANCE AT THE ZAMBIA NATIONAL PUBLIC HEALTH INSTITUTE

Short Communication

By VM Mukonka

Zambia National Public Health Institute, Lusaka, Zambia.

Citation style for this article: Mukonka VM. Electronic Integrated Disease Surveillance And Response System Tools For Disease Surveillance At The Zambia National Public Health Institute. Health Press Zambia Bull. 2018;2(12); pp 3-3.

The Zambia National Public Health Institute (ZNPHI), a specialised technical arm of the Ministry of Health has been mandated to coordinate surveillance and disease intelligence, prepare for and manage health emergencies as well as feed policy and program management with evidence based information. Challenges in data collection, collation and analysis have been recognised as a factor in determining preparedness and responses to health emergencies.

Recognizing that electronic Integrated Disease Surveillance and Response (eIDSR), an application of electronic tools to the principles of IDSR to facilitate prevention, prediction, detection, and response is key to efficient disease intelligence and response to emergencies, Zambia has adopted eIDSR to improve data collection, collation, analysis and usability.

The African region in 2013, adopted an eHealth resolution (AFR/RC60/R3) to address the use of Information and Communication Technologies (ICT) for health and health-related fields, including disease surveillance. This strategy recommended the development of national policies, strategies, norms and appropriate governance mechanisms resulting in long-term strategic plans and frameworks for eHealth capacities in countries.

Further to that, the Government of the republic of Zambia has a vision to have a Smart Zambia, and buying into this vision while recognizing the weakness in disease intelligence and preparedness for responses, the ZNPHI with the support from partners have developed an electronic Integrated Disease Surveillance and Response system (e-IDSR) for capturing disease surveillance data on notifiable diseases that will enhance its capacity to efficiently employ its mandate.

Going electronic will safeguard: near real-time disease reporting, even if not confirmed; electronic laboratory reporting that enables laboratories to report cases to relevant health providers and personnel without transport delays; enable timely confirmation of unconfirmed cases; integration of multiple health information databases into a single repository; electronic messaging capabilities (mobile SMS, emails and messaging within the electronic IDSR (e-IDSR). This enables the sharing of information efficiently with all levels of health professionals that have necessary access to the system and automatic aggregation to generate daily, weekly, monthly, quarterly and annual reports. The electronic Integrated Disease Surveillance and Response tool once rolled out through the country will completely change to a positive, the efficiency of disease intelligence, emergency response and policy direction on the health platform

IMPROVING HEALTH INFORMATION SYSTEMS FOR DECISION MAKING ACROSS FIVE SUB-SAHARAN AFRICAN COUNTRIES: IMPLEMENTATION STRATEGIES FROM THE AFRICAN HEALTH INITIATIVE

Research Article

Wilbroad Mutale[1,2*], Namwinga Chintu[1] , Cheryl Amoroso[3], Koku Awoonor-Williams[4], James Phillips[5], Colin Baynes[5,6], Cathy Michel[7], Angela Taylor[1], Kenneth Sherr[8]

1. Centre for Infectious Disease Research in Zambia, Zambia.
2. School of Medicine, University of Zambia, Zambia.
3. Partners In Health/Inshuti Mu Buzima, Rwanda.
4. Upper East Regional Health Directorate, Ministry of Health, Ghana.
5. Heilbrunn Department of Population and Family Health, Mailman School of Public Health, Columbia University, NY, USA.
6. Ifakara Health Institute , Mikocheni, Dar-es-Salaam, Tanzania.
7. Health Alliance International, Direcçao Provincial de Saúde, Beira, Sofala, Mozambique.
8. Department of Global Health, University of Washington, Seattle, USA.

Correspondence: Wilbroad Mutale (wmutale@yahoo.com)

Citation style for this article: Mutale W, Chintu N, Amoroso C et al.Improving health information systems for decision making across five sub-Saharan African countries: Implementation strategies from the African Health Initiative. Health Press Zambia Bull. 2018;2(12); pp 4-16. *This work has been adapted from the original article "[Improving health information systems for decision making across five sub-Saharan African countries: Implementation strategies from the African Health Initiative]" by [Wilbroad Mutale, Namwinga Chintu, Cheryl Amoriso, Koku Awoonor-Williams, James Phillips, Colin Baynes, Cathy Michel, Angela Taylor, Kenneth Sherr and with input from the Population Health Implementation and Training – Africa Health Initiative Data Collaborative]. BMC Public Health Services 2013, 13(Suppl 2):S9 (https://doi.org/10.1186/1472-6963-13-S2-S9; https://bmchealthservres.biomedcentral.com/articles/10.1186/1472-6963-13-S2-S9). The original article is an*

Weak health information systems (HIS) are a critical challenge to reaching the health-related Millennium Development Goals because health systems performance cannot be adequately assessed or monitored where HIS data are incomplete, inaccurate, or untimely. The Population Health Implementation and Training (PHIT) Partnerships were established in five sub-Saharan African countries (Ghana, Mozambique, Rwanda, Tanzania, and Zambia) to catalyze advances in strengthening district health systems. Interventions were tailored to the setting in which activities were planned.

Comparisons across strategies:

All five PHIT Partnerships share a common feature in their goal of enhancing HIS and linking data with improved decision-making, specific strategies varied. Mozambique, Ghana, and Tanzania all focus on improving the quality and use of the existing Ministry of Health HIS, while the Zambia and Rwanda partnerships have introduced new information and communication technology systems or tools. All partnerships have adopted a flexible, iterative approach in designing and refining the development of new tools and approaches for HIS enhancement (such as routine data quality audits and automated troubleshooting), as well as improving decision making through timely feedback on health system performance (such as through summary data dashboards or routine data review meetings). The most striking differences between partnership approaches can be found in the level of emphasis of data collection (patient versus health facility), and consequently the level of decision making enhancement (community, facility, district, or provincial leadership).

Discussion:

Design differences across PHIT Partnerships reflect differing theories of change, particularly regarding what information is needed, who will use the information to affect change, and how this change is expected to manifest. The iterative process of data use to monitor and assess the health system has been heavily communication dependent, with challenges due to poor feedback loops. Implementation to date has highlighted the importance of engaging frontline staff and managers in improving data collection and its use for informing system improvement. Through rigorous process and impact evaluation, the experience of the PHIT teams hope to contribute to the evidence base in the areas of HIS strengthening, linking HIS with decision making, and its impact on measures of health system outputs and impact.

Background:

Health Information Systems (HIS) are one of the six essential and interrelated building blocks of a health system. A well-functioning HIS should produce reliable and timely information on health determinants, health status and health system performance, and be capable of analyzing this information to guide activities across all other health system building blocks [1]. Thus, an HIS enables decision-makers at all levels of the health system to identify progress, problems, and needs; make evidence-based decisions on health policies and programs; and optimally allocate scarce resources [2-4] – all of which are key elements in the success of large-scale efforts to achieve health improvements [5]. Weak HIS are a critical challenge to reaching the healthrelated Millennium Development Goals [6,7]. Evaluations of routine health facility data have identified consistent problems in HIS completeness, accuracy and timeliness in low- and middle-income country (LMIC) health settings [8,9], which limit HIS use for routine primary health care (PHC) planning, monitoring, and evaluation [10-12]. Other factors associated with poor quality data in resource constrained settings include duplicate, parallel reporting channels and insufficient capacity to analyze and use data for decision making [13]. Improving HIS functioning is a priority given its central

role in the delivery of equitable and high quality health services, though approaches to improving HIS vary. Simple data quality assessments that engage frontline health workers and data managers have been used to verify, standardize, and improve routine HIS data [14-16]. Other approaches have focused on technological interventions such as information communication technologies (ICT) designed to reduce errors through reducing data bulkiness and automating data collection, validation, and analysis [4,17,18]. To ensure that HIS contribute to improved health services, it is essential that policy makers and health system managers utilize available information for ongoing monitoring of plans and programs, as well as for resource allocation purposes. Information management is a basis for the production of knowledge and its translation for health system decision making [19-21]. Further evidence is needed on effective strategies for linking data system improvements with decision making, including its impact on the delivery of health services and population health. The Doris Duke Charitable Foundation launched the African Health Initiative to catalyze significant advances in health systems strengthening through supporting Population Health and Implementation Training (PHIT) Partnerships in five sub-Saharan African countries (Ghana, Mozambique, Rwanda, Tanzania and Zambia) [29]. All five PHIT Partnerships include approaches to strengthen the HIS building block as a means of improving health service delivery and, ultimately, population level health. Despite the common goal of improving data capture to support timely decision making, each partnership uses project-specific strategies to strengthen HIS and improve decision making and to target different levels of the health system, including health managers, clinicians, and the community. The full description of each partnership's methodology is described elsewhere [30-35]. This paper describes, compares, and contrasts the five PHIT Partnership approaches to strengthen HIS and promote the use of data for decision making, focusing on the designs, activities, and the adaptations during the implementation process.

PHIT Partnership approaches to improve HIS and decision making

Table 1 summarizes the range of models to improve HIS across the five PHIT countries, focusing on integration approaches with the MOH's HIS, strategies for improving data quality, procedures for handling and manipulating data, strategies for linking data to decision making, and sustainability plans.

Ghana

The Ghana PHIT Partnership (the Ghana Essential Health Intervention Project, or GEHIP), has two intervention strategies to strengthen the HIS and link information with improved health system operations. The first is to implement a simplified information capturing system as part of the District Health Information Management System (DHIMS-2) that focuses on essential information for district level planning, thereby reducing the reporting burden in primary care settings (Figure 1). The second is the adoption of a District Health Planning and Reporting Toolkit (DiHPART) for use by district health leadership to identify and allocate resources based on the district level burden of disease profile.

Rationale and contextual appropriateness

Data capture for DHIMS-2

Simplified registers were introduced to standardize data sources, and to ensure consistent supply of registers for community health officers (CHOs). The simplified registers also allow health facilities to rapidly tally figures for monthly summary reports in order to address complex data capture responsibilities that occupied more frontline staff time than clinical service delivery [22]. Prior to the adoption of the simplified registers, maintaining patient encounter registers was complex and cumbersome, involving 27 register books to collect information on patient attendance at outpatient consults, maternity, well-child care, family planning, and home visits. Collating and reporting health information was particularly tedious for CHOs, who record, compile, and report client encounters to sub-district and district levels.

Planning and budgeting with DiHPART

Based on the observation that national decentralization policies lack appropriate training and tools for district leaders to base priorities on need, the DiHPART tool was developed to assist managers with planning. As a means of basing decision-making on known patterns of risk, DiHPART removes the guesswork from budgeting, simplifying the task of strategic leadership for health resource allocation.

Activities and feedback mechanism Data capture for DHIMS-2

The GEHIP team worked with district and sub-district managers and CHOs to review, redesign, and implement the improved versions of the simplified registers over a one-year period. A detailed review was carried out to inventory baseline data collection (data fields collected, registers used), identify redundant information, and assess data collection for appropriateness and relevance for district health managers and CHOs. The physical size of the simplified registers was reduced to make them easier to carry during outreach activities. In the course of this iterative process, the simplified registers were piloted in one district and subsequently adapted to the need of all three GEHIP districts after feedback from CHOs and district health information officers. The data fields collected are regularly reviewed to keep them up to date with those collected by the Ghana Health Service. Procurement, distribution, and content revision functions have been fully integrated into the Upper East Regional Health Information Unit, which facilitates rapid adaptation, adoption, and continued use. In their final format, the simplified registers include five registers for CHOs to gather data on facility consults for outpatient, maternal and child care services, and outreach services in homes and schools. Although the initial goal was

Table 1 PHIT Partnership health information system innovations

Health Information System Domain	PHIT Partnership Country				
	Ghana	**Mozambique**	**Rwanda**	**Tanzania**	**Zambia**
Summary	Register simplification.	Improving quality of MOH's routine HIS.	EMR.	Community health information system.	EMR using mobile phone technology.
Integration with national HIS	Harmonizes data from routine MOH facility forms.	Focuses on national MOH information system (*Módulo Básico*).	Integrated into health information system, national roll-out ongoing.	Not currently integrated.	Not currently integrated.
Strategy for data quality improvement	Simplified data capture and streamlined reporting designed to lead to more time to focus on quality.	Ongoing feedback on missing data and outliers, and ongoing data quality assessments across facility, district and provincial levels.	Quarterly data quality audits and automated data quality report based on logic errors generated when administrative and clinical reports are developed.	Facility supervisors review community health agent reports and provide data feedback.	Standardized protocols for data capture with real-time query of data gaps; subsequent follow-up during monitoring visits.
Levels at which data are used	Community, health facility and district levels.	Health facility, district and provincial levels.	Community, health facility, district and national levels.	Community, health facility and district levels.	Community, health facility and district levels.
Data manipulation	Data are aggregated at sub-district, district, and regional levels, and reported to the national level.	Facility and district level graphs and tables routinely updated for Primary Health Care services.	Data are aggregated and summarized to provide summary indicators.	Data are summarized in tables and graphic forms to facilitate trend analysis.	Data are aggregated and summarized into reports and graphics for easy interpretation.
Linkage with decision making	Data used to identify priority areas, and guide planning and resource allocation.	Trend analysis at facility, district and provincial levels to identify priority problems, monitor implementation of modifications, and link with district activity plans and budgets.	Data used by clinicians to plan patient management, as well as district and health facility managers to identify service quality gaps.	Data used for community problem-solving and planning, and incorporated into facility and district planning.	Focus on data use by Community Health Workers to identify patients for follow-up, as well as clinicians and facility managers for performance assessment and improvement.
Sustainability plans	Routine use by MOH managers facilitates ownership and continuity.	Integration with current MOH HIS facilitates adoption and continued use of tools and approach.	The EMR has been incorporated into the national HIS.	Demonstrating feasibility and utility of approach expected to generate support for sustaining the approach.	Training all health workers in the intervention area and close relationship with district managers to build HIS ownership.

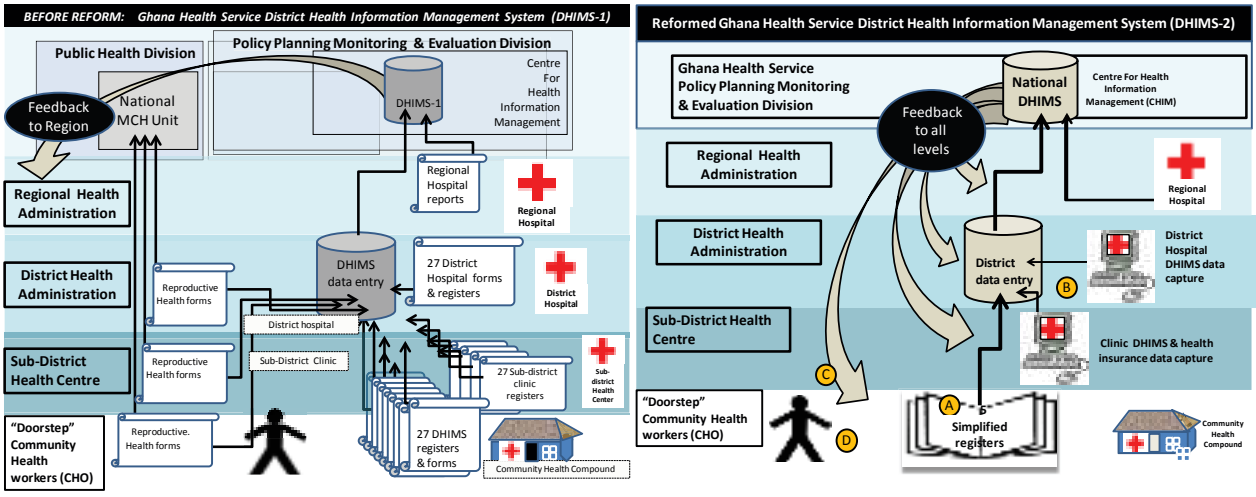

Figure 1 Visual framework for the health information intervention - Ghana

to develop a single register, delineation of functions within health facilities required five registers to collect clinical data when staff were deployed to outreach activities. To ensure data quality and its use, monthly and quarterly data validation meetings are held by CHOs, subdistrict, and district teams to review data collected and identify gaps. Subsequently, the data are compiled and submitted to the regional and national levels.

Planning and budgeting with DiHPART

DiHPART's introduction included an orientation for district health management teams to provide an overview of the disease burden and its implications for current plans and activities, followed by identification of adaptations to align spending priorities with risk patterns. Disease burden models for DiHPART were based on cause of death data from locally derived data provided by the Navrongo Health Research Centre.

Adaptation and learning during implementation

Data capture for DHIMS-2

Qualitative appraisal of reactions to the simplified register system suggests that CHOs welcome the reduced documentation burden and additional time for service and outreach. Essential for the register simplification process has been coordination with national HIS reform (Figure 1), including streamlining data collection and aggregation operations (pathway A) , simplifying and computerizing feedback to all levels (pathway C), and enabling health workers to view data feedback and compare performance with counterparts (pathway D). GEHIP experience has identified additional areas for improvement. Efforts to use cell phone technology for data entry encountered technical problems. In addition, district and regional funds are insufficient to independently cover the recurrent supply cost, including CHO registers. This problem may be resolved when the simplified registers are adopted for nationwide implementation.

Planning and budgeting with DiHPART

The experience with implementing DiHPART has differed from expectations in multiple ways. The lack of flexible funds due to earmarked wages and donor requirements has led to a disconnect between DiHPART plans and actual expenditure, which has impeded implementation of DiHPART guided decision making. However, during its implementation, DiHPART has become an influential resource mobilization tool, providing district managers with evidence to lobby political officials for additional resources.

Mozambique

The Mozambique PHIT strategy focuses on strengthening the MOH's established HIS through applying innovative approaches to improve HIS quality and foment its use for resource allocation, program monitoring, and service delivery improvements at the facility, district, and provincial levels (Figure 2). The Mozambique project has introduced simplified tools based on routine HIS data to highlight service delivery performance success and problems at the facility and district levels. The project team mentors district and facility health managers to use these tools for identifying, implementing and evaluating efforts to improve health system performance.

Rationale and contextual appropriateness

The PHIT strategy is designed to work within the MOH priorities, specifically to strengthen the quality and use of the existing information system (Módulo Básico). The partnership has adopted and modified nationally developedtraining modules and data assessment approaches in developing an intervention that is contextually appropriate for district managers.

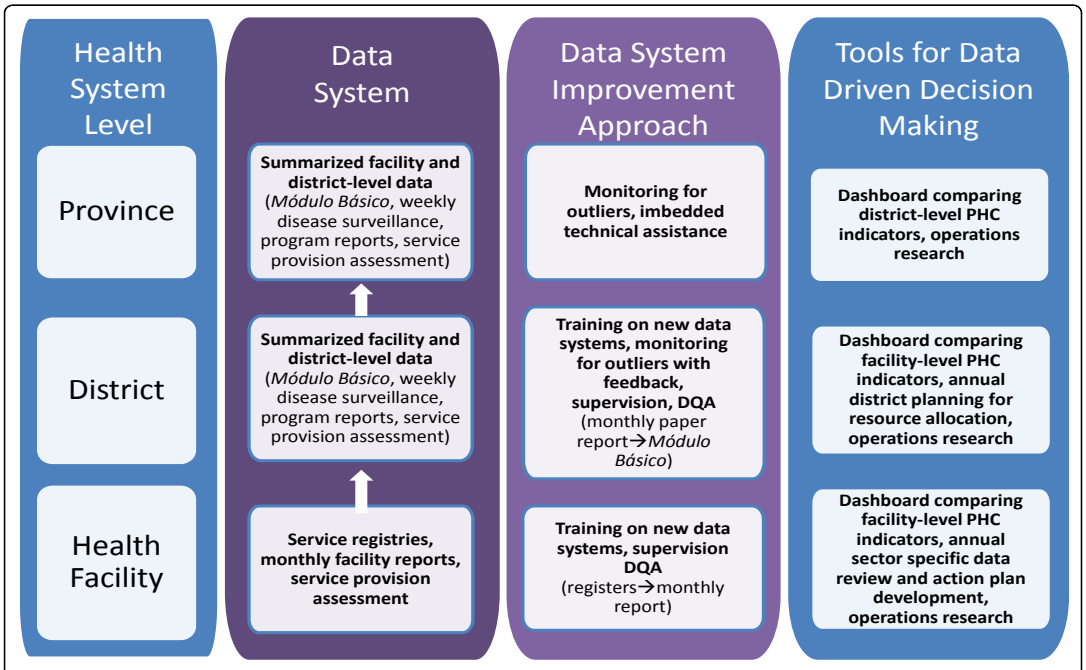

Figure 2 Visual framework for the health information intervention - Mozambique

The PHIT strategy endeavors to improve HIS quality from the facility, district, and provincial levels in Sofala province. Strengthening data for decision making focuses on the district level – the key management unit to support and monitor service delivery improvements at the facility level. Under the government of Mozambique's decentralization program, district managers are increasingly responsible for resource allocation (including financial and non-financial resources, such as human resources), as well as monitoring and evaluating program activities. The PHIT strategy therefore builds district capacity for using data for decision making and supports their linkages with health facilities to lead to health system improvements.

Activities and feedback mechanism

Data quality includes training and supporting district and provincial statistics personnel to continuously monitor the performance of the HIS and the provision of timely feedback to facility and district managers to lead to incremental improvements in HIS quality. Furthermore, an annual data quality assessment (DQA) for primary health care (PHC) services is carried out in all districts in the PHIT intervention province, with feedback provided to district and health facility managers via a summary data quality ranking tool that acknowledges facilities with high data quality and identifies facilities with poor data quality for follow-up by health system managers and PHITsupported personnel [32]. After health facilities with glaring or persistent data quality problems are identified (those in the lowest category of the ranking process), district and provincial health managers provide supportive supervision to facility managers and staff that includes a re-introduction to the HIS and associated tools, clarification of timing and procedures for reporting, and reinforcement of the importance of the HIS. Technical and financial support is also provided to develop and maintain infrastructural capacity to computerize facility summary reports at the district level and send them electronically for monthly collation at the provincial level. Identifying problems and making informed decisions based on up-to-date data from the HIS is promoted at the facility, district, and provincial levels. District and facility managers are trained and mentored to build competencies and routine practices for basic data analysis, including indicator development and secular trend analysis. Simple tools and graphical representations using routinely collected data have been developed, field tested, and implemented for health system managers to use for monitoring primary health care indicators, target interventions, target resources at the district (to improve facility performance), and provincial levels (to improve district performance) [32] and evaluate whether interventions have led to intended service delivery improvements.

Adaptation and learning during implementation

During the six-month planning grant, the Mozambique PHIT Partnership piloted and refined a province-specific DQA methodology, which are now in use [14]. Annual assessment results are disseminated to health facility, district, and provincial managers using a simplified ranking system that was developed based on suggestions from a provincial data quality feedback session. Tools to summarize and regularly compare key PHC indicators across facilities and districts have evolved in design and content over the first three years of implementation to include fewer indicators and focus on secular trend analysis and graphic comparisons among peer facilities and districts. Efforts to promote use of data for decision making have also evolved to go beyond training health managers in data systems, indicator development, and analysis approaches. Periodic district-level review and planning meetings bring together peer facility staff with district and provincial leadership to promote active data review combined with planning and monitoring of plan implementation with key stakeholders.

Rwanda

In Rwanda, the Ministry of Health (MOH) and Partners In Health (PIH) have co-developed an electronic medical record (EMR) system (OpenMRS)[23] and are implementing an enhanced version as part of the PHIT Partnership (Figure 3). In the three PIH-supported districts of Rwanda the EMR holds patient records for 33 health centers, including a catchment area of approximately 800,000 people. The EMR system includes comprehensive medical records for all patients with HIV, tuberculosis, heart failure, epilepsy, hypertension, asthma, chronic obstructive pulmonary disease, diabetes, and cancer. In addition, a medical record system has been developed and is being implemented for acute outpatient consults, including registration, presentation, diagnosis, laboratory tests, and treatment. The EMR supports patient care by providing clinicians with summaries of patient visits and laboratory test results; through reports of at-risk patients (including those with missed visits, low CD4 counts, unsuppressed viral load, and high HBA1c) [24] and through administrative reports to support clinic management, resource allocation, and quality improvement (QI).

Rationale and contextual appropriateness

Though hospitals have paper patient charts recording prior admissions and emergency room visits, the primary care facilities in the project area do not have a standardized comprehensive outpatient paper-based record. As a result, acute and chronic medical history is not always immediately available to clinicians during patient consultation, and information does not always flow optimally between the levels of care. The EMR system allows for synthesis and access to patient history from chronic and acute outpatient encounters at both levels of care. In addition to the nationally required HIS reports, key EMR outputs include customized reports for QI, administration, and infectious disease monitoring. At present, patient registration data have been used to identify geographic areas with low access to acute outpatient services, while chronic care reports guide care for patients with chronic conditions (including HIV, TB, diabetes, hypertension, heart disease, asthma/ COPD and cancer).

The MOH has commenced implementation of a nationwide comprehensive electronic medical record system, based partly on the partnership's work. Core work for this included agreement on standard terminology for national use, including symptoms and diagnoses linked to international standards and development of a tested and refined user interface. This collaboration ensures that parallel systems are not created, with one national information system that integrates across EMR components and feeds into national HIS reporting requirements.

Activities and feedback mechanism

Tools that are being introduced include an electronic patient registration system and an acute patient visit record. Each of these have reports as part of the feedback loop that aggregate data at the facility and district levels (for reporting and administrative purposes), as well as the individual patient level for QI and patient tracking purposes. Training is conducted for data officers and coordinators on a quarterly basis, just prior to the quarterly software releases that deliver new content. Clinicians receive both formal and on-the-job training on using the systems and have a point person from the EMR team to support them.

Adaptation and learning during implementation

In order to allow for integration with the national implementation, the health information model was revised after the terminology standards were discussed with the national e-Health Technical Working Group. Additionally, a training schedule based around software releases and accompanied by more formalized training materials has been developed based on identified field needs.

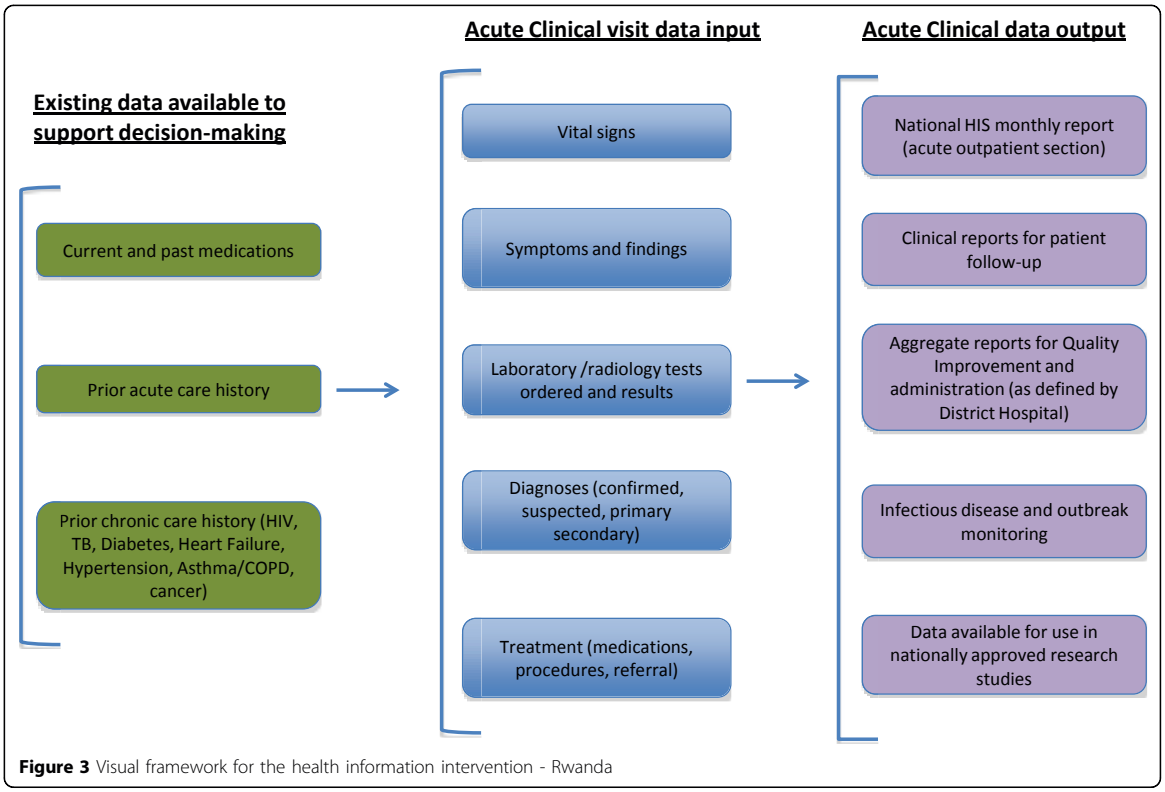

Figure 3 Visual framework for the health information intervention - Rwanda

Tanzania

The Connect Project aims to improve community-level availability, accessibility, and quality of primary health care services using community health agents (CHA) in three districts in rural Tanzania [34]. The Connect Project has adapted and adopted existing community-level health information data capture tools and is working with CHAs to collect and integrate community-level data with the routine HIS at facility and district levels (Figure 4), with data feedback targeting workers at the community, dispensary, health center, and hospital levels.

Rationale and contextual appropriateness

Although the MOH has developed community-level data collection tools, integrating collected data into the MOH HIS (MTUHA) has been challenging. Facility-based health workers are intended to use the community-level module (MTUHA III) to collect information on a range of community health indicators and report to their corresponding council health management teams (CHMT), who use this information to design an accurate profile of their district and develop Comprehensive Council Health Management Plans. Currently, MTUHA III is not fully or uniformly operative throughout the country owing to a range of systems factors, including workforce shortages that prevent timely

and frequent community outreach. The CHA represents an opportunity to pilot and refine approaches to integrate community health information to the MTUHA system.

The Connect project supports integration of community data in the national MTUHA in order to improve the comprehensiveness and quality of health information in general and prompt data interpretation, discussion, and problem solving in community settings. Integration efforts have focused on working with CHA clinical supervisors, village leaders, and CHMT MTUHA coordinators to facilitate their administrative ownership over reporting and utilization of service delivery information from CHAs. As health system and community stakeholder support is built, the Connect HIS system will be customized to reflect the data and reporting requirements of the MTUHA HIS.

Activities and feedback mechanism

Connect staff worked with MTUHA supervisors to develop two community registers (one for service delivery outputs, a second for community mobilization and Symptoms and findings Diagnoses (confirmed, suspected, primary secondary) Laboratory /radiology tests ordered and results Treatment (medications, procedures, referral) Prior acute care history Prior chronic care history (HIV, TB, Diabetes, Heart Failure, Hypertension, Asthma/COPD, cancer) National HIS monthly report (acute outpatient section) Clinical reports for patient follow-up Aggregate reports for Quality Improvement and administration (as defined by District Hospital) Data available for use in nationally approved research studies Current and past medications Vital signs Infectious disease and outbreak monitoring Existing data available to support decision-making Acute Clinical visit data input Acute Clinical data output Figure 3 Visual framework for the health information intervention - Rwanda Mutale et al. BMC Health Services Research 2013, 13(Suppl 2):S9 http://www.biomedcentral.com/1472-6963/13/S2/S9 Page 7 of 12 health education activities) that provide simple project indicators aligned with the MTUHA III modules. Additional health information summary forms were developed for CHAs to record aggregate data from their registers and report each month to supervisors from their community, the health system, and the Connect team. CHAs and supervisors from both health facilities and village governments meet regularly to review monthly outputs, identify and troubleshoot problems, and plan jointly with the health system. Connect project coordinators, district MTUHA coordinators,

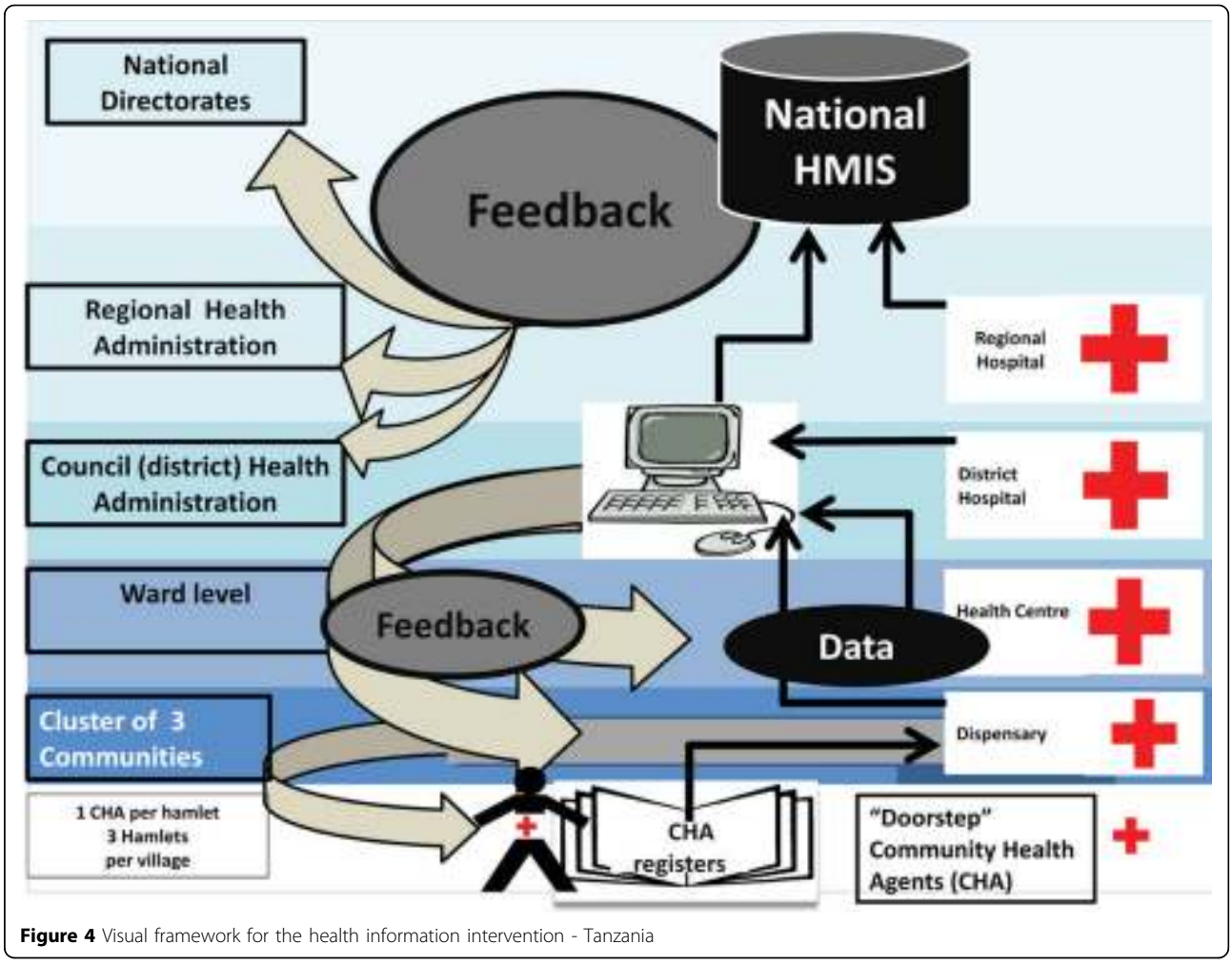

Figure 4 Visual framework for the health information intervention - Tanzania

and CHA supervisors hold similar meetings quarterly and transfer CHA health information to district and project managers for planning and program improvement.

Adaptation and learning during implementation

Data feedback to the CHAs was initially delayed due to the evolving nature of the intervention, the large number and geographic dispersion of study clusters, and variation in CHA supervisor leadership qualities and motivation. To overcome these barriers, the Connect team works with CHA supervisors to motivate their involvement and cover transportation costs incurred while making supportive supervision visits to CHA. There are notable challenges in collecting and using community-based health information. Supervision visits to all CHAs following initial deployment revealed minor problems concerning the uniformity and proper use of the registers. Project staff and supervisors compiled findings from these visits and convened CHAs in the respective study areas in a joint review of the registers to clarify register use. Management of community-based health information has also been a challenge. Though registers are appropriate for recording service delivery information and aggregating data, they did not facilitate CHAs data use for improving client-focused care as they did not capture household and client information, nor qualitative aspects of service encounters that would be useful for follow-up service encounters. Therefore, the project introduced booklets that remain in each village household where CHAs can log more detailed notes Figure 4 Visual framework for the health information intervention - Tanzania Mutale et al. BMC Health Services Research 2013, 13(Suppl 2):S9 http://www.biomedcentral.com/1472-6963/13/S2/S9 Page 8 of 12 from each visit, which has come at a high financial and logistical cost. Patient referrals from CHAs has also been a challenge, as post-referral feedback from health facilities to guide CHA follow-up services has been erratic. To facilitate the CHA/health facility communication, CHAs, supervisors, and referral providers have been provided closed-user phone groups to communicate without incurring costs.

Zambia

The Better Health through Mentorship and Assessment (BHOMA) project is using an Electronic Data Capture System (EDCS) and mobile technology to improve the quality of data captured in the target districts. The BHOMA system includes a dedicated low-wattage Linux client terminal (powered by solar panels and a 12-volt battery pack) with touch screen data entry terminals attached to a miniature data processing server, into which patient visit information is entered (Figure 5). The system automatically generates performance reports based on predetermined performance indicators that identify facility-level performance gaps and are used by clinical QI teams to mentor facility staff on improving clinical care quality. The EDCS system also automatically generates and sends follow-up messages via general packet radio service (GPRS) technology to CHWs (via mobile phones) to indicate a need for patient follow-up. Using modems and cellular networks, BHOMA clinics access the internet to securely synchronize records to a central server, housed at CIDRZ headquarters in Lusaka, which, in turn, transmits the data to BHOMA district offices, and the MOH's District Health Offices.

Rationale and contextual appropriateness

Poor quality data has been a source of concern throughout Zambia and data are frequently not used for evidence-based planning. Furthermore, community-level data are often not collected or used. The expansion of HIV care and treatment in Zambia brought EMR systems to some rural health facilities, which demonstrated their feasibility for capturing patient-level data in real time and their utility in guiding decision making by health system managers. Increases in mobile technology coverage in Zambia has made internet widely available, providing an opportunity to leverage ICT for collection of patient and community level data in real time and to use these data for evidence-based decision making

Activities and feedback mechanism

There are six data entry screens (patient registration, adult, pediatric, sick antenatal care (ANC), normal ANC, and labor and delivery) that follow the flow of information on clinical forms. Data are entered and locally and available in real time. To date, BHOMA has trained 72 clinic supporters to enter data for each patient visit and run reports. The five reports include 1) Clinic report (summarizing the number of patient visits at each facility, including followup visits for patients with danger signs or severe symptoms who missed their appointment); 2) Patient review report (listing patient charts for the QI teams to review Figure 5 Visual framework for the health information intervention - Zambia Mutale et al. BMC Health Services Research 2013, 13(Suppl 2):S9 http://www.biomedcentral.com/1472-6963/13/S2/S9 Page 9 of 12 with clinic staff); 3) Clinic performance reports (summarizing twelve clinical care measures for QI teams and clinic staff to use as a snapshot of clinical care quality); 4) CHW performance report (summarizing follow-up and assessment activity levels for CHWs at the health facility); and 5) HIS reports (to remove duplicate burden of tallying data). Each clinic has a GPRS modem that uses Zambia's cell phone networks to synchronize de-identified patient records to a central district database every 15 minutes when the system is on. Each district office has a server that aggregates information from all clinics in that district, allowing the QI teams to print patient review and clinic performance reports in preparation for each supportive mentoring visit.

Adaption and learning during implementation

The BHOMA HIS model has been deployed in largely rural, remote, and understaffed facilities and lessons have become clear during implementation. First, reviewing and clarifying data entry fields reduced the data entry workload. Second, computers with low-power requirements that run on solar power with battery back-up systems are important due to the unreliability of power. Third, using a dedicated client that runs only the BHOMA software avoids

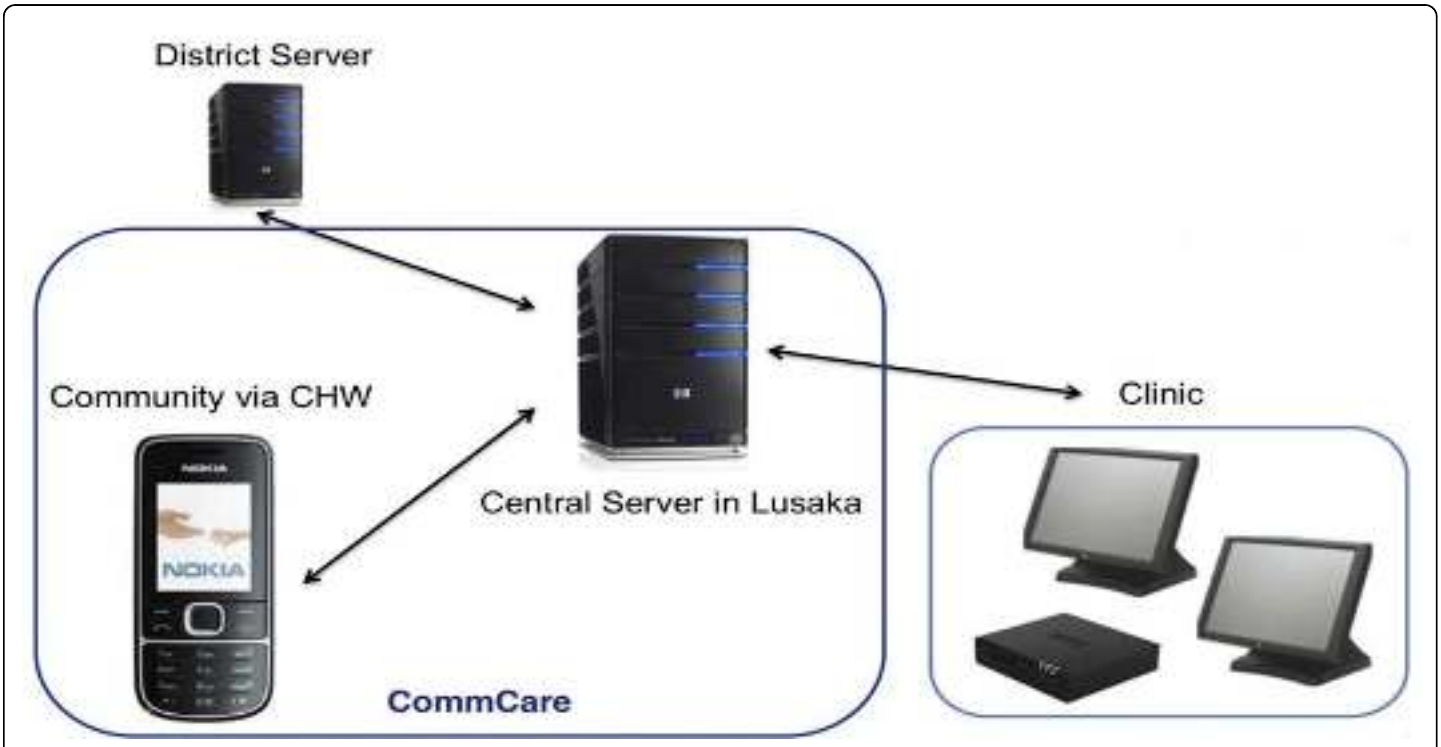

Figure 5 Visual framework for the health information intervention - Zambia

viruses, facilitates updates, and simplifies replacement. Fourth, it is essential that clinic performance reports are immediately available at the clinic level — rather than cycling first through the district — for health facility managers to identify areas requiring improvements and to check whether the corrective measures are working. Finally, patient-level information (rather than aggregate data) is used for flagging specific patient charts for followup with targeted intervention.

Comparisons across the PHIT strategies

Although the five PHIT Partnerships have designed different approaches to strengthen health systems in their respective countries, they share common features in enhancing HIS and linking data with improved decision making. Recognizing the complexity and context-specific nature of the intervention settings, PHIT Partnerships have adopted a flexible, iterative approach in designing and refining the development of new tools for HIS enhancement and improved decision making. Across the partnerships, the tools and approaches are designed to actively provide health system performance summaries to enable health system personnel to make informed decision on where to focus their efforts and limited resources. A second common feature is the use of feedback systems to improve data quality, though the error detection and correction approach varies across PHIT Partnerships. Error-detection approaches include automated troubleshooting mechanisms, routine review of aggregate reports for outliers and missing data, or periodic DQAs. A final similarity across PHIT Partnership approaches is the recognition of the importance of MOH information systems to ensure that HIS strengthening efforts are aligned with national priorities and to increase the likelihood of sustained project approaches beyond the life of the African Health Initiative. However, approaches across Partnerships vary in terms of pace and degree of alignment, which can be best described as either front-end integration (Mozambique), progressive integration (Rwanda), current harmonization (Ghana), and potential future harmonization or integration (Tanzania and Zambia). Despite these similarities, there are notable differences in the PHIT Partnership approaches to HIS strengthening and improved decision making. One difference is the level of focus for data collection, and by extension, its use. The Rwanda, Tanzania and Zambia PHIT Partnerships begin with intensive collection of patient-level data, while the Ghana and Mozambique Partnerships focus on facility, district and provincial-level aggregate data. In addition, the Ghana, Tanzania and Zambia data systems incorporate data from community service provision to direct outreach services from either formal or community health cadres. All systems, however, have sufficient flexibility to manipulate data according to frequency of aggregation (daily, monthly, quarterly, annual), and level of aggregation (health facility, district or province). A second difference is the type of data collection system, with the Rwanda and Zambia Partnerships implementing new EMR systems, while the Ghana, Mozambique, and Tanzania partnerships focus on paper-based HIS that are computerized at the health facility or district levels.

Discussion

Through the African Health Initiative, the five PHIT Partnerships have designed and are testing novel approaches to enhancing data systems and using HIS results as a driver for decision making and health system performance improvements. Design differences described across the PHIT Partnerships reflect the different theories of change for each project, particularly with regards to what information is needed, who will use the information to affect change, and how this change is expected to manifest. Ghana and Tanzania have simplified paper registries that incorporate data on community service provision, and in Ghana a resource allocation tool pioneered in Tanzania intends to support district managers in decision making. Mozambique focuses on strengthening the existing national HIS, and provides data summaries for health system managers to identify problems, evaluate solutions, and allocate resources. Zambia and Rwanda are implementing ICT approaches to improve Mutale et al. BMC Health Services Research 2013, 13(Suppl 2):S9 http://www.biomedcentral.com/1472-6963/13/S2/S9 Page 10 of 12 data quality, and provide timely information to guide decision making for clinicians and managers. Though implementation of the PHIT interventions is ongoing, there has been significant country-level enthusiasm for building on the HIS innovations of the African Health Initiative, with elements of the programs being adopted nationally in PHIT Partnership countries. The first three years of PHIT implementation has highlighted a number of elements important for strengthening HIS and linked decision making. First, though an important starting point, training alone is insufficient to engage and build capacity for facility and community health workers. Stakeholder meetings, data reviews, and mentored use of data as a basis for decisions have been utilized to engage health workers and managers and demonstrate the value of data, HIS quality, and ownership of tools to summarize data and guide decision making. A second lesson learned is that it is critical for HIS interventions to be developed in the context of the national HIS, which has been feasible across PHIT Partnerships and is crucial to ensuring sustainability of the programs beyond the project lifespan. Finally, in two of the PHIT Partnerships, the increased availability of mobile phone technology has facilitated the introduction of EMR systems in rural, resource constrained environments. These ICT innovations have come at a high initial financial cost to build infrastructure, modify software, and build human resource capacity for their use. Like many complex health system interventions, success of the PHIT HIS and decision-making approaches will hinge on whether frontline health workers and managers value, adopt and own the tools and procedures introduced by the country Partnerships [19,21]. For HIS to have an impact on health system functioning, and ultimately population health, it will be the institutionalization of habits and norms around data that will make the difference, such that prioritizing and using quality data is as much a part of routine practice as stocking a pharmacy or immunizing a child. Though exploring different approaches, all PHIT Partnerships are working towards the goal of standardized and routinely used procedures to improve data quality, its availability, and use. The PHIT Partnerships have both a common evaluation framework and project specific evaluation plan in place to assess their impact on health system functioning and population health [36]. Identifying effective and appropriate strategies for improving data availability, quality and its use, as well as the role of HIS in improving the health service delivery (including the quality and coverage of these services), will contribute to the limited evidence on this health system building block. Taking lessons learned to scale, however, will require substantial investment in general PHC information systems rather than disease specific information systems that can fragment, distort, and weaken country HIS at all levels of the health system [25].Without a well-functioning HIS, it is unlikely that the remaining five building blocks of a health system can reach their full potential in improving population health [26-28].

List of abbreviations used

BHOMA: Better Health through Mentorship and Assessment; CHA: Community health agent; CHMT: Community Health Management Team; CHO: Community health officer; CHW: Community health worker; CIDRZ: Center for Infectious Disease Research in Zambia; DHIMS-2: District Health Information Management System; DiHPART: District Health Planning and Reporting Toolkit; DQA: Data quality assurance; EDCS: Electronic data capture system; EMR: Electronic medical record; GEHIP: Ghana Essential Health Intervention Project; GPRS: General packet radio service; HIS: Health information system; HIV: Human immunodeficiency virus; ICT: Information communication technologies; LMIC: Low and middle income country; MOH: Ministry of Health; MTUHA: MOH health information system in Tanzania; MTUHA III: MOH HIS community-level module in Tanzania; PHC: Primary health care; PHIT: Population Health and Implementation Training; PIH: Partners In Health; QI: Quality Improvement; TB: Tuberculosis.

Competing interests

The authors declare that they have no competing interests.

Acknowledgements

This work was supported by the African Health Initiative of the Doris Duke Charitable Foundation. K Sherr was supported by Grant Number K02TW009207 from the Fogarty International Center; the content is

solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. We would also like to thank the members of the Population Health Implementation and Training – African Health Initiative Data Collaborative for their contributions to this manuscript. Members include: Cheryl Amoroso, Manzi Anatole, John Koku Awoonor-Williams, Helen Ayles, Paulin Basinga, Ayaga A. Bawah, Colin Baynes, Harmony F. Chi, Roma Chilengi, Namwinga Chintu, Angela Chisembele-Taylor, Jeanine Condo, Fatima Cuembelo, Felix Rwabukwisi Cyamatare, Peter Drobac, Karen Finnegan, Sarah Gimbel, Stephen Gloyd, Jessie Hamon, Ahmed Hingora, Lisa Hirschhorn, Marina Kariaganis, Handson Manda, João Luis Manuel, Wendy Mazimba, Mark Micek, Cathy Michel, Megan Murray, Fidele Ngabo, Anthony Ofosu, James Pfeiffer, James F. Phillips, Alusio Pio, Ab Schaap, Kenneth Sherr, Ntazana Sindano, Allison Stone, Jeffrey S. A. Stringer. Declarations

This article has been published as part of BMC Health Services Research Volume 13 Supplement 2, 2013: Improving primary health care to achieve population impact: the African Health Initiative. The full contents of the supplement are available online at http://www.biomedcentral.com/ bmchealthservres/supplements/13/S2. Publication of this supplement was supported by the African Health Initiative of the Doris Duke Charitable Foundation.

LIST OF REFERENCES

1. World Health Organization: Strengthening Health Systems to Improve Health Outcomes: WHO's Framework for Action. Geneva: World Heatlh Organization; 2007.
2. World Health Organization: Health Metrics Network Framework and Standards for Country Health Information Systems. Geneva: World Heatlh Organization; 2008.
3. Bodart C, Sapirie S: Defining essential information needs and indicators. World Health Forum 1998, 19(3):303-309.
4. Simba DO, Mwangu M: Application of ICT in strengthening health information systems in developing countries in the wake of globalisation. Afr Health Sci 2004, 4(3):194-198.
5. Peersman G, Rugg D, Erkkola T, Kiwango E, Yang J: Are the investments in national HIV monitoring and evaluation systems paying off? J Acquir Immune Defic Syndr 2009, 52(Suppl 2):S87-96.
6. Jha P, Mills A, Hanson K, Kumaranayake L, Conteh L, Kurowski C, Nguyen SN, Cruz VO, Ranson K, Vaz LM, et al: Improving the health of the global poor. Science 2002, 295(5562):2036-2039.
7. Larsson EC, Atkins S, Chopra M, Ekstrom AM: What about health system strengthening and the internal brain drain? Trans R Soc Trop Med Hyg 2009, 103(5):533-534, author reply 534-535.
8. Mate KS, Bennett B, Mphatswe W, Barker P, Rollins N: Challenges for routine health system data management in a large public programme to prevent mother-to-child HIV transmission in South Africa. PLoS One 2009, 4(5):e5483.
9. Garrib A, Stoops N, McKenzie A, Dlamini L, Govender T, Rohde J, Herbst K: An evaluation of the District Health Information System in rural South Africa. S Afr Med J 2008, 98(7):549-552.
10. Ronveaux O, Rickert D, Hadler S, Groom H, Lloyd J, Bchir A, Birmingham M:
The immunization data quality audit: verifying the quality and consistency of immunization monitoring systems. Bull World Health Organ 2005, 83(7):503-510.
11. Lim SS, Stein DB, Charrow A, Murray CJ: Tracking progress towards universal childhood immunisation and the impact of global initiatives: a systematic analysis of three-dose diphtheria, tetanus, and pertussi immunisation coverage. Lancet 2008, 372(9655):2031-2046.
12. Gething PW, Noor AM, Gikandi PW, Ogara EAA, Hay SI, Nixon MS, Snow RW, Atkinson PM: Improving imperfect data from health management information systems in Africa using space–time geostatistics. PLoS Med2006, 3(6).
13. Chilundo B, Sundby J, Aanestad M: Analysing the quality of routine malaria data in Mozambique. Malar J 2004, 3:3.
14. Gimbel S, Micek M, Lambdin B, Lara J, Karagianis M, Cuembelo F, Gloyd SS,Pfeiffer J, Sherr K: An assessment of routine primary care health information system data quality in Sofala Province, Mozambique. Popul
Health Metr 2011, 9:12.
15. Mphatswe W, Mate KS, Bennett B, Ngidi H, Reddy J, Barker PM, Rollins N: Improving public health information: a data quality intervention in KwaZulu-Natal, South Africa. Bull World Health Organ 2012, 90(3):176-182.
16. The Routine Data Quality Assessment (RDQA) Tool: Guidelines for Implementation for HIV, TB and Malaria Programs. [http://www.theglobalfund.org/en/me/documents/dataquality/].
17. Williams F, Austin Boren SA: The role of the electronic medical record (EMR) in care delivery development in developing countries: a systematic review. Informatics in Primary Care 2008, 16:139-45.
18. Wager KA, Lee FW, White AW, Ward DM, Ornstein SM: Impact of an electronic medical record system on community-based primary care practices. J Am Board Fam Med 2000, 13(5).
19. Redsell SA, Buck J: Health-related decision making: the use of information giving models in different care settings. Qual Prim Care 2009, 17(6):377-379.
20. Corrao S, Arcoraci V, Arnone S, Calvo L, Scaglione R, Di Bernardo C, Lagalla R,Caputi AP, Licata G: Evidence-based knowledge management: an approach to effectively promote good health-care decision-making
in the information era. Intern Emerg Med 2009, 4(2):99-106.
21. Camporesi S: Better, and 'healthier' decision making through information technology: conference report from the Health 2.0 conference in San Francisco, September 2011. Ecancermedicalscience 2011, 5:242.
22. Frimpong J, Awoonor-Williams J, Stone A, Helleringer S, Yeji F, Schmitt M,
Phillips J: Strengthening routine health information systems in rural communities: an approach to improving service delivery and an

antecedent for electronic health infromation systems. Second Global Symposium on Health Systems Research: Beijing China 2012.
23. Mamlin BW, Biondich PG, Wolfe BA, Fraser H, Jazayeri D, Allen C, Miranda J, Tierney WM: Cooking up an open source EMR for developing

countries: OpenMRS - a recipe for successful collaboration. AMIA Annu Symp Proc
2006, 529-533.
24. Amoroso CL, Akimana B, Wise B, Fraser HS: Using electronic medical records for HIV care in rural Rwanda. Stud Health Technol Inform 2010, 160(Pt 1):337-341.
25. Chan M, Kazatchkine M, Lob-Levyt J, Obaid T, Schweizer J, Sidibe M, Veneman A, Yamada T: Meeting the demand for results and accountability: a call for action on health data from eight global health
agencies. PLoS Med 2010, 7(1):e1000223.
26. Adam T, Hsu J, de Savigny D, Lavis JN, Rottingen JA, Bennett S: Evaluatinghealth systems strengthening interventions in low-income and middleincome countries: Are we asking the right questions? Health Policy and
Planning 2012, 27(Suppl 4):iv9-iv19. health systems strengthening interventions in low-income and middleincome countries: Are we asking the right questions? Health Policy and
Planning 2012, 27(Suppl 4):iv9-iv19.
27. Adam Taghreed, de Savigny Don: Systems thinking for strengthening health systems in LMICS: need for a paradigm shift. Health Policy Plan 2012, 27(Suppl 4):iv1-iv3.
28. WHO: Systems Thinking for Health Systems Strengthening. 2009.
29. Bassett MT, Gallin EK, Adedokun L, Toner C: From the ground up:strengthening health systems at district level. BMC Health Services Research 2013, 13(Suppl 2):S2.
30. Awoonor-Williams JK, Bawah A, Nyonator F, Asuru R, Oduro A, Ofosu A,Phillips J: The Ghana Essential Health Interventions Program: a plausibilitytrial of the impact of health systems strengthening on maternal & child
survival. BMC Health Services Research 2013, 13(Suppl 2):S3.
31. Sherr K, Cuembelo F, Michel C, Gimbel S, Micek M, Kariaganis M, Pio A, Manuel JL, Pfeiffer J, Gloyd S: Strengthening integrated primary health care in Sofala, Mozambique. BMC Health Services Research 2013, 13(Suppl 2):S4.
32. Drobac PC, Basinga P, Condo J, Farmer PE, Finnegan K, Hamon JK, Amoroso C, Hirschhorn LR, Kakoma JB, Lu C, Murangwa Y, Murray M, Ngabo F, Rich M, Thomson D, Binagwaho A: Comprehensive and integrated district health systems strengthening: the Rwanda Population Health Implementation and Training (PHIT) Partnership. BMC Health Services Research 2013, 13(Suppl 2):S5.
33. Ramsey K, Hingora A, Kante M, Jackson M, Exavery A, Pemba S, Manzi F, Baynes C, Helleringer S, Phillips JF: The Tanzania Connect Project: a cluster-randomized trial of the child survival impact of adding paid community health workers to an existing facility-focused health system. BMC Health Services Research 2013, 13(Suppl 2):S6.
34. Stringer JSA, Chisembele-Taylor A, Chibwesha CJ, Chi HF, Ayles H, Manda H, Mazimba W, Schuttner L, Sindano N, Williams FB, Chintu N, Chilengi R: Protocol-driven primary care and community linkages to improve population health in rural Zambia: the Better Health Outcomes through Mentoring and Assessment (BHOMA) project. BMC Health Services Research 2013, 13(Suppl 2):S7.
35. Bryce J, Requejo JH, Moulton LH, Ram M, Black RE, Population Health Implementation and Training - Africa Health Initiative Data Collaborative: A common evaluation framework for the African Health Initiative. BMC Health Services Research 2013, 13(Suppl 2):S10.

CHALLENGES OF IMPLEMENTING THE INTEGRATED DISEASE SURVEILLANCE AND RESPONSE STRATEGY IN ZAMBIA: A HEALTH WORKER PERSPECTIVE

Research Article

CB Mandyata, LK Olowski, W Mutale

University of Zambia School of Public Health, Lusaka, Zambia

Correspondence: Brian Mandyata: (mbchomba@gmail.com)

Citation style for this article: Mandyata CB, Olowski LK, Mutale W. Challenges of implementing the integrated disease surveillance and response strategy in Zambia: a health worker perspective. Health Press Zambia Bull. 2018;2(12); pp 17-29.

Despite advances in medical technology and public health practice at the global level over the past millennia, infectious diseases are still the leading causes of death in most resource limited countries. Stronger infectious disease surveillance and response systems in developed countries facilitated the near elimination of infectious disease related deaths in those countries. Today, low-income countries are following this path by strengthening disease surveillance and response strategies that would help reverse the trend in infectious disease associated morbidity and mortality cases. In 2000, Zambia adopted the World Health Organisation Regional Office for Africa's (WHO-AFRO) Integrated Disease Surveillance and Response Strategy (IDSR) to monitor, prevent and control priority notifiable infectious diseases in the country. Through this strategy, activities pertaining to disease surveillance are coordinated and streamlined to take advantage of similar surveillance functions, skills, resources and targeted populations. The purpose of the study was to investigate and report on the existing challenges in the implementation of the IDSR strategy in a resource limited country from a health worker perspective.

Methods: A qualitative study approach was used to achieve the study aim. Data was collected through key informant interviews with selected persons at the Lusaka Province Health Office (LPHO); Lusaka and Chongwe District Health Management Team Offices; and four selected health facilities in the two districts (two from each). Thematic analysis approach was used to analyse the qualitative data.

Results: The major successes included operationalised response and epidemic preparedness at all levels (National to district); full-time staff and budget dedicated to disease surveillance at all levels and adoption of the 2010 World Health Organisations' Integrated Disease Surveillance and Response Strategy technical guidelines to the Zambian context. Several challenges hampered effective implementation. These include inadequate trained human resources, poor infrastructure and coordination challenges.

Conclusion: The implementation of IDSR strategy in Zambia has recorded some successes. However, several gaps hinder effective implementation. It is imperative that these gaps are addressed for Zambia to have a robust surveillance system that could inform policy in a comprehensive and timely manner.

Background

Background A disease surveillance system that continuously and systematically collects, analyses, interprets and utilise health data for decision making at an optimum level is a corner stone of an effective public health system [1, 2]. Disease surveillance systems provide information about disease manifestations and severity, etiological characteristics of the disease, their space-time distributions, the use of and potency of treatments that is vaccines and so on and so on [3–5]. During the 1990s, most African health systems extensively implemented vertical disease surveillance and response strategies for each priority infectious disease that was targeted for control and/or elimination. Several drawbacks had been identified with these types of systems and these included: high cost of maintaining the various parallel systems; inability of the several vertical disease surveillance strategies to adequately fulfil the functions of surveillance and response; heavily centralised systems; inability to detect disease outbreaks in a timely manner; duplication of work due to lack of coordination between several single disease control and prevention programmes; overburdened health personnel responsible for disease surveillance in terms of workload and so on [6–11]. Furthermore, these vertical disease surveillance strategies were also failing to cope with the increasing ease of travel of their targeted populace (mostly propagated by air travel), the rapid urbanisation of African cities, and the associated public health challenges that come with them coupled with the incremental threat of emerging and re-emerging diseases of pandemic

potential alongside endemic diseases such as Human Immunodeficiency Virus (HIV), Hepatitis and other diseases. Meanwhile, the financial costs for implementing these vertical programmes kept on skyrocketing while at the same time most African economies at the time were either declining or remained stagnant. This situation in the continent of Africa at that time prompted the World Health Organisation Regional Office for Africa (WHO-AFRO) to develop a cost effective and efficient disease surveillance and response strategy for African member countries. The strategy was adopted under resolution AFR/RC48/R2 by the WHO-AFRO member countries in September 1998 when the World Health Organisation Regional Committee for Africa met in Harare, Zimbabwe [12].Some of the aims of the IDSR strategy are to: "train personnel at all levels; develop and carry out plans of action; advocate and mobilise resources; integrate multiple surveillance systems so that forms, personnel and resources can be used more efficiently; improve the use of information to detect changes in time to conduct a rapid response to suspected epidemics and outbreaks; monitor the impact of interventions; facilitate evidence-based response to public health events; and inform health policy design, planning and programme management; improve the flow of surveillance information between and within [various] levels of the health system; strengthen laboratory capacity and involvement in confirmation of pathogens and monitoring of drug sensitivity; emphasise community participation in detection and response to public health problems including event based surveillance and response in line with IHRs [International Health Regulations of 2005]" [12]. Under article 5.1 of the resolutions of the IHRs, it is stated that each country will have to develop, strengthen and maintain, as soon as possible but no later than five years from the date of entry into force of the resolutions for that particular country (June 2007 for Zambia) the capacity to detect, assess, notify and report public health events of international concern in accordance with the set parameters contained within the resolutions [13]. These regulations require that each member country develops, operates and manages a real time health event monitoring and strengthened surveillance system [14]. In Zambia, the IDSR has been used to complement the Health Management Information System (HMIS) in reporting detected priority notifiable infectious diseases to the relevant authorities within the Ministry of Health [15]. Within the HMIS, there are indicators for 11 priority notifiable infectious diseases which are reported to the next level in the reporting chain immediately they are detected/ suspected and/or confirmed and these include: Acute Flaccid Paralysis (AFP); Measles; Neonatal Tetanus; Dysentery; Cholera; Plague; Rabies; Typhoid Fever; Yellow Fever; Tuberculosis (TB) and Human Influenza [15]. Notifications of these diseases and health events to the public health authorities in Zambia is mandated by law under the Public Health Act of 1995 [16], Ministry of Health regulations that is, the 2011 Technical Guidelines on IDSR in Zambia [17] and by the IHRs of 2005 [13]. Surveillance data collection is conducted mainly at the health facility level where in most cases paper-based information systems are used to collect information about suspected and confirmed priority notifiable infectious diseases and the associated mortality cases. Tallied information from these tools is then sent to respective District Health Management Team Offices (DHMTs), who then feed the validated data into the District Health Information System version II (DHIS II) – an internet based system with the main aim of reducing the reporting burden in primary health care settings by focusing and easily making available essential information for district level planning [18].

IDSR implementation structure in Zambia In order to effectively and efficiently achieve the aims of the IDSR in the Zambian public health system, the Ministry of Health developed and operationalised the IDSR implementation structure. It emanates from the community level up to the national level. Figure 1 below further illustrates this structure. It shows the surveillance data flow from the community level up to the Ministry of Health headquarters. When members of the community suspect a disease, it is expected of them to report themselves and/ or others to the nearest health facility. In the event that the health facility detects/ suspects a notifiable infectious disease(s), it is required of them (health facilities) to report such cases to their respective District Health Management Teams (DHMTs) within a specified period of time usually on a weekly and monthly basis. Once the DHMTs receive the surveillance data, the health information unit through the District Health Information Officer (DHIO) then compile, validate, analyse and disseminate the received surveillance counts to other office units that is, policy and planning,

Sampling of key informants

Sampling of key informants Targeted key informants were those that were directly involved in the implementation of the IDSR at each level of health service delivery. From the Epidemiological Unit – which falls under the Directorate of Public Health,

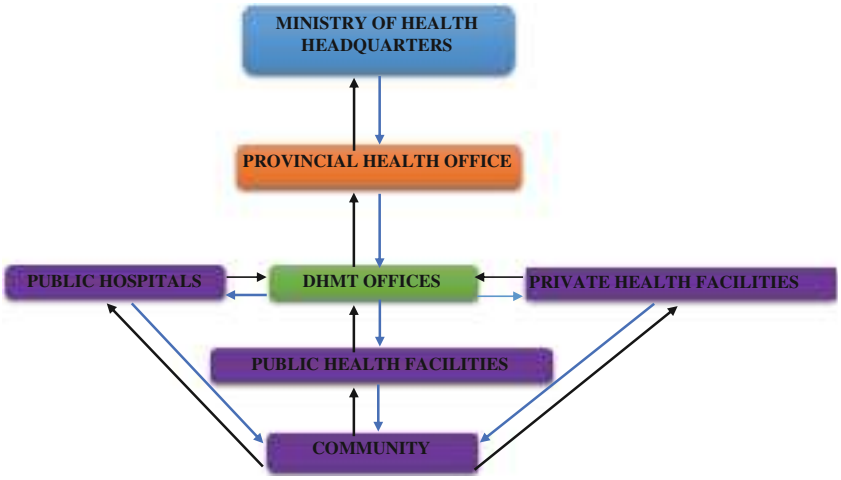

Fig. 1 IDSR Implementation Structure

The disease surveillance unit at the DHMT institutes and leads further epidemiological investigations into any suspected and confirmed priority notifiable infectious disease and/or any public health event of concern with technical support from the respective Provincial Health Offices. At the same time, the DHMTs forward the received surveillance counts to the Disease Surveillance Unit at the Provincial Health Office who perform the same processes on the received data as the DHMTs. Once everything has been deemed to be satisfactory (by approval of the Provincial Disease Surveillance Officer), the respective Provincial Health Offices then send the provincial surveillance counts to the Ministry of Health headquarters. The disease surveillance section at the Provincial Health Office is mandated to provide supervisory and technical support to the DHMTs under their jurisdiction in all disease surveillance activities including case investigations and response. The monthly disease surveillance counts are typically compiled and managed by the Monitoring and Evaluation unit mostly by the District Health Information Officers (DHIOs) while weekly disease surveillance counts are compiled and managed by the Epidemiological section of the Ministry of Health through the Disease Surveillance Officers – where these positions have been filled. Otherwise, DHIOs or the Environment Health Officers (EHO) also perform the duties of a Disease Surveillance Officer.

The aim of the study was to investigate and report on some of the existing challenges in the implementation of the Integrated Disease Surveillance and Response Strategy in a low-income country such as Zambia by documenting the health worker perspectives.

Methods

Study setting

Geographically, Lusaka province is centrally located on the map of Zambia. It covers a total surface area of approximately 21, 896 km2 with an estimated total population of 2, 191, 225 [19]. In the east, the province borders Mozambique at Luangwa district and Zimbabwe in the south at Chirundu district. The province has a total of seven districts namely; Lusaka (provincial and country administration capital), Chirundu, Chilanga, Chongwe, Kafue, Luangwa and Rufunsa.

Study design

The study utilised a qualitative approach in its quest to achieve the study aims. Primary qualitative data was collected through key informant interviews with purposively sampled health workers at all levels of IDSR implementation.

Sampling procedure

Figure 2 above shows the hierarchy (within the IDSR implementation structure) of key informants that were interviewed for this study. The study had purposively sampled the Ministry of Health headquarters and Lusaka Provincial Health Office (LPHO). The study then conveniently sampled two district health administration offices (one urban and one rural) both of which are under the jurisdiction of the LPHO and these were; the Lusaka District Health Management Team Office (LDHMT) located in an urban area; and the Chongwe District Health Management Team Office (CDHMT) – a rural district (Chongwe) located about 40 km east of Lusaka district. In each of the two sampled districts, two health facilities were purposively sampled. At least one of these health facilities in each sampled district had to possess an in-house laboratory capacity of some kind. All health facilities sampled were under the direct super vision of their respective DHMTs. The sampling of only two districts is adequate to show the status of the IDSR implementation for all the other districts and health facilities in the country. This is because the procedures for implementing the IDSR is standardised for all districts and facilities (public or private) irrespective of their size, status or location that is urban or rural, health post or district hospital. This standardisation is stipulated in the 2011 Technical Guidelines for IDSR in Zambia [17] and the Public Health Act of 1995 [16]. Therefore, the findings from this study are transferable to other similar districts throughout the country.

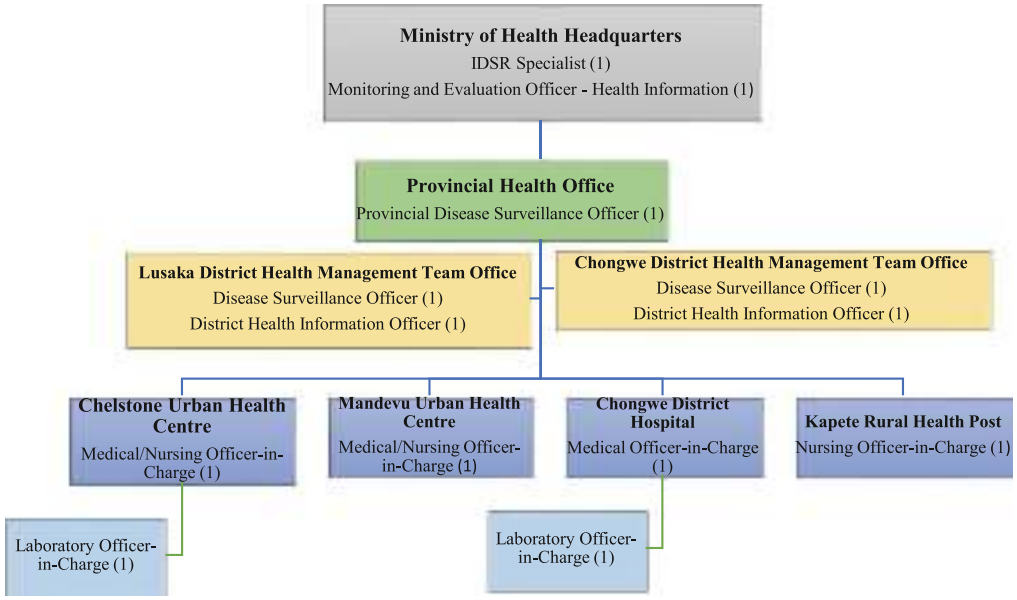

Fig. 2 Flow Chart of Sampled Health Workers and their Positions in the Work Hierarchy

Disease Surveillance and Research, an IDSR specialist responsible for overseeing the optimal implementation of the IDSR strategy at the national level was interviewed. From the Directorate for Policy and Planning, a Monitoring and Evaluation (M&E) Officer was interviewed. The M&E officer is responsible for health information and management of all monthly health indicators (including those concerning infectious diseases that are covered by IDSR) that are submitted through the DHIS II by all District Health Management Team Offices country wide. At the provincial level, the study had sampled one key informant from the disease surveillance unit which is responsible for all disease surveillance activities in the province as well as receiving and compiling weekly IDSR reports from all districts under its jurisdiction. This unit is responsible for instituting and leading disease outbreak investigation efforts in the province. These responsibilities are the same for the district surveillance unit – though restricted to within district boundaries. At each of the two sampled DHMTs, two key informants were sampled; one officer from the health information unit; and the other from the disease surveillance unit. The health information unit is responsible for the collection, management, analysis and dissemination of health data on both communicable and non-communicable diseases as well as on risk behaviours that are of public health concern within the district. The health information unit is also responsible for receiving and compiling monthly reports on selected notifiable infectious diseases and other indicators ranging from service delivery to drug usage at health facilities under their jurisdiction in the district. At the sampled health facilities with an in-house laboratory, two key informants were purposively sampled; the Laboratory Officer-in-Charge and the Medical/ Nursing Officer-in-Charge. The Laboratory Officer InCharge is responsible for all laboratory related activities at the health facility and for entering information about detected diseases in the laboratory register as well as on a weekly and monthly basis to compile and submit reports on tested and/ or detected priority notifiable infectious diseases at the health facility to the Medical Officer/Nursing in – Charge. Coupled with the day to day administration of the health facility, the Medical/Nursing Officer-in-Charge is responsible for compiling and submitting weekly and monthly reports on suspected, confirmed and mortality cases on priority notifiable infectious diseases seen at the health facility to their respective DHMTs. All in all, a total of thirteen health workers that were eligible and consented to participle in this study were interviewed.

Data collection

Data collection was conducted between January and March 2016. Interview guides were used in collecting data from the selected key informants. The study had four separate but related interview guides for each of the selected key informants. These interviews guides were for the following key informants: I) national, provincial and district surveillance officers; II) national and district information officers; III) Medical/ Nursing Officers-in-Charge; IV) Laboratory Officers-n-Charge. The questions in the interview guide were adapted from the World Health Organisation (WHO) Protocol for the Assessment of National Communicable Disease Surveillance and Response Systems [20] and the Communicable Disease Surveillance and Response Systems: Guide to Monitoring and Evaluating [21]. The interview guides were developed and administered by the main author. The duration of the interviews ranged between 30 and 60 min. Each

interview was recorded on a digital recorder. The principal investigator also took notes during the interview process. At the end of each interview, a typed transcript was then developed from the audio of the interview.

Data analysis

Thematic analysis approach was used to aid the data analysis process. This study utilised the deductive technique of qualitative data analysis [22]. This was done by predefining or identifying four major themes of the study. These themes were based upon the four components of the IDSR implementation strategy namely; structure; quality attributes; core functions and support functions [12, 21]. The sub-components of each of these four major components of the IDSR were treated as subthemes of the study. The themes that were falling outside the predefined analysis criteria were labelled and categorised separately. The coding and analysis of the collected data was done by the main author with oversight from the co-authors.

Ethical considerations

Ethical approval was necessary due to the fact that, the study involved human subjects and required asking them about their experiences. In-depth interview guides were used in this study, this raised the risk of the participants delving into personal and politically sensitive matters, hence the need to protect the study participants from these vulnerabilities by seeking ethical approval. Ethical approval for this study was obtained from the University of Zambia Biomedical Research Ethics Committee (UNZABREC) assurance No. FWA00000338 IRB00001131 of IORG0000774. Permission from the Permanent Secretary at the Ministry of Health (the chief administrator of the ministry) and the National Health Research Authority were obtained to conduct data collection within the Ministry. Informed consent was obtained from all participants prior to conducting the interview.

Results

Given the fact that the IDSR strategy is broad as it covers a wide array of activities that are supposed to be effectively implemented to achieve the ultimate goal of timely infectious disease detection and prevention and due to limited time and space, in this study, the researchers purposively selected certain key areas from each of the four components of the IDSR strategy that the researchers felt would to some extent highlight some of the main challenges of implementing the IDSR strategy within the Zambian health system. While the researchers acknowledge the fact that the studied areas of the IDSR strategy in this paper may not be incredibly extensive, it is believed that the findings (based on the selected IDSR strategy implementation areas) do highlight some (not all) of the prevailing challenges in the implementation of IDSR strategy that are ultimately contributing to the high rates of morbidity and mortality cases associated with priority infectious diseases such as Typhoid Fever and Measles in Zambia. The selected key areas of implementation are presented in Table 1 below.

Legal and regulatory framework

IDSR implementation in Zambia is governed by the Public Health Act of 1995, the IDSR technical guidelines, and the International Health Regulations of 2005. Most participants felt that the Public Health Act of 1995 was adequate to govern the effective implementation of the IDSR in the province, although there was a general sentiment that the existing legal and regulatory frameworks were not adequately responding to the current IDSR implementation environment. One key informant had argued that the Public Health Act of 1995, in particular, was not properly aligned with the International Health Regulations of 2005 to which Zambia is a signatory. While the Act covers a broad area of notifiable infectious diseases, it was seen to be weak in providing a legal framework that would be necessary to govern the detection, management and prevention of emerging and re-emerging infectious diseases and events of public health concern that is, H1N1 virus, Zika virus, bioterrorism which are not specifically covered by the Act. The following are some of the perspectives key informants had offered with regard to whether the Public Health Act of 1995 in its current form was adequate enough to provide a legal environment that would bring about an effective and efficient implementation of the IDSR strategy:

Table 1 Emerging Themes from Key Informant Interviews

Main themes	Sub-themes
Structure	Legal and regulatory framework
Core functions	Case detection
	Case confirmation
	Case registration
	Case reporting
	Surveillance data analysis
	Response and control
	Feedback
Support functions	Training
	Logistical (financial, material and human resource) support
	Monitoring and evaluation
	Supervision
Quality attributes	Representativeness
	System stability

"… all issues of prevention, reporting of cases, events and conditions exist within the Public Health Act of 1995 specifically under the section for notifiable diseases and most of the notifiable diseases are the Mandyata et al. BMC Public Health (2017) 17:746 Page 5 of 12 IDSR diseases, only that this time around decision (parameters) have been changed. When you look at the International Health Regulations of 1969 and the International Health Regulation of 2005, they are no longer mentioning that this disease or that disease, instead they are saying any case, condition or event that is unusual or is of international public health concern should be reported". (Key Informant MoH Headquarters) "I do not think they are because you cannot just have one regulation or document that is a guiding principle for the entire implementation of the IDSR. If you look at the Technical Guidelines for the IDSR, you will see that actually, they is a lot that is involved and may be if we can have back up of some other laws, then it will be easier". (Key informant LPHO)

Core functions

Case detection

The study findings revealed that at the LPHO, the log of rumours and suspected outbreaks (used to track the time taken between the first-time rumours and/or suspected outbreaks were recorded and the time action was taken) was non-existent, instead, they relied more on the notification reports. When asked if they have a log of suspected outbreaks, events and rumours, one participant at district level had this to say:

"A log, we do not have, but we only have reports of rumours investigated, outbreaks investigated and so on. Any rumour that we hear we always investigate/ follow ups". (Key Informant – DHMT)

Our findings also revealed that none of the four (4) health facilities that were visited in Chongwe and Lusaka districts had copies of the Zambian Technical guidelines on IDSR, although most of them had copies of the Standard Operating Procedures. The Technical guidelines on IDSR do provide stipulations on the procedures of handling suspected cases of a priority notifiable infectious disease at the facility level. Availability of these guidelines especially at the clinical level and their effective implementation at that level is the foundation of a strong disease surveillance system particularly in the early detection of priority notifiable infectious diseases and events of public health concern. However, what this study has found is that currently there is a challenge in ensuring that the simple procedures of that is, recording and investigating any rumour of a suspected disease or events of public health concern, promptly recording, reporting and obtaining laboratory confirmation of any suspected priority notifiable infectious disease, and optimal utilisation of the IDSR technical guidelines at all levels of IDSR implementation was inconsistently being done.

Case confirmation

Our findings revealed that the two laboratories that were visited had the capacity to test for notifiable infectious diseases such as; Dysentery, Malaria, HIV and Tuberculosis (TB) or those diseases that can be ascertained by simple serological tests. For those diseases that require more advanced laboratory techniques such as culturing, whenever they are suspected, samples have to be collected and sent to the few existing referral laboratories dotted around the country with the largest one being the central laboratory at the University Teaching Hospital in Lusaka. Cooler boxes are used to transport the collected samples to the referral laboratories. What our study results revealed was that, there is a time delay in most lower health facilities that is, urban and rural health centres between the time a priority notifiable infectious disease such Typhoid Fever is suspected and the time it is confirmed at the referral laboratories (and communicated back to the health facility that sent the samples) and the time appropriate treatment is instituted on the affected patients. And this is attributable to the suboptimal laboratory capacities at most district hospitals as well as urban and rural health centres to confirm

diseases that require culturing techniques and the fact that the referral laboratories where some of these tests can be done are usually hundreds of kilometres away. In terms of water supply, both laboratories had consistent supplies; each health facility had at least one borehole as a water source coupled with supplies from the Lusaka Water and Sewerage Company. This study further found that only the T – lymphocyte cell bearing CD4 receptor (CD4) machines were connected to the backup power generators at both laboratories. The study also found that the supplies of reagents and other laboratory materials from Medical Stores was relatively consistent although they would be some months when supplies would be erratic especially when the suppliers did not have the materials that have been requested for.Supply of new laboratory stock is also dependent on monthly reports submitted to Medical Stores. One key informant had the following to say on the consistency of the central Medical Stores in providing the necessary materials to the laboratories at the visited health facilities:

"…not very good because at times you find that some of the things we ordered if they do not have they don't supply. But for HIV test kits they are very consistent… At times, they could be one or two or three months when they could be challenges with the supply. Basically, what you report is what you get. The supply chain is report dependent. The supply of laboratory material is dependent on the report". (Key Informant - Chongwe health facility)

Case registration

Case registration In terms of registration of every case that is seen at the health facility, the study found that in some health facilities particularly those with a high patient demand clinicians are failing to comprehensively enter the appropriate information in the tally sheets, disease aggregation forms and other patient information collection documents available within their offices of operation. One of their arguments as one of the participants (Key Informant DHMT) put it is that: *"I see a lot of patients, tallying [of cases seen on each day] will delay my work"*. Key informants also indicated that the situation was also similar in those health facilities which at most times have low patient demand, thus clinicians have much more time on their hands. However, even in these kinds of health facilities (ones with low average daily patient demand) clinicians simply are not willing to consistently and completely enter and tally information about the cases that they come across at their respective health facilities on each particular day they are on duty. We further found that, in order to work around this challenge of not tallying complete information about cases seen, some health facilities have been engaging data clerks who on a weekly and monthly basis go through each of the patient's books, disease aggregation forms, patient and laboratory register entries and/or other patient documents to extract information to be reported to the respective DHMT by Monday or the first working day of the following week for the weekly IDSR reports and by the 7th of the following month for the monthly surveillance reports on priority notifiable infectious diseases. It was also found that even where they are data clerks available to extract the priority notifiable infectious disease surveillance data from the various patient documents and registers, the illegibility of most clinicians' handwriting is proving to be a barrier to their ability to extract correct information. In some instances, the actual diagnosis as determined by the clinician may not be clear, hence in such situations, the data clerks then have to look at the prescription to determine and sometimes guess the actual diagnosis, due to the illegibility of the attending clinician hand writing. Thus, even when surveillance counts are sent to the respective DHMT on a weekly and monthly basis, the counts may not be the actual representation of the cases seen for that particular period (reporting week or month):

"This means that data is missing, and it is missing because the clinicians are overwhelmed [by the high patient demand] and they have no time to tally all the cases that they see. Equally, the clerks are also overwhelmed because of the huge number of patient books and other materials from which they are supposed to uplift data from and make a weekly and monthly report. So, at the end of the day, they just do what they feel they should do". (Key Informant – DHMT)

Case reporting

Once the weekly number of suspected and confirmed cases seen at the particular health facility have been tallied, they are entered in the standardised reporting forms provided by the respective DHMT offices. Health facility laboratories were available also make reports on the number of samples they have sent to the referral laboratories within a particular week. In instances whereby they are more than average numbers of cases that are being seen at a particular time, a line list is also used to collect information about the cases that are being attended to and these are sent together with weekly and/or monthly surveillance reports. Note that, the DHMTs only receives reports from health facilities under their jurisdiction and the largest facility at the district level is the district hospital – a level one hospital. General, central and teaching hospitals are not supervised by the DHMTs within the district where they are located but are supervised by the Ministry of Health (MoH). Although, these larger hospitals are expected to report any suspected, confirmed and mortality cases associated with priority notifiable infectious cases to the DHMTs from where the disease was originating from (i.e. patient resides in Ndola district in the Copperbelt province but was diagnosed in Lusaka district in Lusaka Province) they usually do not unless the designated district surveillance officer requests for the information. Once, the DHMTs receive the weekly reports from the respective health facilities and upon cleaning the data sent, they also tally the surveillance data received and submit a weekly IDSR report to the Provincial Disease Surveillance Officer at the Provincial Health Office (PHO). In most cases, when the DHMTs are sending Mandyata et al. BMC Public Health (2017) 17:746 Page 7 of 12 weekly IDSR reports to the PHO they also attach copies of notification reports (which highlight preliminary background information about

the affected patient[s]) which are compiled by health facilities. However, what this study found is although these notification reports are much more detailed than the IDSR reports, they are not treated as disease surveillance reports themselves. Only the aggregated information in the weekly IDSR reports is treated as disease surveillance data. The information they provide (notification reports) is only used to aid the suspected notifiable infectious disease outbreak investigations. Note that the IDSR reports submitted to the DHMTs, PHOs and MoH headquarters only highlight total counts of suspected, confirmed and mortality cases seen in that particular week. Key variables such as age, gender, the area of residence, date of first attendance, types of samples collected are not included in the reports. The variables found within the notification where they are reported according to a key informant at the Lusaka Provincial Health Office include such things as:

"Age, gender, place of residence, occupation, date of first attendance, phone numbers, next of kin, specimen that were taken, whether or not they were confirmed, the actual diagnosis among other things. It also contains the historical background for that particular patient and whether or not the patient had died and what was done after that, recommendations and conclusion are also provided." (Key Informant – LPHO).

Note that, the information that is contained within the notification reports is not the information that is entered in the Excel worksheets (treated as databases) at the DHMTs and PHOs. Only information that is contained in the weekly IDSR reports is entered in the Microsoft Excel work sheets. The other challenge we found was that (at the time of the study), the weekly IDSR reports had not yet been fully incorporated in the DHIS II for reporting to the next level. This is despite the fact that, the Ministry of Health rolled out the DHIS platform as far back as 2007 and around 2012, the Ministry upgraded the system to DHIS II. As a result, weekly reports are sent to the next level through phone calls, email and sometimes through the delivery of hard copies on a weekly basis:

"The [weekly] surveillance data is not sent through the DHIS II. The disease surveillance unit have their own database [Microsoft Excel Worksheets] – created by the surveillance unit. They compile a weekly report and submit it through email on a weekly basis. For those who are unable to email, they have hard copies that are blank which they fill in on a weekly basis. " (Key Informant – LPHO).

This study also found that there is a parallel and wellestablished reporting structure for the monthly notifiable infectious disease surveillance reports which are sent to the M&E unit (under the Directorate for Policy and Planning) through the use of the DHIS II. This system is available currently at the district level, however, it is not yet available at the health facility level. On a monthly basis, health facilities tally all information about suspected and admitted cases of all notifiable infectious diseases as well as their associated mortalities that they had seen during that month. This information has to be submitted to the DHMT by the 7th day of every month. Once the information has been validated at the district level, the DHIO now enters this information in the DHIS II which makes the information instantaneously available to anybody who has access to the system. This information should be entered in the system by the 21st of every month. Thus, there is a 14-day delay between the time DHMTs receive monthly surveillance counts from the respective health facilities and the time this information is entered in the DHIS II:

"Before the data is even entered …, you check through the facility reports. If you find that there are issues you can even retain the report to the facilities for them to read through. Then it can be resent. But of course, the person who is sending the data may not be able to check through every indicator. So, certain indicators, you will find that they are okay while in others they may be some lapses…" (Key informant – DHMT)

Surveillance data analysis

Our study findings revealed that the weekly IDSR reporting form does not have the person (that is, age and gender) and place (that is, residential area) variables, only aggregate figures are provided in the report. The findings showed that the main form of analysis conducted is through the construction of trend lines and/or disease monitoring charts as recommended by MoH (see [23]). Each reporting surveillance officer either from the DHMTs reporting to the Provincial Health Offices or this reporting to MoH headquarters gives a brief analysis and discussion of the figures that they had received in the previous week and/or month. When asked whether or not weekly trend and disease monitoring charts, as well as trend lines, were being consistently constructed one key informant had the following to say:

"…we do that, but on a quarterly basis but it's not like every day or every week but from our data, we are able to see that Measles, for example, is coming down or it's going up. Once we see that it is going up or down we notify the next level. " (Key informant – LDHMT)

Microsoft Excel is used to tally and analyse the received weekly IDSR reports while in most cases the statistical functions available in the DHIS II are normally used to analyse the monthly disease surveillance reports. Advanced statistical software such as Stata, SPSS and so on are used only in times when they need to do some further digging on the data. Surveillance data has to be analysed by person and time as well as by place. One of the most accurate ways to analyse surveillance data by place is through the utilisation of the Geographical Information System (GIS). However, currently our findings revealed that this tool (GIS) is not being utilised in aiding the accurate understanding of the precise geographical distribution of priority notifiable infectious diseases in the country:

"We used to have what is called the health mapper, [for] GIS… what you should bear in mind is that we do not have a system now that is in a sharp we would have loved it too. But when we had EPI info system, mapping was provided, meaning that you can do (analyse) your data and show it. Even at this (national) level, we were able to analyse and show which district and in which province or

which province has a particular disease. If we wanted to particularise to a district we would be able to paint the districts that are affected. If we wanted to show which health facilities within the particular district where the cases were coming from, we were able to show those health facilities." (Key informant - MoH Headquarters)

Response and control The study findings revealed that at the provincial and district levels, the Rapid Response Teams (RRTs) have been created and includes such specialised officers such as the: Disease Surveillance Officers, clinical care experts, nursing officers, environmental health officers, transport unit, and laboratory unit:

"…as a province, we have a Rapid Response Team [RRT]. This RRT will first do an on-spot check of the data that was sent. For example, if it is Typhoid Fever or Cholera that has been reported, we will go there as a team to investigate and verify what they [DHMTs] have sent. Then if they is need to support them materially, then we do that. But usually what is there is that we have logistics and supplies that are set aside for such things. So, if they [DHMTs] need any further support from the provincial health office that is, financially or materially then we come in to help." (Key informant – LPHO).

Feedback Validated and analysed disease surveillance counts on specific priority notifiable infectious diseases is disseminated (feedback) back to the lower levels of the implementation hierarchy as highlighted by the arrows pointing downwards in Fig. 1 above. Feedback is provided through quarterly or annual reports, statistical bulletins, supervisory visits, newsletters, workshops and seminars. However, this study found that feedback to the lower implementation levels was not being done in a consistent manner – that is, the Provincial Health Offices sending feedback to respective DHMTs and from these to the health facilities and then finally to the communities. Participants indicated that feedback is at most times provided when the senders have done something wrong that is the presence of errors in the report, have sent higher or lower than usual numbers of suspected and/or confirmed priority cases or during the times of a disease outbreak:

"It is usually when there is something wrong that is when you get that feedback. And also, when you have a meeting and you present your data that is when you will hear some comments on your data. But not immediately that somebody views your data, and gives you feedback. " (Key Informant DHMT). "[with regard to us] sending data [feedback] to the health facilities we have not been doing that, but we are supposed to do it. But what we do normally is that when we see some strange disease trend from some of our reporting facilities, we call them – we notify them. " (Key Informant DHMT).

Support functions Training Key informants especially those at the periphery levels revealed that they have not yet been trained in IDSR although they have a primary role in the implementation of the strategy within their respective districts. The main reason that was given was that these trainings are expensive and at most times there is usually no funding specifically for training in IDSR. In instances where health workers are trained in most cases, it is just an orientation to the system especially for the newly recruited health staff:

"…remember this thing came with donor funding – but what is there now is that where we see gaps we just do an on-site orientation. For example, if we see that a particular DHMT is not doing fine in terms of reporting we do an onsite orientation there and then just to impart knowledge on the IDSR." (Key informant - LPHO)

Logistical support

In terms of logistical support, we found that transportation facilities, particularly at district and facility levels, was the major challenge. At the district level, the unit responsible for district surveillance in most cases has to rely on pool vehicles to conduct its activities as they do not have Mandyata et al. BMC Public Health (2017) 17:746 Page 9 of 12 their own transport facilities. At the facility level, the challenge is even deeper. Due to the general lack of transports facilities, health workers in some cases have to use their own initiative in order to transport samples to referral laboratories for disease confirmations – sometimes at their own costs. Where they can, the core implementers (Ministry of Health Headquarters and Provincial Health Offices) do provide logistical support to the respective DHMTs and their respective health facilities:

…transportation is one of the biggest challenges affecting our work here at the district. If we as a unit can have our own transport instead of relying on pool vehicles [it] would make our work much easier. (Key Informant DHMT)

Supervisory visits, monitoring and evaluation

Our study findings revealed that supervisory visits were not being done in a regular manner and that it is usually only in times of disease outbreaks that is when supervisory visits to the periphery levels are done. One of the main reasons cited was the lack of funding from Central Government for such activities. Furthermore, a clinician interviewed revealed that supervision would at times be conducted when they (clinical staff) visited their respective District Health Management Team offices:

"Supervisory activities are not done due to funding. For 2015 only one was done [at a provincial level." (Key informant – LPHO).

Quality attributes

Representativeness of IDSR surveillance data

The findings from this study have revealed that so far most of the weekly and monthly IDSR data that is reported to the DHMTs is mostly from the public health facilities. DHMTs are still struggling to get the private health facilities to submit the weekly and monthly IDSR reports despite several attempts requesting them to send reports regardless of whether or not they have had a case of a priority notifiable infectious disease:

"Majority of the health institutions that submit the weekly reports are the public health centres. However, we are still struggling to incorporate the private health