

Information System as Part of Epidemic Management in Burkina Faso: From Plan to Reality (Field Findings)

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Abstract

Background: Health information systems (HIS) in most developing countries face many challenges. In view of recurrent weaknesses in preparedness and response during the management of epidemics, we have examined the organization and function of the health information system in Burkina Faso.

Methods: We conducted a cross-sectional study from January 1, 2019 to March 31, 2020 including a review of HIS documents, key informant interviews and direct observations. The study was conducted at the public primary health care (PHC) and community level of Bama and Soumagou in the rural health districts of Dandé and Tenkodogo. Study participants included community-based health workers (CBHWs) and health workers in the PHCs area, community-based organization animators (CBOA), CBO monitoring-evaluation officers and members of the District management team (DMT).

Results: While reporting forms used in all health facilities are standardized, they are not necessarily well understood at community level and at the health center. Reports prepared by CBHWs are often delayed by the head nurse at the primary health care service. Case definitions of epidemic diseases are not always well understood by community-based health workers and front-line health workers.

Conclusion: The health information system in Burkina Faso could be further improved. There is a need to hold regular training/refresher sessions for agents involved in surveillance and to ensure the development of simplified case definitions for emerging diseases and/or diseases of public health interest for community use. Furthermore, existing epidemic management committees need to be revitalize.

Background

The role of health information systems (HISs) is to produce, analyze and disseminate reliable health data in a timely manner [1]. However, few developing countries have a sufficiently robust and effective HIS to fulfil this role. Multiple constraints including lack of adequate health information policies, limited and unequal distribution of available resources, disorganization and fragmentation due to administrative, economic, or donor pressures, as well as the absence of standards are common explanations for fragile HISs [2–4]. Integrated Surveillance and Response (IDSR) defines a strategy that aims to strengthen the HIS through improved disease surveillance as well as laboratory and response capacities at community, district and national level [5]. Notably, the strategy was adopted by all member countries of the WHO-Afro region in 1998 [6–8].

The West-African country of Burkina Faso is challenged by high mortality rates (11.8‰) especially among mothers and children [9]. Notably, 24% of under-5 mortality per 1000 live births is caused by malaria, while 18% of deaths under-5 are attributed to acute lower respiratory infections [10]. High burdens of morbidity and mortality among children due to recurrent epidemics of measles and meningitis are also observed, while epidemic transmission of diseases such as yellow fever, dengue and most recently COVID-19 pose additional health threats across all age groups [9–11]. Faced with these health challenges, the national health policy of Burkina Faso aims to improve the health status of the population

by paying specific attention to the reduction of mother and child mortality rates, as well as targeting high-mortality conditions namely: malaria, tuberculosis, HIV and malnutrition [12].

The national HIS is part of the strategy to achieve this goal and includes all primary, secondary and tertiary health facilities of the country [13]. Non-governmental organizations (NGOs) also contribute to the HIS through their support to various community health structures. The HIS in Burkina Faso has six components i.e. the information system for i) routine health service reports, ii) epidemiological surveillance (early warning system), iii) program management, iv) administration and resource management, v) the community-based surveillance, and vi) periodic surveys and studies [14]. In addition, the IDSR strategy of Burkina Faso aims to support and strengthen the national HIS for all priority diseases, including those with high epidemic potential. The strategy is designed to assist the systematic processes for collecting, analyzing, disseminating, and using health-related data dispatched from the primary health care centres (PHCs) through the district hospitals on to the regional or university hospital centres and the Ministry of Health. The Health District (HD) constitutes the most decentralised level for health care delivery. It comprises two levels of care, the Primary Health care center (PHC), which is closest to the population served with a minimum package of curative, preventive and promotional activities, and the district hospital, which is the referral level with a complementary package of activities [15].

Within the framework of health information management in general, and for epidemics in particular, the managers at the PHC level are to interact closely with community-based health workers (CBHWs), community-based organization animators (CBOAs) and those in charge of monitoring and evaluating the CBOAs. The community-based surveillance include community representatives, neighbourhood leaders, village chiefs, etc. Their role is to provide quality health surveillance information to the PHC managers that are “useful at all levels of the health system for planning and decision-making concerning important public health events and epidemics” [16]. The aim of the community-based system is thus to improve public health surveillance and response to health events in the community by linking communities more directly to their local health facilities [17].

The WHO Health Metrics Network (HMN) is based on the principle that “collecting better health information leads to making better decisions, which lead to better health” [2]. The HMN Framework describes the six components of a HIS and standards required for each component. Through these six components, a HIS can be subdivided into three categories, i) inputs, ii) processes and iii) outputs. Inputs refer to resources, while processes refer to how indicators and data sources are chosen and how data are collected and managed. Outputs refer to the production, dissemination and use of information [2]. Defining what constitutes a HIS and how its components interact to produce better information for improved health and decision-making allows for better understanding of the HIS.

In this study, we use the HMN framework to examine the organization, functioning and interaction of the two surveillance components of the Burkina Faso HIS, namely, the epidemiological surveillance and the community-based surveillance.

Methods

Study design and study sites. We conducted a cross-sectional study from January 1, 2019 to March 31, 2020 at the public primary health care (PHC) and community level of Bama and Soumagou in the rural health districts of Dandé and Tenkodogo, respectively. The two districts are located in “Hauts bassins” (Dandé) and the “Centre-East” (Tenkodogo) regions of Burkina Faso. Given their relative proximity to Mali (Dandé), Togo and Ghana (Tenkodogo) and the continuous cross border movement of humans, animals and goods, these districts are considered at increased risk of epidemic disease transmission and thus relevant cases for assessing the surveillance components of the HIS.

Participants and sampling. Using a purposive sample, we included HIS members responsible for health surveillance in general and epidemic surveillance, specifically, including all Community-based health workers (CBHWs) and health workers in the PHC area. Additional personnel included community-based organization animators (CBOA), CBO monitoring-evaluation officers and members of the District management team (DMT) directly involved in health surveillance

Study items. The goal of the WHO HMN is “to increase the availability, accessibility, quality, and use of critical health information for decision making at the national and global levels” [2]. Referring to the HMN framework (2012), we assessed the following :

i) Inputs, including the legislative, regulatory and planning frameworks required to ensure the full functioning of the health care system, as well as the resources required to ensure that such a system is functioning. These resources include personnel, funding, logistical support, information and communications technology (ICT), as well as coordination. Specifically, we focused on activities by people involved in surveillance, their hierarchical relations and collaborators, as well as their pre-qualifications.

ii) The process, including indicators, data sources and data management, involving all aspects of collection, processing, storage and quality assurance, analysis and interpretation. Specifically, we focused on the typology of data collected, data production and data validation mechanisms.

iii) Outputs, including production, dissemination and use of information. In the study, we focused on the data distribution system and use (Fig. 1).

Data collection. Primary data were collected through key informant interviews based on semi-structured questionnaires and through direct observations of the facility setting using a thematic checklist.

Secondary data were collected from official surveillance documents including job description of agents in charge of the HIS in Burkina Faso, training module documents for CBHWs, guidelines for completion of the monthly activity report of the CBHWs, and activity reports of the PHC. Data were also collected from documents produced in the field as part of data management including monthly activity reports by CBHWs, activity reports of the PHC and statistics of health facilities.

Data analysis. All primary and secondary data were thematically analysed according to study item (inputs, processes and outputs) for comparison between the planned framework and the actual activities taking place at the different levels of the HIS.

Results

Burkina Faso Health information system flow diagram

Figure 2 provides an overview of the health system flow of information in health districts in Burkina Faso.

HMN inputs

❖ Surveillance activities

The different surveillance activities at each level of the health system were clearly defined in the technical guide for Integrated Disease Surveillance and Response and by the job descriptions for the different actors engaged in the HIS [7,16,18–23] (Table 1). Notably, at community level, CBHWs were expected to collect information related to the management of resources such as drugs, rapid diagnostic tests, bed nets etc., curative and preventive activities as number of consultations, debates, counsellings, home visits, and notification of births/deaths in households or rumours. He/She reports suspected cases of notifiable diseases, actively track patients lost to follow-up treatment and participate in monthly meetings with the head nurse (ICP) at the local health centre. The CBO monitoring and evaluation officers were instructed to analyse, interpret and archive all data reported by the CBOAs and to submit CBO progress reports to the Health District. They were also required to provide feedback to CBOs. The CBOAs were responsible for outreach activities regarding disease control, sexual and reproductive health, and child nutrition.

At the primary healthcare level, the Head Nurse (ICP) held numerous responsibilities including the investigation of unusual events based on rumours and unexplained deaths, as well as the immediate notification of suspected cases of disease. The ICP was also in charge of the supervision of CBHWs as well as the provision of materials, guidelines and collection forms to the CBHWs as needed. Moreover, the ICP was responsible for validation, analyses, interpretation and use of health information data for local decision-making and for the compilation and submission of weekly (TLOH) and monthly surveillance reports to the District level. The ICP were to participate in epidemiological surveys organized in the District, to establish the epidemiological profile of the health center and provide feedback to the general community (through the CBHWs), the health facility management committee (CoGes), the municipality and religious leaders.

We interviewed forty-one actors (Table 2). In accordance with available guides and job descriptions, the key informant interviews revealed that surveillance actors are trained at the time of recruitment and that surveillance activities are carried out according to plan. However, identification of notifiable diseases are hampered, as case definitions written in French are not fully understood by some CBHWs or ICPs: “...*there are items that are not well understood [...] or it is a lack of training. There are items that are confusing because if we argue about an item, it is not clear*” (DMT member). Inspection of the monthly reports

submitted by CBHWS also revealed a main focus on reproductive health, malaria and nutrition and that not all CBHWS are able to fill out the surveillance report forms themselves, but require help from the ICP.

❖ **Hierarchical relations and community-level collaborations**

The lines of authority and decision-making power was clearly described in the analyzed document (job description of agents in charge of the HIS), as were the collaborative arrangements within and between the different levels of the HIS. At the community level, with a mean of 10 by PHC in Tenkodogo and 4 by PHC in Dandé (according to 2019 statistical yearbook), the CBHWS are under the authority of the ICP, while collaborating with other CBHWS, the CBOA and the CBO monitoring and evaluation officer. Moreover the CBHWS collaborate directly with community leaders, traditional healers, the head of the village development council, district delegates, delegates of villages in the health area, and the head of the PHC management committee (CoGes). The CBOA is under the responsibility of the CBO monitoring and evaluation officer (incl. annual reporting of activities). He/she collaborates with CBHWS of villages in the health area (sensitization activities). The CBO monitoring and evaluation officer collaborates with CBHWS, PHC health workers, the health information and epidemiological surveillance center/officer (CISSE) at the District and at the Region.

At the PHC the head nurse (ICP) reports to the District medical officer, the District CISSE and the administrative and communal authority. The ICP collaborates with other health workers at the PHC, community actors of the HIS as well as traditional healers in the area of the PHC.

Our key informants confirmed the hierarchical and collaborative relationships as described above. However, some community “rapporteurs” (CBHWS) and the DMT noted that potential collaborators such as traditional healers or primary schools teachers are not sufficiently involved in disease surveillance despite their strong influence - as compared to CBHWS - on social mobilization and case referral.

Prerequisites: the educational/literacy level at recruitment, work resources and the motivation system

The analyzed documents show that the minimum educational/literacy requirement for recruitment of CBHWS, CBOAs and CBO monitoring and evaluation officers is a primary school certificate. The ICP must hold the basic training as nurse or midwife.

The CBHW work materials include checklists, consultation registers, reference and counter-reference sheets, community resources (drugs, rapid diagnostic tests, bed nets etc.), cell phones for communication with the health workers (for case identification), megaphone and a bicycle. At community level the types of motivation planned for health workers are mainly continuous training, regular supervision, study trips, letter of congratulation, honorary distinctions. The CBHWS receive monthly financial motivation supported by the Burkinabe state and the Global Fund to Fight AIDS, Malaria and Tuberculosis.

The ICP has a mobile phone connected to the District fleet, allowing him/her to transmit the PHC's TLOH data. The ICP benefits from continuous training/retraining, study trips, letter of congratulation from the

hierarchical superiors (District medical officer and / or the municipal authority), honorary distinction and promotion to the District level.

According to some CBHW interviewees, the educational/literacy criteria are not applied on recruitment of CBHWs. This aligns with observed difficulties in reading and/or understanding provided HIS documents by some CBHWs (low access to the content of the documents and the reasoning model/logic). The CBHWs also experience difficulties in receiving their regular motivational allowances. *“People are not motivated [CBHWs]; it has been shouted all over the place they are paid 20,000 CFA per month, but in any case I don't know if in 2019 they got anything”* (DMT member). This lack in allowances often leads to difficulties in obtaining telephone units, required as the CBHWs are not covered by the District's fleet, or petrol for transport for notification of suspected cases located in distant rural areas with poor or no telephone network.

HMN process

❖ Typology of data collected and data production

According to the procedures, the CBHW must use standard forms and produce a CBHW report to the local ICP. The ICP must produce a weekly TLOH report and a monthly PHC activity report to the CISSE. In the case of a suspected notifiable disease, the ICP is required to notify the CISSE immediately by phone and complete a follow-up notification form. Verification of collected data (TLOHs, monthly activity reports and notification forms) is the responsibility of the ICP, while the District CISSE aggregates all reports and forms. The CBHW report is submitted after the 25th of the month and no later than the last day of the month covered by the report. TLOHs are sent every Monday at 10 a.m. at the latest and notification forms must be submitted within 24 hours for each suspected case [21].

According to some study participants at the PHC and DMT, the standardized report forms are not always understood by actors at community level or even by newly assigned staff at the PHC level. One reason evoked by a DMT-member is lack of training or retraining on surveillance, its importance and its procedures: *“We need to train people only. [The ministry of health] have to train people in analysis and reporting techniques and then harmonize the items. Because if the items are harmonized, if the definitions are harmonized and people are trained, we have the chance to have a single information. This must not cause confusion. That means that when we say definition, it must be as simple and as clear as possible, so that people do not get confused. And the data collection form must be really clear”*.

It was noted that often CBHW reports are compiled and transmitted to the District with a delay of 2 to 5 days, sometimes without any check of data completeness by the ICP. The tedious verification of data collected in the monthly PHC activity report (consisting of 38 sheets) including verification of missing case information, such as patient data concerning age, socio-professional and vaccine status, often overloads the ICP. This work overload impedes supervision of clinical activities, bi-monthly CBHW supervision and the investigation of disease rumours. At the District level, the CISSE aggregate all data

from the TLOH and PHC reports in an excel sheet, while notification forms of suspected cases are recorded in different electronic databases (IDSR[1], e-Surveillance or STELaB^[2]) for follow-up.

The head nurse usually refers to directives coming from the central level, however there is no formal procedure for verifying the transmitted data. According to a District medical officer (DMO), the local databases set up by the District CISSE do not always undergo corrective actions after the final official validation.

❖ **Data validation mechanisms**

Formally, at the District level, the CISSE and the DMO, validates the disease indicators provided in the CBHW report, the ICP weekly reports and notification forms. They also verify the absence of outliers, completeness and promptness of data, every week and quarterly. A final validation is made every six months with the regional health team and the central level [21].

The main difficulty observed in the field was the lack of formal procedures on how to verify and correct the reported data, and failure to maintain regular epidemic management meetings as exemplified by a DMT member: *“Meetings are no longer being held because they are simply meetings that are no longer funded... There are no resources to hold provincial epidemic committee meetings. Moreover, when you take for example the District Health Council (CSD), it is the highest statutory instance in the district, which is under the leadership of the High Commissioner who is the chairperson [...]. Therefore, people are trying to juggle. If they have the funding for a meeting for example on nutrition...they profit to do their CSD”*. Which means some meetings, do not always involve all the concerned actors.

Finding related to output

❖ **Data distribution system and exploitation**

According to available HIS documents, surveillance data are transmitted from the PHCs to the District CISSE by telephone and on paper form. From the District level, the data are sent to the regional level and by the regional CISSE to the data managers at the central level (Directorate for the Protection of Population Health DPSP and Directorate of sectorial statistic studies DGESS) by telephone and e-mail. Feedback is provided by the central level as part of periodic correspondence to the District and Regional level through quarterly epidemiological reports, statistical yearbook, phone calls, electronic surveillance (laboratory results) and e-mails.

Based on our observations and key informant interviews, the described distribution flow of data is well implemented across all HIS levels. However, whereas the Health districts have a mobile phone fleet covering the PHCs, not all CBHWs have access to this and must use their own resources (cell phones and telephone units) to communicate with the PHC, hampering their reporting efforts. At the District level, sharing of data from the CBHW reports through the Health data warehouse (EnDoS), is incomplete, as

according to the 2018 statistical yearbook, only 16.0% and 64.7% of the CBHW reports were available from the health districts of Tenkodogo and Dandé, respectively [15].

In addition, we observed caseload discrepancies between the weekly data reported by the ICPs and the number of suspected measles (9.2%) and meningitis (33.8%) cases recorded in the IDSR database for the year 2018. According to a DMT member, this is due to poor archiving and a lack of corrective actions for local databases after final data validation sessions. In some cases this may also be due to lack of skills, by certain staff, in the use of computerized platforms for the management of descriptive lists, leading to duplicate or false cases. Among the reported cases registered in the disease surveillance databases (IDSR), we found that missing data, most often relate to socio-professional classification and patient history.

The District CISSE provide laboratory feedback to the ICP directly by phone, but only in the case of positive test results. All negative test results are sent to the PHC's letterbox located within the District itself. In some cases this may be as far as 50 km from the PHC. In addition, due to medical confidentiality, feedback on notified cases provided by the PHC to CBHWs is limited according to an ICP to collective sensitization activities.

Discussion

This study aimed to examine the organization and function of the HIS in Burkina Faso in terms of expected and actual activities by comparing official documents to primary information obtained through key informants and direct observations. Based on the WHO HMN frameworks, we focused specifically on inputs, processes and outputs.

Study limitations

The study has some limitations including potential bias due to the purposive selection of the two Districts and participants, and the risk of being not representative of health districts in Burkina Faso. Moreover, private health facilities and actors were not included in this study. Whereas their absolute number is relatively small and their concentration exclusively urban, they could provide supplementary information and a more holistic overview on surveillance as contributors to the HIS. Nevertheless, the results obtained offer inputs for reflection on improvements strategies in Burkina Faso and similar settings.

Main gaps between the planned and existing system

Input category

Regarding activities relating to community-level surveillance in Burkina Faso, official forms for reporting epidemic diseases and events in the community are in written French, which poses a challenge for some CBHWs in terms of reading and completion. Our study also revealed, that some forms contain certain

biomedical terms that do not align with local symptoms and disease perceptions. This may result in CBHWs failure to detect and report disease cases as required. In their evaluation of the surveillance systems in Burkina Faso, Geers *et al*/ reported that some CBHWs suggested the use of community definitions of meningitis and measles for better comprehension [24]. Moreover, in community settings, the registration of deaths by the civil registry office in municipal councils is often insufficient and verbal autopsies on causes of death are not carried out systematically [25]. This may partly be explained by lack of collaboration between the ministry of health and the ministry responsible for civil registration. This may also hamper the reliability of the detection process and early warning to contain epidemic diseases.

We noted that most of the CBHWs are primarily trained to provide services to the community for reproductive health, malaria, vaccines and nutrition. Furthermore, the community-based surveillance of epidemic diseases is not well developed in terms of training on case identification and reporting [24]. With the appearance of new epidemic diseases such as dengue and COVID-19, a stronger focus on emerging diseases and CBHWs participation is needed, including improved data sharing, and feedback between the different levels of the HIS and the community.

At community level, it may be an advantage to engage for example traditional healers and school teachers in direct collaboration with the CBHWs for epidemiological surveillance. As a matter of fact, their weak engagement has been documented in Dandé's 2018 and 2019 health District action plan, in its stakeholder analysis [26,27]. In similar setting in Niger, Ndiaye *et al.* reported that due to cultural beliefs, patients would consult traditional healers before going to the health centers, causing delays in early detection, reporting and investigation of disease cases [28]. According to the World Bank, "Information on types and volumes of services offered by private facilities is practically non-existent in Burkina Faso. As a result, the role played by the private health care sector is difficult to measure, as well as the quality of services is difficult to appreciate" [29]. As some people prefer to attend private facilities for various reasons such as fast treatment, better comfort and availability of specific services, the insufficient involvement of private actors in the surveillance of epidemics, may constitute a vulnerability for the existing health system in terms of early detection and notification of epidemics.

The compartmentalization of actors engaged in disease surveillance, as noted in this study, has been observed across African health systems, in general [30]. It is suggested that information and communication technologies (ICTs) could improve health system management including the relations between actors [31,32]. This may already be in process with the new WHO e-IDSR strategy [33]. In some countries, an SMS-based mobile phone network has been set up to enable CBHWs exchange short text messages [34]. Use of mobile applications could allow CBHWs to feel part of the system and change their expectations and roles in positive ways to increase personal commitment [35].

The ministry of health and persons in charge of health in Dandé and Tenkodogo should make an effort to improve CBHWs understanding of forms and access to simplified case definitions (with less technical terms) for all disease with epidemic potential. Therefore, information need to be formulated according to their level of instruction and under supervision of a district, regional, or central staff [35]. As noted by

USAID, interconnection of forms and electronic platforms of various programs could allow for real-time notification, collection, analysis and use of data on diseases or events for effective public health interventions. Indeed, directing the CISSE and other data managers such as laboratory technicians, to ensure they perform data entry correctly across existing programs, could solve data quality, as observed in this study. In Tanzania Nsaghurwe *et al.*, showed that it is possible to integrate and share digital data between levels and programs of the health system in spite of different digital tools. Indeed, data entry errors, as for example a discharge prior to admission dates, were resolved through interoperability filters of the health information exchange system, which captured such errors and requested corrective actions from the point of data entry [36].

Ideally information from the community and PHC level are used for the purpose of planning and management of the surveillance system as well as for advocacy and policy development. According to official documents, the head nurse should be able to analyse, interpret and use health information data for local decision-making [16]. In practice, the nurse, and even the DMT, solely refer to directives from the central level in Ouagadougou. They do not have decision-making autonomy regarding the management of problems encountered in their area of responsibility, despite the fact that they carry out annual analyses in which their problems are identified. As reported by Odhiambo-Otieno in Kenya, such centralized decision-making may often overrule or ignore local expectations [37].

Certain actors, particularly the ICP, report to several other actors, such as then CBHW, DMO and CISSE. This increases the risk of errors, caseload discrepancy between the TLOH data and the IDSR database, duplications during the reporting, and delays in the flow of information. Ouedraogo *et al.* highlight the tedious task of entering and reporting health data, including duplicate entry in different databases [38]. Additional explanations for inadequate reporting may be the absence of rigorous quality control by hierarchical managers due to lack of procedures or directives, inexperience with forms and guidelines of new staff, as well as individual or social factors of health workers, as for example labour disputes between health workers and the government. In 2019, health workers went on strike for a continuous period of eight months causing a noticeable drop in the yearly statistical reports [13,39].

Because of different skill levels between some community “rapporteurs” and the ICP, the interface of their collaboration is challenged, in terms of understanding forms provided by the ICP or inadequacy of the ICP to explain the forms in layman terms. This phenomenon was addressed by Schweyer and Cabe for whom “procedures or tools are not those that structure the networks, but a more egalitarian approach between health professionals” [40,41].

Official surveillance documents mention that the head nurse or any other designated person must file the CBHW monthly report. However, because of PHC understaffing, a single nurse may be linked to CBHWs from several villages with responsibility of multiple reports causing work overload and the risk that erroneous data are reported. Each CBHW report has a volume of 38 pages making it a substantial task to complete and verify. Moreover, the head nurse does not always receive the offered DMT support in terms of CBHW supervision and investigation of rumours, including deaths in the community.

Late payment of motivational allowances may also influence the motivation of CHBWs to carry out in-depth investigations of rumours. According to several studies, lack of in-depth investigations may lead to infodemics involving false or misleading information which may again cause widespread public reluctance to adopt the required infection control measures promoted by health authorities – thus delaying essential interventions [42–46].

Several guidelines exist for the completion of standardized forms for surveillance. However, they do not specify the means by which the reported data should be verified. This creates a risk for erroneously aggregated data that is inconsistent with the local reality. In turn this may lead to poor resource estimation, poor planning and performance assessment and eventually poor decision-making at central level. Innovating through the use of online forms or electronic applications could in this case, make it possible to better supervise the completion of forms at community level, promoting timely detection of erroneous or incomplete data [47,48].

In the specific case of diseases with epidemic potential, the multi-skills requirement of ICPs including routine activities, epidemiological surveillance, administration and management of resources, community collaboration, etc. generates a critical need for training and retraining to ensure timely identification and correct completion of surveillance forms. Lack of training of newly assigned ICPs by DMT members on surveillance procedures may be an additional source of poor completion and filling of surveillance forms.

Strategies as on-site training, should also be devised to engage all staff at health facilities, not just ICPs, in surveillance activities.

Processes categories

In a previous study in Burkina Faso, Geers *et al.* identified the cell phone as the main tool for reporting unusual events by CBHWs [24]. This corroborates with our findings, where this tool were used in case of transport constraints or for immediate notification of unusual events. However, the cell phone report is usually followed by a physical transmission (paper) of epidemiological information between the PHC and the health districts. This was pointed out by some actors as leading to an overload of work or a double activity, suggesting a need to reflect on opportunities to improve data transmission and archiving of weekly and monthly reports including digital means.

We observed a lack of simplified case definition for some disease and skills which could explain misidentification of suspected cases or under-detection of cases by CBHWs and health facility workers. Hence the importance of training and use of case definitions that are comprehensible at local level. Issues concerning inadequate understanding of forms and/or case definition could be addressed through the use of local language during training sessions of community actors or by the use of translated forms, as recently applied in the case of community management of childhood infections and illnesses in the District of Barsalogo [49]. In Nigeria, Nnebue *et al.* recommended regular training and retraining of relevant health care workers with adequate and regular provision of IDSR forms, copies of the standard

case definitions, and other necessary logistics to the PHC [50]. These additional training activities by the local and state governments imply the availability of financial resources, which may require considerations as to relevant reallocation opportunities.

We observed that factors such as the quality of the telephone network or available finances affect reporting. It sometimes lead actors across all levels to adopt accommodative methods, in order to report information in time or to promote active feedback to the community level. These accommodative methods included the use of private telephones and/or telephone units and use of any available means of transportation such as privately owned cars or motorcycles facing a cumbersome process of reimbursement. In their study from Zanzibar, Saleh *et al.* reported similar findings in terms of availability of communication services, inadequate transportation capacities and funds, hindering regular supervision, training, and outbreak investigation [51].

Innovative monitoring tools such as RapidSMS[1] and REC[2] [52] are planned for deployment in Burkina Faso for pilot diseases and should hopefully replace current accommodative measures. However, their use must be appropriated by all actors in order to improve the overall performance of the system.

We observed that all data analyses were undertaken at district or regional level, as PHC workers did not perform any analysis or interpretation of collected data at local level. As pointed out by Rasmussen [53], the inability of actors to analyze and work with data at the local level may negatively affect the quality of the data reported to the district level. In this study, we noted several forms with missing or inadequate data submitted to the District level which, given local analysis, were likely to have been noted.

Epidemic management meetings could play a catalytic role for planning and decision-making at the local level, but are increasingly difficult to maintain due to lack of financial means across all levels (regional, provincial, departmental, municipal). The current trend of integrating these meetings with other activities, such as sexual and reproductive health and malaria control programmes are challenged by limitations to attendance numbers. As a consequence key actors are excluded from essential discussions and decision-making that align with local expectations, such as financial support.

We identified a lack of direct laboratory feedback from the District to the PHCs in the case of negative result. This presents a motivational challenge, also noted by Drabo *et al.*, who reported that without regular communication of test results, the relevance of notifying cases and the sense of useful contribution towards the system was questioned at the community level [54]. In fact, this feedback was seen to clearly encourage health workers and the community “rapporteurs” to participate in the surveillance system and continued training [54].

Output categories

At the national level aggregated data are translated into yearbooks, statistical yearbooks, epidemiological reports and other reference documents that are distributed to the district level. Onward distribution of documents may vary between districts. The documents are used for service and system planning and

management, advocacy and policy development at the district level. However, nationally aggregated data may not adequately reflect the health situation in a given district posing a challenge to the effectiveness of the developed policies and plans. Whereas the HMN [2] states that local information should be used to guide local decision-making, the capacity to analyze data often lacks at the peripheral levels where data are generated and where the results should be used for planning and management. Sometimes, it is due to a poor archiving system and a lack of corrective actions in local databases after data validation sessions. In their analysis of the WHO-African region, Mbondji *et al.* underlined that health management information systems generate considerable data, but the information is rarely used because of concerns about bias, quality and timeliness [55].

Conclusion

Reorganization of the health information system of Burkina Faso with inclusion of a stronger focus on emerging epidemics and CBHWs participation would improve its performance in terms of epidemiological surveillance. In fact, even if the health system has guides and manuals for health information management, a well-defined information circuit and an internet platform for the storage of health data, these are not enough. There is a need, to hold regular training / retraining sessions for agents involved in surveillance. To introduce a data quality control system, It is recommended to cultivate a habit of systematic search for missing data, among all surveillance actors, in order to continuously improve the quality of the epidemiological databases, To ensure the development of simplified definitions of cases for emerging diseases, a more pronounced use of local language during training sessions of community actors could be also useful for a better understanding of signs, symptoms, indicators for a timely detection, notification of community case by CBHWs and ICPs. In addition, adapted means for CBHWs to carry out "autonomous" detection and rapid notification of cases in their communities, should be considered. Encouragement of people involved at the peripheral level in routine activities of collecting and storing data should be extended to analysis and interpretation of data by local actors, with a view to stimulate use of local data. Users of health data should not be limited to health professionals, system managers or statisticians. Indeed, those responsible for data collection should also benefit from its use.

Abbreviations

ABBEF: Burkinabe Association for Family Welfare

AIDS: Acquired Immunodeficiency Syndrome

CBHW: Community-based health worker

CBOA: Community-based organization animators

CISSE: Health information and epidemiological surveillance center/officer

CoGes: health facility management committee

CSD: District Health Council

CSPS: Primary health care center

CM/CMA: Medical center

DGESS: General directorate of studies and sectorial statistics

DMT: District management team

DPSP: Directorate for the Protection of Population Health

EnDoS: Health data warehouse

HD: Health district

HIS: Health information system

HMN: Health Metrics Network

ICP: Head nurse of PHC

IDSR: Integrated disease surveillance and response

IPC Burkina: Private and community initiative Burkina

MCD: District's medical officer

NGO: Non-governmental organizations

PHC: Primary health care center

RMA: Monthly reports

SIREP: Epidemiological research and planning information service

SPIH: Hospital planning and information service

STELaB: System for Tracking Epidemiological Data and Laboratory Specimens.

TLOH: Telegram weekly official letter (Weekly reports)

WHO: World health organization

Declarations

Ethics approval and consent to participate

An information sheet to introduce the study background and objectives as well as a consent form were used to collect consent from study participants. Anonymity of interviewees was ensured during data management and analyses by assigning codes to each respondent during the transcription of interviews. The study was approved by the ministry of health, the institutional ethics committee of “Institut de la Recherche en Sciences de la santé” IRSS and was registered under the number 32-2019/CEIRES on October 02, 2019.

Consent for publication

Not applicable

Availability of data and materials

The data that support the findings of this study are available from Emerging EPIDEMICS project but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of Emerging EPIDEMICS project.

Competing interests

The authors declare that they have no competing interests.

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Author's contributions

DCO collected, analysed and interpreted all data and drafted the first version of the manuscript. SKL, SH and DKM contributed to the conception, study design and data analysis and revised the manuscript.

All authors read and approved the final manuscript.

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Tables

Table 1: Summary of secondary data sources in Dandé and Tenkodogo health Districts, Burkina Faso

Official documents	
Standards	Operational
Technical Guide for Integrated Disease Surveillance and Response in Burkina Faso. Section 1 to 8: Steps in surveillance.	TLOH (weekly reports)
Technical Guide for Integrated Disease Surveillance and Response in Burkina Faso. Section 9: Guidelines for priority diseases, illness and other public health events	Notification form
Job description of agents in charge of the HIS.	Activities reports (CBHWs monthly reports, PHCs monthly reports, annual reporting ...)
Training module for community-based health workers.	Monitoring reports
Guideline for completion of the monthly activity report of the community-based health worker.	2018 statistical yearbook
Guideline for completion of the monthly activity report of Primary health care centers/dispensary/maternity ward/birth clinic.	2019 statistical yearbook
Guide to filling in data collection tools- PHC, CM/CMA and District executive team level.	Dandé health District 2018 action plan
National guide for CBHWs supervision.	Tenkodogo health District 2018 action plan
	Dandé health District 2019 action plan
	Tenkodogo health District 2019 action plan

CM/CMA: Medical center

PHC: Primary health care center

TLOH: Weekly report

Table 2: Overview of study participants in Dandé and Tenkodogo health Districts, Burkina Faso

Study Participants

Profiles	Number included/total number
District Management Team (DMT)	
District medical officer (MCD)	2/2
District's health information and epidemiological surveillance officer (CISSE)	2/2
District hospital manager	1/2
Laboratory manager	2/2
Primary health care center staff (PHC)	
Head nurse (ICP)	2/2
ICP colleagues (other health workers)	8/8
<i>Community "rapporteurs"</i>	
Community based health worker (CBHW)	21/22
Community-based organization (CBO) animator	1/-
Community-based organization (CBO) monitoring and evaluation officers	2/-
Total	41

Figures

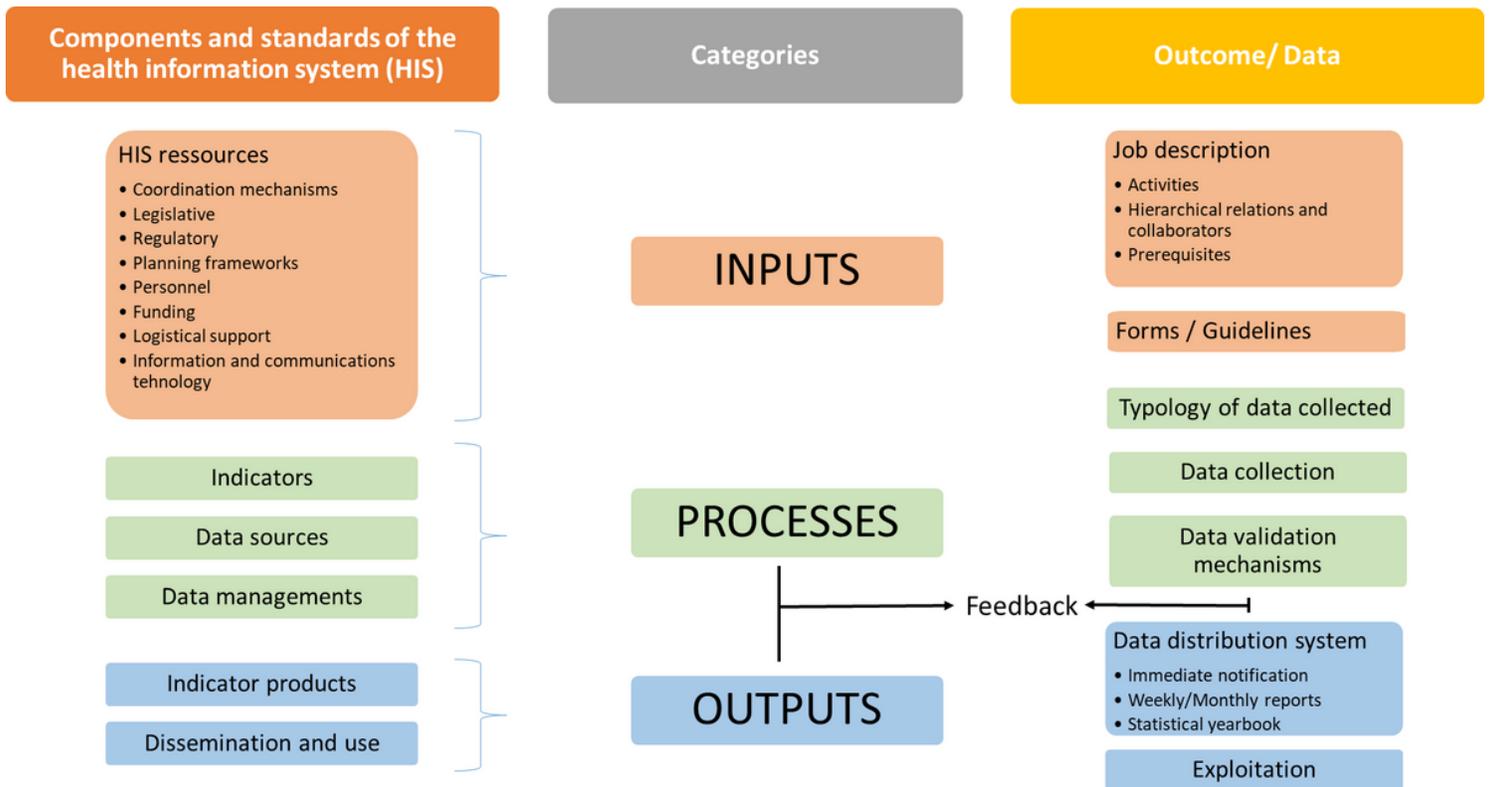


Figure 1

Categories examined in the study (Adapted from WHO framework and standard for country health information systems)

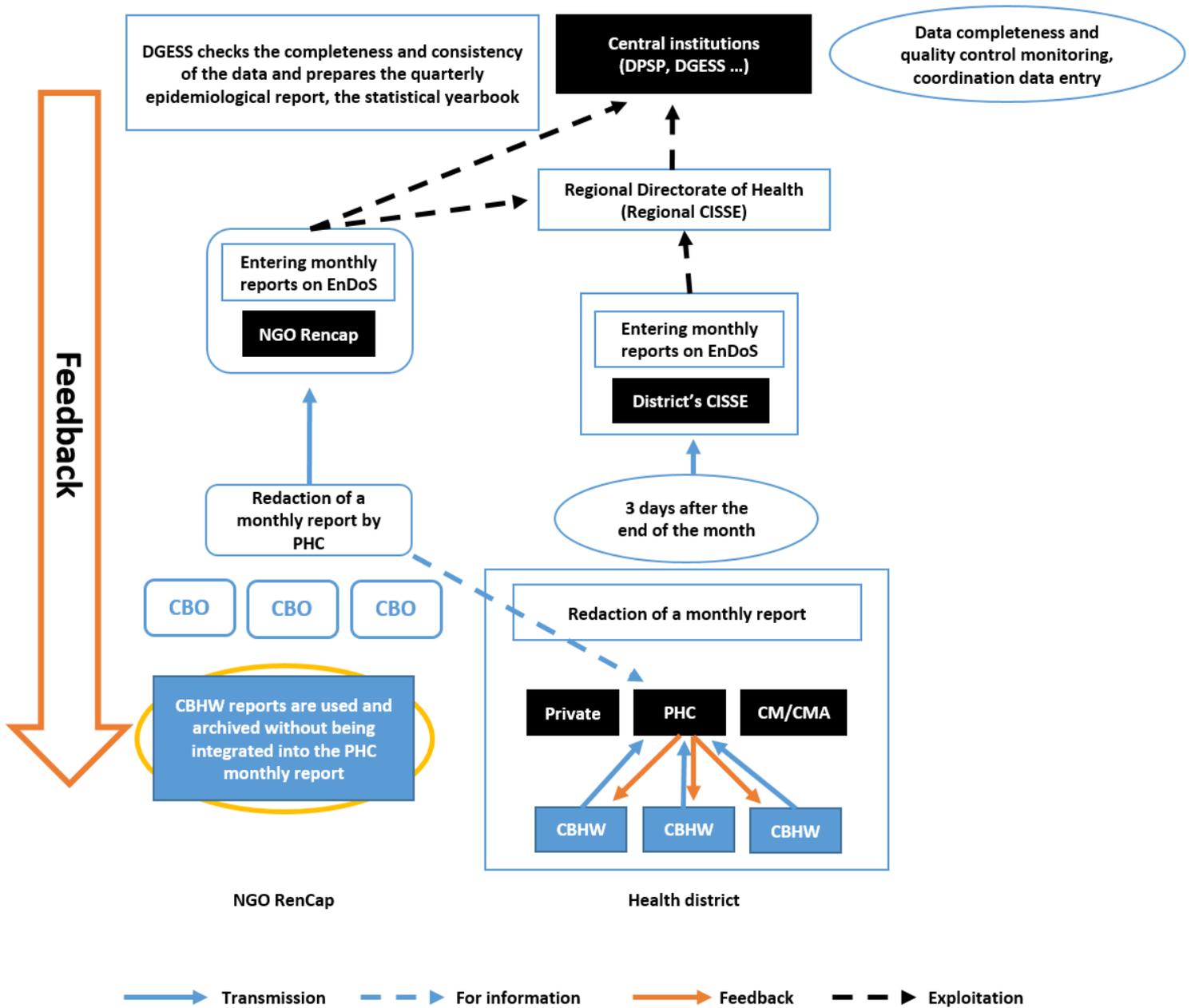


Figure 2

Burkina Faso Health information system flow diagram in health districts (Source: Adapted from Ministry of health) CM/CMA: Medical center CISSE: Health information and epidemiological surveillance center/officer CBO : Community Based Organization CBHW : Community Based Health Worker DGESS : General directorate of studies and sectorial statistics DPSP: Directorate for the Protection of Population Health EnDoS: Health data warehouse NGO: Non-governmental organization PHC : Primary health care center