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Benefits of Local Knowledge in Shaping Standards

A case study from community health service and information systems in Ethiopia

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Abstract. This study investigates the pivotal role of local knowledge in shaping standards in the health service provision and health information systems implementation in the context of a developing country. To do so, we draw on empirical data from a qualitative case study of health data gathering and service provision during a child survival intervention campaign conducted in Ethiopia. Theoretically, we draw on studies that thematize the tension between the universal nature of standards or protocols and the inevitable need for adaptation and flexibility when they are implemented in a given concrete context. The study conceptualizes the national guidelines, which guide health workers in the data gathering and health service provision process, as standards. We examine the implementation of those guidelines in the actual set up, and show the significance of local knowledge in order to fit the standards to the reality at the ground. The findings indicated that health workers sometimes deviated from the standards and devised alternative ways of doing based on their context-specific knowledge and locally available materials. We emphasize both the need for standards as such, as well as the value of productive deviation from the standards when required depending on the context. The article provides theoretical insights relating to standardization with flexibility, and suggests differentiating between fixed and flexible elements of standards. We argue that the lessons learned on the data handling process observed in the campaign can help to improve the data quality and strengthen the routine health information systems.

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Keywords: Standards, flexibility, health information systems, data quality, context-specific knowledge, guideline, enhanced outreach strategy.

1 Introduction

Standardization aims for control by guaranteeing uniformity and predictability, and making actions comparable over time and space. For instance, Hanseth et al. (1996) described standardization and standards as key elements in the realization of the envisioned information infrastructures. We standardize in order to integrate, order and control a fragmented world, and to reduce its complexity; to forge order out of chaos (Hanseth et al. 2006). For instance, the use of the International Classification of Diseases (ICD) in the health care sector reflects an attempt to collect standardized information about morbidity and mortality globally by the WHO in order to help in coordinate action and resource allocation (Bowker and Star 1999). However, overemphasizing criteria of universality, uniformity, and centralization of control to achieve alignment, stabilization, and closure may result in failure (Hanseth et al. 2006). Too rigid standards may fail to get implemented on the ground, or they may fail to accommodate changes over time. Hence, there is an intuitive tension between standardization and flexibility.

The present case focuses on how the health workers implemented the working guideline (the standard) with the required flexibility in a health campaign event. Our approach to the study of standardization resembles those applied by (Timmermans and Berg 1997). The authors describe how clinical research protocols for a multicenter study intervene in a specified situation and prescribe a set of medical interventions, which should be performed in a similar way, to achieve results which are comparable over time and space (p. 281). However, since conditions and needs were not similar in different contexts, there was a need for the standard to be flexible enough to be appropriated to varieties of work practices and locations; only by getting 'localized' could the standard's 'universality' be realized. Timmermans and Berg (1997) identify the issue which is closely related to those we are focusing on. However, the empirical context is different. The present study explores in what manner local knowledge can enhance the implementation of standards with the required flexibility, in a resource constrained setting, while carrying out health service provision and community data gathering.

The relevant health program discussed in this paper is the Enhanced Outreach Strategy (EOS) campaign, designed to address the immediate and underlying causes of child mortality. The health workers in the EOS campaign were given standardized guidelines, and we conceptualize these EOS guidelines as a procedural standard. The guidelines comprise a composite standard since the instructions cover both the health care provision itself and data collection and reporting. These guidelines explain how the essential action should be carried out in relation to organization of the EOS posts, the service provision as well as procedures of gathering, compiling and reporting data. The aim of these standardized guidelines is to minimize deviation and errors, both in service provision and in data gathering. The EOS guidelines for health workers was developed by UNICEF and other health partners, and then adapted to an Ethiopian context by the Federal Ministry of Health (FMOH). Thus the common practice of centrally defined programs, standards and guidelines sometimes goes against the insights from discourses

such as participatory design, user involvement, or development studies emphasize that involving the local community is crucial for effectiveness of implementation and sustainability (Piotti et al. 2006, Puri 2003, Puri 2007). We argue that it is of large practical relevance to study how local health workers and communities can be more involved, and we specifically address how context-specific knowledge can be integrated into health service provision and data collection. Puri (2007) identified deep tensions in the process of co-construction a knowledge alliance among scientists, technologists and the local communities in the context of GIS deployment for land management in rural India. In our case, the practices of health care provision have a scientific basis which is sometimes alien to the local communities. This knowledge, inscribed into the health programs' standardized guidelines, in practice meshes with the local knowledge of peripheral level health workers and community members.

In this article we will demonstrate the significance of local knowledge of health extension workers and community volunteers. It has already been shown that context-specific knowledge was important for health workers in order to successfully perform activities on the ground (Damtew et al. 2010). Here we build on this, but examine in a more detailed way how health care personnel acquire and incorporate such context-specific knowledge, as well as, how this knowledge integration may impact data quality issues. We studied the campaign implementation in November 2008 in the Amhara region in Ethiopia, using qualitative methods such as interviews and observations. We focus on how the standardized guidelines need to be flexible if such context-specific knowledge should be incorporated. The question is, then, whether and how the standards can be adjusted to the local contexts and needs. Through our empirical material, we examine how local knowledge impacts the actual practice, with a special attention towards productive deviation from the guidelines. We argue that integrating local knowledge may in turn impact positively the data quality, both in the immediate context of the campaign, but also in the routine health information systems (HIS). Our research aim is to contribute to the conceptualization of how to design flexible and appropriate standards for healthcare procedures, and we propose that it may be helpful to distinguish between fixed and flexible aspects of a standard.

The remaining part of the paper is organized as follows. In the next section, we present a review of related research that supports our focus on the local context, and that offer theoretical insights on the role of standards. A presentation of the research setting and the research approach, including the data collection and data analysis methods will be presented in section three. Thereafter, in section four, we present our empirical findings. In section five, we discuss the role of context-specific knowledge in the EOS campaign and especially how it contributed to improving data quality, before we discuss the theoretical issue of flexibility in standards. The implications of this research for practice are described in section six followed by conclusions in section seven.

2 Related research

2.1 Data quality

It is recognized that availability of reliable, relevant, comprehensive and timely health information is an essential foundation for any public health intervention. However, very few systems in developing countries meet this demand, and poor data quality is identified as one of the major problems (WHO 2006; Lippeveld et al. 2000). Since routine HIS collect excessive quantities of data that are not relevant to the health professionals responsible for data recording, then the quality of data often suffers and data use at the collection site becomes minimal. There is no single agreed definition for data quality, since quality is a relative term and depends on circumstances. Shrestha and Bodart (2000) define the quality of data as to the degree to which the data or statistics measure what was intended to be measured when the data collection system was designed. According to Heywood and Rohde (2002), good quality data should be correct, complete, consistent and available on time. Many authors, on the other hand, argue that quality should be assessed from a data consumer perspective and that there is more to information quality than mere correctness and accuracy (Parker et al. 2006; Lui and Chi 2002). Much effort has gone into strengthening and improving the quality of the routine HIS in developing countries. For instance, the Routine Health Information Network (RHINO) has developed the PRISM (Performance of Routine Information System Management) assessment framework (Aqil et al. 2009). In the PRISM framework, performance is defined as improved data quality and continuous use of information, and data quality is defined according to four dimensions: relevance, completeness, timeliness and accuracy (Lippeveld et al. 2000). Different HIS researchers emphasized that using of information for action locally can improve the data quality (Shrestha and Bodart 2000; Heywood and Rohde 2002). Use of data at the site where it is collected can lead to detection of errors and inconsistencies, so that correction is made easily. In these debates it is argued that improvement of data quality in HIS needs to engage with and mobilize the local health workers, community members and the district level, since these concerns cannot be addressed at the national level (Igira 2008).

2.2 Standardized protocols

Standardized guidelines in the form of 'best practice' recommendations, clinical procedures, or research protocols are widespread in healthcare, where they are designed to reduce variations in practice and thus to enhance the quality of care in all locations (Komaroff 1982; Wennberg 1991). Guidelines contain a set of instructions telling the implementer how to perform the activities in specific situations. These instructions may be designed as detailed flow-charts, or they may consist of a number of rather vague and general recommendations, but they are all designed to guide the person through a sequence of steps (Berg 1997). Thus protocols or guidelines may enable health workers to perform new tasks, as they fill in the gaps in health care worker's knowledge and assists in decision making (Berg 1997). Timmermans and Berg (1997) analyze clinical

protocols that standardize a set of practices, actors and situations, and prescribe a set of interventions that should be performed in a similar way, to achieve results which are comparable over time and space (Timmermans and Berg 1997, p. 281). However, since conditions and needs are not similar in different contexts, the standard must be appropriated to varieties of work practices and locations; or being localized while retaining its universality. Protocols are well known within a clinical context; however they are also crucial in the domain of public health, including the information systems. For instance, Sauerborn and Bodart (2000) recommended that protocols and operational definitions need to be developed in order to improve data quality in HIS.

2.3 The tensions between universality and locality

There is no doubt that updated and practical standards of performance can be beneficial to the health workers, however, research have also pointed to concerns that the protocol's may prescribe precise and uniform criteria that can be challenging to implement on the ground, within a local context. For example, Mavimbe (2006) describes how a set of uniform guidelines were created by WHO for its Extended Programme of Immunization (EPI). This cook book was translated and adapted by the Mozambican national health authorities, however, it still needed adaptation and improvisation by the health workers who provided vaccination services in the remote areas of Mozambique. One of Mavimbe's main conclusions is the need for flexibility in the standard; it must be able to adapt to the local conditions where it is deployed. As such the standard needs to balance its universal aims with the demands of the locality where it is implemented. This corroborates insights gained from studies of standards in other contexts, that local work practices and specifics of the organizational reality may create tensions when such standards are implemented (Bowker and Star 1999; Hanseth and Monteiro 1997). Ellingsen and Monteiro (2003) describe, for instance, the widespread proliferation of local patient information systems and practices in a hospital as emerging from the health workers legitimate needs, and as beneficial in the local context. Consequently, the imposition of a 'one-size fits all' system proved problematic (Ellingsen and Monteiro 2006).

Rolland and Monteiro (2002) address the issue of how to balance between multiple, and potentially non-compatible, local needs and concerns within a globally dispersed information infrastructure. Hanseth et al. (2006) also focus on the inadvertent effects of pushing too hard for universality, uniformity, and centralization of control through standardization. Timmermans and Berg claim that "patients and medical personnel are not turned into mindless followers of medical scripts" (1997, p. 288), but the protocols are re-appropriated to make them doable for the participants within their context. Flexibility and improvisation thus are not the opposite of universality and standardization, but rather help to achieve it, so that "localization and universality are inevitable intertwined" (Timmermans and Berg 1997, p. 277).

Flexible standards

The above mentioned studies thus call for recognition of flexibility in standardization. 'Flexible standards' is a notion that may seem self-contradictory, but which has been thematized by,

for example, (Hanseth et al. 1996; Braa and Hedberg 2002; Braa et al. 2007) specifically with relation to HIS in both developed and developing countries, a domain where detailed, global standards are prominent. These researchers agree that flexibility is the core criteria of standards. Hanseth et al. (1996) discussed two kinds of flexibility; use and change flexibility. Use flexibility refers to the ability to use a standard in a number of different environments or for a number of different purposes. For this purpose, (Braa and Hedberg 2002; Braa et al. 2007) introduced the principle of 'a hierarchy of standards' that seeks to balance flexibility and uniformity. This approach was a key ingredient to reach consensus during the standardization of health care data in South Africa. The hierarchy of standards allows addressing different information needs at different levels of the health administrative structure. A core principle is that only essential information for action should be collected at each level. At the national level a 'minimal data set' should be defined, and the other levels (such as provinces or districts), which will have additional information needs related to local particularities of, e.g., disease burden, are free to add to this data set. This framework indicated the lower levels in the health care hierarchy have the right to define their own data set as per their local needs as long as they include the data set of the higher level.

Change flexibility is enabled by the principle of modularization (Hanseth et al. 1996). Rather than one complex standard covering everything, one should make several simple standards and combine them; then individual elements can be changed relatively easily without implications for the rest of the system (Hanseth et al. 1996). In (Braa et al. 2007), the need to make HIS work under very uneven infrastructural conditions is discussed. Specifically, where (at which administrative level) it will be appropriate to computerize the HIS, may vary across a country. Thus flexibility is required in where to locate the paper-electronic gateways, and this requires a modular system (rather than an integrated system) where the utilization of gateways allow geographical variation in whether paper-based or computerized information reporting is used.

However, these studies discuss issues relating to systems design and implementation strategy rather than procedural standards. A more relevant example is offered in the study of standards in the EPI programme (Mavimbe 2006). The WHO has issued detailed guidelines for how the vaccination logistics (the so-called 'cold chain') should be organized. This guideline specifies the vaccine's durability, not just under the ideal storage temperature, but for several different storage conditions (such as mobile cooler boxes) that are often encountered in rural areas. In addition, the guidelines come with several additional tools and procedures to help assess the durability. This feature of the standard thus supports delegated decision-making on behalf of the health workers in the actual context, and as such it offers a robustness that is practically significant for the cold chain to work.

While these studies all point to relevant insights, none of them explicitly discusses how to integrate context-specific knowledge in the provision of health services or in data collection. Neither do these studies explicitly discuss what constitutes allowable deviation from the standard, or offer specific criteria for how to distinguish between appropriate and non-appropriate deviations. We are here interested in studying more explicitly the potentially beneficial role of local knowledge among health workers and community members. We conceptualize the EOS guidelines as standards that direct the working procedures of the health workers during the EOS campaign, with the aim of standardizing both the service delivery and data collection procedures. In our analysis, we will focus on how the standards (these guidelines) are implemented in concrete conditions. This will help us to identify where, and for what reasons, flexibility is

required. We will describe the observed deviations from these guidelines, which offer insights on the alternatives that are preferred by health workers utilizing their local knowledge and local materials. We then will examine what effect these deviations may have on data quality, both for the EOS campaign and the routine HIS.

3 Methods

3.1 Research setting

The health service delivery system in Ethiopia is organized in a three tier system, namely Central and Regional Referral Hospitals, Zonal Hospital and the primary health care unit comprising primary hospital, Health Center and Health Post. Central Referral Hospitals give a referral service to for 3 to 5 million population. Zonal Hospitals are expected to serve 1 million population, whereas, primary hospitals for 60,000 to 100,000 populations, including the admission service. Health centers provide both curative and preventive out-patient care to 25,000 population and health posts are the smallest health units serving 5,000 populations, or 1000 households (HH) with more focus on the preventive aspect.

The empirical material reported in this paper is drawn from a case study of an EOS campaign event. The EOS campaign was initiated in 2004 after the massive drought and famine in 2002–3, and it is supported by the UNICEF and World Food Programme (Fiedler and Chuko 2008). The length of the campaign varies from 5 to 10 days depending on the type of services given, the topography and the district's available human resources. EOS interventions are rendered for children from six months to five years of age. The event is designed to improve the child and maternal health status by offering vitamin A, nutritional screening, immunization and other child health services (FMOH 2006). EOS was designed as a temporary strategy that would be translated to a sustainable service provision through the prevention-oriented Health Extension Program (FMOH 2006). The FMOH, and Regional and Zonal health bureaus, as well as other stakeholders, such as UNICEF are involved in the overall governance of the initiative. They provide training of trainers, assist in coordinating and delivering supplies, supervise the campaign and compile the reports on the results. The health authorities in the lowest administrative levels, districts and kebeles (sub-districts) are responsible for the actual organization and implementation of the campaign. The EOS teams, consisting of health workers, health extension workers and community volunteers, render the actual services and collect relevant data.

To assist the districts in the EOS activities, the FMOH has prepared an EOS guideline and the activities are expected to be accomplished based on the standards stipulated in this guideline. The 'Guideline for the EOS for Child Survival Interventions' (FMOH 2006) gives detailed information about the health services being offered, and it also stipulates how the social mobilization of the communities should be carried out, how the outreach health posts should be organized, and how the data gathering and reporting activities should be conducted. Practically, the EOS services are offered through transient posts organized either at the existing health facili-

ties or in the villages, for instance in schools, administrative compounds or in the shade under a tree. According to the instructions, each post needs to have a team composed of five to nine people, of which at least two should be professional health workers.

3.2 Research approach

Case-study analysis is commonly used to explore and understand complex and localized human activity systems and social environments (Yin 1994). We have conducted an interpretive case study, aimed at producing an understanding of how the group of health workers and community volunteers involved with the EOS event dealt with the standardised guidelines in relation to their context-specific knowledge. In this study, we observed the service provision and health data collection process at the community level during the EOS campaign conducted in November 2008. This campaign is particularly well suited for our study, because professional health workers work alongside health extension workers and community volunteers. The campaign activities thus allow us to study situations where health workers are in a different and more involved relation with the local community than in the context of routine data collection in health facilities.

3.3 Data collection

The study was based on data collection at multiple levels in the health hierarchy. Hence, the EOS campaign procedure was followed at the region, zone, district and community levels, however, most field work was done at the service sites in the communities. The data collection took place for a period of three months (from October to December 2008). Four districts within two zones in Amhara region were selected for the study, and sixteen (ten rural and six urban) EOS posts were visited (see table 1).

We used qualitative data collection methods that could help us to capture local work practice, such as observations, interviews and analysis of documents and reports. Focus group discussions were also held with three EOS team members at the community level. The point of discussion included factors that could affect the service provision and data collection processes, actions being done to follow the standard instructions written in the EOS guideline, and ways they could improve routine data quality using the data gathered during the campaign.

Participant observation was done throughout the campaign. The first author observed the implementation, data collection procedures and report compilation, and was present during monitoring meetings. The field researcher (first author) was a staff at Amhara region health bureau. Hence, she also participated in providing the health services and training of health workers. Dwyer and Buckle (2009) mentioned that although the insider role of the researcher can be beneficial to get rapid and more complete acceptance by the study participants, it has also the potential to impede the research process. They posited that it is possible that the participants will be nervous or make assumptions of similarity and therefore fail to explain their individual experience fully. The authors also mentioned issues relating to home blindness or the researcher's personal experience that may affect the data collected.

In this case, the researcher communicated with the study participants in a friendly manner to avoid unnecessary anxiety, and she managed to build good relationships with the team members and supervisors that facilitated frequent informal discussions. The field researcher first obtained the respondents' informed consent and she mentioned the relevance of the research for the improvement of their future work. Anonymity and confidentiality of their responses was ensured to allow the respondents to express their feelings without apprehension. A general literature review of EOS studies, and analysis of relevant documents including the EOS guideline prior to the data collection, helped us shape the interview guide. The interview guide was open ended with the intent of eliciting views and opinions from the respondents. More probing took place when more questions were generated during interviews. Rather than the insider or outsider status of the researcher, the core elements include an ability to be open, authentic, honest, deeply interested in the experience of one's research participants, and committed to accurately and adequately representing their experience (Dwyer and Buckle 2009, p.5 9).

A total of twenty-six interviews were conducted with health workers, health extension workers and health managers (see table 1). The interview and discussion was held in Amharic (the national language), and detailed notes were taken, which were soon transcribed into English. The interviews were conducted on the work place of respondents. Depending on time availability of the respondent, an interview would last from 20 minutes to 1 ½ hours. The interviews allowed the researcher to clarify information that was not understood during observation.

<i>Organizations visited</i>	<i>No. of visited organizations</i>	<i>No. of respondents</i>	<i>Job responsibility of respondents</i>
Regional Health Bureau	1	2	Team leaders
Zonal Health Department	2	4	Head of the department and team leaders
District Health Office	4	4	Health officers
EOS post	16	16	Health workers & Health Extension workers

Table1: Details on the interviews conducted

Prior analysis of the EOS guideline and manuals provided us with relevant background information on the work process of the campaign. The guideline was examined in order to compare what is written in the campaign protocol with the observed, actual practices. The tally sheets and reports for different services in the campaign, such as vitamin A and measles vaccination reports were reviewed for comparison and verification of the quality of data.

A research diary was maintained throughout to document notes from observations, interviews and focus group discussions, and some notes were also cross-checked with the concerned respondents. We have tried to triangulate the data from different data collection sources and we cross-checked some responses with the study participants.

3.4 Data analysis

The interpretive approach, which is adopted for this study helped us to develop insights into the EOS work procedures. Seidler (1998) describes qualitative data analyses as a process of noticing, collecting, and thinking about interesting things in the material. In our case, 'things', indicated the data related to the health service provision, and capturing, cleaning, compiling and reporting health data. However, this process was not linear; it can rather be described as iterative, because it is a cycle that keeps repeating. Myers and Avison (2002) also argued that the analysis of qualitative data is a continuous process that starts in the research field during the data collection process. For example, while thinking about things, the researcher also starts noticing new things in the data. Subsequently, it is possible to collect and think about these new things. In principle, the process is an infinite spiral and the process is holistic, in that each step in the process contains the entire process (Seidler 1998). Our focus was to understand how the experiences from the campaign and the data collected during the campaign help to improve the routine HIS.

In analyzing the data, our conceptual lens was on the need for context-specific flexibility of the standard, particularly related to instances where context-specific knowledge was drawn upon. We sought to identify instances where the health workers deviated from the EOS guidelines. Specifically, we analysed how the instructions in the guideline were modified and implemented at the ground, what role local knowledge played in these modifications, and how this modification could impact data quality. The findings of our study are organized into four empirical themes and presented in the following sections.

4 Case presentation

This section presents the empirical findings of the study conducted on the campaign event in Amhara region of Ethiopia, one of the country's largest regions. In the following sub-sections, we first present organization of the EOS posts and the process of information capturing. Next, practices of estimating children's age, followed by service provision and data collection procedures will be presented. Then, a description of the process of transferring the EOS reports will be provided.

4.1 Flexible organization of the EOS posts and enhanced processes of information capture

Preparations for the EOS campaign, such as detailed planning, training, and mobilization of the targeted community began about two weeks before the campaign. Supervisors from different levels of the health hierarchy and other stakeholders such as UNICEF and USAID were assigned, and cascade trainings offered for the EOS teams and supervisors. The trainings were organized based on the EOS guideline, and the EOS teams were informed to follow the instructions in the guideline. All supplies, including the campaign data collection and reporting tools, were brought from the national level and distributed to each post. It was emphasized that every

EOS team should collect data and transfer reports using these forms. In all visited EOS posts, the team members claimed that they had received training about the implementation of the EOS campaign and some of them had hand-written notes from the pre-campaign trainings. During the EOS campaign, supervisors followed the implementation procedures at EOS posts and offered their support, for instance, on how to keep the vaccines properly, how to administer the EOS ingredients, and how to collect data and prepare reports.

The EOS teams at the visited posts consisted of health workers, health extension workers and community volunteers, and their number varies from 2 to 7 per EOS post. The EOS ingredients needed to be administered to children by health workers or health extension workers, while community volunteers participated in activities, such as data capturing, crowd control and absentee retrieval. The EOS posts organized in the cities had better facilities and a higher number of health workers in the teams than the rural posts. One of the duties of the community volunteers was to record on the tally sheets, i.e., to make a tick mark for every child that received the service. However, the target, i.e., number of children to reach in the campaign was usually an issue. District health offices provided the EOS teams with a target number (of eligible children for the service), which was based on a projection from the 1995 census and which was often claimed to be too high. Community volunteers and health extension workers would count register and mobilize the eligible children who lived in each village. They argued that in most cases the target given for the campaign was higher than the head count. For instance, the supervisor of Banja district mentioned that they did a house to house registration of all dwellers in the district, and the total population was found to be around 86,000. However, the district was considered as if it had 104,009 dwellers based on the projection from census data. Thus, they were expected to make a plan for the present campaign using census data. The population figure issue was also raised in the supervisory meeting of the campaign event in Bahir Dar City Administration, where the researcher attended. The supervisors complained about the inflated target concerning the number of eligible children for the EOS service, but the zonal health department head said “Our aim is to ensure every child in the catchment has got the service, there could be discrepancies between the actual head count and projected population number.” This was meant to notify the supervisors to motivate EOS team members to maintain their work practices based on the head count.

In practice, the EOS teams mostly relied on the number of eligible children from the head counting. Thus they depended on the context-specific knowledge of the community volunteers, who are expected to count and know all children in their respective villages. For example, in one visited rural sub-district, the community volunteers of particular vicinity knew the number of children in each household. They had registered all children under 5 years of age of their locality using an ordinary exercise book that can be purchased in the local market. During the campaign, they were collecting the needed data on their modified hand written register (the exercise book), instead of tallying on the standard EOS formats, which was printed and distributed by FMOH, and which contained only anonymous and aggregated information. The community volunteers said they transferred the data to tally sheets from their register at the end of the day. During focus group discussion, one of the community volunteers said:

“This way helps us to identify the households that did not bring their children for the service. Based on this information, we can trace the absentees and motivate them to

bring their children to the EOS posts using our own line list. This method also enables us to record the data on the EOS tally sheet properly in our spare time.”

Supervisors were also monitoring daily performance of the EOS team, including the number of children who had received service at each EOS post. Accordingly, the district health managers, as well as, supervisors from the health sectors and other partner organizations, pursued close follow-up during the campaign, hence, they understood the dilemma associated with the discrepancy between the estimated target population to each village and the actual population.

4.2 Practices of estimating children’s age drawing on local knowledge and resources

It was very important to determine the age of a child in order to decide whether the child was eligible for the EOS service or not, and in order to choose the appropriate type and dose of ingredients to be given. However, some parents, especially in the rural areas, did not know the exact age of their children, so EOS team members were trying their best to guess the age of children using different local clues. For instance, there are some religious events set for each day of a month in Ethiopia. The rural residents are very conscious of these days, therefore, most of the time they know on which religious event their child was born. In the visited rural EOS posts, health extension workers and community volunteers were trying to infer the age of children by relating the parents’ account with these religious events. Similarly, a given vicinity will also have specific social events, such as the community festivals. Thus, EOS teams also took the opportunity to estimate the age of the child based on such occasions.

These methods were used to estimate the age of younger children. For older children (older than about three years), the guideline instructed that when parents do not know the age of their child, height of the child should be measured, and it should be less than 110 cm in order to be eligible for the EOS service. The EOS manual depicts the measuring procedure using a measuring device which is common in health centres in the western world, a wall-mounted height scale. However, there was no adequate height scale in any of the visited rural EOS posts. Instead, the health workers were using other methods to measure height of children. For example, in two visited rural EOS posts, they had erected two sticks vertically with about 50 cm gap between them. Afterwards; they tied the two sticks together with a rope at height of 110 cm with the intention that children who can pass under the rope will get the service (See figure 1).

4.3 Improvisations during service provision and data collection

The procedure of rendering EOS services and recording data varied between the settings, especially in the rural villages. The EOS guideline as well as the instruction given during the EOS training stipulated that the whole package of EOS ingredients is provided to one child, that all the services given are recorded, and the health worker then proceeds to the next child (FMOH



Figure 1: Measuring height of children using two sticks tied with rope at 110 cm. Photo taken in November 2008.

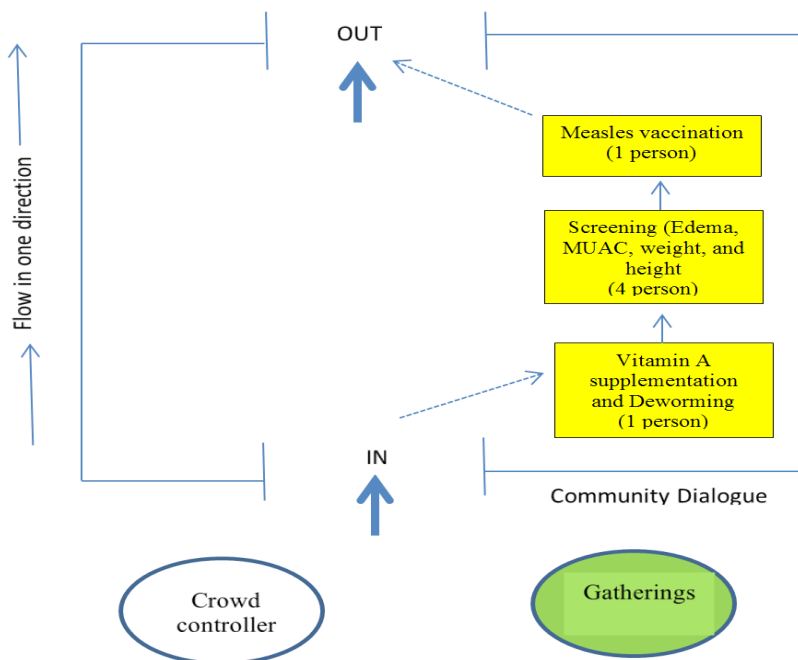


Figure 2: Example of client flow at EOS Post (FMOH 2006, p. 45)

2006). The sketch in figure 2 describes how the post should be organized according to this procedure.

This way of organizing the EOS procedures was followed in most of the visited urban posts where the required human power was available. However, this was not strictly followed in all visited rural posts; where the number of EOS team members commonly deviated from the EOS guidelines. As observed by the researcher, neighbouring children in the rural vicinity mostly came to the EOS posts together. In this case, the EOS teams first selected eligible children, subsequently allowed them to make a line and be seated orderly on the open field in front of the organized post (see figure 3). Then the health extension worker, with the help of community volunteers, provided the oral polio vaccine to all children first, followed by vitamin A and albendazole (de-worming). Lastly, she administered measles injection for all. Following the person who administered the ingredients, the recorder tallied each service as soon as it was rendered.

When asked why they did not follow the guideline, which instruct them to provide all the ingredients to one child at a time, the health extension worker replied:

“Children usually cry after having injection, so if I gave all the ingredients, including measles injection to one child, s/he might cry and all other children would be disturbed and everything will be in a mess. [...] at the same time, it will be easier for the recorder to tally each service correctly.” What she said was supported by the researcher’s observation that most children were crying after the injections.



Figure 3: Provision of EOS service at Waita rural post. Photo taken November 2008.

4.4 Varieties of transferring and checking the EOS reports

Data tallied in the data collection form of the campaign should be aggregated and the EOS reports compiled at all levels (starting from the EOS posts to the national level) and sent to the next level in the health care system hierarchy. According to the instruction in the guideline, the teams were supposed to meet their district supervisors daily and handover the reports. Supervisory meetings, where supervisors and team members who worked in the proximity met, were held daily in the district offices after working hours throughout the campaign period. During the meetings, supervisors evaluated the daily performance of the teams based on their daily reports, and they designed strategies for next day to cover all eligible children. For instance, they would plan additional EOS posts to vicinities where the number of children who did not get the service was high. The meeting was also used to screen the daily reports for errors, and correct them on the spot.

Supervisors were complaining about the inconsistency of the reports, such as having different numbers reported for services that had similar targets. For example, on the second day of the campaign, the report of one sub-district in Bahirdar Special Zone showed that 580 children had received measles vaccine, but only 561 had received vitamin A. However, as the targets for both vitamin A and measles are all children from age six months to five years, the reports for those services need to be equal. Thus, supervisors were expected to recheck the tally sheets with the respective EOS team to identify the correct number to report. The researcher also observed similar errors from the reports compiled by team supervisors, whereas such discrepancies were not found on the reports of districts and regional health bureau, since corrections were done by team supervisors at the spot. This practice of supervisors' immediate checking contributed to a high quality of the campaign data, and could well have been employed also to improve the routine HIS. However, long distances prevented this meeting with all teams daily in most of the rural sub-districts. One district supervisor stated the following concerning daily meeting of team supervisor with the EOS teams:

“If EOS teams work in a very remote village during the day, it will be difficult to meet with their supervisor. They may require to stay there for the night and to continue their work in the next day. In this case, one of the community volunteers, who is part of the team, will bring daily performance report of the teams and submit to team supervisor.” This is to allow the rest of the EOS team members to start their job on time on the following day. Since there is no means of transportation in most rural villages, the health workers are supposed to walk to meet their supervisor. This may waste their time and cause delay on next day's work, however, community volunteers could replace the health workers for bringing the report.

Each team supervisor compiled their reports and submitted them to the district, followed by the district supervisor who also compiled and sent the reports to zonal health offices. Zones reported to the regional health bureau and then to the FMOH and other stakeholders. As observed by the researcher, supervisors at all levels were trying to check completeness, consistency and validity of the reports daily, then took corrective actions when required. When corrections were needed, supervisors went to the EOS teams and checked the tally sheets used by the EOS teams to collect the daily data versus the aggregated reports that helped them to identify most

inaccuracies. They also pointed out other problems, including mathematical errors, and reminded the team to avoid similar errors henceforth. All visited districts, except one, compiled their reports manually, whereas at the zonal and regional levels, they compiled the reports using an Excel spreadsheet and sent to the next level by CD or hard copy.

To some extent, the data collection form of the campaign contain similar information with the routine HIS, such as data about the measles immunization status of children. Thus the campaign data may be used to verify the routine immunization data quality.

5 Analysis and discussion

As previously discussed, several researchers have described how protocols stipulate an explicit order that may be difficult to implement in an actual context. As argued by Mavimbe et al. (2006) and Timmermans and Berg (1997), making changes on the strict orders of protocols and working guidelines, when implementing at the local level was unavoidable. The present study has also showed the health workers' efforts in order to put the standards included in the EOS guideline into practice in the rural vicinities of Ethiopia. We now turn to analyze how local knowledge played a role in this, what the effects were for data quality, and then discuss the issue of flexibility of standards.

5.1 Role of context-specific knowledge in the EOS campaign

We have described how the EOS campaign was assisted by local improvisation of the community volunteers and health extension workers. They used their context-specific knowledge and the available materials in their locality to provide services and collect data. In line with the study conducted in India (Puri 2003), also our study shows the benefits of involving the community members. They know their population, the culture and community rituals, which helped the health workers to get relevant information. For example, it would not be easy for an outsider to infer the age of a child using the community rituals. Thus, we argue, in strengthening public information systems, including routine HIS, in developing countries, there is a need to include the local knowledge of the community members and peripheral level health workers. Local communities' own knowledge traditions are based on "accumulation of experiences, informal experiments, and intimate understanding of the environment in a given culture" (Puri 2007, p. 358). However, this is not only crucial in order to succeed in achieving the EOS campaign's goals. In addition, this case study has shown that some of these local improvisations may actually be worthwhile to take back and incorporate into a revised version of the standard guidelines, as was attempted by the first researcher after this fieldwork.

We argue that paying attention to the context-specific knowledge of the community volunteers and peripheral level health workers can have positive effects in the long run. It is crucial to engage with and mobilize such local creativity if one should achieve a strong information culture and improvement of data quality in HIS. Other HIS researchers also argued that such

local creativity should be supported and incorporated into the routine practices (Kimaro et al. 2006; Igira 2008).

5.2 Improving data quality and building commitment

We have emphasized how the modifications of the EOS guideline in some cases contributed to improving the service and data quality. The use of the modified registers (hand written ordinary exercise books) instead of the anonymous tally sheets is one example. This name-based register helped the health workers also to retrieve absentees and thus to reach more children. The community volunteers had chosen to do this despite the fact that it was more time consuming, since they also had to register their daily performance in the tally sheet of the EOS campaign afterwards. These practices were beneficial not only of the quality of data from the campaign itself, but also for the future service provision, and could also be used to improve data quality of the routine HIS. For instance, the local name-based registers could help to improve the precision of the local population data, which again will positively impact the campaign data and routine HIS. The problem associated with unreliable population estimates is a common and well-known problem in many developing countries. Hence, the targets for the campaign are often questioned as they are projected based on census data and do not correspond well to the actual population figures (see e.g., Mavimbe et al. 2006; Damtew and Kaasbøll 2011).

However, rather than bothering much about the inflated target given from their higher levels, the EOS teams, particularly in rural settings, trusted the context-specific knowledge of the community volunteers. The use of register books with names helped to establish such trust in the locally generated population data. In the same way, the detailed nature of data captured in the campaign was seen as valuable to compare with the data in the routine HIS. For instance, measles vaccination data gathered during the campaign was used to verify the number of children who were already immunized by routine immunization of measles. Hence, these data were useful for the purpose of crosschecking of the routine immunization data quality. Besides, the report generated from the campaign could be useful for planning. For instance, Damtew and Kaasbøll (2011) showed that health managers at the regional health bureau and district health offices had used the data from the survey done after polio immunization campaign to verify the ambiguity related to immunization targets. Although these health managers had no mandate to make changes on the health service planning scheme, they had offered support to peripheral level health workers. The meta-analysis conducted by Abramis (1994) reported that support from supervisors enhance work motivation and job satisfaction, and the reverse may hold true when the support from supervisors is minimal.

In general, the EOS campaign required a strict regime of meetings where reports were checked and discussed. The immediate correction and feedback on the EOS reports, for instance, checking the daily data collection tools (tally sheets) versus the aggregated reports and correcting errors at the spot, were valuable practices that also should be practiced in the case of routine HIS in order to improve the data quality.

5.3 Following and deviating from the EOS guideline

While many researchers have recommended that standards need to be flexible and related to the actual setup in order to create conducive working conditions (Bowker and Star 1999; Braa et al. 2007), the question about the type and limits of flexibility has not been much discussed. What kind and how much local adaptation and improvisation can be accepted? When is a flexible standard no longer a standard? While we do not propose to have general answers to such questions, our study showed that the EOS teams followed the EOS guideline (the standard) strictly with respect to some aspects, and deviated on other aspects. Figure 2 shows examples of how certain instructions in the EOS guideline were treated as fixed requirement, while other instructions were treated as flexible requirements, for which the EOS teams devised alternative practices.

Both the fixed (non-changing) and flexible elements of the standard were important for improved service provision and data collection during the EOS campaign. What we call deviations from the standard may also be called improvisations or workarounds; however, the important point to note is that this happened only to some elements of the standard. The EOS teams were strictly following some instructions in the EOS guidelines, since changing of them could compromise the aim of the campaign. For instance, the EOS teams followed the guidelines' specification of the age group of children that should receive the service, and also they followed the guidelines with respect to the dose of ingredients given to each child. Based on their training, the health workers perceived it as mandatory to follow the guideline in order to give the right EOS package to the right child in the right dose. As such, the EOS guideline was a worthwhile and successful standardization of practices. However, the health workers also sometimes deviated from the guidelines with respect to how they estimated the age of the child and how they organized the administration of the right dose of ingredients. These changes were introduced because the health workers perceived that they could have a positive effect on both service provision and data quality, without compromising the aims; they were other means that contributed to the same ends. The alternative procedures were functionally equivalent, but seen as more suited to the context. Similarly, the use of additional exercise books to capture data was perceived to add to the quality of data collection and service provision, while still allowing adherence to the standard EOS report formats. This practice was an addition to the standards, in the same way as the 'hierarchy of standards' principle (Braa and Hedberg 2002; Bree et al. 2007) indicates the freedom to add, as long as one also confirm to the minimal core requirements. Supervisors from different (national, region, zone and district) levels of the health hierarchy and other health partners were following the implementation of the campaign in order to support the teams and correct errors instantly. We observed that they appreciated and encouraged these improvised ways of doing by the EOS teams depending up on the actual situation. As such the healthworkers' flexibility did not affect the program's aim; rather it made the data collection and health service provision more fruitful. Also the first author of this paper presented her findings to health authorities at the regional level, and recommended the sharing of the observed best practices that were well adapted to the context, although formally deviant.

In line with the health workers' distinction between changeable and non-changing elements of the EOS guideline, we therefore suggest to introduce an analytic distinction between fixed and flexible elements of a standard as depicted by Figure 4. Recognizing that a standard is not

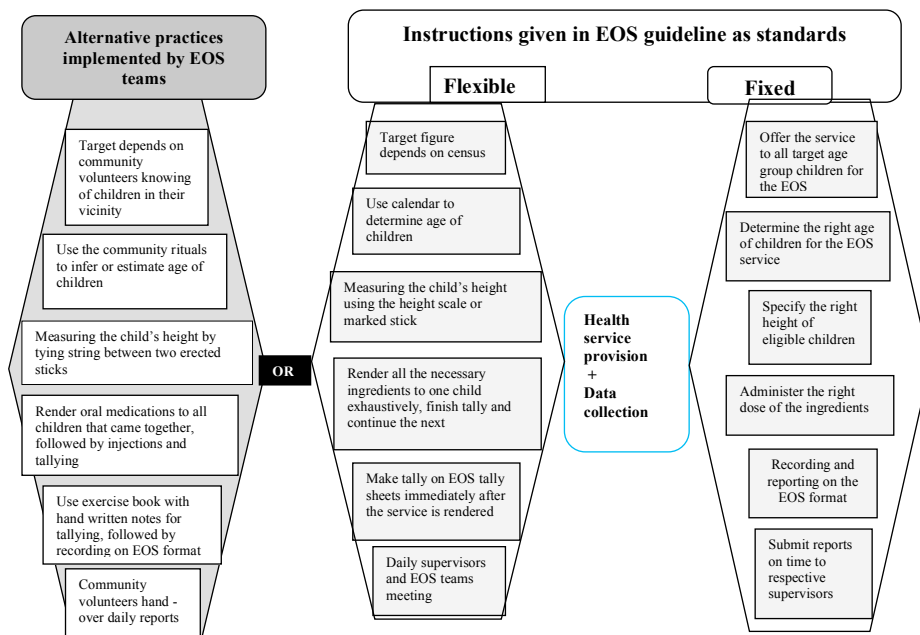


Figure 4: Examples of fixed and flexible standards (instructions given in EOS guidelines) and alternative practices used by EOS teams

homogeneous, but can exist of multiple elements with different importance; can assist in conceptualizing and designing flexible standards. In the present study, the criteria that distinguish the fixed from the flexible component of the standard related to the distinction between means and ends. The means (the procedures and actions to achieve the ends) were considered flexible enough to be changed, while the ends (the program's aims to offer the required service to children) were not considered flexible or changeable. The criteria for necessary, acceptable and/or beneficial deviations from a standard will vary from case to case, and from context to context.

5.4 A standard can have both fixed and flexible elements

The issue of flexible standards is mentioned by several researchers, addressing both change and use flexibility of the standards (Hanseth et al. 1996). We are here concerned with use flexibility; the standards' ability to function in different contexts. Braa et al. (2007) emphasized application of the 'hierarchy of standards' (introduced by Braa and Hedberg 2002) as one way to manage the tension between (different) localities' need for specific data, with the central levels' need for standardized data. Braa et al. (2007) stressed that the standards defined at a higher level in the hierarchy are always to be followed, and the flexibility lies in the allowance of extension to other levels. This 'hierarchy of standards' approach is in theory non-conflictual; since it is additive all

actors get their interest served. However, the ‘minimum data set’ defined at the national level was considered as a given that other levels (such as regions or districts) couldn’t change. In our case, the EOS guideline, which is also designed at the national level, specified the campaign objectives and instructions to be followed by the EOS teams. We have seen that additions and extension were introduced (e.g. using exercise books in addition to standardized recording tools). However, the health workers also perceived some elements of the standard defined at the national level (in the EOS guideline) to be flexible, and they devised alternative ways of conducting the work. Because these alternatives were considered by the EOS teams to be functionally equivalent with what is written in the EOS guideline, they were not considered to compromise the aim of the campaign.

The distinction between fixed and flexible elements of a standard thus goes a step further than Braa and Hedberg’s (2002) model of a ‘hierarchy of standards’. The findings from our study reveal a similarity with Mavimbe’s (2006) observation that a flexible standard must also allow for exceptions and variants of procedures. In this case, the exceptions and deviations were decided on by the knowledgeable workers in the field, and the observed, acceptable deviations could be shared via the supervisors, and potentially fed back and incorporated into the national standard itself. We believe this process of incorporation of context-specific knowledge is of particular relevance for procedural standards, where the aim is to perform an action with a certain level of quality. A guideline can well contain descriptions of alternative approaches without compromising its ultimate goal.

6 Implication for improving data quality

This case study has practical implications, mainly for developing countries that use paper-based system to collect data at the community level. Knowing that health data collected manually at the community are primary data in the health care system, maintaining or improving data quality at this level can benefit the HIS at all levels in the health system hierarchy. Standards and guidelines are valuable for securing data quality; the EOS guideline helped the EOS implementers in health service provision and data collection. Although it was not possible for them to implement all the instructions according to the guideline, they followed the guideline with respect to some instruction (fixed elements of the standard) and they sometimes deviated from the instruction (flexible elements of the standard). Thus it is important to develop standardized working guidelines that guide health workers in data collection and compilation, and such guidelines should also be developed for the routine HIS. However, flexibility is required, and in order to design a well-working standard, productive deviation from the standard should be observed, assessed and shared across the communities who have similar working conditions.

The study has shown the value of recognizing and incorporating the context-specific knowledge of members of the community. Allowing them to participate in the data collection process during the EOS campaign facilitated and strengthened the performance of EOS teams. It is vital to empower members of the communities and let them participate in decisions relating to their own health service, as this can potentially further nurture their accountability and create a condition to use local knowledge for improving HIS. Thus, a process where guidelines and

standards are systematically revised and redesigned, with the aim of incorporating the input of grass root implementers can address concrete problems as well as increase sharing of experience among communities. Such inputs to revision processes require careful study of the local implementation of the standard and specifically of how context-specific knowledge is drawn upon and how specific constraints are dealt with. We therefore suggest that HIS designers and health planners seek to identify the limitations of the current procedures for the routine HIS. There is the need of considering the reality at the ground and context-specific knowledge of peripheral level health workers and community volunteers while developing guidelines (standards), designing HIS, and setting targets for health services. This approach may increase sense of ownership of service providers and stimulate their work motivation that in turn leads to improvement of the health service coverage and data quality.

Important lessons for developing countries can be drawn from this paper. The study showed that data generated during the campaign can help to improve the data quality of the routine HIS. Involving the community in the data collection process during the campaign allows the opportunity to use context-specific knowledge. Hence, there is a need to consider the active search for and spread of valuable local practices to other areas. This in turn may construct new knowledge that can be used for further improvement of data quality and HIS. The need of future research on information system standardization, such as developing standardized working guideline for routine data gathering, and reformation of the current planning scheme, may help to mitigate the problems associated with data quality.

7 Concluding remarks

Although other information system researches have emphasized the need to balance standardization and flexibility (Rolland and Monteiro 2002; Hanseth et al. 2006; Braa et al. 2007), the question about the type and limits of flexibility has not been much discussed. The questions regarding what kind and how much local adaptation and improvisation can be accepted, has so far not been explicitly addressed. In this paper we have described a process where health workers adapted a standard and shown empirically the effect of a mix between standardization and flexibility. We have proposed that it is valuable to theoretically distinguish between fixed and flexible elements of the standard. This is a contribution to the field's conceptualization of what 'flexible standardization' entails, allowing a more nuanced discussion of how flexibility can be built into standards.

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