

Empowering Community Health Workers to Collect and Record Maternal and Child Health Data by Resolving Contradictions

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Background and Purpose: It was noted that traditional birth attendants, village health workers and health facility workers to a substantial extent failed at collecting and recording maternal and child health data in the community.

Methods: This is a qualitative study and data was collected using interviews, observations, participant observations, focus groups and document reviews. To analyse the data, we used the concept of contradictions from the Cultural Historical Activity Theory (CHAT) as an analytical tool to understand manifestations of contradictions that hindered collection and recording of the data.

Results: Based on the analysis, results indicate that, traditional birth attendants and village health workers were empowered to adapt new information practices, which led to improvements in recording and reporting of births, follow-up on pregnant women and an increase of referred women for deliveries to the health center.

Conclusions: This study demonstrates that traditional birth attendants and village health workers' information practices can be changed through understanding and resolving manifestations of contradiction that hinder them to collect and record maternal and child health data. This study also indicates that, traditional birth attendants and village health workers should be empowered to improve their performance and confidence in capturing and communicating these data.

Keywords: Information practices, Empowerment, Transformation, Community health workers, Contradictions.

1 Introduction

Sub-Saharan countries are challenged with higher rates of maternal and child mortality which results from different factors. Studies have shown that it is difficult for most developing countries to meet the Millennium Development Goals (MDGs), especially goals 5 and 6 that stress on the improvement of maternal and child health. There is evidence that, involving community-based health workers in capturing and communicating community health data is a crucial step to achieve the health related MDGs [1-4].

Community health workers provide preventive healthcare services to the majority of the population in rural communities in most developing countries. They are the first contact of women and children before the health facilities. However, research indicates that they lack appropriate skills and they are hardly motivated [1-3] [5] [6]. In this regard, research has emphasized the need for empowering community health workers in order to improve the collection of complete and accurate data from the community level.

The availability of reliable data is specifically important for local management as well as overall management of Health Information System (HIS) [7]. In provision of maternal and child health, information on check-ups made, vaccinations and medications provided to pregnant women and children, and information on births is crucial for health workers because it enables and facilitates management and provision of continuous care to women and children [5] [8]. However, in most developing countries, the reliability of maternal and child health data is questionable. To improve production of and access to reliable information in HISs in this context, research emphasise on using Information Technology (IT) [9-

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13]. But still little is understood about how to develop technologies that will be suitable in the developing countries' context.

Research on information systems development within healthcare in developing countries critically emphasise the need for understanding the context where the technology will be used [14-19]. Due to the nature of healthcare provision, that involves complex procedures and social relations, research has proposed to use of Cultural Historical Activity Theory (CHAT) to understand the context in order to be able to identify requirements, to inform system development, that reflect the lived practices of health workers [14] [15] [17] [18] [20]. CHAT provides analytical lens to focus on people's daily activities, tools they use in those activities, the social and contextual relationships established by rules and division of labour among the people collaborating in those activities.

Korpela et al. [17] describe that health information system context can be understood by understanding the context of health providers, technology providers and the people who receive the services. A systemic view of these stakeholders is crucial in providing insights on tension and misfits in their daily practices. Focusing on health workers, Igira [14] describe that to understand their practices, special consideration on how the work practices are affected by the dynamics of everyday life must be taken into account. Igira emphasizes a holistic understanding of tensions that face health workers in providing health services, data collection, management and reporting, and managing the health facility logistics. Considering the fact that communities and health facilities are the major sources of health data in the HIS, research however, has put more emphasis on understanding information practices of health workers at the health facility levels than at the community levels. Understanding the community health workers' information practices is highly important specifically on improving the quality of maternal and child health data within the HIS. Since the completeness of health facility data highly depends on the data reported from the communities. This paper covers this gap in literature by describing a case that involves re-organisation of work practices of traditional birth attendants and village health workers that led to improvements in referral cases of pregnant women to health facility and recording of births they conducted.

Furthermore, research also emphasises on the importance of putting work processes in place before the implementation of IT [21]. Few studies, example Freitas and Byrne [21] have demonstrated how to do this. This paper also contributes to the IS development community by demonstrating the necessity of re-organising the existing paper-based system and changing information practices among stakeholders involved as a way of developing information systems to facilitate collection and recording of maternal and child health data. To elaborate and analyse the work practices, we have adapted the concept of contradictions as conceptualized in CHAT [22]. CHAT emphasizes the collective nature of human activity and view organizational change as a sequence of events around which practices are transformed, following a process of resolving contradictions [23, 24].

In this paper we will answer the question: How to change community health workers' information practices in order to improve reporting of maternal and child health data from the community level?

The organisation of the rest of this paper is as follows. Section 2 presents the literature review; particularly focusing on discursive manifestations of contradictions and their contribution in transformation of work practices. Furthermore, the section presents related approaches in organizational learning. Section 3 presents research approach and data collection methods. Section 4 presents the empirical material, data analysis and discussion. Section 5 presents concluding remarks.

2 Literature Review

In this section, we describe literature review on CHAT's concept of contradiction to describe manifestations of contradiction and their resolutions as a way of establishing balance in an activity system. We also describe the concept of motivation and training to elaborate their importance in creating actions that can empower individuals to direct behaviour towards performing their activities.

2.1 The Concept of Contradictions

CHAT describes that, to understand context, one must understand the relationship between individuals and their daily activities. These are cultural-historical influences that can be understood by examining tools used, rules enforced and organization of roles in the division of labour [25]. The tools, rules and division of labour mediated the interactions between individuals and their daily activities [18] [23] [26] [27]. The mediators have the power of enabling and restricting the interactions. Engeström [23] describes that an activity is a "system of collaborative human practice" whereby each component of an activity can

be a product of other activities as demonstrated in Figure 1. Thus an activity can be analysed in relation with other activities connected to it. This analysis can be guided by identifying contradictions within and between the activity systems.

Contradictions constitute a key concept in CHAT and are characteristic of activity systems [23] [28]. They are not simply conflicts or problems, but are “historically accumulating structural tensions within and between activity systems” Contradictions are important, not in and of themselves, but because they can result in change and development [28]. In analysing human activity Engeström [23] propose four levels of contradictions; primary, secondary, tertiary and quaternary. As presented in Figure 1 (numbers 1-4);

1. Primary contradictions appear within each component of an activity system
2. Secondary contradictions appear between components
3. Tertiary contradictions appear between object of the central activity and object of a more advanced central activity
4. Quaternary contradictions appear between the central activity and other activities in the network.

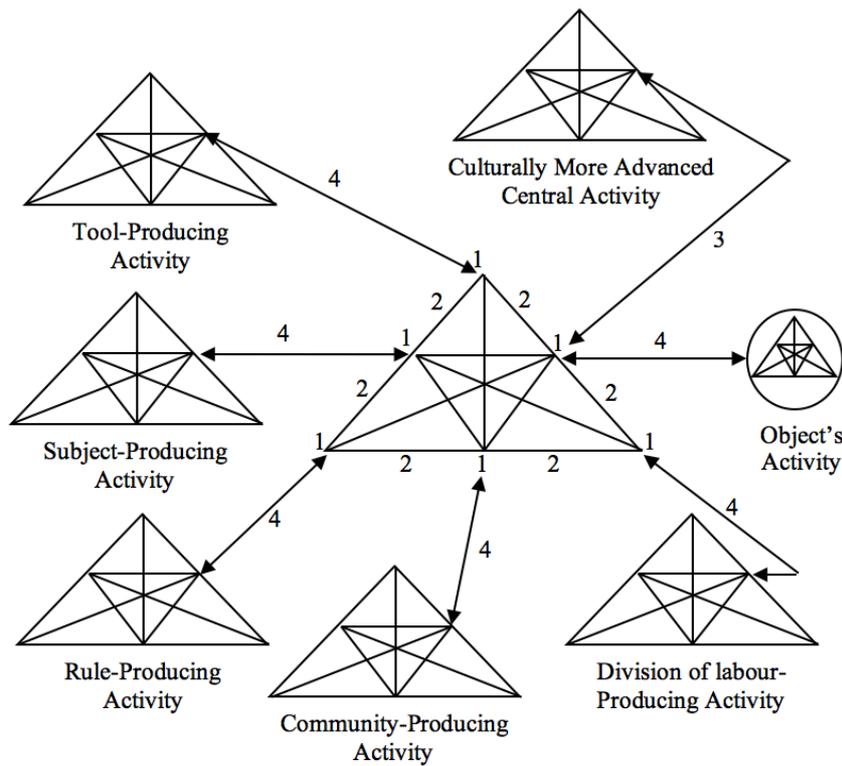


Figure 1. Network of Activities [23]

According to Engeström and Sannino [22] these contradictions can be understood through their manifestations. They argue that in current organizational literature and research, the meaning of the term contradiction is commonly left vague and ambiguous. In this regard, they clarified this vagueness and ambiguity by identifying four types of discursive manifestations of contradictions: dilemma, conflicts, critical conflict and double bind.

Dilemmas are incompatible evaluations on whether to perform the activity or not. Tensions that take form of dilemmas are rather difficult choices that lead to selecting one of two alternatives [29]. Dilemma is more hesitations such as on one hand and the other hand type of condition. A dilemma is typically reproduced rather than resolved, often with the help of denial or reformulation [22].

Conflicts are resistance, disagreements, arguments and criticisms. It occurs when a divergence of interests take place. Conflicts are typically resolved by means of finding a compromise or submitting to authority or majority (ibid).

Critical conflicts arise from neglections that paralyse people from performing the activity. In social interaction context the person in critical conflict feels isolated, guilty and even silenced [30]. Critical

conflicts are resolved through finding new personal sense and negotiating new a new meaning for the initial situation [22].

Double binds are pressing and unacceptable alternatives faced in performing an activity. They involve circumstances of being under enormous pressure and cannot be resolved by an individual alone. A double bind is resolved through practical transformative and collective action that goes beyond words (ibid).

The analysis of the four discursive manifestations of contradictions serves as the basis for planning steps to be taken in resolving contradictions and thus bringing transformation. This is like putting a mirror before an organisation and reflect on the reality and from there learn how people encounter “impossible tasks, stress and failure” [31] in performing their daily activities. Since we can hardly detect contradictions we need to uncover them by using their potential manifestations.

The resolution of contradictions brings back order in an activity system. CHAT demonstrates this as a re-mediation or re-organisation of an activity system whereby the relationship between the components will change and a new context with new practices will emerge. Despite of the fact that CHAT emphasises on re-mediating activity to bring about transformation, CHAT does not describe how individuals can change their behaviour towards engaging in an activity. Literature on empowerment can bring more insights on this matter.

2.2 Health Workers' Empowerment

According to Castelleo & Watson [32], “empowerment occurs when people come to critically understand, then act to change, their personal, social, economic, political, and cultural situations”. This can be realized when individuals participate in activities that are likely to be driven by goals that promise some type of pay-off such as “satisfaction, sense of accomplishment, expansion of action possibilities, expansion of control over life conditions” [33].

In most developing countries, studies indicate the state of poor quality of data collected in health information systems [3] [6] [12] [15] [16] [34-37]. To improve the situation, research emphasise on the need for empowering health workers. Braa et al. [37] and Lippeveld [36] describe that, health workers can be empowered by improving their skills on understanding and using their data instead of obliging them to collect and report more data. Other studies emphasise on motivating health workers by providing them with adequate supportive supervision, meaningful feedback and incentives [38] [40] [42] [45].

Though health facilities and communities are the major sources of data in HIS, there are few studies conducted at the community level with a specific focus on maternal and child health data [3] [4] [6]. Health workers at the health facility level will necessarily be empowered by different things/situations as compared to community health workers who are volunteers and regarded as periphery workers without a job description or salary scheme. Research from the community level emphasise that, community health workers can be empowered by involving them in collecting and reporting the data from the community. To do so, Kanjo [3] urge policy makers to revise policies that discourage TBAs to report births. [4] [6] propose the need for providing health extension workers with appropriate and adequate data collection tools. Even though these studies describe how to empower community health workers, they have not demonstrated how this can be done.

With a specific focus on improving collection and reporting of data from the community level, this study demonstrates the importance of empowering TBAs and village health workers by providing them with appropriate data collection tool and motivating them to record the data. Since health workers view data collection as an excessive demand from higher authority and not as a part of their job [37], it is necessary to understand what can encourage them to record data despite their reservations. In the following sub-sections, we describe motivation and training as major factors that can encourage a change of behaviour towards performing actions.

Motivation.

Motivation is “an individual's degree of willingness to exert and maintain an effort towards organisational goals” [38]. Behavioural psychologists who regard that actions of human beings are governed by rewards and punishments and their motives are governed by behaviours to seek pleasure (food, sex, companionship) and avoid pain (social rejection, physical harm, lack of food) have promoted the concept of motivation. Luoma [39] describes this as an expectation for personal reward whereby workers will initiate and sustain to work if someone cares about their performance and whether there is a reward in return. In this regard, the concept of motivation brings an understanding that, in a collective activity [26], behaviour is expected to be created towards gaining a reward.

Studies elaborate that motivation mechanisms such as provision of support, supervision, feedback and incentives to health workers can create an atmosphere for behaviour change [40-43]. Health workers in Kenya and Benin indicated “supervision provides the feeling of being cared for and of appreciation” [42]. Mathauer & Imhoff [42] indicated that when health workers receive meaningful feedback during supervision, their performance was improved. Ashford et al. [44] also elaborate that people seek feedback for many reasons; one reason is “to attain a goal and perform well”. In this manner feedback is a reflection from which, one reflects on their performance with regard to goal attainment through making a change.

Incentive as another form of motivation reward that associates positive meaning presented after the occurrence of an action with the intention to cause the behaviour to occur again. Provision of incentives has been applied as a motivational factor to improve work performance [41-43] [45]. In the study of motivating health workers by giving incentives conducted in Cambodia, results indicated that provision of performance-based incentives led to provision of “better quality health services” and “increased health worker productivity”. According to Dieleman et al. [41] provision of incentives, being it financial or non-financial, can achieve better performance if it is focused on “showing appreciation and respect”. However, these attributes are highly grounded in the context; they may produce different results in different contexts.

Furthermore, designing incentive mechanisms for health care workers in developing countries can be difficult when it comes to deciding “what to measure and how to measure it” [39]. Luoma proposes using ‘general productivity measures’ such as “hours worked, patients seen per day, cases treated and immunizations delivered” and ‘specific performance measures’ such as “adhering to clinical counselling guidelines, ensuring supply stocks, making supervision rounds and promoting condoms”.

The emphasis of this study is to motivate TBAs and village health workers to record and report the data. Doing so, an incentive mechanism was designed to monitor their performance by measuring the amount of records they kept on births conducted, referral cases made and pregnant women they registered as well as the health facility records on births conducted at the health facility. To be able to do so specific data collection tools were designed to keep these records. To enhance data recording, training was given to improve skills including using the data collection tools.

Training.

From organisational learning studies, the process of changing organizational behaviour by improving actions through better knowledge and understanding can be achieved through learning [31] [46-48]. An organisation is considered to learn when organisation members use knowledge acquired through training, workshop, seminars etc. to make better decisions, improve the organizational ability to develop and apply specific tactics that will improve organisational performance.

Research has shown varying reports on the impact of training community health workers in improving women’s health during pregnancy, birth and after delivery [49-52]. However there is a consensus that when community health workers are trained, there are significant improvements in linkages between the community and the health facility level. This link is significantly important in improving reporting of maternal and child health data. However previous studies have not looked into the impact on data, this study covers this gap in literature.

This paper conceptualizes training as defined by Nadler [46] as “activities that are designed to improve job performance by introducing a new behaviour or modifying existing behaviours.” Training has been widely used to impart knowledge to learners in different disciplines including HISs [53] [54]. However training is often ineffective if is not properly arranged and conducted. Ngoma [53] describes that when health workers gained skills on data collection, report aggregation and data utilization, they changed their perceptions toward the data and started to ensure its completeness and accuracy in order to make appropriate decisions out of it.

Though CHAT emphasizes on re-mediation as a way of resolving contradictions, it is also important to understand what actions will enforce change of behaviour toward performing actions especially when the components of an activity system are a product of a management activity system. Empowering individuals to be aware of the positive consequences of their performance can enforce a change in behaviour.

3 Research Context and Data Collection Methods

In this section we present the empirical setting and data collection methods used.

3.1 Context

The intervention study that is reported in this paper was conducted in Kibaha district of the Coastal region in Tanzania as part of the ongoing efforts in improving reporting of maternal health data from the community level. The community is the lowest level of health care provision in Tanzania that provides preventive health care services. These services are provided by Village Health Workers (VHW) and Traditional Birth Attendants (TBAs). TBAs assist mothers when there are emergency deliveries.

TBAs are supposed to record the name of the mother for each delivery they conducted. The records of deliveries were supposed to be collected by district health managers and reported to the districts. They do not have professional medical training; rather, they use experience and knowledge gained through family relations. Most of the TBAs cannot read and write. The VHW also do not have professional medical training and they are supposed to report data on the provided services to the village government, vertical programs and a nearby health facility.

3.2 Data Collection Methods

This study used qualitative data collection methods: interviews, observations, participant observations, meetings, focus groups and document reviews. We chose this approach to gain an in-depth understanding of social meanings and social relations between TBAs, VHWs, Health facility workers (health center nurse and doctor in-charge) and health managers (TBAs' Coordinator and VHWs' Coordinator) in collecting and recording maternal health data. The analysis of the empirical material was informed by the four discursive manifestations of contradictions as discussed by [22].

Interviews.

Interviews were conducted with 6 VHWs, 7 TBAs, 2 health facility workers and 3 district health managers. These interviews were conducted between January and March 2010. The objectives of interviewing VHWs and TBAs were to understand the data they collected in the community, how they were collected and recorded, where they were reported and challenges they faced in collecting, recording, transferring and storing the data. The objective of interviewing health facility workers was to get an understanding of how they worked together with VHWs and TBAs and how they supported and supervised them in their daily activities. The district health managers were interviewed with the objective of understanding how they perceived, valued and supported the contribution of community efforts in reporting maternal health data from the community. Another objective was to assess procedures used in designing data collection registers and report forms, and providing feedback and supervision.

Observations.

Observations were conducted with the objective of understanding how the activity of data collecting and recording was taking place in everyday practices of TBAs, VHWs and health facility workers. We observed execution of different tasks, the environment within which VHWs, TBA, and health facility workers operated and the tools that were used to accomplish their activities. We also observed practices in recording information used by VHWs while they were doing household visits and compiling monthly reports. In the health facilities, we observed health facility workers during provision of maternal health services in antenatal, postnatal and children clinic sessions.

Participant Observations.

We also used participant observations where we were actively involved in the intervention. We participated in training sessions where district health managers and health center nurse in-charge conducted training to VHWs and TBAs. In the TBAs' training session, twenty TBAs attended and the training took five days with six hours every day. VHWs training session included eleven VHWs and they were trained for three days with nine hours every day. In these sessions we were actively contributing our views in the discussions. We were also involved in designing new data collection registers where we

contributed on what data should be collected and how it should be presented on the registers. The usage of new data collection registers also involved re-defining rules and roles in the division of labour regarding data collection and recording. The process of re-designing the registers and re-defining rules and roles was done by the health managers in collaboration with the health center nurse in-charge, VHWs and TBAs. We were involved in these activities as consultants to share our experiences.

The objective of collecting data using participant observations was driven by the intervention approach we applied in bringing about a change in work practice. With this approach we were involved both as researchers, as practitioners and as consultants. Even though we were not the main drivers of this intervention, our contributions were taken aboard.

Document Reviews.

To further improving the richness of data collected in interviews and observations, this study reviewed several documents. At the district level, documents reviewed were epidemiology reports, country demographic surveys and ministry of health curriculums for training community health workers. In the health center we reviewed data collection registers (5 reproductive and child health registers) and reports (quarterly reports from January to December 2009). In the community, documents reviewed were data collection tools used by TBAs and VHWs and government registers.

These documents were reviewed to get an understanding of the problem domain, guidelines for collecting and reporting maternal health data, what data were collected and reported at the community and health facility levels and different roles and responsibilities of VHWs, TBAs, health facility workers, district health managers, village government and vertical program in accomplishing collection, recording and reporting of maternal health data.

Focus Groups.

In focus groups data was collected for the purpose of identifying contradictions and evaluating results of the intervention. The focus groups were created in meetings. These meetings were held at the village where training was conducted. One meeting was on the 22nd January 2011 (one year after the intervention) and the second was on 18th June 2011 (one and half year after the intervention). In both meetings a focus group of nine VHWs and one health center nurse in-charge that was assigned the role of supervising VHWs and TBAs in a new organisation of work were created. The aim of these focus groups was to evaluate the work done by VHWs and TBAs after the intervention and to identify TBAs and VHWs with outstanding performance.

In these groups we introduced discussion topics on the achievements and challenges encountered in collecting and recording maternal health data as experienced by TBAs, VHWs and health center nurse in-charge. In the discussion we were able to collect data on changed behaviours and practices among VHWs and their collaborations with TBAs and health facility workers.

4 Findings

This section presents findings of the study by elaborating how the work practices of TBAs and VHWs were transformed through an intervention.

We started our intervention by studying the execution of tasks in collecting and recording maternal health data as it was done by VHWs and TBAs (see [5]). The findings indicated manifestations of contradictions as summarized in Table 1. We further present the reflection of the intervention after training was done, new and improved data collection tools were introduced, and an incentive mechanism was introduced.

Table 1. Manifestations of Contradictions and their Proposed Resolutions

Manifestation	Features	Indicative Findings	Proposed Resolution
Double binds	TBAs and VHWs faced unacceptable alternatives in recording and collecting data	The need for data recording Vs inadequate and/or lack of delivery registers, use of unstandardised registers, not having reading, writing and medical skills, limited stationeries, unreliable transport means and receiving no incentives.	<ul style="list-style-type: none"> - Introduce new and improved tools (standardised registers, stationeries, transport means and incentives) - Ensure adequate supply of the tools - Provide training to improve skills
Dilemmas	TBAs and VHWs faced incompatible evaluation on whether to record and collect data or not	<ul style="list-style-type: none"> - TBAs were torn between helping women and gaining income, and recording deliveries. - VHWs were torn between voluntary workers with no income, and recording and reporting information as a responsibility of a VHW 	<ul style="list-style-type: none"> - Translating the directed goals for performing the actions to a motivating goal by rewarding TBAs and VHWs to record data instead of ordering them to record - Re-defining the rules enforced
Conflicts	Unpleasant working relation between TBAs and health facility workers	TBAs referred women with critical conditions to the health center and when confronted, they stopped referring women and also did not record deliveries	Re-defining the roles and rules to open-up communication among and between TBAs, VHWs, health facility workers, women and village members whereby the use of mobile phones is one thing that can facilitate the communications.
Critical Conflicts	TBAs and VHWs were unmotivated to perform any actions in their activity systems	Inadequate and irregular provision of support, supervision and feedback to VHWs and TBAs by health facility workers and district health managers	Re-defining the roles of health facility workers and district health managers in providing support, supervision and feedback

In the activity of collection and recording of maternal and child health data, Ngoma & Igira [5] presented the TBAs' and VHWs' activity systems as central activities under analysis. In both activity systems, the tools used, the rules enforced and the division of labour were produced by the management activity system, the Health Management Information System (HMIS). These are illustrated in Figure 2.

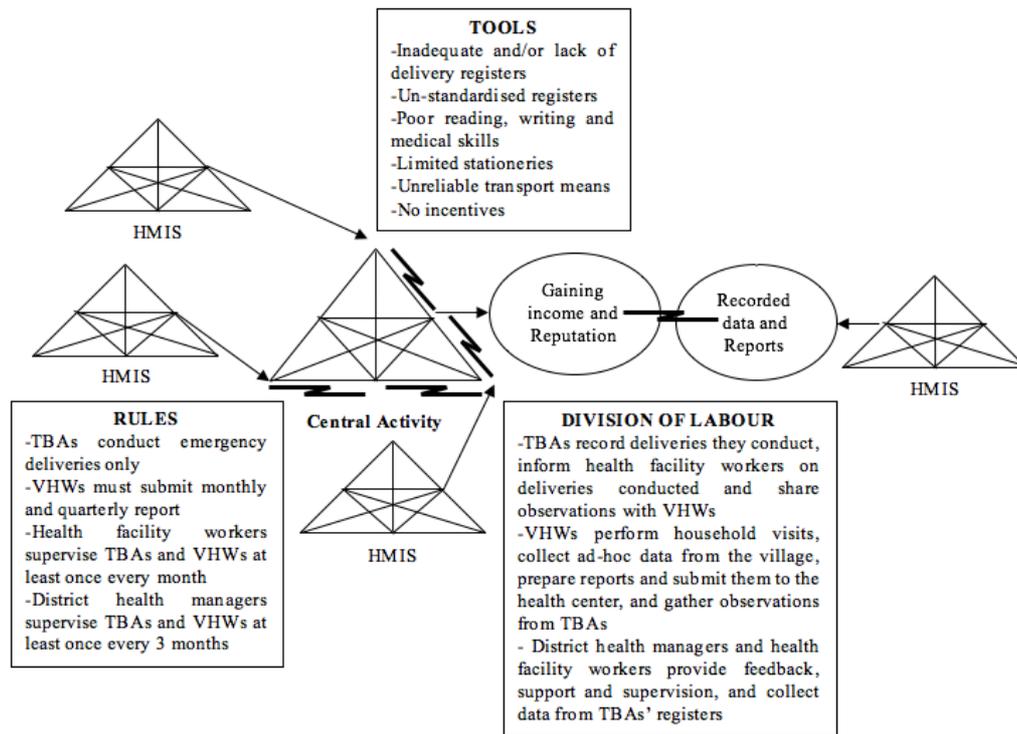


Figure 2. Primary and secondary level contradictions

Primary contradictions within the object of the activities were manifested through dilemmas whereby TBAs and VHWs had to choose to record the data or not. In cases where they chose to record the data, findings indicate that they were faced with unacceptable conditions that discouraged them to do so. These were identified as double binds and critical conflicts that were a result of available tools to perform the activity, established rules and regulations, and organization of roles in the division of labour. These led to secondary contradiction indicated by the lightning arrows in Figure 2. Another primary contradiction was identified as a manifestation of conflict between TBAs and the health facility workers within the division of labour.

4.1 Intervention

In this study an intervention was introduced as a solution that will resolve the identified contradictions as presented in Table 1. Training was proposed as a mechanism for improving skills of TBAs and VHWs in data collection and recording. Training was also aimed at raising awareness of the importance and procedures that need to be taken to improve reporting of maternal health data. Another solution proposed was to design new data collection tools that will enable and improve collection of data from TBAs and VHWs. Furthermore an incentive mechanism was devised to encourage recording and referring women and children to the health center.

Training.

In 2006, TBAs received training from the TBAs’ coordinator from the district for the first time. In that training the emphasis was both on medical practices and recording of births conducted. To support the recording, TBAs were given register to use. In this intervention, TBAs and VHWs were trained with two main objectives. The first objective was to improve VHWs and TBAs’ skills and knowledge on data collection, recording and reporting. The second objective was to improve knowledge and skills on professional provision of medical assistance to pregnant women throughout their pregnancy, during delivery and up to forty-two days after delivery together with monitoring health status of the babies from when they are born until five years of age.

Traditional Birth Attendants' Training Session.

This training was focusing on improving skills on keeping up-to-date records about pregnant women and their delivery outcomes, referring women to deliver at the health center, keeping record of the referrals and recording births of new born babies. The skills given to TBAs did not focus on how to read and write but who to inform when they want to record or report something, when they observe something and how to observe danger signs on pregnant women and report them to the health center or VHWs.

Training method used in this session were discussions, questions/answers and singing and dancing. The classroom arrangement was everyone sitting down around the trainer. Since most TBAs could not read and write, all the training materials were composed into songs. There were 4 training sessions in each day and every session lasted for 1 hour. In each session discussions and questions and answers sessions were done in the first 15. The rest of the time was spent on singing and dancing. These training sessions were very interesting because of the unique way they were conducted.

Village Health Workers' Training session.

The goal of training VHWs was to improve community data management in Kibaha district council by improving VHWs' skills and knowledge on data collection, analysis, utilization and storage. The training focused on keeping an up-to-date record of pregnant women and their follow-up throughout pregnancy, delivery and forty-two days after delivery, improving collaboration with TBAs, and improving medical skills of VHWs to enable them to make proper diagnosis and hence recording, and follow-up of women and children. VHWs were also trained on the importance of updating the village register and how to update it every quarter.

Training methods used were brainstorming sessions, discussions, group work, questions/answers and role plays. The classroom arrangement was a traditional classroom with a trainer in front lecturing. Training materials used were flip charts, data collection registers and report forms.

Designing Data Collection Tools.

During the training sessions, we (researchers, district managers, VHWs and TBAs) discussed on the new format of registers that will accommodate standardised collection of data about pregnant women and birth registration and at the same time follow-up on the performance of TBAs and VHWs. We (researchers) proposed a design of an initial version of the registers where we indicated the necessary data elements to be collected. This design was then discussed in the training sessions together with district health managers, health facility workers, VHWs and TBAs. We collected their comments, amendments were made and the final design was agreed upon and it was put on the registers by VHWs. After the training, TBAs and VHWs were given the new registers.

Registers given to TBAs were two; one was a new book that was based on the current design of delivery registers they were using. This was to record all the deliveries they conducted as they did before. The other register book was of a different design where they were to record the names of all the mothers they refer to health center for delivery and to record all the new-born babies. These records were to be verified and signed by the health center nurse in-charge. All the recorded information was to be reported to the health center or to a VHW. With the new register book, TBAs could keep record on how many mothers they have referred to the health center and the number of births they registered.

VHWs were also given two register books and stationeries to support their daily activities. Of the two registers, one was to be used to record pregnant women in their respective village and their outcome of delivery. This was a new register for them to use. The other register book was an additional notebook for their daily activities.

VHWs and TBAs were trained on how to use the register books and how to collect the data from women and children both on interviewing them and on carrying out observations. In addition to the training, VHWs were also given stationeries such as pens and rulers to support them in data collection and preparation of reports. VHWs were thrilled not only because they gained new skills but also because they received registers and stationeries to use.

Incentive Mechanism.

This study also introduced an incentive mechanism to encourage TBAs and VHWs to collect and report complete data from the community. This mechanism was introduced by a district health manager who copied a similar mechanism used in other districts where it has shown improvements on reducing deliver-

ies conducted by TBAs. However the district health managers declared that they have not been able to introduce it in their district due to shortage of funds. In this intervention, the incentive was given to TBAs if the number of women referred to health center was higher than the ones they assisted for delivery at home. This incentive also was a way of motivating TBAs to record all the referrals and births in their register and to discourage them to conduct deliveries at home.

The training session in itself was taken as an incentive both to the TBAs and VHWs. The new registers together with stationery facilities provided were also considered as incentives. VHWs and TBAs perceived these as means necessary for accomplishing their tasks and also as a way of being recognised and appreciated.

4.2 Results

After the training, introduction of new data collection registers and provision of incentives to TBAs and VHWs, this study evaluated and reflected on the intervention. The evaluation focused on the changed work practices of TBAs and VHWs in collaboration with health facility workers and district health managers based on three criteria; usage of register books to record births, pregnant women and referral cases. The second criterion was on recorded information at the health center on the number of deliveries conducted at the health center as compared with those conducted by TBAs. The third criterion was recording new information in the village registers. Generally we evaluated the improved collaborative work among TBAs, VHWs, health facility workers and district health managers in recording and collecting maternal health data at the community level.

The evaluation was done two times; immediately after training and one year after the intervention. This section presents the results.

TBAs' Work Practices.

Immediately after training, TBAs started to show improvements. For the period of 10 days spent in the field, 3 mothers were referred by TBAs to the health center for delivery. This happened five days after the training. These TBAs were attending the training session and they were taught the importance of bringing women to health center to be assisted for delivery. Instead of assisting the mothers at home, they brought them to the health center. The TBAs also insisted the records to be written in their registers so they can have a good record on referral cases at the end of the year.

After one year, we conducted another evaluation session. During the evaluation, we observed that TBAs started utilising new registers for registering births and recording referrals of deliveries. In several cases, this new behaviour was detected. TBAs started recording the date of birth, name of the baby, gender and place of delivery; Figure 3 presents an example of the registers.

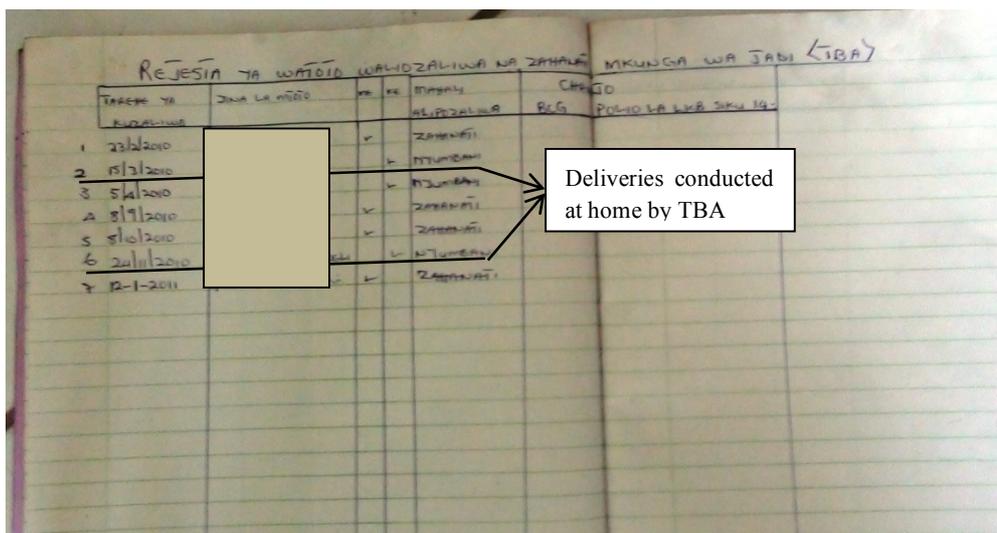


Figure 3. Birth register maintained by traditional birth attendant

As indicated in Figure 3, in a list of 6 births registered in 2010, 2 were conducted at home and the rest at the health center. When asked about how they came up with the records, TBA1 said that;

“The record of these babies is from the women I attended when they were pregnant (as their midwife). These records were written by the health center nurse in-charge when I brought the women to the health center for delivery”

This was an indication that TBAs started to record all the births from the pregnant women they attended and specifically indicating where delivery was conducted. Figure 3 also indicates that TBAs started to record referrals they made for women to deliver at the health center.

A reduction on number of deliveries conducted by TBAs was also observed when comparing what was recorded in TBAs’ delivery registers in the year 2009 (before the intervention) with what was recorded in 2010. Samples of the registers are presented in Figure 4 and 5.

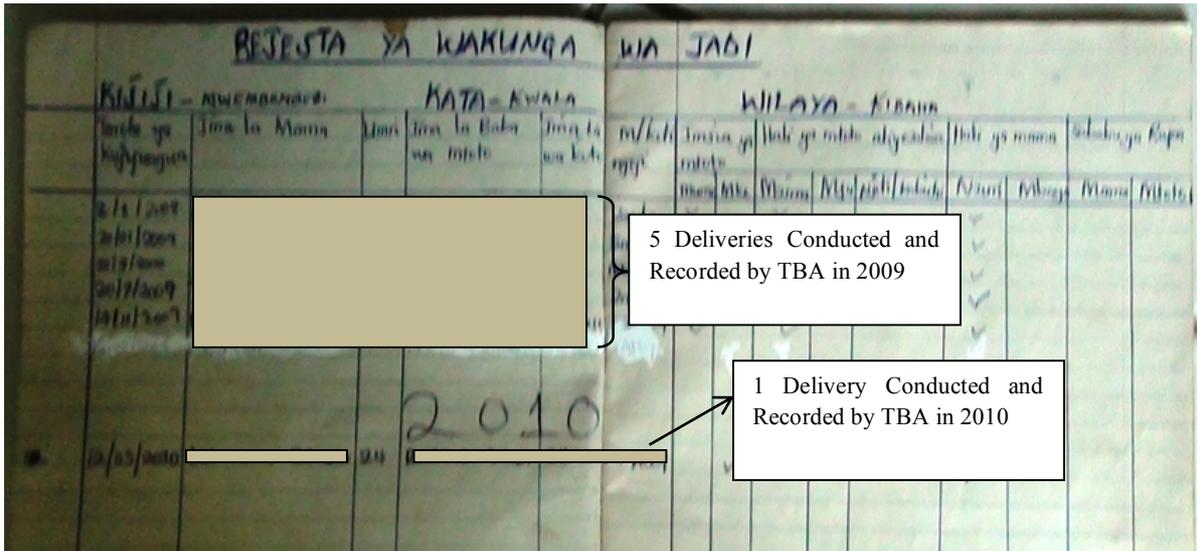


Figure 4. Traditional birth attendant register with records on women who were assisted for delivery in 2009 and 2010

Figure 4 indicates that the number of deliveries conducted and registered by TBA in 2009 were 5 and 1 in 2010.

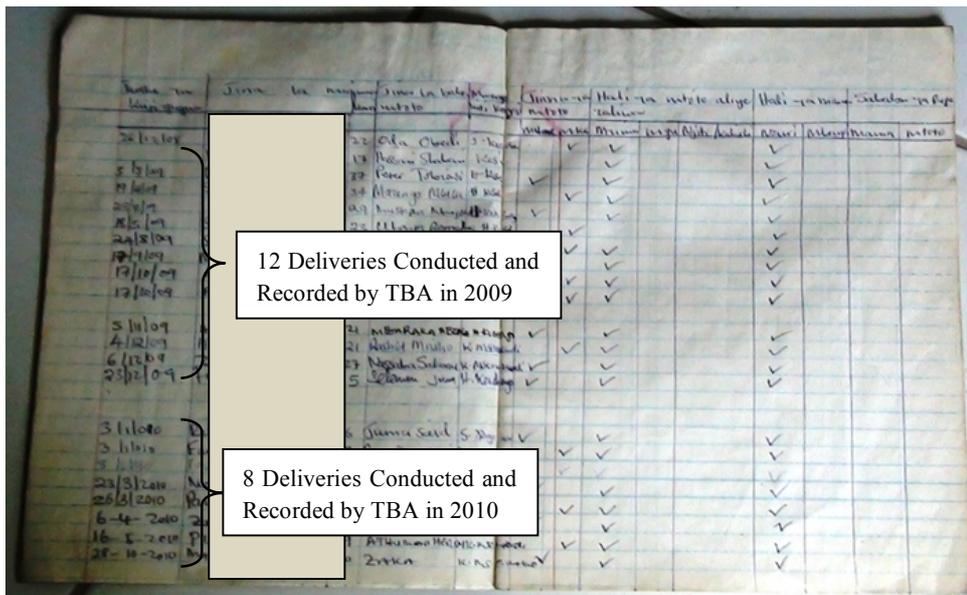


Figure 5. TBAs’ register with records on women assisted for delivery in 2009 and 2010

Figure 5 indicates that the number of deliveries conducted and registered by TBA in 2009 were 12 and those in 2010 were 8.

Figures 4 and 5 indicate a reduction of TBAs deliveries. The reduction in TBAs deliveries could however be caused by several factors such as reduction of fertility rate or non-recording of the deliveries. To clear our doubts, we went further to review reports at the health center where training was conducted and where it was not conducted.

From quarterly reports of the health center in the village where training was conducted to TBAs and VHWs, we noted the status of deliveries conducted at health center as compared to those conducted by TBAs. These are summarised in Table 2.

Table 2. Health Center where Training was conducted

Year	Quarter	Number of deliveries conducted at the HC	Number of deliveries conducted by TBAs
2009	1	7	2
	2	13	3
	3	13	3
	4	10	9
	Total	43	17
2010	1	16	0
	2	8	0
	3	10	3
	4	18	4
	Total	52	7

From Table 2, quarterly reports indicated that, in 2009, there was a total of 60 deliveries, 43 of which were conducted at the health center and 17 by TBAs. In the year 2010, which was after the intervention, reports indicated that, there was a total of 59 deliveries, 52 were conducted at the health center and 7 by TBAs. This shows that TBAs have changed their practice of conducting deliveries at home, from 17 deliveries in 2009 to 7 deliveries in 2010. Instead they referred the mothers to the health center, which shows that the health center deliveries increased from 43 in 2009 to 52 in 2010.

Taking a controlled group of a health center in the village where VHWs and TBAs were not trained, we also compared the number of deliveries conducted at the health center and by TBAs. Table 3 presents a summary of the findings.

Table 3. Health Center where Training was not conducted

Year	Quarter	Number of deliveries conducted at the HC	Number of deliveries conducted by TBAs
2009	1	3	7
	2	1	8
	3	2	10
	4	11	9
	Total	17	34
2010	1	3	7
	2	3	7
	3	11	9
	4	6	14
	Total	23	37

The results from Table 3 indicate a relatively small increase (from 17 to 23) of health center deliveries and an increase (from 34 to 37) on TBAs deliveries.

VHWs' Work Practices.

To evaluate transformation of VHWs' practices in collecting and recording maternal health data, three things were checked; utilisation of new registers, mobilisation of TBAs in recording deliveries and births and referring women to the health centre for delivery, and updating the village register

Findings indicate that, VHWs started to utilise the new registers for recording pregnant women and following-up their health status. The collected data also helped them in preparing their reports. One VHW indicated that:

"The new register for recording pregnant women helps me to have a proper follow-up and be sure of the correctness of data when I prepare reports"

This register became a useful tool for VHWs that helped them in accomplishing the activity. Investigating the efforts of VHWs in mobilising TBAs, findings indicate that the success (changed behaviour) of TBAs was behind what was done by VHWs. VHWs indicated that they now understood that they would get complete information if they worked closely with the TBAs because pregnant women followed TBAs and not VHWs.

Evaluating the updating of the village register, findings indicate that the register was not updated. There was no changed behaviour towards updating the village register. VHWs indicated to have negative impressions towards working with the village government head. This study could not further investigate why this practice was not transformed.

In general, the collaboration between VHWs and TBAs, and health facilities workers and district health managers in collecting and recording maternal health data was also evaluated in this study. Through interviews and observations, health facility workers and district health managers indicated appreciation of work done by TBAs and VHWs after a tremendous increase of deliveries at the health centre. One nurse indicated that:

"Nowadays I meet with VHWs once a month and we discuss on the issues they face and I give them feedback on the work they have done based on the reports (written and verbal) they present to me.... I am getting busier every day because almost all the pregnant women are brought here (at the health center) by TBAs for deliveries and the TBAs demand that I should record on their registers so they can have a higher number of referrals at the end of the year"

The nurse also prepared a roster to follow-up on the TBAs referral cases and she said:

"I am going to reward a present to all TBAs because they all did well, even though we agreed that the top three winners will be rewarded, I have seen an exceptional energy in all the TBAs"

Similarly the district health managers indicated to be surprised by the outcomes of the intervention. She was very happy and said that:

"I am going to express this success as an exemplary case to the district team so we can introduce the same incentive mechanism in all problematic (more TBA deliveries) health centers in the district".

5 Analysis and Discussion

This section presents the analysis and discussion of the findings where we elaborate how the intervention empowered TBAs and VHWs to change their information practices. According to Ngoma & Igira [5], TBAs and VHWs were collecting and recording maternal health data with two conflicting goals; motivated goal and directed goal. TBAs aimed at gaining some income from mothers and reputation from their society over having recorded information on births for supervision. Similarly VHWs aimed at providing the service to the society and gaining reputation over having records for reporting and following-up.

The complex relationships within and between the elements of activity systems of TBAs, VHWs and HMIS created contradictions that were manifested through dilemma, conflicts, critical conflict and double-bind (Table 1). The manifestations of double binds and critical conflicts which were a result of the tools used, led to secondary contradictions. And primary contradictions were identified though the manifestations of dilemmas driven by the rules and regulations enforces. Conflicts were driven by the organization of roles in the division of labour. As a result the activity of collecting and recording maternal health data was crippled; and this lead to under-reporting of data.

According to Kuutti [26], the desire to perform an activity is driven by motives/goals. This study has demonstrated how TBAs and VHWs started to effectively involve themselves in collecting and recording the data after the intervention. Previous findings indicated that VHWs and TBAs performed actions that

were motivating than the others. The analysis indicates that the intervention motivated TBAs and VHWs to record data by imposing actions that rewarded them for doing that instead of ordering them. This empowered TBAs, VHWs, health facility workers and district health managers to create a new meaning [32] for collecting and recording maternal health data.

In the next sub-sections we describe how the resolutions of the manifested contradiction through the introduction of new and improved tools, new and re-defined rules, and new and re-defined roles in the division of labour led to re-mediation/transformation of the activity systems.

5.1 New and Improved Tools

In the TBAs' activity system, the intervention targeted at improving the participation of TBAs in recording deliveries they conducted, referring mothers to the health centre for delivery and registering new born babies. Most TBAs already had delivery registers for recording deliveries. Those who did not have the registers were given a new one and all TBAs were given another register to record referrals and new born babies. Findings indicate that TBAs started to record births and delivery referrals which at the same time; they were referring mothers to the health centre for delivery. Though the new registers demanded more data recording, still the TBAs were motivated to record the data because at the same time they were recording their performance. This was due to an expectation for personal reward as described by Luoma [39] and Roth [33].

Findings also indicate that VHWs' activity system had contradictions (see section 2) that made it impossible to record and collect all the maternal health data at the community. Attempts were made to resolve the contradictions by improving their medical skills, introducing the use of standardised registers to record pregnant women and providing them stationeries to support data collection and recording. Results indicate that the skills gained empowered VHWs to collect complete and accurate information, by including findings from TBAs, and compiling their reports on time.

In both activity systems, the analysis indicates that the presence of new and improved tools resolved the manifestations of double-binds and critical conflicts. As a result, a new context in performing the activity of data collection and recording was created whereby new rules and new roles were defined. This indicates transformation of the work practices as a result of changed behaviour driven by learning and motivation. Learning manifests itself when the acquired knowledge through training and other means is applied in the daily activities [46] [48] [54]. Furthermore, this study indicates that provision of incentives catalysed the application of knowledge in performing the activities. Incentives created an additional purpose for collecting and recording maternal and child health data, and referring women to the health centre. Transformation of information practices for recording and collecting the data was driven by goals that promised TBAs and VHWs a payoff for performing the activity.

5.2 New and Re-defined Rules

Furthermore, the introduction of new and redefined rules brought about changes in the TBAs and VHWs' activity systems as they enforced performance of roles in the division of labour. The modelled solution in this intervention intended to encourage recording and collecting the data and discourage fear of recording.

The redefined rule was the rule that enforced TBAs to conduct emergency deliveries only in the TBAs' activity system. Instead of conducting deliveries through which they gained some income, TBAs were insisted to refer the women to the health centre and ensure that they keep the records so they can receive an incentive at the end of the year. For the TBAs to be rewarded and to know that someone cared about their performance; this rule was enforced and it led to utilisation of the new register for recording referrals and registering births.

The analysis indicates that, the incentives and training provided to TBAs together with the redefined rules resolved the dilemma on whether to record the data or not and empowered them to collect and record the data. Findings indicate improvements in birth registration and referral cases of pregnant women to the health centre.

5.3 New and Re-defined Roles in the Division of Labour

After the introduction of new and improved tools, and new and re-defined rules as an attempt to re-organize the activity systems; new and re-defined forms of division of labour emerged. This re-organisation led to the creation of new responsibilities for TBAs, VHWs, Health facility workers and district health managers. TBAs started to refer women and children to the health center. VHWs were overseeing the work done by TBA. Health facility workers and district health managers provided support, feedback and supervision to the VHWs and TBAs.

Findings indicate that TBAs, VHWs, health facility workers and district health managers started to adhere to their responsibilities. The health facility workers and district health managers used support, supervision and feedback as empowering communication tools rather than as a means of inspection. As a result, TBAs and village health workers were motivated to record and collect the data because someone cared [39] about their performance. However, VHWs did not update the village register. They failed to collaborate with the village government head so as to execute this role for reasons beyond the scope of this paper.

The re-defining of roles in the division of labour also resolved the identified manifestations of conflicts between TBAs and health facility workers. This opened-up communication between the TBAs and health facility workers which was otherwise unpleasant.

In sum, the manifestations of contradiction in the activity of data collection and recording hindered TBAs and village health workers to perform the activity. They were dis-empowered because they were certain that no one recognized their performance. Though the reception of appropriate data collection tools, training and incentives, they were motivated to change their information behaviour by actively starting to collect and record the data. This implies that, empowerment can be a remedy for contradictions.

6 Conclusion

This study has indicated that the manifested contradictions that hindered collection and recording of maternal health data were the driving forces for bringing about change in TBAs and village health workers' information practices. The analysis indicates that, an intervention was attempted to re-organize the activity systems in order to resolve the contradictions. This re-organisation was accomplished by the introduction of new and improved tools, new and redefined rules and roles in the activity systems of TBAs and village health workers.

To answer the research question: How to change community health workers' information practices in order to improve reporting of maternal and child health data from the community level? This study has shown that through understanding and resolving double binds, dilemmas, conflicts and critical conflicts, a change in data collection and recording practices of TBAs and VHWs can be achieved. Reflections on the intervention indicate that, TBAs and village health workers should be empowered to improve their performance and confidence in capturing and communicating these data. Through the provision of standardized data collection tools, appropriate skills through training, motivation and creation of proper means for sharing information among district managers, health facility workers, TBAs and village health workers, the quality of maternal health data can significantly be improved. Findings of this study indicate that, these attributes can lead to creation of a new context where behaviour towards recording and reporting of the data can be directed.

Furthermore, this study had shown that TBAs and village health workers could be encouraged to record data by providing them with data collection tools that keep record of their performance with a goal of receiving a reward. Their registers should not only be regarded as tool for collecting and reporting data upwards, but also a tool for demonstrating their performances.

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