

# **Defaulter Tracing Information System for Maternal and Child Healthcare**

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**Abstract:** Health Information System (HIS) studies in developing countries have a strong focus on upward information flow; from the lower to the higher levels. This paper contributes to HIS in developing countries debates by showing the importance of horizontal flow of information both at facility and community levels in defaulter tracing information system in maternal and child healthcare in developing countries settings. Defaulter tracing information system depends heavily on horizontal flow of information between facility and community. Defaulter tracing information system is also mediated by social-cultural issues such as rural and urban contexts; nature of the health service program; HIS design and implementation; and logistic challenges. Lastly, the paper provides HIS design and implementation implications in order to support defaulter tracing practices in maternal and child healthcare.

**Keywords:** Defaulter Tracing Information System, Maternal and Child Healthcare, Health Information Systems, Developing countries

## **1. Introduction**

With two years remaining for Millennium Development Goals (MDG) deadline, World Health Organization (WHO) claims that few African countries have achieved the target set ([www.who.int](http://www.who.int)). Three goals out of six are related to the well being of infant/child healthcare; reduce child mortality, improving maternal health and combat HIV/AIDS, malaria and other diseases (ibid). For effective healthcare provision for children under five years old, pregnant women have to be enrolled into antenatal care, deliver with assistance of skilled attendants, receive postnatal care and their new born children have to be enrolled into postnatal care and children under five year old clinic. Health workers also need to have continuous contact with pregnant women, children under five years old, and the general population so that continuity of care can be assessed and remedial action taken when need arise. For example in case pregnant women and children have not kept their appointments, health workers need to trace defaulters and remind them. The general population must also have education about health issues and how to take care of pregnant women and children. Undesired traditional practices such as home delivery with unskilled attendants; poor nutritional practices taboos for the pregnant and children; female circumcision and gender inequality should also be discouraged.

Continuity of care can only be achieved through having an effective information system in health unit that will increase client compliance with curative and preventive care (Bodart and Shrestha, 2000). One aspect of health care is involvement of providers with different specialties and/or organizational structure. For example, pregnant women healthcare is performed in antenatal care units, delivery unit, Prevention of Mother to Child Transmission of HIV (PMTCT) unit, immunization section, laboratory, HIV section, and medical unit. These units are likely to be geographically collocated or distributed. To trace defaulters, collaboration need to be extended to the community level. The collaboration involves horizontal flow of information between the providers within health units and communities so that knowledge about which patients are in need of what kind of follow up at what time is known to all those involved in patient care in the area. However, the current approaches to Health Information systems (HIS) design and development in developing countries are a bit biased. Both policy makers (health officials at the ministry) and researchers have given much attention to aggregate or statistical data which flows vertically from health facilities to district, then to the national level. Krickerberg (2007) argues that HIS in developing countries have been built with the intention of providing routine information to higher level health administration. The reasons for the aggregate data focus might also be a result of computerization which was done in phases; starting from national level cascading to district level (Wilson, 2000). It might also be because of prioritizing policy needs; obtaining information which could help decision makers perform health needs assessment, and planning and monitoring of health service.

This paper describes horizontal information flow in maternal and child health care both at facility and community levels. It contributes to HIS in developing countries debates by showing the importance of horizontal flow of information both at facility and community levels. Defaulter tracing information system in maternal and child healthcare is my empirical focus. The paper provides the overview of information system for tracing defaulters in maternal and child healthcare in developing countries settings and compares village health workers and community home-based care providers' defaulters tracing activities. Not the least, the paper shows the importance of community and community based information systems in supporting defaulter tracing activities. There are few information system studies which reports defaulter tracing activities in other health programs in maternal and child healthcare such as vaccination services. Most studies regarding defaulter tracing activities are oriented towards vertical programs or chronic diseases such as tuberculosis, HIV/AIDS and PMTCT (see for

example Fraser et al., 2009; Jones et al., 2005; Kalembo and Zgambo, 2012; Nglazi et al., 2010, Buza et al., 2012; Marcos et al., 2012). Defaulter tracing activities in maternal and child health services are potential for addressing MDG 4 and 5. The paper provides rich insights about information systems to support defaulter tracing in maternal and child healthcare in developing countries. Engestrom (2001)'s activity system framework is used to provide the structure of defaulter tracing activity system in vaccination and PMTCT services. The paper also provides HIS design and implementations implications in order to support defaulter tracing practices in maternal and child healthcare. Not the least, the paper shows the importance of community and community based information systems in supporting defaulter tracing activities. The study draws upon insights from the socio-technical studies of technology, in which an information system is considered not simply a technical-rational process of 'solving problems'; but also understood as involving socio-economic and social processes (Walsham, 1993).

The structure of the paper is as follows: following the introduction, the literature review is presented with focus on facility and community based information systems in developing countries contexts; then literature about defaulters tracing information systems is reviewed with the focus on the influence of socio-cultural issues. The last part of the literature review section presents the theoretical focus whereby activity theory is used and mediation concept is the theoretical focus. Sections 3 and 4 present the research context and methodology respectively. Section 5 presents research findings about vaccination and PMTCT defaulters tracing practices while sections 6 and 7 present analysis and discussions respectively. Section 8 concludes the paper.

## **2. Health Information Systems in Developing Countries: Facility and Community Based Focus**

The primary health care strategy calls for reorganization of the health services system, adapting health care delivery to the needs and limitations at the community level, and involving the community in the planning and management of local health services (Kleczkowski, Elling & Smith (1981) quoted in Sapirie, 2000). Community-based systems include local community participation in planning, managing, and responding to the system and its information (Marsh, 2000). Community involvement could be done by restructuring of HIS in order to give health care managers and providers better understanding of the community needs and to increase community involvement in the generation and use of information (Sapirie, 2000).

Community based information systems stress local participation in responding to the health needs of all in the defined population, often through household and neighborhood level services, especially health promotion and disease prevention activities. Information systems in community based systems include patient based records, and community records. Individual based records are also generated by community leadership regarding data on the health status and living environment of the communities served, including data on births, death and on education (Marsh, 2000). People involved in data collection activities for community-based information systems are community health workers (CHW) and community council members.

In most countries, health facilities provide premises where modern curative, preventive, rehabilitative, promotive and palliative health services are offered. Information is collected during health service provision showing service rendered to individuals and schedules for future health services. Information generated at this level includes patient's records about their diagnosis and treatment, health education and counseling activities (Lippeveld and Sauerborn, 2000). There are also records created for vital registration for births, deaths and migration (Sapirie, 2000).

Community and facility share needs in information such as demographic data, health care coverage, health status, quality of care and financial information. Marsh (2000) argue that community based approach in some cases would allow identification of affected individuals, many of whom were invisible to the health systems because of incomplete coverage.

HIS is one of important tools for the health sector which involves stakeholders situated at national level, regional, district, service delivery and community. Vertical information flow denotes transfer of information at certain intervals (daily, weekly, monthly, quarterly) between levels of healthcare such as community, health facility, district, regional and national level (Shrestha and Bodart, 2000). Upward flow of information provides means mechanisms through which higher levels get awareness of health services at immediate lower levels. It could be through special program reporting or routine reporting (disease incidence or summary reports).

Special program reporting involves upward flow of information to the higher levels from basic services level for special programs such as for tuberculosis control, leprosy control, malaria control and AIDS prevention. Routine reporting are reports created from patient encounters in health facilities or through outreach programs (Lippeveld, 2000). Routine data collection and reporting can also be managed directly by the community. For example, some data in the community is reported to nearby health units, such as immunization and home-based care activities performed by CHW (Marsh, 2000). Vertical flow of information could also occur between health units when clients are referred from lower levels to higher levels (Lippeveld, 2000).

Horizontal flow of information refers to transfer of data among actors and consumers at the same level of the health care system (Shrestha and Bodart, 2000). In a district-centered primary health care approach, users should include the community, the local health facilities, the district, central levels and other sectors relevant to health such as agriculture, education, housing, finance and planning (Sauerborn, 2000). Some reports could also be sent to special programs or projects or development partners in which the community council members are involved.

## **2.1 Defaulter Tracing Systems in Vaccination and PMTCT Health Services**

Defaulter tracing information systems can be defined as procedures and tools which enhances following up of patients who have dropped out of health programs. For instance, vaccination drop out rates can be defined as proportion of children who received the first type or dosage but not the last type or dose of a certain vaccination (Chadambuka et al., 2012). For example for vaccinations, drop out rates can be BCG to measles or Penta1 to Penta3. Reasons for drop outs in vaccination include distance from health facilities, transport cost, and other social issues (Cutts, 1991).

There are social contexts which influence immunization service in general and defaulter tracing information systems in particular. For example, Chadambuka et al., (2012) reports a study where immunization activities and routine immunization registers were not updated routinely and defaulter tracing was rarely conducted.

Contextual factors such as rural and urban differences can have impact on immunization services especially regarding community health workers, community leaders and immunization services (Cutts, 1991). For example in health services communication and information dissemination, urban people are likely to have access to modern communication facilities, and they have higher school enrollment and higher level of education which facilitate information dissemination even though the characteristics are not necessarily uniform (Cutts, 1991).

Approaches for tracing immunization defaulters include using community health workers, house-to-house visit, telephone calls or written reminders (Cutts, 1991; Chadambuka et al., 2012; Marsh, 2000). Message to communities about immunization activities can be disseminated through schools, religious organization and influential leaders (Chadambuka et al., 2012, Cutts, 1991). The ability of health workers to communicate with the community (social mobilization) is equally important for improving vaccination services (Chadambuka et al., 2012) such as announcing outreaches service session cancellation or vaccine stock out.

However, in urban contexts, seasonal movements into and out of residential areas could make defaulter tracing activity difficult (Cutts, 1991). Community leaders in urban areas may be more difficult to identify, have less time to devote to voluntary services, and have less widespread influence on community behavior (ibid). Also the competing priorities and high migration rates of urban families tend to reduce the use of health services. In urban areas there could be minimal lines of communication between health workers and the community and higher drop-out rate among urban community health workers because of the low pay (Cutts, 1991).

Transmission of HIV from mother to child can take place during pregnancy, labor, delivery, as well as after birth via breastfeeding, especially in mixed feeding (Kalembo and Zgambo, 2012). Follow up in PMTCT is done for various purposes, for instance identifying children with HIV and ensure timely initiation of treatment and care and to avoid postpartum HIV transmission and administration of a short-course antiretroviral treatment to exposed children (Kalembo and Zgambo, 2012). Effective HIV treatment requires good information management to ensure that patients are identified and traced on time. Failure to retain a high proportion of patients in care negates much of the potential benefit of antiretroviral therapy (ART) treatment programme (Forster et al., 2008).

Defaulter tracing activities have been emphasized in PMTCT services and the term 'lost to follow up' is commonly used for the activities. Nglazi et al. (2010) defines loss to follow up as patients who had failed to attend the clinic for more than 12 weeks and who were not known to have died or been transferred to another ART clinic. However, Fraser et al. (2007) assert that there are several criteria for tracing patients in PMTCT services; missed clinic appointments, initiation of ART therapy, laboratory check up, ART drug out of stock, and patients with TB. Lost to follow up can be associated with these criteria even though the term have been mostly used for missed appointments (ibid; Tanzania guidelines on HIV care). In PMTCT, several factors are associated with lost to follow up including stigma and discrimination, home deliveries, and social economic factors.

PMTCT services trace defaulters by several approaches such as using phone call, outreach teams, collaboration with community-based organizations, using community health workers and using social workers (Forster et al., 2008; Fraser et al., 2007; Thomson et al., 2010). Information tools used could be list of patients from medical or pharmacy based records, follow up forms, paper-based booking and attendance diary system and reports about follow up activities (Fraser et al., 2007; Thomson et al., 2010; Nglazi et al., 2010). Thomson et al.(2010) provide an example of a defaulter tracing system in a HIV/TB program with the following procedures: patients enrolled into program; patient misses scheduled appointment; patient identified as potential defaulter through daily paper register; social worker traces patient (via phone, home visit), social worker completes tracing form and documents outcome (return to clinic, hospitalized, transferred out, refuses to return to clinic, unable to return to clinic, confirmed dead); and routine data entry and analysis of tracing of defaulters. However,

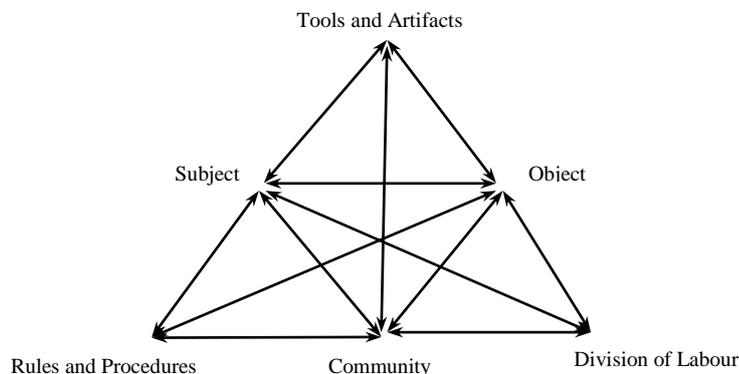
contextual issues such as limited resources and poor information collection practices are likely to hamper the patient follow up activities in PMTCT services and client retention (Forster et al., 2008, Fraser et al., 2007; Thomson et al., 2010; Marcos et al., 2012).

Electronic Medical Record (EMR) systems could enhance tracing of patients lost to follow up through automated e-mail alerts to promote timely initiation of treatment and automated reports generation which can support the tracing of patients lost to follow-up by community health workers (Forster et al., 2008; Fraser et al., 2007). Other modern communication modes for improving follow up communication between health care provider and caregiver could be internet, intranets, telephone, video conferencing, email, short message service, and manual downloading of information (Gentles et al., 2010).

Forster et al. (2008) argue that the concurrent use of several strategies could be most effective in reducing losses to follow up. Community based approaches or strategies are among the approaches which can be used to improve care and retention in PMTCT in resource poor settings (Busza et al., 2012; Marcos et al., 2012). Factors influencing women to use PMTCT services cannot be adequately addressed by clinicians in healthcare settings alone and would be better addressed by personnel well-positioned to intervene at a community level (Marcos et al., 2012). Busza et al. (2012) defines community based approaches to PMTCT as ‘strategies and interventions to improve health behavior and outcome that are delivered outside the formal health settings’. These approaches target their local civil or traditional authorities’ leaders or traditional health providers outside formal health sector. The community groups which could be involved are diverse and include community health workers, peer counselors, volunteers, TBAs, mentor mothers, traditional chiefs and religious leaders (Marcos et al., 2012).

## 2.2 Theoretical Focus: Activity theory

To understand defaulter tracing system in different context such as vaccination and PMTCT health services, activity system framework is employed. Activity system (AT) consists of minimal elements of subject, tools and object which are in mutual relationship (Kuutti, 1996). Third version of AT emphasize social cultural mediation of activity by tools, division of labour, object, community and actors (Engestrom, 2001). A tool can be material tools or thinking tools. Rules cover both explicit and implicit norms, conventions, and social relations within a community (Kuutti, 1996). Division of labor refers to the explicit and implicit organization of a community as related to the transformation process of the goal into the outcome. Figure 1 shows a pictorial representation of the activity system.



**Figure 1:** The structure of human activity system (Engeström, 2001)

Activity theory propose that activity systems itself is the context (Nicoline, 2013). An activity is the minimal meaningful context for understanding individual actions (Kuutti, 1996) Context is constituted through enactment of an activity involving people and artefacts. Consciousness and intelligence do not reside in individual heads or minds but in interaction; realized through socio-cultural mediation of material activity. The meaning of action and context in which it happens are not independent of each other: conception of work objects and contexts arise together as part of a single bio-social-cultural process of development. Activity system theory has been used by information systems researchers to represent the work and hence as source of design (Korpela et al, 2001).

## 3. Research Context

Health Information System Program (HISP) is the setting of the study. HISP is a collaborative research and development program comprising the University of Oslo and universities and ministries in a number of developing countries (Braa et al, 2004). The key areas focused by HISP are software development, research and training in Health information systems. The primary goal of this program is to enhance the information use

behaviour of health managers, planners and workers in the health sector of developing countries by strengthening local professional capacity for the development of sustainable HIS (Braa et al, 2004).

This study had been conducted in the Dodoma Region which is located in central part of Tanzania. The study was done in two districts namely Dodoma Urban and Chamwino. The study was conducted in six health facilities offering Reproductive and Child Healthcare (RCH). RCH aims at social welfare of women and children especially during pregnancy and children under five years old age. It consists of the following sections: children under five year old clinic; antenatal care; family planning; immunization and delivery ward. Nutritional supplement distribution and PMTCT are health service programs which can be performed to clients in all sections. Tanzania healthcare provision is divided into levels: national hospital; specialized hospitals; regional hospitals; district hospitals; health center; dispensary; and community. In the urban district, three facilities were visited whereby two are health centres and one is a dispensary. In Chamwino district, one health centre, one dispensary and one district hospital have been studied. The period of the study was from August 2011 to April 2013.

At the community level, health care provision includes home based care services for chronic diseases such as HIV, cancer and diabetes (Tanzania national policy, 2007). The lowest level of community leadership is ward which is divided into villages which are divided into hamlet or streets. Community leadership includes ward executive officer, village executive officer, village chairman and hamlet/street leaders. Households are within certain hamlet or streets which are headed by hamlet/street chairman. Hamlet residents register are kept by hamlet/street leaders and records information about household members such as their name and age, household leader, status (child, wife, husband, relative, etc).

Community government is responsible for mobilizing, educating and sensitizing community members to receive facility health services. Communities are also involved in taking actions and adopting behaviors that promote and preserve health. In community governments, there are committees for health, education and security and defense. In rural area, every hamlet would have a village health worker (VHW) who is a community link to the health facility (Tanzania national health policy, 2003). Communities are also involved through having representative mechanisms that allow communities to influence the policy, planning, operation, use and enjoyment of the benefits arising from health services delivery (Tanzania national health policy, 1990; 2003; 2007).

Tanzania like other developing countries is faced with problems of illiteracy, shortage of resources, low income, problematic traditional beliefs and low motivation to use modern health services (Tanzania Demographic and Health Survey, 2010). These factors have impact on healthcare provision such as clients' discontinuity in health services and low utilization of maternal and child health services.

#### **4. Research Methodology**

A qualitative approach was favored because the research was concerned with exploring behavior regarding defaulter tracing information systems (Silverman, 2001). The study has employed case study methodology and my case study is 'defaulter tracing work practices in the clinic for children under five year old age' in RCH units. Empirical work has been conducted in health units and community levels.

The main method for data collection has been observation. I have observed work practices in children clinics, where the sessions has usually lasted from 8.00 am to 3.00 pm. I participated in a follow-up activity at the community level whereby we visited six households in search of defaulters. I also participated in community gatherings such as inauguration of a new vaccine at the regional, district and ward levels and national campaign for tracing defaulters at ward and facility levels. I also participated in facility meetings in two facilities where such work practices were discussed.

At facility units, I conducted interviews with health providers of different cadre such as four doctors, one health officer, twenty one RCH nurses, two HIV patient tracing coordinators in two facilities, six village health workers (VHW) and six community based HBC. The main theme of interviews was defaulter tracing work practices. At the community level, I interviewed two village chairmen, two village executive officers and six hamlet leaders. I also interviewed and held three focus group discussions with a total of eight traditional birth attendants and health providers.

At the district level, I interviewed coordinators for home based care, vaccination, PMTCT, HIV/AIDS and RCH. At regional level, I interviewed one health officer and coordinators for RCH & HIV/AIDS. The theme of my interviews with district officials was the essence of follow up practices and its relations to data management work practices at the facility level.

I also analysed patient retained cards (antenatal & children cards, CTC cards) and facility registers and other health services records. I analysed CHW data management tools and practices. At the community level, I have reviewed hamlet leaders' residents' records. I have also reviewed several policy documents such as Tanzanian health policy, RCH strategic plan, Home Based care policy and HIV act and policy.

The data has been analysed using interpretive approach (Walsham, 2005). During fieldwork, I took notes, and when appropriate I photographed or video recorded. But this activity was restricted in PMTCT and rural area where clients found it very uncomfortable to be photographed or video recorded. Later I created narratives (Miles and Huberman, 1994) which are some sort of analysis for detecting themes. It appeared that one of the narratives was related to the activity of tracing defaulters. I further conducted an in-depth study in order to expand the narrative by doing more interviews and observations. I then expanded the narrative by organizing it into different programs of vaccination and PMTCT and did comparison across them and between rural and urban contexts. When I was reading the story of tracing defaulters in vaccination, PMTCT and the comparison between them, a theme of horizontal information flow emerged and I then reviewed HIS in developing countries literature.

## **5. Research Findings**

Tanzanian health policy entails that every child should be provided with one dose of BCG (Bacillus Calmette–Guérin), three doses of OPV (Oral polio vaccine), three doses of DPT-HB (Diphtheria-Pertussis-Tetanus), three doses of rotarix, three doses of PCV 13 (Pneumococcal Conjugate Vaccine) and one dose of measles vaccine (Tanzania national road map strategic plan to accelerate reduction of maternal, newborn and child deaths in Tanzania 2008–2015). Nevertheless, not all children are immunized or fully immunized, the current figure being 75% (TDHS, 2010). There are also variations in vaccination coverage between urban and rural; current figures being 86% and 75% respectively. There is also a trend in decrease in vaccination coverage between first and third dose of DTP-HB.

The government have set operational targets to be achieved by 2015 such as increased immunization coverage of DTP-HB 3 and Measles vaccine to above 90% in 90% of the districts; PMTCT services provided to at least 80% of pregnant women, their babies and families; 75% of villages to have community health workers offering MNCH services at community level; and reduced stunting and underweight status among under-fives from 38% and 22% to 22% and 14%, respectively.

To address the problem, district, facilities and communities has put several mechanisms including tracing of defaulters' practices which involves collaboration between facilities and communities and data elements about drop out rates in monthly reports from facility to district. Some communities have set bylaws where community members can be punished such as setting amount of money to be paid in case of home delivery or if children have not attended vaccination services. However, these bylaws have to be approved by the legal department of the district administration.

The next sections present defaulter tracing for children of under five in vaccination and PMTCT services.

### **5.1 Vaccination Health Care Provision Work Practices**

Recommended children vaccination schedule is at birth, six weeks, ten weeks, fourteen weeks and nine months. Children are enrolled into a child clinic. During vaccination service provision, records are created into a facility register and some information filled into children RCH cards. One aspect in both facility register and patient records is recording of residential information (address) and community leaders (such as name of hamlet leader). In facilities, community leaders' names list is displayed in facility offices. Regularly facility registers is searched to generate a defaulters list which is always recorded on a plain paper. The list at the basic level include name of client, mother's name, street/hamlet, service defaulted. The interval for generating the list could be daily, week, monthly; it differed from facility to facility and it depended on other factors such as workload of providers.

The next step after acquiring a list is to doing intervention by informing or reminding clients. Facility could use two approaches for communicating: community engagement within the facility or community follow up.

- a. Community engagement within the facility was performed in some facilities; it would involve nurses inquiring information from clients who are living in the same street as defaulters' mothers during clinic sessions to give feedback or convey message to defaulters. The audience would respond with comments like client is doing certain socio-cultural and economic activities; migrated; travelled; deceased; or was visiting a certain family. Nurses usually evaluated feedback obtained from the audience and then either updated the registers or gave the message to be conveyed to mothers.

For some clients using community engagement within the facility was not an effective approach; perhaps the neighbors did not know anything about the defaulter; or clients ignored the message and did not come for services. Facility arranged for home visits in the community which could be performed by VHW (in rural area) or local government authorities (street, hamlet or village) or nurses. In case it was not nurses, defaulters' list needs to be communicated to VHW or community leadership. In some cases, community leaders could inquire defaulter names from the facility management so that home visit can be done.

- b. Community follow up activities - If nurses or VHW knew the location of the house, they would go and inquire from household members. If not they would inquire the household location or family details from

village authority. Mothers' name/information was a key to find a child. Hamlet/street leader knows his members and their households' location or could use hamlet residents' records to find information about defaulters' house location. Hamlet leaders could communicate directly with mothers and inform them that they are needed in vaccination services. In some cases, nurses/VHW could ask neighbors or any community member about the whereabouts of the defaulter's mother. Finding clients is not easy. Some times it would take days to meet clients, or for messages to reach clients, especially during harvest and farming seasons in rural areas in which people move temporarily to remote areas. When mothers were found, providers would ask for the RCH cards of the children. The provider would compare personal attributes in RCH card and personal attributes in defaulters' list. RCH cards would show children's vaccination status. If RCH cards show that she is a defaulter, she would be advised to bring a child for vaccination. For some clients who would not abide with schedule, community guards could be sent to arrest them. During the home visits, nurses/VHW will be updating the defaulters' list about status of the visit.

If follow up was performed by VHW or hamlet leaders, feedback about defaulter tracing activities would be provided to facility. The outcome of defaulter tracing activities is either children coming to vaccination services or registers updated with comments like deceased/migrated/ received in other facilities. Feedback could also be updating the register since vaccination services had been performed in the same facility but data was not recorded in facility registers.

Defaulter tracing activities information and reports are used within the facility and in the community. In facility meetings, defaulter tracing plans and activities are discussed. I observed that one facility had created RCH daily reports register where defaulter tracing activities plans for the next day were made. Other cases of uses of defaulter local reports could occur when facility staff communicates to hamlet leaders about low attendance of their members in vaccination services. It could also occur in village or hamlet meetings where community behavior towards health service usage is discussed.

## **5.2 PMTCT Health Care Provision Work Practices**

In Tanzania, children born from HIV positive mothers undergo PMTCT child follow up services from birth until 18 month of age in a monthly schedule. The clinic involves children taking ARV for six months, being tested at four weeks, nine months and eighteen months. It also involves education and counseling about breastfeeding, nutrition practice (e.g. the child on exclusive breastfeeding should not have alternative food before six months) and prevention of other means of infection such as using common teeth brush and razor.

In HIV care in general and PMTCT, there is involvement of donors and non governmental organizations such as TUNAJALI programme. TUNAJALI is a comprehensive HIV programme funded through USAID, aiming at engaging with Tanzanian National AIDS Control Program (NACP) and district councils within some selected regions (Iringa, Morogoro, Dodoma and Singida) to increase quality, synergy and a comprehensive continuum of care for people living with HIV.

The TUNAJALI program facilitates defaulter tracing for HIV services. Together with facilities management and district councils, every residential area has community home based care provider (C-HBC) and/or some could also be connected to certain catchment health facilities. C-HBC gets allowance of approximately 30 USD per month from TUNAJALI programme. The program also provided mobile phone airtime allowance to health unit home based care providers so that defaulter tracing can be done through mobile phones. At TUNAJALI central office, there was C-HBC coordinator who could provide linkage between different C-HBC in the districts. In facilities' CTC section you would find list of C-HBC for different residential areas.

Tanzania HIV care policy entailed that all clients diagnosed HIV positive would be attending CTC clinics regardless of whether they are on ARV treatment or not. When PMTCT pregnant women or children started CTC, they would be connected to C-HBC of their residential areas. One of C-HBC's responsibilities was tracing and reminding clients about their continuum of care. In some cases especially in rural areas, C-HBCs were escorting their clients to the CTC clinic on the clinic days or would take drugs or provide information to the facility when the client was sick. C-HBC kept records of their clients (PMTCT pregnant women, PMTCT children and CTC clients) ranging from 20 to 30 clients according to C-HBC coordinator at central office. However, some C-HBC in rural areas through document analysis of two C-HBC records or one during interviews informed me that they could have up to 70 clients.

In PMTCT, follow up activities are supposed to be done for missing appointments, breastfeeding mothers, testing schedules and tracing if mothers have received the results, tracing linkage to HIV clinics when results are positive (Tanzania PMTCT guidelines, 2011). However, in facilities visited it was done mostly for missing visits and tracing linkage to CTC clinics due to higher workload and information systems limitation (tedious to search).

Information would be recorded for every visit in PMTCT mother child follow up register in RCH section. Tracing of defaulters' activity would start by searching the PMTCT register (which does not records names and

mobile phone number). Local registers existed which recorded personal attributes such as name, mobile phone number and residential information. In local register, some clients provided mobile phone numbers of their relatives to be used when phone contact is needed and in such records phone ownership would be noted. PMTCT register defaulter list would be concatenated with child's personal attribute from local register.

Facility providers would make phone call to defaulters who have access to mobile phones. During phone call, the message to be delivered depended on the ownership of the phone. Provider differentiated phone calls between phone owners and those who used relative's phones. For clients who had access to phone (relative or friend) provider would ask phone owner to inform client that was she was needed in a certain facility, while direct message would be given phone owner. However, some clients could not be reached due to changing phone number, or could not pick phone number or was unavailable. Providers informed me that some clients could be reluctant to release their phone number for recording and mobile calling.

For those clients who could not be reached through mobile phone plus those who do not own or have access to mobile phones, their names would be passed down to their residential C-HBC. Names of residential C-HBC could be found in CTC section. Again defaulters' list for different residential area would be recorded on plain paper, even though the list would mention no service for which the client had defaulted. Removal of some information contents is done for protecting privacy of clients. In other cases, for clients that because of no mobile phone access or due to a busy schedule could not visit the house, a letter with encoded message could be given to other clients informing mother to bring the baby to the clinic.

However, C-HBCs' tracing activities were complex since it depended on willingness of clients. C-HBC knows mothers of children who are to be traced as C-HBC were usually introduced to pregnant women on PMTCT services of their residential area during enrollment into CTC healthcare. Even though C-HBC could know the exact location of house of the defaulter, going to the household was not a straightforward issue. In some cases, C-HBC would not go to clients' household, because the client did not give permission for home visit. In other cases C-HBC could not convey message in presence of other relatives/people because they are unaware of HIV status of mother or a child. In such instances, provider would use other opportunities such as religious meetings, burial or wedding ceremonies or open day markets or on the road path. This had impact on information practices. For example some female C-HBC would have notebook in their handbag so that they can record any time when they meet clients while for others recording would take place later after coming back home.

Again, for privacy purpose local leaders (such as hamlet/street leader) were not fully involved. In case, client had changed house location, C-HBC could ask local leader or community members about house of clients but would not speak the truth why the client is needed.

Tracing activities could be extended to involve PLWHIV (association of people living with HIV) if it is known that a clients were associated with one. CTC patient forms recorded the PLWHIV/community support group which clients were associated with. PLWHIV/community support group members were also responsible for reminding each other about appointments. In areas where there were no C-HBCs, communication could be done to reach in-charge of the nearby facility of the residential area of clients. Sometimes the communication could be done to the district administration office incase there are difficulties in communication with doctor in-charge of the nearby facilities. The communication about defaulters could also be passed between C-HBC in residential areas when it is known that client have migrated to certain area. For example, at TUNAJALI headquarter, a list of C-HBC in different residential areas of different districts was maintained.

Other challenges faced in PMTCT/HIV tracing activities include clients' using different names in the facility and community, using different names in different facilities and unwillingness of some clients to be associated with C-HBC or PLWHIV.

Later facility provider or C-HBC would provide feedback about the follow up activity. Clients could come and receive services and PMTCT registers updated. In some cases, local tracing information tools could also be updated with comments like deceased, very sick, unknown or refused services.

Defaulter tracing activities information and reports are used within the facility and with partners (e.g. TUNAJALI OR PLWHIV). In facility meetings, PMTCT/HIV defaulter tracing plans and activities are discussed. I observed in four CTC clinics, local tools for tracing defaulters and daily reports; one item was about number of clients with missed appointment. Lost to follow up status could also be indicated on patient folder and facility quarterly reports showed the clients' number on lost to follow up status.

## **6. Analysis**

This section provides analysis of the empirical findings by elaborating commonalities in defaulter tracing practices and then differences between programs and rural/urban context. Finally, a framework for defaulter tracing information system is presented by using human activity system framework.

### **6.1 Commonalities in Defaulter Tracing Practices**

Part of both vaccination and PMTCT services is to trace attendance within the two programs. When a mother attends vaccination services, nurses would inquire from mother attendance of PMTCT and remind her to attend PMTCT services and similarly for PMTCT services. In some cases, nurses in vaccination/child health services would inform nurses in PMTCT about presence of PMTCT children so that they can be reminded to attend the service.

Defaulter tracing activities are challenged by logistic issues such as lack of transport, higher workload, follow up incentives, and lack of communication between tracers and clients about the time of visits. Default tracers might walk big distance to reach defaulters houses even though the problem is magnified in rural context. Higher workload in health facilities is another barrier since nurses could not have time to generate defaulters list. Home visits were also challenging. It was possible that the provider would not find the client at home and this would require visiting the house more than once.

VHW are not paid employees and hence some are reluctant to perform follow up activities. For example, in two rural health facilities which had 14 and 11 hamlets and VHW respectively; only one VHW from each village was active in her roles as community link to the facility. C-HBCs also receive little incentives and in some cases it results into lack of cooperation between facilities and C-HBC.

There were also challenges arising from information systems design and implementation challenges. The first challenge arose from manual information system operating in health facilities where it was tedious to generate defaulter names (difficult to search) or wrong calculation (naming someone a defaulter while the date is not yet due). Second challenge was associated with data quality problem; information recording incompleteness. Nurses could fill patients' cards but not facility registers and since defaulter names were generated from facility registers wrong defaulter entries would be generated.

Logistic and information systems limitations made defaulter tracing activities to be performed in limited perspective; just in catchment area for vaccination or not all criteria for PMTCT services. For PMTCT services, tracing of breastfeeding mothers or parents receiving results were not done through mobile phones for the similar reasons (higher workload and tedious to search).

In general in RCH, defaulter tracing practices are mostly done in vaccination and PMTCT services while tracing activities are either not performed or done in very limited perspective in other areas such as underweight and stunted children; missed appointments for other children not in immunization schedule; nutritional supplement distribution; because of logistic and information systems challenges.

### **6.2 Differences between Urban and Rural Contexts**

There are differences in defaulter tracing practices between urban and rural contexts. First, in urban facilities, defaulters tracing activities could be done by providers through home visit or local leaders while in rural settings VHW could mediate role of nurses through doing home visit or passing defaulter names to local leaders. Second difference is that community engagement approach is more likely to be performed in rural area because of its nature (few people who interact more frequently). Some local arrangements in rural area such as children clinics schedule organized streetwise enhances community engagement.

Third difference is that in rural settings less PMTCT clients have access to mobile phones than in urban settings (interviews and document analysis proved so). Hence mobile phone tracing is more likely to be performed in urban settings and more dependence on CHW in rural settings.

### **6.3 Differences between Vaccination and PMTCT Programs**

There are also differences in defaulter tracing practices between vaccination and PMTCT health programs. First, PMTCT services involve multiple implementation partners and this facilitates defaulters tracing through mobile phones calling and structure and incentives to C-HBC. The impact is seen in information recording practices whereby there is recording of phone numbers and mobile phone follow up which is not part of the vaccination services.

Regarding defaulter criteria, PMTCT have many criteria (missing appointments, breastfeeding mothers, testing schedules and tracing if mothers have received the results, tracing linkage to HIV clinics when results are positive) than vaccination where by missing appointment is the concern.

However, PMTCT defaulter tracing activities is complicated by the nature of the program which demands continuum of care and in which privacy is main concern, while vaccination program is simple and therefore uses existing community leadership facilitates tracing activities. Privacy issue limits the involvement of CHW when the client is not willing. There were inventions of local tools in almost all facilities visited to facilitate PMTCT and HIV defaulter tracing activities compared to vaccination services. Social stigma related to HIV also limits mobile phone usage during defaulter tracing; for example clients could not agree to be traced through phone or would not answer the call when she knows that it is the provider calling.

There are many people involved in tracing activities in PMTCT which could be in different areas such as nurses, provider in other facilities, CHW, local leaders, PLWHIV, district administration and TUNAJALI. That is tracing activities can be expanded to other people and geographical areas in search for defaulters. This is not the case in vaccination.

#### **6.4 Activity systems of Defaulter Tracing Systems**

This section presents defaulter tracing system by using the activity theory framework. Activity theory framework is used for the purpose of elaborating on the components which the defaulter tracing system for both vaccination and PMTCT program consist of. The elaboration also compares the vaccination and PMTCT programs in rural and urban contexts. Table 1 shows vaccination and PMTCT defaulter tracing activity systems for rural and urban context.

		Vaccination		PMTCT	
		Rural	Urban	Rural	Urban
<b>Object</b>	Tracing defaulters	Prioritized with local government enforcement	Prioritized	More prioritized with donor support	More prioritized with donor support
<b>Subjects</b>	Health providers	Nurses and health officers	Nurses and health officers	Nurses	Nurses
	Community Health workers	Village health workers	Not in the organization structure	Community home-based care provider	Community home-based care provider
	Local government	More involved	More involved	Limited involvement	Limited involvement
	General Population	Catchment area	Likely from different parts of town	Likely from different health facilities	Likely from different health facilities
<b>Mediating Tools</b>	Facility Registers and Patient cards	Children and RCH cards	Children and RCH cards	PMTCT register, and Local registers and RCH cards with PMTCT code	PMTCT register, and Local registers and RCH cards with PMTCT code
	Defaulters' list	Yes	Yes	Yes with privacy concern	Yes with privacy concern
	Local reports	Yes	Yes	Yes	Yes
	Phone ownership and access	Not recorded (not in use)	Not recorded (not in use)	Low	Higher
	Community residents records	Used	Used	Limited Use	Limited Use
<b>Rules and Procedures</b>	Recording in patient cards and facility registers	Information recording incompleteness	Information recording incompleteness	Information recording incompleteness	Information recording incompleteness
	Searching and compiling defaulters' list	Missed appointments and Multiple program; tedious, could be	Missed appointments and Multiple program; tedious, could be erroneous	Many criteria and Multiple program, more tedious, could be erroneous	Many criteria and Multiple program, more tedious, could be erroneous
	Community engagement within the facility	More used	Limited use	Limited use due to privacy concern	Limited use due to privacy concern
	Communication to other facilities	Unlikely	Likely	Very Likely	Very Likely
	Nurses communication for Multiple program tracing	Yes	Yes	Yes	Yes
	Mobile phones calls to clients	Not probable	Not probable	Likely ( due to HIV stigma)	Likely ( due to HIV stigma)
	Communication to other facilities	Not probable	Not probable	Likely	Likely
	Social networks in the community	More Likely	Likely	Likely (related to PMTCT only)	Likely (related to PMTCT only)
	Communication to other facilities within certain area	Probable	Not probable	Probable	Probable
	communication to local government	possible	possible	Possible with privacy concern	Possible with privacy concern
	Home visit	Possible	Possible, challenged with continuous migration	Possible with privacy concern	Possible with privacy concern
	Feedback to health facility	Yes	Yes	Yes	Yes
	<b>Division of Labor</b>	Facility and community: Trace & provide feedback to the facility	Yes	Yes	Yes with privacy concern
<b>Communit</b>	Defaulters	Defaulting clients	Defaulting clients	Defaulting clients	Defaulting clients

Table 1: Vaccination and PMTCT Defaulter tracing activity system in rural and urban contexts

## **7. Discussion**

### **7.1 Social-Cultural Mediation: Rural-Urban Contexts and type of the Program**

This section discusses how socio-cultural issues are mediating on patient tracing activities. Activity theory laid down by Vygotsky (1978) point out that human action is mediated by technical and psychological tools. Defaulter tracing information system depends heavily on horizontal flow of information between health providers and clients or health providers and community members (VHW and local leaders). Both cases of PMTCT and vaccination shows how different approaches are used to trace defaulters; community engagement, communication between nurses in vaccination and PMTCT, use of community health workers, use of local government or extending communication to other facilities within and across districts and other community groups such as PLWHIV. Horizontal flow of information refers to transfer of data among actors and consumers at the same level of the health care system (Shrestha and Bodart, 2000). Different defaulter tracing approaches are within horizontal flow information category which had been neglected in HIS debates in developing countries.

Horizontal information flow is mediated by rural and urban contexts; nature of health service program; HIS design and implementation; and logistic challenges. Horizontal information flow is mediated by urban and rural contexts due to its influence on use of community resources or mobile phone access. For example, community resources (social relations, community health workers, community bylaws) are more available in rural than in urban. For example, community engagement which depicts flow of information between clients in the same neighborhood in community is more likely to work in rural contexts than in urban contexts. In PMTCT services clients' mobile phone access is higher in urban than in rural contexts.

Type of the health program also mediates horizontal flow of information. For example, in vaccination services there is a freer flow of information than in PMTCT services due to privacy concern. Findings also show how donor/partners such as TUNAJALI programme are facilitating horizontal flow of information between clients and providers in PMTCT whereas such infrastructures were not available in vaccination services. However, vaccination services defaulter tracing uses existing community resources such as social relations to perform tracing.

Health information systems in developing countries are challenged by limited resources in both medical, fiscal and information systems. This study found so. Logistic challenges could be barriers to flow of information between health workers and clients; problems associated with higher workload, lack of transport, motivation for tracing defaulters and lack of communication between clients and provider about the time of home visit could be barriers in defaulter tracing systems.

Fraser et al. (2009) argues that there is lack of good information systems to support tracing of clients at risks. This study found so. Defaulter tracing information system is mediated by poor quality of existing information systems; both manual aspect and data quality problems limit flow of information between community and facility. There have been some critics for HIS in developing countries about the quality of data (correctness) from lower levels. Examples of critics include inaccurate data generated and reported from lower to higher levels (Rubona, 2001) and little or poor use of information (RHINO, 2001; Lungo, 2003; Sheikh, 2005; Nyella, 2007). Findings from this study corroborates with those studies. This study have shown the local use of information in facility and community levels through activities of tracing defaulters and also have shown the impact of poor quality of information in delivering service whereby clients could be termed defaulters while actually it was the problem of data recording incompleteness. The next section discusses local reports and how it enhances facility management and collaboration between facility and community in health service provision.

### **7.2 Information Flow within the Facility and With the Community**

Shrestha and Bodart (2000) argue that properly designed information system will ensure that information needs are relevant at both higher and lower levels of the health sector of the particular country. Findings show presence of local reports which are used to facilitate health services provision (defaulter tracing) and facility management (defaulter tracing plans) and collaboration between facility and community (defaulter information to be discussed in community meetings).

Local reports can be termed short-long term reports because some aspect can be addressed in temporary manner while other aspect in long term manner. For example, the defaulters whose status is unknown after tracing activities will remain in need until the status is resolved. These reports are different from long term reports such as monthly reports, quarterly reports which in most cases remain as facility records and also sent upward and will be used for many years for planning and policy purpose.

## 8. Conclusion

HIS studies in developing countries have focused on information flow from the lower (facility) to the higher levels (district, region & ministry). Shretha and Bodart (2000) argue that better understanding of methods that enhance horizontal transmission mechanism is critical, given the increase of community actors. The paper provided an overview of defaulter tracing information system in maternal and child healthcare in a developing countries setting. Defaulter tracing information system use both facility based information systems and community based information systems and it involves multiplicity of people, relationships, information tools and uncertainties within and across health facilities and communities. This study aimed at describing horizontal information flow in health facilities and communities and it contributes to HIS in developing countries debates by showing importance of horizontal flow of information in the continuity of care. Defaulter tracing information system depends heavily on horizontal flow of information between facility and community. Defaulter tracing information system is also mediated by socio-cultural issues such as rural and urban contexts and nature of health service program. Defaulter tracing information systems is also influenced by HIS design and implementation, and logistic challenges.

This study might have design and implementation implications for researchers and developers of computer based patient care information systems in developing countries. With an increase use of computer based systems and mobile phone usage, how design and implementation of HIS in maternal and child healthcare can support defaulter tracing activities for maternal and child healthcare should be considered. The first step is to include clients' mobile phone number recording practices in the design and implementation of health information systems so that communication between health providers and clients/ community health workers/ community leaders could be done through mobile phones. However, rural and urban context should be taken into consideration and limiting issues such as low phone access in rural should be combated with some mechanism for instance generating printable defaulter list which could be communicated to community health workers or leaders. Hence flow of information need not only to focus on client registered into health programs but also other people (local leaders, community health workers or any one) who are supporting defaulter tracing and delivery of care in general.

Design of defaulter tracing information systems need also to be aware that there could be different demands for different health programs and that in some cases clients need to be traced for attendances in multiple programs. This has implication for the design of patient forms/ registers and related reports in both manual and computerized forms: There should be features for showing comprehensive overview of clients' attendance in both programs.

Designers should also be aware that within the facilities, program performance (program summary attendance or defaulters names) should be included in the design of computer based system which is in contrast to the current HIS design where the focus is on aggregate data. HIS design in developing countries needs to address such kind of reports. For example, some local information practices are done to facilitate these kinds of reports such as local tools found in RCH and CTC to facilitate defaulter tracing practices. The availability of local reports would enhance communication and hence collaboration between facility and community and would enhance local facility management.

The study might also have HIS implementation implications. To enhance information systems to support patient based care, the problem of data quality (information recording incompleteness) should be addressed. One approach could be to see how the community can be involved in improving quality of facility based information systems.

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