Bringing Visibility to Community Health Work with mHealth Systems: A Case of Malawi

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Abstract. The paper explores how technology created visibility of work and its implications. Places create social meanings and significance in which work is situated. Community health work is mostly confined in places of physical settings for many mobile and distributed workers. As their work contexts stretch in place and far from other actors, the visibility of their work becomes blurry. An in-depth interpretive case study of a mobile health system designed to support decision-making for Community Health Workers in maternal and infant care in Malawi was used to unravel how mHealth systems make their work visible. We uncover work aspects like; work interactions, collaboration, coordination, surveillance among others that flow through place and space in our empirical findings. Each relates to work visibility/invisibility creating both theoretical and practical implications.

Keywords. Visibility, Place, MHealth Systems, Community Health Workers

"...work has a tendency to disappear at a distance, such that the further removed we are from the work of others, the more simplified, often stereotyped, our view of their work becomes."

[1]

1 INTRODUCTION

Community health work has thrived for decades. The Alma Ata declaration backed this work to support primary healthcare in underserved communities with low human resource [2]. The term Community Health Worker (CHW) covers a generic type of community based workers known differently in various countries [3]. A widely accepted definition was proposed by the World Health Organization [4] as, *"Community*

health workers should be members of the communities where they work, should be selected by the communities, should be answerable to the communities for their activities, should be supported by the health system but not necessarily a part of its organization and have shorter training than professional workers"

They are trained as health aides to conduct various tasks in communities. For example; sanitation inspections, home visits, treating simple illnesses, facilitating maternal and child health, collecting data among others. The tasks are performed with varying degrees of breadth and depth across countries [4]. Notably, CHWs remain lowly recognized [5, 6] with their work backgrounded in communities. Yet, this work input backs formal health systems. This invisible work has important consequences for CHWs and others involved. Making CHWs' work visible creates community recognition, an incentive for CHWs [4]. It also motivates Ministries of Health to support and sustain CHWs. Visibility of work and actors has been implicated in influencing recognition, control, social identities and power relations according to social places and subjects [7, 8].

This paper does not cover the full range of services provided by CHWs. We study a group of CHWS in Malawi, referred to as Health Surveillance Assistants (HSAs). HSAs live with local communities, providing similar services in maternal and child healthcare. This work is currently supported by a mobile Health (mHealth) system developed to aid decision-making while attending to infants and expectant mothers.

HSAs' work is conducted in their catchment areas far from their supervisors and other actors at health facilities, the district and Ministry of Health. Supervisors often see finished work products through indicators in reports and changed community conditions. This work becomes invisible to differently placed individuals who only see it through some indicators [1, 9]. Work contexts, practices and categorizations from a distance are often narrowed and simplified. This can be consequential for system development and implementations. We seek to address the following question;
How does the introduction of technology influence the visibility of the work of community health workers?

We address this question by combining two bodies of theory based on the notions of 'visibility of work' and 'place'. With place, we take the two time-space configurations of place and space that characterize the temporal and spatial dimensions in which HSAs' work is constructed. With visibility, we learn how work situated in different places may become visible or invisible. The mHealth system we describe is part of an initiative to strengthen HSAs' work delivery in maternal and child health. We undertake an interpretive case analysis.

2 THEORETICAL BACKGROUND

2.1 Place

Place elucidates how social meanings and existential significance are related to places- physical, social and electronic [10]. Places embody social and cultural milieus that shape and are shaped by recursive social actions [11, 12, 13]. Place and time are tem-

poral and spatial environments in which individuals make sense of their interactions and work organization [14, 15].

Place and space should not be equated [13, 14, 16]. Space is an abstract and infinite expanse in which people and ideas freely move with potential for newness and growth [15]. Space is freedom [17] and a container for place, whose meanings are shaped by what one does in them [18]. Place on the other hand relates to a person's sense of boundedness, being and contented belonging where tradition prevails [14].

In place, social activities and interactions occur in physical settings situated geographically where time and space are intertwined [14]. In Giddens' account [14], modernity broke away from locality, tradition and cyclical time associated with place in what he describes as time-space distanciation. The social world is homogenized, interactions lifted out of the here and now and the ties that hold practices in their place are dissolved in space. Space takes on an image of a uniform and infinite expanse in which people and ideas move freely promising generalizability of knowledge, freedom of movement, social independence and growth [15].

Place and space are socially constructed configurations of the time-space continuum and are interrelated [17, 18]. We attempt to understand their difference in order to examine physical presence, an absence of it and work visibility without presence. Noteworthy, ICTs have disembedding mechanisms separating space and time, creating absent actors but simultaneously extending locally specific social relations to different space and time contexts. Interactions can thus occur in placeless spaces [19].

HSAs' work provides a subtle case in which work is predominantly contained in a physical world. Situated in their rural catchment areas, HSAs are mobile and distributed workers but seek work coherence. However as their work is predominantly bound in place, it may become invisible to others differently placed. Suchman [20] notes that, "the relation between our own social location and our views of others sustains boundaries among organizational actors, including boundaries between professional designers of technology and technology users". Implying that if a place of work is territorial, it can become blurry and black boxed by outsiders including technology designers who do not know the details of the territory but enter work contexts to build technology supporting systems. Place therefore creates a basis for our understanding of how work may be visible or invisible to those differently placed.

2.2 Visibility

Visibility denotes legitimacy and rescue from obscurity or exploitation [9]. Work invisible to formal requirements analysis, is crucial in representing effort levels and subtleties [9]. Making work visible is crucial in motivating and determining the significance of events [21]. But what exactly is work and whom should it be visible or invisible to? Star and Straus [9] describe how domestic work was for decades not considered work and invisible to family and workplaces. They stress the "contextual importance" of what work is and what may or may not be visible citing a scene from a film, "The Gods Must be Crazy". The scene is between a western ecologist studying elephant migration and a !Kung tribesman curious about what the ecologist does. "The !Kung man asks the ecologist what he does to which he replies, he is an ecol-

ogist. Seeing a puzzled look on the !Kung man's face, he narrows it down to the activity: "Well, actually, I walk around all day behind elephants and pick up their dung." The !Kung man's expression changes to pity mixed with amusement. Lacking a mutual context, only plain action is visible, which is of great importance in the scientific world, yet preposterous to the !Kung man. Suchman [20] describes it as work getting black boxed by those differently placed.

Work becomes invisible in three ways [9]. First, in work where the actor is seen as a non-person, the work product is visible to both employer and employee. The employee however is invisible due to power relations between employer and employee. For example domestic workers' legitimate work is defined by employers and employees are invisible. This creates complications especially that certain work processes may get excluded and misrepresented in system development and implementation.

Secondly, work becomes invisible when it is disembedded background work [9]. Hamson and Junor [22] also refer to this as "invisible, routine work". Workers are quite visible but their work is demoted to background expectations. For example, nurses are visible in healthcare but continue to struggle to make their work visible. Their work is expected but is backgrounded and invisible by virtue of routine and social status. Such work often supports others and CHWs in rural communities support formal health systems. Suchman [20] narrates the articulation work of air traffic controllers who improvised communication strategies outside standard procedures to maneuver the orderly arrival and departure of planes out of their sight blocked by buildings. This articulation work although relatively easy to uncover, is not registered yet it is necessary. Such background work is vulnerable in systems design especially because it is diffused through the working process, partly due to the social status of workers and also because it requires so much articulation work.

Thirdly, by abstracting and manipulating indicators, both work and people become invisible when; 1) formal and quantitative work indicators are abstracted from work settings and they become the basis for decision-making especially by those who do not see the work first hand. And 2) when work products are commodities purchased at a distance from the work setting making both work and workers invisible [9].

But should all work be visible? Much invisible work remains so for various reasons [9]. For instance, workers hide flaws. For technology design, the less of users' behavior systems encode, the less functionality they can provide. The more behavior they encode, the more they may prescribe human activities [1]. Therefore, for information systems, forced representations of work may antagonize work processes.

Technology is implicated with visibility. It enlarges the field of the socially visible, liberating visibility from the spatial-temporal properties of here and now [8]. We assess the mHealth system's implications on work visibility.

3 RESEARCH APPROACH

The research approach aimed at developing a detailed understanding of work processes among HSAs. We therefore undertook an interpretive case study [23] to achieve

this. The case was selected because it represents the work of mobile and distributed workers in different physical settings currently using a mHealth system.

3.1 Research Context and Case

Malawi is a developing country in southeast Africa with over 17million people [24]. This is one of the highest population densities in sub-Saharan Africa. It is among the poorest countries in the world with 85% of its population in rural areas [25]. Among its many challenges, is its poor health system laden with a heavy disease burden [26]. This is evidenced by a high disease prevalence of; malaria, HIV/AIDS, other tropical diseases, high childhood and adulthood mortality rates.

Maternal mortality in Malawi is still considered the highest in Africa [27] at 675 births per 100,000 and infant mortality at 66 per 1000 live births [25]. Universal health coverage is low and the country still has a struggling healthcare system. For example, human resource challenges cannot meet Malawi's health demands. The few medical personnel available are often distributed in urban areas.

In 2005, Malawi implemented an Emergency Human Resource Plan (2005-2010) to increase its health work force [27]. By 2011, Malawi had over 12,000 HSAs linking communities to the health system [28]. These become the largest health workforce for the country offering both preventive and curative health services [5]. For maternal and child health, HSAs perform activities such as; educating, treating, referring and following-up cases in communities. They are deployed in rural communities where professional health workforce is low and these under-recognized but important health workers endure most of the additional work pressure.

What and where is HSA's work? .

HSAs core work involves disease prevention and extending primary healthcare services to local communities. The health facility acts as a focal point of healthcare to community members in a catchment area. In this study, the catchment area serves 34,325 people. This catchment area is further divided into smaller catchment areas each with a HSA serving up to 10 villages, and an average of 2,286 people. HSAs work significantly in communities where they provide primary healthcare and link community members to the formal health system. A locally constructed structure- a Village clinic (VC) - in a HSA's catchment area is a focal point for service provision. Community members come to the VC for immunization, treatment, education among others. A heavy workload requires collaboration with colleagues but HSAs also work with Village Health Committees in communities. Other activities like sanitation inspections, data collection, and follow-up exercises among others require HSAs to move around in catchment areas often walking or using bicycles.

HSAs are attached to a health facility, an average of 7.2km away from their catchment areas. 12 HSAs are attached to the health facility we contacted. They make formal reports, get facilitation, training and organize their work at the health facility. Additionally, tasks like attending to patients, vaccinating women of reproductive age and children are assigned to HSAs by professional medical personnel in need of assis-

tance. HSAs organize themselves in groups, often rotating their services in the community and at health facilities amongst these groups.

Their immediate supervisor is the HSA coordinator with similar duties. HSAs record daily activities in paper registers which they aggregate monthly. Monthly reports are physically delivered to the HSA coordinator at the health facility. The coordinator aggregates all HSAs' reports and submits them to the health facility In-charge. The In-charge makes a health facility report he delivers to the District Health Office and the Ministry of Health. However, daily work registers are stacked at the health facility. Apart from the HSA coordinator, all other superiors are differently placed in various physical and hierarchical places. They only receive aggregated reports on particular indicators from HSAs' work and often give no feedback.

The mobile system.

Organization mHealth (pseudonym) developed a decision-support system on smart phones. The system is designed to facilitate HSAs' decision-making. Existing paper protocols were integrated into the system to facilitate antenatal and postnatal care of expectant mothers and infants. The system goes through a step by step data capture of signs and symptoms which it analyses and gives a recommendation to either treat or refer patients. The data is simultaneously sent to the organization's database shared with the Ministry of Health. Patient follow-up after an initial visit is crucial, as moving forward to a new section in the system, requires completion of previous sections.

3.2 Data Collection

Empirical data was collected with semi-structured interviews, observations and a Focus Group Discussion for two months in Dowa district. We visited 12 HSAs, 3 health facility staff and 4 community members. 6 HSAs were interviewed for a group's perspective on their work. HSAs narrated their everyday work, where they conduct it, work interactions and experiences using the mobile system. Health personnel and community members also discussed their interactions with HSAs.

We also observed HSAs' work in health facilities and communities. We combined observations with informal discussions to understand what HSAs said they did and what they actually did. This was done for a full understanding of their work and its interaction with the mobile system. We made field notes and recorded interviews.

3.3 Data Analysis

We started our analysis by reading and discussing emerging themes from collected data. Recorded data was transcribed from field notes and audio recordings to proceed with analysis. We moved from raw data by giving similar data codes to organize it. Then, we analyzed the coded data to generate themes with similar descriptions grouped as; HSAs' work description, HSAs' work location, social interactions and experiences with the mHealth system. We moved back and forth through the themes

and transcribed data, to make sense of the data. We then related the themes to our theoretical concepts of place and visibility for further assessment. From this comparison, we generated interpretations for the study.

4 FINDINGS/DISCUSSION

The mobile system has driven some work aspects like collaboration, mobilization, data reporting and work organization previously bound by temporal or spatial constraints of here and now to be conducted in spaces. This impacts on work visibility as the next discussion depicts.

4.1 Work made visible/ invisible with the mobile system implementation

Visibility among colleagues.

HSAs work activities are physically bound in communities and the health facility that shape their work interactions [13]. One's catchment area embodies locally specific activities and interactions in physical places of here and now. In communities, HSAs are highly mobile but seek sameness in work delivery across their distributed workplaces. Previously, the health facility was a common ground for HSAs to plan and seek assistance. The mobile phone has lifted these interactions out of the here and now of the health facility into space [15] affording work interactions, coordination and collaboration in space while sharing common interests and meanings [18]. An example is a 'WhatsApp group created by HSAs.

*"We have a WhatsApp group and we now coordinate some activities with each other there. We are very active in the group; we share interesting experiences and make inquiries amongst ourselves. We now do not have to wait until the weekly meeting or the monthly meeting at the health facility to do this because everyone is distributed in different geographical areas…we reach each other anytime on WhatsApp and if something is urgent, we call."(*HSA in group discussion)

The mobile phone affords HSAs with spatial features where group collaborations and inquiries occur. It liberates work from the confines of place and translates it into spatial integrations where HSAs interact. This accommodates knowledge sharing and work coherence across distributed physical locales. Locally specific social relations are dissolved to occur in placeless spaces without physical presence of colleagues creating visibility for work interactions occurring in a virtual space.

Visibility to supervisors.

The mobile system instantly captures fieldwork activities into the organization's database. Work processes- the how, with whom and when- previously only in places of the community, become visible to supervisors. HSAs reported that data on how they attend to expectant mothers or infants in the community was immediately captured. Disembedded background work [9] formerly seen through monthly abstracted indicators become visible to contextually distanced supervisors at the District Health Office and Ministry of Health. Consequently HSAs focused on making their work

visible due to increased control and surveillance. To HSAs, working more implied more registered work performance for supervisors to see, evaluate and appraise their efforts. Work processes were freed from places of the community and information entered by individual HSAs encompassed their work processes in electronic spaces.

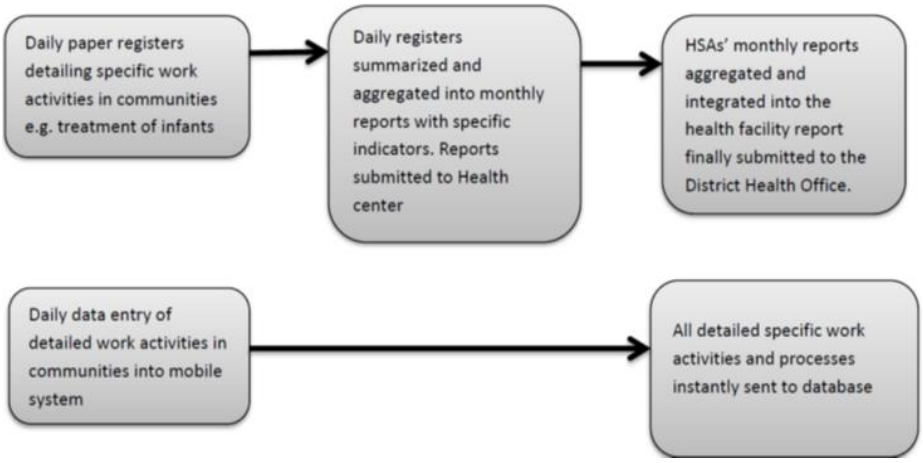

Fig. 1. Illustration of reporting formats before and after mobile system intervention

The HSA coordinator noted;

"Every field visit is accompanied with reporting whether we intend it or not. They (HSAs) are forced to do the work. Before, people were lazy but now they have improved. They can visit 10 expectant mothers in a day. That is good. If they do not, I can see that so and so is not registering any data in the system. I call them to ask what is going on. The phone has enabled me to monitor and follow up with what is happening in the field."

Space denotes to freedom, a uniform expanse where people and ideas move freely [15, 17]. However, as HSAs work is lifted into this infinite electronic expanse, it becomes visible to supervisors and they are forced to work more due to increased surveillance. This raises the question whether all work should be made visible [9]. Traditional monthly reports did not entirely illuminate HSAs' fieldwork processes as the mobile system does. Notably, HSA's laziness is thrown out. Schultze and Boland [15] argue that space creates social independence but this is diminishing as HSAs feel more control and seek approval for their efforts by working harder.

Besides supervisors, HSAs' fieldwork impacts in rural catchment areas also indirectly become visible to health personnel at the health facility. One noted,

"HSAs are the ones reaching out to expectant mothers in communities. The mothers tell us when they come here to the health facility, that they have been referred by so and so (a HSA). …yes they do still refer patients but not as much because most times, cases are solved in the community. That mobile app is really supporting their decision-making which means more work is done in the field" (Community midwife Technician).

Health personnel reported having no access to the database or HSAs' work in electronic space but insisted that reduced cases at health facilities indicated more impact in communities.

Knowledge visibility to the community.

HSAs reported infant and maternal healthcare to require efficient knowledge to foster diagnosis and treatment. Patients are seen in homes or the village clinic. HSAs traditionally used paper forms to register signs and symptoms, make thorough analysis and develop diagnosis. However, some acknowledged forgetting to ask some questions which affected diagnosis. With the mobile system, it is impossible to skip questions as interactions are standardized and continuation to another section requires completion of previous sections.

"…with the paper forms, sometimes we forgot to ask some questions. But with the mobile system app, you cannot go to the next level without filling in responses to all the various sections…we are able to properly assess various conditions and also give a proper diagnosis" (HSA)

With the system, HSAs' knowledge to effectively diagnose health conditions is made visible to community members who recognize them as knowledgeable village doctors. The HSAs' social status and recognition increased as one noted,

"Our value has increased. The number of pregnant women one week after we received the phones went up. Now husbands are coming up to us and request we go to their homes to visit their expectant wives with the mobile phone. They see us with the smart phones and presume we are knowledgeable because they see the phone as a computer…With the phone we display our knowledge. For example the phone helps me to calculate the gestation period of a woman so I don't come off like as if I do not know what I am doing. " (HSA)

Another HSA proudly added,

"...they [community members] do not even know the health center In-charge. They know me as the doctor because I am giving skilled health services..."

And a community member added,

"…our names are in that computer [referring to the HSA's smart phone]. They enter our details so when I come back to the village clinic, they can trace my health information. They know what they are doing..." (Community member)

As HSA's knowledge is displayed with the mobile system use, the health facility personnel's identities slowly fade. Simultaneously, HSAs' identity grows to a doctor-like level for the community. Community members sometimes consult HSAs physically distant, over the phone and are no longer limited to face to face interactions. HSAs' knowledge is shared in space making it visible to communities across time-space spans. However with standardized care provision on the mobile system, other potential forms of knowledge like tacit knowledge gained through practice in patient care are underplayed. Suchman [1] warns that when every aspect of human behavior is encoded in information systems, they prescribe human activity.

Work needs made visible to superiors.

HSAs' traditionally made logistics demands from communities on monthly forms, delivered to the HSA coordinator who submitted them to the health facility In-charge and finally to the District Health Office. All interactions occurred in places of hierarchical structure. With the mobile system, it became possible to skip the hierarchies through instant messaging requests. This made visible HSAs' logistics needs in communities to the Ministry of Health, prompting immediate responses. One HSA noted, *"Government now knows our needs whenever they arise. We send out our logistics needs anytime instead of the monthly forms and having to wait."* (HSA)

5 CONTRIBUTION/CONCLUSION

This analysis has implications for ICT4D, Giddens' agenda of place and visibility work. Place interacts dynamically with work, forming a sphere for shared meanings and interactions for HSAs. HSAs' work requiring mobilization, collaboration and organization was mostly confined in physical places and obscured. The mobile system created space [14, 19] where work continued without physical presence. Noteworthy, place remains relevant for constructing some work aspects like patient treatment. This refutes Giddens' [9] 'phantasmagoric places' logic where relations are between absent actors without face to face interactions. HSAs remained place-dependent and sought stability by situating patient treatment in places of the village clinic. Other activities like coordination and mobilization flowed into space. This implicated on visibility.

Practically, the movement of work from physical to technological spaces created more visibility in communities. This had implications like; facilitating work coherence, knowledge exhibition, work identity affirmation and increased work effort. However work interactions between HSAs and patients (expectant mothers and infants) were so standardized blocking the expression of other knowledge forms gained in practice. It raises questions for system design and implementation. How much work should be encoded in technology? How much work should be made visible? It is our view that approaches to system design and implementation understand work contexts and technology users to meet their objectives.

We have presented how HSAs' work flows through the logics of place and space implicating on work visibility with technology intervention. We also found that work does not simply become place free as HSAs simultaneously sought work situatedness in place. The study demonstrates the significance of understanding place for various work actors and the implications of making work categorizations visible to differently placed actors with technology intervention. Our theoretical basis presents opportunities for perspectives that seek to discuss technological work representations.

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