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# Integration of mHealth technologies to support service interaction moments in tertiary healthcare of Western Cape, South Africa

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## *Abstract*

*There is an increasing publication of scholar articles that describe the ubiquitous nature of mobile technologies as an enabler of mobility. However, there is limited empirical evidence that indicates the defined service interaction moments wherein mobile Health (mHealth) technologies could be useful and are actually used during the execution of work activities with minimal disruption in a clinical setting. The nature of healthcare professionals work activities often requires mobility and continuous management of information but the predominant use of paper-based systems and desktop computer workstations cause time and location constraints. This ultimately defeats the purpose of health information technologies to provide automation of work activities and enhance performance efficiency at points-of-care during service delivery. Hence, it is arguable that mHealth technologies could somewhat redress time and location constraints at points-of-care in clinical practice. The study adopts an interpretivist approach to understand work activities of healthcare professionals in relation to the integration of mHealth technologies, by means of service design as a strategy. Preliminary findings show that, there are specific forms of mHealth applications developed by clinicians but it can be disruptive during work activities while consulting with patients. Ultimately, the study indicates how the interplay between human and machine agencies influence work activities. Furthermore, mHealth technologies would integrate into workflow of professionals at points-of-care where coordinated care involves several professionals for communication purposes. The overall intended outcome of this study would contribute as groundwork on which future studies could design mHealth technologies specific to the work practices of healthcare professionals in sub-Saharan Africa public hospitals.*

## *Keywords*

*mHealth, service interaction moments, service design, stakeholders, ActAD*

# 1 Introduction

In the healthcare sector of low and middle income countries (LMICs), the lack of timely application and inappropriateness for clinical work processes affect the seamless use of information and communication technologies (ICTs) for services delivery (Kumar, Paton & Kirigia, 2016). Mostly because hospital service delivery processes are complex, information driven, and beset by time as well as cost inefficiencies, health information technologies (HITs) are developed and implemented to facilitate support for healthcare professionals (Cresswell, Bates & Sheik, 2013). Due to the nature of healthcare professionals' job in practice, stringent conditions and the constraint of technologies such as computer desktops and stationary electronic systems, it could be often extremely difficult for healthcare professionals to get access to up-to-date information and provide adequate services as they ought to (Nasi, Cucciniello & Guerrazzi, 2015). Therefore, it can be argued that there is potential need to incorporate a form of health-related mobile technology at points where stationary technology might be a constraint rather than assist the work process of healthcare professionals for services delivery (Bloom, Waldman, Labrique & Hampshire, 2017). The aim of the research is to explore opportunities of integrating mHealth technologies into the existing electronic Health (eHealth) system to support service delivery at points-of-care in the clinical settings of tertiary care in Western Cape, South Africa. The research objective is to understand how technology could facilitate work activities at different service touch points as moments of interaction by regarding the human and technology components as nodes of a socio-technical network at the point of interaction.

## 1.1 Related literature

The adoption of mHealth technologies can be linked to the need for improvement in the management of information as well as easier communication at the points-of-care (Ventola, 2014). Prior to the design of health-related software applications (apps) on mobile devices, hospital information systems (HIS) were mainly enabled via desktop computers and medical electronic devices (Svanæs, Alsos & Dahl, 2010). Several scientific authors have investigated different types of mHealth ranging from self-monitoring applications to data collection tools and management of diseases (Free et al., 2013; Bloomfield et al., 2014; Fortuin et al., 2016). In a review of literature on the use of HITs in sub-Saharan Africa (SSA), Bloomfield et al. (2014) identified the lack of empirical evidence that supports the effectiveness of mobile health for non-communicable disease (NCD). The authors reported that mHealth served to provide decision support with automated algorithms to assist in diagnosis and adherence to clinical guidelines. This argument supports the considerations for the integration of mHealth into the current public healthcare system especially since the rate NCD has been increasing across SSA. According to Adepoju et al. (2017), the extent to which mHealth supports shortage in personnel and complements decision support systems in Africa is not well-grounded. Most mHealth technologies are used to capture health data, monitor specific types of health conditions and physical activities (Baig et al., 2015). Given the opportunities that the utilization of mobile devices and apps provide in healthcare services delivery, established benefits include faster remote access to information, enabling time and cost efficiencies; use of multimedia for communication irrespective of time and location and adherence to medication usage (Kumar et al., 2013).

## 2 Research approach

An interpretivist approach was adopted because the knowledge being sought to address the research problem depends on social and contextual reality (Walsham, 2006). The choice of adopting an interpretivist view point is to understand how different human actors make sense of their work activities by shaping, and being shaped by the interactions with each other and respective technology components. The implications of adopting this viewpoint helped to determine why nodes (humans and their experience/intentions, as well as technology tools and their intended uses were inscribed in its designs) allow or resist the resulting interactions.

A modification of the activity theory (AT), which is activity analysis and development (ActAD) was applied as a theoretical lens to understanding information systems (IS) – the complementary network of people, processes and technology. The ActAD assumes that work activity system can be regarded as a social activity that is purpose-driven and context-based (Mlitwa, 2017). Work-oriented activities can be defined as actions carried out according to rules, performed by people such as healthcare professionals for a purpose (object of or motive for the activity) for example, to deliver care. Ideally, social actors (individuals) will use a tool or technology (means of action) whilst being guided by policies, guidelines and procedures (rules) to execute actions during an activity (Korpela, Mursu, Soriyan, Eerola, Hakkinen & Toivanen, 2004). Consequently, the processes which describe transformative actions include: assigning tasks, utilization of tools, assigning roles among subjects and lastly, translation of policies or standard procedures. The details presented in Figure 1 are a visual illustration of activity analysis and development (ActAD) by Korpela et al. (2004), where the transformed outcome of an activity becomes the object of action for the next activity.

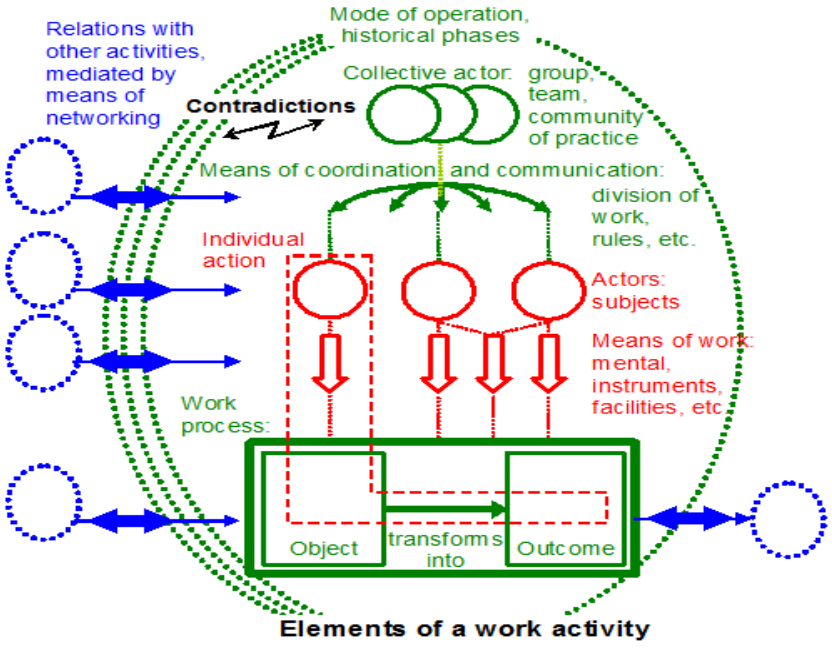


**Figure 1: Activity Analysis and Development (ActAD) Model from Korpela et al. (2004)**

### 2.1 ActAD and mHealth-assisted service interaction moments

An activity system can be considered as a socio-technical relationship network (Wolff-Piggott & Rivett, 2016). The ontological position of this study is informed by the assumption that a service touch point is a product of the convergence between social actors, rules, processes and technology for a purpose driven activity (i.e. object of the activity). Thus, it can be argued that the momentary convergence of social actors within an activity system can be conceptualised as a service interaction moment. At these moments, user experiences are formulated and likely to influence perceptions of a service. For the purpose of this study, the researchers explored the opportunities to integrate a means of action for easier access to the shared object of networking or link between activities. The means of action in this context refers to a mHealth technology while shared object of networking is the information of the patients as different information objects. The authors explore the pain and gain points of healthcare professionals attributed to the use of technology during care delivery processes, using relevant methods to identify the inadequacies of existing work practices.

## 3 Research methodology

To explore how social actors interpret their experiences, a qualitative methodology has been adopted to gain in-depth information from participants (Babbie & Mouton, 2001). The participants were purposively sampled to include healthcare professionals such as specialist doctors and nurses who use technology for their work activities. The strategy adopted was service design to collaboratively engage potential end-users to get design characteristics for a fit-for-purpose mHealth technology that meet their expectations (Clatworthy, 2011). The tool of enquiry used to engage participants was semi-structured interviews with open ended questions, combined with participatory design activities. The activities included the use of visual probes to generate user journey at each touch point and identify the service interaction moments. These two methods were used to collect two sets of data. The semi-structured interviews helped to engage and understand participants daily work activities of the participants. Similarly, the participatory co-design sessions assisted to visualise the current workflow of activities to explore emergent areas on current and desired situations. Ethical clearance and considerations were obtained and adhered to ensure responsible and safe research that does not cause harm to the selected participants, the researchers and the environment.

## 4 Preliminary discussion of findings

The findings presented (in bold italics) are discussed in relation to constructs of the ActAD model. According to Alter (2018) understanding a systemic entity implies a comprehensive analysis of the independent interaction or the relationship between the subjects, tools, object of activity, the transformation process, rules, and the outcome (goal of the activity) in an activity system. The findings show routine actions such as access to information, information management and communication between healthcare professionals during service delivery are the objects of the activity system within tertiary healthcare. Participants gave examples of technologies that assist their daily work activities. For instance, "***ECM is our electronic patient database where all notes on patients are being stored, theatre lists and waiting lists are booked on this system.", "VULA is a mobile application used by referring health care***

***personnel to refer patients to us" and "Trackcare is the NHLS system where you can access all laboratory examinations that was done on a patient in any public hospital in the country.."*** Healthcare professionals use technology and some form of mHealth application to facilitate service delivery especially at the points-of-care. The prominent rule that guided the usage of technology was related to security of patient information. This is common with respect to concerns about device loss or theft, the protection of personal health data stored or during exchange between internetworked web-based apps on mHealth (Baig et al., 2015).

The transformation process of the interactions within an activity system is influenced by the interplay between human and technology agency. Agency can be described as autonomy to intentionally make a difference as shaped by the object of an activity and the level of their participation within a particular context (Engen et al., 2016). For example, a mobile application called VULA is used to communicate and requests consultation remotely between healthcare professionals on medical images referrals. A participant mentioned that ***"The amount of patients accepted by us is much less now as many unnecessary referrals can be prevented...it takes a lot of multitasking and when disrupted by calls and VULA referrals"*** During the participatory design session, one of the participants mentioned that ***"…You can easily be interrupted for 10, 15 minutes where you're not seeing the patient in front of you because you're now replying to this, and you're getting another one that you have to now look at again and reply…"***. While another respondent said that, ***"During the day it actually interferes and it slows you down massively…because you have a lot of patients that you need to see…".*** These responses from healthcare professionals show that, there is a strong belief that the existing mHealth technology applications can be negatively disruptive especially when consulting with clients. In this case, attending to the VULA referrals interrupt the care process of healthcare professionals while attending to patients. A systematic review on the factors that influence adoption of mHealth applications by healthcare professionals indicated that mHealth technologies could be time consuming and disrupt workflow (Gagnon et al (2016). Therefore, it could be argued that it is insufficient to implement mHealth technology for a specific purpose without considering full implications of its introduction. It is necessary to introduce technology considering contextual factors such as actions being performed by the professional, time and location; then, mHealth technologies can be perceived to improve performance and does not disrupt workflow negatively.

## 5 Conclusion

In conclusion, the study intends to develop a socio-technical network conceptual model that shows mHealth-assisted healthcare information services. The eventual outcome of the study would serve as a groundwork on which future studies could design mHealth technologies specific to standard practices of healthcare professionals in sub-Saharan Africa public hospital system. Methodical contribution would be the use of semi-structured interview narratives to map the moments of interactions and the service blue print of a mHealth-assisted clinical workflow using service design methods. The study intends to contribute theoretically to the body of scientific knowledge by integrating the interplay between human and machine agency in relation to the application of activity analysis and development model in the health information systems field. Practical contribution would include guidelines for the Western

Cape provincial department of health to develop a feasible framework for the design of a sustainable mHealth for healthcare professionals in South Africa.

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