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ScienceDirect

Procedia Computer Science 196 (2022) 533–541

Procedia Computer Science

www.elsevier.com/locate/procedia

CENTERIS - International Conference on ENTERprise Information Systems / ProjMAN - International Conference on Project MANagement / HCist - International Conference on Health and Social Care Information Systems and Technologies 2021

Towards a theoretical understanding of workarounds emerging from use of a referral mobile application: a developing country context

Meke I. Kapepo*, Jean-Paul Van Belle, Edda Weimann

Department of Information Systems,University of Cape Town, 8001, South Africa

Abstract

Health Information Systems (HIS) in public health institutions are currently not used as intended; health care providers (HCPs) are increasingly resorting to workarounds or informal systems known as "Shadow Information Technologies" to accomplish their work. This multiple case study in three public hospitals in South Africa and Namibia describes factors driving the enactment of workarounds to the Vula mobile referral application. An interpretive paradigm was taken and semi-structured interviews conducted with 29 HCPs were analysed using a thematic analysis approach. Substantial evidence is found indicating misfits between work and use of referral applications in public hospitals. A conceptual framework is developed to explain workaround practices based on emerging concepts. The study finds that there is misfit between work and use e-referral applications in public hospitals. As a result, HCPs are enacting workarounds in a form of 1) Shadow IT (Information technology), 2) Augmenting existing systems by using alternative computer-based, telephonic and paper-based referrals 3) Fitting by adapting the e-referral application to accommodate misfits with work activities. These practices suggest a design-reality gap in failing to accommodate these issues in the e-referral application design. Additionally, these practices have brought severe security risks to clinical information used on shadow systems, compromising the privacy and confidentiality of patient information. Public health institutions therefore need to develop more effective measures, policies, and strategies to address unresolved constraints in the referral system.

Keywords: electronic eferrals; Healthcare providers; Shadow IT; Health Information systems

* Corresponding author. Tel.: +27-21-6502199.
E-mail address: meke.kapepo@uct.ac.za

10.1016/j.procs.2021.12.046

1. Introduction

Public health institutions implement digital health interventions to streamline health processes and to improve efficiency in healthcare service delivery.

The world health organization defines digital health interventions as mobile and digital technologies used to support any form of health system needs [1]. Electronic referrals can be classified as a digital health intervention or a subset of e-health that focusses on electronically storing patient information and related information on computers for purposes of referrals. Electronic referrals are also defined as the "electronic transmission of patient data and clinical requests between health services providers" [2] .Electronic referrals can be facilitated by the use of mobile referral applications to transmit patient information between clinicians. Public health institutions implement health information systems and mobile referral applications to facilitate clinical work including daily referral activities. The use of mobile referral applications bring about benefits such as improved efficient referral processes, better access to health service information, securely sharing of patient information and better quality of documentation and communication between health providers [3,4]. Additionally, electronic referral solutions offer a more efficient and effective way for healthcare providers (HCPs) to share, update patient information and offer better service and care delivery. Electronic referrals are well adopted and used in countries such as United States, Finland, Iran, Norway, Denmark, Netherlands Australia and Netherlands [4,5,6,7].In South Africa, the Vula mobile application was adopted at numerous tertiary hospitals in Cape Town. Specialties such as dermatology, orthopaedic and cardiology adopted the intervention as part of their standard operating procedures for referrals in the respective departments [8].

Despite the documented benefits, literature shows an interesting phenomenon of medical doctors and other HCPs resorting to alternative systems. This phenomenon is observed from developing contexts, where use of WhatsApp has become prevalent in healthcare for teleconsultations and sharing clinical information [9,10]. Use of informal systems and applications occur when misfits are experienced between HCPs work and the mandated or official systems. These informal systems are referred to as Shadow IT. HCPs usually deploy alternative systems and Shadow IT with similar functions to complete their work [11]. The term Shadow IT is described as alternative systems deployed by end-users alongside formally supported systems by the organization [12].

This study answers the question: *What are the causing factors driving the enactment of workarounds to the Vula application in public hospitals*?

In this paper we review literature on workarounds as studied in various contexts. The next section then discusses the theoretical frameworks explaining workaround practices in the healthcare context. A research methodology is presented in section four. A conceptual framework and findings are presented in section five. This section discusses the identified themes and new concepts developed for the conceptual framework. The study then concludes with a summary of practical recommendations and implications for practice in public hospitals.

2. Literature Review

The notion of workarounds has been extensively studied in various contexts. Different definitions are adapted to describe this phenomenon. Alter defines workarounds as "a goal-driven adaptation, improvisation, or other change to one or more aspects of an existing work system in order to overcome, bypass, or minimize the impact of obstacles, exceptions, anomalies, mishaps, established practices, management expectations, or structural constraints that are perceived as preventing that work system or its participants from achieving a desired level of efficiency, effectiveness, or other organizational or personal goals" [13]. His conception of workarounds is similar to Patterson, who defines workarounds as behaviour associated with practitioners who deviate from an intended work process to overcome some obstacles [14]. Laumer, Maier, and Weitzel, similarly define workarounds as conscious adaptations of work activities that are not expected or specified to be changed in a certain manner [15]. This study adopts the definition by Alter as it captures a wide range of characteristics of workarounds relevant to this study [13]. Moreover, the study will explore workarounds in a form of Shadow IT deployed alongside the Vula application.

Workarounds in the information systems literature are characterized as shadow information technologies [16,13,17,18]; Some form of resistance to usage of system due to lack of system functionalities[19,20] bricolage/improvisation [21,22,23]; non-compliance [18,22,23]; and deviation due to technology misfits [17,23].

In Information systems literature, workarounds are generally enacted to address constraints or limitations perceived by system users to achieve their work [13]. In other instances, they are observed where there is a design-reality gap such as lacking functionalities or capabilities of a system [23,24] or when systems or processes are poorly designed, users resort to alternative systems or shadow IT to accomplish their work. These practices can lead to positive benefits, where workarounds can be a source of improvement to existing design of such systems [13,26].

Conversely, workarounds are viewed to be risky because they lead to errors or inefficiencies [27] that can immediately impact work activities or they can become institutionalized [5,16].

Some scholars have characterized shadow IT (SIT) as workarounds or feral practices or systems. Feral practices or feral information systems are "any technological artefact that end users deploy instead of mandated systems by an IT department [28,12]. Shadow IT are also characterised as " workarounds [13,22].Workarounds are described as " informal temporary practices for handling exceptions to normal workflow" or conscious adaptations of work activities that are not expected or specified to be changed in a certain manner [15]. Other scholars characterize Shadow IT as un-enacted projects [27,28] and shadow sourcing [18,29].

The above show workarounds are generally and widely studied in healthcare contexts, but undertheorized. A few studies have offered useful models and frameworks that explain general workaround practices. This study therefore fills this gap by developing a conceptual framework explaining constraints and causing factors of workaround practices in a developing context. The next section outlines existing workaround models.

3. Theoretical Framework

Workarounds are undertheorized and there are limited frameworks and models bringing to light the unique concepts and implications pertinent to health institutions in limited resource settings. For example, a literature survey was conducted on the use of WhatsApp in clinical practice [30]. Their study reveals workarounds in a form of shadow information technologies (shadow IT) or feral systems such as WhatsApp as being very popular in a developing context, but their study does not provide theoretical lens to examine workarounds. Their study confirms that issues bringing about workarounds are related to use of personal smart phones for work (Bring your own device (BYOD) by Healthcare providers (HCPs). Another study in Botswana, highlights dermatologists working around a telemedicine platform due to inefficiency and burdensome of integration into the resource limited healthcare system [36]. Their study did also not offer a theoretical lens. We therefore argue that workarounds are generally and widely studied in healthcare contexts, but undertheorized.

A few studies have offered useful models and frameworks to explain workaround practices in the healthcare context. For example, workarounds are studied as situated practices in a healthcare setting by investigating the medical dispensing system use to support the pre-approval policy for anti-microbial drugs [16]. Their follow up study developed a framework explaining workaround practices and how they are institutionalised in organisations. Their framework illustrates workarounds not as temporary but as continuous practices prompting to be observed by looking at the tension between the task environment and the information technology (IT) artefact. Their study concludes that "Institutionalised behaviour to information systems are in response to establishing some 'equilibrium' between the pressures from outside the organization and the bottom-up pressure of real work activities within the organisation" [16].Their developed framework takes the perspective of decoupling and loose coupling practices of actors.

Other popular models used to study workarounds are the Systems Engineering Initiative for Patient Safety (SEIPS) model [33]. The SEIPS model include human factors and the health domain by incorporating concepts such as person-centeredness, design-driven improvements and systems orientation. Even though an explanation is offered on how different components including actors and the socio-technical system interact, the model does not particularly include concepts explaining workaround practices. Given the shortcomings of the above models, a SEWA (Sociotechnical Electronic health record Workaround Analysis framework) framework is adapted to this study [35].

4. Research Methodology

To explore workaround practices, an interpretive paradigm was followed to interview healthcare providers. An interpretive perspective is employed to explore subjective meanings HCPs assign to workarounds related to the usage of the referral application [31]. Semi-structured interviews are conducted with HCPs in dermatology units at three

tertiary hospitals. Two hospitals (Hospital A and B) selected for this study are located in Cape Town, South Africa and one (Hospital C) in Windhoek, Namibia. HCPs in the respective hospitals are introduced to the Vula mobile application, with limited access and this was evident in Hospital C.

Vula mobile is an application implemented as an intervention to link healthcare workers with specialist care [37]. The intervention was adopted in some public hospitals in South Africa as a response to challenges experienced by rural healthcare works to provide access to specialist advice and means to efficient referrals [38]. Vula is used by different specialities in public hospitals. The dermatology units in Hospital A and B were among the first to introduce e-referrals via Vula and it has offered numerous benefits. For example, Vula brings about educational benefits and an efficient patient flow between hospitals [38]. Hospital C, on the other hand had HCPs who were familiar with the referral application but have adopted alternative applications for referrals. The two contexts were therefore chosen to achieve theoretical replication. This research aims to answer the question: What are the causing factors driving the enactment of workarounds to the Vula application in public hospitals? Interviews were therefore conducted with HCPs to explore their workaround practices to answer question.

Ethics approval with the relevant institutions was sought prior to the beginning of this study. Semi-structured interviews were conducted with 29 healthcare providers in three hospitals. In Hospital A, 1 dermatologist, 8 medical officers and 2 nurses were interviewed. In Hospital B, 1 dermatologist,3 medical officers were interviewed. In Windhoek (Hospital C), 1 dermatologist, 8 medical officers and 2 nurses, and 2 IT personnel were interviewed. Case study participants were recruited using a snowball sampling, as it was easier to get referrals from unit managers or consultants responsible for the respective departments. All HCPs participating in the study were asked for an informed consent prior to interviews. The interviews were recorded with each interview lasting between 30 and 40 minutes. Interviews were transcribed and NVivo software was used to thematically analyse the transcripts.

An inductive approach was followed to analyse the data. Interview transcripts were open coded to generate initial themes [31]. Open coding was conducted to explore possible theoretical directions emerging from the data [32]. For example, themes related system constraints were grouped under the concept of constraints from the SEIPS model [33,34]. Additionally, uncovered workarounds practices were analysed through the lens of fitting, augmenting and workaround concepts from the SEWA framework [35]. The conceptual framework was then developed from the generated themes. This framework was complemented with a literature search to find relevant theories and concepts that were later adapted to extend existing frameworks. The framework offers an appropriate lens to examine issues with existing referral methods across different hospitals and contributed to a nuanced analysis of emerging work-arounds to address unresolved issues with use of referral mobile applications. The study findings are discussed next.

5. Findings

A conceptual framework is developed to describe antecedents (pre-implementation) and characteristics of workarounds in relation to the use of the Vula application (as seen in figure 1). Our framework is developed by using inductively generated themes. These themes were used as a guide to extract associated concepts from theories in literature and describing their relationships based on the study findings. The next sections unpack the proposed framework as presented in relation to study findings.

All the three hospitals used traditional referral methods such as paper-based referrals and telephonic bookings as received from referring providers. Hospital A and B used computer-based referrals to manage triage by prioritising urgent clinical cases and for electronic consultations to seek second opinion from specialists. Among the many issues experienced with existing referral methods, HCPs confirmed that self-referrals were evident and problematic in all the respective public hospitals. For example, patients are bypassing primary health care levels to access health services at high levels of care leading to underutilization and over utilization of services at primary public hospitals. Workflow issues were reported to be caused by missing or incomplete information in patient history. This was attributed to lack of integration of the public health system. Moreover, there is no evidence of appropriate functioning of the referral system and feedback among healthcare providers. Implementation of computer-based referrals such as the Vula application is intended to overcome the above-mentioned constraints. Vula provided HCPs with instantaneous access to clinical information and patient medical history. Use of the application offers numerous benefits linked to better access to specialists for second opinion and remote consultations. The primary benefit of Vula is secure storage of

patient information and generation of referral reports thereafter. Referral information collected on the electronic platform is used for management of clinical information and analysis of referral trends.

HCPs explain that access to this information in a form of reports providing insights on a number of referrals initiated, referral response times and outcomes.

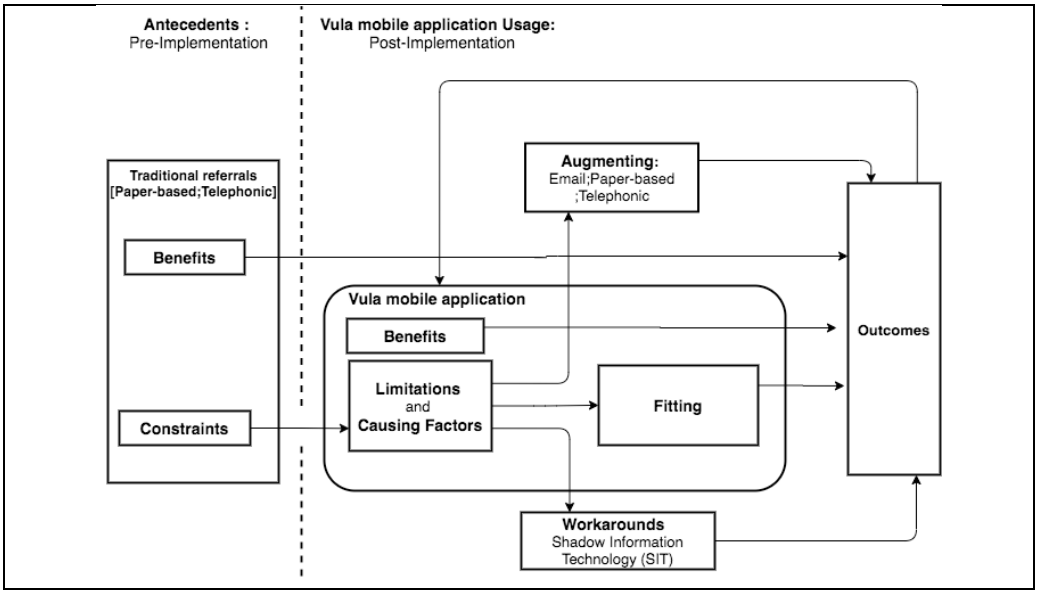

Fig. 1. Conceptual framework of workarounds to referral mobile applications

Even though the intended use of the Vula application was to link rural healthcare workers to specialist care by using electronic means, there is evidence of misfits between HCPs work and Vula. Findings confirm Vula as an e-referral application is not supporting the work of HCPs as intended. These practices are a result of constraints linked to technological, task and organisational related issues as summarised in Table 1.

Table 1. Identified issues leading to workarounds

Technology related Issues
Software incompatibility: incompatible operating system on personal devices.
Design issues: Some text-fields on the user-interface does not control input of clinical information hence time consuming to populate content.
Poor picture quality: affecting diagnosis process due to unstandardized device specifications.
Lack of internet connectivity: Use private data bundles and personal devices (BYOD).
Organisational related Issues
Inadequate training: Users perceive that the introduction training is not sufficient and follow up training should be offered for newer versions of the system.
Lack of buy-in from users and management: Users resistance to e-referrals use; Lack of buy-in from Hospital management
Non –compliance: HCPs evading registration linked to their institution, which interferes with referral protocols for drainage areas.
Workflow/Activity related Issues
Misuse and unintended use of e-referrals**:** The e-referral application is misused to bypass referral drainage areas which affects workflow.
Interruption of patient consultations: The use of e-referrals by HCP interferes with their patient consultation

Findings confirm amongst others, technical issues such as software incompatibility, inadequate training on existing information systems, lack of buy-in from users and management lead to users enacting workarounds (Shadow IT).

Numerous causing factors lead to HCPs employing several workarounds or Shadow IT they used alongside Vula. Shadow IT was adopted by HCPs to share information. Shadow IT are a form of workarounds characterised using WhatsApp messenger and Telegram for consultations and for seeking second opinion. The rationale for adapting these shadow systems is lack of buy-in from end-users. Henceforth, the users opted for conveniently available software applications to complete their work: *"Why WhatsApp is important, because then we can't exclude people just because they don't have an app. So, how do they refer people in the periphery? They use WhatsApp!"* HCP_3

Limited training on the current e-referral application leads to frustrations from some providers not being able to use newer versions and overall Vula application. Lack of follow up trainings lead to limited system use especially from new subscribers due to 1) incompatible operating systems 2) unfamiliarity with technical functionality of the system. To adapt, HCPs used WhatsApp which is compatible with their phone specifications.

Findings also confirmed that in resource constrained contexts such as a developing context, there is lack of access to other formal information systems mandated by governing institutions to handle referrals in respective hospitals. In such cases, alternative paper-based and traditional referral methods were adapted to augment work: *"Like people in the other African countries would send us an email for advice. Some countries don't have dermatologists in the entire country. So, they would send us an email with a picture of the lesion...Or whatever it is... And then we would give some sort of advice... You try and give as best... But it's obviously quite tricky as well because you haven't consulted with the patient in person examined... So, there is a chance of being wrong. But I mean they're desperate"* HCP_4

Despite the Vula application being freely available, HCPs still used Vula synonymously with telephonic consultations, paper-based referrals, and pagers/bleepers: *"So, we use telephones and then a letter, even if, if we use the mobile application, after that you still have to write a letter, yah."* HCP_8. HCPs deemed alternative workarounds to be more beneficial for consultations particularly for diagnoses of patients and for seeking specialist opinion. In other cases, the phone was used to follow up on e-referrals by acquiring additional information on the patient history.

The specialists further said that they received paper-based referrals in a form of referral notes or letters from other healthcare providers. The reasons for augmenting e-referrals were related to improved efficiency and ensuring an effective and complete referral workflow. Using alternative ways to accomplish the tasks improve overall efficiency or completing missing information. Moreover, HCPs reported that a telephonic booking for referrals was quicker as there was division of labour, where the administrator or a nurse handled the bookings for referrals leading to time savings and dermatologists focusing more on consulting with patients: *"Obviously it's saving them time, so if the secretary calls, they don't have to fill in an app, or give us all the information, because you can't make a judgement if you don't have all the information, so usually we then just discuss everything, um, telephonically, yes"*. HCP_13.

Users also received short message service (SMSes) which they refer to as "bleepers". They reported bleepers were used hand in hand with the e-referral application. "*The bleep used to look like a small bleeper. You know it was fashionable in the eighties. You know in the hospital you just do the four digits. So, they send you the four digits as an SMS effectively. So, before the bleep used to just show you the four digits. That used to be a bleep. But now it's an SMS with the four digits."* HCP_11. When for example messages on Vula were not attended to, an SMS is sent to a HCPs on call as a reminder. Using bleepers improves communication, as doctors are more responsive.

The majority of HCPs also confirmed that they were members of WhatsApp groups created for their respective departments. Patient information was shared on these groups although anonymously with other medical officers. *"We have "WhatsApp groups. We're not in. I think the WhatsApp groups are more for respective departments so if you happen to be in the surgery department you will be on a whatsapp group and they just communicate, whatever needs to be communicated regarding maybe a patient that's referred, or maybe problems in the department so for the emergency department we do have a WhatsApp group*" .HCP_20.

Use of information systems in public hospitals tend to be a continuing challenge. IT personnel reported other information systems used in hospitals consisted of e-referral modules but were underutilised. In particular, the Namibian hospital faced pertinent challenges related to fragmented health information systems and funded systems by donor programmes. *"For instance, these the TB system, where they monitor patients, these they are this donor funded programmes. These funded systems are administered and controlled by donors".* HCP_29 It is also important to note that there are other health information systems that might be used in these hospitals for referrals.

Results of this study should therefore be interpreted with care as they are limited to the use of the Vula application and findings might not be applicable to other contexts. It is also noteworthy to indicate this study was undertaken from

2017-2018 and deployment of Shadow IT or workaround practices may have changed with use of later versions of the application. Thirdly, this study might have not captured all workaround practices related to the use of the Vula application. The workaround practices covered are those of healthcare providers working in the dermatology specialty.

6. Conclusion

This study sought to investigate the factors driving the enactment of workarounds to the Vula mobile referral application in public hospitals. It was clear that the application did not fully streamline the referral workflow and improve work of HCPs as intended. As a result, users resorted to alternative ways of augmenting and working around the current system to accomplish their work. This claim is supported by Gasser, when he argues that when computing resources slip or slack in supporting work it was intended to support, a misfit between such a computing resource and work is observed and as result, users institute workarounds to "as locally appropriate solutions to these misfits or problems" [24]. Our research findings also found that the social contexts of HCPs need to be matched to their needs and the IT artefact. As seen from the study findings, users are not utilising Vula as intended but resort to shadow systems and other workarounds. This finding confirms Mars and Scott claim that doctors resort to "spontaneous" telemedicine services leading to integrated practice [30]. The spontaneous telemedicine services are theorised as workarounds.

In this study, these workarounds occurred due to several reasons. Firstly, there is lack of buy in from systems end-users brought about by inadequate IT infrastructure and functionality. For example, when HCPs indicated that there was no internet connection in public hospitals even though Vula requires internet connection to operate. This resulted in limited system usage due to this design-reality gap. This finding is in agreement with Heeks [21]. His study concluded that when information systems are developed for a different setting and implemented in another setting, they are prone to failure. In this research, the e-referral application does not match the public sector hospital realities, regarding the internet infrastructure to support access to the application. Secondly, lack of follow-up training of the system has contributed to underutilization of the application. System developers should therefore provide follow-up training sessions especially when a new version of the software is released. Training users can improve the way users ultimately adopt and use the application. When users encountered misfits with Vula, they alternatively augmented with the same referral methods they were previously using. Resorting back to the paper-based referrals and relying on telephonic booking systems, can be interpreted that the system is not used as intended to achieve an efficient workflow. This evidence confirms that when technology does not fulfil its intended use, users enact alternative solutions and workarounds to fit contingencies of daily work [13,16]. Finally, workarounds can also bring about unprecedented security risks especially if they manifest in a form of shadow systems. The privacy and confidentiality of patient information is compromised when official health information systems are undermined. HCPs are not aware of referral and security policies to safeguard patient information.

Overall, workarounds can have negative and positive consequences for referral outcomes. This study was limited to developing a conceptual framework to explain causing factors and rationales that gives rise these practices. Future studies can test the framework to determine how augmenting, fitting and workarounds impact referral outcomes.

In conclusion, this study made a theoretical and practical contribution by developing a conceptual framework that explains causing factors of workarounds to e-referrals in public hospitals. Practical implications were highlighted to support healthcare providers, their supervisors and the health community to understand antecedents and rationales for workarounds. Results of this research can help public health institutions in dealing with this phenomenon by developing more effective measures, policies, and strategies to address these practices.

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