Spring 6-29-2022

Philosophical Dimensions of Research in M-Health-Based Disease Surveillance in Sub-Saharan Africa: A Systematic Literature Review

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PHILOSOPHICAL DIMENSIONS OF RESEARCH IN M-HEALTH-BASED DISEASE SURVEILLANCE IN SUB-SAHARAN AFRICA: A SYSTEMATIC LITERATURE REVIEW

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Abstract

We examine the current literature on mobile health (m-Health) based disease surveillance in sub-Saharan Africa (SSA). We aim to uncover the philosophical assumptions scholars use to drive research studies in the field. We considered this pertinent because philosophical assumptions play significant roles in how Information Systems (IS) and their users are conceptualised. We sought to address the following broad review question using a systematic literature review approach: what are the philosophical assumptions that drive research in m-Health-based disease surveillance and the impact on methodological assumptions and theoretical frameworks adopted by scholars? Our findings reveal that positivist and pragmatist traditions dominate the research area. However, given the complex contextual conditions in SSA, alternative philosophical assumptions in the post-positivist philosophy, particularly interpretivism, could enhance our understanding of phenomena surrounding m-Health-based disease surveillance. Therefore, we seek to stimulate the IS community's interest in investigating m-Health-based disease surveillance from interpretivist perspectives to offer more meaningful contributions in theorising the phenomenon.

Keywords: Philosophy, disease surveillance, sub-Saharan Africa, m-Health, review.

1.0 Introduction

The SSA region is burdened with the highest global rate of communicable and non-communicable diseases and has the lowest healthcare personnel to patient ratio compared to other parts of the world (Faruk et al., 2020). In rural regions of Nigeria, the ratio of doctors to patients is 1:2,500 as compared to the recommendation by the World Health Organization (WHO) of 1:600 (WHO, 2021). Over the years, SSA has also been burdened with high political instability, civil unrest, armed conflicts and deprivation; all of these conditions have further impeded healthcare services and delivery, especially in the rural and remote regions of the continent. As a result, special interventions have been designed and tailored towards the contextual settings of the

SSA region to strengthen the healthcare system and improve healthcare outcomes. These special healthcare intervention programs are designed to improve immunisation coverage, treatment of diseases such as HIV/AIDs, malaria, and tuberculosis.

More recently, mobile devices have proven useful and contributed meaningfully towards strengthening the health system in SSA following the increased adoption of digital technologies in delivering healthcare services (Frost et al., 2018). Hence, the emergence of what has come to be known as m-Health due to the use of mobile devices for delivering healthcare services. There is a global consensus that the application of m-Health for providing healthcare services improve access to healthcare and ensure efficient and effective healthcare delivery (Brinkel et al., 2014; Frost et al., 2018; Kazi et al., 2017). Therefore, findings in the extant literature show that m-Health applications can promote efficient and effective disease surveillance (Brinkel et al., 2014). These findings have attracted the attention of scholars from various disciplines to investigate the phenomena surrounding how m-Health-based disease surveillance is used to achieve efficient and effective disease surveillance.

Consequently, several benefits of m-Health applications in SSA have been underscored in the extant literature. For instance, m-Health has been reported to improve maternal health in Nigeria (West, 2015), Malawi (Nyemba-Mudenda & Chigona, 2017) and Ethiopia (Atnafu et al., 2017). Given that 80% of new cases of cervical cancer reported globally are from Africa (Jedy-Agba et al., 2020), the potentials of m-Health have been explored in the effective management and screening of patients with cancer (Moodley et al., 2019; Ngoma et al., 2021; Okunade et al., 2020). In addition, m-Health has also been shown to improve the timeliness and completeness of disease surveillance reports in the Central African Republic (CAR) (El-Khatib et al., 2018). Similar findings have been reported in the pilot studies of m-Health-based disease surveillance projects in rural South Sudan (Yugi & Buesseler, 2016) and Ghana (Mohammed et al., 2018).

Despite the seeming contributions of m-Health, the SSA region still suffers several setbacks to delivering efficient and effective healthcare services. Some of the setbacks could be linked to the term known as ‘pilotitis’, which emerged from the frustrations resulting from the failure of m-Health interventions to scale or survive beyond the pilot phase (Huang et al., 2017; Scherr et al., 2020). Some contributing factors resulting in major challenges for m-Health implementation especially in the rural communities where they are most needed include loss/theft of mobile phones (Dick et al., 2017; Moodley et al., 2019), erratic or non-existent power supply and poor network coverage

particularly in rural settlements (Mustapha & Utulu, 2021), legal and regulatory implications of cloud computing (Manyazewal et al., 2021). Hence, scalability and sustainability have become persistent challenges of m-Health interventions in the SSA region (Huang et al., 2017). This has resulted in insufficient evidence of the effectiveness of m-Health interventions required to guide policymakers on effective decision-making and public health action (Franz-Vasdeki et al., 2015; Marcolino et al., 2018). Therefore, some scholars argue that the effectiveness of m-Health interventions in SSA is still contentious and indicates a gap in existing m-Health research and evaluation methodologies (Dick, O'Connor, & Heavin, 2020). This phenomenon also suggests that scholars who study m-Health are not considering the nature of the IS artefact, in this case, mobile devices used for m-Health, and the people involved in the m-Health projects. Issues regarding IS artefacts and their conceptualisation of users have been addressed in the IS discipline, given their impact on the outcome of scientific inquiry, emphasising adoption and use of IS (Lamb & Kling, 2003). Scholars in the IS discipline emphasise philosophical assumptions in conceptualising IS artefacts and social actors (Orlikowski & Baroudi, 1991). For instance, the positivist philosophy postulates that the IS artefact is deterministic and that those involved in its implementation and use are objective (Lamb & Kling, 2003). Conversely, the interpretivist philosophy postulates that the IS artefact is socially constructed and that those involved in IS implementation are subjective (Lamb & Kling, 2003; Orlikowski, 1992).

On account of these debates, we argue that researchers' philosophical lens to investigating m-Health interventions can influence their methodological and theoretical frameworks; and ultimately determine the type of knowledge contribution. The purpose of this paper is to contribute to this debate by conducting a systematic literature review (SLR) on m-Health-based disease surveillance in SSA over the last ten years with emphasis on the philosophical assumptions underpinning such investigations. We adopted the SLR approach to describe the available knowledge on m-Health-based disease surveillance in SSA, identify research gaps and potential areas future research to enhance the field. Therefore, the relevance of the findings of this review to IS researchers is to acknowledge the research gaps and opportunities to explore alternative philosophical perspectives. In addition, IS intervention designers, implementers and practitioners may also find it relevant by understanding and considering the contextual conditions where such interventions are implemented.

Senior scholars in the IS discipline have articulated the need to reflect and explicitly state the philosophical assumptions driving any research investigation by IS researchers (Rowe, 2018; Walsham, 1995b). The essence is to ensure that the right amount of rigour and insight improves the quality of the research (Hassan et al., 2018) and is assessed by the appropriate evaluation criteria (Klein & Myers, 1999). Over the past three decades, a lack of diversity in the IS discipline was decried by scholars and encouraged that IS researchers adopt diverse approaches to study IS development and use (Orlikowski & Baroudi, 1991). IS scholars have attempted to classify the different philosophical assumptions used to investigate IS phenomena. These classifications are illustrated in Mingers (2003) and Orlikowski and Baroudi (1991). Conventionally, a set of philosophical assumptions are called a paradigm. A paradigm is "*a construct that specifies a general set of philosophical assumptions covering, for example, ontology (what is assumed to exist), epistemology (the nature of valid knowledge), ethics or axiology (what is valued or considered right), and methodology*" (Mingers, 2003, p. 559).

Historically, in the IS discipline, the positivist philosophy dominated the research investigations (Hassan et al., 2018; Orlikowski & Baroudi, 1991) until the emergence of post-positivist assumptions, mainly the interpretivist philosophy (Walsham, 1995a). Much is owed to Burrell and Morgan (1979) for the objectivist-subjectivist dichotomy in the philosophical assumptions, which has influenced IS research. Their work has shifted focus from the objectivist view of reality mainly used by positivist researchers to a subjectivist view of social reality often used by interpretivist researchers. The most fundamental distinction in the objectivist-subjectivist dichotomy is the assumption of the nature of reality. While the positivist researcher assumes that reality is objective and can be investigated using the methods in natural science, the interpretivist researcher rejects the notion of objective reality. Therefore, interpretivism postulates that reality is socially constructed through the actions of human actors to create and sustain a social world of intersubjectively shared meaning (Burrell & Morgan, 1979).

The implications of the diversity in philosophical assumptions reflect how IS research is undertaken, especially when dealing with IS artefacts. The diversity in philosophical assumptions in IS research determines how the IS artefact is viewed and conceptualised either as deterministic or non-deterministic. Consequently, this influences the methodology best suited to investigate the IS phenomenon as it is guided by the philosophical assumptions adopted by the researcher.

Research methodology is a complex term in the literature with different meanings. In this study, however, we draw from one of the three definitions in Mingers (2003, p. 559) as "*the particular methods used in a specific project or study (as in 'what was your research methodology?')"*. The most common distinction of research methods used is between the qualitative and quantitative methods (Myers, 1997). However, more distinctions and classifications exist across various disciplines. For example, Burrell and Morgan (1979) classified research methods as objective versus subjective.

Further dimensions also extend to nomothetic (seeking universal laws through systematic protocols and techniques) versus ideographic (understanding the social world through the research subjects), prediction and control versus explanation and understanding, ethics, researcher role, and many other dimensions (Myers, 1997). All these dimensions influence how research is undertaken and what research methods are best suited to investigating the phenomenon under study. This paper is mainly concerned with the objective versus subjective dimension of research methods and acknowledge its influence by the philosophical assumptions guiding the research. For instance, the objectivist research philosophy relies mainly on quantitative methods, while the subjectivist perspective emphasises qualitative methods.

Some quantitative methods used by objectivists include survey methods, laboratory experiments, formal methods (such as econometrics) and numerical methods (such as mathematical modelling) (Myers, 1997). These methods have their origins in the natural sciences to investigate natural phenomena. Although the quantitative methods have gained acceptance in the social sciences, they have been criticised for their limitations to adequately capture the complexity of social phenomena (Kaplan & Duchon, 1988). On the other hand, qualitative research methods mainly adopted in the IS discipline include action research, case study and ethnography. The hallmark of qualitative research methods from a subjectivist perspective is immersion in the context of the study (Kaplan & Duchon, 1988). The researcher is involved in the detailed observation of the phenomenon under investigation within its natural setting. This is coherent as the qualitative researcher aims to understand how others construe, conceptualise, and understand events, concepts and categories, influencing their behaviour (Kaplan & Duchon, 1988). Therefore, interviews and questionnaires, documents and texts, fieldwork observations and the researcher's impressions and reactions constitute the data sources for qualitative research (Myers, 1997).

Theoretical and practical research contributions form the basis for knowledge contributions in the IS discipline. More recently, however, artefactual contribution has been re-emphasised as it has been a neglected form of IS research contribution (Ågerfalk & Karlsson, 2020). Theory building and theorising of IS phenomena have been relevant in developing the field to produce insightful knowledge claims and contributions and continue to be emphasised by senior scholars (Burton-Jones et al., 2021; Gregor, 2006; Orlikowski & Iacono, 2001) particularly in developing countries (Sahay & Walsham, 1995; Walsham, 2017). A classification of the types of theories in the IS discipline is illustrated in Gregor (2006) as theories for i) analysis, ii) explanation, iii) prediction, iv) explanation and prediction and v) design and action. These theory types form the basis of different types of theoretical contributions in the IS discipline. For instance, the theory for analysis offers description and analysis of the phenomena under investigation while theory for explanation explains the IS phenomena without seeking to predict. The theory for prediction aims to predict an IS phenomena with a testable hypothesis but lacks causal explanations. The theory for explanation and prediction encompasses both predictions, and causal explanations about some IS phenomena with testable propositions. Lastly, the theory for design and action (also prescriptive theory) prescribes some guidelines on how to do something, for example, developing an IS artefact. The theory for explanation and prediction and design and action are better positioned to offer practical research contributions informed by theory. Contributions to IS practice are developed through a clear articulation of the implications of the theory produced as a product of research (Ågerfalk & Karlsson, 2020). For this reason, IS scholars agree that good theories inform practice (Davison & Martinsons, 2015; Sahay & Walsham, 1995). Therefore, a good understanding of the theory in a given context, as in middle-range theories, offer meaningful contributions to how IS interventions are implemented. Thus, shifting the attention of IS practitioners towards theory-driven IS implementations that are empirically informed. Artefactual contributions have received less attention in the IS discipline than theoretical and practical contributions. Artefactual contributions describe proposed new or modified artefact, which sets a foundation for theorising the use of the artefact (Ågerfalk & Karlsson, 2020).

While m-Health research has gained traction in the healthcare and medical field, relatively less attention has been recorded in the IS discipline. In this paper, we argue that the IS discipline has much to enhance understanding of m-Health implementations

and theorising. Insufficient theorising is one of the key criticisms facing m-Health research, particularly in the context of developing countries (Chib et al., 2014; O'Connor et al., 2016). Research on m-Health-based data collection and disease surveillance, as one of the significant areas of the application of m-Health in the IS discipline, is currently underexplored. Other areas of m-Health application services include diagnostic and treatment support, health education and awareness, health information systems and point of care services, and emergency medical services (Motamarri et al., 2014).

More recently, the provision of neurological services in SSA has sought to leverage m-Health services after it came under pressure from the COVID-19 pandemic (Adebayo et al., 2021). With the prevalence of diseases and potential outbreaks in developing countries, particularly in SSA, improved disease surveillance can play a crucial role in reducing the mortality rate of treatable diseases and controlling disease outbreaks. While several m-Health-based disease surveillance projects have been implemented in the SSA, most research investigations were undertaken from non-IS perspectives. Our preliminary literature review on m-Health-based disease surveillance in the IS discipline identified only one empirical study (Andersson et al., 2017) published in an IS academic outlet. The study focused on a qualitative investigation of the information quality on the data collected through a smartphone application to improve disease surveillance in Malawi (Andersson et al., 2017).

2.0 Methods

A SLR is a well-recognised methodology for conducting literature reviews in the IS discipline (Okoli, 2015). There is a consensus among researchers that literature reviews play a vital role in enhancing the body of knowledge on a topic or discipline (Schryen et al., 2017; Webster & Watson, 2002). Therefore, this review aims to enhance the evidence base of m-Health research in the IS discipline focusing on m-Health-based disease surveillance implementations in SSA. The purpose of this paper is to review the philosophical assumptions adopted by scholars to investigate m-Health-based disease surveillance in SSA and their methodological and theoretical implications. This is important to understand the nature of research work carried out in this area and identify essential methodological and theoretical gaps that may spark the interest of the research community in this area. Therefore, explicating the gaps in the literature on the topic and

recommend directions for future work. We believe this will be relevant to the growing number of researchers and practitioners to adopt alternative lenses in investigating and evaluating m-Health-based projects in SSA.

We follow the guidelines and procedures outlined by notable scholars in the IS discipline for conducting effective literature reviews (Levy & Ellis, 2006; Okoli, 2015). We conduct a SLR to answer the following review questions:

- What dominant philosophical assumptions drive research in m-Health-based disease surveillance in SSA, and how do scholars adopt methodological assumptions and theoretical frameworks?
- What research discipline do these research investigations emanate from?
- How does the dominant philosophy and discipline determine how mobile devices are conceptualised?
- How is social reality conceptualised by scholars investigating m-Health-based disease surveillance systems?

2.1 Search Strategy and Selection Criteria

We conducted a systematic electronic search for relevant literature from three selected online databases, including ProQuest, Science Direct and Google Scholar. The selection of these online databases was informed by Levy and Ellis (2006) publication highlighting the majority of IS and related journals hosted in the ProQuest database. For instance, the ProQuest database hosts several highly rated IS journals such as MIS Quarterly, Communications of the Association for Information Systems, and the European Journal of IS. Non-IS journals from health and medical informatics such as Journal of Medical Internet Research, BMC Public Health, PLoS One, and JMIR Public Health and Surveillance are also hosted on ProQuest and relevant to this review topic. We also observed that Science Direct hosted several journals not in ProQuest, thus, the reason for selection. Google Scholar database was selected to enhance the scope of the search and capture as many relevant materials as possible. While the use of Google Scholar for conducting literature reviews is contentious, some scholars justify its relevance, especially to complement other online academic databases (Haddaway et al., 2015). Developing our search terms was informed by the goal of this review and directly related to our research questions. The combination of the search terms went through two iterations before coming up with the most efficient terms which elicited the most relevant results. Optimising our search terms enabled us to retrieve a more focused result, not too narrow nor too broad, and relevant to our review topic. Eventually, we used the following terms to query the three selected databases:

("mhealth" OR "mobile health") AND ("disease surveillance" OR "public health surveillance") AND "sub-Saharan Africa".

2.2 Inclusion/Exclusion Criteria

Our literature search was conducted in October 2021, and the search results were limited to articles published in English over the last ten years (2011-2021). The last ten years has recorded notable disease outbreaks such as COVID-19, Ebola, poliovirus and malaria with catastrophic effects in the SSA region. These outbreak occurrences sparked interest in deploying relevant m-Health solutions across the region. We focused primarily on studies conducted within the SSA region, which consists of 48 African countries, according to the World Bank (2021). On the same note, our interest was mainly in peer-reviewed conferences and journal empirical studies, investigating any form of a mobile-based disease surveillance system, project or initiative. Grey literature was exempted from our literature search due to its subjective nature and numerous variations which has raised "considerable confusion and disagreement among organisations, researchers and librarians" (Mahood et al., 2013, p. 2). Consequently, time and resource constraints hindered our search efforts to include grey literature.

Table 1 outlines in more detail the steps taken for the inclusion and exclusion of the identified studies for this review.

Step	Description
1	We used EndNote 20 referencing software to aid in managing and organising the search results, such as removing duplicates. However, a manual revision for addressing duplicate records was also performed. We also used Microsoft Excel to save our search records and serve as backup for verifying records.
2	We excluded materials published as theses, books, and articles containing "review" or "protocol" in their title. This was achieved using EndNote 20. All other empirical study designs such as RCTs, pilot studies, qualitative, quantitative and mixed methods were included.
3	We selected articles that contained either "mHealth" or "mobile" or "surveillance" or "sub-Saharan Africa" in their title using EndNote 20.
4	We read through the abstracts of all the remaining articles to determine their relevance for the final selection for full-text reading. Occasionally, we scanned through the full text of the article to ascertain relevance. In doing this, we excluded articles published as commentaries, perspectives or viewpoints. To determine the relevance of an article, we selected only empirical studies conducted in the context of sub-Saharan Africa that investigated any type of disease surveillance project or initiative. The actors must have used any mobile device (mobile phones or tablets) or form of communication (short message service, interactive voice response, unstructured supplementary service data) to collect and transmit health surveillance data.
5	The full-text of relevant articles were searched using the EndNote software and manually from digital online sources for review and analysis.

Table 1. Inclusion and exclusion criteria for identified studies.

3.0 Results and Discussion

Our search yielded 1,212 publications from the three online databases discussed in the previous section (3.1) over the last ten years. However, after removing duplicate records as highlighted in step 1 (see Table 1), we were left with 1033 records. Accordingly, after applying the exclusion criteria in step 2, we had 760 records of publications. Out of the 760 records, only 259 items had at least one of the keywords in their title as defined in step 3. We reviewed the abstracts of the 259 publications to determine their relevance to the review topic and inclusion for full-text reading as in step 4 (see Table 1). After reviewing the abstracts, 39 publications from peer-reviewed journals and conferences that met our inclusion criteria are discussed in this review. Our findings revealed that the healthcare system in Kenya, a country in eastern Africa, has gained much attention among researchers and practitioners investigating m-Health-based disease surveillance systems. This is evident as eight studies were conducted in Kenya. Findings from other SSA countries, including Malawi (6), Ghana (5), Tanzania (4), Nigeria (3), Uganda (3), Sierra Leone (2), Benin (1), Botswana (1), Central Africa Republic (1), Democratic Republic of Congo (1), Rwanda (1), Senegal (1), Togo (1), and Zambia (1) were also reported. Figure 1 provides a graphical representation of the number of publications by country.

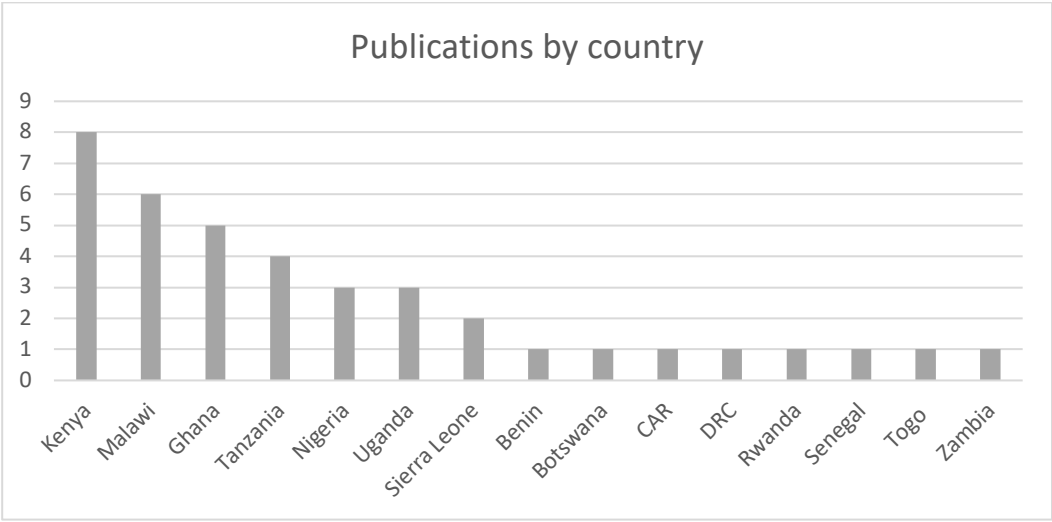

Figure 1. Publications by country

In addition, the majority of m-Health-based disease surveillance systems investigated in this context were reported from pilot or feasibility studies (Adeoye et al., 2017; Andersson et al., 2017; Aw et al., 2020; Brinkel et al., 2017; Cherutich et al., 2016; Debrah et al., 2020; El-Khatib et al., 2018; Mohammed et al., 2020; Thomas et al., 2019; Wamwenje et al., 2019). The reports from pilot and feasibility studies include 1) investigations where the m-Health solutions were designed and developed for the research and 2) evaluating an already existing m-Health solution. Only two studies reported findings from a large-scale, m-Health-based disease surveillance system in Sierra Leone (Martin et al., 2020) and Tanzania (Mtema et al., 2016). Interestingly, these countries take the lead in SSA with functional electronic disease surveillance systems at a national scale, which is a result of the integration of m-Health in the health infrastructure. However, it has been reported that 33 member states of the WHO in the African region are using electronic Integrated Disease Surveillance and Response systems as of December 2017 (Fall et al., 2019). Yet, this review identified studies reported from 15 African countries illustrating the need for more reports from more countries to aid policymakers in making evidence-based decisions.

Concerning the study design, various approaches were used to investigate m-Health-based disease surveillance systems in SSA. These include quasi-experimental (Adjei et al., 2021; Joos et al., 2016; Toda et al., 2016), cross sectional (Hounmanou et al., 2016; Mohammed et al., 2020), quantitative (Mannik et al., 2018; Mohammed et al., 2018; Onoka et al., 2019; Otu et al., 2021; Ticha et al., 2020; Valdes Angues et al., 2018), qualitative (Andersson et al., 2017; Ide et al., 2019; Jacobson et al., 2015; Larsen et al., 2017; Ssemugabo et al., 2019) and mixed method designs (Aw et al., 2020; Blanas et al., 2015; Brinkel et al., 2017; Diese et al., 2018; Moyo et al., 2015; Mtema et al., 2016). However, quantitative designs with statistical analysis to represent study findings have mainly been explored in this research area. This presents opportunities for more studies adopting mixed methods and qualitative research designs. Similarly, the use of theories or frameworks to conceptualise, understand and explain m-Health-based disease surveillance has been underexplored. We identified some studies that operationalised theories on technology adoption, such as the Technology Acceptance Model (TAM) (Blanas et al., 2015; Ssemugabo et al., 2019) and Unified Theory of Acceptance and Use of Technology (UTAUT) (Adjei et al., 2021; Brinkel et al., 2017) in investigating m-Health-based disease surveillance in SSA. In addition, Andersson et al. (2017)

adopted Wang and Strong framework for information quality in their investigation of a m-Health-based surveillance project in Malawi.

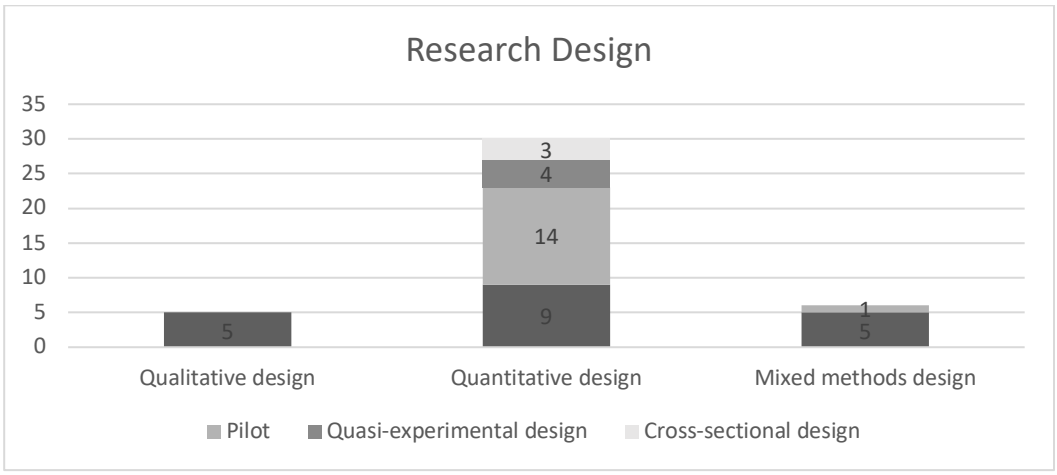

Figure 2. Research Design

3.1 Research Philosophies Driving m-Health-Based Disease Surveillance in SSA

We discuss the research philosophies driving m-Health-based disease surveillance literature based on the findings from this review. We categorise the studies based on four research philosophies adopted in IS and non-IS research. These include positivism, interpretivism, pragmatism and critical realism. The majority of the authors did not explicitly mention the research philosophy underpinning their study. Thus, we inferred the philosophical traditions underpinning the studies based on each study's adopted research design and data presentation. However, this inference was cautious as we acknowledge some philosophies such as pragmatism which promote methodological pluralism. In the case of pragmatism, we further investigated the role of actionable knowledge production to inform practice, being among its core principles. We identified positivist research primarily based on their reliance on a statistical representation of research findings and aim towards population generalisation with many study participants. Interpretivist studies were identified primarily based on qualitative findings reported thematically from the study participants' perspectives. Surprisingly, we found no studies that investigated m-Health-based disease surveillance in SSA from a realist perspective.

The findings from the review show that the dominant philosophical stance adopted in m-Health-based disease surveillance studies is pragmatism. This is given that seventeen of the studies captured through the SLR adopted pragmatism. The next was positivism, given that it was adopted by fifteen of the studies captured through the SLR adopted in the study. We found only five studies underpinned by interpretivism. This highlights a need for more studies underpinned by interpretivism and realism. Adopting interpretivism offers researchers opportunities to explore better the social and historical contexts of m-Health-based disease surveillance from participants' perspectives, being one of its core principles. This principle of contextualisation allows the interpretivist researcher's audience to understand how the phenomenon under investigation emerged and evolved (Klein & Myers, 1999). Considering the wide range of diversity and complexity of the social context in SSA (civil unrests, illiteracy, political instability, poverty, poor infrastructure and armed conflicts), interpretivist studies may prove helpful in enhancing the understanding of m-Health-based disease surveillance from a socio-technical perspective. In addition, qualitative interpretive studies are relevant in examining unintended consequences of IS implementations, for example, Parks et al. (2017). While scholars have adopted realist perspectives in the medical informatics field to evaluate m-Health projects (Abejirinde et al., 2018; Desveaux et al., 2018; Kabongo et al., 2020), disease surveillance projects have been largely overlooked.

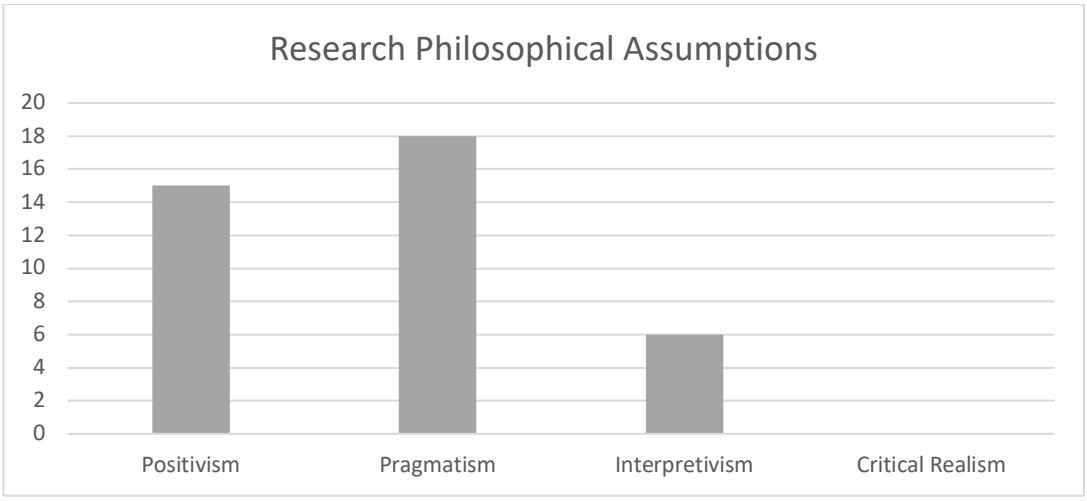

Figure 3. Research Philosophical Assumptions

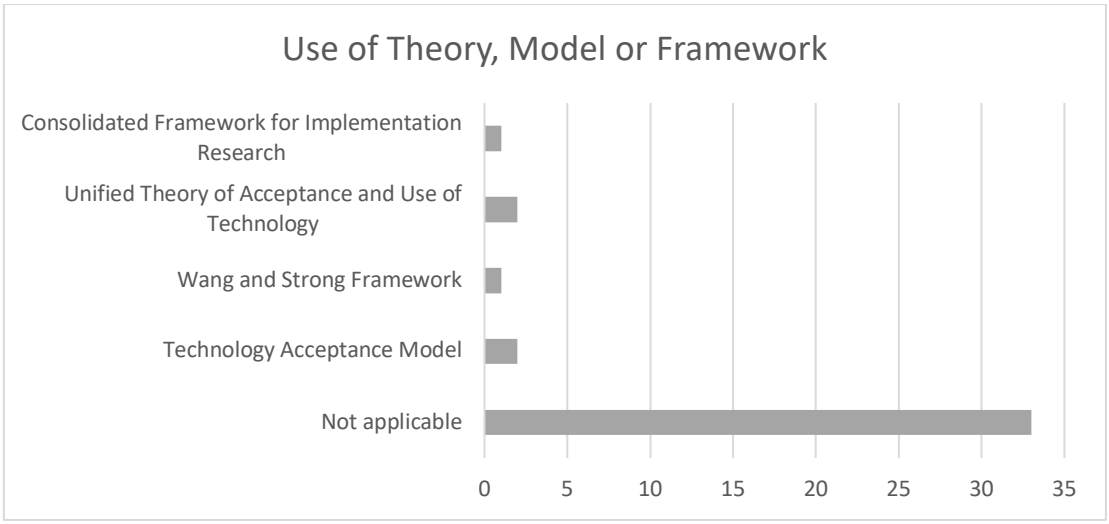

Figure 4. Use of theory, model or framework

Debates concerning how philosophical stances are taken in IS research studies impact outcomes of research studies in the discipline also extends to how they impact the methodological assumptions and theoretical frameworks. The m-Health field, for instance, has faced challenges of lack of ample evidence base for policymakers and practitioners mainly due to the methodological design adopted by scholars in the area (Chib et al., 2014; Dick, O'Connor, Thompson, et al., 2020). An experimental design, consisting mainly of Randomised Controlled Trials (RCTs) and Quasi-Experimental Design (QED), are widely adopted to evaluate m-Health interventions (Chib et al., 2014; Dick, O'Connor, Thompson, et al., 2020).

While some scholars take the Randomized Controlled Trials (RCTs) as the 'gold standard' design to evaluate the effectiveness of health interventions (Kendall, 2003; Stephani et al., 2016), it has attracted criticism due to its rigid structure and its philosophical roots in the objectivist (or positivist) traditions (Marchal et al., 2013; Yusof et al., 2008). These criticisms are often related to the oversimplified view of causation and reliance on quasi-experimental methods, which are argued to play down the richness of contextual data. The RCT approach determines the effectiveness of an intervention by comparing results from the participants in the test group and the control group. Scholars argue that the quasi-experimental design used in evaluating m-Health has limitations in capturing contextual data, which may influence research findings due to 1) reliance on rigorous statistical analysis of the data (Bamberger et al., 2016), and 2) high costs of conducting RCT designs (Dick, O'Connor, & Heavin, 2020). In addition, another stream on this debate suggests that m-Health interventions are implemented within pre-existing social contexts that influence implementation

outcomes in real-life settings (Bailey & Osei-Bryson, 2018; Duclos et al., 2017; Tian et al., 2017). Therefore, it is essential to consider the role of the social context and how it influences the effectiveness of m-Health interventions to provide detailed descriptions and explanations of the social processes involved.

3.2 Research Discipline of Scholars

Based on this review, we found that most of the scholars that investigate m-Health-based disease surveillance are from medical science and public health. This was obtained by reviewing the authors' information on each of the papers included for full-text reading. There is a severe lack of IS scholars investigating the m-Health-based disease surveillance in SSA. We argue in line with Orlikowski and Iacono (2001), that IS scholars have much to contribute to m-Health-based disease surveillance, particularly in theorising the social and technical aspects of m-Health-based disease surveillance. This is given the insights in available studies in the discipline on how social and technical aspects of IS implementations are embedded, and socially constructed and how IS successes are ascribed to multiple interpretations across different levels of assessments (Avgerou, 2017; Avgerou & Walsham, 2017; Utulu & Ngwenyama, 2019; Wilson & Howcroft, 2002). Scholars investigating m-Health have decried a lack of theorising in the field as one of its main criticisms, an area that distinguishes IS scientific inquiry (Fox et al., 2020; O'Connor et al., 2016).

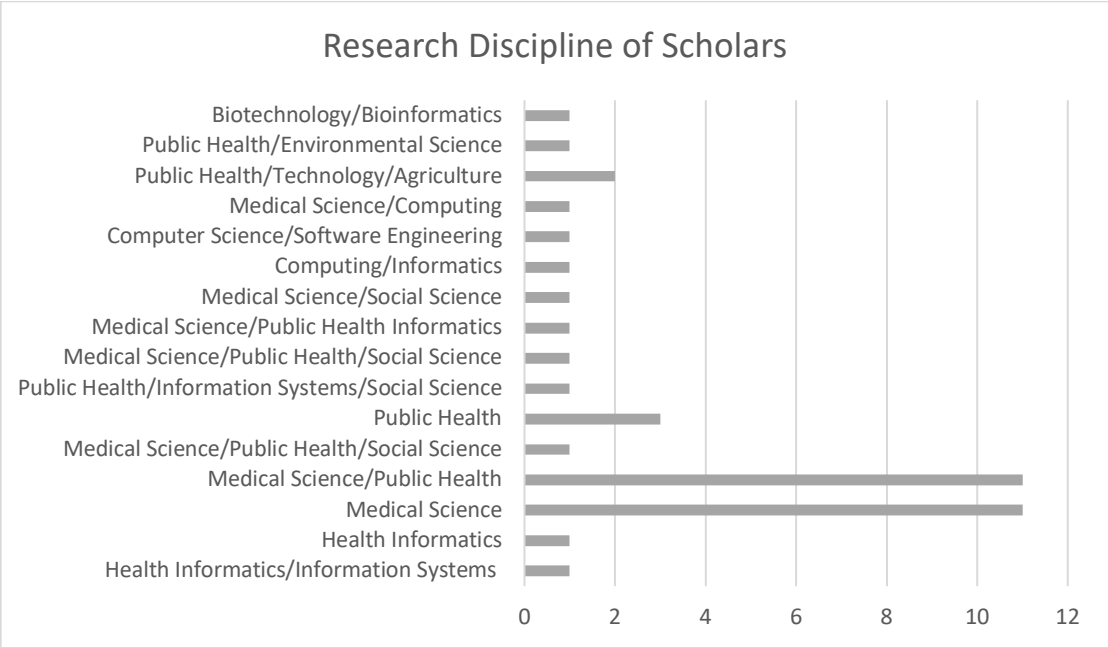

Figure 5. Research Discipline of Scholars

3.3 Conceptualisation of Mobile Devices and Social Reality by Scholars

This review argues that the research philosophy and discipline of scholars investigating m-Health-based disease surveillance in SSA influences their conceptualisation of mobile devices and social realities. Considering that the dominant philosophy adopted by scholars is positivism, mobile devices are conceptualised as objective entities directly linked to causal effects to produce an outcome. In other words, the scholars fail to consider the need to appropriately conceptualise m-Health as IS artefacts that are subjective in nature, as well as those involved in its implementation as social actors. In the context of disease surveillance, it means postulating that the adoption of mobile devices will inherently improve disease surveillance outcomes. Hence, this assumption rests upon the ideas of technological determinism propagated in the early days of technology adoption to improve organisational processes (MacKenzie & Wajcman, 1985; Williams, 2019). However, a different line of thought emerged, which rejects the ideas of technology determinism and emphasises the role of context in which the technology is implemented (Davison & Martinsons, 2015; Duclos et al., 2017). The central argument in Davison and Martinson's (2015) line of thought discourages universalistic research designs as it hardly makes considerations for cultural, institutional and environmental differences. Thus, ignoring indigenous constructs and relying on convenient data samples limits the contributions and quality of research findings. Therefore, a non-deterministic view of technology considers the role of contextual differences and how they influence technological interventions.

Understanding the complexity of the SSA context may help researchers, designers, and practitioners to understand the implementation of m-Health-based disease surveillance better and offer valuable practical insights to address peculiar sustainability challenges (Mustapha et al., 2019). For example, Larsen et al. (2017) reported an initial reluctance of community members to participate in surveillance due to fear of Ebola, however, this was overcome through community engagement. This implies that despite the availability of the mobile phones to engage in surveillance, external factors such as fear of the disease and restricted access due to conflicts or insecurity (Meteke et al., 2020), may impede the successful implementation of mHealth solutions. In addition, Brinkel et al. (2014) highlighted the involvement of policymakers throughout the implementation stages and reliable flow of information among stakeholders as key factors for successful implementation, sustainability and scalability of mHealth-based disease surveillance.

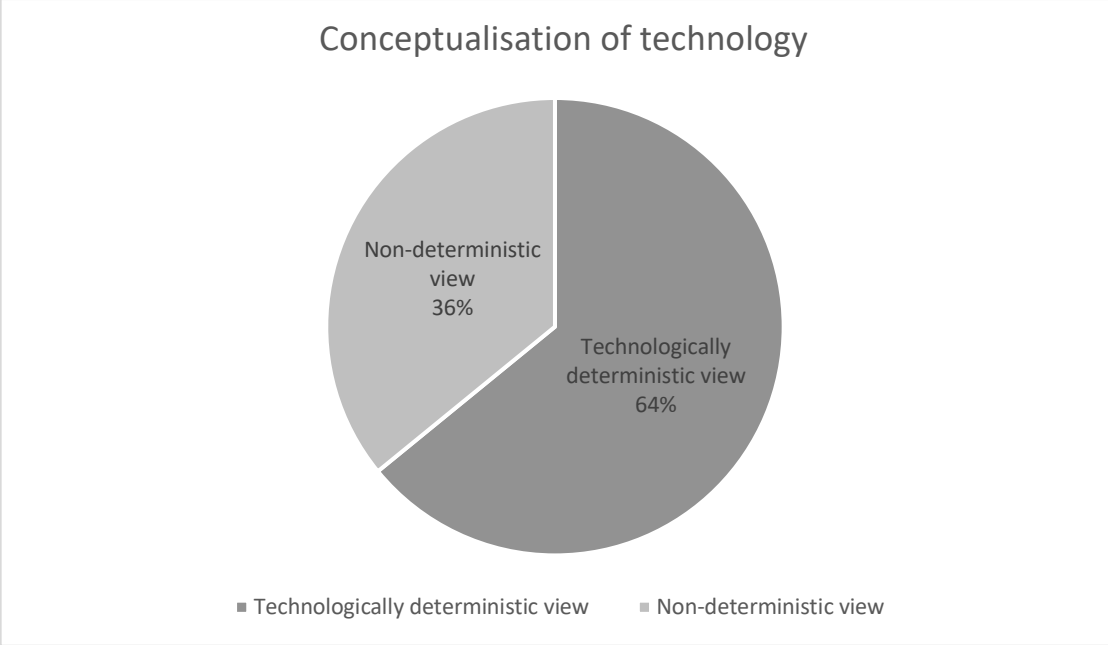

Figure 6. Conceptualisation of technology

4.0 Conclusion

This review examined the literature on m-Health-based disease surveillance in SSA over the past decade. We found that positivism and pragmatism are the dominant philosophical assumptions scholars adopt investigating m-Health-based disease surveillance in SSA. We also found many pilot studies reported from fifteen African countries in the SSA region, although thirty-three African countries reportedly use electronic Integrated Disease Surveillance and Response systems. This illustrates a need for more findings from other African countries to understand the practice in SSA better. Our results also highlight a need for more studies with more diverse philosophical underpinnings, especially interpretivism. The methodological implications can offer a more diverse understanding and valuable contributions towards enhancing the field. This will also promote a shift in the conceptualisation of m-Health-based disease surveillance from technology deterministic and universalistic views to particularistic and non-deterministic perspectives. The latter perspective may enhance understanding of the context to identify and promote indigenous constructs, useful in addressing some of the challenges and criticisms facing m-Health research in SSA. For example, the deplorable state of healthcare infrastructure, armed conflicts, political instability and civil unrests create a new dimension of challenges, especially for underserved and hard to reach communities. By presenting the findings from this

review, we have contributed to building an evidence base for m-Health-based disease surveillance in SSA, which is often underreported in the literature. We also hope to stimulate the interest of the IS community, including researchers and practitioners, to generate new insights on m-Health-based disease surveillance in SSA. Utilising the full potential of m-Health-based disease surveillance could be relevant to assist countries with limited resources to achieve the United Nations' Sustainable Development Goals.

5.0 Limitations

One limitation of this review is that it is focused only on SSA. The arguments and assumptions are mainly tilted towards explaining the realities and benefits of adopting the interpretivist philosophy to study m-Health-based disease surveillance phenomena. Time and resources constraints were also limitations of this review as they influenced the selection of the databases used based on accessibility. Thus, limiting the scope of the review. Future studies may focus on examining and assessing the quality of the findings from m-Health-based disease surveillance interventions in SSA, including findings from grey literature.

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