Evidence-based Information Systems (IS) research: the case of systematic literature review (SLR)

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January 31, 2024

Abstract

Over the last decades there have been increased in the application of information systems (IS) in the form of digital health technologies to enhance access to healthcare services, improve healthcare quality and efficiency of healthcare systems. Evidence on the efficiency of digital health technologies in clinical settings to enable the adoption and scaling up of such technologies is buried in ever increasing and complex extant literature including grey due to lack of the application of robust evidence-based research in IS. By and large, in the medical and health domain, decision-making is based on evidence-based research. In this study, we advocate for the increased use of evidence-based research using systematic literature review (SLR) as reference point in IS interventions especially in healthcare settings as digital health interventions increase. We believe the increased use/application of evidence-based research in the domain of IS will be key to identifying and scaling up relevant digital health technologies, and one step forward from "potential" as they are known for. We demonstrate this by liking IS research to medical research in various aspects. We also provide a step-by-step guide to conducting systematic review in IS including strategies on how to harness evidence through strategic use of the contentious grey literature.

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Abstract

Over the last decades there have been increased in the application of information systems (IS) in the form of digital health technologies to enhance access to healthcare services, improve healthcare quality and efficiency of healthcare systems. Evidence on the efficiency of digital health technologies in clinical settings to enable the adoption and scaling up of such technologies is buried in ever increasing and complex extant literature including grey due to lack of the application of robust evidence-based research in IS. By and large, in the medical and health domain, decision-making is based on evidence-based research. In this study, we advocate for the increased use of evidence-based research using systematic literature review (SLR) as reference point in IS interventions especially in healthcare settings as digital health interventions increase. We believe the increased use/application of evidence-based research in the domain of IS will be key to identifying and scaling up relevant digital health technologies, and one step forward from "potential" as they are known for. We demonstrate this by liking IS research to medical research in various aspects. We also provide a step-by-step

guide to conducting systematic review in IS including strategies on how to harness evidence through strategic use of the contentious grey literature.

Keywords: IS, Digital health technologies, Evidence-based research, Health/Medical research, Systematic Review

Introduction

The discipline of information systems (IS) has embraced a continuum of research approaches to enable it to continue to expand and acquire knowledge, contain its rapid innovation and to continue to provide understanding to new concepts as they emerge. Empirically, qualitative, quantitative, mixed research methods, case research strategy etc. have been extensively and successfully applied to the field of IS. IS reviews have generally been narrative and criticised for being singular descriptive accounts of the contributions of scholars in the discipline. However, literature reviews play critical role in establishing the foundation of academic inquiries. It collates and synthesises literature to establish roadmap for research – establish research agenda and identify gaps through the understanding of the length and breadth of existing body of knowledge (Webster & Watson, 2002). True and valuable gaps can only be identified after exhaustive search and synthesis of literature in targeted domains and IS is indifferent. As such, approaches to scientific inquiries and in IS for that matter need to be valid, reliable, and repeatable and literature review research is foundational to these (Xiao & Watson, 2019).

IS research has drawn its methodologies largely from behavioural theories and practices that explain human behaviour by examining the experiences and their impact. This is present in the individual's environment and the learned associations he or she has acquired through previous experience to develop IS that seek to solve specific practical world problems. On the other hand, design-science paradigm seeks to extend the boundaries of human and organizational capabilities by creating new and innovative artifact (Chatterjee & Hevner, 2010) (Hevner, March, Park, & Ram, 2004). Okoli and Schabram (2010) assert that information systems' research methods are different from those of the health sciences. Information Systems is a combination of social science, business, and computing science, whose research methods are different from those of the health sciences, from which the systematic literature review (SLR) or systematic reviewed (SR) methodology has largely been developed. For example, qualitative, quantitative, and mixed research methodologies have all been extensively applied in research in IS domain and in health as well. However, with the advent of digital health or health information systems and the increased in the innovation and application of information technologies to improve health care and health outcome, evidence-based research has become imperative in IS research. In fact, evidence-based research outcomes will serve as the basis for decisions on the development, adoption, and use of IS that solves problems, especially in patient care and health systems in general will be based on convincing evidence from rigorous research. Thus, the main aim of this article is to develop guidelines for conducting evidence-based research in IS given its increased application in healthcare in the context digital health using SLR as the gold standard for evidence-based research. We believe this will help advance from the "potential" to actual capabilities of digital health technologies, adoption and scaling up in relevant settings. To achieve this objective, we demonstrate with various components of research design on how IS research can be adapted to those of health and medical sciences and develop a step-by-step guide on how to conduct rigorous systematic literature review in this context and beyond.

Systematic investigation used in both research and operational investigations collects or analyses data to answer a specific question about a phenomenon. Thus, a systematic investigation designed for the purpose of expanding (i.e., for the purpose of developing or contributing to) the knowledge base of a scientific discipline constitutes research. In this context, this is about establishing the needed evidence regarding the application and outcomes of health technologies. This is done to ensuring the validity and integrity of trial data, customizing the plan for monitoring intervention fidelity (i.e., including all potentially variable aspects of intervention fidelity, including delivery, receipt, acceptance, and intention to use), and adopting strategies to keep pace with technology change (DeVito Dabbs et al., 2013). In other words, it is about the utilization of these technologies to create and test the equipoise and dynamism of information technology and health research theories to advance safety and adaptability in the application of information systems

and technologies in healthcare (Riley et al., 2011). As such, the establishment of facts/evidence regarding the efficacy/reliability of such technologies relies heavily on data and methods of analysing such data.

For example, with clinical trials of health interventions, clinical evidence on the use of these technologies is still patchy due to lack of evidence-based research. In fact, despite the proliferation of digital health interventions, descriptions of the unique considerations for conducting randomized trials of health IT interventions and intended consequences for use on patients are lacking (DeVito Dabbs et al., 2013). It is perceived that when comparing the pros and cons of digital health technologies, the pros outweigh the cons. However, an unintended consequence or errors from digital health systems such as computerised physician order entry (CPOE) could be fatal in addition to its known association with increased time for completion of selected physician workflow and financial challenges. For example, in the past, studies such as Berger and Kichak (2004) discovered a convincing level of association between the implementation and use of CPOE systems and expanded medical errors due to inadequately designed system interfaces as with lack of system end-user training and support.

On the one hand, IS research is defined as the inquiry into the impact from the adoption and use of IS on people's behaviour, performance of their duties, groups, and organizations (Galliers, Markus, & Newell, 2007). On the other hand, management information systems (MIS) research is defined as "the systematic investigation of the development, operations, use and/or impact of an information (sub) system in an organizational environment" (Ives, Hamilton, and Davis 1980, p.11). Both definitions emphasis on the impact of information on organizations. Research in health and medical sciences systematically investigates any impact an intervention may have on identified problem or case.

As opposed to ontology and epistemology, critical realism has no preference for methods as this largely depends upon the research question and its accompanying characteristics such as causal mechanisms. On this, Mingers, Mutch, and Willcocks (2013) contend that critical realism offers potential opportunities to shift attention away from a focus on the data and methods of analysis towards real problems and their causes. However, real problems do not occur or exist in isolation. The data provide source to the problem including identifying their causes when it is analysed using appropriate method. Grover and Lyytinen (2015) proposed that one way to overcome the challenges of agonizing over the dearth of original and bold theorizing over IT is to "generate richer data and theory and engage in faster knowledge production cycles—cycles that feed back into stronger mid-range theorizing" (P.288). When integrating theory with empirics by creating disproportionate mid-range models that are difficult to consolidate, it is critical we examine and debate the negative impacts of the field's dominant epistemic scripts and relax them by permitting IS scholarship that more fluidly accommodates alternative forms of knowledge production. One of such alternatives is literature review research that leads to conceptualisation of concepts and testing them empirically. Again, there is the need to move beyond statistical generalizability as one can observe that different researchers and philosophers have used the term generalizability to mean different things - Whether research is conducted quantitatively or qualitatively, there is only one scientifically acceptable way to establish a theory's generalizability to a new setting: thus, it is for the theory to survive an empirical test in that setting (Lee & Baskerville, 2003).

However, with all these, as foundational, methodological review of past literature as a crucial endeavour for any academic research of which IS no exemption (King & Rodriguez, 1978; Levy & Ellis, 2006; Snyder, 2019) is lacking and in IS discipline. Literature review is taken for granted resulting in scanty evidence for the formation of insight into the rest of the research processes. In fact, there is a real dearth of scientific literature involving the systematic evaluation of information systems (King & Rodriguez, 1978). This has not improved since Webster and Watson (2002), the initial senior editors for MISQ Review identified that methods of structuring and presenting literature reviews remain a challenge. Nonetheless, IS continues to evolve, resulting in the proliferation and advancement of IS technologies. Empirical studies also continue without evidence-based foundations informing such advancements and future studies. Surely, that there have been some attempts to providing guidelines for conducting literature review in the IS discipline. For example, systematic literature review (Okoli, 2015b; Okoli & Schabram, 2010), standalone literature review (Okoli, 2015a), literature review (Bandara, Furtmueller, Gorbacheva, Miskon, & Beekhuyzen, 2015), to mention but

just a few. We will summarise the key outputs of these works and more a little later. Worst yet, leading information systems journals such as MISQ, Informs, etc. do not appear to have interest in calling for such studies.

SLR provides an evidence-based research outcomes and serves as foundation for the advancement of IS development and application. For this study, we will stick to SLR. This research will contend that systematic literature review as a rigorous research method could serve as a theoretical foundation for empirical research and will be useful in linking IS research to policy and practice. Additionally, whilst systematic literature reviews provide exhaustive literature search and synthesis, there appears not any guide for building conceptual frameworks/models, which serve as foundational bedrock for testing, refining, building, and validating expanded existing and new theories in the domain of IS. We are not making the case for the literature review of every study be systematic given its very tedious nature. In fact, by far systematic literature review papers are some of the most frequently cited papers across disciplines. What we are encouraging is an increased in rigorous SLR studies that can provide reliable insight for future studies that researchers can reference to. As with a few other researchers who made attempt to address literature review shortcomings in literature review we concur with Brocke et al. (2009, p.2) in contending "that the process of searching the literature must be comprehensibly described. Only then can readers assess the exhaustiveness of the review and other scholars in the field can more confidently (re)use the results in their own research".

But first, we provide an update on the trend of methodologically focused research in IS published in MISQ as a leading journal in the discipline. As a result, we retrieved 21 MISQ IS methodology-related studies and 1 from Informs for detail review to provide a trajectory for future related studies as the field continue to evolve. We did not find any systematic literature review study in the history of MISQ. In Table 1 below, we summarised characteristics of retrieved publications for detail analysis.

With its origins from the social sciences, mixed methods have now been embraced by other disciplines including but not limited to medical and health sciences, nursing, social and mental health, etc. (Wisdom & Creswell, 2013) and in IS as a social science discipline. Mixed research methodology provides the needed environment for researchers to achieve a better understanding of a phenomenon being researched by exposing relevant "connections" in the context of complementarity, completeness, developmental, expansion, corroboration/confirmation, compensation, and diversity (Venkatesh, Brown, & Bala, 2013). Better still, mixed research methods also help in uncovering "contradictions" in the context of gaps, unexplained findings and inconclusions that exist between qualitative and quantitative data (Shorten & Smith, 2017). The opportunity to integrate data allows for triangulation, laying the foundation for rigorous analysis and interpretations of phenomenon from wide and far, resulting in the development of novel or grounded theory that can be tested. The debate on when mixed methods research is most appropriate is on-going. However, one understanding is clear – the ability of mixed methods research to offer rich insight into various phenomena and develop novel theoretical perspectives. As suggested Venkatesh et al. (2013), if little attention can be paid to paradigmatic or cultural incommensurability when the research question, purpose, and context requirements have all been met, the questions that need to address this broad proposition in the context of IS are: what research questions can appropriately be answered by mixed methods research? What research purpose can be addressed using mixed research methods? And of course, the question of in what context in IS can mixed research methods be found to be appropriately useful or applicable?

Whilst advocating for case research strategy, Benbasat, Goldstein, and Mead (1987) reiterated that the goals of the researcher and the nature of the research topic influence the selection of a strategy (Benbasat, 1984). Following the recommendations by Yin (2003) on when to appropriately apply case study approach, Benbasat et al. (1987) emphasised on three situations/or reasons to validate the application of case study research in IS. They are: IS in practice or use in its natural settings, e.g., in organizations to help answering the "how" and "why" questions to gain insight into the nature and complexity of IS in use; and to research an under-research area. The relevance of case study is its potential to link research to practice. Case study research in IS is likened to systems requirements elicitation for systems development. Over time, a holistic/comprehensive and exhaustive secondary research on case study research will produce valuable outcomes that will enable

academics in partnership with practitioners to offer insight into the future of IS as with guidelines describing how organizations could adopt, digitally transform, and manage the transition process sustainably given the technological change and innovative nature of IS.

As pioneers of case study research approach, Stake (1995) and Yin (2003) premised their philosophy on case study on constructivist paradigm. Constructivists claim that truth is relative and that it is dependent on one's perspective. Although constructivists are inclined on saying that truth is subjective and dependent on the experience of the individuals, there is a limit to the degree of subjectivity, which does not allow a sweeping shift in the meaning of the context of a phenomenon being studied (Baxter & Jack, 2008).

IS discipline is known for its dynamism and enduring unabating change and innovation. There is acknowledgement for the need to cope with such dynamism as with keeping up with change and innovation. By and large IS research has been based on quantitative and positivist experimental models to determine relationships among variables (factors) and their impacts and the overarching impact of this relations on outcome variables or a concept of interest (Kaplan & Duchon, 1988). These relationships have generally been among technology, processes, people, and organizations. The interpretations and conclusions from these relationships provide insight for IS improvement, development, and advancement. As such, instruments used in establishing, determining, and measuring these relationships need to be credible – would have gone through validation process with high level of fidelity. 11 years after Straub (1989) called for new efforts to validate the positivist, quantitative instruments that IS researchers were using, it is unclear whether the 17% that reported reliability, 13% that validated their constructs or 19% that either utilizing pre-test or a pilot test has improved both in terms of percentages and rigorousness. Given the dynamic and innovative nature of IS, relying on archaic research methodologies and other older research resources, then we might be losing track of the real progress and advancement made in the discipline and those yet to be made. To determine the progress made in instrument validation, there need an exhaustive or comprehensive review of literature over a period determined to hold relevant milestones in the history the discipline to establish a new starting point for the future of the discipline.

Generalizability has the tendency to be used inappropriately. However, in a profound critique on this matter, Lee and Baskerville (2003) concluded that be it in case study environment or statistical premise, theory may never be generalized to a setting where it was never tested empirically tested and confirmed as with no sample size or the number of sites in a multisite case study would be an indicator of greater generalizability of a theory to new settings. Indeed, depending on the of individuals and the peculiarity of such experiences, unknown biases in collected data in both scenarios limited opportunities for subjects to freely say what they feel about a research subject. Do people choose answers that best relate to their understanding or that is there could have been a more suitable words/phrases as pertaining to individuals. And if these two are not sufficient to validate generalizability why would researchers not stop generalizing their research findings? What are the best research approaches those researchers can confidently use to generalize findings?

Behavioural and design sciences are the hallmark of IS research (Hevner et al., 2004). Hevner and colleagues expound that whilst behavioural science paradigm sought understanding and establishment of theories of human and/or organizational behaviour, design science sought to advance the boundaries of both human and organizational capabilities by creating new innovative products. As briefly touched on early, the relationships between humans, technology and organization epitomises the discipline of IS. Given their very abstract nature, the scopes of the concepts of human and organization encompass the understanding of creative nature of human and vision of organization and the sustainability of such creativity and the realization such vision. The ability of IS to create value lies in designing and developing products that support such creativities and vision and adapting their changing nature. Hevner et al. (2004) note that Benbasat and Zmud (1999) "argue that the relevance of IS research is directly related to its applicability in design, stating that the implications of empirical IS research should be implementable, ... synthesize an existing body of research, [or] stimulate critical thinking among IS practitioners. For this to be achieved, there need an exhaustive synthesis of existing knowledge on relevant empirical IS research to gain insight into the trend of existing technologies to establish evidence sufficient to warrant implementation of outcomes of empirical

studies. This exhaustive synthesis would be multi-facet/level structured but adaptable in its approach to establish facts that encourage critical thinking among IS practitioners.

No one approach to information systems research can provide the richness that information systems, as a discipline needs for further advancement. Recently, top journals including MISQ have focused intensely on theory expansions and development and less on research methods. If this study as with many others is anything to go by, we can attest to the aged of existing research that renews energy for research methods in IS.

Literature review as a research methodology in IS discipline has not received sufficient attention. At the same time, extant literature from empirical studies is growing at an exponential rate with rich knowledge that need to be collated and synthesised for purposes not limited to identifying needs for further research, develop theories, provide answers to formulated questions, and gain insight into research trend. Some common examples of literature review are the narrative review, SLR, the semi-SLR, and the integrative review.

Narrative literature reviews are "are comprehensive narrative syntheses of previously published information" (Green, Johnson, & Adams, 2006, p.103). Other types of narrative literature review are commentary and editorial (Carey, 1998; Gray & Chambers, 1997). The commentary type of narrative review that are expression of an opinion and are usually shorter than full length review articles. Authors usually synthesis extant literature that aligns or justifies the opinion of the author. The very "opinion" nature of commentaries make them bias given that they tend to focus on the perception or philosophy of the commentator. Editorials, as the name suggests, are usually written by editors of journals in which they synthesis existing literature on current issues. They are short and narrowly focused. Depending on how they are written, editorials are not always narrative reviews (Green et al., 2006, p.103).

Integrative review is usually a literature review that is conducted for the purpose of developing/discovering theoretical framework (use of this theory). Theoretical frameworks provide the required structure within which researchers can situate their research paradigms in the context of philosophy, epistemology, methodology and critical analysis (Adom, Hussein, & Agyem, 2018; Grant) in synthesising relevant literature to derive concepts.

SLR, which we are advocating for in IS research is the gold standard for evidence-based review developed within the medical discipline given its convergent nature when gathering facts for evidence-based practice. Information systems reinforces evidence-based practice given its ability to capture, process, and store data as evidence for decision-making. "If the raw data is valid, then the processed data, or "information", can be considered as equivalent to evidence" (Rodrigues, 2000, p.1344). Information systems used in clinical settings are used as interventions for improved healthcare delivery.

We retrieved 10 MISQ IS research methodology-related studies for detail review to provide a trajectory for future related studies as the field continue to evolve. In the table below, we summarised the characteristics of retrieved publications.

Table 1: MISQ IS research method related studies

Source: Developed for this study

Extant guidelines for conducting literature reviews in various disciplines including business Snyder (2019), psychology (Baumeister & Leary, 1997), management (Tranfield, Denyer, & Smart, 2003), human resource (Torraco, 2005), medicine (Liberati et al., 2009; Wong, Greenhalgh, Westhorp, Buckingham, & Pawson, 2013), social sciences (Davis, Mengersen, Bennett, & Mazerolle, 2014), marketing (Palmatier, Houston, & Hulland, 2018), and (Onwuegbuzie & Frels, 2016). For IS, we found the works of Okoli and Schabram (2010), and Okoli (2015a). A phrase we consistently came across in literature was "comprehensive literature review". Specifically, we were concerned about the term/concept "comprehensive". This term seemed to be used interchangeably with "systematic". However, they do not mean entirely the same. We perceive that in the context of narrative literature review, "comprehensive" may be the most appropriate terms whilst in systematic literature review, "exhaustive" may serve a better purpose. Unfortunately, majority of authors

do not comprehensively search and synthesis extant literature, which effectively impact the generalizability of the findings of such studies. As one editor-in-chief asserts in response to a narrative review/conceptual paper we wrote:

"Nowadays, systematic reviews have increasingly replaced traditional narrative reviews and expert commentaries as a way of summarising research evidence. Examination of quantitative and if possible, with qualitative evidence or a mixed-method systematic reviews are highly desired".

The rigorous standardized methodology for conducting a SLR that has developed from the health sciences and other fields is virtually unknown in IS research (Okoli & Schabram, 2010). However, more and more healthcare services now heavily rely on IS for improved delivery. For example, the increased use of digital health to support evidence-based practice (Agarwal, Gao, DesRoches, & Jha, 2011) and to better generate evidence and deliver evidence-based care.

Evidence-based Research in IS – the like of Medical Research

We expounded the themes used by when comparing medical research and management research

2.1 The nature of the IS discipline

Drawing on sociology of science foundations, Taylor, Dillon, and Van Wingen (2010) posit that to survive and prosper, health applied disciplines must meet the dual demands of academic and practitioner audiences by demonstrating both focus and diversity in their research. The nature of the IS discipline can be likened to that of medical field in the context of convergent and management in divergency. Convergent in the sense of gathering and collating facts and relationships among key findings in relevant studies. Thus, the extent to which two measures of variable that theoretically should be related are indeed related is a consideration often used in sociology, psychology, and behavioural sciences. The objective of this concept lies in the need for existing relationship between/or among key findings from selected multiple studies from practice and interventions to serve as evidence for decision-making. In fact, IS and the continuous emergence of Internet-based health information technologies and other decision support systems provide evidence-based knowledge. It is the power of being able to attribute causes to effects through accrued evidence. For example, it would have been useful if there was sufficient evidence to support providers to know when to appropriately order telemetry and appropriately discontinue telemetry when it was no longer medically indicated.

IS is a combination of social science, business, and computing science and increasingly of health sciences. Divergent thinking capability has become increasingly important for innovation and problem solving and in a spontaneous, free-flowing manner, many ideas are generated in an emergent cognitive fashion (Ni, Yang, Chen, Chen, & Li, 2014). The discipline of IS, particularly IS, e.g., IS Strategy tends to be more abstract and exploratory with flexibility to respond to the ongoing rapidly changing needs of businesses. This can be achieved through the exploration of emerging business trends with new evolving models for the development, implementation, and use of systems in various application domains: IS strategy and business outcomes; Internet applications, computer-supported collaborative work, virtual teams, and knowledge management (Taylor et al., 2010). The nexus between medical research and management research is IS research. On this, the study by Tranfield et al. (2003) provides the difference between medical research and management research. This allows researchers in IS to operationalize both convergent and divergent in the context of "Nature of the discipline". We demonstrate this by adapting these differences. Early on we contended that the definition of IS was narrow due to its exclusion of health sciences and given the increasing role of IS in healthcare domain.

2.2 Research culture

IS has demonstrated both rigorous scientific evaluation and the split between positivist and phenomenological perspectives. In fact, "the essence of Information Systems as design science, for example, lies in the scientific evaluation of artifacts" (Iivari, 2005) in (Chatterjee & Hevner, 2010) (Hevner & Chatterjee, 2010). According to Smith (1998), positivists attitudes toward sociology are of the view that objective or hard facts and the relationship between these facts are foundational to scientific facts. For positivists, such laws have the status

of truth and social objects that can be studied in much the same way as natural objects.' These hard facts are the objective (quantitative) and the technical aspects of IS that are logically established and programmed into systems with defined functionalities or outputs and excludes any priori speculations. For example, embedded business rules, primary keys, and other information systems functionalities that are not subjected to broad discourse and varying outputs. On the contrary, phenomenology is generally qualitative and subjective, more abstract and draws on divergence and exploratory. Again, in IS non-technical and managerial decision-making based on the outputs from sets of computerised set of systems and procedures. For example, digital transformation, IS Strategy and other management related issues.

2.3 Research questions

In medical field, research questions are based on high level of unanimity given defined healthcare cases. The formulation of research questions is based on evidence gathered from scoping and systematic literature reviews. Scoping reviews are used to mapping broad topics, identify knowledge gaps, scope a body of literature, clarify concepts, investigate research conduct, or to inform a SLR (Munn et al., 2018; Pham et al., 2014). These are part of the evidence-based guidelines (EBG) and Model Process and Grading of Recommendations Assessment, Development, and Evaluation (GRADE) framework for developing, implementing, and evaluating EBGs in the prehospital care setting (Patterson et al., 2017). Similar models and processes for formulating research questions are developing in IS with digital health reshaping how healthcare is delivered and their evaluations using gold standards such as randomised controlled trials (RCTs) to determine how efficacious with evidence these systems are for scaling and implementation/adoption. See for example, Fatehi, Smith, Maeder, Wade, and Gray (2017). We see the use of common IS products in various service and production industries. Similar approaches could be used for formulating relevant questions for research in IS.

2.4 Interventions and evaluation

In the medical discipline, interventions can be measured through experiments – laid down procedures agreed on consensus to be followed to make discoveries, and test hypotheses. This is applicable to the implementation and use of IS given their technical nature in several settings although digital health interventions, for example, are characteristically complex with multiple components and potentially multiple goals, which give rise to evaluation methodological challenges, they can be measured through experiments. Whilst experiment does look less applicable in the management domain, it does also imply that the introduction of IS is not always a technical issue, necessitating the addressing of softer or management issues. In IS, interventions may not follow laid down procedures to measure the extent to which such systems influenced or changed identified/existing and targeted situations play similar roles. For example, IS can serve as intervention or be used to facilitate processes that improve behavioural health lifestyle through capturing relevant data (Penn, Goffe, Haste, & Moffatt, 2019). In addition to capturing data, there are other IS interventions that seek to ensuring that such data have met required quality through specific interventions. For example, interventions to improve routine health information system data quality and use for decision-making (Lemma, Janson, Persson, Wickremasinghe, & Källestål, 2020). Such an intervention can be evaluated by investigating actual system use, user needs, varying user experiences, user expertise and system user friendliness, and training. Again, in some cases, ISs are introduced to improve operations in organizations (Maguire & Ojiako, 2007). Generally, scholars have used IS Success Model as a theoretical base in a bid to understand the impact IS technologies on user behaviour and how that translates into overall improvement in services. Such improvement could be efficient resource allocation, improved hospital admission process in the context of reduced waiting time/queue to admission in the hospital. Again, user satisfaction and systems usage are by far the most widely used factors to evaluate the effectiveness of IS systems. Whilst the effectiveness of such user systems may vary depending on a range of factors including user acceptance and support as with training and change management issues, there could be the development of standardized system evaluative tools for various systems in the equivalence of medical practice guidelines established on consensus and by authoritative bodies. Similar roles could be assumed by accredited IS bodies.

2.5 Research designs

The objective of research design is to inform details of how a research is being conducted. It talks about "how" every activity in the research was carried out (procedures) including but not limited to the source of data and how it will be collected, how research questions will be formulated, how they be answered and theories where applicable. A design would have explicitly provided information about the study type, described the study population and sample size with justification, the unit of analysis and measuring technique. Several research designs have been adopted in practice to help evaluate IS interventions, in particular digital health interventions. Research designs in the medical field are influenced by a hierarchy of evidence from existing literature. This evidence must be based on exhaustive search and collation of literature in a systematic manner. Similarly, in IS, the achievement of validity and reliability are fundamental when using quantitative research and questionnaire instrument for that matter. When using qualitative research method, validity and reliability are achieved through triangulation, the use of multiple data source with a succinct explanation of strategies used in collecting data including meticulous design of interview guide. Of the four triangulation types, namely method, investigator, theory, and data source type, the data sourced type is used by most qualitative research on human phenomena in many cases to test validity (Carter, Bryant-Lukosius, DiCenso, Blythe, & Neville, 2014). However, the challenge with multiple data types is scope and the level of consistency or fidelity regarding the instruments used in gathering the data. IS research has enjoyed designs from both medical and management.

2.6 Theory

A theory not only explains known facts; it also allows scientists to make predictions of what they should observe if a theory is true. Theory expounds facts by providing scientist with the framework to ask questions about the reality. However, the "lack of consensus on exactly what theory is may explain why it is so difficult to develop strong theory in the behavioural sciences [given the growing scholarship on that] references, data, variables, diagrams, and hypotheses that are not theory" (Sutton & Staw, 1995). Additionally, over time IS as a discipline has been gaining traction in the medical field. In medical field, attention has been paid to what works, why it worked and how it worked. For example, did the intervention brought about the expected change or improvement in accordance with implementation fidelity or integrity. This logic of whether a digital health intervention brought about any expected change, why and under what conditions could be of great importance in generalizing the outcomes of IS interventions.

2.7 Aims of policy

Decision-making across building blocks of all health systems is based on reliable information that is available to authorised persons in the context of data-generation, compilation, analysis, and communication and use (World Health Organization, 2009) to provide scientific evidence. Reliable information is also fundamental to developing health systems policies and adoption, health research as with governance and regulation. For example, IS systems are used to capture relevant information about health interventions. To achieve this, such IS systems need to follow existing medical intervention structured procedure. As opposed to multiple and competing policy aims of IS in non-medical disciplines, IS interventions in the behavioural sciences are now beginning to streamline towards achieving specific outcomes. Overwhelmingly, these outcomes are all geared towards improving organizational performance as with the aim of digital health. Digital health improved used of digital technologies including data and information technologies to improve healthcare delivery by helping to live heathier lives whilst taking greater control of their lives. In fact, the policies and aims of digital health transcend reducing illness and death to include sustaining such achievements by offering people greater control over through access to relevant health information. Where there are multiple policy aims, aspects of larger systems would be tailored for various components. For example, a Business architecture, Information architecture, Technology architecture

2.8 Methods

In the domain of IS, two dominant methodologies have been used by researchers: Action Design Research and Design Science Research (Chatterjee & Hevner, 2010). These main research methods lack operational processes and decision support tools that are rigorous (Mandran & Dupuy-Chessa, 2018) with any fidelity

that can be verified. For example, the problem with the extensive use of end-user characteristics is the lack of evaluative process to verify the validity of relevant qualitative data collection tools and whether the outcomes of such studies are generalizable. It is often said that quantitative research is a theory in search of data, while qualitative research is data in search of a theory. To improve system interactions with users, ISO9241210 has outlined three main user-centred design. They are requirement elicitation from users, which uses mainly qualitative data collection method; the design phase that develop systems in collaboration with users through workshops and focus groups; and the quantitative evaluation (experiment). The shortcoming of this user centred design is the lack of baseline to measure the impact of such systems. A baseline could be the established post-phase one of the user-centred design. As a result, an exploratory sequential mixed method, for example, prior to phase two to develop rigorous instrument to confirm the findings of phase one is very useful. This will improve the reliability of findings of the evaluative or experimental phase.

2.9 Literature review

Literature review is defined as the collection, synthesis, and evaluation of published studies. Published studies could be primary, secondary, and tertiary. Primary literature review makes use of materials encompassing empirical studies – ranging from observation, interviews, to experimental and is meant to provide an assessment of what has been published on a topic of interest mainly of actual practices. The secondary literature derived from the exposition of the primary literature sources are generally reviewed studies. These studies could be narrative, systematic, semi-systematic and integrative. Authors of these studies integrate primary literature studies through synthesis, thus, further expanding on the findings of primary literature studies. The outcomes of this type of literature review have the potential to be generalizable. The tertiary source encompasses the distillation and collection of materials derived from the hybrid of primary and secondary literature sources, for example, textbooks, guidebooks, encyclopedia. Thus, the purpose of the tertiary literature is to offer an impression of important findings of existing studies or research. One of the importance of a tertiary literature review is its ability to introduce principles to practices in a discipline. By far this type of literature review is the least used one in academia. Literature can either be narrative or systematic. Narrative review is the conventional and the oldest means of studying extant studies and is generally qualitative with no particular "formal" guide for undertaking it. As a result, it does not generally seek generalization. Below, we provide an overview of systematic literature review.

Literature review in the medical field has largely been systematic and meta-analysis providing a quantitative evidence for reliable conclusion and generalizability (Tranfield et al., 2003). Narrative literature review has been used extensively in the non-medical field to provide basis for further exploration of multi-facet and ongoing changes of situations and a timely response to the experiences of people/subjects and situations. Whilst not generally generalizable, it serves a great purpose for providing immediate overview/understanding of existing and new phenomena using varied methodologies including socio-cultural, natural and library and processes in the context of data collection and conception, data analysis, and data reporting (McAlpine, 2016). It is interesting how researchers can draw conclusion from a narrative literature study given unstructured nature. There must be some assurance that the study is comprehensive and has covered prominent research of the given time. The selection of and critically analysing large set of literature from varying sources is appearing to be relevant to produce generalizable results.

Often, and generally, SLR studies selection criteria have been one that is based on published empirical materials. A concern with this criterion emanates from the fact that "there is a growing recognition that often evidence is difficult to find because of decisions that are made about where, how, and when to publish the results of studies based on the findings of those studies" (Balshem et al., 2013, p.1). This makes room for undetected biases in publish materials. One of such sources of materials is the grey literature. Grey literature is literature from unpublished reports from government and others such as dissertation that is now being touted as becoming an important additional source of literature towards evidence-based studies. The Institute of Medicine and the Agency for Healthcare Research and Quality (AHRQ) and current Cochrane guidance made recommendations to this effect. Generally, useful interventions are published far more than interventions that produced negative poor outcomes. Whilst the inclusion of grey literature is being encouraged, the impact

of their exclusion has been found to be relatively small or negligible. Given both technical (structured) and non-technical (abstract) nature of IS, the careful collation and consolidation of materials from grey literature and unpublished dissertation and theses will be useful. Like in management this will help respond directly and timely to changing practice and policy needs. Whilst majority of SLR studies searched for non-English and unpublished papers, less than 5% of these studies are included for full review (Hartling et al., 2017).

As research continue to grow and information explodes in the discipline of IS, literature reviews have increasingly become crucial in the definition and understanding of IS for academics, practitioners, and policymakers alike.

Overview of systematic literature review

In the medical and public health fields, SLR has been hailed as a gold standard methodology for evidence-based research since the establishment of Cochrane Collaboration in 1993. In the discipline of IS, a rigorous systematic literature review study would be critical to collate and summarise evidence on how IS technologies, specifically digital health technologies are improving healthcare delivery and outcomes. Currently, digital health technologies are generally known for their "potential".

SLR approach is already in use in the IS research. SLR requires thought, probing of concepts, interrogation of assumptions and expectations, and a considered appraisal of where a SLR might fit into the general scheme of knowledge and keep expanding in the domain of research that apply it. Can machines be trained to apply the criteria of inclusion and exclusion? Can machines be trained on how to apply assessment of bias? (Gough, Oliver, & Thomas, 2017). Theory-based SLRs, which summarise evidence on what works, when and why, strive for more than greater policy relevance. In fact, they strive for premise for decision-making by top management in practice. For example, in the assessment of the evaluation process of MIS products, King and Rodriguez (1978) categorised assessments into four categories – attitudes, value perceptions, information usage, and decision performance. Holistically, each of these categories requires a systematic evaluation that is exhaustive of existing literature to gather evidence on these categories to avoid the pitfalls of common scientific basis, fallacy of affirming the consequent, summative validity and called for basic reasoning that accommodates the latest developments in positivist, interpretive, action, and design research (Lee & Hubona, 2009). This ultimately leads to technology adoption mindfulness in an era populated with mundane and bleeding edge technologies. This is the case for digital health technologies. These technologies still lack rigorous evaluations as with methods used in evaluating them to provide sufficient/reliable evidence on their functionalities and the most suitable circumstances in which they will be more beneficial. Reviews that answer these questions adopt a mixed methods approach and draw on a range of study types. Answering the 'what works' and 'what doesn't' questions mean drawing on effectiveness studies, conducted to standards of high-quality impact evaluation. But in formulating answers to the 'when' and 'why' questions require a broader range of evidence from both quantitative and qualitative research (Snilstveit, 2012) for policy relevance. Ideally, this would normally be theory-based SLRs, which are usually mixed method-based reviews (White, 2018). According to White, mixed methods review is one which draws on a variety of evidence, factual and counterfactual, qualitative and quantitative, to address different questions along the causal chain (p.1). Drawing on different types of studies theory-based SLRs are policy-focused (Snilstveit, 2012). Both theory-based SLR and health technology assessment (HTA) are all theory-focused evaluations.

Let us look at the concept of Health Technology Assessment (HTA), which is the application of organized knowledge and skills in the form of devices, medicines, vaccines, procedures, and systems developed to solve a health problem and improve quality of lives" given the rampant medical errors and system inefficiencies during the pre-digitization. The World Bank also defined HTA as a complete policy-focused research that evaluates short and long-term impact from the application operationalization of technology, which include but not limited to benefits, costs, risks (World Bank, 1995), and accessibility/availability. With advanced health information technologies such as electronic health/medical records and many more the domain of health care has witnessed improvement in every facet of its management and administration. From improved communications between healthcare provider and consumer to improved medication safety, tracking, and reporting; and promoting quality of care through optimized access to and adherence to guidelines" (American

College of Obstetricians and Gynecologists, 2015, p.1). Health technologies can range from medicine and medical devices, and pharmaceuticals as with computer-aided information systems such as electronic healthcare records (EHR) systems, health information exchange (HIE), personal health records (PHR), national information networks, 3D printing, Artificial intelligence (AI), etc are examples of computer- supported IS. Again, a revisit to the definition of IS provides an understanding of the social-technical aspect of IS vis-à-vis people and their roles to accomplish task using technology. The challenge remains with the availability of limited contribution of high-quality evaluations resulting in ungeneralizable reviews in the context of policy and practice implications, necessitating the need for further rigorous studies. Whilst substantial progress has been made, however, there challenges with the wider adoption of health information technologies given the lack of concrete evidence to answer 'when' and 'why' questions in the adoption of these technologies, costs and risks associated with such technologies would need a structured-procedure/process-based evaluative methodology with fidelity. These requirements fit well into SLR.

There are not many studies that have provided guidance for conducting SLR in general. Existing ones include (Okoli & Schabram, 2010; Onwuegbuzie & Frels, 2016; Tranfield et al., 2003). The guide/steps recommended by these authors are summarised in the Table 2 below.

Table 2: Existing works on how to conduct SLR

Whilst these guides do provide straight-forward steps for conducting standard SLR, we believe they appear too general. Systematic literature review needs to be structured in the true sense of structure – specific and procedural in ways that allow for easy replication for similar outcomes/conclusion, which is the essence of evidence. For example, what are the pre-SLR preparations? What are the strategies that are used for searching the literature? Many more concerns need to be addressed/transparent and form part of methodological or studies given SLRs help in the systematic and exhaustive search for, collation/organization of relevant literature for analysis and dissemination of evidence?

In the IS discipline, gathering evidence has become paramount as data and information have increasingly become critical for every service improvement. SLRs aid the analysis and dissemination of evidence, using rigorous and transparent methods to generate empirically attained answers to focused research questions. Identifying all evidence relevant to the research questions whilst an essential component, is also a challenge of SLRs. Below, we present steps to follow when conducting SLR not limited to the discipline of IS.

Step 1: Pre-SLR preparations

3.1.1 Select belief and topic that align with your research interests.

To begin any literature research, researchers must first identify the need for such a research – topics and what problem(s) have been identified. In other words, researchers need to establish the purpose for such a research, thus, the summarising all extant information about a phenomenon to establish evidence capable of being generalized. Literature review is used to justify a need for research through A thorough identification of the need for the research sets the basis for step 2 below. In fact, it is the identification of research gaps that need to fill. To identify research gaps, a reasonable amount of reading is necessary to establish research gaps. When doing this reading, researchers tend to touch on wide range of extant literature, which enable them to narrow down to focused areas.

Conduct scoping reviews on published and unpublished (grey) literature

As the name suggests, scoping reviews are carried out to map out the extent of available literature on a chosen topic and their general overview, preparing grounds for SLRs without necessarily paying attention to quality and other specifics. Scoping reviews are focused on helping to answer the question: "What information has been presented on this topic in the literature?" and for gathering and assessing information prior to conducting a SLR (Munn et al., 2018). Thus, scoping review is used to derive specific questions to answer in SLR. Steps involved in conducting scoping review has been outlined by Munn et al. (2018).

Grey literature

Grey literature is literature or evidence not published in commercial publications or journals outlets. Among others, grey literature could range from theses and dissertations, academic materials, ongoing research, working papers, briefings, conference papers, discussion papers, government reports, and evaluations. There is debate among evidence-based researchers on the inclusion of grey literature when conducting SLR given their very nature – not peer-reviewed. We also need to be aware that more recently, Open Access journals are prone to publishing research that were rejected by non-open access journals for poor quality due to exorbitant article processing charges as they are increasingly doing so. We contend that the challenges of including grey literature in SLRs are not embedded in the quality of the materials, but rather in the search strategy. A carefully thought-out grey literature search strategy may be an invaluable component of a SLR by thusly reducing publication bias, increase reviews' comprehensiveness and timeliness, and foster a balanced picture of available evidence (Paez, 2017). Grey literature is a key part of the evidence produced and used for public policy and practice as posit Lawrence, Houghton, Thomas, and Weldon (2014). The authors found that "the most important or very important resources that policy makers use are reports (81%), journal articles (75%), discussion papers (69%), briefings, reviews and guides (66%) and data sets (61%) demonstrating the relevance of grey literature in policy and practice. The findings of Lawrence and colleagues only intensifies the ongoing debate on whether to include grey literature or not in SLR. These said, the main challenges of including grey literature are how to search or locate them as with how they meet the methodological requirements of articles to be included. Whilst we do not necessarily subscribe to any camp of this debate, we believe a scoping review on grey literature will provide an invaluable insight into the broader evidence out there and help set some expectations in scoping review on published literature. The outcome from these reviews will inform a more relevant research question for the actual SLR.

3.2 Step 2: Set your inclusion and exclusion criteria.

Prior to commencing the actual search activity, the researchers need to develop a protocol to guide the selection of would-include and -exclude study materials. This is determined after the research question has been formulated and is used to set the delineations – in/out-scope of the study. Inclusion criteria are the factors that an extant study must have to answer the focused research question set. On the contrary, exclusion criteria are all the characteristics of extant study that do not in any way contribute to answering the research question. These criteria could be study objective or purpose, year study was carried out or published, peer-reviewed, study methodology, study population and sample size, age, language in which study was published, geographical location of study, theory-/non-theory-based review etc.

When the study is theory-based, inclusion and exclusion criteria should focus on IS interventions that have been evaluated and the use of theory of change. Over the last decade or so, IS has seen increased in implementation science, an equivalent of process evaluation to verify the fidelity of system implementation activities. For example, there is no doubt about the effectiveness of digital health. However, little is known about the unintended consequences of digital health from a system point of view, making it difficult to institutionalize eHealth into routine care as with the challenge of reforming health policies in this regard.

In IS, evaluation is the appraisal of the quality and value of the characteristics/functions of systems and their impact on end-user and on business operations in an organization. It is "the act of measuring or exploring properties of a health information system (in planning, development, implementation, or operation) (Ammenwerth et al., 2004, p.480). Conventionally, evaluations in IS has been impact evaluation, an assessment of how an IS intervention been assessed affects existing conditions to bring about needed change. For example, when evaluating the effectiveness of an IS, attention is focused on the impact of an implemented system on organizational/business operations in the context of the effectiveness of users and other outputs (Hamilton & Chervany, 1981). Again, this could have also been how the feature/functionality of a system impacted end-user perception. Furthermore, the evaluation of health information technologies for high-quality, safe and cost-effectiveness to improve quality of and increase access to healthcare. IS requires rigorous and effective evaluation with fidelity. "Interestingly, change theory has not been much explored in IS research.

A SLR protocol provides guides for undertaking systematic literature review study and help to minimise risks of bias whilst optimising standardization/uniformity resulting in increased transparency and fidelity.

It is a mini-guide or reference within the broader guide for conducting SLR. In fact, the protocol services as a quick reference tool for the researcher(s). Components of the study protocol include but not limited to the research question to be answered, study selection criteria and procedures, eligibility, checklist for study quality assessment, search strategy, etc. (Kitchenham, 2004) and above all the methods for performing synthesis (Ryan, 2019). Examples of tools that help in developing protocol are PRISMA checklist, Theta Collaborative tool, Cochrane Review handbook, AMSTAR checklist.

3.3 Step 3: Search strategy/define your search terms/phrases.

An important characteristic of SLR is replicability. However, formulating search strategies to be used for SLRs, finding the best balance between sensitivity and specificity, and translating search strategies between databases is challenging (Bramer, de Jonge, Rethlefsen, Mast, & Kleijnen, 2018). It takes thorough preparation, including scoping reviews to understand the extent of scope and relevant concepts to derive research questions and ultimately, search strategies that captures every part of the research question. To achieve replicability, there is the need for consistency in search strategy that must be exhaustive and efficient. Overarchingly, search strategy is influenced by a clear and concise research question around which phrases/key words are derived to be used for searching through relevant databases. It is important the search phrases/words, which are usually key concepts addresses various aspects of the research question. It is critical that the same key concepts/phrases are used throughout the search across all search databases and search engines. The search activity needs to be well documented including where the search in taking place, the keywords used for search, the output/out in terms of number of initial studies to be included.

3.4 Step 4: Practically screen your organized literature in accordance with step 3 above

Executing this guide implies that author(s) would need to appraise all potential papers to be included for full review (Okoli, 2015a). This takes place after protocol and getting participating authors on the same understanding on all the requirements of the studies (Fink, 2019) based on their inclusion and exclusion criteria set above in step 3. Arguably, this step determines the quality of the review study to be conducted. To achieve this, authors would need to adhere to protocols and ensure that all authors strictly follow through. An important outcome from this guide is "screened down" potential paper that are most likely to be included. It is important to note here that the outcome of this exercise does not seal the faith of paper that met the initial elimination criteria. A further screening would need to be conducted when authors provide further clarification around potential papers on why they should be included or not be included at all. Some of the fundamental criteria suggested by Fink (2019) to include content (topics or variables), publication language, journal, authors, study setting, participants or subjects, research design or sampling methodology, publication date, source of financial support. Authors would notice that the criteria recommended by Fink are superficial and might only help in the initial elimination stage. Other important criteria such as quality of study, study objectives/purpose, study focus, length of paper, theory-free or theory-based study, intervention, etc will later need to be considered as further inclusion/exclusion criteria. To minimise the tediousness of this step, the use of referencing program or software is recommended. For example, when using EndNote, authors can create group folders that enable them to put likely papers together whist attaching core/important articles and other relevant materials as needed for full review later. The advantages of the refencing programs include the minimization of referencing errors and the alphabetical arrangement of articles. It automatically identifies categories of papers during referencing. Note that practically screening papers does not encompass assessing the quality of papers.

3.5 Step 5: Data extraction and synthesis

Depending on your research aims and question, at least, there could be two phases of this exercise. It is the act of locating and acquiring/accessing appropriate materials deemed relevant for the study and all sources of information well documented. There are many referencing systems that help in organizing and documenting information, for example, EndNote. First, specific characteristics of studies among others such as geographical location, study objectives, methods, study design, population, and theory where relevant will be looked at. This step is about bringing ideas and information together for the purpose of identifying the overall pattern

and how each pattern fits into the whole. The outcome sought here is an overview of the research focus. This outcome crucial in confirming/or refining formulated research questions. Attention is paid to the connections among the extracted materials in the context of agreements and disagreement, flow among relevant materials for the purpose of drawing conclusion as organizing proposition for the synthesis The second phase could be extracting the actual results/findings of IS implemented as an intervention Inclusion and exclusion criteria.

3.6 Step 6: Appraise the quality of studies to include.

For this section, we define quality as the extent to which various parts of studies coherently fit the whole. Thus, the match among various parts of research design – research question and method, selection of research subjects, sample size data collection process, measurements, analysis, and reporting. In this section, particular attention needs to be paid to the quality of each section of the entire research design. For example, to prioritize papers according to their quality and to exclude certain papers deemed not useful due to inferior methodological quality (Okoli, 2015a). Okoli (2015a) posits that "perhaps the most significant distinction between classes of quality appraisal methods is whether the primary studies are quantitative (i.e., they obtain knowledge by measuring numbers) or qualitative (i.e., use text or other non-numeric data with discussion and argumentation to understand the phenomenon); hence" (p.896).

When appraising the quality of qualitative studies, Okoli highlights that study reviewers should endeavour to distinguish the lines of arguments in the context of inference, assertion, or supposition drawing on logics of how arguments were developed. For theoretical papers, particularly those that aimed at deriving or discovering theories such as grounded theory, the need to identify whether authors premised their arguments along deductive or inductive reasoning is of great importance.

Research quality in IS when focused on digital health has become a matter of life or death given the dearth of knowledge on the unintended consequences and side effects of the application of digital health technologies. As the primary objective of this study, to we posit that, given the increased application of IS in the healthcare environment, there is a growing evidence of identical interventions in the application of IS in the healthcare domain. This warrants stricter methodological quality of the highest standard. The implication of this new evidence unlike Fink's, is that the advocacy of Petticrew and Roberts (2008) for "leniency of hierarchy of evidence" when conducting SLR in social sciences no longer really hold much on which to reckon, particularly for IS.

On incorporating non-peer reviewed/unpublished papers, we suggested above a scoping review on grey literature for insight or broader idea on the topic being researched as a starting point for systematic literature review. Additionally, high-quality reports with quality/well-cited references could be of great use. Again, as opposed to Fink (2005), Okoli broke ranks with these differences to assert that both qualitative and quantitative lend themselves to rigorous empirical structured methodology of SR to achieve explicit, comprehensive exhaustive, and reproducibility (Okoli, 2015a). To achieve the same level of quality among multiple authors, a standard form developed by all authors would be relevant. See an example developed by Fink.

3.7 Step 7: Results

In the results section, researchers/authors need to describe study selection and the characteristics of studies found as with the process involved in appraising those studies. Here, it is ideal to talk about the overall studies identified, how many were examined in the context of titles, abstracts, and other relevant characteristics such as theory-based and non-theory papers, methodologies, etc. Where relevant, authors need to clarify issues relating to any identified risk of bias with individual studies. Part of this section would have also demonstrated the application of inclusion and exclusion criteria set above. How many papers met initial inclusion criteria, why additional papers were later excluded, etc. The roles of authors/researchers involved also needed to be mentioned in this section. For example, how many authors appraised the quality of the papers.

3.8 Step 8: Data synthesis

Data synthesis is the combined evaluation of extracted data – qualitative, quantitative, or mixed for evidence and decision-making. It is about the organization and presentation of data from the findings of the actual

review to draw conclusion about a body of evidence. The implication of this stage/activity in SLR is the systematic and holistic assessment of results of individual study included with particular attention paid to key features of the studies, which may include but may not be limited to study design, study subjects, etc. Depending on what the purpose and the criteria set for the study are, data from both qualitative and quantitative studies can serve complementing or triangulating role for the purpose of exploratory or explanatory of evidence. For qualitative data, a narrative or meta-synthesis allows the SLR and combination findings and "offer an appropriate balance between an objective framework, a rigorously scientific approach to data analysis and the necessary contribution of the researcher's subjectivity in the construction of the final work" (Lachal, Revah-Levy, Orri, & Moro, 2017. p.1). Meta-synthesis builds a rigorous foundation for reporting given that it is not constrained to synthesising studies for the purpose of comparison, which is largely great when reporting findings. For quantitative data, a statistical synthesis is employed in the context of meta-analysis, the combination of statistical results from multiple studies. Like in the medical field, in the domain of IS the implementation of new systems and the application of digital health interventions carry potential for change. As such the application of data synthesis methodologies such as realistic synthesis helps in the categorizations of these changes for evidence-based decision making. A good SLR should make it easier for the practitioner to understand the research by synthesizing extensive primary research papers from which it was derived (Tranfield et al., 2003).

3.9 Step 9: Discussion and conclusion

When aligning or relating discussion in IS research to that of medical discipline as we are advocating for in this study, it implies the need for not only a simple account of facts, but rather a logical presentation of arguments of available facts (Jenicek, 2006). It implies a thorough evaluation of extant literature from IS implementations or cases. Remember, "no one has thought as long and as hard about your study as you have" and that your discussion should start off with the major findings of the study (Şanlı, Erdem, & Tefik, 2013, p.1239). The fundamental function of the discussion for systematic literature review is to lead readers in understanding the main findings from your review. This emanates from the results and synthesis exercises above and implications for practice theory, literature, and policy. Thus, your discussion will seek to raise and answer questions that include but are not limited to the extent to which your findings or evidence challenge existing literature, theory, practice, and policy. When interpreting your findings, ensure to situate and relate back to the overall results of the study, how the findings agree, disagree and or complement with existing body of knowledge or literature (Masic, 2018). Whilst highly tempting, it is important that both the results and synthesis are not repeated here. The focus of this section is to summarise the key findings, highlighting the strength/weakness for each of the main outcomes. Remember the results above only presented the characteristics without detailing their implications for the study whilst considering alliterative explanation of the findings. As such, at this stage, authors now have the room to discuss in detail and describe the place of their findings from the results and synthesis of literature and demonstrate how the results build on existing evidence or body of knowledge and suggestions on how to use/apply the results in the context of specific use settings and generalization. In fact, when we relate This section also discusses any identified limitations of study and how that might impact/have impacted the findings of the study. These sections also point out the implications as with suggestions for further studies.

Conclusion

First, this paper advocated for and has demonstrated the need for adapting IS research to that of medical/health research and echoed the growing importance of evidence-based research influenced by increased use of IS in the healthcare domain using SLR as the case. The paper did this by looking at the commonalities between IS medical/health domains in various contexts, which included the nature of the disciplines of IS and medicine/health, research culture, research questions, interventions and evaluations, research designs, theory and aims of policy, methods literature review. Secondly, the paper emphasised and made a new call for increased importance of literature review studies particularly SLR studies as a gold standard for gathering evidence and for the purpose of generalizability of findings. We then provided a step-by-step guide on how to conduct systematic literature review including the use of grey literature. To include grey literature in

SLR, we suggested that a scoping review on grey literature be conducted. The outcomes of scoping literature review on grey literature provides the extent of evidence available in non-published materials, which can be validated with scoping review on mainstream literature.

Disclosure Statement

The author has no conflict of interest to report

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