USE OF SYSTEM INNOVATION FOR SUSTAINABLE HEALTH SYSTEM IN ANGOLA

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Available at http://www.ssrn.com/link/OIDA-Intl-Journal-Sustainable-Dev.html
 ISSN 1923-6654 (print) ISSN 1923-6662 (online).

Abstract

Background: Health systems in low-and middle-income countries face different problems as they generally fall short of providing universal, equitable, and appropriate high-quality services. The challenges relate to amongst others, double burden of disease, high maternal and child mortality and growing non-communicable diseases. Furthermore, people living with mental or physical disabilities do not have sufficient access to healthcare. Angola is also faced with these challenges due to its weak health system and also other social determinants of health such as lack of proper housing, education, water and sanitation. Conventional solutions to address these problems have generally not led to the desired effects in many countries. Therefore, this study looked at how adoption and diffusion of system innovation may facilitate sustainable health systems in Angola.

Research Problem: The Angolan health system, like many health systems from low- and middle-income countries, faces problems eluded in the background. Problems are also manifested in sub-systems of the health system, such as lack of skilled personnel; leadership and governance issues; inappropriate service delivery models and lack of access to quality and affordable medicines. Furthermore, other challenges relate to understanding how innovations (such as new policies, new knowledge and novel technologies) can be effectively introduced into the health systems and how these innovations interact with health system variables to influence health outcomes.

Aims: We presented an adapted model in the context of low and middle-income countries for analyzing adoption and diffusion of innovations in health service delivery and organizations towards more sustainable health systems and contribute towards improved health outcomes, focusing on Angola.

Methodology: We searched 10 database for peer-reviewed and grey literature published between 2000 and 2013. The keywords varied according to the database. From an initial set of thousand articles, only 647 were identified as relevant to the focus of inquiry. Of these, 23 were selected after data extraction independently by two team members using a pre-established data extraction form to list determinants that may facilitate or impede the dissemination, diffusion, adoption, implementation of innovation in service organizations or systems. These determinants were divided into four categories: characteristics of the environment, characteristics of the organization, and characteristics of the user (or adopting person), and the characteristics of the innovation.

Results and Conclusion: The study has demonstrated the usefulness of systems innovation to study health system change. In the context of low and middle-income countries, there are multiple interacting determinants of innovation factors which influence adoption of innovations ranging from understanding characteristics of innovation, complex health system and socio-political contexts and characteristics of adopting person (or user). Therefore, understanding these innovations determinants, sophisticated analysis of the socio-political context and health system user will enable better understanding of the short- and long-term effects of an innovation when introduced into health systems. Hence, systems thinking approach will assist in understanding of the linkages, inter-relationships, interactions, and behaviors among elements that characterize the entire health organization or system. The study has also provided insights on the central role of systems change agents in the restructuring the thinking and organizing of sustainable health system in Angola and other low- and middle-income countries. Furthermore, we proposed a framework for analyzing adoption and diffusion of innovations in health service delivery and

organizations towards more sustainable health systems. This framework will help to shift the boundaries of the debate, especially in low and middle-income countries. As with any conceptual or analytical framework, our model will evolve over time.

Keywords: Angola; Health system; Innovation; Sustainable development; System thinking

INTRODUCTION

Africa's human capital is the continent's most important resource for social, human and economic development. The endeavors of economic development are aimed to economically and socially transform the well-being of people through sustainable health and social interventions or systems. Good health has direct impact on the development outcomes. Hence, it is important that the strategies, policies, by-laws and legislatures that encourage healthier population are understood and promoted towards enhanced economic development. Health system's goal is to improve overall health outcomes in equitable and responsive ways. Health issues or concerns are central to other core functions of a vigorously growing foreign policy; such as pursuing economic growth, fostering development, and supporting human rights and dignity [1]. Health system is not a monolithic operation as its multi-faceted incorporation involves people, organizations and politics. The ability of the involved players to orchestrate the system contributes towards the robustness of the health system. Therefore, robust synergy between the building blocks or sub-systems of the health system is of crucial importance for health system to function efficiently. Health systems in low-and middle-income countries face different problems as they generally fall short of providing universal, equitable, and appropriate high-quality services. The challenges relate to amongst others, double burden of disease, high maternal and child mortality and growing non-communicable diseases [1,2]. Furthermore, people living with mental or physical disabilities, particularly in low- and middle-income countries, generally do not have sufficient access to healthcare. Angola is also faced with these challenges due to its weak health system and also other social determinants of health such as lack of proper housing, education, water and sanitation [3]. To this end, many countries have introduced a series of health system reforms and innovations in health care and health systems. However, evidence of the effects of many health system reforms, both from developed and developing countries have not had the intended effects. This is mainly due to poor monitoring and evaluation, and the high number of variables makes causality difficult to determine. As a result, costs of healthcare have not been curbed, quality has not improved, the poor are not benefiting from reform process, and equity could not be reduced [4,5,6]. In some cases reforms have led to increased inequities in access to care and reduced quality [7,8] and that some reform processes have not been evidence-based and have often overlooked the needs of the population [9]. Furthermore, countless experimental projects have been implemented to address problems in health systems such as a focus on priority-disease interventions. It is, however, increasingly acknowledged that weak health systems may have been compromised by the introduction of disease-specific interventions because they draw resources away from other parts of the health system [6,10,11]. In addition, these interventions often fail to scale-up to the system level [12]. As such, given the complexity of health system reforms, there is a need for a more coherent approach to change that includes a deeper understanding of the contexts of reforms; understanding how the health system operates; the need for information for decision making and institutions issues [13,14]. So why is it not possible to solve the problems in our health systems or to meet the commitments of *Health for All*? Reasons are that health systems are, in fact, a complex and adaptive systems. This implies that the problems in our health systems are complex and therefore need to be conceptualized differently. In particular, long-standing, complicated problems require a new way of thinking about practices and system structures. Health system is therefore 'more than a pyramid of public-owned facilities that delivers personal health services' and includes state and non-state actors such as non-governmental organizations, civil society organizations, and the private sector [6].

The WHO health systems framework consists of six building blocks (**Table 1**), namely, service delivery; health workforce; health information; medical technologies (including medical products, vaccines, and other technologies); health financing; leadership and governance [6, 15]. Health systems are then a dynamo of interactions, synergies, and shifting sub-systems [16, 17]. The system has and creates feedback loops of information flows that constantly moderate the behaviour of actors in the system. As a result, the outcomes of actions in any system, and the (negative) side effects, cannot always be predicted. As a result of these observations, health system researchers increasingly turn to complex adaptive systems theory to explain the functioning of health systems [5,6,16]. Complex adaptive systems are a collection of change agents (semi-autonomous) who constantly act and react upon one another [16,19]. The decisions of all actors within and outside the system contribute to the behaviour of the system. However, change agents in the system do not necessarily act autonomously. Generally, they respond to their environment by using a set of (collective) rules (interpretive frames, mental models, behavior) that are embedded in

the system. Not only change agents are adaptive, but also the system itself. Therefore, one can say that as a complex adaptive system, the health system constantly changes but, at the same time, it is constricted to pathways of change that are embedded in the system [16,19]. Hence, there is a need to use systems thinking approaches to better understand how health system functions. Systems thinking therefore demand a deeper understanding of the linkages, inter-relationships, interactions, and behaviors among elements that characterize the entire system [6, 17]. In the context of the health sector, there is a need to shift focus to the nature of the relationships among the building blocks; the spaces between the building blocks; and the synergies emerging from interactions among the blocks [6].

Table 1: Summary of health system building blocks[6]

Building Block	Description
Governance	Production of intelligence; formulation of strategic policy framework; safeguarding instruments for implementation (powers, incentives, and sanctions); building coalitions or partnerships; adequate measures between policy objectives and organizational structure and culture; and accountability
Health Workforce	A well-performing team of health professionals that works in a fair, efficient and responsive manner to achieve best health outcomes.
Service Delivery	Quality health service delivery that is effective and safe.
Health Information System	System that is vigorous for the production, analysis, distribution and use of reliable and timely information.
Medical Technology, Vaccines and Products	Access to medical products, vaccines and technologies is a complex block. It is intertwined within the four (4) A's: accessibility, availability, acceptability and affordability. The 4 A's should be accompanied by quality assurance as well as demand and supply.
Financing	Crucial for health system performance to thrive, which is also reliant on good governance and stewardship. Insufficient financing and mal-distribution of the finance equitably, impedes on the other building blocks and essentially hamper on the realization of development goals.

Similarly, introduction of innovations to health care and health system is widely recognized as a complex process. Innovations in health systems refer to new medicines, diagnostics, health technologies, new ideas, practices, objects or institutional arrangements perceived as novel by an individual or a unit of adoption [20]. Innovation is crucial for improving health outcomes and for achieving the Millennium Development Goals [21,22]. The legitimacy of system innovation is the perceived urgency of system actors or change agents to try to solve persistent problems. As mentioned before, persistent problems involve many actors that do not agree on facts and values in the system. To deal with this, actors need to be able to reflect on the underlying structure in the system, change structures and processes through their actions and vice versa. Therefore, persistent problems perspective has significant value to describe, analyze and explain the process of system innovation and its driving forces. Hence, system innovation requires leadership and governance/management that involves constant learning, reflection and deliberation. This requires a multi-level process which demands a deeper understanding of landscape, regime and niche interactions in organizations or systems.

Sustainable development - guiding vision in health system innovation?

The focus of policy makers and health reforms has shifted to the concept of sustainable development to promote healthy populations [24,25]. If we use the famous "Brundtland Report" definition of sustainable development, it defines sustainable development as "development that needs to meet the needs of the future generation, without compromising the ability of the future generations to meet their own" [26]. Therefore, it is a broad concept that spells out the need for an intertwined and highly interactive system, hence it applies within the health system innovation as well. To introduce innovative modalities that would impact on the sustainable performance of the Angolan health system, it means that system must fulfill "innovative" concept within the context of sustainable development (discussed in the following section). In this paper, we argue that the introduction of innovative into the

health system of Angola will potentially yield desired health and ultimately positive economic outcomes. We can hypothesize that adoption of innovation within the health care system should take into cognizance the processing stages or strategies (i.e. service delivery process, finance distribution, data capturing etc.); implementation of processes; system antecedents, readiness and challenges. Hence we argue that system thinking approaches are able to take into account the system's dynamic or potential problems and incorporate them into a realistic, resilient functional system. Therefore, our proposed innovation framework has taken that into account both realistic challenges and potential solutions to strengthening health system.

Theoretical framework

In this paper, we propose an adopted conceptual framework representing the main stages in innovation process and related categories of determinants (**figure 1**), based on several theories and models [27,28,29]. When developing our framework, we paid particular attention to studies which explored innovations in the health sector [29,30,31]. The framework integrates the four dimensions of the diffusion process that influence the rate and pattern of adoption of an innovation. As noted later, the model is intended mainly as memory aide for understanding the interrelationships connecting health sector innovation processes and health systems strengthening, with specific focus on systems thinking approaches. Each of the four main stages in innovation process includes dissemination, adoption, implementation, and continuation. The analysis of the interrelationships between these factors provides a useful tool to predict the effects of different 'technical designs' on the elements of health systems that they affect, to identify determinants that can affect the successful implementation of the innovation, and to accommodate these in the strategy. The central role of actors as change agents is recognized in our model. Also, all aspects of the six broad innovation process and related categories of determinants take place within a general context that includes economic, social, political, and environmental factors. We are however mindful that the proposed conceptual framework may have limitations that arise because health systems are 'complex adaptive systems' [16, 19].

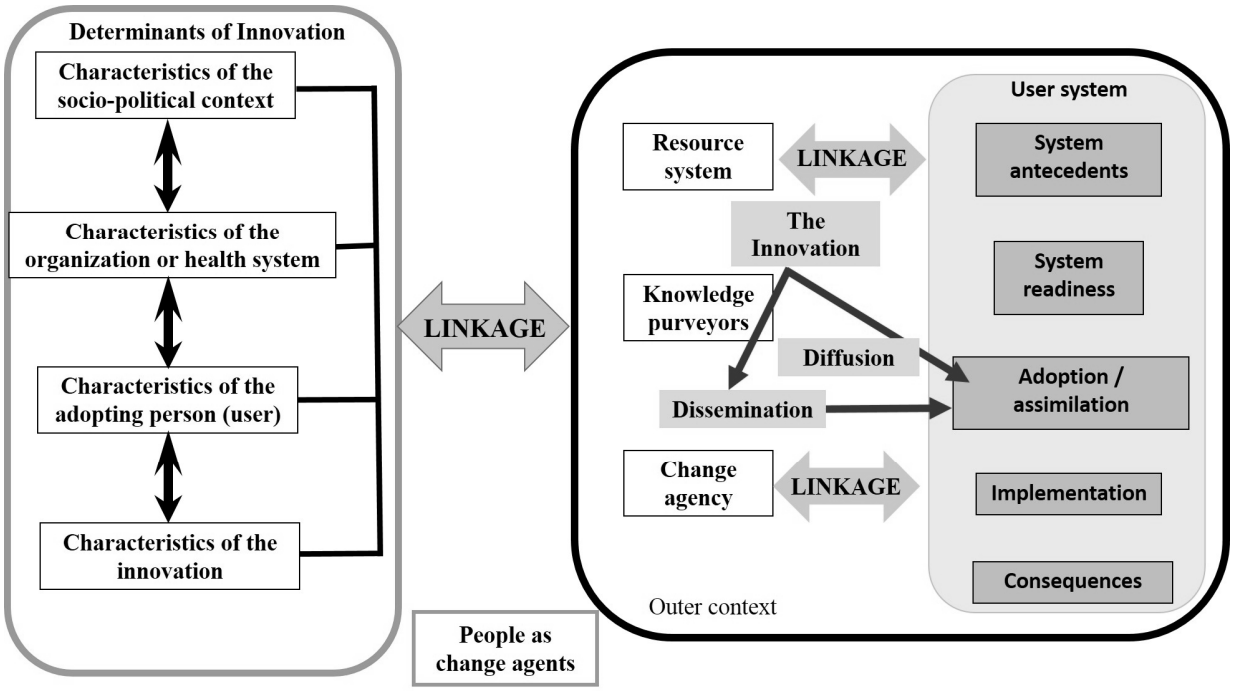

Figure 1: Adapted Framework for analysing adoption and diffusion of innovations in health systems

The bidirectional interactions as reflected in figure 1 above, indicate a complex adaptive systems and dynamic complexity of health organizations or systems. Hence, approaches that foster systems thinking are particularly useful when planning the introduction of innovations into health systems to improve health outcomes, efficiency and equity, or when analyzing the reasons for rapid or poor uptake of affordable innovations with proven benefits. Accordingly, we sought to synthesize the evidence from peer-reviewed and grey literature to produce a practical model of adoption and diffusion of system innovation for sustainable health development in low and middle-income

countries, with particular reference to Angola. For the purposes of our analysis, we refer to innovation as the use of products, practices or approaches, objects or institutional arrangements perceived as novel by an individual or a unit of adoption that, for the user, are new [20]. We further presented our findings into six broad innovation processes and related categories of determinants, as outlined in the adapted theoretical framework used (**figure 1**), namely: (1) the innovation itself; (2) the adoption/assimilation process; (3) communication and influence (diffusion and dissemination, including social networks, opinion leadership, champions, and change agents); (4) the inner (organizational) context, including both antecedents for innovation in general and readiness for particular innovations; (5) the outer (interorganizational) context, including the impact of environmental variables, policy incentives and mandates, and interorganizational norms and networking; and (6) the implementation process. These broad innovation processes and related categories of determinants provided lenses through which to examine and recommend diffusion of innovations processes in health service delivery and systems in low and middle-income countries. We pay particular attention to Angola as one of the countries that comes from a history of conflict and war and which is in the process of rebuilding its health system. Although studies have explored diffusion of innovations in the health sector, we are not aware of any studies that have empirically examined sustainable development as a guiding vision in health system innovation in low- or middle-income countries from an innovation diffusion perspective, or any studies that have explored the introduction and diffusion of systems reforms in the Angolan context. Hence, our study, examining health systems reforms in a low-income country from an innovation lens, is novel and provides empirical evidence on health system innovations in Angola—a particularly complex post-war setting.

Materials and Methods

Study Design and sampling

We conducted a mixed method study design that included a systematic review of peer reviewed and grey literature. Therefore, this study combined the two approaches within one 'mixed' method study to get answers to both the 'what' and 'why' questions in order to obtain a more complete understanding of the research problem by comparing findings [32,33,34]. We chose to include a qualitative approach because this method is well suited for studying complex and nuanced social processes [35] and for generating novel insights [35,36] through the use of inductive approaches.

Literature review

The paper is based on a desk review of published literature conducted between February and May 2014. We included peer-reviewed journal articles, book chapters, academic reports, and documents. We included studies conducted in low- and middle-income countries in the review because many countries are today middle-income. We included publications post-2000. For each process of system innovation, we searched for peer-reviewed literature in 6 electronic databases (Pubmed, Medline, CINAHL (Cumulative index to nursing and allied health), Africa Health Review, Web of Knowledge and PsycINFO), including any literature published since the earliest date indexed in each database up to December 2013. We also extracted data from 4 electronic databases of leading global health organizations, donors, implementers and technical agencies to identify relevant grey literature such as World Health Organisation, African Development Bank, World Bank and United Nations Development Programme (Fig. 2). All searches used a standard set of search terms related to dissemination, diffusion, adoption, implementation of innovation in service organizations, and a tailored set of search terms specific to health system innovation (Box 1).

Some additional articles were also identified through hand searches of relevant journals. We looked at studies that provide insights into the ways of dissemination, diffusion, adoption, implementation of innovation in service organizations may facilitate towards more sustainable health systems in low- and middle-income countries, including Angola. Because the search was conducted in English, the findings are limited as there might be other valuable papers written in Portuguese. Constant comparative method of qualitative and quantitative data analysis were conducted to extract recurrent themes from various data sources was used, and we integrated these themes with findings from the literature review to generate the proposed model of health systems innovation towards more sustainable health systems in low- and middle-income countries. For the peer-reviewed literature, we screened the abstracts of all search results and screened the full text of those articles retained following abstract screening. Screening was conducted independently by two team members to ensure consistent application of the predetermined exclusion criteria. An article was excluded if it did not meet the study's definition of the innovation; if it did not address dissemination, diffusion, implementation or sustainability of the innovation; if it did not address low income or middle-income countries; if it was superficial in its discussion and/or did not provide empirical evidence about scale up of the innovation; if the full text of the article was not available online; or if the article was not available in English.

Box 1: Search terms and inclusion criteria

Search terms:
Health systems AND system thinking; health system AND dynamic complexity; health systems AND system thinking; dynamic complexity AND systems thinking; health systems AND dynamic complexity AND systems thinking; health system AND innovation; health systems AND innovation AND systems thinking; health system AND 'sustainable development'; sustainable development AND health system AND innovation; sustainable development AND health system innovation; adoption AND health system AND innovation; dissemination AND health system AND innovation; diffusion AND health system AND innovation; scale up AND health system AND innovation; sustainability AND health system AND innovation; health system AND innovation AND sustainable development; sustainable development AND health system innovation AND Africa OR Asia OR Latin America OR Caribbean OR Pacific OR Middle East OR East Europe OR developing countries OR transitional countries NOT US OR America OR UK OR Australia OR Canada or developed countries etc.

Inclusion criteria, steps 2-3:
- Published in English
- Full article accessible
- Health system innovation focus
- Considers the processes of adoption and diffusion of innovation in health systems
- Considers sustainable development as a guiding vision in health system innovation
- Considers experience in low and middle income, including transitional, countries
- Largely acceptable methodology

Inclusion criteria, steps 3-4:
- Primarily empirical study or clear empirical base
- Focuses entirely or mainly on adoption and diffusion of innovation in health systems experience within or across country settings (analysis largely undertaken at meso- and/or micro-levels)
- Largely acceptable methodology

Grey literature searches included any documents available via the organization's web site on the February 2011 search dates. Owing to the large volume of hits generated from these web site searches, the titles of all hits were screened first. If a document appeared relevant on the basis of its title, the full text was reviewed using the same exclusion criteria as applied to the peer-reviewed literature. For the systematic review, screening was conducted independently by two team members to ensure consistent application of the predetermined exclusion criteria. Data extraction from the final sample of peer-reviewed and grey literature was conducted independently by two team members using a pre-established data extraction form to list the enabling factors and barriers dissemination, diffusion, implementation and towards more sustainable health systems. Disagreements that occurred during the review in application of the exclusion criteria or in data extraction were resolved through negotiated consensus among the researchers conducting the review. The resulting enabling factors and barriers found in the literature for each innovation process were then mapped to conceptual model for considering the determinants of diffusion, dissemination, adoption and implementation of innovation in health delivery and organizations to determine the degree of support in the empirical literature for diffusion process captured in the model of diffusion in service organizations. All authors reviewed the mapping, which was achieved through negotiated consensus and is illustrated in **Table 2** below. We found limited published literature specifically on sustainable health system in Angola. We thus propose to do a further stage of work in the future to interview key informants on the issues raised in the literature, to draw further evidence and analysis.

RESULTS AND DISCUSSIONS

Description of samples

Our search of peer-reviewed literature returned 647 unique articles and grey literature, of which 23 were retained for data extraction based on our review criteria (**Fig. 2**). Additional papers not identified through the electronic search were obtained from the authors' files. Because formal search techniques drew poor yield, we relied on 'snowball' methods and sought advice on sources from various experts in various fields. In general, the evidence meeting all inclusion criteria outlined above was sparse. So the literature on the sustainability of health systems innovation was very sparse, so little literature in this area was used in this article. We have cited in this article only illustrative studies and/or reviews that provided evidence relevant to the diffusion of innovations in health systems or health service organizations (**Table 2**)

Table 2: Research traditions relevant to diffusion of innovation in health system innovation

Research tradition	Academic discipline	Definition and scope	Diffusion of innovation conceptualized as
Structural determinants of systems or organizational 'innovative'	Systems organization and management	Study of how organization's structure influences its functions in relation to the use of new ideas and practices	System or organizational attributes influencing 'innovative', like size, slack resources, and hierarchical versus decentralized line of management
Studies of systems or organizational process, context and culture	Interdisciplinary	Study of the development and impact of culture (meaning systems, language, traditions, accepted ways of doing things) in systems/organizations and professional groups	Changes in culture, values and identities
Inter-organizational studies (networks and influence)	Interdisciplinary	Study of inter-organizational norms, fashions, and influence	Inter-organizational fads and fashions, spread through social networks.
Knowledge utilization	Interdisciplinary	Study of how individuals and teams acquire, construct, synthesize, share and apply knowledge	Transfer of knowledge, both explicit (formal and codified, such as in guidelines) and tacit (informal and embodies, a in 'knowing the ropes')

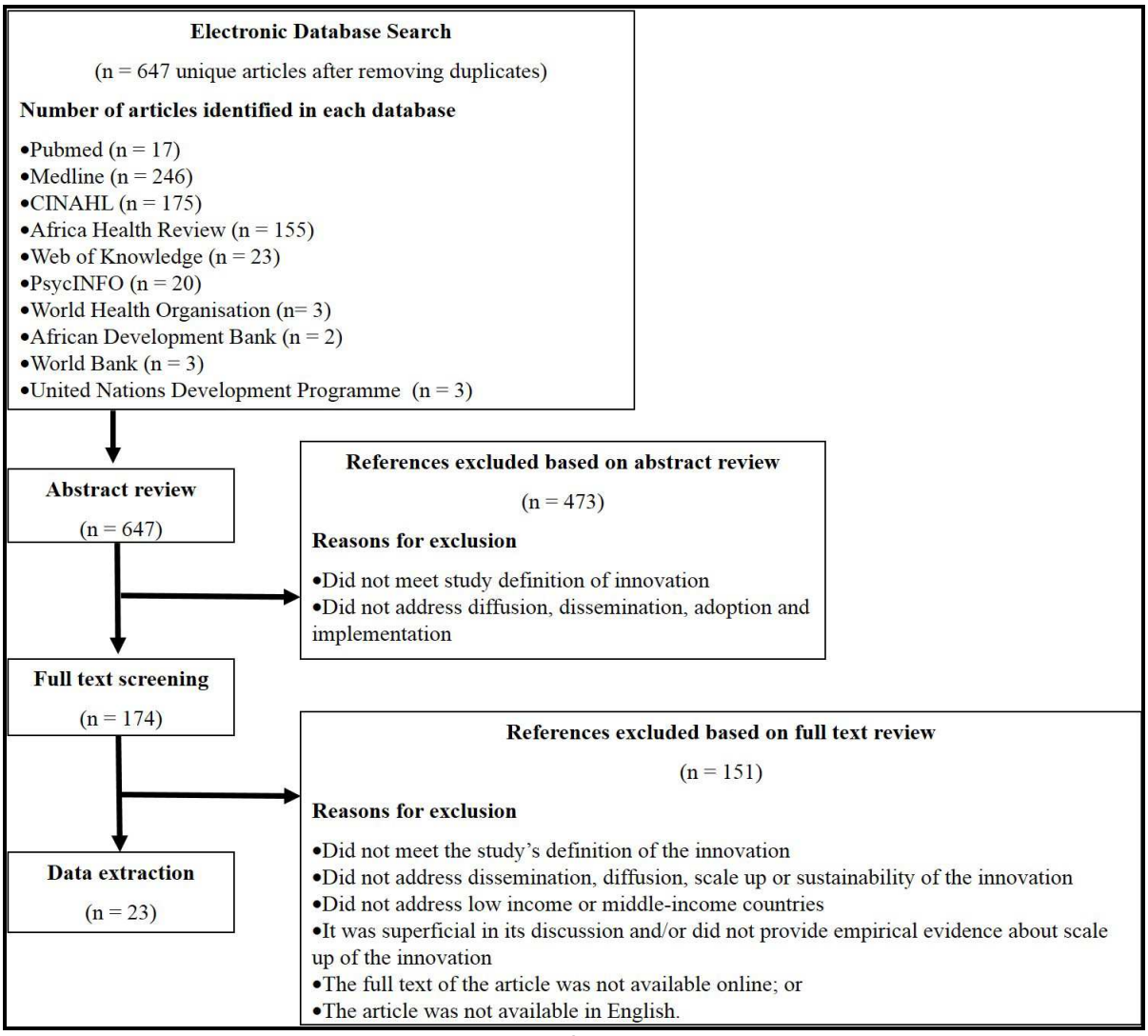

Figure 2: Selection of peer review literature

Model for adoption and diffusion of system innovation

Synthesis of the peer-reviewed and grey literature revealed six broad innovation process and related categories of determinants, as outline in the adapted theoretical framework used (Figure 1), namely: (1) the innovation itself; (2) the adoption/assimilation process; (3) communication and influence; (4) organizational) context; (5) inter-organizational context and (6) the implementation process. The data highlighted the complexity and non-linearity of the process, which included multiple feedback loops.

The innovation

In our proposed model for adoption and diffusion of system innovation, this component referred to the relative advantage of innovation (that is clear, unambiguous, cost-effective); compatible with the intended adopters; values, norms, and perceived needs; and complexity in terms of easy to be implemented; trialability where users can be afforded spaces for experimentation [16,27,28,29]. Furthermore, this component refers to the way benefits of innovation are made visible to the adopters; if the potential adopters can adapt, refine or modify innovation to their own needs; if there is balanced between risks and benefits in organization; if interventions are feasible and workable and that if the knowledge required can be codified and transferred from one context to another [27,29,37]. Literature review has clearly demonstrated that decentralisation agenda in Angola did not bring about desired effects (reduce the dependence on local administration) [38,39]. Decentralization agenda in Angola was anticipated that it will bring a conveyance measure to increase representation and political participation; and assignment of accountability and responsibility. However, because there were no prescribed guidance on execution of responsibilities and budget distribution this intervention did not materialize as anticipated. A number of examples in low and middle-income countries have clearly indicated that even when evidenced-based innovations are available, such as expansion of antiretroviral treatment (ART) and distribution of long-lasting insecticidal nets (LLINs) to reach universal coverage, however, the uptake of innovations is still consistently far lower than that for the richer socio-economic groups [40,41]. These findings clearly demonstrated that attributed of innovation are not stable rather, it is the interactions among the innovation and also elements of health system, the indented adopter(s) and a particular context that determines the rate of adoption of health system innovation [6,16,17,20,40,41]

Adoption/assimilation process by adopters

In our adopted framework, this component referred to the ability of the adopters, as actors in the system, to experiment, change, evaluate, develop feelings, gain experience and modify innovations to local context and preferences, so that receptive users would perceive the innovation as providing relative benefits in their specific context or environment [27,29,31]. The meaning attached to any innovation is generally not fixed, but it is constantly negotiated, changed and reframed because health systems themselves are a complex adaptive system [16,19,29]. Furthermore, successful adoption of innovation is more likely to be successful if intended adopters have sufficient knowledge about innovation, have continuing access to information, and that there is adequate feedback about the consequences of adoption [27,29]. Often, the reasons for slow adoption and diffusion of health innovations are less to do with the perceived benefits of the innovation, but the decisions made by an individual within an organization, concerns in pre-adoption stage, concerns during the early use of innovation, and whether the intended adopters have the sufficient opportunity, autonomy and support to adapt and refine the innovation to its fitness for purpose, within the health system and the broader context. For example, since 2005, there has been a notable movement in the government of Angola in general toward more transparency and strategic planning across all sectors, due in large part to the efforts of development partners. This includes an emphasis on the creation and use of an evidence base, an integral part of these planning activities, and the active engagement of the various levels of government. The existence of a single guiding National Health Policy that outlines strategic priorities and implementation strategies, including financing strategies, facilitates the development and alignment of various other health related policies [42,43]. However, like many countries that come from a civil war, the country's infrastructure was left in ruins, its interior areas heavily mined, and its social, political and economic institutions largely non-functional. The country still face a number of health challenges. The capacity and/or ability of the adopters, as actors in the system, to experiment new strategic planning, implementation, change, evaluate and modify, still remains weak [38,39,40]. This is particularly true for the authorities and representatives at lower levels of the health system, such as the district and community levels. These are no mechanisms yet to fully engage these systems adopters and it will take some time to build that capacity. Furthermore, there is a lack of a sector-wide donor coordination mechanism, and as a result the various health-related policies that emerge over time run the risk of being contradictory or competing while leaving gaps [38,39, 42,43]. In addition, while it may also be argued that the lack of strong directives from the national level will allow for local level prioritization and local solutions, it does not assure protections for the most vulnerable populations. These findings again clearly demonstrated that attributed of

innovation are not stable, rather, it is the interactions among the innovation and also elements of health system, [6,16,17,20,40].

Adoption/assimilation process

In our model, this component referred to the process where the diffusion of innovation process is assimilated by the team, a department or system/organization [29]. There is a tendency in many literature reviews on diffusion of innovation to focus on single, product-based innovation which occurs by simple imitation [27]. Hence, systems thinking, approached on the contrary, helps us to demand a deeper understanding of the linkages, to understand inter-relationships, interactions, and behaviors among elements that characterize the entire system [6,19]. In the context of the health sector as a system, there is a need to shift focus to the nature of the relationships among the building blocks; the spaces between the building blocks; and the synergies emerging from interactions among the blocks [6,19,20]. For example, there are a number positive innovations happening in Angola, such as ability of government to finance district health strategy; the growth in the spending on primary health which is faster than any other category since 2000; public payroll system is functioning well; health workers are paid their salaries consistently; there is low dependence on external assistance; there is high GDP growth rate; and that there is general improvement in infrastructure, such as building of new health facilities, water, sanitation, and roads [38,39,42,43]. These show some positive elements of sustainable development. Notwithstanding these achievements, there are some indications that decentralization agenda could limit the level of funds allocated to health and lead to financial barriers if patients must buy drugs and supplies in the private sector [44]. Furthermore, the need to advocate for allocation of funds to health will be more labor intensive as Angola shifts the responsibility from 18 provinces to 164 districts. Furthermore, the district financial management is still weak, the central funding and procurement of essential drugs is inconsistent, leading to stock outs and poor quality, and a disconnect between approved budget and actual spending can discredit the planning and budget process [38,39]. These findings clearly demonstrated that diffusion of innovation process is assimilated by a system and not individual elements of health system. It is the interactions among the innovation and also elements of health system, the indented adopter(s) and a particular political and socio-economic context that determines the rate of adoption of health system innovation [6,16,17,20,40]

Communication and influence

In our framework, this component referred to the process where the spread of diffusion of innovation process can be thought of lying between pure diffusion (in which the spread of innovation is unplanned, informal, decentralized and largely horizontal) and active dissemination (in which the spread of innovation is planned, formal, centralized and largely vertical [29]. Drawing from Greenhalgh et al's overview (2004) and other empirical work, our adapted model have identified a number of components, namely: social networks which can influence adoption of innovation by individuals formally or informally [45]; homophilous where adoption of innovation is through individuals who have similar socioeconomic, educational and cultural backgrounds [30]; opinion expert leaders where they influence adoption of innovation through their authority, status and their credibility [30,46]; organizational champions who are willing to support innovation; and formal dissemination programs where organizers take full account of adopters' needs and perspectives, where different strategies are tailored to different demographic, structural and cultural features of subgroups, through the use of appropriate communication channels and incorporating rigorous evaluation and monitoring [31,41,47]. Although many literature on diffusion of innovation tend to focus on development of products or products in formal programs and mechanism of spread which is centrally driven and controlled, however, many innovations in service delivery and systems are spread informally and largely in uncontrolled ways [16,20,29]. For example, there have been a number of positive innovations in the area of human resource in Angola, within its decentralization programme. These include reintroduction of Community Health Workers (CHW) to strengthen the link between communities and health facilities; recruitment of foreign health professionals from countries such as Cuba and Brazil as a short-term solution to doctor shortage to provide needed health services and also for capacity building; and establishment of new universities and medical schools to increase production of new cadre of health professionals [39,42,43]. Notwithstanding these innovations, Angola, like many low and middle-income countries, continues to have challenges with poor distribution of health workers; low number of qualified health workers; lack of updated and reliable human resources information system; and lack of mechanism for evaluating, sharing and coordinating experiences and pilots, such as CHW models [39,42,43]. One of the reasons is lack of understanding of mechanisms for the spread of diffusion of innovation process. These innovations, such as piloting of reintroduction of CHWs, is spread centrally and controlled by experts sometimes without taking into consideration adopters' needs and perspectives, the different demographic, structural and cultural features of subgroups, and incorporating rigorous evaluation and monitoring [45,46,47]. These findings clearly demonstrated that diffusion of innovation process is assimilated by a system and not only through formal dissemination programs.

It is the interactions among the innovation and also elements of health system, the indented adopter(s) and a particular political and socio-economic context that determines the rate of adoption of health system innovation [6,16,17,20,40]

Organizational context

In our framework, this component referred to contexts for innovations and how some features of organizations can influence the likelihood that an innovation will be successfully assimilated by a team, a department or system/organization [29]. Our analysis has identified organizations or (health) systems which will assimilate innovations more readily if it takes into consideration, the following structural determinants, namely, if organization or system is larger, mature, functionally different, and specialized, if it has slack resources to channel into new projects; and if it has a decentralized decision-making structures[11,29,30,48,49]. Although these structural determinants are significantly positively and consistently associated with organizational innovativeness, however, a number of alternative theoretical approaches have been used to assess interventions and health systems [50], from perspectives of organizational behavior, strategy and innovation studies [23,27] and specifically within complex health systems [29,41]. These studies have clearly indicated that the determinants of organizational innovativeness interact in a complex and unpredictable way with one another [16,17,19]. Furthermore, organizations such as the health sector, its absorption for new knowledge depends on the organizations' existing knowledge and skills base and pre-existing related technologies, a learning organizational culture and a proactive leadership directed towards sharing knowledge [51,52]. This knowledge has to be socially constructed and must be continually negotiated among members of the organization or system so that there is a development of shared meaning and values in relation to innovation [29,51]. In health care organizations or systems, innovations should be informed by evidenced-based knowledge. In the case of Angola and other low and middle income countries, the reintroduction of Community Health Workers (CHW) to strengthen the link between communities and health facilities, will clearly depend on how this new evidence is enacted, circulated on interpersonal networks (professional and no-professional, including CHWs), and will spread only if these social features have been taken into consideration and barriers are overcome. In addition, an organization or a system need to have a receptive context for change in order to assimilate innovations [23,51,53]. Receptive context include a strong leadership, clear strategic vision, good management relations, visionary staff in pivotal positions, a climate conducive to experimentation and risk taking and effective data capturing systems. Although an organization may be amendable to innovation in general, it has to also move towards a specific state of readiness for that innovation [27]. In our model, the elements of systems readiness that need to be taken into consideration, include: staff tension for change, innovation that fit with organization's existing values, norms, strategies, goals, skills mix and supporting technologies; assessment of implications for new innovations; ongoing support and advocacy for innovation; availability of adequate budget and resources throughout the innovation process; and that the system has tight systems and appropriate skills in place for monitoring and evaluations of the innovation [27,54]. These findings clearly demonstrated that adoption, diffusion and assimilation of health innovation into health system is as a result of a cumulative and unpredictable translation process. Often, the adoption involves not just changes in service content or individual elements of health system, but it involves systematic planning and changing of regulatory, organizational, financial, clinical and relational changes involving multiple stakeholders, within and outside the health system.

The outer context

In our framework, this component referred to the interplay of the demographic, economic, political, legal, ecological, socio-cultural (including historical legacies), and technological factors in the environment in which the foregoing considerations (the problem, intervention, health system characteristics and the adoption system) are considered [55]. Critical events (such as challenging post-war context and lack of quality health professionals in Angola), technological change (such as a new diagnostic tool, a new and affordable drug, implementation of decentralization agenda or a new prevention mechanism) and economic changes (such as availability of mineral resources) can provide opportunities for more rapid adoption and assimilation of interventions into health systems. However, inter-organizational networks would only promote adoption of an innovation when there is demonstrable synergies and benefits that can be achieved by such innovation (such as nutritional interventions with immunization, joint programmes for malaria, tuberculosis and HIV/AIDS and so on). However, even when evidence of the benefits of an intervention exists (providing technical and economic legitimacy), the prevailing political economy and socio-cultural norms (affecting cognitive and normative legitimacy) will influence the desirability for adoption and assimilation of the intervention. In Angola, like many other countries that comes from prolonged wars that erupted even upon independence, has hampered the development of a proper health system. The introduction of systems innovations have been particularly challenging as the country face a rapid transition from command to market economies with financial instability, widening of socio-economic inequalities, decline in expenditure of social

sectors (including health), and dramatic falls in life expectancy [42]. Furthermore, Angola inherited a colonial health system that catered almost exclusively to the colonizers and was inappropriate to address the health needs of the local population. Moreover, the organizational structures, financing systems and hospital centeredness of the health systems has made it particularly challenging to introduce health system innovations [42,43]. After decades of destruction, in the first few years of peace there was a rush to invest in the development of the health sector, such as building of new health infrastructures. However, this investment did not necessarily match the health priorities of the population, since it was carried out without much information or planning [42]. However, the developments in the past five years are important steps in positioning the Ministry of Health to effect meaningful and lasting change. Furthermore, the last five years have been witness to a major thrust to implement national development policies of administrative and fiscal decentralization that began when the Government enacted the Local Administration Decree in 1999 (Law 17/99). However, this transfer of responsibility was not accompanied by any specific or prescriptive guidance on how to carry out this responsibility. These findings clearly demonstrated that adoption, diffusion and assimilation of health innovation into health system is a complex process and that health systems are open systems, with interlinked components that interact within the context within which the health system is situated [16,17,19]. Hence, systems thinking approaches will help the country to take into account the structures, patterns of interaction, events and organizational dynamics as components of larger structures, helping to anticipate rather than react to events, and to better prepare for emerging challenges.

Implementation process

In our proposed framework, we used Meyer, Sivakumar, and nakata definition of implementation, as "the early usage activities that often follow the adoption decision" [56]. Despite the availability of wide range of health system innovation that can prevent much of the burden of diseases in the poorest countries, effective implementation mechanisms of these innovations are complex and relatively sparse [29]. There is also growing evidence that despite some progress made in achieving health related MDGs, health inequalities are widening within and between countries [6,57]. Furthermore, we still need to deal with extreme levels of poverty and under-development in Africa and many parts of the world. A number of conceptual frameworks on system innovation have been used in various settings and has identified a comprehensive range of factors related to health and non-health systems, public and private sector, the broader national and global contexts. However, there is little published literature regarding effective implementation and routinization of innovation, especially in low and middle-income countries. We argue that implementation and routinization of innovation in any system is generally characterized by multiple shocks, setbacks and unanticipated seatbacks [23]. While we have provided some of the key components of system readiness, the following are an additional elements specifically associated with successful implementation and routinization, namely: organizational structure; leadership and governance; human resource issues; funding; interorganizational communication; interorganizational networks, feedback and adaptation/reinvention [11,20,23,27,30,54,56]. For instance, leadership and governance involves three main sets of actors, namely state actors, health service providers and health service users, and the general public [36]. Therefore, successful implementation and routinization of innovations in health organizations to achieve broader health system objectives, is largely depends on effective health system governance and motivated and competent individual health practitioners

Potential application of the proposed conceptual model

In this study, we have identified four central elements of a guiding vision for sustainable health systems, namely: (1) identification and analysis of the problems or challenges within the health system that lead to urgency for introduction of system innovation; (2) formulation of a limited set of shared core values through a broad participatory process; (3) an explicit focus of understanding interaction between the innovation itself, the adoption/assimilation process, communication and influence, thorough understanding of systems and inter-organizational contexts and the implementation process; and (4) understanding the complexity and non-linearity of the process, which included multiple feedback loops. The proposed framework, for adoption and diffusion of innovation in health system, from the context of low and middle-income countries, can be used when undertaking literature reviews, programme reviews, detailed country case studies to explore how novel health systems innovation or interventions and health systems interact, or programme planning at the national or sub-national levels. In relation to case studies, the adapted conceptual framework can be used to develop tools to capture data including a topic guide for in-depth interviews with key informants. Furthermore, the framework proposed here can be used for a detailed exploration of why and how the health system innovations can be integrated into various health system functions, and how the extent and nature of integration is influenced by factors relating to the intervention, adoption system, system antecedents for innovation, system readiness for innovation, health system and the outer context, implementation and routinization. We anticipate that the use of this framework at the country level will lead to its

refinement over time, and its use to develop a database of health systems that could be compared and contrasted in terms of their adoption of interventions. The other factors to explore, is the role of change agents in diffusion, dissemination and implementation of innovation in health service delivery and systems. Change agents in Angola therefore, need to be constructing a vision on sustainable health system change, through participatory processes with broad stakeholders in the system. Health system change can be a constructive for change processes; it re-affirms values in society (and opens up the discussion on what is important), allows for shared change and mobilizes and aligns actors for change. Such processes can be meaningful to address the health system as a whole, or elements thereof, such as the implementation of decentralization system.

Conclusion

The conceptual framework and the analytical approach we propose are intended to facilitate analysis in evaluative and formative studies of—and policies on—integration, but not as a prescription. The framework can be used to systematically compare and contrast health interventions in a country or in different settings to generate meaningful evidence to inform policy. Lessons emerging from this study clearly demonstrate that the adoption and diffusion of innovations which underpin responses to health problems are influenced by the innovation itself, the adoption/assimilation process, communication and influence of innovation, complex and adaptive health system, the socio-political context within which the health systems are embedded, and the implementation and routinization of innovations. In the context of low and middle-income countries, there are multiple interacting determinants of innovation factors that influence adoption of innovations, ranging from understanding characteristics of innovation, complex health system socio-political context, and characteristics of adopting person (or user) , and not only new technologies, novel service delivery models, and health policies. Therefore, understanding these innovations determinant, health system problems, sophisticated analysis of the broader context and health system user will enable better understanding of the short- and long-term effects of an innovation when introduced into health systems. Hence, use of systems thinking approaches will lead to a deeper understanding of the linkages, inter-relationships, interactions and behaviors among elements that characterize the entire system. In the context of the health sector, there is a need to shift focus to the nature of the relationships among the building blocks; the spaces between the building blocks; and the synergies emerging from interactions among the blocks. Our proposed conceptual framework builds on existing theoretical propositions and empirical research in innovation studies, and in particular adoption and diffusion of innovations within health systems, and builds on our own earlier empirical research. Our framework will help to shift the boundaries of the debate, especially in low and middle-income countries. As with any conceptual or analytical framework, our model will evolve over time.

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