Surviving the disconnections: The use of information systems in Indonesian public health facilities

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Abstract. The adoption of information systems in public health management in Indonesia aims to manage the data properly in order to improve the effectiveness of the provision of health services. However, based on previous works, it does not live up to expectation. This paper reports an insight coming from the field about the use of various and disconnected information systems in one place without sufficient coordination mechanism among those systems. The systems were developed by the superordinate body and it is compulsory for the public health facilities to adopt and implement the systems. This raises several problems related to the quality of the system itself, human resources capability, ambiguous procedures, various reports with the relatively same data, and unclear incentive mechanism for staffs. We conceptualize the problems of disconnections among three elements: actors, context, and information systems. These lead to different types of disconnections: between government agencies at national level, between information systems, between information systems and the context, between government agencies at national and local level, and between information systems and available staff capacity. This study also points out practical implications, which includes the use of more holistic approach to design and develop information systems, to develop an integrated information infrastructure for public health facilities.

1. Introduction

Previous works report that public health management in developing countries face several challenges, including lack of facilities and healthcare systems [1]. The use of information systems in the health sector has been advocated as this can help to improve the quality of healthcare service and policy making [1]–[3], which is referred as evidence-based public health policy [4]. This idea has also strong connection with public health surveillance systems [5]. Both surveillance and policy formulation are dependent on quality data [5] that can be provided with the help of well-designed and integrated information systems [6]. In this case, the data are presented in an electronic format so that they are relatively inexpensive to obtain and use [7]. From the extant literature, we understand that the improperly managed data will lead to the poor policy formulation in the health sector [3].

In this context, the availability of integrated health information systems is necessary. The question is, what happens if the information systems are in place, but the integration among them is absent. This study pays attention to the context where various information systems are already in place. The

intriguing question here is: does the existence of many information systems really contribute to the better quality of public health management?

Previous study [8] pointed out that evidence-based public health policy modeling has to cope with several challenges in synthesizing and interpreting evidence, taking evidence into decisions, and using evidence at different levels. Our previous study [9] unveils that these challenges are found in the Indonesian context, where segregated health information systems are in place. However, there is no readily available information that explains this phenomenon. Hence, in this study we seek to answer the following question: *how to explain segregated health information systems in Indonesian public health facilities* (*Pusat Kesehatan Masyarakat* [*Puskesmas*])? Answers to this question will provide insights to the former question. In answering the question, we conducted an interpretive case study involving several public health facilities.

The remaining of the paper is structured as follows. Section 2 describes a literature review on the area of concern, i.e. the use of information systems in managing public health. In Section 3, we explain the research context and findings, which are then discussed in the subsequent section. Conclusion and recommendations in Section 4 bring this paper to end.

2. Conceptual Basis: Evidence-Based Public Health Policy

According to Brownson et al. [10], evidence-based public health policy has three interconnected domains: process, content, and outcome. Process domain is intended to understand approaches to improve the likelihood of policy adoption. Content domain is related to the identification of specific policy elements that are deemed to be effective. Outcome domain deals with the potential impact of implemented policy. Several actions need to be taken in this regard to prepare and communicate data, to use analytical tools in more effective way, to manage policy surveillance, and to monitor outcome of various types of evidence [10], [11].

Several factors influence evidence-based decision making [12]: research evidence, resources, and population characteristics (see Figure 1). These three factors altogether with environmental and organizational context inform the decision-making. However, we need to note that evidence may manifest in different forms, ranging from subjective (e.g. personal experience) to objective data (e.g. scientific literature). Recorded data by the public health facilities lies between these two extremes (see Figure 2). Administrative data from public health facilities are also beneficial as reference for planning and surveillance [7].
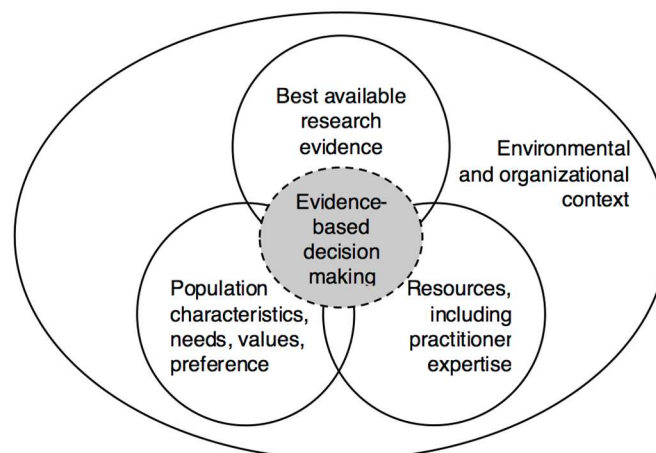

Figure 1. Determinants of evidence-based decision making.
Source: Satterfield et al. [12].

Further, public health surveillance systems may be evaluated by examining their properties, such as simplicity, flexibility, data quality, acceptability, sensitivity, predictive value positive, representativeness, timeliness, and stability [5].

In setting the roadmap for planning and improving evidence-based policy, Spencer [13] proposes a conceptual framework (see Figure 3) consisting of a continuum of quality of policy (as an example of practices; from emerging, promising, leading, to best) which is determined by two interconnected elements: (a) public health impact (effectiveness, reach, feasibility, sustainability, and transferability) and (b) quality of evidence (weak, moderate, strong, and rigorous). However, further conceptualization is needed, for example, to measure the quality of evidence.
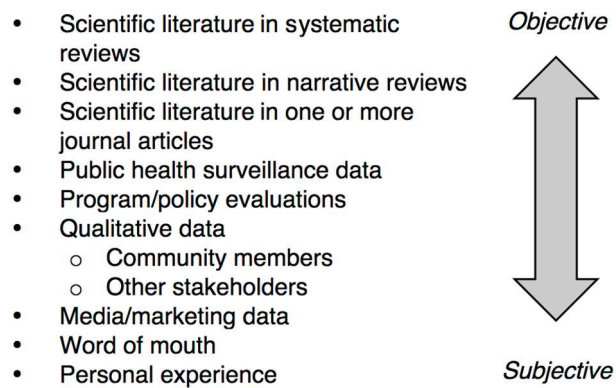

Figure 2. Different forms of evidence.
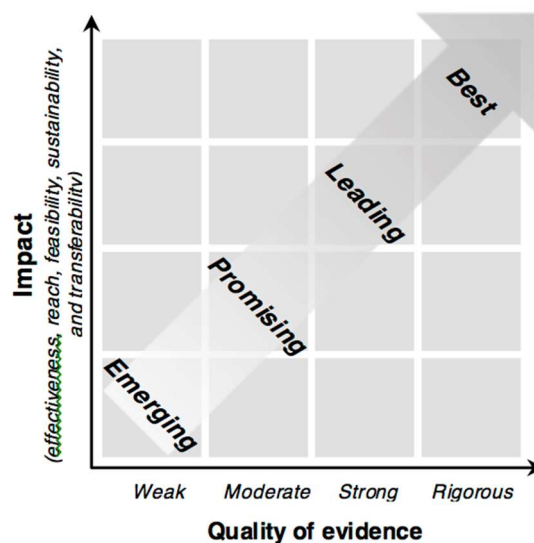Source: Brownson et al. [10]

Figure 3. A conceptual framework for planning and improving evidence-based practices.
Source: Spencer [13]

Implementing evidence-based policy is not without barriers. Previous studies [10] has documented these barriers, such as lack of value placed on prevention, insufficient evidence base, mismatched time horizons, power of vested interest, researchers isolated from the policy process, and complex policy making process. In China, implementation of evidence-based policy faces some barriers which are related to (i) mentality and capability of individual and organisational actors and (ii) the absence of mechanism to translate scientific findings from research into policy [14]. In doing so, they develop several yardsticks, such as improvement of knowledge, attitudes, and practice; development of capability and intermediation; and establishment of a translation system [14].

This recent study can be considered as a preliminary stage focusing on mapping the use of information systems in public health facilities, which is needed in policy construction. In this case, an integrated system is necessary [15]. Otherwise, fragmented and overlapping systems will be in place and this often happens in some contexts [16]. This situation will lead to more severe problems, such as questionable data quality and unresponsive policy health policies [3].

3. Findings and Discussion

In the previous work [17], we found eight important insights, i.e. various information systems have been used by public health facilities, data entry redundancy, top-down decision model in developing information systems, lack of human resources capability, ambiguous job descriptions, overwhelming different reporting procedures, the absence of standard procedures to verify reports, and lack of incentive scheme.

These insights trigger some important issues that can be discussed further. It is obvious that the main problems here are 'disconnections'.

a.   Types of disconnection

First, 'sectoral ego' or silo thinking is commonplace. This public secret in the public sector management in Indonesia[1] still extensively influences the design and the development of information systems. From inter-organizational perspective, this is problem of **disconnection between government agencies at national level**. As its consequences, a series of disconnected information systems was produced. From technical perspective, this creates **disconnection between information systems**.

To ensure the optimal benefits of the information systems, in the future, a better orchestration in designing and developing the systems is a must. One of our informant asserts and tells her expectation, "*... the systems should be crafted into a single system to provide more integrated data. But, this needs good infrastructure and qualified human resources.*" Silo thinking has been found to a great burden in many context [18]. Various solutions have been advocated, include sticking on process thinking, defining standards and interoperability, developing ERP-like solution, and building enterprise architecture (EA) [18].

Second, it seems that the developers of new information systems always start from scratch and neglect the installed base, i.e. the information systems that have been in use to be developed further. This neglect has closed the opportunity to take the plethora of information systems into the next level as information infrastructure e.g. [19], [20]. This is a problem of **disconnection between information systems and the context**. The context here is the existence of installed-base, which is not taken into consideration when developing new information systems. This lack of orchestrated systems to some extent will create derived problems, such as energy consuming reporting systems. One informant unhappily criticized, "*if we use the systems, we should able to send the report immediately.*" Another informant adds, "*... the report format should be unified.*"

Third, from the findings, we understand that the public health facilities have been rarely involved in designing and developing information systems. Changes on the systems may take a long time to be accommodated as the bureaucratic communication between actors involved. This indicates another problem of **disconnection between government agencies at national and local level**.

Fourth, each information system needs to be operated and it needs specific attention form the staffs of public health facilities. What we found on the ground is that the staffs often have no sufficient skills to operate the information systems. This is the problem of personnel capacity, which leads to another **disconnection between information systems and available staff capacity**.

b.   Conceptualizing the disconnections

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[1]Be aware that 'sectoral ego' or 'ego sektoral' is an Indonesia-originated term to refer the similar phenomenon as silo thinking does.

Reflecting further on the types of disconnections that emerge from the findings, we may demystify the relationship between three elements: **actors**, **context**, and **information systems** (see Figure 4). We found four types of disconnections (X1, X2, X3, and X4). X1 is the most complex disconnections as it involves government agencies at the national and local level, including the public health facilities. In this point, we found two disconnections between actors, i.e. (a) **between government agencies at the national level** (X1a), such as between the Ministry of Health and the Ministry of Religious Affairs, in the case of provision of reports related to pilgrimage (hajj), and (b) **between government agencies at the national and local level** (X1b), Example of this disconnection is the absence of the involvement of public health facilities in designing information systems, which are elitist as it involves actors from upper level only.
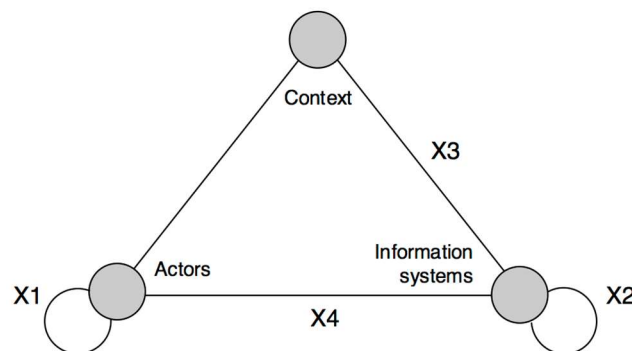

Figure 4. Elements of the disconnection.

As a result, fragmented information systems are developed and in place. This creates another problem, i.e. **disconnection between information systems** (X2). This disconnection has several derived consequences, including the validity of data, laborious data entry, and discouraged working morale.

Another unfavourable consequence of disconnection between actors, especially between national and local actors, is that the information systems do not fit with the context. Here, another problem arises, i.e. **disconnection between information systems and the context** (X3).

Each information system demands for specific skills to operate it. Our findings indicate that workarounds are taken to assign persons that are responsible for each information system. The problem is that they do not always have the needed skills. This creates **disconnection between information systems and available staff capacity** (X4)**.**

4. Concluding Remarks

We have found many problems without clear and well-designed solutions regarding to the use of information systems in Indonesian public health facilities. These problems relate to lack of integration of various information systems used by health facilities, data entry redundancy, top-down decision model in developing information systems, lack of human resources capability, ambiguous job descriptions, overwhelming different reporting procedures, the absence of standard procedures to verify the reports, and lack of incentive scheme. We identified four factors that cause these problems, i.e. silo thinking, neglecting the legacy systems, uninvolved health facilities in the development of information systems, and lack of staff capability.

These problems create various disconnections among actors, information systems, and context. We conceptualize the problems into different type of disconnections: between government agencies at national level, between information systems, between information systems and the context, between government agencies at national and local level, and between information systems and available staff capacity.

The findings lead to several research avenues. First, our data does not reveal the motivation between these segregated information systems. Better information about the motivation may provide a

more complete picture of the phenomenon under investigation. Second, further research may also pay attention to strategies to solve the problems on the ground, by for example, redesigning all the information systems into a more integrated one, or providing "a hub" that enables all the information systems to communicate to each other. Another systematic data collection is needed to provide contextualized design or solution.

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