A Framework for E-Health Strategy for managing pandemics in Saudi Arabia: in the context of COVID-19

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Table of Contents

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Abstract

Background: Increased frequency of epidemics such as MERS, SARS, EDOLA, ZIKA has been creating stress on the healthcare management and operations, and relevant stakeholders. In addition, the recent COVID-19 outbreak has been creating challenges for various countries and their respective healthcare industries for managing and controlling the pandemic. One of the important observations, which can be observed from the recent developments is the lack of effective E-Health framework for managing and controlling pandemics.

Objective: Focusing on the limitation, this study reviews the current National E-Health strategy of Saudi Arabia, and proposes an integrated E-Health framework, which can be effective for managing healthcare operations and services during pandemics.

Methods: A questionnaire-based survey was administered with 316 healthcare professionals for reviewing the current National E-Health framework of Saudi Arabia, and identify the key objectives, factors and components necessary for managing and controlling pandemics. Purposive sampling was used to collect responses from diverse experts including physicians, technical experts, nurses, administrative experts, pharmacists etc. The survey was administered at five hospitals in Saudi Arabia, by forwarding the survey link using the online portal. A final sample rate of 350 was achieved, which was filtered for excluding the incomplete and ineligible sample, giving a sample of 316, which is considered for the study.

Results: 59.2% of the total participants identified the current E-Health framework to be ineffective and more than 50% of the total participants stated that it lacked few essential components and objectives. The additional components and objectives focusing on using E-Health for managing information, creating awareness, increasing accessibility and reachability, promoting self-management and self-collaboration, promoting E-services, and extensive stakeholder engagement were considered to be most important by more than 80% of the total participants.

Conclusions: Managing pandemics require an effective and efficient E-Health framework, which can be used for managing various healthcare services by integrating and collaborating all the stakeholders in relation to the different E-Health components.

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Abstract

Background: Increased frequency of epidemics such as MERS, SARS, EDOLA, ZIKA has been creating stress on the healthcare management and operations, and relevant stakeholders. In addition, the recent COVID-19 outbreak has been creating challenges for various countries and their respective healthcare industries for managing and controlling the pandemic. One of the important observations, which can be observed from the recent developments is the lack of effective E-Health framework for managing and controlling pandemics.

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Keywords: COVID-19, E-Health, Framework, Infectious Disease, Pandemics, Pandemics.

Introduction

E-Health, basically is the application of ICT (Information & Communication Technologies) in healthcare sector [1]. It is considered to be one of the major developments in the past few decades, which has revolutionized the operations in healthcare industry. Various studies [2-4] have indicated positive impact of E-Health approaches in improving the healthcare service delivery, minimizing

operational costs, increasing process efficiency, and most importantly healthcare information management. Focusing on the concept of 'application' derived from the definition [1], the success of E-Health depends on how it is applied and managed in different areas of healthcare operations. For improving the process of E-Health implementation, different frameworks were developed by different countries (ex. Austria, European Union) and healthcare organizations according to their needs and specifications [5, 6]. However, these frameworks and documents mainly focus on examples and present the outlines (high level designs), but offer very little information on the guidance to the process of development [1]. There are few studies [8, 9], which have attempted to provide a framework for strategic planning and implementation of E-Health strategies. However, they are mostly related to the normal healthcare operations. There are few studies [10, 11] which have developed a framework for healthcare management during pandemics, but are only limited in scope, relating the framework for assessing preparedness/readiness, but not for managing healthcare operations during pandemics. These studies focused on readiness, such as resource management, finances, vaccination etc., however, the operational framework during the pandemic, which includes the approaches, stakeholders' roles and responsibilities, approaches were not highlighted. In addition, these studies were distributed across different regions, and may not be applicable in all cases.

The National E-Health frameworks were formulated based on the vision and selected objectives targeting the healthcare management and dissemination of general healthcare services [6, 12]. These frameworks may not be effective in dealing with pandemics, which may require sudden changes in the healthcare policies, strategies, and information management. For instance, there are various myths and misinformation about COVID-19 was identified to be circulating over the internet; which proved to be challenging for the governments and healthcare officials to address [13]. In addition, there were more frequent pandemics were including SARS, H7N9, Zika, Ebola, MERS, COVID-19 were identified in the recent years. Considering such unexpected risks and other healthcare challenges, a sudden change in healthcare policies and strategies may be inevitable. In these conditions, creating awareness among public, disseminating legitimate information, making changes to the healthcare services: access and delivery etc. are few aspects of E-Health, which can be useful in managing the pandemics. E-Health can be one of the effective operations during pandemics, as it can enable remote management of healthcare operations and services. Focusing on the gaps identified in relation to the management of healthcare operations during pandemics, and considering these challenges and the possibilities of E-Health approach towards managing pandemics, the aim of this paper is to review the existing National E-Health framework of Saudi Arabia, and propose an integrated E-Health framework for managing the pandemics in Saudi Arabia.

Background and Literature Review

According to World Health Organization [14], out of 194 member countries, only 58% countries have an E-Health strategy, only 55% countries have legislation in relation to electronic health data. The frameworks developed by these countries were based on the needs and various contexts such as finance, resource, and technological capabilities. With few countries having an E-Health framework, and proper legislation, it can be challenging for the countries to coordinate and manage healthcare operations during the pandemic, when there is a need for collaboration among countries for managing pandemics. However, it is equally important to manage the healthcare operations internally, and control the rapid spread of disease/infections during pandemics. There are different healthcare components, which may need to be effectively managed during pandemics. Accordingly, this section reviews the literature various components of E-Health framework and their applicability in pandemics, according to the guidelines prescribed by World Health Organization [22].

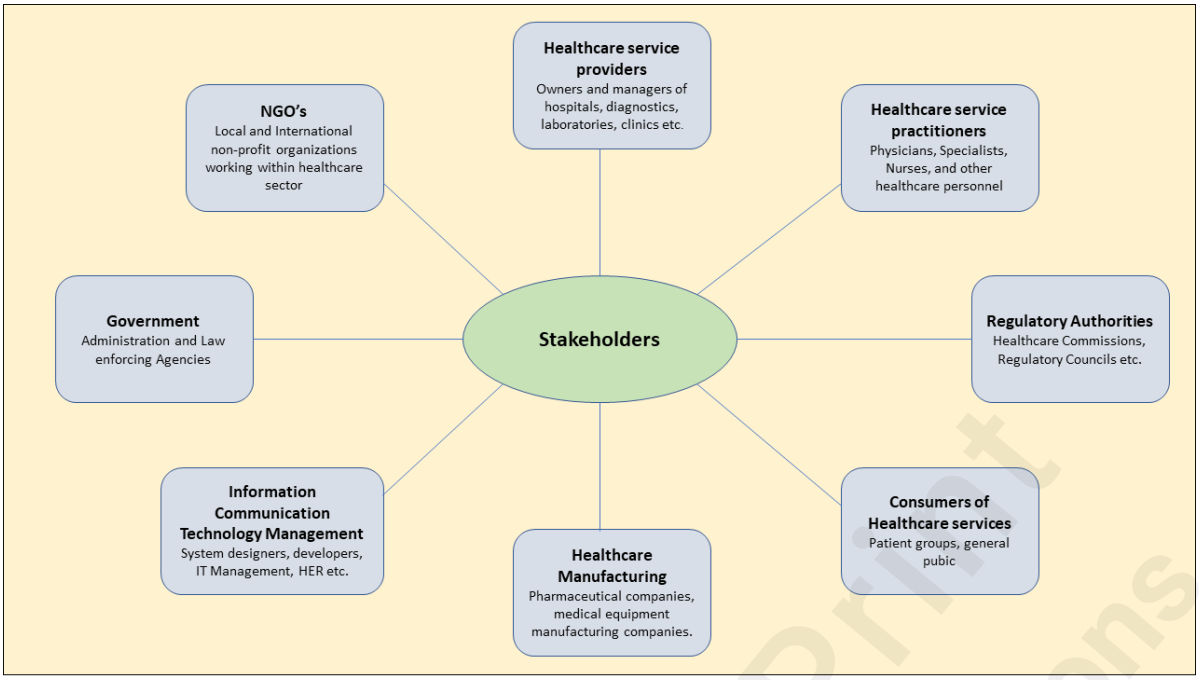

Figure 1. Stakeholders in Healthcare Management

Stakeholders are considered to be one of the important components in the process of managing pandemics. Usually, pandemics requires greater participation of various stakeholders as shown in figure 1 in healthcare management, and it is not only applicable to the healthcare practitioners, but also requires the participation of whole society [15]. Therefore, stakeholders in the times of pandemics includes the whole society, where every individual share the responsibility for containing the spread of infectious diseases. However, there is a need for defining the roles and responsibilities of all stakeholders including healthcare workers, Research organizations, healthcare equipment manufacturers, pharmaceutical companies etc. and prepare for the pandemics [16]. Healthcare service providers and practitioners have the responsibility of planning, delivering healthcare services, managing healthcare resources etc. Regulatory authorities may need to monitor the healthcare services operations across various hospitals, and formulate standards and regulations to be adopted by healthcare service providers and practitioners. Accordingly, manufacturing organizations should focus on meeting the growing needs for medicines, equipment, and other resources; while Information and Communications management unit should focus on managing online healthcare operations and creating awareness among publics. Governments should monitor all healthcare operations and administer these at different levels including cities, towns, and villages in both public and private hospitals to prevent contamination and risk of infections. Pandemics may have a serious impact on the mental health of the people. Anxiety, depression, stress are few illnesses resulting from the fear about pandemic, or under preventive measures such as isolation and social distancing [17, 18]. Therefore, support and awareness are very much essential, which need to be provided to the people. E-Health, in this context can be effective, as support, services, and information can be remotely shared among the people using various applications. Stakeholders usually rely on less timely and traditional sources of disease surveillance, therefore there is a need for timely and reliable pandemic intelligence, using effective communication technologies [19].

Operations management is another important area to be considered during the pandemics. Available resources such as finance, medical supplies, equipment, devices, nurses, practitioners, need to be effectively managed, resulting in maximum efficiency of the healthcare operations [20]. Large upfront investments in diagnosis, tests, and treatment were identified to be resulting in most efficient use of resources during pandemics [21]. In addition, operations related to Research and

Development, pharmaceutical companies have to be managed for maximum outputs. E-Health can play an important role in all such health-related operational activities, by effectively disseminating the quality information across the supply chain. In addition, operations such as diagnosis, disease surveillance, monitoring, tracing and tracking can be effectively managed through mobile applications, which can limit the number of patients visiting hospitals, preventing the spread of infections.

Information Management is one of the most important aspects to be considered during pandemics. The success in managing pandemics mostly relies on how the information is managed and shared among the stakeholders, which can help in taking timely actions. The increasing number of myths related to COVID-19, such as burning down of 5G towers in UK [22], drinking raw alcohol [23] in Iran to prevent from transmission of novel coronavirus are few examples of poor information management, and rapid spread of wrong information through social media platforms, which can result in serious losses. It is the key to the operational management, and containment of infectious disease by effective monitoring and tracking, and most importantly creating awareness about the novel diseases and the precautions to be taken by the responsible authorities.

The next set of factors focuses on the approach for developing strategies, which include strategic context; experiences from previous events and research; formulating mission, objectives; identifying the target components; analyzing opportunities and gaps; developing strategies; implementation; monitoring and reviewing the approaches; and making the necessary changes to the approaches deployed. Strategic context is related to the main area, which the approach is targeting for. It can be related to the containment of infectious disease, or reducing the spread of wrong information, or any other specific context related to pandemic [24]. The experiences from the past, such as approaches adopted by different governments in controlling the pandemics such as SARS, MERS, ZIKA, EBOLA can be used for identifying the context. The mission statement would be the foundation for developing the approach for managing pandemics. It must clearly define the purpose, and the instill a sense of motivation and hope among all the stakeholders [25] involved in containing pandemics. It should inspire and present a message of contributing to the delivery of best healthcare services to those who are affected in pandemics through an integrated clinical practice, education, research, and effective resource management for containing the pandemic.

The next step focuses on formulating the objectives. The objectives define the set of goals or activities which need to be achieved. It can include statements related to the development of workforce, developing research activities, improving healthcare services and delivery etc. [25]. Next, the components which need to be targeted are identified, these can include different areas/activities related to healthcare management [24]. Based on the objectives, the opportunities and gaps for achieving the specified objectives have to be identified. Based on the identified components, objectives, and resources availability, the necessary strategies for managing pandemics have to be developed and implemented. The whole approach being adopted for managing pandemic has to be monitored and evaluated. Based on the evaluation, the approach can be updated by making necessary changes in the areas which are not effective. These guidelines can be used for developing E-Health strategies by different countries, as the basic components, which need to be considered are outlined. However, the success of the framework depends on how the strategies are formulated and implemented, which is mainly the application of ICT to the healthcare framework.

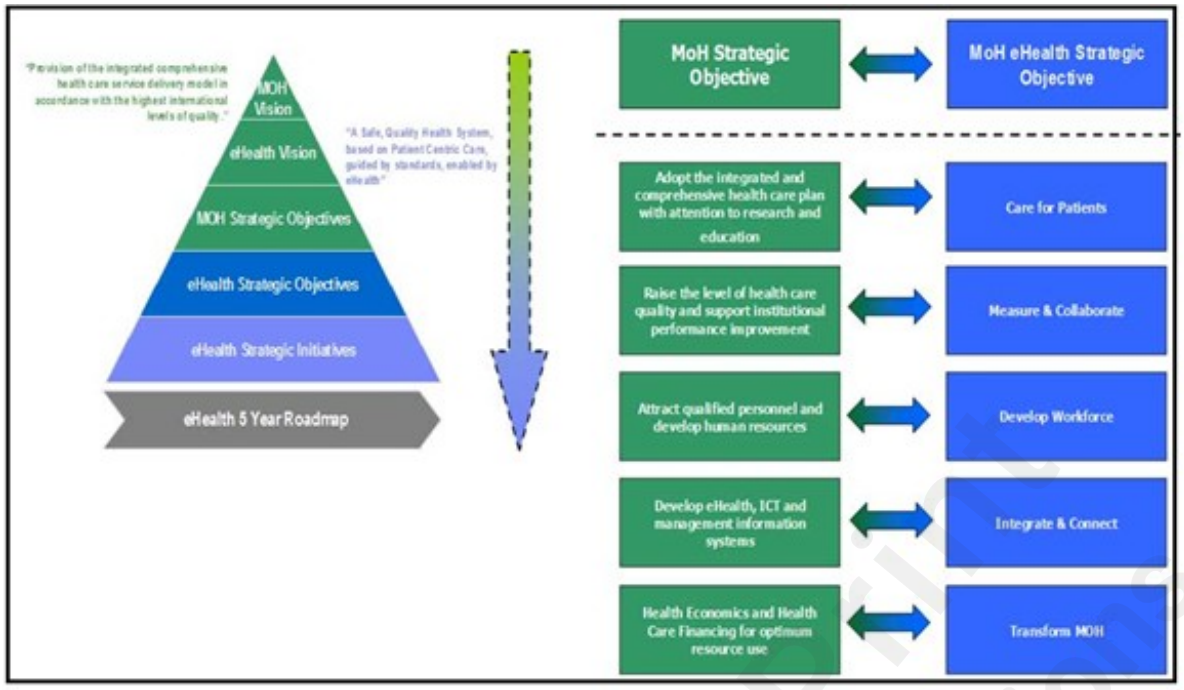

Figure 2. National E-Health Strategy of Saudi Arabia

As a part of this study, the National E-Health strategy of Saudi Arabia (as shown in Figure 1) is reviewed in the context of its applicability in managing pandemics. The framework provides the details of the approach, and objectives; which is usually updated every five years. However, it is not clear and reflective in relation to various components and lacks clear approach, and process, supporting the findings of [1]. The necessary components such as information management, operations management, stakeholders' participation etc. were not included in the framework. In addition, two most important aspects such as dissemination of legitimate information among all the stakeholders (information accessibility), and preventing the circulation of wrongful information (information misuse) were not considered in this study. The strategy is further reviewed by the healthcare experts in the context of managing pandemics, and the need for integrating additional components were assessed using the questionnaire-based survey, which is discussed in the next section.

Methods

The purpose of the study is to review the current National E-Health strategy of Saudi Arabia in the context of managing pandemics and propose an integrated E-Health framework which can be used in the general healthcare context and also for managing pandemics. The questionnaire was mainly divided in to four components. First component focused on question related to current National E-Health strategy (four items); second component focused on the key considerations to be considered in an E-Health framework (nine items); third component focused on the key factors in E-Health framework (one item); and the fourth component (two items) focused on assessing the need for an integrated E-Health framework for managing pandemics, such as COVID-19 in Saudi Arabia. The items in the questionnaire are developed based on the components reviewed in the background study, and National E-Health strategy toolkit provided by Work Health Organization [22]. A five-point, Likert scale [26] was used for collecting the responses for the questions. The participants can present their opinions on five scales (1: Strongly Agree; 2: Agree; 3: Neutral; 4: Disagree; 5: Strongly Disagree) relating to each item in the questionnaire. The questionnaire was translated into Arabic by a professional translator. However, both English and Arabic versions were utilized in the process of data collection. The survey was designed using Google Surveys platform, and the survey links for

English and Arabic versions were created for inviting the participants. A pilot study was conducted with six healthcare professionals (three practitioners, two nurses, one manager). Based on the feedback from the participants, few changes in the questionnaire formulation and multiple-choice options were made in relation to grammatical errors. In addition, Cronbach's alpha for all items in four components was identified to be greater than 0.85, revealing good consistency.

Recruitment

The healthcare professionals were recruited using emails, which included the information (purpose) of the survey, with a survey link. An additional note, requesting the participants to forward the email to their colleagues was placed for increasing the number of participants. Initially, using the portals at five hospitals (King Fahad hospital in Jeddah, General Hospital in medina, King Abdulaziz Medical city in Riyadh, King Khalid Ibn Abdul Aziz in HafarAlBatin and King Khaled Hospital in Majma'ah), the email requesting to participate in the survey was forwarded to all the healthcare professionals working in the hospital.

Sample

This study utilized purposive sampling whereby, a nonprobability sample was obtained based on the purpose and the objective of the study, which mainly focused on reviewing the current National E-Health strategy and proposing new integrated E-Health framework for managing pandemics. Accordingly, the survey link was initially forwarded to 257 healthcare professionals working at five hospitals in Saudi Arabia. Snowball sampling is one of the effective techniques to reach larger sample population in a short time. It is a technique where existing study subjects are requested to recruit future subjects from among their acquaintances [27]. As a result of using snowball sampling (requesting participants to forward emails to their colleagues in other hospitals), a final sample of 350 was achieved. 23 were removed for low quality responses and incomplete data; and further 11 were removed as they are not working in healthcare related organizations. As a result, 316 eligible participants completed the survey.

Analytical Process

The survey was developed using Google Surveys Platform, and was conducted from March 9 to April 6, 2020. Frequencies were calculated, to analyze the collected data. The data is analyzed using four themes relevant to the study, which include review of current National E-Health strategy; objectives of E-Health framework; importance of ICT; and the need for an integrated E-Health framework in the context of managing pandemics in Saudi Arabia. Accordingly, the results are discussed in the following section.

Results

The final sample size recruited for this study was 316 respondents. Among the respondents' sample, majority of the participants were male (221/316), followed by 30.1% of females (95/316). In terms of age, majority of the participants belonged to 35-44 age group (147/316), followed by 25-34 age group (10/316), 45-54 age group (30/316), 18-24 age group (15/316), and only 4.4% were aged more than 54 years (14/316). In terms of education, majority of the participants had a qualification of bachelor's degree (161/316). A good number of participants were having master's degree (74/316), and Doctorate (24/316), reflecting the expertise among the participants. In addition, 18% of the participants had diploma/high school qualification (57/316). In terms of profession, the sample was evenly distributed across the relevant experts. 26.3% of the participants were related to Administrative departments (83/316), followed by 23.4% of nurses (74/316), 20.6% of physicians (65/316), and 19.9% of technical experts (63/316). In addition, 9.8% of the participants were involved in other healthcare activities such as research and development, pharmaceutical operations,

academicians etc. In terms of work experience, 54.8% of the participants were having an experience of more than ten years (173/316), followed by 27.5% having an experience between five to ten years (87/316). indicating that about 81% of the participants were having an experience of more than five years, reflecting that majority of the participants were reliable. In addition, 12.3% of the participants were having an experience of less than two years (39/316), and 5.4% were having an experience between two and five years (17/316). Table 1. includes the frequency distribution of these variables.

Table 1. Frequency distribution of key variables

Variables	**n (%)**
Gender	
Male	221 (69.9%)
Female	95 (30.1%)
Age	
18-24	15 (4.8%)
25-34	110 (34.8%)
35-44	147 (46.5%)
45-54	30 (9.5%)
>54	14 (4.4%)
Education	
High School graduate/ Diploma	57 (18%)
Bachelor’s Degree	161 (50.9%)
Master’s Degree	74 (23.4%)
Doctorate	24 (7.6%)
Profession	
Physicians	65 (20.6%)
Nurse	74 (23.4%)
Technical Experts	63 (19.9%)
Administrative	83 (26.3%)
Other healthcare operations	31 (9.8%)
Work Experience	
< 2 years	39 (12.3%)
2-5 years	17 (5.4%)
5-10 years	87 (27.5%)
>10 years	173 (54.8%)

The next set of results focus on reviewing the current National E-Health framework in Saudi Arabia. The effectiveness of the current framework in managing pandemics/infectious disease was identified to be ineffective by majority of the participants. 50.3% of the total participants (159/316) disagreed, and 8.9% of the total participants (28/316) strongly disagreed with the statement that the current E-Health framework is effective, comprising nearly 60% of the total participants. Similarly, the statement, the current E-Health framework covers all major objectives of healthcare management has got mixed responses. While, 40.2% of the total participants (127/316) disagreed, and 7% of the total participants (22/316) strongly disagreed, there are considerable number of participants (101/316), who were neutral. However, the findings suggested that the current E-Health framework lacks few objectives related to healthcare management. Similarly, considering the statement on inclusion of essential objectives for managing pandemics, 50% of the total participants (158/316) disagreed, and 10.1% of the total participants (22/316) strongly disagreed. Focusing on the need for revising the

current framework, 53.8% of the total participants strongly agreed, and 16.5% of the total participants (accounting nearly 70% of the total participants) agreed that the current framework has to be revised.

In addition, 91.4% of the total participants agreed that there is need for a new effective and efficient E-Health framework for Saudi Arabia. It can be observed from figure 3, that the opinions about the current E-Health framework slightly differed between physicians and nurses. Slightly a greater number of physicians reflected the opinion that the current E-Health framework is ineffective for managing pandemics compared to nurses. However, majority of both physicians and nurses reflected an opinion that current E-Health framework needs major revisions.

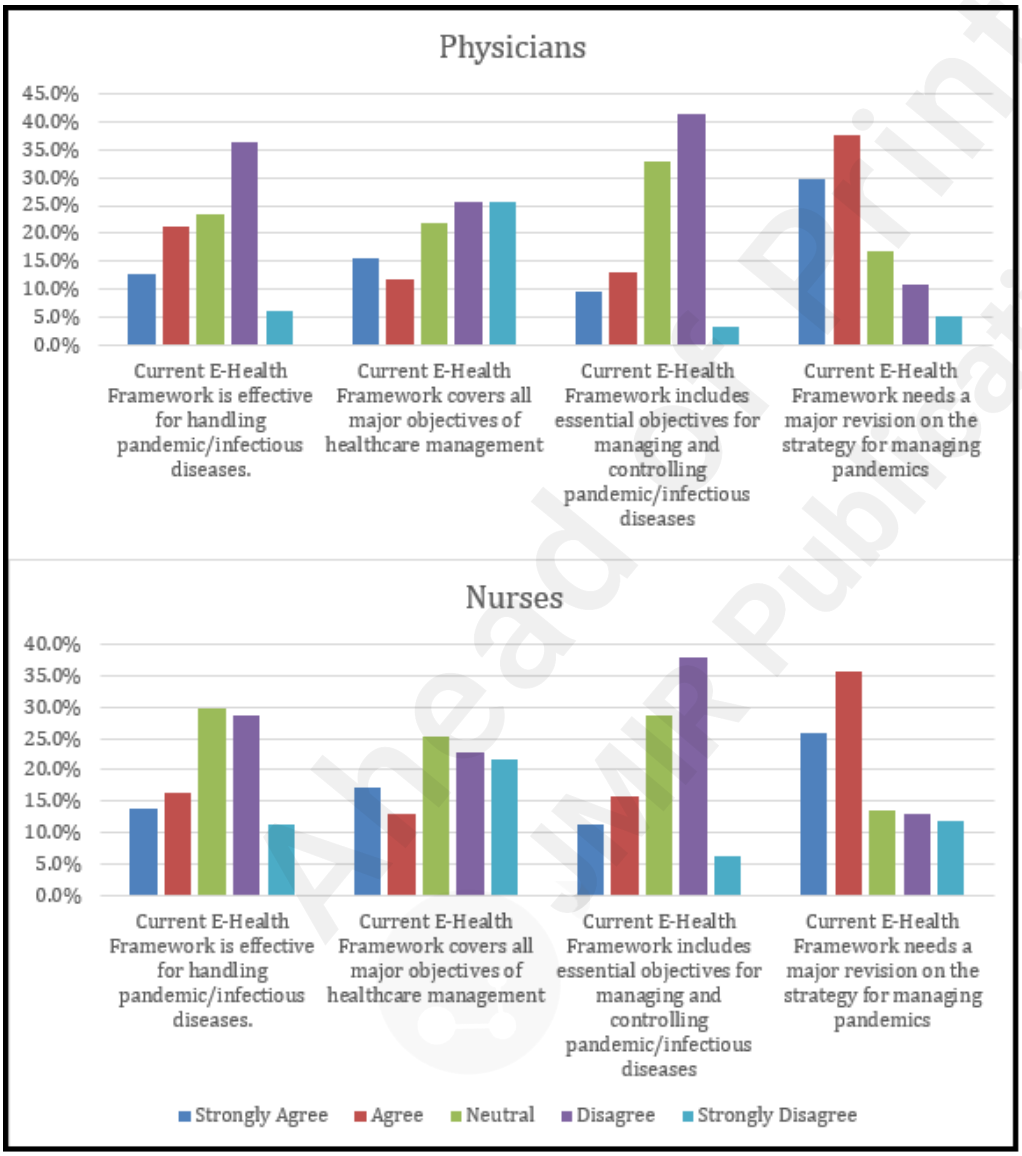

Figure 3. Comparison of Physicians and Nurses opinions about current E-Health Framework

The next set of results (as shown in Table 2) focus on the key considerations for developing new integrated E-Health framework for managing pandemics in Saudi Arabia. In relation to the statement that 'the new framework in contradiction to the existing framework should focus on long-term objectives', 32.28% of the total participants (101/316) strongly agreed, and 57.59% of the total participants (182/316) agreed with the statement. Focusing on the distinction of services during normal conditions and pandemics condition may be useful in clearly outlining the service delivery

guidelines in two conditions, which may clear any ambiguity considering the operations and services. Accordingly, the idea of having different set of objectives in two conditions was supported by 94.62% of the total participants (combined total of participants who strongly agreed (30.7%) and agreed (63.92%). It is interesting to observe the results focusing on the compatibility and integrated services being agreed by 94% of the total participants. Accordingly, the need for inclusion of all stakeholders including government, healthcare practitioners, businesses, and governments; and need for clear roles and responsibilities of all stakeholders was supported by more than 85% of the total participants.

Table 2. Frequency distribution (%) of key considerations related to the National E-Health Framework of Saudi Arabia for managing pandemics

Items	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
New Framework should focus on long-term objectives	32.28%	57.59%	7.59%	1.27%	1.27%
It should have different objectives relevant to managing healthcare services during pandemics	31.65%	58.23%	8.54%	1.27%	0.32%
It should include regular healthcare objectives along with the objectives for controlling and managing pandemics	30.70%	63.92%	4.11%	1.27%	0.00%
It should include all stakeholders: Public, Healthcare Practitioners, Businesses, and Government	34.49%	52.53%	10.44%	2.22%	0.32%
It should specify clear roles and responsibilities for all stakeholders	38.29%	55.38%	5.38%	0.00%	0.95%

The next set of results (as shown in Table 3) focus on identifying the key factors to be considered in the framework for managing pandemics. Results have identified that public awareness, promotion of precautionary methods, disseminating genuine information, increased stakeholder participation, increased reachability and accessibility of E-Services, improved communication, promotion of self-management and self-control approaches, formulation of new guidelines, and regular monitoring and updating of the processes and approaches were identified to be the key factors in managing pandemics by majority (>80%) of the total participants.

Table 3. Frequency distribution (%) of key objectives to be included in the new E-health framework

Items	Strongly	Agree	Neutral	Disagree	Strongly

	Agree				Disagree
Develop Awareness raising Programs	39.24%	53.16%	5.70%	1.27%	0.63%
Promote the precautionary methods during pandemic	43.04%	53.16%	2.53%	0.63%	0.63%
Make genuine information accessible to public	36.39%	50.32%	9.81%	2.53%	0.95%
Increased participation of all stakeholders at individual, community, and national levels.	36.39%	54.75%	6.01%	1.27%	1.58%
Increasing richness and reachability of E-Services	40.19%	52.53%	4.43%	1.90%	0.95%
Heightened consciousness and improved communication	44.62%	51.27%	3.48%	0.00%	0.63%
Promoting Self-management and self-control approaches among individuals	31.01%	55.70%	9.81%	2.22%	1.27%
Formulating new guidelines for managing healthcare services during pandemic	33.54%	57.59%	7.28%	0.95%	0.63%
Review of the framework at regular intervals and updating the objectives	33.54%	57.59%	7.59%	0.32%	0.95%

Focusing on the use of ICT, it may be considered that they are effective in managing the information flow, and streamlining the operations to increase efficiency. Accordingly, in relevance to the importance of ICTs for tracking and monitoring the spread of infectious disease, majority of the participants, 74.1% (234/316) considered it to be important. Keeping in view of rising pandemics in the past few decades, the importance and the immediate need for E-Health framework for Saudi Arabia was assessed in context of COVID-19. The findings revealed that more than three-fourth (249/316) of the total participants (78.8%), agreed that developing an integrated framework as very important. The results from the survey are reflected the need for an integrated E-Health framework, and various components which need to be considered for managing pandemics. The findings are accordingly, discussed in the next section.

Discussion

The results clearly indicated that the current National E-Health strategy is ineffective for handling pandemics, as it does not incorporate all the necessary components and objectives for managing pandemics using E-Health strategies. In addition, more than 90% of the total participants expressed an opinion for developing an integrated E-Health framework for managing pandemics. Focusing on these gaps, the necessary components of the framework are identified based on the findings (Table 2; Table 3) related to the key considerations and key factors to be included in the framework for managing and controlling pandemics. Firstly, it is important to determine the strategic context. The

strategic context describes the priorities and challenges which E-Health can address. It can be developed by reviewing the health statistics of the population, current health strategy, priorities and goals. As identified from the key considerations (Table 3), 89% of the participants stated that long term objectives should be considered. As pandemics can have long term impacts [28, 29], the framework should focus on both short-term (as adopted in the current National E-Health strategy), and long-term objectives. In addition, it is necessary to consider and review the current healthcare system. Accordingly, 93% of the total participants stated that the objectives related to general healthcare, and healthcare services during pandemics must be considered. In addition, the priorities and goals must be revised according the situation arising out of pandemics. In addition, past trends and experiences in dealing with pandemics can be used as a valuable source of information for setting the context, priorities, and goals [29].

A vision statement presents a long-term objective, while a mission statement considers short term objectives for achieving the vision. Managing and controlling epidemics require short term objectives which are effective in delivering the healthcare services and preventing the spread of infectious disease using E-Health approaches. Based on the mission set, next step is to assess the required components for achieving the mission. The components can also be considered as building blocks required for achieving the mission, which include leadership and governance, strategy and investment, services and applications, standards and interoperability, infrastructure, legislation, policy and compliance, and workforce [24]. The leadership, standards and interoperability, investment, policy and compliance are ensured by the governments and healthcare ministries for setting up the mission, and overseeing all healthcare operations. While infrastructure, and services and applications are related to ICT environment, all other components can be considered as enablers in creating the environment for managing pandemics.

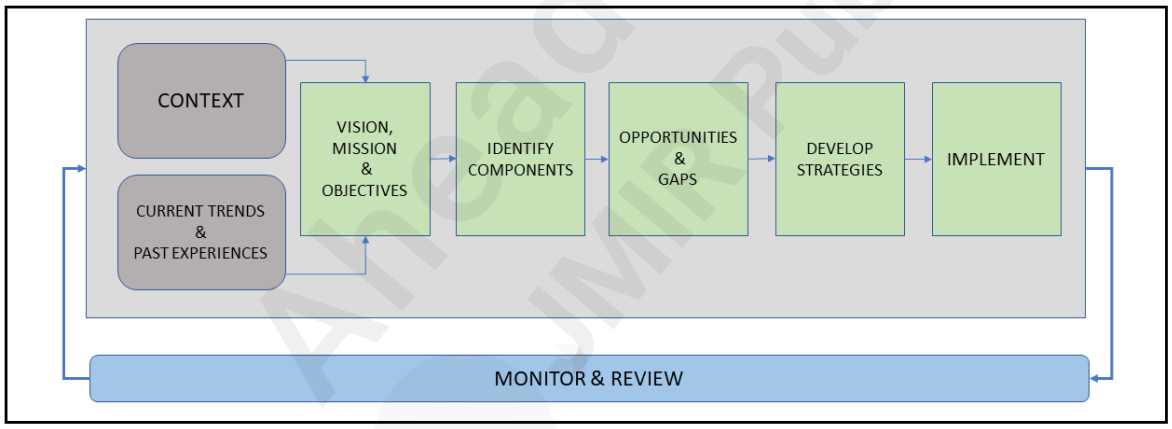

Figure 4. Approach for developing E-Health Strategies during Pandemics

The next step is to analyze the opportunities, gaps, risks, and barriers for creating e-Health environment for the components identified. While the opportunities suggest the possible E-Health solutions and applications relevant to components, gaps can be identified in relation to services and infrastructure [29-32]. For instance, the opportunities for collaboration between research and development, healthcare units such as hospitals, physicians, and pharmaceutical companies can be achieved by using a common E-platform or portal for sharing the information related to disease such as symptoms, diagnosis factors, effects of various medicines, the need for medicines and medical equipment etc. Lack of effective collaboration between these components can create risks and gaps related to healthcare services delivery, which can be assessed from the recent outbreak of COVID-19, where the shortage of medical equipment, vaccines, lack of information are clearly evident in various regions [32, 33]. Based on the assessment of opportunities and gaps, the strategies can be

developed and implemented. As identified from the findings (Table 3), few strategies such as promotion of precautionary methods, creating awareness, promotion of self-management and self-control practices, increasing accessibility to genuine information etc. were considered to be highly important during pandemics. One of the most important aspect in the process of developing strategies during pandemics is the rapid monitoring a review of the whole development and implementation process. Accordingly, the whole approach is presented in Figure 4.

There are few components, which need to be managed throughout the process, including operations management, stakeholders' engagement, and information management, as shown in Figure 5, representing an integrated E-Health framework for managing and controlling pandemics in Saudi Arabia. Healthcare operations during pandemics not only involves the service delivery and administration of healthcare activities, but the scope of operations would be increased by engaging all the stakeholders and their respective activities. This process requires high-level leadership and support, appropriate governance structure, a multi-disciplinary team, and an agreed timeline and resources for completing the tasks with maximum efficiency in minimum time [24]. For instance, the manufacturing of masks, testing kits, and medicine such as hydrocychloquine was being implemented on war-footing in different countries for managing and controlling COVID-19 [34, 35], and lack of effective leadership and strategy may result in various risks and challenges for controlling the pandemics [36, 37]. This represents a collaborative effort under the leadership of governments with various stakeholders including physicians, pharmaceutical companies, manufacturers of testing kits being operating with maximum efficiency to cater the needs of healthcare system during pandemic.

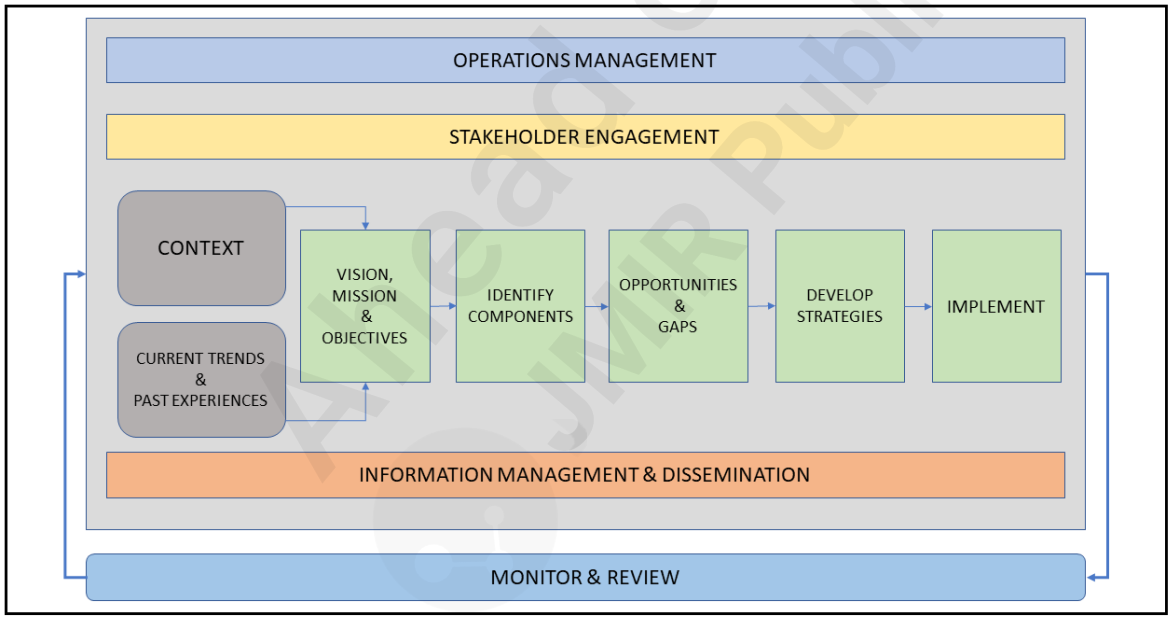

Figure 5. An integrated E-Health Framework for managing Pandemics

Stakeholders engagement is another important component which need to be managed during pandemics. The engagement process should focus on government's role as leaders, overseeing the engagement of all stakeholders; identifying different stakeholder groups such as healthcare professionals, public, pharmaceutical companies, medical equipment manufacturers, administrators, managers, and all other personnel involved and related to healthcare activities; developing an approach for managing these groups; and defining the points of consultation, and dissemination of information across all stakeholder groups. Some major stakeholder groups as analyzed in [24] include decision-makers, key influencers, engaged stakeholders, and broader stakeholders and

general public. The leaders should ensure supportive and constructive engagement of all stakeholders during pandemic, involving everyone in the process of managing and controlling pandemics. The benefits of ICTs in healthcare management can be greatly realized during pandemics. They can help in preventing the spread of misinformation, and creating awareness about the infectious diseases, promoting precautionary methods, accessibility of healthcare services through enhanced online/ mobile applications, dissemination of information and services in remote areas, promotion of self-management and self-control practices during pandemics. All these factors were rated to be highly important by the majority of the participants in the survey (Table 3).
Thus, the three additional components are integrated with the strategy development components to form an integrated E-Health framework for managing and controlling pandemics. The process of review and monitoring is accordingly applied to all the components in the integrated E-Health framework as shown in Figure 5. Accordingly, all the essential components of E-Health strategy for managing pandemics were identified and integrated.

Limitations

This study has identified various E-Health components required for managing and controlling pandemics. However, functions within these components may differ from their application perspective in different regions. There is a need for clear definitions and explanation of these functions, which are not presented in this study, as the study focused only on identifying the key components at national level. In addition, the framework was developed in specific to Saudi Arabian context, based on the review of current National E-Health strategy, which may not be applicable to other countries. However, it is ensured that the selection of components are more generalized, focusing on the necessity and the needs for healthcare management during pandemics.

Implications

There are both theoretical and practical implications, which can be derived from this study. The literature reviewed, and the proposed framework can be used by the researchers as a conceptual for developing and evaluating various strategies during pandemics, such as lockdown strategy during COVID-19. In addition, the proposed framework offers valuable information for the academicians and researchers regarding the E-Health components and the approach for developing and implementing E-Health strategies. Practical implications include the consideration of proposed framework by the Saudi Arabia government and Ministry of Health in developing and implementing effective E-Health strategies during pandemics, by relating the E-Health strategies in relation to the various components proposed in the framework.

Future Research

The current framework was proposed in specific to Saudi Arabia. Future work in this research focuses on evaluating the framework in the context of Saudi Arabia. Though the framework was designed in the context of Saudi Arabia, it may be applicable in other similar regions with similar healthcare operational infrastructure and strategies. Therefore, future research may focus on validating the framework in other similar countries in the Middle East and other developing countries. In addition, both qualitative and quantitative methods may be used in the evaluation of framework, which may lead to the collection of various types of data, from which various inferences

can be made. Authors also propose to extend the framework in relation to various healthcare operations and the involvement of stakeholders (roles and responsibilities), using the approach of collective intelligence, where the active engagement of all global stakeholders is considered for overcoming the challenges of pandemic.

Conclusion

This study has reviewed the current National E-Health strategy of Saudi Arabia, which has revealed various limitations and drawbacks in relation to the healthcare management during epidemics. Accordingly, the survey instrument was administered with healthcare professionals for identifying the necessary E-Health components, and an approach for developing and implementing the strategies in relation to the identified components. The proposed framework is considered to be effective and efficient, as it is designed in a way that it can be used for managing general healthcare services, and also the essential healthcare services during pandemics. It is designed to be used under both conditions. This study has proposed the main components in E-Health framework for managing and controlling pandemics. The future work focuses on evaluating the identified components, and identifying the necessary functions related to each component, which are necessary during pandemic.

Abbreviations

JMIR: Journal of Medical Internet Research
RCT: randomized controlled trial
ICT: Information & Communications Technology

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Supplementary Files

Multimedia Appendixes

Untitled.
URL: https://asset.jmir.pub/assets/5e5b47a2ac33a817a06fb7d521bebd93.pdf