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Review Article

The Reality of the Awareness of the Workers in the National Health Information Center of the Importance of Big Data: A Survey Study

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Abstract. This study aimed at identifying the reality of the awareness of workers in the National Health Information Center of the importance of big data. It used the descriptive approach (survey study) through the personal interview tool with the aim of collecting data to identify the views of the study sample about the main question of the study, which is "What is the reality of workers' perceptions in the National Health Information Center of the importance of big data?"From this main question the following sub-questions derive: First, "What is the awareness of workers at all administrative levels of the concept and importance of managing and analyzing big data?". Second, "What is the importance of managing big data in the National Health Information Center?". Third, "What value does managing big data add to the National Health Information Center?". Out of This third question, emerge the following sub-questions: First, "What is the value of big data in the National Health Information Center follow-up on e-health projects?". Second, "What is the value of big data in decision support for health policy-making?". Third, "What value does big data add to support health innovation?". Fourth, "What value does big data add to enhance clinical trials?". Fifth, "What is the investment value of big data?" The study community consisted of the National Health Information Center, and the study sample was the intentional sample, which consisted of officials, administrative and technical staff directly related to dealing with big data in the center. In its results, the study found a difference in the awareness of the workers in the center of the importance of big data, according to the administrative levels they occupy. The strategic position of the center and its role in making health decisions at the national level and the huge volumes of data it contains and produces illustrate the importance of managing big data in the center. The value added by the management of big data in the center is namely assistance in following up on e-health projects, assisting decision-makers in making health policies. In addition, it is considered one of the most important tributaries to support the process of health innovation and health research, to enhance the aspect of clinical trials, and in investment. In light of these results, the study recommended raising awareness among the center employees through holding seminars and specialized workshops, directing the health sectors and relevant authorities and guiding them with the basic rules for managing and preserving big data, completion of operational plans to actually launch the investment phase of big data.

Keywords. Big Data, Big Data Management, The National Health Information Center

Mathematics Subject Classification (2020). 94A16, 68T09, 62R07

1. Introduction

Societies are witnessing a remarkable development as a result of technological progress and the information explosion, so that the progress of nations is measured through the progress of their knowledge. In fact, knowledge is the fourth sector in the new economy, and it is the most valuable asset, and the most important factor of production is the modern type of capital that is based on experiences in the new economy, while the traditional economy is based on (labor, land, and capital) (Ba'ali [11]). Therefore, the studies focused on how to invest in knowledge by exploring it from its sources, preserving it, managing and exploiting it, and on the role of technologies and communications in making the most of them in record time and at the least cost and effort.

Information centers are considered part of these important societies because of their prominent role in managing data and information resulting from its various sources, sizes and types, and transforming them into value if they are properly invested. Hence emerges the role of the National Health Information Center in the Saudi Health Council. This center aims to coordinate between the various health authorities, such as the Ministry of Health and medical services in the military, university hospitals, and other relevant government agencies, with the goal of information interconnection between these bodies so that data flows between them and builds health information bases by collecting and organizing this information from its various sources at the national level. Therefore, it is a priority to take care of the center and develop it to keep pace with the progress that is taking place in the world, especially as it seeks continuous development in providing support and information services necessary in treating citizens with high efficiency.

On the other hand, there is a massive increase in the size of this data, the speed of its processing, the different sources and the different types of text data, digital, images, audio, video, tables,... and other various forms in different ways and sources of production on a daily basis, as indicated by Dash *et al*. [13], who referred to this increase by the term "Digital world". This term is interpreted as "quantifying such huge amounts of data that are generated, replicated and consumed in one year". He also indicated that the IDC estimated the approximate size of the digital world at 1,300 Exabyte in 2005 AD, then it expanded to 16,000 Exabyte, or 16 zeta bytes in 2017, and the company also expected that the digital world by 2020 AD will be 40,000 Exabyte, and we have to imagine this number allocating approximately 5200 gigabytes of data to individuals. In fact, this represents the tremendous speed In which the digital world is growing (Dash *et al*. [13]), and here is the biggest challenge in how to manage this amount of data because it is difficult to manage it in traditional ways. It is supposed to adopt modern technological methods and trends to make a radical change in the way this data is used.

Researchers stressed the role of big data management in information centers and the hoped-for benefit behind investing in this big data for the centers and the beneficiaries and which accelerates the development process. In the study of Abdulkadri *et al*. [1], researchers noted that the main benefits of incorporating big data into official statistics are in its timeliness and low cost of production. Given the above clear role of managing big data in information centers and with reference to the lack of studies in this aspect, to the knowledge of the researchers, which requires increased research and insight, this study will provide a comprehensive and deep view of the reality of the awareness of workers in the National Health Information Center in the Kingdom of Saudi Arabia of the importance of big data and its management and the value it adds to the center.

2. The Study Problem

Health data is considered one of the most important data that brings benefits to the organization and the patient if it is invested in the best way. It is also considered a huge data that exceeds in size the capacity of ordinary database management tools in its storing, processing and managing. Pramanik *et al*. [18] stressed, as indicated in there port issued by EMC Corporation & IDC[1], the growing volume of healthcare data as this sector generated approximately 153 Exabyte of data in 2013.

On the basis of the researcher's practical experience in the health sector, she finds that one of the most important problems facing hospitals is the existence of separate databases. No other hospital can retrieve the patient's information from the basic hospital in which he was treated. Thus, there is a need for a national health information center to include patient data and his sickness history, the electronic records of patients, records of diseases, treatments, financial costs, employees, etc. As a result of this huge amount of data that comes from all health sectors in the Kingdom from hospitals and government and private health centers, the National Health Information Center decided to take advantage of this data by saving and managing it to extract knowledge from it.

Failure to invest this big data makes health facilities have to bear financial costs that can be avoided if they were able to invest this data properly. As emphasized by Dash *et al*. [13], it is "believed that the implementation of big data analytics by healthcare organizations will result in more than 25% annual cost savings in the coming years", in addition to increasing profits. It is estimated that by 2024, the total healthcare analytics market will reach $50.5 billion in comparison with $14.0 billion in 2019, with a compound annual growth rate of 28.3% during the forecast period[2]. Big data can also contribute to providing health care services in a timely manner with high quality and at the lowest cost, as well as in making administrative decisions and supporting officials. Therefore, it is preferable to study the possibility of employing, managing and using the big data they own.

Since the National Health Information Center is in the process of establishing serious work to manage big data as shown in their desire to cooperate with both researchers to build an integrated management of health big data, both researchers value high the importance of this cooperation that may achieve societal benefit and the hoped-for benefit of the National Health Information Center from behind the results of the current study. Thus, the first stages of construction is to ensure that workers are aware of the concept of big data and its uses and the importance of its application in the center, especially as it is a new technical concept that has invaded the information arena recently.

The problem of the study came to examine the reality of the awareness of workers in the National Health Information Center of the importance of big data, seeking to answer the main question of the study, which states:

What is the reality of the awareness of workers in the National Health Information Center of the importance of big data?

From this main question, the following sub-questions are derived:

[1]IDC, *The Digital Universe Driving Data Growth in Healthcare*, retrieved at 22nd November 2021, URL: https://www.cycloneinteractive.com/cyclone/assets/File/digital-universe-healthcare-vertical-report-en.pdf, (2014).

[2]Marketsandmarkets, *Healthcare Analytics Market By Type (Predictive, Prescriptive, Cognitive) Application (Clinical, Rcm, Claim, Fraud, Waste, Supply Chain, Phm) Component (Service, Software) Delivery (On-Demand, Cloud) End User (Payer, Hospital) - Global Forecast To 2024*, URL: https://www.marketsandmarkets.com/Market-Reports/healthcare-data-analytics-market-905.html, (2019), retrieved on 31st May, 2021

1: What is the awareness of employees at all administrative levels of the concept and importance of managing and analyzing big data?

2: What is the importance of managing big data in the National Health Information Center?

3: What value does managing big data in the National Health Information Center add? The following sub-questions emerge from this third question:

3.1: What is the value of big data in following up on e-health projects?
3.2: What is the value of big data in decision support for health policy making?
3.3: What value does big data add to supporting health innovation?
3.4: What value does big data add to advancing clinical trials?
3.5: What is the investment value of big data?

3. The Objectives of the Study

1: Recognizing the awareness of employees at all administrative levels of the concept and importance of managing and analyzing big data through the opinions of the study sample.

2: Recognizing the importance of managing big data in the National Health Information Center through the opinions of the study sample.

3: Identifying the value added by managing big data in the National Health Information Center through the opinions of the study sample, and the following objectives emanate from this goal:

3.1: Recognizing the opinions of the study sample about the value of big data in following up on e-health projects.
3.2: Shedding light on the views of the study sample about the value of big data in decision support for health policy-making through the opinions of the study sample.
3.3: Uncovering the value added by big data to support health innovation through the opinions of the study sample.
3.4: Learn the opinions of the study sample about the value that big data adds to enhancing clinical trials.
3.5: Determining the investment value of big data through the opinions of the study sample.

4. Previous Studies

Both researchers would present foreign and then Arabic studies in order from the oldest to the most recentbetween 2019 and 2021:

The study of ElHamlaoui *et al.*[3] entitled "Big Data Project Management"
This study aimed to identify project management approaches and big data projects based on works in the field, with explanations of the use of traditional and rapid project management methods, in particular, big data management projects with citing and identifying various methods of managing big data, and providing some recommendations for the use of agile project management for the successful start of the big data project, with case studies and their results. The study concluded in its results that the agile approach could be applied to smaller and

[3]M. ElHamlaoui, A. ElMajjodi, A. Boumahdi and M. Chakli, *Big Data Project Management*, (2019), DOI: https://doi.org/10.13140/RG.2.2.18399.18089.

less important projects that are implemented in the enterprise directly to manage the big data project. The goal of these projects should be to identify the opportunities available to benefit from the current business data. The study also showed the differences between the traditional and agile approaches to project management, with recommendations that help in choosing the appropriate approach to project management. Managing big data requires the availability of certain characteristics and skills for human resources. It also needs some practical recommendations to set realistic goals and ensure good management of big data projects. The steps of Big Data projects and case studies of agile project management and its applications in large distributed projects and product development projects inspire ideas for using agile project management methods to manage big data projects considering scheduling, requirements, teamwork, and collaboration with customers. This study is related to the current study in that it clarifies the steps for launching a successful big data project, taking into account the implementation requirements and the necessary skills for workers in the field of big data. This provides a clear image and model that can be used in understanding the awareness of the concepts associated with big data in the current study.

The study of Ahmed *et al.* [3] entitled "A Framework for Managing Big Data in Enterprise Organizations"

This paper aimed to provide a comprehensive survey of big data management frameworks as it presented a new proposed framework for big data management. It also discussed the management of big data from various aspects, namely data processing, governance, strategies, decision-making, new value creation, security, and the used technology. The proposed framework covered all areas that every organization might need, from data entry to creating new values. The proposed framework is divided into four layers: the pooling layer, the processing layer, the analysis layer and new value creation, the presentation layer, and the decision support layer. Each layer contains the methods and techniques that will be used. It is also characterized by the presence of integration between each layer, and the presence of four other important components that interact with each layer (security, governance, control and monitoring, and the organization's strategy). This proposed framework will deal with most of the challenges that the organization may face (data security, data quality, data accountability, new value creation, timely decision-making, cost reduction, matching between business needs and data provided). This study is linked with the current study in its presentation of a comprehensive proposed framework that discussed the various aspects of big data management and its contribution to decision-making and creating new values from it, which can be used in understanding and managing big data and extracting values from its investment in the center.

The study of El-Sayed [14] entitled "Benefiting from big and open data in administrative development and its role in achieving the Kingdom's Vision of 2030: Aa case study in the environment of the Kingdom of Saudi Arabia"

This study aimed to present the utilization of data in administrative development and to look at the applications that help in achieving this benefit (big data, open data, data analysis, knowledge building) and to identify the challenges facing big data analytics and the use of open data and benefit from it in administrative development. In its results, it concluded that the Kingdom of Saudi Arabia is at a very early stage in its use of data in administrative development. It also shows the benefits of open data for society, such as enhancing the concept of accountability and transparency. Through the availability, processing, exploration and development of open data its role is highlighted in supporting community participation and innovation. As well, the poor

quality of content and data descriptors that are published is one of the most important problems for open data. The study clarified that security, privacy, identity and individual rights are among the most severe challenges of big data. It recommended the formulation of an integrated legal framework that controls the mechanism of publishing, sharing, use and employment of open data in addition to the importance of providing a consultant committee working on managing and developing the open data initiative. The study is related to the current study through its presentation of taking advantage of data in administrative development and its role in community participation and innovation. This provides a link with the current study in understanding the value of big data in health innovation, in addition to its studying of the environment of the Kingdom of Saudi Arabia, where both researchers consider the National Health Information Center as part of that environment.

The study of Al-Ghobeiri and Muhammad [5] entitled "Big data and its impact on achieving the vision of the Kingdom of Saudi Arabia 2030, an applied study"

This study aimed to identify the impact of the big data variable on the direction of its use in the planning of Vision 2030 for the Kingdom of Saudi Arabia, to identify the intermediate variables, and to record the impact of big data services on the vision planning process. The descriptive analytical method was used. The study tool was a questionnaire that was analyzed using the SPSS statistical program and the SMARTPLS v3 program.

As for the study sample, it consisted of 93 of the authorities responsible for planning the Kingdom's Vision 2030. The study results concluded that the variable of the quality of big data affects the trend towards using its services in planning for the sustainable development of the Kingdom's Vision 2030, as well as the positive impact on the mediating variable (the perceived benefits of big data), and a negative impact on the mediating variable (perceived costs of big data) on the trend towards using big data. However, there is no effect of the variable capacity of big data. The study recommended the need for good planning for the adoption of big data services in all types of organizational planning by the authorities responsible for planning for sustainable development in the Arab countries and the Kingdom of Saudi Arabia in addition to training planners on its use. This study is linked to the current study in emphasizing the importance of good planning before adopting big data services and training planners on it, which meets with the current study in the need to educate workers about concepts and issues related to big data as a basic stage before implementing its projects in the center in addition to the perceived benefits thereof and its role in the planning process after ensuring its quality.

The study of Al-Zahrani [10] entitled "Big data and the extent of awareness of its use among workers in the archives of the Secretariat of the Holy Capital in Makkah Al-Mukarramah"

This study aimed to identify the degree of awareness of the term big data, its importance and how to benefit from it and the new roles that will be required to deal with it among employees of the archive of the Secretariat (Amanah) of the Holy Capital in Makkah Al-Mukarramah. It also sought to identify the degree of awareness of the term big data, and the extent to which there are statistically significant differences in the degree of awareness of the meaning of big data and its implications according to the variables of type, academic qualification, specialization and years of experience. It used the descriptive survey method and the case study method. The study tool was the questionnaire. The sample of the study consisted of 84 employees of the General Secretariat. The study results concluded that the employees of the archives in the Secretariat have a high rate of awareness of the importance, characteristics and uses of

big data according to the educational qualification variable from University degree holders. It recommended the need to give more attention to the field of big data and its importance and ways to benefit from it for all employees at different functional levels, the need to train workers on modern analysis methods and data mining software, and directing the attention of Saudi universities to data science. This study is related to the current study on the need to educate workers about the concept and importance of big data and the areas of benefit from it.

The study of Buarki *et al*. [12] entitled "The Role of Kuwaiti Society in dealing with Big Data and the Spread of the Coronavirus"

The study aimed to identify the community's awareness of the existence, concept, importance, and ways of benefiting from big data in the conditions of the Corona crisis in relation to the variables of gender, educational qualification, specialization, years of experience, knowledge of available big data sources and tools, and readiness to deal with big data. The survey method was used to deal with the published intellectual production related to big data and the descriptive and inferential method using the questionnaire tool. The descriptive and statistical analyzes were also used to describe the composition of the demographic participants and the extent of their knowledge of big data and their use of applications to deal with the Corona crisis. The study sample was a random sample from the community from all governorates involving adults aged 18 and over. The results showed that 36% of the respondents are familiar with the concept of big data. In addition, most of the respondents emphasized the paramount importance of using their personal data in crises and the usefulness of analyzing it in order to make decisions. The society's awareness of the existence of big data emerged through its use from several aspects, including the commitment of Kuwaiti families to the official instructions issued by the Ministry of Health and the transparency of the presentation of important data on the Corona virus in Kuwait by government agencies. The study recommended the employment and analysis of big data for the various authorities in the country to benefit from it in decision-making, and to develop plans in addition to training workers on it. It also stressed the importance of hiring an information specialist to spread informational awareness about big data, the necessity to educate the community about the importance of employing and benefiting from big data. This study is linked to the current study by emphasizing the importance of education and awareness regarding the concept and importance of big data and its use in making health decisions, and this is what the current study examines.

The study of Ahmed [2] entitled "Big data management in the National Library: An exploratory study"

The study aimed to clarify the degree of awareness in the digital book house of the concept and characteristics of big data, and the important sources for the availability of data in it, the skills of using them. It also sought to clarify personal, administrative, professional and technical skills of importance to library and information specialists in the near future, ways to protect their privacy. The study used the descriptive approach as a case study. The study tool was the questionnaire and the personal interview. The study sample consisted of 595 managers distributed over the general and sub-departments of the Digital Book House. In its results, the study showed a medium degree of awareness of the concept of big data, the presence of huge data in the library, the diversity of sources that provide it with big data, the availability of many organizational and administrative preparations and infrastructure for managing big data, the important role of big data within the library, the diversity of data analysis tools, image and

sound processing, etc., the presence of a set of different skills that are required for the future librarian and information specialist, the vast majority of workers' need for experiences in dealing with it in terms of its acquisition, organization, analysis and exploration, and the high degree of diversity of privacy protection methods. It recommended the necessity of continuously qualifying workers, presenting seminars and courses on its management and techniques, recognizing the importance of big data and encouraging its use, finding strategies that support benefiting from it, the need for international cooperation in addition to cooperation with various quality institutions. This study is related to the current study in its clarification and study of workers' awareness of the concept of big data and their need to acquire skills and experience in it and in highlighting its importance and role in improving services, which provides a strong link through studying the reality of workers in the National Health Information Center's perception of the concept of big data.

5. The Study Methodology

The current study is a qualitative study, and it relied on the descriptive approach (a survey study) in order to study the reality of the awareness of workers in the National Health Information Center of the importance of big data in an in-depth way.

6. The Study Tools

Based on the objective of the study, the methodology used in the study, and the nature of the data that the study needs, the researchers used the semi-structured interview with direct open questions that emerged from the objectives and questions of the research, in order to explore the opinions of the study sample members on the subject of research and answer the questions in a detailed and more in-depth manner.

7. The Study Community

The study community in this research consists of the National Health Information Center in the Kingdom of Saudi Arabia, and the intentional sample will be the sample on which the current study will depend because it achieves the purposes of the study and because big data is a newly created topic that needs to answer the questions of the interview form to specialized individuals. Thus, they were selected from officials and employees (administrative and technical) who are directly related to dealing with big data in the center to conduct an interview with them, each according to his specialization, by following the mechanism of nominating respondents to each other. When reaching the stage of information saturation, the researchers will be satisfied with the data retrieved from the sample.

8. The Applied Framework

Through field visits conducted by the researchers to the National Health Information Center and based on interviews with the study sample members, which numbered 9 respondents from managers and officials directly related to the big data, the researchers were able to reach answers to the objectives and questions of the study, which emanated from the main question of the study, which is:

What is the reality of the awareness of workers in the National Health Information Center of the importance of big data?" which will be answered through the following questions:

The answer of the first question: What is the awareness of employees at all administrative levels of the concept and importance of managing and analyzing big data:

Through the respondents' answer to question No. 1 in the interview form, which states: "How do you see the extent to which employees at all administrative levels in the center are aware of the concept and importance of managing and analyzing big data?", the awareness of workers differed from one level to another. At the level of all the administrative leaders in the center, all of them without exception have awareness and believe in the importance of big data in the National Health Information Center. As for the employees at the lower levels of administrators and coordinators, they do not have sufficient awareness. In fact, they have awareness, but they do not have interest in terms of strategic planning. However, they are all familiar with the center's work, and they are all aware of the importance of this government agency, but with regard to managing big data, this is more ambitious with leaders in the National Health Information Center.

Therefore, the center needs to raise the level of awareness more and more about the importance of big data as well as its meaning, how to deal with it,and how to adopt it. It has to work to increase awareness among employees and these are the first tools that the center should work on. It is necessary for all employees, even the smallest employee to know what the center is doing now and why it is doing it. Raising awareness is one of the important tools that must be followed through holding workshops, forums, internal meetings, explaining to all employees about the center's projects and objectives and what has been accomplished. It is important for all employees, regardless of their job levels, to be aware of the mission, vision, and objectives of the center and its projects and goals. Every employee must know what even junior employees and their administrative work will contribute to the committees and follow up on the records. All employees must understand and be aware that their contribution and the work they do is at a national level and not only at the level of the institution. When the employee works in any other sector, such as the specialist hospital or the armed forces, he serves specific people. As for the National Health Information Center, it provides its services at the level of the entire country. Every employee would feel that it would even motivate him to do more work, and therefore periodic meetings contribute to raising awareness and understanding and thus raise the level of participation, and this is what would the center plan for its work in the field of big data at the level of all employees. The Center also has a special department for emerging technologies in the Department of Digital Technologies, which has begun work on proving concepts regarding big data and its analysis by conducting some experimental studies on some diseases such as tumors and chest rays.

Moreover, and according to the following indicators:

1: The agreement of the study sample on the awareness of administrative leaders of the concept and importance of managing big data.

2: The study sample agreed on the center's need to raise awareness about the concept and importance of big data among employees.

3: The difference in the study sample on the awareness of employees at the lower levels of the concept and importance of big data.

4: The study sample agreed to conduct experimental studies to prove the concepts of big data analysis in the management of digital technologies.

Both researchers assume from the interviews and indicators that there is awareness by the sample members of the importance of big data and the importance of building a special department for it in the National Health Information Center to invest it and come up with the benefits resulting from the process of managing it, regardless of their awareness of the concept of big data management. The researchers noted that there is a lack of awareness of the correct concept of big data and its characteristics. Each respondent explains big data in his own sense, with everyone agreeing that it is data of very large sizes, and the researchers attribute this to the fact that big data is a new concept and is still in its initial stages.

The researchers also found a difference in the awareness of the center's employees about the importance of managing big data according to the administrative levels at which they work. The holders of the upper and middle management leaderships have sufficient awareness of the importance of big data in the center and a high ambition to reach this level of data and its analysis, while the employees at the lower levels do not have sufficient awareness. The level of awareness among the employees of the Department of Digital and Emerging Technologies is greater than the rest of the employees from various other departments. The biggest evidence of this is the establishment of empirical studies to analyze big data related to tumors at the Emerging Technologies Department in the Department of Digital Technologies to prove the concept and success of big data and its suitability in the center using advanced tools such as Hadoop. Thus, they were able to transfer this awareness to other leaders in an attempt to adopt the concept and receive all kinds of support. The results of the current study agree in regard to the tendency and effort of technology specialists in the center to prove the concept, which is a part of the conclusion reached by Ali [6] about the weakness of public and administrative awareness of health care institutions, both public and private in Egypt, towards the use of big data, as it is not the priority of the current stage. However, there is an individual move from some private hospitals to big data technology and the formation of work teams with knowledge of these technologies. The researchers attribute this to the government's interest and urging the authorities to adopt emerging technologies in the Kingdom in all its sectors.

Since the number of employees in the center is higher than the leaders, therefore it somewhat agrees with the conclusion reached by Mbaluka [17], which is that 38.71% of the respondents felt that their awareness of big data products in the market was low, while 3.23% believed that they are fully aware of big data management and its products in the market. 19.35% of respondents gave a fair assessment of the awareness and visibility of big data management in the market. It also aligns with Elsirr's finding [15] stating, "Respondents somewhat strongly agreed (78%) that there is a lack of awareness of the importance of implementing IT tools for hospital data management. Elsirr's finding [15] "that (68.5%) of the respondents believe that the senior management is constantly aware of the developments of big data technology and the importance of its use". Yet, it differs with Al-Muzayin's result [7], which showed the extent to which library officials are aware of what is meant by big data management, as it is clear by starting to choose information sources corresponding to the information needs of the beneficiaries, then describing them in an easy technical description that facilitates access to them and paves the way for the start of the stage of processing and extracting new information that helps to achieve knowledge integration between sciences by linking the topics together, before making them available to the beneficiaries and keeping copies of them to ensure their protection from loss or damage. It differs also with the results of Al-Ghamdi's study [4], which stated that more than half of the study community of employees in the central library at King Abdulaziz University (from male and female heads of departments) at a rate of 52.1% do not

have knowledge of the concept of Big data, its characteristics, and its role, compared to an average of 47.8% for employees who indicated that they have knowledge and understanding of the concept. This is in contrast to the findings of the current study, where leaders' awareness of the concept is partial, and there are fewer employees who do not have sufficient awareness of the concept of big data.

The researchers attributed the reasons for the lack of awareness of employees at the lower administrative levels to the failure to involve employees in meetings that discuss plans for the development of the center. In the researchers' opinion, meetings are not restricted to leaders and managers, as isolating employees from them loses them basic skills in developing themselves in the field of work and everything related to ways of development and technology used for it, such as the issue of big data and their awareness of its role in the development of the center, in addition to the lack of opportunities for them to attend conferences and scientific symposia in which everything that is new and relevant to the fields of work is presented. This is consistent with the results of the study of Al-Ghamdi [4] assuming that the reason associated with the lack of opportunities for employees to attend scientific conferences, enabling them to know about recent topics related to their professional field, is the most prominent and most important reason for which employees are not familiar with the concept of big data in the Central Library of King Abdulaziz University, at a rate of 75%. In addition, and due to the geographical distance between the center and the library, as all of them adopt one culture because they are in the same country, the researchers support this agreement between the two studies. From the researchers' point of view, to address this problem, leaders must involve employees in the field of big data and assign roles to them, whether they are basic roles or simple roles, and upgrade these tasks from time to time, while providing awareness or specialized courses in this field.

The answer of the second question: What is the importance of managing big data in the center?

The respondents' answer to question No. 2 in the interview form, which states: "'In your opinion, is the management of big data important in the center? What is it?" showed that they believe that the issue of managing big data is one of the important topics and one of the departments that the center seeks to establish. Indeed, there is great interest, both at the level of departments in the center or at the level of employees working in information technology, in the process of investing, analyzing and organizing this data in a way that supports decision-making and improves health decision-making by helping even the leaders in the health sector know the indicators and the reality of their sector. The center currently owns many data that exceed terabytes in size and there is data in the process of being built. The largest window in the matter of big data at the center may be the topic of national health records. Its objective is to create a record for some specific diseases such as tumors or heart diseases, which have an impact on any health system. Specific diseases are identified to create health records for them at the national level so that data is collected, for example, on tumor patients in all health sectors. It is expected in the future, that these records will be one of the largest windows towards increasing data sizes, and therefore can be considered as one of the windows. Currently, the center has a registry that is approximately 20 years old, with data of 20 years for patients with tumors in the Kingdom. The other records that have been released are about five registries: the National Heart Registry, the National Stroke Registry, the National Registry for Developmental Disorders, the National Registry for Hearing Impairment, and the National Diabetes Registry. These five registries were recently released and are still in the process of construction and data collection. The researchers

also noted, up to the research date, that the center has a set of records under construction. Thus, since the center serves all health sectors in the Kingdom, whether civil, military, governmental or private, it is expected that when the entire health records are completed, the volume of huge data will double in the center, and therefore the demand will increase to implement all standards of data management, storage and massive retrieval.

In addition, the researchers noted the clarity of the officials' interest in the issue of big data through their good response to applying the study in the center in order to obtain the results that this study will produce to be used in the implementation of the big data management project in the center. This, in fact, indicates the importance of the topic of the study for them. Both researchers attributed this also to the expectation that the volumes of large data in the center will increase in the future to very large volumes more than they are now, given the strategic position of the center and the importance of its role in making health decisions at the national level.

The indicators through which the researchers inferred the results of the study are as follows:
The agreement of the study sample on the importance of the topic of managing big data in the center.
The study sample agreed on their desire to establish a special administration for big data in the center.
The study sample agreed on the importance of applying the current study in the center.
The agreement of the study sample on the presence of huge data in the center and that it will multiply in the future because of the data projects that the center is currently seeking to implement.
The study sample agreed on the importance of the center's role at the national level.
The agreement of the study sample on the interest of the information technology staff in investing the center data.

From the above study sample views and indicators, both researchers inferred that it is clear that workers are aware of the importance of managing big data in the National Health Information Center. This result is consistent with the result of Al-Talhi study [9], which revealed the extent of the Jeddah Chamber of Commerce's awareness of the importance of managing the big data available in it. This indicates that there is a general government interest and focus, based on 2030 Vision and what it directed towards investments in all fields, including big data, as it is considered an important national wealth that would bring many investments and benefits in the field of planning, human development and national development.

The answer of the third question: What value does managing big data add to the center?

Through the respondents' answer to question No. 3 in the interview form, which states: "In your opinion, what is the value added by managing big data to the center?". The workers' awareness of the value added by managing big data in the center was clear. The researchers found, through the interviews, that the center gets its value from the data it owns. It is a national health information center management in the Kingdom, which is intended to be the container of all health information related to the patient's journey while receiving treatment and care, and thus managing the big data in the center is a necessary goal and it must reach it one day because this data and its investment would provide a real addition to the center and its benefits. This addition would be in several aspects, the first of which is that it would enable the center to carry out its work in terms of following up on the implementation of projects related to e-health.

In addition, it would help the center understanding the health reality and help decision-makers by providing complete and high-quality information that helps them in making policies. It would also be one of the most important tributaries to support the process of health innovation and health research, and enhance the aspect of clinical trials in the future. As well,it is an opportunity for the National Center to gain an investment stream in the future as investing in data is permissible, even from a regulatory point of view, and is available to all sectors with regulations for data life and artificial intelligence that explain the process of data management and the process of investing in it. The following figure shows the value added by managing big data in the center:

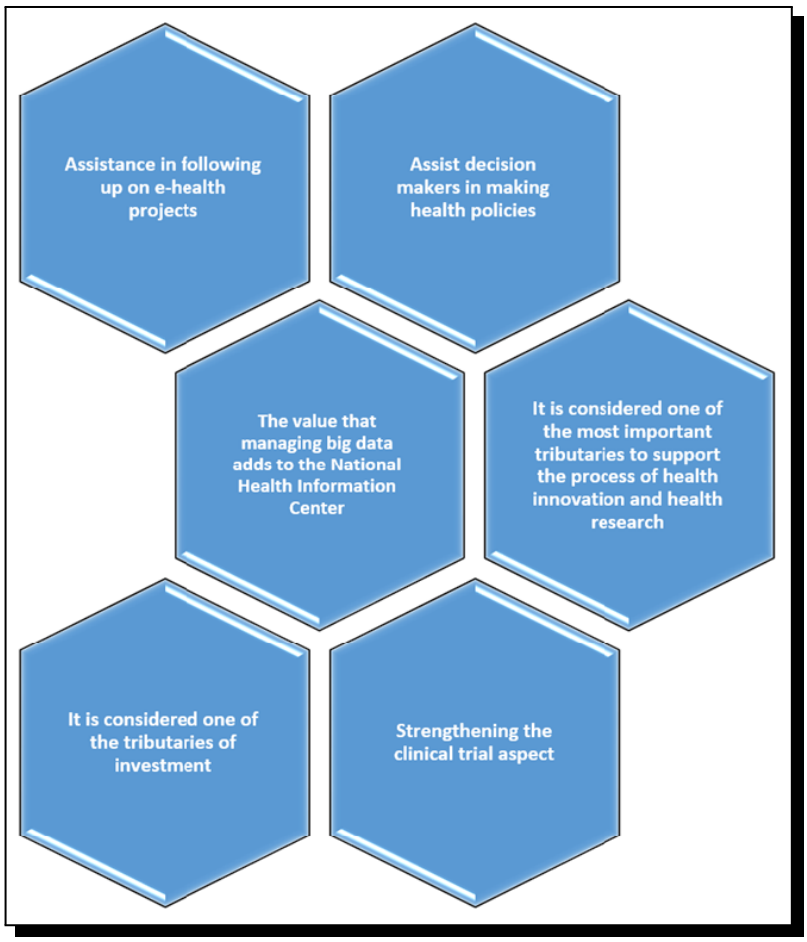

Figure 1. The value added by big data management in the National Health Information Center (source: prepared by the researchers)

The researchers will deal with these aspects in some detail based on the respondents' answers to the following sub-questions:

The answer of the first question: What is the value of big data in following up on e-health projects:

The respondents' answer to question No. 3/1 in the interview form, which states: "In your opinion, what is the value added by big data in following up on e-health projects?", showed that there are many existing projects in other health sectors, such as the existing projects at King Abdulaziz City for Technology, where they have the Saudi Genome Project, in which they collect

data on Saudi patients in order to reach the process of determining the Saudi genome, which is a very large project. Therefore, the huge data available in the National Health information Center would help them in that it will be one of the tributaries that support the genome project. The second point, "SDAYA", which was launched by the National Center for Artificial Intelligence, repeatedly requested data from the National Health Information Center about the health sector like data on diabetic patients in order to build their own electronic applications. Therefore, the presence of this data with the National Center, its collection, maintenance, management and processing is essential for other sectors that need to implement their projects. This is believed to be the biggest supporter, and there are many other projects even in the health sector that need data on the health sector to help them implement their projects and works. In fact, this means that the huge data located in the center would also help even other sectors in the implementation of some projects related to the data world, because most of the projects are mainly based on studies and analysis of the current situation. Most of the academic or research projects that are adopted by some government agencies begin by studying the current reality in which they are, and what they possess. There may be as well a need for some data in the health sector, for example, the reality of the health sector or even facilities within the health sector. They need to understand, through some technologies or in some business, what stage the health sector has reached. For example, the databases in the Saudi Authority for Health Specialties that are related to human resources, their preparation and distribution in the Kingdom serve other projects that exist in the Saudi Health Council or other departments. Thus, the center requests data such as the numbers of nursing workers or others. In the end, all of these data serve the same sector or any other sector, and therefore what is meant is that the center and the huge data available in it, current or future, could help others implement and complete their work.

The answer of the second question: What is the value of big data in supporting the decision-making of health policies?

The respondents' answer to question No. 3/2 in the interview form, which states: "In your opinion, what value do big data add to decision support for health policy making?" indicated that making health policies often comes out of a problem in the health sector or poor coordination etc. The goal of policy work is to organize a specific work or practice. The presence of data is always essential, whether it is data on performance in the health sector, data on practitioners in the health sector, or data on contributors or influencers in the health sector, provided that this data is of high quality that can be analyzed. Indeed, this data may give indications of a defect in some aspects, especially those related to quality as the center contains data about the patient's complete journey or the problems she/he encounters, such as medical errors or others. Besides, these data over time will give an indication to decision makers that there is something wrong that must be taken care of, investigated, and examined to know its causes. Thus, we can come up with an excellent policy to organize a specific practice, and therefore policy making depends on what data the center has and how it is analyzed, studied and looked at, which is a very important aspect.

On the other hand, dealing with data may differ from one person to another. Some people are creative and try to answer questions. However, with some other people, the issue of creativity may be somewhat limited. In order for the center to succeed in dealing with data, it is not only that it has big data, but also, it must possess the tools of dealing with this data and benefiting from it. Thus, these policies based on right data and their analysis may serve the center in

this regard. Therefore, it is necessary for the center to have clear policies and procedures that explain how big data contribute to decision-making, what do we need to do, what data is needed and mentioned in reports to decision makers from time to time. For example, The Saudi Health Council is the umbrella for the health sector. It is a legislative umbrella for the health sector in the Kingdom, or anything related to the health of the citizen and resident is included in the Council's work in terms of facilitating their good quality reaching. These represent the mission of the Council and fall within its responsibilities. Among the existing projects that the General Secretariat is working on in cooperation with the National Health Information Center is the development of national health indicators, and therefore we will have indicators at the level of the Kingdom, approximately 30 or 40 indicators that contribute to giving an accurate impression to decision makers about the performance of this sector and what problems it faces and what measures it needs to take. They are clear and explicit indicators, and in several areas such as Indicators of financial performance, indicators of clinical performance, indicators of patient outcomes, indicators of quality and safety, etc. This is an approach applied in more than one country. This means that big data, for example, for these health indicators, will be collected periodically. It is expected that applying big data methodologies and tools on it will produce other indicators or results for decision-makers about other issues that should be taken care of. Another example is the national health records. The tumor registry has greatly helped in establishing policies, so the center now has more than 12 guidelines as a clinical protocol and it is included in the types of policies. Policies are a large umbrella under which types of regulations, protocols, and others are included. Guides have been created for how to treat some diseases, such as lung tumors, gland tumors, cervical cancer, and breast cancer, and they are now available at the National Cancer Center, which is affiliated with the Saudi Health Council. All these guides came as a result of collecting data within the tumor registry databases at the level of tumor patients in the Kingdom, reviewing, analyzing and researching them until these results were reached. Thus, through the big data on tumors in Saudi Arabia, we would come up with results that help in the making and formulation of policies, protocols, regulations and systems that contribute to improving service. The role of the center in this process was to enable other beneficiaries, whoever they are, to use its collected data since the center is a National Health Information Center.

The answer of the third question: What value does big data add to support health innovation?

The respondents' answer to question No. 3/3 in the interview form, which states: "In your opinion, what value does big data add to support health innovation?", showed that the more available data is, the more its content is structured and has characteristics that can be benefited from, and therefore this data will support health research related to following up on specific patients or diseases, analyzing them and following up their results. For example, the industrial sector, especially manufacturers of medicines, medical devices and other technologies before they start working on their projects, they need data about the patients targeted in their innovative product. Heart patients in a pharmaceutical company, for instance, have produced some heart medications. The first thing they started with in order to measure the effectiveness of the drug is to search for heart patients who are treated with this treatment in particular. Thus, as the center has data based on a national level in a solid and accurate way, it will enhance the process of health research and innovation in a very large way, meaning that it will be like the station from which very huge business is launched. Moreover, because the center provides health data

to other parties, many and many data requests come to accomplish huge and huge works. In addition, one of the roles of the center is to produce periodic reports on a regular basis, and they are announced even to the public, not just to health authorities, in order to benefit from them in their research and innovations.

Thus, it attracts researchers from doctors in various specialties, for example, to carry out their research and studies and observe the current situation at the national level. Thus, the center plays the role of the catalyst, as it performs the process of collecting data, archiving, storing, dealing with it, and presenting it to others to benefit from whatever this benefit is, whether in making a research decision, accelerating investment, etc.

The answer of the fourth question: What value does big data add to advancing clinical trials?

Through respondents' answer to question No. 3/4 in the interview form, which states: "In your opinion, what value do big data add to enhancing clinical trials?" It was clear that big data helps clinical trials in that it may indicate priority in the process of choosing medicines, as its importance may become clear in one of the most important programs of the Kingdom's Vision 2030, which is the Industrial Development and Logistics Services Program, which is called "Nadleeb". One of the sectors targeted by this program is the health sector or industries in the health sector, where most of the industries in the health sector are based on the manufacturing of medicines or the nationalization of producing medicines or the process of manufacturing health supplies.In fact, the Kingdom annually imports approximately 80-85% of our needs of medical supplies such as gauze pads, needles, or supplies needed by the operating room or even medical equipment such as CT scans etc. The current trend is to nationalize the market, such as nationalizing medicines and health supplies. This nationalization needs the implementation of clinical trials to help in the process of manufacturing new things or even nationalizing a specific drug that becomes produced within the Kingdom. This scientific approach is always implemented during clinical experiments, where the question arises in the minds of the producers from where to start, and what is the priority in the initiation process. They will not be able to answer these questions without the availability of databases at a national level that helps them to identify accurately how diseases spread at the national level, what are their patterns, what are the priorities, what are the health tools used, and what are the most frequently used medicines. This is actually achieved by the project of the National Pharmaceutical Platform implemented by the Center in 2017 and 2018, through which the distribution of medicines and their uses in the health sector in the Kingdom is extracted. Each health sector clarifies what medicines it uses and dispenses to patients, and where the largest expenditures are, the benefits, and what is the most bought or used medicine in the Kingdom, whether it is in the health sector or in pharmacies. This platform is owned by the Center and contains a lot of data and has very beautiful benefits at the national scale through which it is possible to answer the questions of producers or manufacturers about which medicines we are starting to nationalize and what is the reason for nationalization. The presence of data in general will be useful in these researches as they form their basis. As well, it helps in the process of selecting priorities related to clinical trials.

The answer of the fifth question: What is the investment value of big data?

The respondents' answer to question No. 3/5 in the interview form, which states: "In your opinion, what is the investment value of big data?" indicated that the issue of data investment is not a new topic and is practiced in many countries. In fact, it is one of the most important

topics raised in the center at present. It revolves around how to achieve income from it and exploit it financially as it is one of the tributaries of investment. The Center has developed a framework in cooperation with one of the consultants, which clarifies what data can the center financially exploit and use? However, so far, work has not been started yet, and as we mentioned, the framework has been developed and they are now in the process of developing an implementation plan to determine where to start, what the priority is, how it is invested, and what its expected revenues are, and this will be in the second stage.

Based on the foregoing and through the following strategic indicators:

1: The study sample agreed on the role of big data management in supporting health decision-making and making health policies at the level of the Kingdom.

2: The study sample agreed on the role of big data management in following up on e-health projects.

3: The study sample agreed on the importance of exploiting big data in clinical trials.

4: The agreement of the study sample to consider big data as one of the tributaries of innovation and one of the tributaries of investment.

It became clear to both researchers that there is an importance for managing big data in the National Health Information Center, especially in the health decision support process, because the center works at the national level and is the main and central center for health data to which decision-makers refer when making health decisions at the national level in the Kingdom of Saudi Arabia. Big data and its technologies in the center add value to the center in helping to follow up on e-health projects and completing the implementation of data-related projects, assisting decision-makers in making health policies because the analysis of big data helps in predicting the existence of a defect that needs regulatory policies. This is one of the most important tributaries to support the process of health innovation and health research, coming up with products that serve patients and the health sector, enhancing the aspect of clinical trials and setting priorities for their implementation. It is one of the investment streams because it helps determine the priority and methodology for using data financially. The researchers attribute the diversity of expected benefit from big data to the study sample's awareness of the importance of investing big data in the center.

The researchers also believe that the value of benefiting from big data depends on the extent to which others use this data and their practice of managing it in the center and their belief in its importance. This is what (Al-Salmi and Bani Arabeh [8], and Khalfalawi [16]) emphasized by stressing that the value of big data doubles when managers' conviction and trust (such as data users) double in the data used in making decisions, and the value of the data is also attributed to its impact on making the right decisions in organizations. Therefore, the value of the data represents the value of the change in the decision, and the differentiation between them depending on the adequacy of the available data, which shows the difference in making a specific decision among the many available alternatives based on the data flowing in the institution.

9. Summary of the Results, Recommendations and Suggestions

After the researchers analyzed and discussed the answers of the study sample members, in this axis, the most important findings of the study will be presented in order to answer the following main question:

What is the reality of the awareness of workers in the National Health Information Center of the importance of big data?

The results revealed the reality of the awareness of workers in the National Health Information Center of the importance of managing and analyzing big data, which the researchers summarized as follows:

The answer of the first question: What is the awareness of employees at all administrative levels of the concept and importance of managing and analyzing big data?

It became clear to the researchers that there is awareness by the sample members of the importance of big data and the importance of building a special department for it in the National Health Information Center to invest in it and come up with the benefits resulting from the process of managing it, regardless of their awareness of the concept of big data management where there is a lack of awareness of the correct concept of big data and its characteristics. They interpret big data in their own way, with everyone agreeing that it is data of very large sizes, due to the fact that big data is a new concept and is still in its initial stages.

The researchers also found a difference in the awareness of the center's workers about the importance of managing big data according to the administrative levels they work with. The holders of the senior and middle administrative leaders have sufficient awareness of the importance of big data in the center and a high ambition to reach this level of data and its analytics. However, the employees at the lower levels do not have enough awareness, and the staff of the Department of Digital and Emerging Technologies have more awareness compared to the rest of the staff from various other disciplines. The biggest evidence of this is the establishment of experimental studies to analyze the big data of oncology at the Emerging Technologies Department within the Department of Digital Technologies to prove the concept and success of big data and its suitability in the center using advanced tools like Hadoop. Thus, they were able to convey this awareness to other leaders in an attempt to adopt the concept and receive support of all kinds. One of the reasons for the employees' lack of awareness at the lower administrative levels is the lack of employees' involvement in the meetings that discuss the center's development plans, in addition to the lack of opportunities for them to attend conferences and scientific symposia in which everything new and related to their work fields is presented.

The answer of the second question: What is the importance of managing big data in the center?

It became clear to the researchers the importance of managing big data in the center and the realization of the study sample of its importance, as it stems from the center's strategic position and role in making health decisions at the national level, and the fact that the center owns huge data of more than terabytes in size, and there is data in the process of being built through a group of projects that the center implements, which are considered gateways to increase the inflation of data volumes and thus the demand is increasing to apply all the standards of management, storage and retrieval of big data. The most important of which are the national health records project such as tumor registries, the national heart registry, the national stroke registry, the national registry for developmental disorders, the national registry for hearing impairment, the registry of the National Diabetes Institute, as well as through the departments' interest and their efforts to establish a large data department in the center

and the employees' interest in the process of investing and analyzing this data in order to improve health decision-making. In addition, the good response of the respondents to applying the current study in the center and their interest in the results of the study to support them in starting the establishment of a special administration for big data, represents one of the biggest indications that shows their awareness of the importance of managing big data in the center.

The answer of the third question: What value does managing big data add to the center?

The awareness of the study sample about the importance of big data is evident through the diversity of their opinions about the expected benefit from big data and the value it adds to the center, especially since the center works at the national level and is the main center for health data to which decision-makers refer when making health decisions at the national level in the Kingdom of Saudi Arabia. The main added values are assisting in the follow-up of e-health projects, assisting decision-makers in making health policies, being one of the most important tributaries to support the process of health innovation and health research, promoting clinical trials, and being considered one of the investment streams. The value of big data multiplies when it is used and believed in. The researchers explain this through the following results:

Answering the first question: What is the value of big data in following up on e-health projects:

The benefit of the big data in the center emerges after its collection, maintenance and processing to assist other health or non-health sectors in the implementation and completion of some projects related to data by providing them with the data available in the center, such as the Saudi Genome Identification Project at King Abdulaziz City for Technology, and the building of electronic applications implemented through SDAIA, which was launched through the National Center for Artificial Intelligence.

Answering the second question: What is the value of big data in supporting the decision-making of health policies:

It became clear from the sample answers that the presence of high-quality large data in the center, whatever it is, whether data on performance, practitioners, contributors or influencers in the health sector, gives an indication to decision-makers of a defect that must be paid attention to and research into its causes, and thus come up with a specific policy to regulate a particular practice. In this regard, the center came out with 12 guidelines as a clinical protocol as a result of collecting, reviewing and analyzing patient data in the national health records, or by collecting and analyzing huge data for health indicators and coming up with policies that organize work.

Answering the third question: What value does big data add to support health innovation?

The results revealed that big data with good characteristics and structured content supports health research related to analyzing specific diseases and following up on their results, as well as creating a specific product that needs data on the targeted patients for this product to measure its effectiveness. In addition, the center produces periodic reports that are announced to the public in order to benefit from them in their research and innovations.

Answering the fourth question: What value does big data add to advancing clinical trials?

It became clear to the researchers that the presence of big data in the center is useful in the process of selecting priorities related to clinical trials. For instance, the process of nationalizing medicines and health supplies and their production needs to implement clinical trials, and big data helps in knowing the priorities of these medicines and supplies based on the frequent use and the largest expenditures and the most common diseases. The National Pharmaceutical Platform Project is a good example of this value.

Answering the fifth question: What is the investment value of big data?
It became clear to the researchers that it is possible to benefit from the large data in the center by exploiting it financially, as it is one of the tributaries of investment. The ways how this would be done and the expected revenues would be in the second stage.

10. Recommendations

One of the most important objectives of scientific research is to come up with realistic recommendations to solve the problem under study. Through the results of the current study, the researchers were able to put forward the following recommendations, which enhance the ability of the National Health Information Center to manage its huge data, which are as follows:

1. Working on raising awareness of the relevant parties about big data, as shown in the following:
    A. Introducing employees to all administrative levels in the center's organizational structure with the correct concept of big data, how to deal with it, the value generated from it and its role in making decisions, through holding periodic and internal meetings, informing employees of its projects and plans, informing them of what has been accomplished and assigning tasks to them, each according to his specialization in addition to raising their awareness of data management controls, systems, and policies.
    B. Designing training courses for using modern technological tools to analyze, store, and retrieve big data.
    C. Raising awareness of the various health sectors and relevant authorities in the center of the importance of health big data and its investment by holding seminars related to it and guiding and providing them with the basic rules for its management and preservation.
2. Work to finalize the development of the executive plan to determine where to start, what is the priority, how the data is invested, and what are the expected revenues from it to actually start the investment phase.
3. Suggestions for Future Studies:
    A. The role of big data management in making health strategies in the Kingdom.
    B. Big data analytics and its relationship to improving decision-making in information centers.

Competing Interests

The authors declare that they have no competing interests.

Authors' Contributions

All the authors contributed significantly in writing this article. The authors read and approved the final manuscript.

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