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The implementation of evidence-based infection prevention in healthcare facilities in Egypt: A systematic literature review

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Abstract

The idea of searching: This study tends to assess the impact of implementing evidence-based infection prevention in healthcare facilities in Egypt, with the aim of improving surveillance systems and altering the facility designs according to the data acquired on HAIs patterns.

Background: Hospital acquired infections (HAIs) are becoming one of the major concerns for the patients and healthcare providers leading to significant increase in mortality rates, morbidity rates and financial losses for healthcare organizations. The incidence rate of HAI in Egypt was as recorded as 3.7% recently. Certain environmental interventions, implemented during construction of the healthcare facility could lead to enhanced prevention against the transmission and spread of the HAIs. Studies revealed that the integration of Surveillance programs could provide evidence for the designers to alter the healthcare facility design with the aim of infection prevention. Therefore, EBD approach is used to potentially measure psychological and physical effects of the environment design of a health facility on the patients and hospital staff.

Methodology: Previous scientific literature is assessed to collect the relevant data which is then organized and analyzed in this study. A systematic review is generated based on the analytical outcomes of the selected data.

Conclusion: EBD approach has the potential to prominently decrease HAIs burden in Egyptian healthcare facilities as it provides a diverse insight into the layout, equipment, and materials that contribute in the transmission of pathogens due to faulty design.

Findings and recommendations: In order to improve the poor indoor quality by MEP (mechanical, electrical, and plumbing), previous studies have also indicated certain solutions including advancements in private room, improved surface selections, isolation, integration of touchless systems, and enhanced ventilation systems that must be applied in the healthcare facilities in Egypt for infection prevention.

Keywords: Hospital acquired infections (HAIs); Evidence-Based Infection Prevention; Healthcare Facilities; Surveillance systems.

1. Introduction

With the increasing challenges in maintaining a safe environment within the healthcare facilities, Hospital acquired infections (HAIs) are becoming one of the major concerns for the patients and healthcare providers [1]. As these infections are acquired by the patients while getting treatment for a certain condition, therefore, are referred as the hospital acquired infection or nosocomial infection as described by Monegro, Muppidi, & Regunath, (2017) [2]. Several factors that could potentially assist in the proliferation of infection causing bacteria around the facility, include the

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inappropriate use of medical equipment, negligence or inefficiency of healthcare staff, the infrastructure of the facility and operation's management and maintenance. However, an active surveillance program is the ultimate requirement to monitor the spread of HAIs throughout a certain targeted population, which can be used for future improvements in strategies and policies [3]. The following study will be focusing on exploring and evaluating relevant scientific literature to provide an evidence-based overview of endemic burden of HAI in Egypt. Moreover, the study will also elaborate how advancements in the physical design of the healthcare facilities in Egypt may prevent HAIs from spreading. Following these elaborations, the study will also highlight the effectiveness of surveillance programs in shaping future policies regarding infrastructure of healthcare facilities, with the aim to prevent HAIs.

1.1. Problem Statement

Hospital acquired infections (HAIs), leads to significant mortality and morbidity among patients, therefore, resulting in financial losses for health systems [4]. Although several other studies such as, Hassan, El-Gilany, El-Mashad, & Azim, (2020), highlights the necessity of surveillance programs for HAIs, limited data is available regarding the risk factors and burden of HAI in Egypt [5]. Moreover, not enough literature tends to support the implementation of evidence-based infection prevention about the environmental design of healthcare facilities in Egypt, creating research gaps. Therefore, the problem statement for the following study could be, whether promising infrastructural materials and strategies related to the facility design, tend to reduce the bacterial burden in real-world settings.

Research objectives

Highlight the emerging problems from Healthcare Associated Infections in Egypt that are unrecognized by public.

Identify major obstacles that prevent authorities from evaluating the magnitude of HAIs burden within the healthcare facilities in Egypt and steps for improvement in future.

Develop a process to structure a surveillance program to access the magnitude of HAIs in Egypt.

Establish guidelines for implementing Evidence-Based Infection Prevention to improve the selection of design and materials for the Healthcare Facilities in Egypt.

2. Literature review

While healthcare facilities are constantly facing challenges due to the prevalence of HAIs, the implementation of evidence-based practices have proven to be effective in controlling infections. The prevalence of HAIs has increased the rate of mortality and morbidity, eventually resulting in longer stay of the patients in hospital and financial loses to the healthcare facility. Therefore, hospital facilities have taken momentum towards environmental sustainability and maintenance, as it directly reflects the vigilance level and compassion for the patients' health. However, surveillance systems lack in developing countries, like Egypt, leads the authorities to miscalculate the national burden of HAIs, as elaborated by Kandeel, Dawson, Labib, & Said, et.al., (2016) [6]. While on the other hand, Kizny, Mathers, Cheong, & Gottlieb, et.al., (2017), highlights those environmental interventions in Healthcare Facility Design tend to play the most crucial part in preventing the transmission of HAIs [7]. Based on these rationales, it is evident that an efficient infrastructure of Health system develops the effectiveness, timeliness, patient-centeredness, access, safety, and efficiency of health being provided. The following literature review identifies, compare, and contrast several studies and journal articles to evaluate the HAIs burden in Egypt, the surveillance programs being applied and the significance of evidence-based infection prevention in Egypt healthcare facilities by improving the healthcare facility design.

2.1. Healthcare Acquired Infections burden in Egypt

Healthcare Acquired Infections are considered major burden in Egypt that are efficiently determined through surveillance programs. Research studies including Hamam, Sakr, & Zahran,et.al.,(2021); Abd-ElNasser, Abdel-Rahim, & Mahmoud, et.al., (2020), demonstrated a high HAIs burden in the Egypt tertiary hospitals[8],[9]. Thuy, Campbell, Thuy, & Hoang, et.al., (2021), indicated a high incidence of blood stream infection caused by Staphylococcus aureus[10]. On the other hand, Hamam, Sakr, & Zahran,et.al.,(2021), highlighted that around 67% of the total recorded pathogens, associated with HAIs, were gram-negative organisms, whereas high rate of multidrug-resistance demonstrated by these bacteria necessitate the adoption to antimicrobial supervision[8]. Study by Hassan, El-Gilany, El-Mashad, & Azim, (2020), tended to evaluate the risk factors, incidence rate, and bacterial etiology associated with the HAI in Mansoura, a tertiary care hospital, in Egypt. The results indicated that the incidence rate of HAI was recorded as 3.7%, which was although lower than Saudi Arabia but higher than China [5]. The most prominent element leading to this improvement in the incidence rate was the integration of surveillance program.

2.2. Significance of Surveillance programs

Surveillance systems, in association with HAIs prevention, is referred as the systematic process of data collecting regarding a particular pathogen or health condition [3]. Regular endemic reports obtained through these surveillance programs, allows national authorities and healthcare facilities to restructure their existing strategies, policies and standards associated with health, with the aim of improvement in the healthcare sector. Although HAIs surveillance programs exists in developed countries such as Canada, US, Germany, and England, developing countries still lack surveillance systems [11]. The most prominent underlying reasons are the economic and environmental problems that have deprivation of social and healthcare systems, initiated by the environmental and unresolved economic challenges. Due to the sparsity of data from these resource-limited countries, like Egypt, the global burden of HAIs is eventually miscalculated. The lack of surveillance also serves as the contributory factor in a country lacking infection control guidelines, policies and professionals trained enough to deal with these emerging challenges. Research studies including including Hamam, Sakr, & Zahran,et.al.,(2021); Abd-ElNasser, Abdel-Rahim, & Mahmoud, et.al., (2020), used sentinel surveillance programs to identify the burden in the tertiary hospitals in Egypt[8],[9].

2.3. Impact of Healthcare facility design in infection prevention

Although several factors potentially promote the transmission of pathogens within a healthcare center, healthcare facility Design still tend to play a crucial role in this transmission chain [12]. Studies such as, Singh, (2020); Ashfaq, Saleem, & Masoud, et.al., (2021), have potentially highlighted those certain environmental interventions, implemented during construction of the healthcare facility could lead to enhanced prevention against the transmission and spread of the HAIs [13],[14]. Cohen, Liu, Cohen, & Larson, (2018), indicated that testing certain environmental factors within a healthcare facility such as, room occupancy, several patients in a single room and activity level within the room, have potentially assisted the hospital staff in reducing the infection transmission rate [15]. While on the other hand, Şimşek, Grassie, Emre, & GEVREK, (2017), evaluated certain ambient environmental factors that could promote the growth and transfer of a microorganism such as, air change rate, temperature, ventilation, and relative humidity etc. [16]. Another study by Joshi, Kaur, Kaur, & Mishra, (2019), have also seriously considered the significance of the built and design of the environmental surfaces within healthcare facilities towards mitigating the infection transmission chain thus the design and selection of surfaces, materials and finishes must also be considered in light of organizational policies and cleaning procedures [17]. Furthermore, throughout literature reviews, it has been revealed that those operations, people, and built environmental factors can all play a key role in infection prevention as shown in Figure 1; For each element within the organization, it is necessary to pay close attention to the hosts, reservoirs, and carriers of infections, including inanimate surfaces that may be potential routes of transmission.

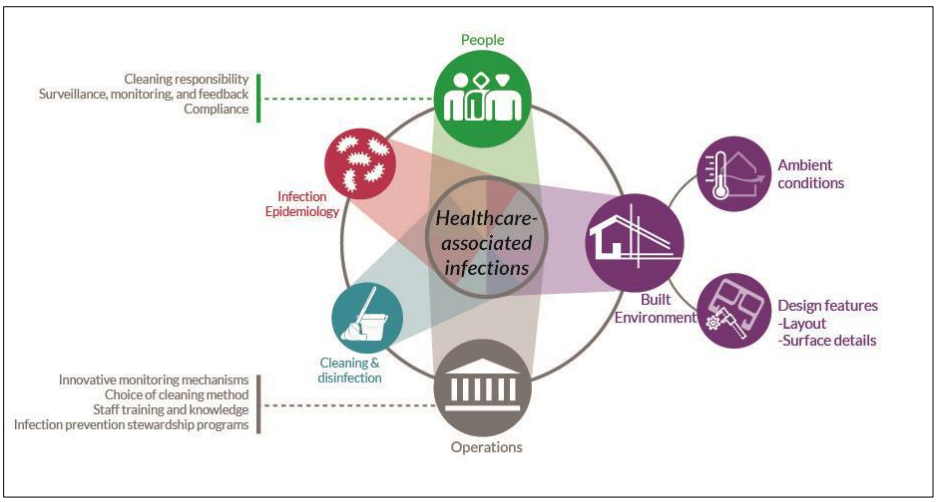

Figure 1 Systematic approach to infection protection, [17]

In other words, stakeholders must take a systems approach that considers all the elements and interactions of the system holistically in order to optimize design for infection control. Additionally, Department of Health, (2013); highlights the importance of a clean, safe environment for all aspects of healthcare by following designed-in (IPC) Infection Prevention and Control, method at the very outset of the planning and design stages of a healthcare facility and continues to final building stage [18]. Therefore, design has to facilitate cleanliness and cleaning by using finishes that are impervious, smooth and seamless moreover slip-resistant in clinical areas.

2.4. Evidence-based infection prevention

Evidence-based design (EBD) is referred as a methodology used for scientific analysis, through which the design process of hospitals is influenced based on the data acquired in a specific analysis [19]. EBD is used to potentially measure psychological and physical effects of the environment design of a health facility on the patients and hospital staff. The process initiates with formulation of a hypothesis which is then tested and analyzed. The outcome of the experimental analysis of the hypothesis is then recorded as potential data, based on which the designers create a framework for facility design [20]. The data required regarding the pathogen transmission through facility design, could be successfully interpreted through surveillance systems. EBD approach tends to assist the designers in postulating what factors associated with patients, healthcare providers and overall organizational operations, are influenced by environmental design of the facility. While some prominent postulations may include decreased operating costs, infections rates, length of stay, use of painkillers, and improved experience of the caregivers. Therefore, it implies that EBD approach has the tendency to allow the management with making optimum decisions while using the available evidence uses the best available evidence to cognize decision making and includes measurement of outcomes [21]. EBD is a process that contains multistep sequences: Framing of goals and models, Incorporation of healthcare facility guidelines, Planning and design and Operations as shown in Figure 2. The process of designing facilities progresses from planning decisions, such as the number, type, anticipated use, and overall organization of rooms, to more detailed decisions about layout, sizes, materials, finishes, and equipment. These steps are reflected in a series of documents, such as schematic design, design development, and construction documents (21].

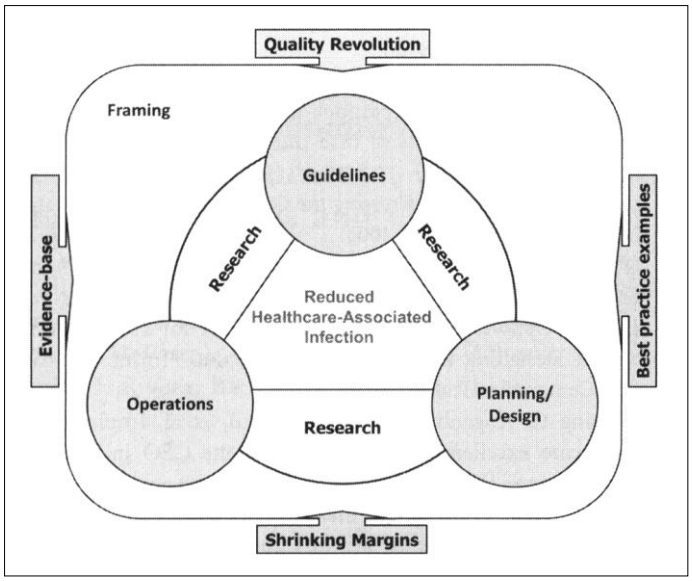

Figure 2 Evidence-based design diagram model adapted from Zimring, Megan, & MAEd, et.al., (2013) [21].

These are in turn affected by the economic and professional culture in which decisions are made: the evidence base, the greater visibility and pay for performance that comes from the quality revolution, best practices or examples, and shrinking reimbursement margins in a competitive environment, As well as the intervention of infection prevention at each step. In case of Egyptian healthcare facilities, although several studies such as Abdulall, Tawfick, El Manakhly, & El Kholy, (2018); Kotb, Lyman, Ismail, & Abd El Fattah, et al., (2020) have brought some surveillance systems into practice, literature still lacks the aftereffects of the integration of surveillance system with EBD to alter facility design [22],[23].

3. Methodology

The following research comprise of methodology and relevant research tools used to assess the significance of evidence-based infection prevention in improving the environmental design of the healthcare facilities in Egypt, and its indirect impact on the prevention of HAIs. The methodology concludes several components including the research design, data collection and analysis, followed by some prominent limitations of the research methodology chosen.

3.1. Research design

According to the studies by Lewis, (2015), research design tends to provide a comprehensive framework to collect and analyze data for the underlying research [24]. As this study tend to evaluate the effect of the evidence-based practice

implementation for infection prevention within hospital facilities, the evidence must be based on various theories in literature previously proposed by researchers regarding surveillance systems. Therefore, for the following study, a qualitative research methodology will be used, as it is concerned with targeting non-numerical data for collection, analyzation, and interpretation. Moreover, secondary data will be collected for this study and will be analyzed through triangulation technique.

3.2. Secondary Qualitative research

Although researchers tend to use two types of research methods, which include qualitative and quantitative. According to Brannen, (2017), quantitative method tends to collect quantifiable data and perform statistical analysis to derive conclusions. Whereas, qualitative method tends to generate non-numerical data method by evaluating people's beliefs, behavior, interactions, and other experiences [25]. As the focus of this study is assessing the experiences of designers, surveillance teams and hospital staff regarding how much the facility have succeeded in preventing the facility from HAIs by improving its infrastructure. Therefore, qualitative research method is preferred for this study. Moreover, this study will be evaluating these experiences through previous or pre-existing research literature, therefore, secondary data will be collected. Johnston, (2017), defines secondary data as the data that is collected from a primary source such as articles [26].

3.3. Data collection

As secondary data needs to be collected in this study, therefore, previous research articles and journals that comply with the research objectives of this study will be selected, evaluated, analyzed, and will be used to draw conclusion.

3.4. Search strategy and selection criteria

Certain online platform will be used to search the relevant literature including google scholar, PubMed, and Elsevier. Appropriate and suitable keywords and phrases were used during search such as “Hospital acquired infections”, “Egypt infection prevention” “impact of healthcare facility design on HAI” and “HAI in Egyptian healthcare facilities”. Boolean operators (AND, OR) will be used to provide more combinations of keywords and eventually boost the search. Such as “HAI AND healthcare facility design”, “HAI AND Egypt hospitals AND facility design AND construction”, and “Egypt healthcare facilities AND construction AND infection prevention” etc. the references of the relevant literature were further assessed to boost the search. Only that literature with the publication date of previous five years (2015-2021) was selected from the online sources. The abstracts of the relevant research articles were assessed and those irrelevant to research objectives were excluded.

3.5. Data analysis

For this study, triangulation data analysis technique will be used to analyze the secondary data collected through previous literature. According to Renz, Carrington, & Badger, (2018); Triangulation is a method which tends to combine theories, observations, and methods in a research study, and provide the readers with a more balanced explanation. The essence of triangulation data analyses is “sense making”, which is considered a process of giving meaning to a raw and irrationalized collected data [28]. Therefore, triangulation technique helps to predict and interpret the results of a study rationally, therefor, the credulity and validity of the research is eventually increased.

3.6. Limitations

As the research gaps of this study is concerned, insufficient literature regarding the research objective, in case of Egypt, could be difficult. Therefore, using secondary data could be considered as a limitation to this methodology, which could have been encountered by conducting a primary research.

4. Conclusion

Based on the above study, it is evident that the physical design of a hospital or any healthcare facility plays an essential role in infection prevention and control (IPC) measures, as it potentially reduced the risk of infection transmission. Documenting the structural characteristics of a pathogen is necessary to strengthen surveillance programs. The results from surveillance programs are used to conduct substantial planning and coordination during building projects, with the aim of reducing infection transmission. Therefore, Evidence-based design approach requires to establish a multidisciplinary team to conduct projects related to environmental design. It could be concluded that EBD approach has the potential to prominently decrease HAIs burden in Egyptian healthcare facilities as it provides a diverse insight into the layout, equipment, and materials that contribute in the transmission of pathogens due to faulty design.

Findings and recommendations

Research studies such as, Abdulall, Tawfick, El Manakhly, & El Kholy, (2018), have provided evidence associated with the substantial impact of the construction and design healthcare facility in Egypt, on the patterns followed by nosocomial infections [22]. The study tested the resistance mechanism of Carbapenem-resistant Gram-negative bacteria, which a bloodstream infection transmitted through catheter. The results demanded the antimicrobial stewardship must be boosted to prevent CRBSI. While another study Kotb, Lyman, Ismail, & Abd El Fattah, et al., (2020), highlighted the significance of improving infection prevention and the need to reinforce antimicrobial stewardship, when he results observed an increased burden of CRE burden in Egyptian hospitals [23]. These studies demonstrate an urgent need of an efficient surveillance systems to identify the facility design-related issues that tend to promote the transmission of infections. However, in Egypt healthcare facilities, the operations must not be ceased just after surveillance programs, rather it must be paired with EBD approach to alter the facility design into a more advanced form to achieve higher infection prevention. In order to improve the poor indoor quality by MEP (mechanical, electrical, and plumbing), previous studies have also indicated certain solutions including advancements in private room, improved surface selections, isolation, integration of touchless systems, and enhanced ventilation systems that must be applied in the healthcare facilities in Egypt for infection prevention.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest statement.

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