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Modernizing Healthcare Delivery for Displaced Persons in the Middle East

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Master of Public Health

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Abstract

Modernizing Healthcare Delivery for Displaced Persons in the Middle East

By Natalie Hakim

Inequitable healthcare delivery for displaced populations, particularly refugees in the Middle East who have escaped their countries due to war and political uprise, is perpetuated by the lack medical record history that is synchronized in a health-record tracking system. The establishment of a secure, cloud-based health information system, following the example of RFID wristband use throughout the Hajj pilgrimage in Saudi Arabia, could modernize healthcare and public health surveillance in these areas, but must consider relevant barriers and guidelines. The goal of this literature review was to discover what the most effective and user-friendly electronic health record (EHR) system currently existed in the Middle East that could be integrated into refugee camps and communities with displaced persons. Literature that was reviewed focused on the implementation of electronic medical records (EMRs) in Lebanon, Saudi Arabia, and Jordan. The review finds that there is a lack of a synchronized, cloud-based EMR models across the Middle East, resulting in gaps in quality of care, inconsistent treatment for chronic conditions, and inaccurate patient medical records. The prevalence of non-communicable diseases (NCDs) is high in the region, with hypertension, diabetes mellitus, and cancer being the most common. The implementation of EMRs in cross-border settings has been shown to improve continuity of care, accuracy of patient data records, and chronic disease management. EHR systems in the Middle East vary in effectiveness and implementation across countries, with the Saudi Arabian Ministry of Health being a main supporter of their implementation. Hajj, a pilgrimage in Saudi Arabia, was a driving factor for advocating for EHR implementation due to the spread of NCDs and the need for crowd control. Two favorable recommendations for EHR integration during Hajj were suggested, including an RFID wristband tag and a secure cloud-based system accessible through a key-shaped USB drive called Sijilli. The integration of Sijilli, a secure and accessible EHR cloud innovation, and an RFID wristband is suggested as the optimal way to synchronize refugee health records in the Middle East due to its coverage for refugees of any nationality, low-cost, and potential for cross-border migration. The use of cloud-based EHR systems, like Epic in the US, has transformed medical records, and a similar system in countries with weak healthcare infrastructure could greatly benefit families who have escaped political crisis across the Middle East.

Modernizing Healthcare Delivery for Displaced Persons in the Middle East

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Chapter 1. Introduction

Healthcare delivery is not equitable across the world, especially for 80 million forcibly displaced persons. [1] Within healthcare services, electronic medical records (EMRs) are essential drivers for healthcare transformation. [1] Unfortunately, the process for storing medical records is not equitable across the globe. Displaced populations (e.g., refugees) are concentrated in high volume camps in the Middle East and are more susceptible to chronic disease and other physical health problems due to lack of availability of refugees' health records. Lebanon has the greatest number of refugees per capita in the world; and Syrian refugees make up 1.5 million of the total population.

Considering this, establishing a secure health information, cloud-based system would be more effective and efficient in answering questions such as: organization of health information architecture; security of health information; and understanding constraints in this process of digitization. Hajj – the pilgrimage for Muslims – located in the Kingdom of Saudi Arabia (KSA), uses Amazon as their cloud vendor to encompass patient information. This framework will serve as the basis for working to consider how a cloud system could be established for displaced populations in the Middle East.

This project aimed to address questions on how modernization of healthcare and public health surveillance (PHS) can occur in areas concentrated with displaced persons, such as refugee camps in Lebanon. We will consider barriers and guidelines that should be followed when establishing a cloud-based system for electronic health information.

1.2 Problem Statement

This systematic literature review aimed to address is the absence of proper tracking of refugee health records in the Middle East.

1.3 Purpose Statement

The purpose of this systematic literature review was to determine the strengths and limitations of the current electronic health record system (EHR) in the Middle East, and how to build upon missing components to create an integrated PHS system.

1.4 Objectives

The objective of this systematic literature review was to summarize existing literature surrounding EHR use for displaced populations in the Middle East (e.g., Syrian refugees based in Beirut, Lebanon refugee camps). Summarizing existing literature allows for interpretation and analysis for a more synchronized and usable EHR system that is usable for displaced persons. Recommending next steps for implementation in Middle Eastern healthcare delivery and EHR systems would ultimately be the goal for reducing refugee susceptibility to chronic disease.

1.5 Significance Statement

The significance of this systematic literature review is to determine a better EHR system to manage the high burden of chronic diseases among displaced refugee persons. Chronic diseases (e.g., hypertension, psychiatric disorders, and diabetes) are commonly found among Syrian refugees. Continuation of care is difficult without a proper EHR system to maintain patient records to adequately deliver healthcare services. Analyses of

pre-existing literature on healthcare delivery for displaced persons in the Middle East aims to make strides towards prevention and continuation of care for chronic disease.

Chapter 2. Literature Review

This literature review aimed to review current EHR systems in the Middle East and social determinants and disease prevalent among displaced persons in refugee camps. The studies selected were meant to provide a framework for building upon a pre-existing EHR system or selecting one that is feasible for use in refugee camps.

The earliest literature related to this topic is from 2012, a study conducted by Sahlool, *et* al. (2012) that evaluated the healthcare services provided to Syrian refugees in Turkey. [1] The sample size in this study included three refugee camps (Altinöz, Islahiye, and Kilis) visited by the evaluation team and individuals and officials were interviewed. While Turkish authorities provided social and physical needs (e.g., lodging, food, health services, security, social activities, and education) and there was an absence in psychological health services, infection control, and outbreak PHS [1].

Healthcare delivery recommendations include the implementation of both a Syrian physician team and a psychiatrist team who spoke the same language as the refugees, as well as a long-term care program for specific medical conditions based on prevalence and available treatment services. [1] Absence of health provider teams and a long-term treatment plan demonstrate the lack of delivery in initial care service and continuation of care. Medical record tracking was done through a written logbook, which demonstrates the need to have a proper EHR tracking system in a setting like this.

One year later, a study by Al-Hashedi, *et* al. (2013) examined the benefits of potential application of Radio Frequency Identification (RFID) technology in the Muslim Hajj (Pilgrimage) to improve identification of pilgrims and the storage of their health information. [2] Management of pilgrim health is challenging because of the large number of patients who arrive at health centers every hour. [2] Additionally, language barriers cause health providers to misdiagnose health status or not account for pre-existing conditions during treatment, which greatly affected pilgrim quality of care. [2]

This study states that RFID tags can be put on wristbands and distributed to every pilgrim at the time of their visa approval, and will allow patients to store medical information such as health and disease status. [3] Wristband RFID tags will be able to identify pilgrims and access health records at hospitals, outpatient clinics, and health care camps near the site. [2] RFID tagging is a monumental technology integration that could be used in tracking health records for refugees in camps across the Middle East. This study doesn't account for synchronization of medical records to one EHR system, which can be an issue when tracking refugee camps in different countries.

Likewise, Hajj is the center of the study by Nafea, *et* al. (2014) and the many challenges faced by Saudi Arabia Ministry of Health (MoH) due to the risk of communicable diseases. Data accumulation during the event can be analyzed and used to understand disease spread, prevention, and for improving early warning and response to infectious disease outbreaks. [3] Nafea, *et* al. (2014) suggests using big data technology and cloud computing to manage and analyze the data for disease prevention and control during Hajj. [3] The system presented in the study would include a magnetic card for each

pilgrim's demographic and health profile data, while sensors in cell phones are used to record health information. [3]

The cloud infrastructure is used for storing and analyzing big data, with Amazon Web Services (AWS) as the chosen vendor for implementation. [3] Both the pilgrims and ministries would benefit from this approach since pilgrims would be able to run their applications anywhere and anytime with accurate results, while ministries would be able to share resources and get cooperation. [3] The concern that arises with this approach is the connectivity to the mobile device in certain areas with low cell phone signal. One strength is the idea that each pilgrim has a unique magnetic card that has 10 digits for each pilgrim based on a coding system for specific demographic and history of health profile data. [3] AWS being the study's main source for big data storage is one solution to the problem of not having a specific EHR system for displaced persons.

Analyzing the current Middle East healthcare system is imperative when trying to implement changes in healthcare delivery. Benlamri, *et* al. (2017) summarizes how healthcare systems in the Middle East operate despite differences in wealth and infrastructure. [4] This article examines the healthcare systems in six Middle East countries: Oman, UAE, Egypt, Lebanon, Palestine, and Yemen. [4] Wealthy oil-producing countries, like the UAE, have allowed for more investment in healthcare. [4] Countries such as Lebanon and Egypt often result in more health inequities due to limited financial resources to serve the population size. [4] Access to health insurance in Egypt is reliant on an individual's financial status; 55% of the population don't have insurance and pay out-of-pocket for healthcare. [4] Lack of government financing in war-involved countries

(e.g., Palestine and Yemen) affect the functionality of healthcare facilities. [4] Analyzing these countries' healthcare systems assists with improving current healthcare delivery and prioritizes which countries need more immediate EHR implementation.

Healthcare systems in the Middle East don't adequately control the rapid spread of disease during mass gatherings. Nafea (2017) proposed the implementation of a mobile-cloud application that links data sets from different ministries to draw patterns of disease spread during Hajj. [5] Cloud computing is proposed in the article as a beneficial model due to its reliability, cost-effectiveness, and availability. [5] The proposed system in this article states that mobile applications and social networks will be able to collect disease outbreak data, and this data would be matched to patients for the reported diseases. [5] A magnetic card that would collect all patient data on a first-hand basis is also described in this plan. [5] Similarly in the research done by Nafea, *et* al. (2014) AWS is the proposed cloud vendor for the mobile application described. EHR implementation through a cloud that synchronizes real-time data, with the addition of a magnetic card that collects patient information, exemplifies an excellent basis for a strategy to implement this approach in refugee camps.

Determining the health needs and priorities of refugees in camps is essential for implementation of an EHR system. Al-Rousan, *et* al. (2018) conducted a study to assess the health needs of Syrian refugees living in camp and community settings in Jordan. [6] Two hundred and thirty Syrian refugees participated in the study, and focus group discussions were conducted to determine the health needs of Syrian refugees and the barriers in obtaining care. [6] Study participants identified the high smoking prevalence

as a major contributor to rising chronic conditions, as well as the lack of transportation when trying to access emergency care. [6] High cost of care led to Syrian refugees to seek care from pharmacists. [6] Camp-based refugees emphasized the need for more security and emphasized domestic and sexual violence as a concern. [6] In relation to EHR implementation for displaced persons in these settings, it's notable to see the various health needs and chronic conditions that haven't been recorded properly on any type of cloud system.

Lack of health record tracking led to a study conducted by Alshagathrh, *et* al. (2018) that presents the experiences of building an implantable medical device registry in the Kingdom of Saudi Arabia. [7] A medical data registry is a place to store, extract, analyze, and share large amounts of clinical data. [7] Implantable biomedical device (IBD) registry refers to a registry that captures data relating to IBDs like pacemakers and hip and joint replacements. [7] This was a two-year case study involving 60 health professionals from five hospitals in Saudi Arabia who participated in a readiness assessment survey. [7] This assessment examined hospital workflow and operations, clinical staff engagement, and system-level capacity as related to the Implantable Medical Device Registry (IMDR). [7] Results from this study show that there are differences among Saudi hospitals that demonstrate their readiness for IMDR implementation. [7] Some of these factors were differences in hospital organization systems, clinical practice, technology infrastructure, and data sharing capabilities. [7] While this review isn't focused on IBD data, it is a good resource for looking at a technological implementation plan and the implications as to what went wrong.

E-Health in the Middle East is the subject of a review by Neamah, *et* al. (2018). Specifically for developing countries like Iraq, they found that patient EHRs are scattered in various locations within the hospital. [8] This made it difficult for a physician to provide quality care to a patient. Eleven middle eastern countries (Jordan, Saudi Arabia, Turkey, Israel, Qatar, Kuwait, United Arab Emirates [UAE], Oman, Iran, Bahrain, and Iraq) and their E-Health implementation plans were reviewed. Saudia Arabia was a top performer in healthcare, with a large amount of money being spent to expand government and private hospitals. [8]

One issue with the rapid expansion that occurred is variations in the information systems being used, which has caused patient information to become scattered in different healthcare facilities unless the patient has always used the same provider. [8] UAE embraced the information technology (IT) and EHR revolution with the implementation of “Wareed”. [8] Wareed is an EHR system that was established to link patient records across the seven emirates. [8] Scattering of patient information is a relevant theme here that is linked to the over-arching theme of the creation of one EHR system.

The Syrian refugee crisis was a driver for this work, especially with such a large displacement in where Syrian refugees end up residing. Alawa, *et* al. (2019) states that Turkey holds the greatest proportion of Syrian refugees. [9] Chronic conditions (e.g., diabetes and cardiovascular disease) are focused on in this literature review on identifying publications that pertain to Turkish healthcare policies and the provision of refugee health services in the country. [9] One of the major challenges for Syrian migrants was the registration procedures. To access health services, Syrian migrants must be registered

with an identity card number. Migrants who already registered had personal numbers starting in 98, but after the Temporary Protection Regulation (TPR) was introduced in 2014, newly incoming migrants were given a number starting in 99. [9] Individuals who already migrated to Turkey were asked to re-register to receive a number starting in 99 because the electronic health system that Turkey utilizes only recognizes numbers starting with 99. [9] This is interesting to analyze because of the number system and how much of a barrier to access it is.

Access to medical records is discussed in a systematic review by Chiesa, *et* al. (2019). The European Commission has invested in the development of EHRs to improve interoperability of different health systems in the European Union (EU). [10] It was found that health information technology and exchange have the potential to transform health care, but the review identified which health records have been developed so far specifically for migrants and refugees. [10] The United Nations Relief and Works Agency (UNRWA) started in 2009 to develop an electronic records system (e-Health) to provide primary health care for five million Palestine refugees in Jordan, Syria, Lebanon, the West Bank and Gaza. [10]

The UNRWA decided to expand its cohort analysis to the other primary care clinics in Jordan that had already adopted E-Health and to expand E-Health to all primary healthcare clinics in Jordan and other countries or territories where UNRWA operates in Middle Eastern countries (West Bank, Gaza strip, Lebanon, and Syria). [10] This study found that EHRs for migrants implemented in cross-border settings improve continuity of care, accuracy and quality of patient data records, access anytime and anywhere to

patient health info, and better efficiency of health care delivery [10]. Consideration of cross-border settings is notable for this review, as implementation of an EHR system needs to be able to synchronize across country borders in the Middle East.

Returning to the theme of Syrian refugees located in Turkey, a different journal article by Tayfur, *et* al. (2019) also illustrates the healthcare services provided to migrants in the country. The introduction of infectious diseases such as polio, typhoid, hepatitis A was a major concern for hosting refugees since these diseases are endemic in Syria. [11] Preventative services were a deficiency in refugee health care, specifically for pregnant women, newborns, young children, and family planning services. [11] Chronic health problems and elderly care were also stated to have not been prioritized. [11] Chronic health conditions that were noted include hypertension as the worst, followed by arthritis, diabetes, respiratory illness, and cardiac disease. [11] Putting in perspective the specific conditions that occur in Turkey's highly populated camps is important to consider for EHR implementation, especially how this varies in countries across the Middle East that are hosting refugees.

The Saudi Arabia Ministry of Health (MoH) is known to put in copious amounts of money towards healthcare, so evaluating the use of EMRs in this country was essential for this review. As mentioned by Alsadrah (2020), the government of Saudi Arabia declared the development of eHealth a priority in 2008. [12] Moving from paper-based records to EMRs was the goal, and it was so important that the MoH devoted over four billion Saudi riyals (1.07 billion US) to eHealth programs. [12] Despite these efforts, Alsadrah (2020) states that the implementation of EMRs in Saudi health care institutions is low. [12] Alsadrah

(2020) mentions a 2018 study that surveyed 15 hospitals in the Eastern province of Saudi Arabia and discovered that only seven had a running EMR system. [12] Advantages stated to adoption of EMR in Saudi hospitals includes help with chart review, recording all the patient's history in one place, improvement of clinical performance, and documentation. [12] Often times, it's easy to overlook how an innovation may be ready to use, but not yet implemented. This article provided a new perspective on the outcome if a hospital system or refugee camp actually implemented an EHR system, depending on various factors in their practice.

Saleh et al. (2020) discusses the design and implementation of a scalable and innovative cloud based EHR named Sijilli, which targets refugees in low-resource settings. [13] Lower middle-income countries (LMICs) are stated to be the majority that hosts refugees, even though they already have fragile health systems. [13] This drove the idea of implementing a low-cost, innovative, feasible solution that targets the needs of this population. [13] Lebanon is named in the article as one of the main LMICs housing refugees, which hosts around one million Syrian registered Syrian refugees.

These refugees often reside in underserved rural Lebanese areas, where health service delivery is insufficient. [13] Phoenix was an existing EHR system that was developed by the Lebanese Ministry of Public Health (MoPH) and targets disadvantaged Lebanese and refugees who received primary care within the 229 primary health care centers (PHCs) under the supervision of the MoPH. [13] Sijilli was launched in 2018 and collaborated on between the Global Health Institute (GHI), American University of Beirut (AUB), and the US health care software company Epic. [13]

Considering security, Sijilli accounts for this and only external health providers and the patients can access records by providing a pin and answering security questions. [13] One strength of Sijilli is that it takes into consideration the potential for upscaling to cover refugees of any nationality worldwide and provides them and their providers with access to their records wherever they migrate. [13]

Sijilli has a high potential for scalability since it's a low-cost cloud-based EHR that can be exported to crisis areas that lack the required digital infrastructure. [13] Sijilli is an optimal EHR model that is a great resource to consider as a main driving point for EHR implementation. Security, scalability, and its low-cost are imperative factors for EHR implementation that have been emphasized in this review.

Saudia Arabia's E-Health implementation is revisited in a study published by Fahad Alanezi. To determine the factors that influence E-Health adoption in the Kingdom of Saudi Arabia (KSA), a quantitative survey-based analysis method was used. [14] The questionnaire was developed based on the findings of previous studies and by analyzing the status of E-Health in the country. [14] The questionnaire was initially viewed by 438 people, and 130 of them answered the survey. [14]

Results stated that 86.2% of respondents would provide their medical information to doctors in clinics or hospitals and preferred face-to-face contact instead of online. [14] Respondents (79.6%) stated that they would be happy to receive online health care and share their medical details on the phone. [14] These results demonstrate the importance of patient relationships with providers, a closer relationship with a provider could be more motivating to adapt the use of online care. [14] Provider-patient relationship is an element

that was deemed to be important from the results of this study, which isn't something that was initially factored into this review. After seeing this importance, patient-provider relationships will be an element that is recognized in overall EHR implementation.

Following into more recent literature, Alawa, *et* al. (2022) reviews various EHRs that were mentioned earlier in this review, such as Sijilli and UNRWA's e-Health platform. [15] Sijilli uses user-friendly tablets and computers to generate a password-protected PDF document of patients' health records after their care visit, which is then stored in a key-shaped USB drive. [15] This drive can be transported throughout their migration, and the records can be unlocked at another site using a unique combination key. [15]

Hikma Health, a California-based non-profit, is highlighted in this review for their development of a modular and offline EHR. [15] This platform allows clinicians to tailor the system to capture and report their specific needs. [15] Unlike Sijilli, this platform makes it difficult for patients to access their own records outside of a clinic. [15] This system isn't as useful since refugees migrate and need to securely access their records. One area of improvement that was brought up was clinical user engagement, specifically within providers. [15] Poor EHR uptake by providers can be resolved by including an EHR software development tool. [15]

The EHR software development tool allows clinical users to collectively work together to generate the interface or workflows that they want. [15] Sijilli was found to be the best EHR model because patients have a USB with their record and a login to the cloud-based site. [15] However, the Sijilli record does not allow patients or providers outside their system to edit any part of a patient's EHR for security purposes. [15] This prevents

patients from having autonomy over their medical records. [15] Sijilli was found to have a lot of pros as mentioned in Saleh, *et* al. (2020) article, but there are more considerations found in this article that demonstrate the need for further improvement.

A study by Aljohani, *et* al. (2022) examined both primary and secondary data to figure out how to provide health logistics services through e-government. [16] KSA devotes a large amount of time and funding in preparation and management of Hajj, especially in the sector of health care. [16] Smart hajj health applications were developed to allow pilgrims to monitor care at any time throughout their pilgrimage. [16] Asefny is an application that offers resources that complement the Saudi Red Crescent Authority efforts which include: notifying the Saudi Red Crescent Authority of an emergency, using SMS text messaging to deliver a crisis message in the time of an extreme emergency, keeping track of the status of reports, keeping a detailed record of medical history, and directing users to nearby medical services. [16]

Sehha app provides access to medical consultations through text, speech, and video conversations provided by doctors accredited by the MoH. [16] Artificial intelligence tools allow access to safe medical information automatically and provide solutions to help individuals receive preventative and health care tips to improve their health and fitness level. [16] Elaje app is an electronic portal that helps individuals schedule appointments and purchase medical equipment. [16] While all these applications are resourceful, they are not interconnected, and each use a different database. [16]

Primary data was collected through a four-question close-ended survey, with open-ended interviews. [16] The second survey was an electronic survey established through Google

Forms to support the study and gain more information, and 83% of respondents are aware that there is no unified health application, while 16% don't even know if there is an application or not; 66.7% of respondents said that the time has come for a technical shift in their organizations and patient care for more high-quality service. [16]

Strengths in this literature that align with this review are that even with a variety of applications, they are fragmented and not unified. Hajj has annual growth in the number of pilgrims traveling to the KSA every year, just like the annual growth of displaced refugees in camps in the Middle East. This study recommended the creation of an Electronic Control and Monitoring Center in the Ministry of Hajj that can link pilgrim service centers with decision-makers. [16] The other suggestion that is valuable to this review was an RFID electronic bracelet that can track pilgrims and monitor their health status for timely care. [16]

While most literature has been about how to implement EHRs in various settings, there wasn't much on how much EHRs will affect health outcomes on people with chronic health conditions. [17] In a literature review by Buford, *et* al. (2022), the impact of EHRs in the care of displaced people with chronic conditions and the barriers and facilitators to successful EHR implementation for refugees are identified. [17] Data that Buford, *et* al. (2022) cited from a study by Doocy, *et* al. found that the metrics for both hypertension and diabetes improved when utilizing EHRs, and this was because increased rate of data collection, more accurate recording of chronic disease metrics, and more frequent lifestyle counselling compared with paper records. Additionally, physicians were more likely to record blood pressure, body mass index, and blood sugar levels with EHRs compared

with paper records. [17] Buford, *et* al. (2022) found that EHRs improved chronic disease outcomes in refugee camp-based clinics, which was achieved through provider adherence to guidelines, monitoring of clinical indicators or disease metrics, patient counselling, and patient adherence through messaging services. [17] Clearly, there is evidence that chronic disease conditions are improved with the use of EHRs. Furthermore, it's critical to note that physicians play a big role in the delivery of care through an EHR system rather than on paper.

Similarly, an article by Saleh, *et* al. (2022) outlines the chronic illness that Syrian refugees deal with in the Eastern Mediterranean Region (EMR) [18]. The EMR has one of the highest prevalence of non-communicable diseases (NCDs) globally, with over 100 million people living with hypertension, 50 million people with diabetes mellitus, and 1.35 million with cancer in 2021 [18]. Child health in the refugee population also faces conditions like increased prevalence of acute respiratory disease, acute malnutrition, and micronutrient deficiencies due to inadequate feeding practices and diarrhea due to limited safe water access [18].

Syrian refugees in Lebanon have access to over 200 primary health care facilities, but the cost of consultation and lab tests are still a barrier for Syrian refugees [18]. Palestinian refugees are also located in Lebanon, but they are ineligible for the State's health services and can only access private health care [18]. The UNRWA operates 28 primary health care facilities that are open for Palestinian refugees, since private sector healthcare has high fees [18]. Lebanon has also faced a price surge in food, necessities, and out of pocket health expenditures [18]. Jordan has one of the strongest healthcare systems in

the EMR, with the two major public programs that deliver care services being the Jordan Ministry of Health (JMoH) for civil health and the Royal Medical Services (RMS) for the military program [18]. While public primary care services are widely distributed, specialized care is concentrated in urban areas with a weak referral system [18].

Integrating refugees in the national health system in Lebanon is one recommendation, but this isn't feasible in the short run due to the country's economic crisis [18]. Contrastingly, Jordan's health care system has been one of the strongest after the COVID-19 pandemic [18]. Despite this, there is still a challenge to ensure that everyone has access to quality health care due to overburdened health services to meet the influx of refugees [18]. Political factors are equally important to consider when moving towards an EHR implementation plan, and this could be easily overlooked.

Chapter 3: Results

Eighteen studies in total were included in this review, concentrating on implementation that was in the EMR (Lebanon, Saudi Arabia, Jordan). The results conclude that there is a lack of one cloud-based model that is synchronized across the Middle East, causing a lot of gaps in quality of care, inconsistent treatment for chronic conditions, and inaccuracy in patient medical records. It was also found that the EMR has one of the highest prevalence of NCDs globally, those diseases being hypertension, diabetes mellitus, and cancer. These conditions were found to be worse in countries like Lebanon, where OOP cost is high and the influx of refugees doesn't match the availability of services [14]. Furthermore, the need for security to protect against domestic and sexual violence was found to be a concern for camp-based refugees [7].

Results from the various literature demonstrated that EHRs for migrants implemented in cross-border settings improve continuity of care, accuracy of patient data records, improvement of chronic disease conditions, and closer monitoring of clinical or disease metrics [3]. EHR systems in the Middle East were found to vary from country to country in how effective they were and how much they were being implemented in hospitals. The Saudi Arabia MoH was a main supporter for the implementation of EHRs and e-Health [14]. Hajj was a driving factor for why implementation of EHRs was advocated for more because of NCD spread and lack of crowd control due to the large number of pilgrims [4]. There were two favorable recommendations that were brought up to integrate EHRs during Hajj while also being able to track pilgrims. One of these methods was through an RFID wristband tag, which would allow patients to store medical information [18]. Sijilli

was the EHR cloud innovation that was another favorable option targeted towards refugees, and it stands out because it's secure and accessible through a key-shaped USB drive [10].

Chapter 4: Discussion and Public Health Implications

Following the analysis of these EHR methods previously implemented in the Middle East, and discovering innovative tracking systems being used for Hajj, it's clear that the integration of Sijilli and an RFID wristband would be the most optimal way to synchronize refugee health records. Since the rate of chronic conditions will only increase with the displacement of refugees, it's imperative to implement an innovation that can be accessed at any time.

Use of Sijilli means that refugees can migrate from one country to the other without having to worry about the storage of their medical records. Coverage for refugees of any nationality was an additional factor that makes it so appealing for implementation. Low-cost is another positive element that makes it the most optimal health care delivery solution. Alongside the use of Sijilli, an RFID wristband that works in conjunction and syncs to the cloud would be a superior option since it's wearable and harder to lose than a USB. Revolution has occurred with the use of cloud-based EHR systems, such as Epic, that have transformed how we view medical records in the US. Evidently, a similar system adapted in countries where the health care system is weak and there is a lack of EMR tracking infrastructure makes this innovation vastly more impactful for families who have escaped crisis.

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