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Editorial

The Electronic Medical Record—A New Look at the Challenges and Opportunities

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Electronic medical record (EMR) systems possess the potential to enable smart healthcare by serving as a hub for the transformation of medical data into meaningful information, knowledge, and wisdom in the health care sector. This vision will only be realized after medical imaging, wearable devices, genomic data, sensor data, environmental data, and behavioral data are coupled with machine learning algorithms [1]. Some propose that transforming EMR data will result in more accurate diagnoses, individualized therapy, and improved patient well-being and outcomes. Nonetheless, these processes have faced numerous hurdles since the inception of the EMR nearly half a century ago via its introduction in the United States in 1972 [2], subsequently progressing slowly and steadily. At the time, the EMR raised the prospect of major patient advantages in terms of utilizing past patient data to improve medical decision making and treatment outcomes. Increased connectivity allowed clinicians to see records that were physically separated or contained multiple types of files.

Over time, the integration of EMR [3] into other systems across healthcare has enhanced EMR's potential to provide complete patient data and greater data sharing across the medical system, resulting in system efficiency, and improved medical care. With the introduction of data mining, textual analysis using natural language processing [4] and AI, as well as new mobile health application, Internet of Things devices [5], and telehealth [6], EMR can now be used not only to benefit individuals but also to mine, access, and analyze useful medical information at the population level [7]. This has been especially important for patients suffering from chronic illnesses [8]. Moreover, in many countries, nation-wide EMR (also known as the electronic health record) has significantly enhanced research opportunities. Patient participation in data entry into the EMR [9], as well as sensor data input [10], have created new opportunities to extend EMR capabilities and use, transforming data into wisdom.

EMR not only improves medical outcomes, but it also creates significant resource savings [9]. Prior to the implementation of EMR, hospitals allocated acres of space for the storage of paper-based records and hired many workers to search and retrieve them. Even small community clinics faced a significant burden in satisfying the legal and patient-service requirements of storing patient files. EMR has freed up enormous human and physical resources that would otherwise be necessary to retain and access paper records at all levels of the medical system.

However, the EMR has introduced significant challenges that have frequently prevented health organizations from fully leveraging the potential benefits of these advances [10]. Examples of such issues include (i) the high cost of implementing and maintaining EMR, which includes expenses for hardware, software, and trained personnel. This

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cost often competes with other financial needs within the healthcare system. (ii) Interoperability issues arise when integrating EMR with existing systems, especially in large hospital settings where systems are introduced gradually. (iii) The data from previous systems must be transferred to the new EMR accurately and reliably. (iv) Storing large amounts of highly sensitive digital data poses significant challenges in terms of data privacy [11], legal issues, and security risks [12]. Instances of significant data breaches have occurred in the field of electronic medical records (EMR), such as the Tricare breach in 2011, the UCLA Health Data breach in 2015, the Banner Health breach in 2016, and the Trinity Health breach in 2020. These breaches had a widespread impact, affecting millions of patients. Thus, while EMR's ability to collect and digitally preserve patient data in a form that can be easily retrieved and analyzed can provide significant benefits to both individuals and communities, it also introduces some significant hazards that deserve greater investigation and consideration.

Against this backdrop of both benefits and concerns, we chose to publish this Special Issue on challenges and opportunities in the electronic medical record (EMR). Despite their over 50-year history and widespread and practically universal presence in major health settings throughout the developed world, new publications demonstrate that several problems remain in their successful implementation and use [13].

The accepted papers published within this Special Issue explored numerous aspects previously unaddressed in the literature on this topic. They employed a variety of methodologies, including interviews (Campos-Castillo et al.) [14], data science (Baja et al.) [15], the co-design of a digital mental health intervention (DMHI) followed by workshops (Patrickson et al.) [16], and an intervention in the form of workshop followed by a survey (Paplialonga et al.) [17]. A number of different theories were explored, including neo-institutionalism [14], the diffusion of innovation [15], and positive deviance [17].

Campos-Castillo et al. [14] provided a social perspective on EMR by exploring how EMR might be utilized to claim professional autonomy. The paper examines the usage of EMR systems as a means of enforcing medical power over patients. This can prevent patients from actively participating in their healthcare journey. It is an especially intriguing story in a context when patient empowerment and patient-centered care are frequently discussed topics, and when people are being asked to contribute their own data to their patient record. This article examines how organizational change, such as the use of EMR, might destabilize hospital hierarchies, as well as how the electronic record can be utilized to either disrupt or reinforce existing relationships. The paper effectively depicts the difficulty of implementing change due to prior habits being frequently mistakenly duplicated. This research demonstrates that for, the EMR to effectively serve as a communication tool between physicians and patients, health organizations must actively plan and guide its implementation, and the technological architecture must support this transformation.

Bajaj et al. [15] explored the integration of data from smart watches (an IoT device) into EMR, a topic that will become increasingly important in the management of large EMR controlled by organizations, such as health funds. Smartwatches are now a key source of personal data collection worldwide, collecting data on a wide range of health parameters such as steps taken, heart rate, and mood indicators. Again, collecting and utilizing this data has the potential to yield significantbenefits if the risks are mitigated. This study looks into the practical problems of adding smart watch data into EMR and how it may be used to help health care personnel and reduce their workload. The paper evaluates a prototype system and highlights the benefits of collaborative design. The participatory component of multimodal fusion in smart healthcare allows patients to actively engage in the creation of their health-based database, allowing for collaboration and shared decision making with healthcare practitioners, as well as the development of tailored treatment plans. This approach integrates data from mHealth devices with patient-reported information to provide real-time feedback and insights on health status.

Patrickson et al. [16] discuss a digital platform participatory design approach aimed at incorporating individual health monitoring data into EMR, this time in the context of mental health. This study examines the use of digital mental health applications, which

is an essential topic in an age when there is a global scarcity of face-to-face mental health practitioners. Patients are increasingly turning to digital mental health treatments, which can collect and store large amounts of sensitive personal information. They describe how digital mental health interventions (DMHI) can be used alongside EMR and as inputs into EMR. This highlights the usefulness of such systems in public health monitoring. However, this paper's innovation stems from the authors' acknowledgment of the need to include caregivers, in addition to patients, in the design of DMHI to ensure a client-centered approach with a human focus rather than a data-driven ethos. They found that digital treatments must be adaptable and flexible, and that patients must be able to optimize information in their own EMR to focus on beneficial patterns. Enhancing patient-centered care can be accomplished by incorporating caregivers into platform design, particularly when their participation improves digital platform interfaces. The data collected through digital mental health interventions must be used to develop the digital therapeutic alliance, which promotes shared accountability between health providers and patients. This study emphasizes the significance of evaluating several data sources and data users to appropriately serve the mental health setting. It broadens the definition of participatory healthcare to include not only the patient, but also their significant others.

Paplialonga et al. [17] use the central repository of EMR data to add knowledge and wisdom through research, demonstrating how data taken from a primary-care network allowed them to study an intervention that compared two distinct groups of patients with type 2 diabetes. They demonstrated how a data-driven strategy might bring valuable insights in this area of substantial challenge for health systems. This study intended to create an information-driven approach to peer-to-peer help. The authors relied on two approaches: segmentation, which divides patients into groups based on their needs (in this case, medication-taking behavior), and positive deviance, which applies learning principles. The article demonstrated how data from EMR may be utilized to segment patients into peer-to-peer virtual workshops, potentially leading to treatments that are more specifically targeted to patient needs.

Overall, this collection of articles provides a new look at some of the challenges and opportunities offered by EMR. They show how the use of EMR data may be used to help support some of the most significant health issues of our time such as diabetes and mental health. The two articles in these areas [16,17] indicate the benefit of future work on how EMR can help promote more equitable health outcomes with a greater focus on prevention and wellness. Campos-Castillo et al. [14] suggest further research into how EMR can promote patient–doctor face-to-face communication in a less hierarchical setting. This is especially crucial in a data-driven medical landscape where patients are expected to provide extra medical information, collected for example via wearable devices, so that it can be incorporated into EMR data. Finally, Bajaj et al.'s [15] article on smartwatch sensing data provides considerable impetus for future research, as the topic of IoT becomes increasingly relevant. Interest in the data from such devices and how they might be used will undoubtedly increase as more users adopt these technologies, resulting in enormous untapped data repositories. The development of smartwatches from individual tools to part of a wider EMR hub will raise several ethical concerns that must be investigated and addressed in order to protect its tremendous potential advantages.

Multimodal medical data fusion, achievable with EMR, has been developed with the aim of revolutionizing preventive, personalized, and participatory techniques to enhance health outcomes, identify risk factors, offer customized interventions, and empower patients throughout their healthcare experiences [1]. However, there remain numerous challenges that require exploration from various disciplinary viewpoints.

Conflicts of Interest: The authors declare no conflict of interest.

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