"BRIDGING" OF INFORMATION TECHNOLOGY AND PUBLIC HEALTH

Abstract

Information technology (IT) plays a pivotal role in transforming public health practices and outcomes worldwide. Through the utilization of various digital tools and platforms, IT enables efficient collection, analysis, and dissemination of health data, facilitating early detection of outbreaks, monitoring of diseases, and formulation of effective interventions. Additionally, IT enhances communication and collaboration among healthcare professionals, policymakers, and the public, fostering a more coordinated response to health challenges.

One significant way IT contributes to public health is through electronic health records (EHRs), which allows securely storing and accessing patient information. This not only streamlines patient care but also supports population health management by identifying trends and disparities in health outcomes.

Furthermore, IT empowers public health surveillance systems by integrating data from various sources, such as social media, wearable devices, and environmental sensors, to detect and respond to health threats in real-time. The proactive approach can help implement targeted interventions and mitigate the spread of infectious diseases.

However, challenges such as digital illiteracy, interoperability issues, and digital divides must bead dressed to fully harness the potential of IT in public health. By investing in innovative IT solution, technology can be leveraged to advance public health goals.

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I. INTRODUCTION

COVID 19 or SARS-CoV-2 has ravaged populations and countries. Developing countries like India have witnessed collapse of healthcare infrastructure and resources. There is no denying of the fact that the way health is managed today is unsustainable. The affordability of end users is way less than the costs.[1] "These instances of outbreaks have demonstrated that lethal pathogens know no boundaries. The outbreaks of Zika, Ebola, SARS and the rampant COVID 19, have exposed the vulnerability and gaps in health care systems. "The healthcare systems are unequipped and compromised in terms of preparedness for a crisis, allocation of resources, response capacity and readiness for these extraordinary times".[2] The hospital beds, medicines and availability of life saving resources has been much debated politically. Even more, elective treatments were deferred either to meet the requirements for Covid patients or by the people themselves. This is increasing the burden of undiagnosed and unattended chronic diseases in community.

Digital technology has largely been restricted to data management in healthcare. It can help make healthcare more sustainable and affordable. Technological advancements can be better used specially in balancing the need-delivery equation across the globe. The significance of it gets exemplified in management of pandemics like Ebola, SARS. Healthcare Information Technology (HIT) may be described as the utilization of information processing, encompassing both computer hardware and software, focuses on managing the storage, retrieval, sharing, and utilization of healthcare information, data, and knowledge to facilitate communication and decision-making.[3] Health Information Technology (Health IT) is a comprehensive term referring to the technology and framework employed for recording, analyzing, and disseminating patient health data. Diverse technologies encompass health record systems, spanning personal, paper, and electronic formats, personal health tools such as smart devices and apps, and communities designed for sharing and discussing information.

The evolution of healthcare hinges on a collaborative partnership between technology and healthcare professionals, necessitating the active embrace of emerging healthcare technologies by practitioners to remain pertinent in the years ahead. However**,** as exemplified by the COVID 19 outbreak, there is a necessity for impactful calls to action, involving the enhancement of electronic monitoring systems for better readiness and response to similar incidents in the future. Additionally, there is a need for improved coordination and the sharing of reliable Public Health Intelligence. Public health and healthcare systems need to adopt and accept information technology (IT) as a tool for improvisation of health care services. A "PIE" of Promotion, Information, Engagement is the necessity at present. The question that needs to be addressed is "Can IT (Information Technology) be the "IT" Factor in transforming healthcare and empowering Public Health?" This review is intended to summarize the available scientific evidence on the applicability and impact of health information technologies in improving healthcare delivery and system.

II. IDENTIFIED GAPS

Upon review, it was certain that adoption of IT was slower in comparison to banking and aviation sector. Currently information technology in health sector is mostly being used for health billing, organisational management, regulatory reporting. The gaps can be grouped as: chaotic data, inadequately handled information, absence of reliable knowledge, and insufficient Public Health Intelligence..

III. DISORGANISED DATA

The concept of "Big data" raises significant questions. Enormous financial investments have been made in extensive initiatives to capture substantial data, often within isolated projects. The National Institutes of Health's (NIH) All of Us initiative is dedicated to gathering data from one million or more patients, including Electronic Health Records, genomic information, imaging, socio-behavioural data, and environmental data in the coming years. The Institute of Medicine supports the Continuously Learning Healthcare System, aiming to bridge the gap between scientific discovery, patient and clinician engagement, and clinical practice. Despite these efforts, the potential of big data in healthcare has not been fully realized, as the mere availability of data does not automatically translate into knowledge or improved clinical practices.

Challenges such as the complexity and structure variations in data, lack of computational technologies, and concerns about sharing private patient data contribute to the limited availability of large clinical data sets for researchers. While big data systems have demonstrated potential for transformative changes in care delivery and treatment discovery, including cost reduction, decreased hospital readmissions, targeted interventions for emergency department (ED) visits, patient triage in the ED, and prevention of adverse drug effects, realizing these promises requires the healthcare community to address core technological and organizational challenges. Despite initial promises, the application of big data in healthcare faces unique challenges compared to other disciplines, with additional constraints related to data quality, privacy, and regulatory policies.

IV. POORLY MANAGED INFORMATION

Enhancing the management of healthcare technology is both a cost-saving and life-saving measure. The World Health Organization strongly advocates for effective management of healthcare technology and issued a series of reports in 2011 highlighting the problems associated with poorly managed assets. These issues include the underutilization of medical equipment, insufficient standardization, a shortage of trained professionals for operation, added maintenance costs, and unforeseen additional expenses.

The crucial role of medical technology in supporting healthcare delivery cannot be overstated. Technology is pivotal to healthcare, and if not managed efficiently, it hinders effective healthcare management.

1. **Lack of Trustworthy Knowledge:** In reality, it places verified scientific opinions in opposition to information from critics, advocates, and conspiracy theorists, eroding the crucial trust between public health officials and the general public. Instances of anti-vaccination messages exemplify the difficulties posed by this emerging medium. The question arises when a mainstream news source like CNN is considered more trustworthy during a public health crisis than the Centers for Disease Control and Prevention (CDC). This situation highlights the excessive dependence on less scrutinized sources of information, such as the Internet, social media, talk radio, and cable news outlets.

2. **Inadequate Public Health Intelligence:** The global landscape is evolving, and the expectations from stakeholders for comprehensive intelligence now encompass individual health consumers. In light of this, that overseeing public health system information must

transition from conducting surveillance on people to conducting surveillance for people. The proposal is for a consumer-centric approach to public health intelligence, advocating for the establishment of a national center dedicated to guiding the gathering and synthesis of public health intelligence.[9]

Instances of public health crises can reveal shortcomings in (1) procedures (such as events, task execution, or actions), (2) policies (including absent, outdated, poorly communicated, or inconsistently implemented guidelines), and (3) responsiveness (involving poorly coordinated or deployed resources, insufficient, and ineffective strategic responses, and so forth). The consistent factor contributing to failures in these public health crises is a lack of actionable intelligence that informs processes, policies, and responsiveness. Once actionable intelligence has been properly collected and shared, sufficient resources must be mobilized to execute containment and preventive measures.[9]

According to Davenport and Prusak, Information imbued with significance constitutes knowledge. Knowledge is obtained by scrutinizing information to extract additional meaning, importance, and relevance to assist in our decision-making and actions. Through knowledge, patterns become discernible, cycles can be identified, and the foundation for predictability starts to emerge. Any breakdown in the progression from data to information, information to knowledge, and knowledge to decision and action can be harmful, leading to costly errors in both individual and collective judgment and strategy.

The Ebola crisis serves as an unfortunate instance where chaotic data, inadequately handled information, and a lack of reliable knowledge led to insufficient public health intelligence for all involved parties.[9]

V. POST GAP IDENTIFICATION

The domains of public health and population health informatics are expanding, with significant advancements concentrated on surveillance, workforce enhancement, and establishing connections to or delivering clinical services.
Upon review, the major trends that resonate with are:

1. **Surveillance Practice:** Recent publications have also emphasized the utilization of novel data streams from clinical health systems as an alternative to survey data for monitoring chronic diseases in the community. Use of Real Time Surveillance to

   - Monitor environmental triggers
   - Implement prevention programs and strategies
   - Formulate epidemiological profiles
   - Monitor emerging disease threats

2. Surveillance Techniques employing spatial analytics to observe and comprehend the dissemination of diseases and manage responses to outbreaks. eg GIS

3. *m-Health* The CDC has created interactive visualization platforms to assist in the prevention of injuries.

5. **Population Health Informatics:** Differences in data standards, protocols for data collection, and tools or devices used for measurement have evolved over time. Challenges in informatics arise in maintaining a resilient data system at the population level.

VI. DISCUSSION

For significant advancements in healthcare quality in the next decade, the redesign of the healthcare system must prominently feature Information Technology. Public health informatics is commonly defined as the systematic application of information, computer science, and technology to public health practice, research, and learning, officially included in MeSH in 2003. Numerous lessons are available for learning and implementing strategies to bridge the gap in healthcare services.

1. **Lessons Learnt 1:** A model of public health intelligence that prioritizes consumers and the establishment of a national center to oversee the gathering and synthesis of public health intelligence.

2. **Lessons Learnt 2**

   - **Workforce Building**

     - Educational and training institutions should collaborate to create specialized informatics competencies (ongoing education) for existing professionals to align with technological advancements.
     - Healthcare professionals consider themselves technologically challenged. Hence, the informatics competencies can be perceived to be the need of hour to prepare public health professionals better for future.

3. **Lesson Learnt 3:** Are we seeing a crossroads in how future health care professionals should be taught?

   Is it necessary for upcoming healthcare professionals to possess a fundamental comprehension of data analytics or health information technology (HIT)?

   Digital health technologies accessible directly to patients are advancing more rapidly than their integration into clinical practice. The question arises: How can healthcare professionals stay proficient in the face of constantly evolving technological developments? Additionally, how should future practitioners handle AI-generated suggestions or analyses for their patients? Could the solution involve revising curricula to incorporate Public Health Informatics (PHI) and Big Data management?

VII. CHALLENGES

1. **Implementing Interoperable and Reusable Systems:** The expenses related to obtaining hardware and software are no longer a concern. The challenge lies in standardizing systems and data. Standardization has the potential to decrease costs and streamline the gathering of meaningful data.

2. Another difficulty involves the sharing of data and information across organizational and jurisdictional borders.

3. Ethical and procedural concerns related to the management and protection of public health data.

As promising as it looks, challenges too are many. Main challenge remains silos of isolated electronic health data. While the potential is significant, there are numerous challenges to address. The primary obstacle is the existence of isolated electronic health data silos. It is undeniable that the most effective enhancement of community health in the current information age and beyond necessitates a robust Public Health Informatics (PHI) infrastructure. Meeting this requirement entails substantial investment in workforce development and capacity-building through education and training in PHI. The next phase in public health involves the restructuring of public health courses, learning competencies, skills, and practices.

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