Editorial

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Scalable and Interoperable Platform for Precision Medicine: Cloud-based Hospital Information Systems

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Hospitals' clinical, administrative, and financial operations are managed via hospital information systems (HISs), which are sophisticated, integrated information platforms [1]. The effectiveness of a system and the quality of its information are associated with user satisfaction [2,3]. Therefore, many hospitals are investing significant financial resources into building next-generation HISs in order to create and utilize high-quality biomedical data. HISs have also been recently acknowledged as a vital component in the digitalization and intellectualization of hospitals. However, because of the high level of difficulty in domain expertise, HIS renewal projects are large-scale IT initiatives that frequently fail [4].

Korea University Medical Center (KUMC) began developing "P-HIS 1.0," a cloud-based hospital information system, in 2017, and became the first institution in Korea to operate an HIS using cloud infrastructure on March 29, 2021. Since then, it has obtained approximately 18 months of experience in operating the system. This period was not just a time interval, but a community-wide effort to provide future medical care and a challenge to adapt to the changing environment of the biomedical industry. The leaders who introduced these changes emphasized the scalability and interoperability of the HIS as a platform for the future medical industry. The data flowing through the system are extracted as standardized terms, transformed into common modules, and loaded into an integrated database. The biomedical data are used for clinical services and for research and development to achieve precision medicine. To effectively regulate incursions from external networks to internal networks, the cloud architecture incorporated an intrusion prevention system (IPS). The security capacity was further enhanced by deploying several anti-distributed denial-of-service (DDoS), IPS, and firewall security devices. In addition to general user access, a virtual personal network (VPN) system with enhanced security is installed for those in charge and users who need access to systems and servers from outside, and all information is encrypted through externally enhanced security access to maintain operational continuity. In other words, general users and hospital personnel use the network separately.

Scalability can be defined as the capacity of an HIS to match the increasing number of environmental requirements comprehensively and allow the integration of systemic growth [5]. Interoperability implies the capacity of different software applications and information technology systems to communicate and share data consistently, effectively, and accurately, as well as to properly use the shared data [6]. The utilization of a tremendous amount of biomedical data is only possible on a platform equipped with scalability and interoperability. The construction and operation of the platform are close to the realm of art based on the essential characteristics of its data, medical services, and technical design. KUMC's information technology leaders understand

this vital significance well and are building and growing the foundation of P-HIS with an organized approach.

The core backbone for the expanded utilization of HIS includes standardized language. A terminological consensus should be advanced scholarly and verified globally. The project team that developed the P-HIS established a standardized terminology based on SNOMED-CT with a research team from Samsung Medical Center (SMC). The officers and researchers of KUMC and SMC have been organically collaborating to maintain high-quality terminology and biomedical data. The team standardized 89,004 terms and codes, including 39,495 for clinical diagnosis, 9,485 for surgery, 3,325 for nursing, and 36,699 for residential addresses. Based on the emergent properties of highly connected networks, registering more hospitals in the P-HIS will enhance the quality of the biomedical database. The goals are for the best healthcare services to be shared across regions in a way that is more efficient compared to existing infrastructure and more precise on an individual level.

Security issues must be mentioned for a system that deals with sensitive information. Many institutions are paying substantial costs in return for security failure. Even if one does not emphasize that legacy systems on local servers are not perfect for security, it would be counterproductive to argue that the use of cloud servers makes systems vulnerable in terms of privacy protection. In addition, hospital managers should accurately identify whether the HIS, the heart of hospital operations, is simply a system for protecting information or a support system that enables on-site clinics to function continuously. It should be kept in mind that the backup protection method of the cloud system for preparing for a disaster such as ransomware-induced inaccessibility may prevent interruptions in the operation of on-site clinics.

Through the actual use of the HIS running on cloud infrastructure for 18 months, we discovered potential ways of fixing the issues described above. This platform will address the issue of the concentration of large hospitals in metropolitan areas because small and medium-sized hospitals can easily use medical software and data that are comparable to those of large hospitals, and the quality of healthcare will be improved by lowering medical costs through patient risk group management and preventive treatment. This will soon present a chance to raise the satisfaction levels of patients, their families, and medical staff.

Conflict of Interest

No potential conflict of interest relevant to this article was declared.

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References

1. Ahmadi H, Nilashi M, Shahmoradi L, Ibrahim O. Hospital Information System adoption: expert perspectives on an adoption framework for Malaysian public hospitals. Comput Human Behav 2017;67:161-89. https://doi.org/10.1016/j.chb.2016.10.023
2. Javed SA, Ilyas F. Service quality and satisfaction in healthcare sector of Pakistan: the patients' expectations. Int J Health Care Qual Assur 2018;31(6):489-501. https://doi.org/10.1108/ijhcqa-08-2016-0110
3. Asagbra OE, Burke D, Liang H. The association between patient engagement HIT functionalities and quality of care: does more mean better? Int J Med Inform 2019;130:103893. https://doi.org/10.1016/j.ijmedinf.2019.05.029
4. Sligo J, Gauld R, Roberts V, Villa L. A literature review for large-scale health information system project planning, implementation and evaluation. Int J Med Inform 2017;97:86-97. https://doi.org/10.1016/j.ijmedinf.2016.09.007
5. Belgaum MR, Alansari Z, Musa S, Alam MM, Mazliham MS. Role of artificial intelligence in cloud computing, IoT and SDN: reliability and scalability issues. Int J Electr Comput Eng 2021;11(5):4458-70. https://doi.org/10.11591/ijece.v11i5.pp4458-4470
6. Heubusch K. Interoperability: what it means, why it matters. J AHIMA 2006;77(1):26-30.

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