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# The Role of Health Informatics in Bridging Dental, Nursing, Radiology, and Public Health Fields for Improved Patient Care

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## ABSTRACT

Over the course of the past several years, the discipline of health informatics has experienced a significant expansion. The entirety of the technology, software, procedures, and methods that are required to gather, store, retrieve, and analyze medical and health records are included in this. By utilizing health information technology (HIT), healthcare informatics makes it possible for a wide range of stakeholders to have electronic access to their medical records. These stakeholders include patients, nurses, hospital managers, physicians, insurance companies, and also include other individuals. In order to collect, manage, analyze, and communicate data, health informatics merges nursing science with data science and analytical disciplines. This brings together specialists and makes health information clear and accessible to the general public.

**KEYWORDS:** Radiology; Public Health ; Improved Patient Care; Dental; informatics.

## 1. Introduction

The field of health informatics is one that is experiencing tremendous growth within the healthcare sector. Everything from the tools and protocols to the hardware and software required to gather, store, retrieve, and use health records and related data falls under this category. Through healthcare informatics and HIT, many parties, including patients, nurses, hospital administrators, physicians, and insurance companies, have electronic access to medical records (1). Health informatics brings together analytical fields, data science, and nursing science to gather, process, interpret, and convey data. This facilitates communication amongst specialists and

improves the accessibility and comprehension of health records.

Numerous sectors, including healthcare, have witnessed fast technological advancement. Technology has revolutionized healthcare, allowing for more efficient and better results for patients. Nanorobots that administer drugs intravenously and robotic arms used in surgery are two examples. Medical administration is one area that AI is finding value in (2,3). It makes sure that healthcare staff focus on the most critical tasks first, so that doctors, assistants, and nurses can focus on other things that really matter. Transcribing voice notes into text might be useful for healthcare administration. They are useful for automating non-patient care activities such taking notes in charts, making medication recommendations, and ordering tests (4-6)

A digital profile is maintained for every person, which includes information on their background, health history, allergies, lab results, and more. Both public and private sector vendors have access to the records because they are transmitted over encrypted information networks. Since each record consists of a single editable file, doctors can make changes over time without having to fill out more paperwork or worry about data replication (7). In this review, we will look at how the fields of dentistry, nursing, radiology, and public health might work together to improve patient care using health informatics.

Definition of Health Informatics

Health informatics is a specialist field concerned with the administration of patient data via clinical databases and health information clinical decision support systems. This specialized topic includes a variety of subfields, such as nursing informatics, clinical informatics, consumer health informatics, and public health informatics. In healthcare, the term "health informatics" refers to information technology that makes it easier to organize and analyze health data in order to enhance healthcare outcomes (8, 9). Artificial Intelligence (AI), Internet of Medical Things (IoMT), 3D bioprinting, Telemedicine, Cloud computing, Big Data, Nanomedicine, mHealth, IT Systems, Robotics, Augmented Reality (AR), Virtual Reality (VR), and Wearable Technology are among the most important health informatics technologies. Healthcare informatics solutions include the resources, tools, and procedures used in medical practice. There are several equipment available, including computers, communication networks, and medical technology. Patients, nurses, hospital managers, insurance companies, and health information technicians can all access their medical records electronically(10). People in the wide subject of health informatics work together to uncover the best ways to use biomedical data, information, and knowledge for scientific research, problem solving, and decision making, with the ultimate goal of improving people's health. To put it another way, it is the study of information, defined as meaningful data. The field of clinical informatics is the most advantageous for healthcare workers. Clinical informatics is a discipline that integrates medical, information technology, and behavioral management principles. Clinical informatics is neither a purely academic or technological discipline. Instead, it is a helpful field that raises healthcare quality, improves patient outcomes, and promotes medical research. Understanding that the success of health care evolution is defined not by how well the technology performs, but by how well it fits into existing cultures, regulatory frameworks, and institutional

procedures is crucial to meeting these goals(7).

Importance of Health Informatics in bridging Dental, Nursing, Radiology, and Public Health fields

Informatics amalgamates information technology with healthcare to provide patient-centered and efficient medical services. The primary objective of health informatics is to utilize data management and technology to improve healthcare support. Enhancing patient care, optimizing healthcare processes, and improving health outcomes requires the effective organization, analysis, and management of health information. It entails utilizing data management and technology to enhance healthcare service delivery and efficiency. The healthcare sector employs EHRs to systematically organize, store, and manage patient health information, hence improving the patient experience. The significance of healthcare systems and its personnel has escalated in the contemporary big data landscape. Utilizing these technologies enables healthcare practitioners to get patient data more rapidly, resulting in expedited decisions and outcomes for physicians and nurses (11-13).

The Role of Health Informatics in Dental Field

Progress in dentistry is significantly influenced by advancements in information technology. Coined by Zimmerman et al. in 1968, "dental informatics" denotes the utilization of computer and information sciences in dentistry to enhance clinical practice, research, education, and management(15,16).

Advancements in dental informatics includes applications such as diagnostic equipment, 2D or 3D digital acquisition, computer-assisted design and manufacture, and computer-assisted surgery(17,18). The advancements were analyzed in a systematic study published in 2017 (19).

Other research have looked into the implementation of computerized health information systems (HISs) in dentistry. Health information systems collect, store, process, and communicate the data required to organize and implement care (17,20). The electronic dental record (EDR) is a well-known HIS component that practitioners utilize to track patients' medical and dental histories, as well as thorough consultation information. Given the clear benefits of EDRs, particularly at large clinical institutions, the total adoption rate in the United States climbed from 52% in 2012 (21) to 77% in 2017 (22). Indeed, EDRs are more than just a digital version of paper records. They are ideally interoperable with other HIS components, allowing for data capture control, data storage and access, administrative and management assistance, and public health policy guidance. They can also be employed in research and education (23, 26).

Scalable, shareable, and domain-specific standardized clinical coding systems are necessary for the maximum utilization of EDRs, especially in relation to data transfer, aggregation, and reuse (26).

In order to effectively use informatics in their work, public health professionals require an in-depth understanding of the subject. Biostatistics, geographic information systems (GIS), teledentistry, community health education, and other areas have all benefited from informatics in public health dentistry (27).

The practice of teledentistry is a hybrid of traditional dentistry and modern communication technology. The Westinghouse Electronics Systems Group in Baltimore, Maryland, created it in 1989(28). It's a great tool for dental consultations and treatment planning since it allows for excellent communication between remote places and dental specialists (29). Therefore, it makes dental treatment more accessible to everybody. Additionally, it benefits both communities and public health professionals due to its cost-effectiveness.[1] By doing so, it hopes to bridge the divide between urban and rural areas and make specialized healthcare more accessible in the world's most inaccessible places. Both self-study and interactive video-conferencing have found uses in the dental field. The user is required to store the web-based self-instruction system in the system prior to using it. The materials can be accessed multiple times, and users can learn at their own pace (30)

Interactive video conferencing is conducted by plain old telephone service, satellite, integrated services digital network, Internet, or Intranet. It comprises two systems: a live interactive video conference and supplementary information. The live video conference necessitates an appropriate camera setup that conveys information from the patients. The supplementary information maintains a record of patients' data, including medical history and radiography. This information may be transmitted during the video conference or subsequently. The user receives immediate feedback (30).

In India, the advancement of telemedicine has significantly enhanced healthcare accessibility for rural populations. Given that a majority of the population in India resides in rural areas, teledentistry can facilitate the fulfillment of the demand-and-supply chain in these places (30)

The Role of Health Informatics in nursing

Nursing informatics (NI) is a mechanism for delivering safe, high-quality patient care. It enables the firm to transform data into meaningful knowledge. This thus enhances the efficiency and efficacy of healthcare services, as evidenced by the organization's overall outcomes (31). Nurses can leverage technology to locate, comprehend, organize, and assess information from many sources to enhance decision-making on patient care and address issues. Nursing informatics can enhance patient care(32). However, nursing informatics appears to be failing to effect the anticipated improvements in nursing services. This may be due to nurses lacking the requisite skills or insufficient knowledge of information technology. Nurses require enhanced knowledge of health information technology and administration, as well as further training in informatics.Competence necessitates the integration of knowledge, skills, and abilities, including values, attitudes, critical thinking, and clinical decision-making capabilities. Every nurse must possess extensive knowledge of informatics to deliver safe, high-quality care. Alongside advocating for safe and high-quality nursing practice, it is essential to ensure ethical conduct, facilitate the advancement of the nursing profession, enhance nursing education, and recognize personal limitations (33).

"Nursing informatics competencies" (NIC) stands for "an acceptable level of knowledge, skills, and ability to do specific informatics tasks." (33). Also, nurses need to have the right (NIC) knowledge, skills, and attitudes to move forward in their

schooling and be ready for their jobs (34). The way workers feel about their jobs is likely to have a big impact on how well information technology is put in place. When employees have bad moods, it's harder for them to accept and use technology well. Adoption of a digital system is mostly based on how nurses feel about using it (35). How people feel about computers is going to have a direct effect on how well they are used in nursing. So, it's very important to know how nurses feel about computers. For computers to be used in healthcare, there needs to be objective, similar data on how nurses feel about them and what makes them feel that way. How nurses do their jobs has also changed a lot because of the rise of hospital computer systems (36). Attitudes are how nurses feel about doing something, whether they like it or not. They are very important to their job success(37)

The Role of Health Informatics in Radiology Field

With the number and complexity of imaging investigations on the rise, radiologists are under increasing pressure to improve medical imaging by providing interpretations that are more informed, accurate, practical, and efficient, and by communicating these findings in the most effective way possible. Improved, quicker, and less expensive radiological services are required from both the department and the radiologist. Radiologists rely on medical imaging informatics (MII) for a lot of the tasks that make this possible. MII stands for medical imaging information technology, which includes creating, implementing, and evaluating IT systems for use in clinical settings. It encompasses the points of contact between people and IT.(38) When it comes to radiology, MII is already happening on a fundamental level from the time a clinician thinks about ordering an imaging scan all the way through to when the patient's treatment is planned using the pictures and interpretation. MII isn't just for the classroom. Its fundamentals should be understood by all radiologists. While knowledge of MII's products, procedures, and advantages, as well as how to integrate and execute these systems at the visionary and managerial levels, is not required of radiologists, it will improve their lives (39). The most obvious components of MII are PACS and RIS, or radiology information systems, although that is far from everything. Throughout the development of PACS and RIS, radiologists played an integral role (40). The risk of radiologists losing interest in informatics grows as basic PACS/RIS become standard in radiological procedures. A member of the IT department, the radiology administrator, or a CIIP (certified imaging informatics professional) may be assigned this task. Many radiologists feel pressured to limit their practice to imaging study interpretation in order to keep up with patient loads and pay levels (41).

The Role of Health Informatics in Public Health Field

In the field of public health, the term "public health informatics" (PHI) refers to the systematic application of information, computer science, and technology in various aspects of public health, such as surveillance, prevention, preparedness, and health promotion of the entire population, which will ultimately promote the health of individuals (42) by preventing diseases and injuries by changing the conditions that increase the population's risk (43). These are the principal applications for personal health information (PHI).Informatics is primarily employed in the collection, analysis, and implementation of public health-related actions. Public health

informatics (PHI) differs from other subfields of informatics in that it focuses on sickness prevention in the general public, achieves its objectives through the use of a variety of therapies, and functions within governmental contexts. Personal Health Information (PHI) encompasses the conceptualization, design, development, deployment, refinement, maintenance, and assessment of public health-related communication, surveillance, and information systems (45).When it comes to disease surveillance, epidemics, natural catastrophes, and bioterrorism, PHI could be one of the most valuable systems. It is possible that the use of computerized global surveillance and data collection systems, such as health information exchange (HIE) and health information organization (HIO), will help with population monitoring.

Surveillance and outbreak management

Public health surveillance include collecting, analyzing, and interpreting data that is crucial for preventing accidents and diseases. The timely and comprehensive reception, appraisal, and analysis of sickness case reports can aid in the early detection of epidemics using available data. A thorough surveillance strategy allows for timely investigation and identifies data requirements for efficiently managing public health responses to outbreaks or terrorist incidents(46). Globally, governments are improving their public health disease monitoring systems by harnessing modern information technology to deliver an integrated, efficient, and reliable sickness reporting system. A surveillance system, similar to a syndromic surveillance system, can collect symptoms and clinical characteristics of an unknown disease or health event in near real time, potentially signaling the early stages of an outbreak or bioterrorism occurrence. Health Information Organizations (HIOs) can make a substantial contribution to Public Health Information (PHI) by providing easily accessible patient data during natural catastrophes when paper records may be degraded or unavailable. Recent advances in public health informatics, such as geographic information systems (GIS), use digitized maps derived from satellites or aerial photography to give large datasets(47).

This allows for the combination of multiple information, such as geographic location, trends, circumstances, and spatial patterns. Surveillance systems were mostly paper reports provided by hospitals, physicians, and clinics to local health authorities. In the United States, for example, these institutions sent their reports to the state level and then to the Centers for Disease Control and Prevention (CDC) via email or fax. The reports would eventually reach the World Health Organization (WHO). Paper-based surveillance systems necessitate extensive human data entry and are sometimes deemed fragmented since data from different areas of a research are not collected or made available. These papers are examined separately as cases, clusters, or trends, which takes time and is constrained by incomplete data collection and analytical capabilities. Thus, they are unable to provide timely information for public health action. Another disadvantage of paper-based surveillance systems is the susceptibility of the paper records, particularly in the event of natural disasters. Furthermore, these systems do not contribute to the globalization of trends or data(48). Currently, there is a constant shift toward electronic surveillance systems that provide more rapid data and information about a disease or scenario that could lead to an outbreak. This shift has been assisted by the modern Public Health Information Network (PHIN), which allows for effective information access and

exchange among public health organizations at all levels. The PHIN is standardized, enabling for easy interoperability between multiple levels of public health bodies. To put it simply, information in PHIN is shared across the network, may be readily saved and accessed, and can be traced back to its sources. Data provided via the network can be further examined to offer information that assists public health experts and supports their decisions. Unlike paper-based surveillance systems, PHIN data is saved digitally and cannot be simply deleted. Paper-based surveillance systems were unable to generate appropriate and useful data in a timely manner due to the difficulty in accessing the data. Furthermore, paper-based systems suffer expenses in terms of paper, manpower, and storage space (49). Paper-based data cannot be easily shared with other systems and is more vulnerable to privacy and confidentiality violations. Electronic health records improve early detection of communicable illness cases, clusters, epidemics, and trends, as well as exposure to environmental hazards. These qualities boost the likelihood of detecting disease surveillance, epidemics, natural disasters, and bioterrorism incidents. The utilization of systems, such as real-time epidemic detection systems, enables the real-time, daily detection, analysis, and dissemination of outbreak information to the targeted populations and agencies. Real-world examples demonstrated a clear distinction between the paper-based monitoring system and PHIN. The examples demonstrated that collecting information for disease surveillance using smartphone devices was faster and less expensive than conducting paper-based surveys, which were previously thought to be the typical method of collecting illness information(50). In Kenya, a surveillance study of influenza and respiratory disorders was carried out utilizing paper or smartphone surveys. This survey contained 2038 questionnaires, with 1019 on paper and 1019 on smartphones. Researchers in this study discovered that 3% of smartphone questions were incomplete, compared to 5% of paper-based questionnaires. Furthermore, they discovered that 7 of the paper-based questions were replicated, whereas no smartphone questionnaires were repeated (51).

## 2. Conclusion

Great reliance is based on technologies such as AI, telemedicine, and cloud computing for better administrative and clinical efficiencies in health informatics.

it has many Interdisciplinary Responsibilities such as Nursing science, data science, and analytics that merge together to provide accessible health records and improvement in quality for healthcare. Since Knowledge-based applications facilitate diagnosis and teledentistry consultations.

Moreover, nursing informatics enables safe and efficient care. This branch, however, faces lots of challenges because not all the nurses are at the level of IT competencies. In addition to the Medical Imaging Informatics which improves the accuracy and accessibility of imaging data. This becomes very important as the demand for imaging continues to grow.

Public health: Public Health Informatics applies electronic systems that enhance disease surveillance and the management of outbreaks.

## References

Jen MY, Mechanic OJ, Teoli D. Informatics. [Updated 2023 Sep 4]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK470564/

Carney, T. J., & Kong, A. Y. (2017). Leveraging health informatics to foster a smart systems response to health disparities and health equity challenges. Journal of biomedical informatics, 68, 184-189.

Sadineni, P. K. (2020, October). Developing a model to enhance the quality of health informatics using big data. In 2020 fourth international conference on I-SMAC (IoT in social, mobile, analytics and cloud)(I-SMAC) (pp. 1267-1272).

Gibbs, D., Gibbs, K., & Hewitt, B. (2023). Health information management and physiotherapy faculty collaboration to discover the use of health informatics hiding in plain sight in an entry-level DPT program. Health Information Management Journal, 18333583231194750.

Wickramasinghe, N. (2019). Essential considerations for successful consumer health informatics solutions. Yearbook of medical informatics, 28(01), 158-164.

Bath, P. A. (2008). Health informatics: current issues and challenges. Journal of information science, 34(4), 501-518.

Javaid, M., Haleem, A., & Singh, R. P. (2024). Health informatics to enhance the healthcare industry's culture: An extensive analysis of its features, contributions, applications and limitations. Informatics and Health.

O'Connor, S., & LaRue, E. (2021). Integrating informatics into undergraduate nursing education: A case study using a spiral learning approach. Nurse Education in Practice, 50, 102934.

Ryan, A., & Eklund, P. (2008). A framework for semantic interoperability in healthcare: a service oriented architecture based on health informatics standards. Studies in health technology and informatics, 136, 759.

Aarts, J., Peel, V., & Wright, G. (1998). Organizational issues in health informatics: a model approach. International journal of medical informatics, 52(1-3), 235-242.

Luna, D., Almerares, A., Mayan, J. C., de Quirós, F. G. B., & Otero, C. (2014). Health informatics in developing countries: going beyond pilot practices to sustainable implementations: a review of the current challenges. Healthcare informatics research, 20(1), 3-10.

Achampong, E. K. (2012). The state of information and communication technology and health informatics in Ghana. Online journal of public health informatics, 4(2).

Khairat, S., Sandefer, R., Marc, D., & Pyles, L. (2016). A review of biomedical and health informatics education: a workforce training framework. J Hosp Adm, 5(05), 10-20.

Zimmerman JL, Ball MJ, Petroski SP. Computers in dentistry. Dent Clin North Am. 1986;30(4):739–43.

Lam R, Kruger E, Tennant M. How a modified approach to dental coding can benefit personal and professional development with improved clinical outcomes. J Evid Based Dent Pract. 2014;14(4):174–82.

Chhabra KG, Mulla SH, Deolia SG, Chhabra C, Singh J, Marwaha BS. Dental informatics in India: time to embrace the change. J Clin Diagn Res. 2016;10(3):ZE12–5.

Islam MM, Poly TN, Li YJ. Recent advancement of clinical information systems: opportunities and challenges. Yearb Med Inform. 2018;27(1):83–90.

Schleyer TK. Dental informatics: a work in progress. Adv Dent Res. 2003;17:9–15.

Jokstad A. Computer-assisted technologies used in oral rehabilitation and the clinical documentation of alleged advantages - a systematic review. J Oral Rehabil. 2017;44(4):261–90.

Masic F. Information systems in dentistry. Acta Inform Med. 2012;20(1):47–55.
Acharya A, Schroeder D, Schwei K, Chyou PH. Update on electronic dental record and clinical computing adoption among dental practices in the United States. Clin Med Res. 2017;15(3–4):59–74.
Chauhan Z, Samarah M, Unertl KM, Jones MW. Adoption of electronic dental records: examining the influence of practice characteristics on adoption in one state. Appl Clin Inform. 2018;9(3):635–45.
Tokede O, Ramoni RB, Patton M, Da Silva JD, Kalenderian E. Clinical documentation of dental care in an era of electronic health record use. J Evid Based Dent Pract. 2016;16(3):154–60.
Sidek YH, Martins JT. Perceived critical success factors of electronic health record system implementation in a dental clinic context: An organisational management perspective. Int J Med Inform. 2017;107:88–100.
Wongsapai M, Suebnukarn S, Rajchagool S, Beach D, Kawaguchi S. Health-oriented electronic oral health record: development and evaluation. Health Inform J. 2014;20(2):104–17.
Atkinson JC, Zeller GG, Shah C. Electronic patient records for dental school clinics: more than paperless systems. J Dent Educ. 2002;66(5):634–42.
Mohapatra U, Nagarajappa R, Satyarup D, Panda S. Informatics in dental public health – A review. J Global Oral Health 2023;6:123-6
Tiwari T, Diep V, Tranby E, Thakkar-Samtani M, Frantsve-Hawley J. Dentist perceptions about the value of teledentistry. BMC Oral Health. 2022;22:176.
Goswami M, Nangia T, Saxena A, Chawla S, Mushtaq A, Singh SR, et al. Practical applicability of teledentistry in pediatric patients amidst pandemic: A narrative review. Front Dent Med. 2021;2:748089.
Chen JW, Hob-Dell MH, Dunn K, Johnson KA, Zhang J. Teledentistry and its use in dental education. J Am Dent Assoc. 2003;134:342-6.
Al-Balawi, Z., Taie S., & Alsesei N. (2020): Nursing Informatics Competency Based Assessment for Nursing Personnel in Primary Healthcare Centers in Tabuk, King Abdul-Aziz University.
Singh, F., & Masango T. (2020): "Information technology in nursing education: perspectives of student nurses ".The Open Nursing Journal 14.)1
Kinnunen, U.-M., Kuusisto, A., Ahonen, O. Koponen, S. Kaihlanen, A. Hassinen T. & Vehko T. (2022): "Nurses' informatics competency assessment of health information system usage: a cross-sectional survey." Research Square
Mohamed, L., & Abouzaied M. (2021): "Selfassessment of nursing informatics competencies and attitudes among baccalaureate-nursing students." Egyptian Nursing Journal 18(1): 28.
Koltsida, V., & Jonasson L.-L. (2021): "Registered nurses' experiences of information technology use in home health care-from a sustainable development perspective." BMC nursing 20(1): 1-8.
Joseph, M., Inayat, A., Hussain M., & Afzal M. (2019): "Factors influencing nurses' attitudes towards information technology in nursing practice." European Academic Research 7(3): 1751- 1769.
Terkes, N., Celik F., & Bektas H. (2019): "Determination of nursing students' attitudes towards the use of technology." Japan Journal of Nursing Science 16(1): 17-24
Andriole KP: Introduction to medical imaging informatics. Cancer Informatics: (in press), 2007
Sinha U, Bui A. A review of medical informatics. Ann NY Acad Sci. 2002;980:168–197. doi: 10.1111/j.1749-6632.2002.tb04896.x. [DOI]
Kulikowski C, Ammenwerth E, Bohne A, et al. Medical imaging informatics and medical informatics: opportunities and constraints. Findings from the IMIA yearbook of medical informatics 2002. Methods Inf Med. 2002;41(2):183–189

Geis JR. Medical imaging informatics: how it improves radiology practice today. J Digit Imaging. 2007 Jun;20(2):99-104. doi: 10.1007/s10278-007-9010-2. Epub 2007 Feb 16. PMID: 17505868; PMCID: PMC1896265.

Hoyt R., Bailey A. 6th ed. Lulu Press; Raleigh: 2014. Health informatics: practical guide for healthcare and information technology professionals.

Chen H., Hailey D., Wang N., Yu P. A review of data quality assessment methods for public health information systems. Int J Environ Res Public Health. 2014;11(5):5170–5207. doi: 10.3390/ijerph110505170.

Yasnoff W.A., O'Carroll P.W., Koo D., Linkins R.W., Kilbourne E.M. Public health informatics: improving and transforming public health in the information age. J Public Health Manag Pract. 2000;6(6):67–75. doi: 10.1097/00124784-200006060-00010.

Choi B.C.K. The past, present, and future of public health surveillance. Scientifica. 2012;2012:26. doi: 10.6064/2012/875253.

Kraft MR, Androwich I. Informatics for health professionals. 1st ed. Burlington: Jones & Bartlett Learning, 2017. Chapter 17, Using Informatics to Promote Community/Population Health; 251–263.

Wang L., Wang Y., Jin S., Wu Z., Chin D.P., Koplan J.P., Wilson M.E. Emergence and control of infectious diseases in China. Lancet. 2008;372(9649):1598–1605. doi: 10.1016/S0140-6736(08)61365-3.

Yasnoff W.A., Overhage J.M., Humphreys B.L., LaVenture M. A national agenda for public health informatics. J Am Med Inform Assoc. 2001;8(6):535–545. doi: 10.1136/jamia.2001.0080535. [DOI]

Fan S., Blair C., Brown A., Gabos S., Honish L., Hughes T. A multi-function public health surveillance system and the lessons learned in its development: the Alberta real time syndromic surveillance net. Can J Public Health. 2010 Nov–Dec;101(6):454–458. doi: 10.1007/BF03403963.

Njuguna H.N. Disease surveillance via smartphones cheaper, faster vs. paper-based surveys. Infect Dis News. 2012 April;25(4):13. [Google Scholar]

Aziz HA. A review of the role of public health informatics in healthcare. J Taibah Univ Med Sci. 2016 Oct 11;12(1):78-81. doi: 10.1016/j.jtumed.2016.08.011. PMID: 31435217; PMCID: PMC6694885.