

# Role of HIS and RIS in Improving Quality of Patient Care

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## Abstract

Healthcare providers consider patient care has a foremost aspect to achieve high degree of patient satisfaction. Use of HIS/RIS plays an active role in improving quality of patient care in a hospital these days. The benefits of HIS and RIS include reduction of errors, access of patient information in real time, improvement in clinical decision making. Hospital information system manages medical and administrative information. Radiology information system has ability to provide patient scheduling, radiology reporting, retrieving and storing radiology images from various modalities. In such a way, HIS and RIS improve quality of patient care by minimizing errors and providing information in real time.

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**Keywords** Patient care; Hospital information system; Radiology information system; Quality of patient care; Information system

## Abbreviations

Hospital information system-HIS, Radiology information system-RIS, Health layer7-HL7, Electronic medical record- EMR, Picture Archiving Communication System-PACS

## Introduction

The patient care quality is determined essentially by the quality of infrastructure, quality of data, competence of personnel and efficiency of operational system.<sup>1</sup> The quality of data in health records is one of the most important factors in improving quality of patient care.<sup>2</sup> Inadequate patient care or poor patient outcomes are due to lack of efficient and effective information.<sup>3</sup>

Hospital information technology (HIT) is a fundamental requirement in healthcare improvement and is a primary strategy for enriching its quality, improving patient management, expanding research and evolving capabilities in healthcare. Health Management Information System (HMIS) is an integrated Management Information System (MIS) that collects management information about on healthcare sector.<sup>4</sup> Patient information allows better understanding of health patterns and can be used not only for curing diseases but also for preventing them, improving patient safety and preserving quality of life i.e., it improves overall health outcome and reduces healthcare spending.<sup>5</sup> In USA, the quality of healthcare data is focused by American Health Information Management Association (AHIMA) at a more precise level. The implementation of HIS/RIS is beneficial to healthcare providers and the patients as it can provide high

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quality service. Quality of HIS indicates attributes such as timeliness and reliability provide complete and accurate information about patients for physician practice.<sup>6</sup> Technology and technological breakthroughs have improved the lives of patients in terms of diagnosis and the management of serious diseases in the 21st century.<sup>7</sup> The patient health information and education in healthcare is widely expanding with Hospital information system (HIS), Radiology Information System (RIS), Picture Archiving Communication System (PACS) and Healthcare apps.<sup>8</sup> Conveying quality healthcare to patients maintains professional pride, increases professional influence, and in turn achieves organizational goals. Monitoring patient experiences by healthcare organizations helps in evaluating and improving the quality of care. A patient experience reflects the quality and services provided by the healthcare organization. More descriptive information on quality patient care is given by quality assessments and patient ratings. HIS implementation, main objective is to identify priorities for managerial intervention based on user evaluations of the performance of the HIS attributes as well as the relative importance of these attributes to user satisfaction and productivity outcomes.<sup>9</sup>

HIS is the core informational system for patient management across the health-care system and radiology information system (RIS) is considered the core system for the electronic management of imaging departments.<sup>10</sup> Efficient information management and communication are essential for providing high-quality clinical care.<sup>11</sup> RIS/HIS reduce redundancy in test ordering because clinicians can more readily find past test results and are alerted to similar tests ordered recently. HIS maintains EMR of patient which improves patient care by recording patient's vitals and treatment. RIS is used by radiologists to edit and report the radiology diagnosis. HIS interfaces with RIS which communicates through an application layer HL7.

### **Quality of Patient Care**

The effective care coordination of a patient's health care services is a key component of high quality and efficient care. Such effective care coordination can be achieved by HIS/RIS which records patient health information. The healthcare quality across the continuum depends on the integrity, reliability, and accuracy of health information.<sup>12</sup> Collaboration among clinical services and other departments has been limited in the area of patient care.<sup>3</sup> Most of the information transfer is done through medical records which at often times are poorly documented. All kinds of health information related to healthcare are produced and managed effectively in order to evaluate the quality of health services and monitor the health status of Hospital. Providing continuous quality healthcare to patients are based on fulfilment of the two factors mentioned below:

All healthcare providers and health organizations establish effective relationship among themselves.

Producing and managing high quality health records to exchange them among constituent organizations of national health information system.

The patient's level of satisfaction with the quality of health care services can be measured through its structure, process and outcome.<sup>13</sup> Patient safety, Patient monitoring, tracking, continuity of care and patient involvement is enhanced by HIS/RIS. It is a multidisciplinary field which links information technology and healthcare to provide better quality care to the patients, ensuring patient safety and to safeguard the information generated is accurate and of good quality.<sup>14</sup> It also has a potential use in medical education, training and issues for research. A personal, professional and organizational relationship is a quality of Patient-centred care.<sup>15</sup> Educating and enthusing clinicians about information system may improve organizational quality. Empowering

clinicians to participate in local and national information management decisions; exploring how information can be used to improve patient care and outcomes; and evaluating clinical information systems and helping to realize their benefits.<sup>16</sup> The key component for foundation of decisions at all levels in a health care system is a high quality patient data. Other important challenges include issues with interoperability with other systems, medical staff support and usage of HIT, difficulty building a strong business case for adoption, availability of IT staff, and privacy and security of patient information.<sup>17</sup>

### **Role of HIS and RIS in Patient Care**

Patient understanding of information communicated by healthcare providers can lead to enhanced patient satisfaction, better compliance with treatment instructions, improved outcomes, and decreased treatment times and costs. Collection, storage and analysis of health information are the fundamental tools to provide efficient healthcare services and its importance is increasing by considering the more amounts of health information collected every day.<sup>5</sup> The real time access of clinical data provided by HIS improved clinical documentation, reduced duplication of health services and also supported better decision making related to patient care. The recently introduced tools for patient education and diseases management are mobile health apps.<sup>18</sup> It provides access to wide population at low cost which is helpful in delivering healthcare interventions, specifically in areas with less health resources without even requiring people to visit health centers physically.<sup>19</sup> Hospital information system implementation significantly reduces clinician workload and medical errors while saving the healthcare system major expense. EMR is a clinician based data on diagnosis and treatment.<sup>20</sup> Apart from storing patient information it also keeps a track on diagnosis and its necessary medical information. HIS is the potential to reduce payment lag and improve health system performance. However Radiology information system maintains radiology information of patient and their reports. It is software used by radiologists for analyzing and reporting the radiology diagnosis by viewing PACS images. RIS allows retrieving and storing of radiology information, edit reports, patient scheduling, maintaining patient workflow management within the radiology department. HL7 is a set of international standards for exchange, integration, sharing, and retrieval of electronic clinical data and administrative data between hospital information systems. A Comprehensive Health information System, is a safe and effective communication among the health care providers. It is the basis of quality and health care development. Factors that increase the complexity of patient care include multiple chronic or acute physical health problems, the social vulnerability of the patient, and a large number of providers and settings involved in a patient's care.<sup>21</sup> The collection and interpretation of patient information from patients can guide in clinical care. HIS has the potential to improve the health of individuals and the performance of providers, yielding improved quality, cost savings, and greater engagement by patients in their own health care.<sup>22</sup> Clinical guidelines embedded in the HIS promote consistent use of evidence-based care, and automated systems help to catch and prevent errors. The HIS automatically performs numerous tasks done by hospital staff, enabling them to reduce the number of employees or redirect them to other responsibilities. The patient data collected are analysed or interpreted and diagnoses are formulated as the indicators for the patient's need for care.<sup>23</sup> Medical errors may occur in regard to incorrect diagnosis, wrong prescription of medication, inaccurate interpretation of laboratory results and incorrect information generated from medical equipment. By having HIS/RIS such errors can be minimized. Use of the HIS/RIS has been encouraged by Quality Improvement (QI) program which provides regular reports on selected quality indicators included on the health maintenance list.<sup>24</sup> The successful implementation of HIS/RIS can be evaluated by the dimension of quality, utilization and satisfaction.

Adverse events in hospitalized patients increase patient morbidity and mortality and are costly to individuals, hospitals, and society can be effectively observed by EMR.<sup>25</sup> Implementation of HIS itself is not patient-centered unless it strengthens the patient-clinician relationship, promotes communication about things that matter, helps patients know more about their health, and facilitates their involvement in their own care. HMIS is a framework that would improve the collection of timely reliable data at all levels in the system. HIPAA Privacy Rule created the first national standard to protect personal health information and medical records. HIS is developed in such a manner to secure patient database and business information. Hospital Information System addresses the entire major functional areas of modern multi-specialty hospitals. HIS implementation process is categorized into planning, design, implementation and operation.<sup>26</sup> Evidence-based design and incorporating it into hospital best practices is expected to reduce medical waste, improve quality outcomes, reduce medical errors, and improve patient and employee satisfaction while instilling a culture of safety.<sup>27</sup> The design and use of various HIS reports containing information on inpatient utilization and costs, physician office visits and physician practice patterns, physician productivity, physician referral patterns and costs, and the health problems of members are presented. HIS activities include Patient registration, appointment scheduling, billing, order entry, recording vitals and doctor's prescription. The integration of electronic patient data records with RIS is the only way today to provide high-quality clinical services.<sup>28</sup> It constitutes the permanent documentation of patient health, permitting the medical professional to evaluate symptoms and signs within a broader temporal perspective, contributing to improvements in making diagnoses and providing treatment.<sup>29</sup> This information can be used in statistical surveys, help with the analysis of procedures, be applied to preventative medicine, and be utilized for the control of hospital infections. Apart from the above benefits, clinical and nursing audits can be performed easily by considering hospital information system. The importance of HIS is to reduce patient waiting time, billing and dispatching of medicines from pharmacy, easy appointment scheduling and easy access of statistical data to middle and top level management. It provides online data on patient statistics, doctor performance and financial data. It also improves patient care, cost control and security of data. It also helps in streamlining operations, enhanced administration and control, improved responses, cost control and improved profitability. Integration of HIS and the radiology information system (RIS) into department workflow have done much to increase departmental efficiency.<sup>30</sup> Embedding RIS and other imaging systems into the HIS, which should improve the accuracy and efficiency of patient management while increasing clinician and patient satisfaction via collaboration and information sharing. Reports are usually stored in the Electronic Patient/Medical Record (EPR or EMR) of the Hospital Information System (HIS), and particularly in the Radiology Information System (RIS), which is designed to store, manipulate, and retrieve information for planning, organizing, directing, and controlling administrative activities associated with the provision and utilization of radiology services and facilities. High quality services can only be provided, however, if EPR data is integrated with the digital images in PACS. Requesting physicians can enter orders directly into the RIS through an HL-7 HIS via secure Web communications reducing entry tasks and possibilities for error. It all adds up to a more efficient workflow for the radiology unit and better service to referring physicians, as well as expanded marketing options. PACS Fundamentally changed the relationship of radiology to the enterprise, as immediate availability of images to the enterprise was considered a capability as important as Distribution of the radiologist's interpretation. HIS/RIS are expected to improve the accuracy of patient care information recorded in health records, support clinical decision-making, and improve accessibility of patients' healthcare information for continuity of care over space and time.<sup>28</sup> HIS have enhanced efficiency by alerting clinicians to

duplicate orders, enabling faster prescribing and other orders, and reducing transcription, medical records, and claims expenses. HIS is a massive, integrated system that supports the comprehensive information requirements of hospitals, including patient, clinical, ancillary and financial management. HIS/RIS has emerged to improve quality of healthcare delivery. Hospitals enterprises wield HIS/RIS to provide strategic, connected information to reduce costs, improve Patient care and increase service levels to their customers.<sup>31</sup> HIS have enhanced efficiency by alerting clinicians to duplicate orders, enabling faster prescribing and other orders, and reducing transcription, medical records, and claims expenses. Complete patient record can be stored and retrieved at any point of time. Links to the fledgling hospital Information systems were also being made beginning with the computer system that handled admissions, discharges, and transfers (ADT) so that patient demographic data could be readily accessed.<sup>32</sup> The main objectives of HIS/RIS are to improve patient safety, support effective and efficient health care delivery and facilitate management of chronic conditions.<sup>33</sup> Patient satisfaction is increasingly the focus of research and evaluation of health care interventions and is identified as an important quality outcome indicator of health care in the hospital setting.<sup>34</sup>

### **Role of RIS in Radiology Department**

There is an increasing interest in use of information and communication technologies to support health services In health care, patient privacy concerns is important that any unauthorized individuals should not have any access of clinical records. Nursing staff are the first pioneers to develop application content that reflects valid hospital staff roles and to communicate to each practitioner the standards of practice which will guide in planning and delivery of quality nursing care.<sup>35</sup>

### **Hospital Information System / Radiology Information System and its Efficiency**

To promote HIS implementation and optimization process, planning and modifications are continuously updated to address technological, professional, and organizational perspectives.<sup>36</sup> Electronic medical records help healthcare professionals to see uncertainties and risks in health care and make possible to solve complex problems. The fast-growing, tremendous amount of data collected and stored in large and numerous data repositories has far exceeded human ability for comprehension without powerful tools Electronic health records, decision support systems, mobile applications, telemedicine, e-medicine and electronic prescription are just some examples but the list is much longer.<sup>37</sup> Several key indicators for hospital performance are developed has a benchmark for comparison including reduction in hospital length of stays, reduction in in-hospital deaths, reduction in or prevention of an increase in the cost of healthcare, and optimization of the rates of admittance in emergency departments/other hospitals/long term care.<sup>38</sup> Such key indicators can be obtained from hospital information system and radiology information system. Patient's access to online health information leads to increase of its accessibility and credibility. The health care data management systems provide lifelong records, such as EHR, the electronic part of the health-related information about a patient includes diagnoses, medications, allergies, lab test results, and prescription renewals, which can be extracted from multiple sources.<sup>39</sup> Optimizing and experiencing the usage of HIS/RIS improves physician experiences. The tremendous progress achieved in health care sector, it is an area of never ending experiments which initially began with controlling mortality and now extends up to improvement in quality of life. HIS/ RIS can improve the speed and ascertainment completeness of reporting and also can affect the surveillance work flow and work load.<sup>40</sup> Sometimes health records

provide information that can reduce costs and inconvenience of repeating routine medical tests. Communication systems interface with EHR, patient monitors, and critical systems are empowering caregivers to be more productive and effective in the healthcare setting. Challenges for radiology health informatics include refining the systems and user interfaces, adhering to privacy regulations, and strengthening collaborative relations among stakeholders, including radiologists and public health officials.<sup>41</sup> As the information age progresses, patients become more health literate and health professionals will have to ensure they can provide advice as to how their patients can find reliable web sites among the many misleading and biased sites on the Internet. There is evidence to support information technology to primary health care in India is cost effective and ensure accountability of the services and helps in behavior change of the beneficiaries. The focus of health informatics is the application of electronics health records and HIS/RIS in clinical care, it uses various other applications to assist with health care process. Patient peers and health care providers are the expected information users; however also provide opportunities for policy makers, insurers and health-related businesses to gather information about patient experience. With the progress of technology over the last two decades and the diffusion of informatics into the healthcare field, the role of the physicians to adopt the technology has changed dramatically.<sup>42</sup> Healthcare apps and other e-health application tools typically target health promotion, disease prevention, and informal management of symptoms or problems. Hence, we can fully accept the beneficiaries from new knowledge about health care and from new and efficient methods of information technology in healthcare. The healthcare system involves the flow of patients among service delivery areas. The addition of information system has confounded the issue of inadequate provider documentation by mandating providers to adopt complex and time-consuming methods to perform documentation in healthcare.<sup>43</sup>

Centralized and distributed databases introduce the possibility to access large volumes of patient information in a short period.<sup>44</sup> The bioinformatics algorithm, analytical methods in assessment to relationship is the major research directions in health information analysis. PACS is a distinct and aggressive clinical diagnostic entity which facilitates the storage and acquisition of large quantities of diverse radiology information, and maintain the ability to grow in size and diversity. Patient-level, provider-level, system-level, geographic and cross-sectional data are needed for a wide range of purposes.<sup>45</sup> The challenge for HIS/RIS is to design systems that are powerful enough to handle the volume of information and the complexity of medical data, but also to support both patients and professionals in doing their work. Clinical informaticians utilize their clinical expertise and knowledge of patient care, operational processes, and information systems to participate in the design, specification, implementation, and evaluation of an EHR system. It appears that informatics community is a virtual health care database, a national health care knowledge base, and personal clinical health records would make a better health system. Health Informatics is a combination of information science and computer science within the realm of healthcare. Healthcare information systems are critically acclaimed for their ability to increase legibility, reduce medical errors, shrink costs and boost the quality of healthcare.<sup>46</sup> HITECH (The Health Information Technology for Economic and Clinical Health Act) act strengthens protections of health care information. Primary care unit enable the performance of electronic medical records, and improve the management of the institution.<sup>47</sup> Healthcare information technology had minor role in clinical governance and health care organizations are improving standardized data sets, reporting forms, and mechanisms for data analysis. Patient satisfaction and patient outcomes is particularly important to hospital management. Healthcare organizations intend to prevent and cure disease and to serve patients with a high quality of care. The Total Quality Management puts them in center

of all efforts of an organization or an enterprise the level of satisfaction of the customer/beneficiary satisfaction. The HIS/RIS is strategically placed to manage information within the public healthcare to unify the fragmented healthcare systems.<sup>48</sup>

## **Conclusion**

Quality healthcare is the most prominent concern for the patients. Patient might not judge clinical judgment of physicians hence judge the quality of services provided by hospitals. Patient satisfaction can be evaluated and identify the opportunities for improvement in care, reducing costs, monitoring and performance of health plan. Hospital information system (HIS) and Radiology information system (RIS) is widely used in many healthcare organizations to improve efficiency and effectiveness of patient care. HIS stores, manages and captures information related to health activities of patients and statistical data of healthcare organizations. Such information is secured as per HIPAA privacy rule which establishes law related to secure healthcare information. HIS reduces the burden of day to day operations and streamlines the process flow in hospital which improves the patient care. RIS is software used by radiologist in a radiology department to improve the quality of radiology reporting and secures the diagnostic details of patients over years. It also ensures smooth work flow in a radiology department and improves quality of reporting. HIS and RIS integration optimizes patient waiting time and improves patient's satisfaction. The HIS and RIS communicates through HL-7 which sets international standards for communication of clinical data of HIS/RIS.

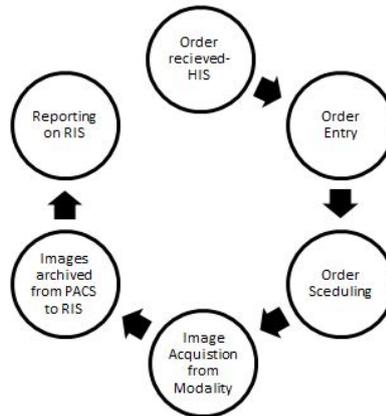
## **References**

1. Gullapalli N Rao., L V Prasad Eye Institute. How can we improve patient care? *Community eye health* 2002; 15(41): 1-3.
2. Hamid Moghaddasi. Health Promotion in Light of Effective Communication of Health Care: A Crossroad for the Electronic Health Record and E-Health. *J Healthc Commun* 2016.
3. Timothy L Wiemken., Robert R Kelley. improving patient care, medical education, and biomedical research in the United states: the role of social medica. *Journal of socialomics* 2012.
4. Usman Waheed. Analysis of Management Information System in Blood Transfusion Services, Pakistan. *Journal of Blood Disorders & Transfusion* 2015.
5. Roesems-Kerremans G. Big Data in Healthcare. *J Healthc Commun.* 2016; 1: 4.
6. Hesamaddin Kamalzadeh Takhti., Azizah Abdul Rahman., Samireh Abedini., Sedigheh Abedini. Impact of Hospital Information Systems on patient care: Nurses' perceptions. *Canadian Journal of Nursing Informatics* 2012; 6: 4.
7. Macri J. Australia's Health System: Some Issues and Challenges. *Journal of Health & Medical Economics* 2016.
8. Randolph SD., Cary MP., Gonzalez-Guarda RM. The use of technology for health information for African American men. *J Healthc Commun* 2017.
9. Renate AMM Kieft., Brigitte BJM de Brouwer., Anneke L Francke., Diana MJ Delnoij. How nurses and their work environment affect patient experiences of the quality of care: a qualitative study. *BMC Health Services Research* 2014; 14: 249
10. Kevin W. McEnery. Radiology Information Systems and Electronic Medical Records. *American College of Radiology* 2013.

11. Lisa M. Korst., Jordana M. K. Signer., Carolyn E. Aydin., Arlene Fink. Identifying Organizational Capacities and Incentives for Clinical Data-sharing: The Case of a Regional Perinatal Information System. *J Am Med Inform Assoc* 2008; 15: 195-197.
12. Sue Bowman. Impact of Electronic Health Record Systems on Information Integrity: Quality and Safety Implications. *Perspectives in Health Information Management* 2013.
13. Olomi GA. Patients' Level of Satisfaction with the Health Care Services Received at Outpatient Departments in Kilimanjaro Region, Tanzania. *Journal of Patient Care* 2016.
14. Quek Kia Fatt., Anuar Zaini Md Zain. Implementation and issues concerning electronic healthcare records. *J Healthc Commun* 2016.
15. Ronald M. Epstein., Richard L. Street Jr. The Values and Value of Patient-Centered Care. *Annals of Family Medicine* 2011 9 no. 2
16. Jeremy C Wyatta. Hospital information management: the need for clinical leadership. *The BMJ* 1995; 311: 175.
17. Stephenie Loux., Robert Coleman., Matthew Ralston., Andrew Coburn. Consolidated Imaging: Implementing a Regional Health Information Exchange System for Radiology in Southern Maine. *Agency for Healthcare Research and Quality* 2008; 4.
18. Shereen Nabhani-Gebara., ReemKayyali., Nada Philip. Digital Solutions to Support Patient Care at Home: Is Mobile Health a Reality?. *Blood Disorders & Transfusion* 2014; 5: 4.
19. Mawani M., Masood Kadir M. Use of M-Health Technology for Preventive Medicine in Pakistan. *Health Care : Current Reviews* 2016.
20. Nhi-Ha T. Trinh., Rachel LaRocca., Susan Regan., Trina E. Chang., Stephen E. Gilman. Using the Electronic Medical Record to Examine Racial and Ethnic Differences in Depression Diagnosis and Treatment in a Primary Care Population. *Primary Healthcare: Open Access* 2012.
21. Meyers D., Peikes D., Genevro J., Peterson Greg., Taylor EF. et al. The Roles of Patient-Centered Medical Homes and Accountable Care Organizations in Coordinating Patient Care. *Agency for Healthcare Research and Quality* 2010; 11: 5.
22. Melinda Beeuwkes Buntin., Matthew F. Burke., Michael C. Hoaglin., David Blumenthal. The Benefits Of Health Information Technology: A Review Of The Recent Literature Shows Predominantly Positive Results. *Health Affairs* 2011; 30: 3
23. Amakali K. Clinical Care for the Patient with Heart Failure: A Nursing Care Perspective. *Cardiol Pharmacol* 2015; 4: 142.
24. Ann K. Avery., Michelle Del Toro., Douglas Einstadter. Using the Electronic Decreasing Missed Opportunities for HIV Testing in Primary Care through Enhanced Utilization of the Electronic Medical Record. *Journal Of AIDS and Research* 2012.
25. Fletcher J., Jensen R. Impact of Health Information Technology on the Quality of Patient Care. *Online Journal of Nursing Informatics*.
26. Nurul Izzatty Ismail., Nor Hazana Abdullah., Alina Shamsudin., Nik Azliza Nik Ariffin. Implementation Differences of Hospital Information System (HIS) in Malaysian Public Hospitals. *International Journal of Social Science and Humanity* 2013; 3: 2.

27. Charles Andel., Stephen L. Davidow., Mark Hollander., David A. Moreno. The Economics of Health Care Quality and Medical Errors. *Journal of Health Care Finance* 2012; 39: 1.
28. Moshe Ayal., Abraham Seidmann . On the Economic Role of RIS/PACS in Healthcare: An Empirical Study. *Proceedings of the 42nd Hawaii International Conference on System Sciences* 2009.
29. Pedro Luiz Côrtes., Eliana Golfette de Paula Côrtes. Hospital information systems: a study of electronic patient records. *Journal of Information Systems and Technology Management* 2011; 8: 1
30. John W. Nance Jr., Christopher Meenan., and Paul G. Nagy. The Future of the Radiology Information System. *Am J of Roentgenol* 2013; 200: 5.
31. G. V. R. K. Acharyulu. Assessment of Hospital Information System Quality in Multi-Specialty Hospitals. *International Journal of Innovation, Management and Technology* 2012; 3: 4.
32. Michael A. De Georgia., Farhad Kaffashi., Frank J. Jacono., and Kenneth A. Loparo. Information Technology in Critical Care: Review of Monitoring and Data Acquisition Systems for Patient Care and Research. *The Scientific World Journal* 2015; 727694.
33. Robert Festersen. Objectives for Health Care Information Systems and Electronic Health Records in Primary Care.
34. Wen J., Schulman KA . Can Team-Based Care Improve Patient Satisfaction? A Systematic Review of Randomized Controlled Trials. *PLoS ONE* 2014; 9: 100603.
35. J. B. Kelly. Computers in hospitals nursing practice defined and validated. *The Seventh Annual Symposium on Computer Applications in Medical Care* 1983. *Proceedings*.
36. Fredric Blavin., Christal Ramos., Arnav Shah., Kelly Devers. *Lessons from the Literature on Electronic Health Record Implementation* 2013.
37. Calinici T. Software: The Universal Solution?. *J Health Med Informat* 2015; 6: e136.
38. Raghupathi V., Raghupathi W. Benchmarking Hospital Performance Using Health Analytics. *J Health Med Informat* 2015; 6: 188.
39. Yawen Y., Nakamura M., Nakashima N. Designing Health Data Management Systems: Learning From Prominent Worldwide Applications. *J Health Med Inform* 2016; 7: 216.
40. Thomas G. Savel., Seth Foldy. The Role of Public Health Informatics in Enhancing Public Health Surveillance. *Center for Disease control and Prevention* 2012; 61: 20-24.
41. Mollura., Daniel J. (2008) Bridging Radiology and Public Health: The Emerging Field of Radiologic Public Health Informatics. *J of the Ame Col of Radiol* 2008; 5: 174 - 181.
42. Ali B, Hamza AS., Maryam AH., Abdullah A. Assessment of Professionals' Literacy in Information and Communication Technology at the Administration of Food and Nutrition in Kuwait. *J Health Med Informat* 2015; 6: 198.
43. Stacy TJ., Washington G., Vuckovich PK., Bhatia S. Impact of Electronic Health Record Documentation and Clinical Documentation Specialists on Case Mix Index:

- A Retrospective Study for Quality Improvement. *J Health Med Informat* 2014; 5: 154.
44. Achampong EK. Readiness of Electronic Health Records for the Cloud Network. *J Health Med Informat* 2014; 5: e127.
45. Thomas H Payne., David W Bates., Eta S Berner., Elmer V Bernstam., H Dominic Covvey et al (2013) Healthcare information technology and economics. *J Am Med Inform Assoc* 2013; 20: 212-217.
46. Madison Ngafeeson. Healthcare Information Systems: Opportunities and Challenges 2014; 14.
47. Marcin and michamichalski. Mobile Applications As A Tool Supporting Healthcare Management, *Polish Journal of Management Studies* 2015; 12: 7-15.
48. Houser S. H., Manger B. J., Price B. J., Silvers, C., & Hart-Hester S. Expanding the Health Information Management Public Health Role. *Perspectives in Health Information Management / AHIMA, American Health Information Management Association* 2009; 6: 1.



**Figure 1:** Role of HIS and RIS in patient care.