Editorial

Vishal Midha

College of Business,
Illinois State University,
Normal, IL-61790, USA
Email: vmidha@illinoisState.edu

Madison N. Ngafeeson

College of Business,
Northern Michigan University,
Marquette, MI 49855, USA
Email: mngafees@nmu.edu

Kaushik Ghosh

Department of Information Systems & Analysis,
College of Business,
Lamar University,
Beaumont, TX 77710, USA
Email: kghosh@lamar.edu

Biographical notes: Vishal Midha is an Associate Professor in the Department of Accounting at Illinois State University. His current research interests include OSS development, privacy and security concerns, and individual and organisational level adoption of technology. He has published in a variety of journals, including *Information Systems Research*, *Decision Support Systems*, *E-Markets*, and *Communications of the AIS*.

Madison N. Ngafeeson is an Assistant Professor of Computer Information Systems and Director of the MBA program at the Walker L. Cisler College of Business, Northern Michigan University. His broader research interests are in the adoption, implementation, diffusion and use of information systems in organisations, especially in healthcare.

Kaushik Ghosh is an Associate Professor of Management Information Systems (MIS) at Lamar University. He received his PhD in MIS from the University of Mississippi. His research has appeared in journals such as *Communications of the Association for Information Systems (CAIS)*, *Journal of Computer Information Systems (JCIS)*, *Industrial Management and Data Systems (IMDS)*, and conferences such as *International Conference on Information Systems (ICIS)*, and *Americas Conference on Information Systems (AMCIS)*. His current research interest includes IT-enabled healthcare process and quality improvement.

1 Introduction

Since President George W. Bush's 2004 call for the widespread adoption of electronic medical records in the USA, the use of information technology/systems in healthcare has greatly intensified. Currently, technology not only plays a significant role as a supporting tool for medical records keeping, but it also has become a strategic necessity in curtailing healthcare costs (Kolodner et al., 2008; Reinhardt and Oliver, 2015), improving access to patient care (Eysenbach, 2001), reducing medical errors (Radley et al., 2013), enhancing care coordination and integration (Rantz et al., 2010), providing clinical decision support (Middleton et al., 2016), and improving patient satisfaction (Epstein et al., 2010).

It is no surprise why investing more in health information technology (HIT), US$ 10 billion annually for five years, was among President Obama's healthcare plan (Ryan, 2009). Several other industrialised nations are also making significant investments in healthcare. Overall, the HIT market around the world is expected to expand by 11.80% from 2014 to 2020, rising in valuation from US$ 96.8 bn in 2013 to US$ 210.3 bn by 2020. The developing economies are not very far behind in expanding their HIT initiatives. Nations from Asia-Pacific, Latin America, and the Middle East are expected to offer immense opportunities for HIT growth and are projected to witness remarkable expansion over the next few years (TMR, 2014).

The obvious question that arises is if all this expenditure is worth it. Even if everyone agrees on the importance of IT/IS in 21st century healthcare, its profitability has still not been justified. The need to understand the factors that play a role in accurately quantifying the value of IT/IS in the healthcare needs 'deeper' investigation. The objective of this special issue is to do just that and demonstrate how empirical and theoretical IT/IS research can assist in drive the future of healthcare. Thus the core objectives of this special issue are:

- publish quality research demonstrating the role of IS in all areas of healthcare, including but not limited to operations management, quality of care, patient and/or physician experience, cost management, performance improvement
- articulate an agenda for IS research in the healthcare area.

We initiated this special issue in an effort to consolidate existing research and stimulate new work that focuses on the interplay between healthcare and IT. After successful revision rounds of several submissions, we have *five* outstanding papers that are sure to invigorate fresh investigations of critical issues surrounding the importance and role of IT in healthcare. Both qualitative and quantitative research works were considered. The final five papers could be classified into five broad and somewhere overlapping categories:

- HIT resistance
- HIT worth
- HIT patient values
- HIT crosses physical barriers
- HIT technical advancements.

In the remainder of this section, we organise our discussion of the papers within the context of these broad categories. Finally, we conclude with the potential future outlets for the field of HIT.

2 Current research

2.1 Of what use is HIT non-use?

Despite the increasing investments in health IT and regulatory requirements under the Affordable Care Act, the transition from paper-based health record systems to electronic health record (EHR) systems constitutes one of the biggest organisational changes in the healthcare industry. The use of electronic records is expected to reduce medical errors, improve continuity of care, cut down costs, and boost the overall quality of health (Blumenthal and Tavener, 2010). In spite of these purported benefits, evidence continues to suggest that health professionals resist EHRs. Studies from around the world provide evidence of implementation challenges which have caused some healthcare organisations to either slow down or withdraw implementation altogether (Stone, 2014). Information technology resistance has been identified in the literature as one of the major reasons why technology implementation failure happens. These failures have also been found to affect health information technology implementation, including electronic health records; thereby necessitating a thorough investigation of the phenomenon of user resistance (Lapointe and Rivard, 2005; Kim and Kankanhalli, 2009; Ngafeeson and Midha, 2014). However, studies that explain and examine user resistance are limited, even though the challenge of technology resistance is clearly known. Moreover, solutions to the current implementation challenges, clearly depend on a correct understanding and explication of this concept of user resistance.

In this issue, Samhan and Joshi contribute to this discourse by examining the key determinants that drive user resistance to an EHR system. The authors' approach takes an empirical qualitative research methodology. They argue that while quantitative analysis could explain and predict resistance behaviours, a qualitative approach could provide deeper and richer insights about people's experiences with a new EHR system that shape resistance behaviours. To this end, the investigators, using the broader framework of the user resistance model proposed by Kim and Kankanhalli (2009), administered open-ended questions to capture user perspectives of a new EHR implementation. The researchers use *revealed causal mapping* to identify constructs and linkages revealed from respondent statements, with particular attention to the context. Results from the study show that *EHR perceived threats*, *EHR perceived value,* and *facilitating conditions* were most directly linked with *EHR resistance.*

These findings have significant implications related to the implementation of IS systems to support healthcare professionals. The literature on resistance shows that organisational support is beneficial in eliminating resistance behaviour. Samhan and Joshi further show that merely providing organisational support without considering all relevant factors could lead to an overhead leading to negative feelings about the new system and may not achieve its purpose. Additionally, involving healthcare providers in the development to increase their self-efficacy should positively impact their perception of the value of the EHR system, which in turn should reduce the resistance behaviour.

2.2 Is HIT worth it?

The quality of healthcare is more vital to us than that for any other goods or services. The consequences of poor quality healthcare are dire. No doubt why we spend so much on healthcare. The healthcare expenditure in the USA alone accounted for $3.2 trillion spent in 2015, or almost $10,000 for every person (Herman, 2016).

As part of the Obama Administration's efforts to make the US healthcare system more transparent, affordable, and accountable, the dollar amount billed to Medicare physician was made public in 2012. The released data gained considerable attention, in part because of its potential to empower patients, physicians, purchasers, and policymakers with a new way to make decisions about healthcare. At the surface level, the dollar amounts paid to some physicians or specialists made headlines in several outlets. At a deeper level, variations in the reimbursement for similar procedures, for instance, average payments from under $7,000 to over $34,000 for heart failure complication cases, raised some questions (Saifee and Bardhan, 2017).

In our next paper, Saifee and Bardhan examine such variations in reimbursements for similar procedures using hospital-level data from multiple sources, including Medicare, CMS Hospital Compare, and HIMSS Analytics. The focus on studying the association between Medicare reimbursements, healthcare quality outcomes, and health IT to usage to offer important insights on the extent to which variations in healthcare reimbursements can be explained by hospitals' quality and health IT usage. Their findings indicate hospital characteristics are significantly associated with mortality rate. For example, they findings indicate that rural hospitals exhibit a higher mortality rate compared to urban hospitals. Academic hospitals, when compared to non-academic hospitals, not only receive higher payments for every Medicare congestive heart failure patient discharged, but also exhibit a higher readmission rate for the patients. Taken together these results could be due to that academic hospitals handle medical cases of greater complexity requiring highly skilled resources. Such complex medical cases not only lead to higher reimbursements, but are also more prone to be readmitted more frequently.

With respect to usage of health IT, they find a partial support for *efficiency* as well as *effectiveness* of patient care. In their paper, improvement in efficiency has been studied as the direct association between health IT usage and average payments, whereas effectiveness has been studied as the indirect association between health IT usage and average payments. Their results suggest that hospitals can justify health IT expenditures with respect to their quality (effectiveness) outcomes, even if such investments do not have a direct impact on Medicare reimbursements.

Though the study is situated in the years 2011–2013, when fee-for-service model was more prevalent, the findings still have significant implications for public health policies and payment reform initiatives. At the same time, this also provides an opportunity for theory development and empirical testing in value-based reimbursement period.

2.3 HIT for patient values

The National Institutes of Health (NIH) has begun to place a significant importance on the use of technology-enabled self-management of chronic diseases such as diabetes, asthma, and cardio-vascular diseases among others, for disease treatment, management, and lifestyle changes. Huge investments are being made to develop digital solutions like smartphone apps, sensors, and web-based interactive systems in real time, real world

disease self-management (SM) because of their potential to support patient care and elevate the general quality of healthcare (Bailey et al., 2013; Jacelon et al., 2016). While the superiority of these technology-enabled SM over traditional SM techniques are unclear from literature, some researchers suggest that if patient values like empathy are not built into technology-enabled SM systems, the enhancement of patient care through technology will not yield its promise (Koller et al., 2012).

In the following study, Dadgar and Joshi investigate SM systems literature to find out if and how such values that are important to the patients are built into these technology-enabled SM systems. To achieve their objective, the authors use the *value sensitive design* (VSD) as a theoretical lens for their enquiry. They argue that without an understanding of values that are important to patients, SM systems will not achieve improved care. Through a systematic review of literature from information and communication technologies (ICTs) and SM areas, they extract and evaluate the value dimensions in the context of chronic diseases. The authors' findings suggest that few SM systems incorporated these theoretical perspectives of patient value. They further argue that these theoretical grounds are needed for congruence and consistency as suggested by Jacelon et al. (2016). The authors observe that the lack of theoretical support for SM systems can lead to fragmented systems that fail to assist patients with all aspects of SM activities. Dadgar and Joshi conclude that designing SM systems that fully support the values of patients are a sustainable approach for chronic disease management.

The complete VSD enables system designers to comprehensively address values throughout the design process by employing a combination of three types of investigations: conceptual, empirical, and technical (Friedman et al., 2006). Empirical investigations often extend the work of conceptual investigations. While conceptual investigations provide a framework and language for talking about values in the design of a system, empirical investigations allow designers to directly evaluate the success of a particular design. By completing the conceptual work, the current paper has laid the ground work for and provides an opportunity to extend the work empirically as well as technically. Through its conceptual analysis alone, this paper highlights the value of end users' emotional needs in HIT systems. The paper by Samhan and Joshi, as discussed earlier, provides a complimentary view and attests to the importance of the cognitive need of the end users. Taken together these two papers provide an opportunity to provide a comprehensive theoretical framework to understand health IT systems from both cognitive and emotional needs as well as for two groups of end users – healthcare professionals and patients.

2.4 HIT goes beyond physical/ geographical boundaries

Driven by high-speed internet, smartphones and changing insurance guidelines, an increasing number of health providers are turning to telemedicine for the delivery of healthcare. To put into perspective the rate at which telemedicine is proliferating – upwards of 15 million individuals in the USA received some form of remote care in 2015. It is expected that these numbers will grow by 30% this current year (Beck, 2016). Most popular avenues of telemedicine include linking patients with their care providers by phone, email, and videoconference; providers consulting with each other remotely; patients using medical devices to transmit their blood pressure, heart rate and other vital signs to their providers so they can manage chronic conditions at the convenience of their

home. Telemedicine also enables for improved care in places or locations where medical expertise has rare or limited availability.

Telemedicine is not without its challenges. These may be attributed to several factors. Policies regulating telemedicine differ widely from state to state and are constantly changing; physicians have set guidelines about what care they consider appropriate to deliver in what forum; and the question remains about what services physicians should be reimbursed for since insurance coverage varies based on the health plan. Several experts believe that the future of telemedicine will depend on whether the stakeholders (regulators, providers, payers, and patients) can tackle these challenges.

In the paper by Paul, the research takes a qualitative research approach to examine how technology management challenges to telemedicine have changed with time and how they impact its implementation and utilisation. The study investigates two active telemedicine networks based in rural settings. The findings reveal that previously identified technology management challenges associated with lack of end-user training, and limited remote site technology support and infrastructure still exist. Further, technology management issues centred on the relationships between the telehealth centers responsible for the technology and the various clinical units involved have become more critical.

This research highlights the importance of the traditional barriers to 'efficient' and 'effortless' use of technology; in this case, application of telemedicine may be hindered owing to lack of end-user training and inadequate technical support. Thus, both academicians and practitioners must proceed with caution to develop strategies and best practices to overcome these barriers as well as policy and governance related challenges associated with the successful implementation of telemedicine.

2.5 HIT technical advancements

Our last paper in this special issue departs from the consumer-oriented behavioural research and deals with algorithmic and technical issues pertaining to medical imagining arena. Healthcare professionals depend on accurate images for proper interpretation and diagnosis. However, intensity inhomogeneity with real-world images often presents a challenge in image segmentation (Li et al., 2011). Several image segmentation algorithms have been proposed to address this issue. These proposed algorithmic techniques often rely on image homogeneity, which may not always the case for objects with inhomogeneous intensity. The level set method of image segmentation has become increasingly important as an important tool in tracking interfaces and shapes (Paragios and Deriche, 2000). In this method, contours and surfaces are represented as zero level set of a higher dimensional function, called a *level set function*. However, the current level set methods do not fragment images with inhomogeneous forces as a rule. In the last paper in this issue, Kashyap and Tiwari propose an energy-based active contour method for image segmentation. This novel set active contour method consolidates the benefits of hybrid methods and the active contour methods to produce better results in segmentation. The authors use a progression of images to assess the proposed method by contrasting existing segmentation calculations. Results from their exploratory trials seem to show that the proposed approach would section medical images more accurately. This further highlights the important role that technologies as this, which convey correct medical imaging information, are critical to today's healthcare industry.

3 Future directions for healthcare IS research

The five papers in this issue are a representation of the balanced and realistic account of the *status quo* of the issues pertaining to the HIT. Though the topics covered and problems discussed cover a diverse range, we believe that some additional venues of research would be beneficial to healthcare researchers. We aim to involve new researchers in the dialogue and to provide them with some challenges for developing their own research agendas in the field. In particular, we see two areas where major technological advances are opening new landscapes for IT-driven healthcare practice that have not yet received much attention from IS researchers:

3.1 Big-data analytics

With the vastly increasing amounts of healthcare data, a big-data revolution is already underway in healthcare. The sources of data range from pharmaceutical research and development to digitisation of patient records to health records under public insurance programs to social media feeds. In totality, the amount of data generated by US healthcare alone by 2011 exceeded 150 exabytes and has been predicted to grow up to yottabytes proportions in the coming years (Raghupathi and Raghupathi, 2014).

The potential of healthcare big-data for improving health is enormous. It can be used to improve the efficiency and effectiveness of prediction and prevention strategies or of medical interventions, health services, health policies, and even healthcare fraud. One estimate suggests that healthcare big-data analytics has a potential to save between $300 billion to $450 billion in healthcare costs (Groves et al., 2013). Not only can it help at individual level healthcare, big-data research can also help in detecting of population-level effects, such as the adverse effects of drugs. For example, the analysis of clinical and cost data led to the discovery of adverse drug effects and subsequent withdrawal of the drug Vioxx from the market (Rubin, 2004). Another oft-cited example is Google Flu Trends, a service that predicts and locates outbreaks of the flu by making use of search queries, not originally collected for this purpose (Google, 2012).

Despite the great potential, researchers who wish to analyse this healthcare big-data are still faced with technical challenges of combining dispersed and diverse data. These challenges are further exacerbated by the ethical and legal obstacles limiting access to the data. It is hoped that large-scale adoption of HIT infrastructure and standards for interoperability will improve this situation. This is where a body of research comes in to play, as these changing horizons will guide the future of Healthcare IT. We see a number of worthwhile questions for future research at the intersection of healthcare practice and big-data analytics:

- How prepared are we to handle the big-data? A large percentage of healthcare executives, almost 77% executives as per Cottle et al. (2013), give their organisations a ‘C’ or below for their abilities to manage the data. What (and how) can be done to improve the situation?
- Who owns the data? Considering a hypothetical and a simple scenario about a person injured, and unconscious, due to an accident gets treated by a hospital. During the course of treatment using equipment loaned by a private business or a public academic hospital, a lot of data, including clinical data, financial data, behavioural

data, as well as personally identifiable data, is generated and stored by the hospital. Does the patient get a say in how and by whom that information can be used, and for what purposes? Does the equipment provider get the data? To what extent can the data be further used for business purposes?

- Do we have sufficient data and infrastructure? The bulk of costs in the current system is due to patients having chronic care diseases. Is there enough data and then necessary resources and infrastructure to analyse the data to provide acceptable predictive quality?
- How does it impact the patient care? Physicians face challenges in successfully synthesising the deluge of information from new data sources, such as wearable technologies, and the increasing scientific knowledge. Would this push physicians to rely on data analytics that is capable of synthesising and condensing information? Does this new born artificially intelligent decision-making support help or hinder physicians' judgements? Does the current medical system education enable medical professionals to understand and use such systems?

3.2 Personal health management

Today's consumers want to rely more on themselves for managing their health. In general, this is governed by the need to control their healthcare costs, the want to take charge of their own health, or the balance between the best value and best quality for their health. This has given rise to personal health management (PHM), a consumer-driven proactive and quantitative approach of taking responsibility for one's health (Giri et al., 2015), as opposed to paternalistic qualitative and passive approach to manage one's health through traditional approach (Childress and Siegler, 1984).

In its simplest form, PHM can occur through people relying on the internet for important health information (Kivits, 2009). In another form, it can be wearable technologies allowing us to record our biometric results, such as skin temperature, heart rate, oxygen saturation, respiration rate, and arterial blood pressure, at any given time, and even the diseases we have had, or the immunisations and screenings we have received (Chan et al., 2012). It may even be able to help us in selecting the best physician or hospital, or even in selecting a treatment option for a particular medical condition. Apart from its value to patients, a PHM system can provide doctors the vital medical history information that a patient might not be able to recall or is unable to provide.

In the light of the growing number of consumers adopting PHM (Giri et al., 2015), we see three broad implications for future IS research related to PHM. The first relates to consumer needs, perception, and acceptance. To understand this, Davis (1989) developed the technology acceptance model (TAM) that shows how users come to accept a technology. Although TAM is very well studied model in IS literature, we suggest that IS research needs to be careful in adapting TAM to this domain. PHM is not only about functionality and usability of technology, it is about one's healthcare goals and lifestyle, including the dimensions of aesthetic appeal as well as expressiveness. From the perspective of healthcare professionals, how do PHM systems integrate with their workflows? In other words, what is in it for the medical professionals to adopt? The second relates to integration and use of information to make healthcare decisions. In addition to the technical integration issues, physicians have obvious reasons to be concerned about the reliability of data. What happens when a physician relies on

inaccurate data, provided by the user? Who is held responsible in that case? Clearly, the physicians would lean towards controlling the input of data (Spil and Klein, 2014). One possible solution is IS solutions that allow for bi-directions control of information exchange and flow in a regulated fashion. Finally, we see potentially dramatic implications for research on privacy and security. Health information is extremely sensitive, and with good reason: privacy breaches can lead to social embarrassment to the patient, to potential discrimination by employers and even insurance providers. IS research has a great potential to contribute here. IS solutions can ensure anonymity of personal data, enforce authorisation controls, put patients in control of their own information.

Acknowledgements

We would like to express our sincere thanks to all the reviewers who generously shared their time and effort in keeping the process moving and bringing the special issue into fruition: Babajide Osatuyi; Bahae Samhan; David Gomillion; Jim Marquardson; Joseph Nwankpa; Juan Chavarria; Kartik Ganju; Kulraj Singh; Mamode Khan; Manal Yunis; Michael Dohan,; Mohammad Abdel-Rahman; Mohammad Merhi; Priya Seetharaman; Ravi Thambusamy; Samer Takieddine; Sankara Subramanian; Steven Wallace; Wan Khairunizam bin Wan Ahmad; Ying Wang; Zareef Mohammed.

References

Bailey, S.C., Belter, L.T., Pandit, A.U., Carpenter, D.M., Carlos, E. and Wolf, M.S. (2014) 'The availability, functionality, and quality of mobile applications supporting medication self-management', *Journal of the American Medical Informatics Association*, Vol. 21, No. 3, pp.542–546.

Beck, M. (2016) 'How telemedicine is transforming health care', *The Wall Street Journal*, Accessible at http://www.wsj.com/articles/how-telemedicine-is-transforming-health-care-1466993402

Blumenthal, D. and Tavener, M. (2010) 'The 'meaningful use' regulation for electronic health records', *N. Engl. J. Med*., Vol. 363, pp.501–504.

Chan, M., Estve, D., Fourniols, J-Y., Escriba, C. and Campo, E. (2012) 'Smart wearable systems: current status and future challenges', *Artificial Intelligence in Medicine*, Vol. 56, No. 3, pp.137–156.

Childress, J.F. and Siegler, M. (1984) 'Metaphors and models of doctor-patient relationship: their implications for autonomy', *Theoretical Medicine*, Vol. 5, pp.17–30.

Cottle, M., Hoover, W., Kanwal, S., Kohn, M., Strome, T. and Treister, N.W. (2013) *Transforming Health Care Through Big Data: Strategies for Leveraging Big Data in the Health Care Industry*, Institute for Health Technology Transformation, New York.

Davis, F.D. (1989) 'Perceived usefulness, perceived ease of use, and user acceptance of information technology', *Management Information Systems Quarterly*, Vol. 13, No. 3, pp.319–340.

Epstein, R.M., Fiscella, K., Lesser, C.S. and Stange, K.C. (2010) 'Why the nation needs a policy push on patient-centered health care', *Health Aff. (Millwood)*, Vol. 29, No. 8, pp.1489–1495.

Eysenbach, G. (2001) 'What is e-health', *J. Med. Internet Res*., Vol. 3, No. 2, p.e20.

Friedman, B., Kahn Jr., P.H. and Borning, A. (2006) 'Value sensitive design and information systems', in Zhang, P. and Galletta, D. (Eds.): *Human-Computer Interaction in Management Information Systems: Foundations*, M.E. Sharpe, Armonk, NY, pp.348–372.

Giri, P., Bafaloukos, N., Bhaumik, A. and Singh, A. (2015) 'Personal health management: the rise of the empowered consumer', *White Paper*, PWC, Accessible at https://www.pwc.com/us/en/advisory/customer/publications/assets/pwc-personal-health-management_-final.pdf

Google (2012) *See Google Flu Trends: How Does This Work?*, Google, http://www.google.org/flutrends/about/how.html

Groves, P., Kayyali, B., Knott, D. and Van Kuiken, S. (2013) 'The 'big data' revolution in healthcare', *McKinsey Quarterly*, p.2.

Herman, B. (2016) 'Healthcare spending growth rate rises again in 2015', *Modern Healthcare*, Accessible at http://www.modernhealthcare.com/article/20160713/news/160719963

Jacelon, C.S., Gibbs, M.A. and Ridgway, J.V. (2016) 'Computer technology for self-management: a scoping review', *Journal of Clinical Nursing*, Vol. 25, pp.1179–1192.

Kim, H-W. and Kankanhalli, A. (2009) 'Investigating user resistance to information systems implementation: a status quo bias perspective', *MIS Quarterly*, Vol. 33, No. 3, pp.567–582.

Kivits, J. (2009) 'Everyday health and the internet: a mediated health perspective on health information seeking', *Sociology of Health & Illness*, Vol. 31, No. 5, pp.673–687.

Koller, A., Miaskowski, C., Geest, S.D., Opitz, O. and Spichiger, E. (2012) 'A systematic evaluation of content, structure, and efficacy of interventions to improve patients' self-management of cancer pain', *Journal of Pain and Symptom Management*, Vol. 44, No. 2, pp.264–284.

Kolodner, R.M., Cohn, S.P. and Friedman, C.P. (2008) 'Health information technology: strategic initiatives, real progress', *Health Affairs*, Vol. 27, pp.w391–w395.

Lapointe, L. and Rivard, S. (2005) 'A multilevel model of resistance to information technology implementation', *MIS Quarterly*, Vol. 29, No. 3, pp.461–491.

Li, C., Huang, R., Ding, Z., Gatenby, J.C., Metaxas, D.N. and Gore, J.C. (2011) 'A level set method for image segmentation in the presence of intensity inhomogeneities with application to MRI', *IEEE Transactions on Image Processing*, Vol. 20, No. 7, pp.2007–2016.

Middleton, B., Sittig, D.F. and Wright, A. (2016) 'Clinical decision support: a 25 year retrospective and a 25 year vision', *IMIA Yearbook*.

Ngafeeson, M.N. and Midha, V. (2014) 'An exploratory study of user resistance in healthcare IT', *Int. J. Electronic Finance*, Vol. 8, No. 1, pp.74–94.

Paragios, N. and Deriche, R. (2000) 'Geodesic active contours and level sets for the detection and tracking of moving objects', *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol. 22, No. 3, pp.266–280.

Radley, D.C., Wasserman, M.R., Olsho, L.E., Shoemaker, S.J., Spranca, M.D. and Bradshaw, B. (2013) 'Reduction in medication errors in hospitals due to adoption of computerized provider order entry systems', *J. Am. Med. Inform. Assoc*., Vol. 20, pp.470–476.

Raghupathi, W. and Raghupathi, V. (2014) 'Big data analytics in healthcare: promise and potential', *Health Information Science and Systems*, Vol. 2, No. 1, p.3.

Rantz, M.J., Skubic, M., Alexander, G., Aud, M.A., Wakefield, B.J., Galambos, C. and Miller, S.J. (2010) 'Improving nurse care coordination with technology', *Computers Informatics Nursing*, Vol. 28, No. 6, pp.325–332.

Reinhardt, R. and Oliver, W.J. (2015) 'The cost problem in health care', in Gurtner, S. and Soyez, K. (Eds.): *Challenges and Opportunities in Health Care Management*, Springer International Publishing, Cham, pp.3–13.

Rubin, R. (2004) 'How did Vioxx debacle happen?', *USA TODAY*, 12 October, 2004, p.D1, Available athttp://www.usatoday.com/news/health/2004-10-12-vioxx-cover_x.htm

Ryan, L. (2009) 'System overhaul', *The Hospitalist*, Accessible at http://www.the-hospitalist.org/article/system-overhaul/?singlepage=1

Saifee, D.H. and Bardhan, I.R. (2017) 'Healthcare outcomes, information technology, and medicare reimbursements: a hospital-level analyses', *Int. J. Electronic Healthcare*, Vol. 9, Nos. 2/3, pp.129–156.

Spil, T. and Klein, R. (2014) 'Personal health records success; why google health failed and what does that mean for Microsoft HealthVault?', *Proc. Annual Hawaii Int. Conf. Syst. Sci*., pp.2818–2827.

Stone, C.P. (2014) *A Glimpse at EHR Implementation around the World: The Lessons the US can Learn*, The Health Institute for E-Health Policy, May, Retrieved from http://www.e-healthpolicy.org/docs/A_Glimpse_at_EHR_Implementation_Around_the_World1_ChrisStone.pdf

TMR (2014) *IT-Enabled Healthcare Market – Global Industry Analysis, Size, Share, Growth, Trends and Forecast 2014–2020*, Technical Report, Available through http://www.transparencymarketresearch.com/it-enabled-healthcare-market.html