Healthcare Big Data Analytics: Re- engineering Healthcare Delivery through Innovation

Pei Kuan Lai, Chun Wai Mai, Lokman Hakim Sulaiman, Patricia Kim Chooi Lim

IeJSME 2019 13(3): 10-13

Keywords: Healthcare, big data, analytics

The Institute for Research, Development, and Innovation (IRDI) of the International Medical University (IMU) had collaborated with the Malaysia Digital Economy Corporation Sdn Bhd (MDEC) and Fusionex International to organise the third Policy Dialogue titled *Healthcare Big Data Analytics: Re-engineering Healthcare Delivery through Innovation* on 13th September 2019 in the IMU Bukit Jalil campus.

Disruptive and innovative technologies are revolutionizing how healthcare is delivered today and have brought tremendous growth to the sector. Featuring distinguished healthcare thought leaders and practitioners, the objective of this half-day seminar and forum was to provide perspectives and insights on the ongoing opportunities and challenges facing Malaysians and the global healthcare industry.

This seminar and forum was well-attended by 300 participants consisting of a wide range of healthcare professionals as well as hospital and health system leaders spanning a variety of executive, clinical, strategic, and operational areas as well as executives leading physician practices, life science companies, consultancies, and academics.

Of late, with the rapid growth of mobile devices such as smart phones, laptops, and tablets, we are inevitably bombarded with digital flood filled with torrents of data ranging from numbers, words, music, images to videos. With the rampant use of internet for email, Facebook, LinkedIn, Twitter, personal blogs, or online surfing for information, digital data is embedded in deepening rivers catering to the rapid digitization of large amounts of data.[1,2]

At the first mention of big data, size is the first thing that comes into the picture[3]. Big data is defined as "large volume of high velocity, complex, and variable data that require advanced techniques and technologies to enable the capture, storage, distribution, management and analysis of information"[4]. Big data in healthcare is essential to handle the extremely large and complex electronic health data sets which are challenging and hardly possible to manage with traditional software or data management tools and methods[2,5,6].

Big data is characterised by four Vs – volume, variety, velocity, and veracity[1]. Volume is the quantity or magnitude of the data[3] and it is increasing exponentially from terabytes to zettabytes. The variety of data is the format of data and it can be structured, semi-structured and unstructured. As for velocity, big data infrastructure helps us to manage large volume of data at a faster pace from batch processing to real-time streaming. Lastly, veracity refers to the truthfulness, relevance, and predictive value of data to generate error-free and credible data.[1,2,7]. In other words, big data enables us to handle massive volume and variety of data with high velocity[7].

One of the most promising areas where big data can be applied to effect a change is healthcare which is considered one of the most data-intensive industries[8]. Big data analytics (BDA) is the process of extracting knowledge from sets of big data[9] using various analytical techniques such as descriptive analytics and mining or predictive analytics that are ideal for analysing a large proportion of text-based health documents and clinical data from clinical research, pharmaceutical care, physicians' written notes, prescriptions and medical imaging[10]. In healthcare, big data is applied in healthcare analytics which is the systematic use of health data and related business insights developed through applying analytical such as statistical, contextual, quantitative, predictive, cognitive and other models, for planning, management, measurement and learning in healthcare with fact-based decision making[11].

With digitalization of big data, healthcare industry is bound to realise many benefits. Potential benefits include detection of diseases at earlier stages for early and effective treatments as well as prediction of patient outcomes based on vast amounts of patient historical data such as length of stay (LOS), complications from medical procedures or surgeries and illness or disease

Institute for Research, Development and Innovation, International Medical University, 126, Jalan Jalil Perkasa 19, Bukit Jalil, 57000 Kuala Lumpur, MALAYSIA

Corresponding Author:
Ms Lai Pei Kuan, Institute for Research, Development and Innovation, International Medical University, 126 Jalan Jalil Perkasa 19, Bukit Jalil, 57000 Kuala Lumpur, MALAYSIA
E-mail: LaiPeiKuan@imu.edu.my

IeJSME 2019 13(3): 10-13

progression, comparative effectiveness research to seek more cost-effective treatments, statistical tools and algorithms to improve clinical trial design and subject recruitment, predictive modelling for more targeted research and development (R&D) pipeline in drugs and devices, and analysis of disease patterns and tracking disease outbreaks and transmission for better public health surveillance[2].

Some of the useful applications of BDA tools in healthcare include using machine learning to predict admission trends and arrange for staffing; implementation of Electronic Health Records (EHRs); Real-Time Alerting which is a system that sends alerts to the doctors when patients' health data show anomalies; predictive models to identify high-risk or high-cost patients which facilitates accurate and rapid treatment resulting in more effective patient care[12,13]; population management, the proactive monitoring of a population of patients that are cared for by a clinical, hospital, or health system[12]; drug and medical device surveillance to evaluate large volumes of electronic health record, medical device, clinical registry, social media, and patient-recorded data for drug or device safety signals[12,14]; artificial intelligence in predictive analysis for patient monitoring; telemedicine to deliver remote clinical services using technologies such as online video conferences, smartphones, wireless devices, and wearables, as well as medical imaging to read images using algorithms.

The Policy Dialogue has decided on the following recommendations:

1. Digitalisation in healthcare is in place where connected devices, data analytics, and artificial intelligence (AI) technologies are introduced for automation of processes using computers and electronics.
2. There is a need for new healthcare delivery models in order to address the challenges of the current model of healthcare delivery which is fragmented, transactional, unsafe, and unsustainable.
3. There is a need for a transformation in digital health and digital care towards a connected healthcare delivery model to retrieve the right data and convert it into personalized insights in an effort to tackle the issue of underutilised clinical data and promote health and provide healthcare outcomes.
4. Integrated efforts from a multidisciplinary healthcare team are essential to shift the healthcare trend towards more digitalisation and ensure its effective implementation.
5. Digital health is crucial to achieve the goal of Universal Health Coverage (UHC) where everyone can have access to essential quality health services everywhere without facing financial hardship.
6. Government should formulate regulatory frameworks on healthcare practice, data ownership, data security, and privacy in the efforts to facilitate digital health.
7. New strategies and action plan are in place but requires further enhancement and coordination to strengthen governance and stewardship in digital health research and development and innovation.
8. The investment in health is substantial but still insufficient. As of 2017, 4.4% of Gross Domestic Product (GDP) was spent on healthcare as compared to 1.8% in 1985, an increase of 5% over the past 30 years.
9. All healthcare providers, both public and private, should invest, adopt, adapt and implement more healthcare delivery enhancing technologies, products and innovations.
10. The government needs to consult and engage the industries to promote and establish partnership in digital health. Engagement with the stakeholders should be initiated to ensure smooth implementation of digital health.

IeJSME 2019 13(3): 10-13

11. Public sector should collaborate with the private sector to sustain a good digital health innovation ecosystem.
12. Data analytic tools are crucial in healthcare to focus on value-based care and health outcomes to improve practitioners' performance and service delivery, reduce patient cost, and attain better predicting risk.
13. Upgrade and improvement of public facilities, infrastructure, and connectivity is warranted so that the public can have better access to digital health.
14. More industry sponsored research is required to sustain research and development and innovations in healthcare big data analytics.
15. Translational research is warranted to utilise research findings for policy development and decision making as well as to translate research findings into marketable research products and innovations including clinical trials.
16. Research and health technology assessments for new technology and innovation need to be enhanced to facilitate healthcare big data analytics.
17. More training programmes need to be set up to develop new skills and expertise for capacity building and open new career pathways.
18. Healthcare professionals should observe and practice data ethics while handling healthcare data.
19. There should be a paradigm shift among healthcare professionals to embrace and accept digital health with open hearts.

ACKNOWLEDGEMENTS:

The authors gratefully thank the following for their participation and contributions in the discussions and formulation of recommendations for this policy dialogue session:

Fusionex International: Dato' Seri Ivan Teh

New Technologies, Fusionex International, Singapore: Mr. Raju Chellam

International Medical University (IMU): YBhg Tan Sri Dato' Dr Abu Bakar Suleiman,
Professor Peter Pook, Professor Leong Chee Onn

Ministry of Health (MOH) Malaysia: Dr Fazilah Shaik Allaudin

Malaysia Digital Economy Corporation Sdn Bhd (MDEC): Puan Yaszrina bt Mohamad Yassin

Naluri, Malaysia: Mr. Azran Osman Rani

American Chemical Society (ACS) Malaysia Chapter

Association of Chiropractic Malaysia

Malaysian Academy of Pharmacy (MAP)

Malaysian Association of Pharmaceutical Supplies (MAPS)

Malaysian Community Pharmacy Guild (MCPG)

Malaysian Dietitians' Association

Malaysian Pharmaceutical Society (MPS)

Pharmaceutical Association of Malaysia (PhAMA)

Royal Chemistry Society (RSC) Malaysia Chapter

All the 300 registered participants who have contributed actively during the dialogue session.

IeJSME 2019 13(3): 10-13

REFERENCES

1. Feldman B, Martin EM, Skotnes T. Big data in healthcare hype and hope. Dr. Bonnie. 2012 Oct; 360: 122-5.
2. Raghupathi W, Raghupathi V. Big data analytics in healthcare: promise and potential. Health information science and systems. 2014 Dec 1; 2(1):3.
3. Gandomi A, Haider M. Beyond the hype: Big data concepts, methods, and analytics. International journal of information management. 2015 Apr 1; 35(2): 137-44.
4. Cottle M, Hoover W, Kanwal S, Kohn M, Strome T, Treister N. Transforming Health Care Through Big Data Strategies for leveraging big data in the health care industry. Institute for Health Technology Transformation, http://ihealthtran. com/big-data-in-healthcare. 2013.
5. Frost and Sullivan. Drowning in big data? reducing information technology complexities and costs for healthcare organizations, 2012.
6. Kankanhalli A, Hahn J, Tan S, Gao G. Big data and analytics in healthcare: introduction to the special section. Information Systems Frontiers. 2016 Apr 1; 18(2): 233-5.
7. Roski J, Bo-Linn GW, Andrews TA. Creating value in health care through big data: opportunities and policy implications. Health affairs. 2014 Jul 1;33(7):1115-22.
8. Kuo MH, Sahama T, Kushniruk AW, Borycki EM, Grunwell DK. Health big data analytics: current perspectives, challenges and potential solutions. International Journal of Big Data Intelligence. 2014 Jan 1;1(1-2):114-26.
9. Labrinidis A, Jagadish HV. Challenges and opportunities with big data. Proceedings of the VLDB Endowment. 2012 Aug 1;5(12):2032-3.
10. Groves P, Kayyali B, Knott D, Kuiken SV. The'big data'revolution in healthcare: Accelerating value and innovation.
11. Cortada JW, Gordon D, Lenihan B. The value of analytics in healthcare: From insights to outcomes. IBM Global Business Services. 2012:1-5.
12. Rumsfeld JS, Joynt KE, Maddox TM. Big data analytics to improve cardiovascular care: promise and challenges. Nature Reviews Cardiology. 2016 Jun;13(6):350.
13. Bates DW, Saria S, Ohno-Machado L, Shah A, Escobar G. Big data in health care: using analytics to identify and manage high-risk and high-cost patients. Health Affairs. 2014 Jul 1;33(7):1123-31.
14. Platt R, Carnahan R. The US Food and Drug Administration's Mini-Sentinel Program. Pharmacoepidemiology and drug safety. 2012 Jan;21:1-303.