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Guest editorial: The bright side and the dark side of digital health

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Digital technology has transformed how individuals, organizations, and societies use information to improve their decision-making in daily lives. In recent years, the healthcare industry is also actively adopting digital technology to enable the formation of digital health. Due to the COVID-19 pandemic, the speed of technology diffusion in the healthcare industry is even faster than before. New technologies enable medical professionals and patients to interact, provide and receive services without physical contact, thus keeping social distance. Digital health includes a lot of advanced technologies, such as mobile health (mHealth), health information technology (HIT), wearable devices, service medical robots, Artificial Intelligence (AI), telehealth and telemedicine, health data analytics, and personalised medicine (Lupton, 2017). These technologies offer new exciting opportunities to improve medical outcomes, enhance healthcare efficiency, and balance health resources.

In particular, digital health can better collect, process, and analyse health-related information, and provide decision support for patients, doctors, healthcare organizations, public health management, and medical research (Guha and Kumar, 2018; Zheng *et al.*, 2021). There are many positive and negative issues associated with the use of digital health. On the one hand, it empowers patients to make better decisions on their own health and provides new options for improving prevention, early diagnosis, monitoring management and prediction of chronic conditions outside the traditional healthcare settings (Lin *et al.,* 2017). Doctors can also get a more comprehensive view of patients' health by making it accessible to data for improving the quality of care (Lin *et al.,* 2019). Pharmaceutical companies and digital health companies can also benefit from patient-generated knowledge for the advancement of medical research (Kallinikos and Tempini, 2014) and the design of personalised healthcare interventions (Bernardi, 2019).

On the other hand, the integration of digital technology in the healthcare industry presents several risks such as the spread of misinformation (e.g. anti-vax communities) (Doty, 2015), the disclosure of patients' privacy that could be used by healthcare organizations and health insurance companies to make discriminatory policies (McFall and Moor, 2018), increased doctors' technical anxiety, slow acceptance of digital health innovation (Bernardi and Exworthy, 2020), and health inequalities due to the digital exclusion of patients (Latulippe *et al.,* 2017; Halford and Savage, 2010).

Healthcare is one of the largest and most important industries for citizens' wellbeing. Addressing the complexities of positive and negative healthcare issues requires more than one perspective and needs more interdisciplinary collaboration and research (Gianchandani, 2011; Greaves *et al.,* 2013). The rapid development of advanced technologies and methodologies such as social media, Internet of things (IoT), data

analytics, machine learning, and AI creates opportunities to handle complicated problems in the healthcare industry. Information technology makes it possible to improve people's health conditions smartly and comfortably. However, the adoption of digital technology in the healthcare industry lags behind other industries due to some major technological and managerial obstacles (Bunduchi *et al.,* 2015) such as the lack of health data integration, data overload issues, data privacy as well as security, and limited or inefficient data visualization (Agarwal *et al.,* 2010; Turel *et al.*, 2019).

This special issue aims to serve as a podium where digital health, e-health, healthcare management, and other information systems scholars can discuss emerging issues related to the bright and the dark sides of digital health. In bringing technical, behavioural, and managerial perspectives altogether, this special issue intends to generate new insights into the adoption, utilization, optimization, and management of digital health and understand its risks and potentially adverse consequences for individuals, organizations, and societies.

Special issue contents

We received ample submissions, holding different methodological, theoretical, and multidisciplinary perspectives. After a rigorous peer-review process, nine full-length papers were selected and included in this special issue. These papers covered a wide range of research questions from authors in different aspects of digital health.

The first article by Hongze Yang, Zeyu Peng, Xitong Guo, and Kee-Hung Lai identifies the subtle mechanisms by which social support from Online Pharmacy Services (OPS) affect patient experience and by which patient experience is associated with key healthcare outcomes such as diet adherence and medical adherence. This study makes an important contribution to research on the impact of online support services on patient experience and provides healthcare providers and designers with guidance on how to design these services to achieve positive patient outcomes (Yang *et al.,* 2021a).

The second article by Xuejie Yang, Dongxiao Gu, Jiao Wu, Changyong Liang, Yiming Ma, and Jingjing Li proposes a theoretical model of health anxiety based on the Stimulus-Organism-Response framework. They find that anxiety sensitivity (i.e. excessive fear about physical symptoms of anxiety) and the severity of physical symptoms are associated respectively with metacognitive beliefs (e.g. self-consciousness, self-monitoring, and self-regulation) and catastrophic misinterpretation of physical symptoms, which then in turn exacerbates health anxiety. This study makes an important contribution by revealing the underlying psychological mechanisms which may augment health anxiety following the consumption of e-health information (Yang *et al.,* 2021c).

The third article by Yan Wan, Ziqing Peng, Yalu Wang, Yifan Zhang, Jinping Gao, and Baojun Ma reveals the factors that influence patients' choice of a doctor on an Online Medical Consultation (OMC) platform by investigating the key service features that impact patients' trust in a doctor. This study enriches trust-related research in the field of OMC and makes a significant contribution to research on trust in online doctor-

patient relationships. This research provides doctors with useful insights on how to maximise patient consultations volume (Wan *et al.,* 2021).

The fourth article by Xin Pan, Hanqi Wen, Ziwei Wang, Jie Song, and Xing Lin Feng develops a probabilistic model to provide real-time rankings of physicians. The model captures patients' browsing behaviours and uses a value approximation algorithm that combines a 'greedy ranking policy' and value function approximation methods to design a ranking system. This study makes an important contribution by solving the dynamic physician ranking problem. The dynamic ranking system can support patients' decision-making in selecting a physician, thus helping digital health platforms improve system and operational performance (Pan *et al.,* 2021).

The fifth article by Ruihuan Liu, Chunqiao Tan, and Chengwei Zhao builds a pricing and coordination model of the vaccine supply chain based on blockchain technology and demonstrates how blockchain increases total profit, consumer surplus, and social welfare of the vaccine supply chain. This study makes an important contribution by revealing how blockchain can meet the challenge of vaccine safety by supporting operational efficiency in vaccine supply chain management (Liu *et al.,* 2021).

The sixth article by Shijie Song, Yuxiang Chris Zhao, Xinlin Yao, Zhichao Ba, and Qinghua Zhu investigates the relationship between affordances and user experience and examines the factors that contribute to users' intention to continue using short video apps as a health information source on TikTok. This study makes an important contribution to the health information behaviour literature by highlighting the often-neglected role of user experience in sustaining use of health information sources. It extends the application of affordance theory to users' health information acquisition and has important practical implications on how to use short video apps on social media to improve public health communication (Song *et al.,* 2021).

The seventh article by Tuotuo Qi, Tianmei Wang, and Jiarui Yan analyses the short-term and long-term spillover effects of high-yield and low-yield monetary incentive on health experts' online free knowledge contribution behaviour. This study makes a novel contribution by combining theories of reciprocity and resource limitation. It also contributes to monetary incentive research by demonstrating how the impact of incentives on knowledge contribution online may not remain consistent across time. This research bears important contributions for digital platform managers who want to maximise health experts' knowledge contribution, which is vital for promoting health knowledge and improving health literacy (Qi *et al.,* 2021).

The eighth article by Shufang Yang, Lin Huang, Yanli Zhang, Pengzhu Zhang, and Yuxiang Chris Zhao shows how different patterns of active and passive social media usage influence seniors' loneliness through online social support, upward social comparison, and social presence. This study makes an important contribution towards our understanding of the role of social media in alleviating seniors' sense of loneliness, which can then generate positive impact by relieving the pressure on health and social care systems (Yang *et al.,* 2021b).

The ninth article by Hangzhou Yang, and Huiying Gao proposes a user recommendation method that uses rich social information in social media effectively. This novel recommendation system can generate positive impact by helping online

health community members to find appropriate peers for social support exchange. An important contribution of this research is to demonstrate the value of social information from online health communities in significantly improving the performance of a recommender system (Yang and Gao, 2021).

Contribution and direction for future research

The articles in this special issue have covered essential and critical issues related to digital health services and technologies in the healthcare industry, such as OPS, e-Health information, OMC services, online health community (OHC), blockchain technology, social media, recommendation systems, and physician ranking systems.

Regarding the bright side of digital health, these articles have demonstrated the positive impacts digital health technology can have on various key players of the health ecosystem, including patients and medical professionals, and owners of digital health platforms. The articles have evidenced the positive impact that digital health services and technologies can have from the perspective of patients, doctors and digital health platforms owners. The positive impacts such as diet and medication adherence from online social support platforms and digital health services (Yang *et al.,* 2021a); increased productivity and efficiency in the distribution of healthcare resources, such as maximising the volume of patients' consultations online (Wan *et al.,* 2021) and health experts' contribution of medical knowledge to digital platforms (Qi *et al.,* 2021); vaccine safety (Liu *et al.,* 2021); social impact, such as the benefits of social media use in curbing senior's loneliness (Yang *et al.,* 2021b).

The articles in this special issue shed light on the experiential as well as sociomaterial dimensions of the impact of digital health. For example, with regards to the experiential dimension of digital health, Yang *et al.* (2021c) show how the potential negative health consequences of the consumption of online health information is associated with users' subjective experience with a medical condition. This research underscores that there is not always a clear distinction between the bright and the dark sides of digital health. Positive or negative outcomes resulting from the use of digital health are experiential and contextual and therefore not always easy to predict. The unpredictability of the impact of digital health is also linked to its sociomaterial dimension. Sociomateriality transpires as an important theme across several of the articles in this special issue. In particular, these articles show how behavioural, health and social outcomes of digital health emerge from assemblages between algorithms of digital platforms and patterns of behaviours and social products (e.g. social information) emerging from users' reciprocal interactions and engagement with these platforms (Song *et al.,* 2021; Yang and Gao, 2021).

Finally, the articles in this special issue are an important source of inspiration concerning the dark and less predictable side of digital health. Important questions that emerge concern, for example, the ethics of using monetary incentives in eliciting knowledge contribution from health experts (Qi *et al.,* 2021). Will these incentives maximise quantity at the expense of quality of medical knowledge? What implications does this have for the reliability and safety of the medical knowledge shared? Potential unintended negative consequences may also arise from the use of algorithms, dynamic ranking systems, and recommender systems on digital health platforms (Song *et al.,* 2021; Yang and Gao, 2021). Can these systems lead to biased decisions or recommendations? Are these decisions or recommendations in the best interests of patients? Can service providers on these platforms game these systems to their

advantage and to the disadvantage of less powerful actors such as patients in need of medical advice or help? Articles in this special issue have also demonstrated the increasing role that big social media companies play in publishing and sharing health information showing the positive impact they can have on public health communication (Zhao *et al.,* 2021). Nevertheless, this research also raises important ethical questions about the involvement of these tech-giants in influencing our health behaviours, particularly given that advertising is their major source of revenue. We recommend that the academic society pays more attention to these and other important issues related to the negative consequences of digital health in the future.

Overall, we hope that our special issue will make significant theoretical and practical contributions to the academic literature in healthcare and digital health-related disciplines within the Information Systems field. All the articles published in this special issue provide compelling evidence for the value of research related to the digital health phenomenon and suggest significant impact of digital service and technology on the future of the Information Systems and healthcare-related disciplines.

We would like to extend our sincere gratitude and appreciation for all of the hard work and contributions from all the authors. We wish to express our gratitude, especially to Professor Christy Cheung, the Editor-in-Chief of Internet Research, for supporting initiating this special issue topic and providing thoughtful and pertinent advice during all stages of the project. In addition, we would like to give our thanks, particularly to all the special issue review board members and the anonymous reviewers. The editorial review board members and reviewers' time and effort invested in the manuscripts helped improve the quality of the articles published in this special issue.

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References

Agarwal, R., Gao, Guodong (Gordon), DesRoches, C. and Jha, A. K. (2010), "The digital transformation of healthcare: current status and the road ahead", *Information Systems Research*, Vol. 21 No. 4, pp. 796-809.

Bernardi, R. (2019), "Online health communities as social spaces for experimentation:

individual and collective epistemic practices of knowledge co-production", *OKLC Conference*, Brighton, 24-26 April 2019.

Bernardi, R. and Exworthy, M. (2020), "Clinical managers' identity at the crossroad of multiple institutional logics in IT innovation: the case study of a health care organization in England", *Information Systems Journal,* Vol. 30 No. 10, pp. 566-595.

Bunduchi, R., Smart, A., Charles, K., McKee, L. and Azura-Blanco, A. (2015), "When innovation fails: an institutional perspective of the (non)adoption of boundary spanning IT innovation", *Information & Management,* Vol. 52 No. 5, pp. 563-576.

Doty, C. (2015), "Social epistemology and cognitive authority in online comments about vaccine safety", iConference 2015 Proceedings.

Gianchandani, E. P. (2011), "Toward smarter health and well-being: an implicit role for networking and information technology", *Journal of Information Technology,* Vol. 26 No. 2, pp. 120-128.

Greaves, F., Ramirez-Cano, D., Millett, C., Darzi, A. and Donaldson, L. (2013), "Harnessing the cloud of patient experience: using social media to detect poor quality healthcare", *BMJ Quality & Safety,* Vol. 22 No. 3, pp. 251-255.

Guha, S. and Kumar, S. (2018), "Emergence of big data research in operations management, information systems, and healthcare: past contributions and future roadmap", *Production & Operations Management,* Vol. 27 No. 9, pp. 1724-1735.

Halford, S. and Savage, M. (2010), "Reconceptualizing digital social inequality", *Information, Communication & Society*, Vol. 13 No 7, pp. 937–955.

Kallinikos, J. and Tempini, N. (2014), "Patient data as medical facts: Social media practices as a foundation for medical knowledge creation", *Information Systems Research,* Vol. 25 No. 4, pp. 817-833.

Latulippe, K., Hamel, C. and Giroux, D. (2017), "Social health inequalities and ehealth: a literature review with qualitative synthesis of theoretical and empirical studies", *Journal of Medical Internet Research*, Vol. 19 No. 4, pp.e136.

Lin, Y. K., Chen, H. C., Brown, R. A., Li S. H. and Yang, H. J. (2017), "Healthcare predictive analytics for risk profiling in chronic care: a bayesian multitask learning approach", *MIS Quarterly,* Vol. 41 No. 2, pp. 473-A473.

Lin, Y. K., Lin, M. F. and Chen, H. C. (2019), "Do electronic health records affect quality of care? evidence from the HITECH Act", *Information Systems Research,* Vol. 30 No. 1, pp. 306-318.

Liu, R., Tan, C. and Zhao, C. (2021), "Pricing and coordination of vaccine supply chain based on blockchain technology", *Internet Research*, Vol. ahead-of-print No. ahead-of-print.

Lupton, D. (2017), *Digital health: critical and cross-disciplinary perspectives*, Routledge, London, UK.

McFall, L. and Moor, L. (2018). "Who, or what, is insurtech personalizing?: persons, prices and the historical classifications of risk", *Distinktion: Journal of Social Theory*, Vol. 19 No. 2, pp. 193-213.

Pan, X., Wen, H., Wang, Z., Song, J. and Feng, X. L. (2021), "Physician ranking optimization based on patients' browse behaviors and resource capacities", *Internet Research*, Vol. ahead-of-print No. ahead-of-print.

Qi, T., Wang, T. and Yan, J. (2021), "The spillover effects of different monetary incentive levels on health experts' free knowledge contribution behavior", *Internet Research*, Vol. ahead-of-print No. ahead-of-print.

Song, S., Zhao, Y. C., Yao, X., Ba, Z. and Zhu, Q. (2021), "Short video apps as a health information source: an investigation of affordances, user experience and users' intention to continue the use of TikTok", *Internet Research*, Vol. ahead-of-print No. ahead-of-print.

Turel, O., Matt, C., Trenz, M., Cheung, C.M.K., D'Arcy, J., Qahri-Saremi, H. and Tarafdar, M. (2019), "Panel report: the dark side of the digitization of the individual", *Internet Research*, Vol. 29 No. 2, pp. 274-288.

Wan, Y., Peng, Z., Wang, Y., Zhang, Y., Gao, J. and Ma, B. (2021), "Influencing factors and mechanism of doctor consultation volume on online medical consultation platforms based on physician review analysis", *Internet Research*, Vol. ahead-of-print No. ahead-of-print.

Yang, H., Peng, Z., Guo, X. and Lai, K-H. (2021a), " Balancing online pharmacy services for patient adherence: a stimulus-organism-response perspective", *Internet Research*, Vol. ahead-of-print No. ahead-of-print.

Yang, H. and Gao, H. (2021), "User recommendation in online health communities using adapted matrix factorization", *Internet Research*, Vol. ahead-of-print No. ahead-of-print.

Yang, S., Huang, L., Zhang, Y., Zhang, P. and Zhao, Y. C. (2021b), "Unraveling the links between active and passive social media usage and seniors' loneliness: a field study in aging care communities", *Internet Research*, Vol. ahead-of-print No. ahead-of-print.

Yang, X., Gu, D. Wu, J., Liang, C., Ma, Y. and Li, J. (2021c), "Factors influencing health anxiety: the stimulus-organism-response model perspective", *Internet Research*, Vol. ahead-of-print No. ahead-of-print.

Zheng, H., Sin, S.-C.J., Kim, H.K. and Theng, Y.-L. (2021), "Cyberchondria: a systematic review", *Internet Research*, Vol. 31 No. 2, pp. 677-698.

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