Chiba Medical J. 95E：17－19, 2019
doi:10.20776/S03035476-95E-2-P17

〔Original Article〕

Affinity of health care providers for artificially intelligent robots at bedside in the pediatric intensive care unit

Naoki Shimizu[1)], Makoto Motomura[1,2)], Osamu Saito[1)], and Takanari Ikeyama[1,2)]

[1)] Department of Pediatric Emergency & Critical Care Medicine, Tokyo Metropolitan Children's Medical Center, Tokyo 183-8561. [2)] Department of Critical Care Medicine, Aichi Children's Health and Medical Center, Aichi 474-8710.

（Received August 7, 2018, Accepted August 20, 2018, Published April 10, 2019.）

Abstract

***Background*: Information technology in the medical field has made swift and dramatic progress in recent years. On the other hand, data overload, particularly in the intensive care setting, may pose a problem. Artificially intelligent（AI）robots may supply the solution to the increasing technical complexity of medical care. However, little research has yet been done to study the affinity of health care providers for bedside AI robots in the pediatric intensive care unit（PICU）.**

***Methods*: A bedside AI robot, SotaTM（Viston Co., Ltd.）, was installed in the PICU at Tokyo Metropolitan Children's Medical Center for the AI programming. After the health care providers in the PICU observed the operations of the robot, they were asked to respond to a questionnaire assessing their reactions to the robot.**

***Results*: Twenty-five health care providers were enrolled. Forty-three % of the respondents stated that the robot's recognition of abnormal data（notified by an alarm）was very useful, 76% thought that AI and robots had an important role to play in improving treatment safety, and over 70% thought that the further development of this system was desirable.**

***Conclusion*: In this study, we assessed the affinity of health care providers for a bedside AI robot in a PICU. Current robotic technology is far from mature, but AI and bedside robots in PICU merit serious consideration as future adjuncts to medical care. Properly integrated AI will doubtless improve patient outcomes and health care efficiency.**

***Key words*: Information technology, electronic medical records, department information systems, human error, visualization, risk management**

Ⅰ. Introduction

Recent years have seen astounding progress in information technology including electronic medical records, advanced biological information monitoring systems, and complex medical devices. On the other hand, particularly in the intensive care setting, we are facing the danger of data overload leading to the possibility of a higher rate of oversights, errors, and omissions[1,2].

The role of artificial intelligence（AI）and robots in supporting medical personnel is expected to expand in the coming years. There are already a number of trials evaluating the usefulness of AI[3-6]. However,

Address correspondence to Dr. Naoki Shimizu.
Department of Pediatric Emergency & Critical Care Medicine, Tokyo Metropolitan Children's Medical Center, 2-8-29, Musashidai, Fuchu, Tokyo 183-8561, Japan.
Phone: +81-42-300-5111. Fax: +81-42-312-8160.
E-mail: naoki_shimizu@mac.com

little research has yet been done to assess the affinity of health care providers for bedside AI robots in the pediatric intensive care unit (PICU) setting.

Ⅱ. Materials and methods

A bedside AI robot, Sota™ (Viston Co., Ltd.), was installed in the 20-bed PICU at Tokyo Metropolitan Children's Medical Center (TMCMC) for AI programming. Face and voice recognition was used to log in. Natural language processing was prepared for limited medical scenarios. Voice warning systems were coupled with alarms to indicate anomalies in the biological information monitored at the bedside. A voice warning system was also used to alert physicians of abnormal data in the department information systems (Fig. 1).

The operation of this AI robot was demonstrated to health care providers including pediatric intensivists and nurses in PICU, TMCMC. Afterwards, they were asked to respond to a questionnaire assessing their response to the presence of the robot. The survey also asked about the respondents' views on the viability of the bedside robot, its ability to detect anomalous data, and its role in improving treatment safety.

The demonstration using the robot was performed without interfering with the actual, active medical information systems in the PICU. Any personal information of actual patients was fully protected. The survey was administered with the informed consent of the health care providers. This study was approved by the ethics board of the Medical Research Committee of TMCMC. Publication of the study was approved by the Institutional Review Board of TMCMC.

Fig. 1 Sota™ (Viston Co., Ltd.) bedside AI robot system

Ⅲ. Results

Twenty-five health care providers were enrolled; seven were pediatric intensivists and 18 were nurses. Twenty-percent of the respondents stated that they thought that the current bedside AI robot system was feasible while 14% did not think so (Fig. 2). Nineteen-percent of the respondents thought that the robot's level of recognition of abnormal data and its notification system were on a par with the currently existing systems while 43% thought that they marked an improvement (Fig. 3); 76% believed that robots had a role to play in improving treatment safety (Fig. 4); and more than 70% thought that the use of AI and robotics in medicine would expand in the future.

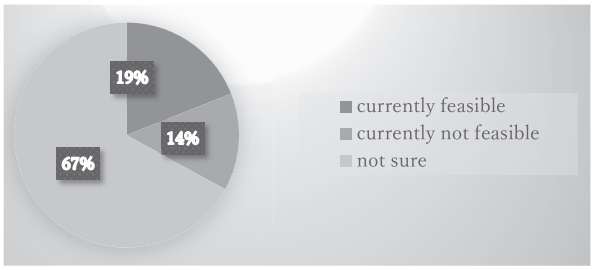

Fig. 2 Results of questionnaire for feasibility of the bedside AI robot

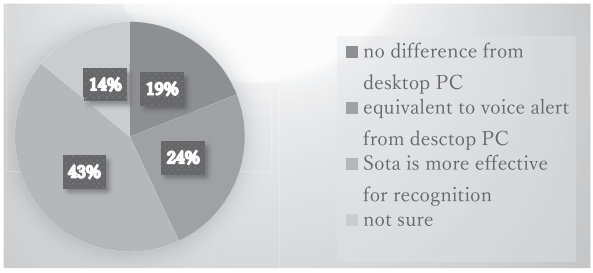

Fig. 3 Results of questionnaire for merits of detecting anomalies

Fig. 4 Results of questionnaire for role in treatment safety

Ⅳ. Discussion

The amount of data not only on patients' vital signs and nursing observation, but also on laboratory findings and settings for ventilators, dialyzers, extracorporeal life support apparatuses, and even infusion pumps in the ICU is rapidly increasing, and the ICU data bundle is now recognized as a major source of big data[7].

This data set is now too immense for human beings to use effectively in real time, real world settings without oversights or errors. New visualization modalities have helped to improve monitoring of sick patients in the ICU but have failed to eliminate human error due to recognition failure.

AI deep learning and robotics are expected to play an ever-expanding role in supporting medical personnel in the future. More trials are being conducted to evaluate the usefulness of AI and robots. A critical care robot system improved the quality of care and financial outcomes in one study[3]. AI can also predict the onset of severe sepsis using physiomarkers in critically ill children[4]. Predictive models created by AI and machine learning may lead to earlier detection of patients at risk for clinical decompensation and thereby improve care for critically ill pediatric cardiac patients [5].

In this study, we demonstrated the affinity of health care providers for a bedside AI robot in a PICU. About half of the personnel thought that the alerts issued by the robot to warn of detected anomalies was more effective than the current desktop-based system. Over 70% of respondents stated that they expect future expansion of the role of AI in risk management and improving treatment safety.

The current AI and robotic technology is obviously far from mature, and only 20% of the respondents stated that they were satisfied with the quality of the technology. Nonetheless, AI and bedside robots for the ICU merit further, serious consideration. In the meantime, we should also be aware of the capabilities as well as limitations of current AI[8]. A properly integrated AI system will doubtless improve patient outcomes and health care efficiency.

Author contributions

NS conceived and designed the study, collected, analyzed, and interpreted the data. NS, MM, OS, and TI were involved in writing and reviewing the manuscript.

Acknowledgements

I would like to thank Mr. Yoshihiro Shindo for his assistance with developing and programming this Sota™. I also would like to thank Mr. James Robert Valera for his assistance with editing the manuscript.

Conflict of interest

The authors declare that they have no conflicts of interest, either financial or non-financial, with the context of this article, except for the public grant from Tokyo Metropolitan.

References

1) Duarte Sda C, Queiroz AB, Büscher A, Stipp MA. (2015) Human error in daily intensive nursing care. Rev Lat Am Enfermagem 23, 1074-81.
2) De Franco S, Rizzollo S, Angellotti P, Guala A, Stival G, Ferrero F. (2014) The error in neonatal intensive care: a multicenter prospective study. Minerva Pediatr 66, 1-6.
3) Murray C, Ortiz E, Kubin C. (2014) Application of a robot for critical care rounding in small rural hospitals. Crit Care Nurs Clin North Am 26, 477-85.
4) Kamaleswaran R, Akbilgic O, Hallman MA, West AN, Davis RL, Shah SH. (2018) Applying artificial intelligence to identify physiomarkers predicting severe sepsis in the PICU. Pediatr Crit Care Med 26, [Epub ahead of print].
5) Olive MK, Owens GE. (2018) Current monitoring and innovative predictive modeling to improve care in the pediatric cardiac intensive care unit. Transl Pediatr 7, 120-8.
6) Desautels T, Das R, Calvert J, Trivedi M, Summers C, Wales DJ, Ercole A. (2017) Prediction of early unplanned intensive care unit readmission in a UK tertiary care hospital: a cross-sectional machine learning approach. BMJ Open 7, e017199.
7) Rush B, Stone DJ, Celi LA. (2018) From big data to artificial intelligence: Harnessing data routinely collected in the process of care. Crit Care Med 46, 345-6.
8) Tarassenko L, Watkinson P. (2018) Artificial intelligence in health care: enabling informed care. Lancet 391, 10127.