News Release

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Hitachi announces pharmacotherapy outcome prediction technology for drug selection support in type-2 diabetes mellitus
Data-driven approach to support pharmacotherapy selection

Tokyo, November 6, 2017 --- Hitachi, Ltd. (TSE: 6501, Hitachi) today announced the development of a machine learning-based outcome prediction and comparison technology that predicts with high accuracy the success and failure of various medication options for patients with type-2 diabetes mellitus (T2DM), in collaboration with University of Utah Health ("U of U Health"). The technology analyzes electronic medical records and creates a prediction model which calculates the probability of different medications attaining a target value for hemoglobin A1c (HbA1c)[1] after 90 days of commencing treatment, thus potentially helping medical practitioners choose the most effective medication option. The high accuracy[2] of the technology in predicting the effectiveness of various medications was confirmed using simulation on past records of patients with diabetes.

Currently, the importance of value-based healthcare, which aims to realize both better outcomes while reducing healthcare costs, is receiving attention worldwide. In the United States, the number of patients with diabetes has risen to about 23 million, and one in four people over the age of 65 is diagnosed with T2DM[3]. Treatment of T2DM spans from several months to several years or more, during which time the drug(s) selected and the dosage(s) need to be adjusted based on the patient's condition. This significant variability in pharmacotherapy regimens often leads to a trial-and-error approach in drug selection.

Hitachi has been working on developing various measures to address diabetes using IT, such as life-style modification support and diabetes prevention services [4]. In this research collaboration, the knowledge and experience of Hitachi, and doctors, pharmacists and biomedical informaticists at the U of U Health, were used to develop technology to predict the probability of achieving a treatment target with each medication. In developing the technology, data from approximately 6,800 patients were analyzed chronologically from various aspects such as drug category, dosage, treatment period, weight, trend in test results, etc. Machine learning techniques were then applied to the resulting information to build a prediction model for HbA1c, generating patient-specific predictions of the effectiveness of alternate treatment

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options. Using the resulting model, it is possible to predict and compare the effectiveness of treatment at 90-days, a common period in the United States between clinic visits for patients whose diabetes therapy is being adjusted. As a result, the technology has the potential to support the selection of the most effective medication depending on the patient's background and condition. The technology was verified using data from another 2,200 patient files by simulation, and the highly accurate nature of the predictions was confirmed.

Hitachi will continue this collaborative research with U of U Health to realize the practical application of this technology and its development of healthcare informatics technologies that support medical practitioners and patients with improved healthcare outcomes[5]. Additionally, part of these results will be presented at the IEEE-NIH Special Topic Conference on Healthcare Innovation and Point-of-Care Technologies to be held from 6th to 8th November 2017, in Bethesda, Maryland, U.S.A.

(1) HbA1c：Laboratory test value which reflects average blood sugar level for the past two to three months.
(2) AUC (Area Under the Curve) of 0.85. The area under the Receiver Operator Curve (ROC) represents prediction model performance with a value range from 0.5 to1 (ideal).
(3) Centers for Disease Control and Prevention. National Diabetes Statistics Report, 2017. Atlanta, GA: Centers for Disease Control and Prevention, U.S. Dept of Health and Human Services; 2017 https://www.cdc.gov/diabetes/pdfs/data/statistics/national-diabetes-statistics-report.pdf
(4) For more information on Hitachi's services, please reference: Proof of Concept Project for a Diabetes Prevention Service in Greater Manchester, United Kingdom. *A Hitachi Review, 64* (No. 1): http://www.hitachi.com/rev/pdf/2015/r2015_01_102.pdf
(5) Implementation of this technology will require due diligence to ensure sufficient protection of personal information and privacy.

About Hitachi, Ltd.
Hitachi, Ltd. (TSE: 6501), headquartered in Tokyo, Japan, delivers innovations that answer society's challenges. The company's consolidated revenues for fiscal 2016 (ended March 31, 2017) totaled 9,162.2 billion yen ($81.8 billion). The Hitachi Group is a global leader in the Social Innovation Business, and it has approximately 304,000 employees worldwide. Through collaborative creation, Hitachi is providing solutions to customers in a broad range of sectors, including Power / Energy, Industry / Distribution / Water, Urban Development, and Finance / Government & Public / Healthcare. For more information on Hitachi, please visit the company's website at http://www.hitachi.com.

About University of Utah Health
University of Utah Health is the state's only academic health care system, providing leading-edge and compassionate medicine for a referral area that encompasses 10% of the U.S. A hub for health sciences research and education in the region, U of U Health has a $291 million research enterprise and trains the majority of Utah's health care professionals at its Schools of Medicine and Dentistry and Colleges of Nursing, Pharmacy and Health. Staffed by more than 20,000 employees, the system includes 12 community clinics and four hospitals. For eight straight years, U of U Health has ranked among the top 10 U.S. academic medical centers in the Vizient Quality and Accountability Study, including reaching No. 1 in 2010 and 2016.

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