R&D Theme

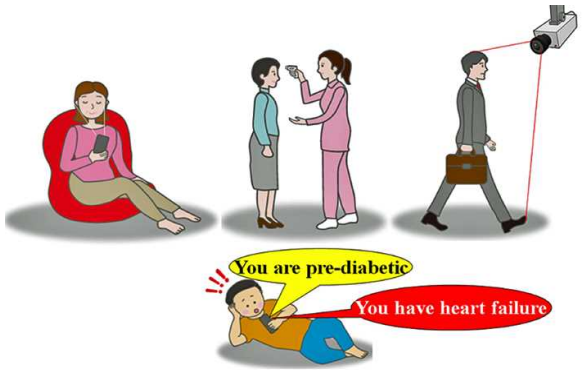
Development of technology for easy acquisition of biometric data in humans and analysis of human data

Progress until FY2022

1. Outline of the project

This R&D theme is responsible for the development and social implementation of a method to detect and predict the early stages of diabetes and its co-morbidities as simply and non-invasively as possible based on the analysis of biological information, genome, and hepatic glucose uptake capacity using contact and non-contact devices (See figure below).

To achieve this, we are working on creating a highly accurate early diabetes detection algorithm, improving the accuracy of the diabetes omnigenic model, and collecting data from the $^{13}CO_2$ breath test as challenging themes. We are working on the concept of early detection of diabetes and heart failure from non-invasive devices only, which is completely different from conventional methods, using high-speed spectral cameras, AI, cohort data analysis, and other methods.



https://www.moonshot-katagiri.proj.med.tohoku.ac.jp/research-e.html

2. Outcome so far

(1) Establishment of a system that displays the degree of heart failure over time using a contact device (lower figure)

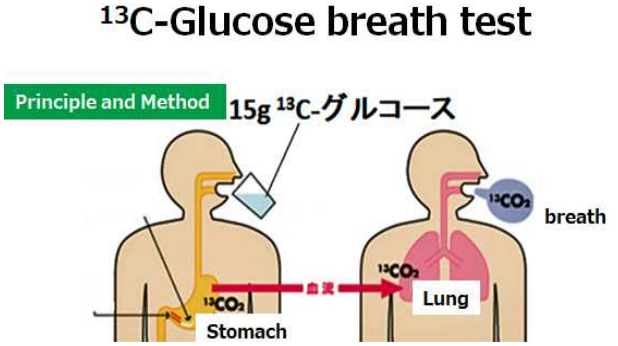
(2) Development of an algorithm (HF-index) that can be used to estimate blood BNP levels from electrocardiograms obtained with a contact device and use them for alerts

(3) Non-contact detection of blood pressure from mouse skin using a spectral camera

(4) Detecting high polygenic risk scores by measuring risk prediction performance using large-scale genomic data

(5) Cohort study found a correlation between 1-hour post-glucose tolerance and subsequent life expectancy and a cutoff value of 170 mg/dL in human normal glucose-tolerant subjects

(6) Elucidated the cause of death in human normal glucose-tolerant subjects with postprandial glucose intolerance >170 mg/dL



(7) Proved the importance of hepatic glucose uptake capacity in determining postprandial blood glucose in humans (upper figure)

In the above, (1) is in the process of being IP-enabled. (2) is in the process of filing for IP and conducting clinical trials. In (7), the ^{13}C-glucose breath test, a simple test for glucose uptake by the liver, has patented as an intellectual property.

3. Future plans

In order to enable early detection of hypertension and diabetes by non-invasive devices, we will acquire data from 200 to 300 patients and healthy subjects, and try to create and evaluate algorithms. This will enable the evaluation of diabetes and its concomitant diseases in the human condition using non-invasive biometric devices.

For the $^{13}CO_2$ breath test, we will also try to accumulate data on a 75 g ^{13}C -glucose load in order to link it to the data related to life expectancy obtained in the Ohasama cohort. This will allow us to examine the relationship between sugar processing and glycoxidation by the $^{13}CO_2$ breath test and to estimate its relationship to the prognostic impact of the cohort.