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STUDY PROTOCOL

Database profile of the Fukuoka-City Information Platform for Community-based Integrated Care

Takanori Honda[1,2,*], Hiroko Furuhashi[2,*], Yoshihiko Furuta[2,3], Shoko Tomooka[2,4,#], Takahiro Tajimi[2,5,6,#], Fumi Nagasawa[2], Emi Oishi[1,2,3], Yasumi Kimura[2,7], Daigo Yoshida[2,8], Toshiharu Ninomiya[1,2]

ABSTRACT

BACKGROUND

The Fukuoka-City Information Platform for Community-based Integrated Care is an advanced big data platform that aggregates information on the health and medical services of Fukuoka citizens. Fukuoka City is engaged in a joint project with Kyushu University to promote policy making through a large-scale real-world data analysis. This paper describes the framework for this cooperative effort and the features of the analytical platform.

METHODS

Fukuoka City is the fifth most populous ordinance-designated city in Japan, with an estimated population of approximately 1.6 million. Under an agreement with Fukuoka City, Kyushu University was granted access to a portion of the city's anonymized healthcare database as secondary-use information. The database contains information on resident registration, health insurance claims, specific health checkups and health checkups for the older adults, specific health guidance, long-term care insurance data, and cancer screenings collected after fiscal year 2012. Each of these constituent datasets can be interlinked using anonymized hashed key variables, allowing individuals to be followed across databases and over time.

CONCLUSIONS

The platform allows longitudinal investigation of the complex association between various aspects of healthcare, such as medical procedures, examinations, interviews, medical costs, long-term care certifications, and care costs. The platform can provide valuable public-health information because it is relatively large for a single database, and because it allows analysis of data across multiple domains and tracing of individuals over time.

KEY WORDS

database profile, administrative claims, health checkups, long-term care, cancer screening

[1] Center for Cohort Studies, Graduate School of Medical Sciences, Kyushu University
[2] Department of Epidemiology and Public Health, Graduate School of Medical Sciences, Kyushu University
[3] Department of Medicine and Clinical Science, Graduate School of Medical Sciences, Kyushu University
[4] Section of Geriatric Dentistry and Perioperative Medicine in Dentistry, Division of Maxillofacial Diagnostic and Surgical Sciences, Faculty of Dental Science, Kyushu University
[5] Department of Orthopaedic Surgery, Graduate School of Medical Sciences, Kyushu University
[6] Emergency and Critical Care Center, Kyushu University Hospital
[7] Department of Health Nutrition, Faculty of Health Sciences, Hiroshima Shudo University
[8] Division of Community Health Nursing and Home Care Nursing, Graduate School of Nursing, Fukuoka Nursing College

Corresponding author: Toshiharu Ninomiya
Department of Epidemiology and Public Health, Graduate School of Medical Sciences, Kyushu University, Maidashi 3-1-1, Higashi ward, Fukuoka City 812-8582, Japan
E-mail: t.ninomiya.a47@m.kyushu-u.ac.jp

*Authors contributing equally to this work

#Authors contributing equally to this work.

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INTRODUCTION

The Data Health Plan drawn up by the Cabinet of Japan mandates that all medical insurers analyze the health information of their enrollees in order to anticipate and prevent diseases. The plan has been treated as a priority initiative in preventive medicine and health management in Japan order to promote a healthy aging society [1]. However, the challenge is that data on health information is often stored and operated independently by different entities, or by different departments even within the same municipality [2]. To address this issue, the Health Insurance Act was recently amended to establish a system for the Integrated Implementation of Health Services for the Older Adults and Long-term Care Prevention, which aims to realize the independence and social participation of a community's older residents by providing tailored support for each. This situation calls for the establishment of a system in each municipality to analyze health information across the life course, including data on healthcare, long-term care, and health checkups and screening programs, and to reflect this information in policy making.

The Fukuoka-City Information Platform for Community-based Integrated Care is an advanced big data platform that aggregates the health and medical services information of individual Fukuoka citizens, including information on health insurance claims and long-term care insurance, as well as specific health checkups and specific health guidance. As part of Fukuoka City's project to create a sustainable society, known as *Fukuoka 100* [3], Fukuoka City and Kyushu University are implementing a joint project to achieve "effective policy planning and information dissemination based on scientific evidence" [4]. This project aims to promote evidence-based policy making through data analysis and surveys. This paper describes the framework for this cooperative effort and the features of the platform and its constituent datasets.

METHODS

GEOGRAPHICAL AND DEMOGRAPHIC INFORMATION OF FUKUOKA CITY

Fukuoka City is the capital of Fukuoka prefecture. It is located in the western part of Fukuoka Prefecture and consists of seven administrative wards with a combined area of approximately 343 km^2. Fukuoka City is the fifth most populous of the ordinance-designated cities in Japan: it has an estimated population of approximately 1.63 million (21.3% of whom are 65 years old or older) as of January 1, 2023, and a population density of ~4,700 persons/km^2 (**Fig. 1**). Foreign residents account for ~3% in the population of Fukuoka City, slightly higher than the national average. Unlike the rest of Japan, where the population continues to decline, Fukuoka City's population continues to grow. This is mainly due to an excess of

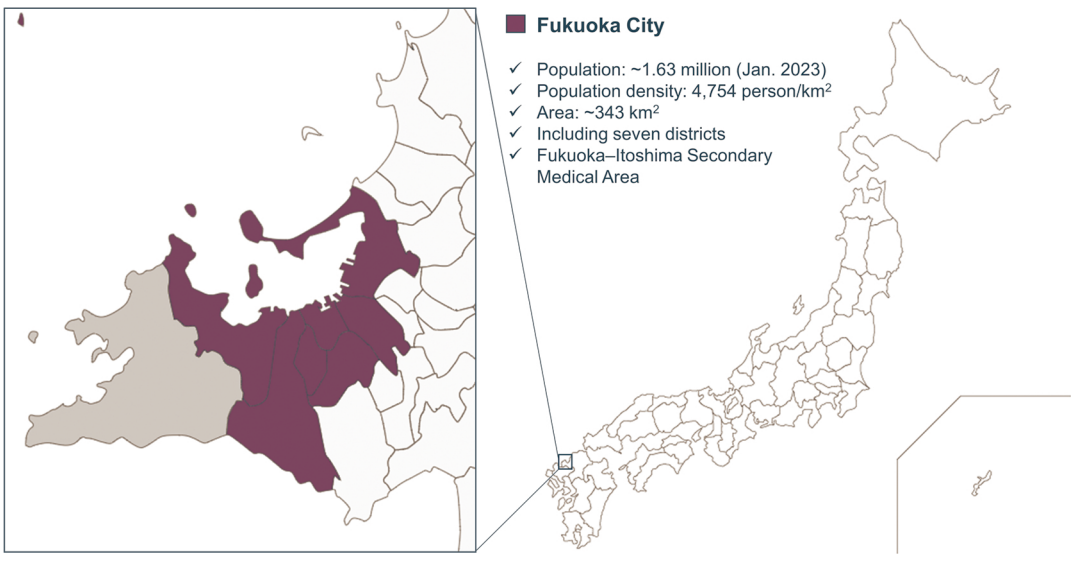

Fig. 1 **Location and basic information of Fukuoka City.**

The area colored purple is Fukuoka City, with the boundaries of the seven administrative wards outlined. The gray area to the west is Itoshima City, which together with Fukuoka City constitutes the Fukuoka–Itoshima Secondary Medical Area.

young to middle-aged people moving into the city.

Fukuoka City, together with the neighboring Itoshima City, makes up the Fukuoka–Itoshima Secondary Medical Area. In terms of population, 94% of the residents of the medical area are citizens of Fukuoka City, and thus the medical resources of the Fukuoka–Itoshima Secondary Medical Area mostly reflect those of Fukuoka City. As for the distribution of healthcare resources, **Fig. 2** compares the numbers of clinics, hospitals, beds, medical specialists, and long-term care facilities in the Fukuoka–Itoshima Secondary Medical Area with the national average, based on data from the Japan Medical Analysis Platform (http://jmap.jp/). Fukuoka City has two Special Functioning Hospitals (also referred to as Advanced Treatment Hospitals in the Medical Care Act) and ten Regional Medical Care Support Hospitals, making the local healthcare resources in Fukuoka City more abundant than the national averages in Japan.

OVERVIEW OF THE DATA PLATFORM

The Fukuoka-City Information Platform for Community-based Integrated Care (hereafter, the platform) consists of a data aggregation system known as the *Care Base* and a data analysis system called *Care Vision* [5]. The *Care Base* is a database that aggregates the big data that Fukuoka City possesses on healthcare insurance, long-term care, health checkups, etc., by linking it to resident-registry information. Because the data stored in the *Care Base* are linked at the individual level, it is possible not only to analyze cross-sectionally between databases in different domains, but also to examine associations longitudinally. The *Care Vision* is a graphical user interface for data analysis that allows Fukuoka City staff to read and use information from the *Care Base* for practical purposes.

Under the agreement, Kyushu University was granted access to a portion of the database included in the *Care Base* as text data in order to perform data handling and advanced statistical analysis. The portion of the database

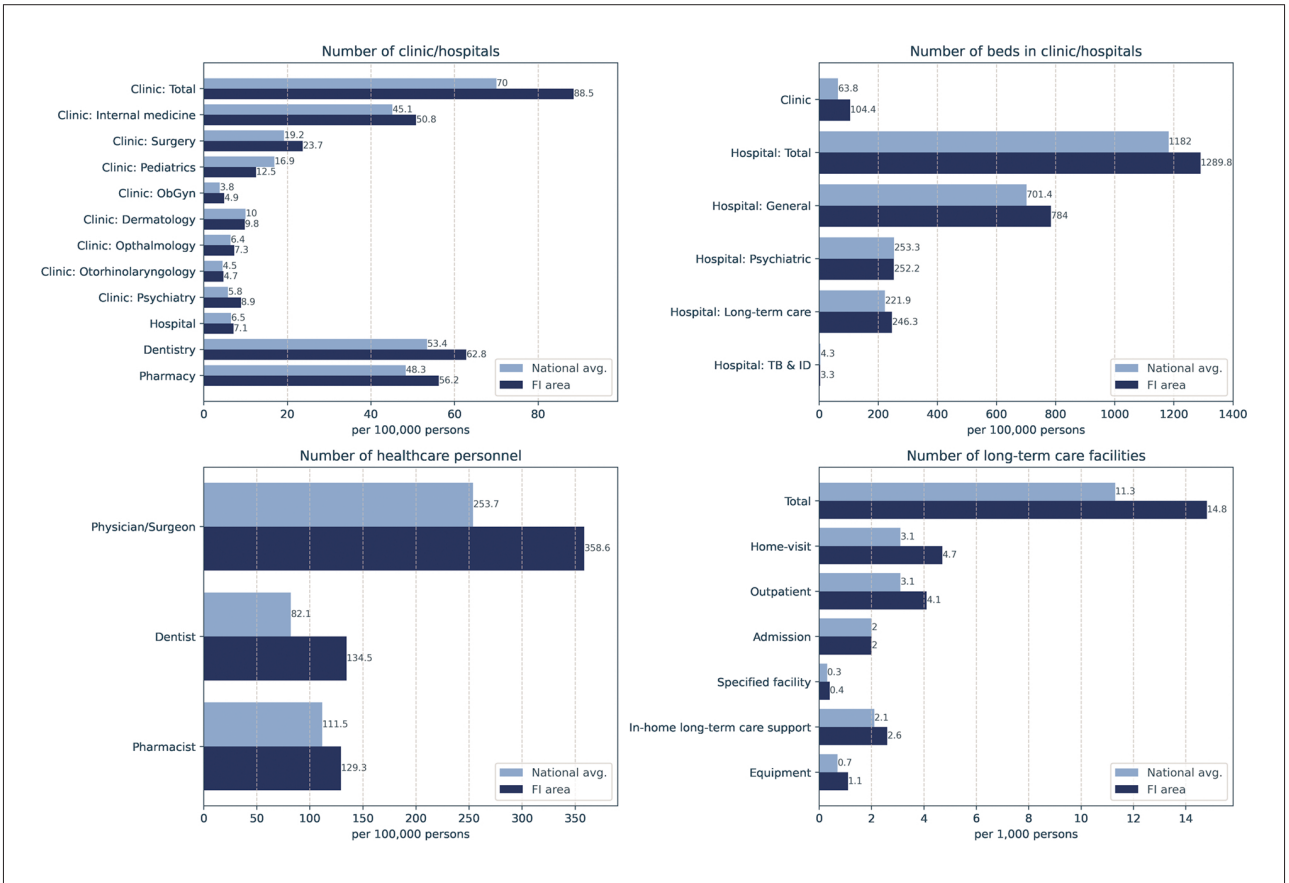

Fig. 2 Healthcare resources in the Fukuoka–Itoshima Secondary Medical Area.

Data were obtained from the Japan Medical Analysis Platform (http://jmap.jp/) provided by the Japan Medical Association. The numbers of medical facilities and long-term care facilities were those in the region as of November 2022 and September 2022, respectively. The values were calculated using the 2020 Census total population as the reference population.
FI area, Fukuoka–Itoshima Secondary Medical Area; ObGyn, obstetrics and gynecology; TB, tuberculosis; ID, infectious diseases.

provided to Kyushu University contains information on resident registration, health insurance claim data, data on specific health checkups and health checkups for the older adults, long-term care insurance data, and cancer screening since fiscal year 2012. Each of these datasets can be interlinked using anonymized hashed key variables, allowing individuals to be followed across databases and over time.

Since the purpose of this project is to analyze data and make policy recommendations in a timely manner as a joint project with Fukuoka City, no specific hypothesis was established prior to the start of the project.

ETHICAL CONSIDERATIONS FOR THE OVERALL PROJECT AND THE ANALYTICAL ENVIRONMENT

This project was approved by the Kyushu University Institutional Review Board for Clinical Research (2021-254). This project is being conducted as a secondary use of information collected by Fukuoka City. Fukuoka City and Kyushu University signed an agreement including personal information protection. Fukuoka City asked a system vendor to hash the IDs and create an anonymized database, which was then provided to Kyushu University. A secure analysis environment was established at Kyushu University in order to permit data access only to authorized individuals and to ensure that the raw data could not be rewritten or taken out from the server. The data were stored on a dedicated server isolated from the Internet in a locked room, where only the database administrator has access to this server room. The data could be analyzed by remote access from a read-only PC terminal installed in another locked room. An account was set up for each analyst on the PC in the analysis room, and an access record for each analyst was kept. Only summary data were allowed to be taken out. Restrictions on access permission prevented unauthorized data extraction and data falsification.

DETAILED DESCRIPTIONS OF AND THE NUMBER OF RECORDS IN EACH DATASET

Table 1 describes the types and features of the provided datasets. In Japan, there are three types of public health insurance that collectively cover the entire population: Employee Health Insurance for employees and their families, National Health Insurance for those aged less than 74 years who are not covered by the Employee Health Insurance, and a Late-Stage Medical Care System for the Older Adults for those aged 75 and over. In Fukuoka City, approximately 20% of the population are covered by the National Health Insurance system, approximately 10% by the Late-Stage Medical Insurance System for the Older Adults, and the remaining 70% by Employee Health Insurance. In addition, residents aged 65 and over are also insured by long-term care insurance as the *primary*

Table 1 Types and characteristics of datasets included in the platform

Types	Tables	Description
Population	Resident registration Transfer Death Birth	Data were extracted from the Basic Resident Registration System. The data included information on monthly demographics, transfers in and out, births, and deaths for all citizens.
Health insurance claims	Health insurance eligibility Hospital visit Disease (a) Profile Disease (b) E-file F-file	Data included information of persons who were insured by National Health Insurance and Late-Stage Medical Care System for the Older Adults. Administrative claim data included medical, dental, and dispensing receipts. Profile, disease (b) and E- and F-files are reformatted datasets like DPC data, with some information largely overlapping with the hospital visit and disease (a) data.
LTC insurance claims	LTC insurance eligibility LTC service utilization Preliminary judgment Screening/judgment	Data included information on coverage of LTC insurance and claim data for LTC service utilization. Data also included information on the results of the assessment for certification.
Health checkups	Health checkup eligibility Specific health checkup Specific health guidance	Data included information on attendance and examination results of Specific Health Checkups and Specific Health Guidance.
Cancer screening	Cancer screening	Data included information on participation in cancer screenings.

LTC, long-term care

insured persons, and they can receive long-term care insurance services upon certification, regardless of the cause of their long-term care condition. Those aged 40–64 are the *secondary* insured persons who are insured by long-term care insurance, while utilization of long-term care insurance services for the secondary insured persons is limited to patients with specified diseases. Specific health checkups and specific health guidance are conducted for insured persons in the public healthcare insurance system aged between 40 and 74 years. Cancer screening is a health promotion program conducted by municipalities for residents for several types of cancer, targeting specific age groups for each test. All data are collected and stored in a publicly defined format with the municipality as the operating entity.

Fig. 3 shows the number of records included in each dataset in the platform. The population dataset (Panel A) includes monthly record counts from the fiscal year 2012 to 2021. As shown in the figure, the population steadily increased over this period. The number of insured persons decreased overall, with a decrease in National Health Insurance enrollees and an increase in the number of insured persons in the Late-Stage Medical Care System for the Older Adults (Panel B). The total number of claim records increased, with the number of inpatient receipts remaining almost unchanged, while outpatient and dispensing receipts increased (Panel C). The number of dental receipts were very limited in the initial approximately three years; this is because data had not been fully linked to the database at that time. The long-term care

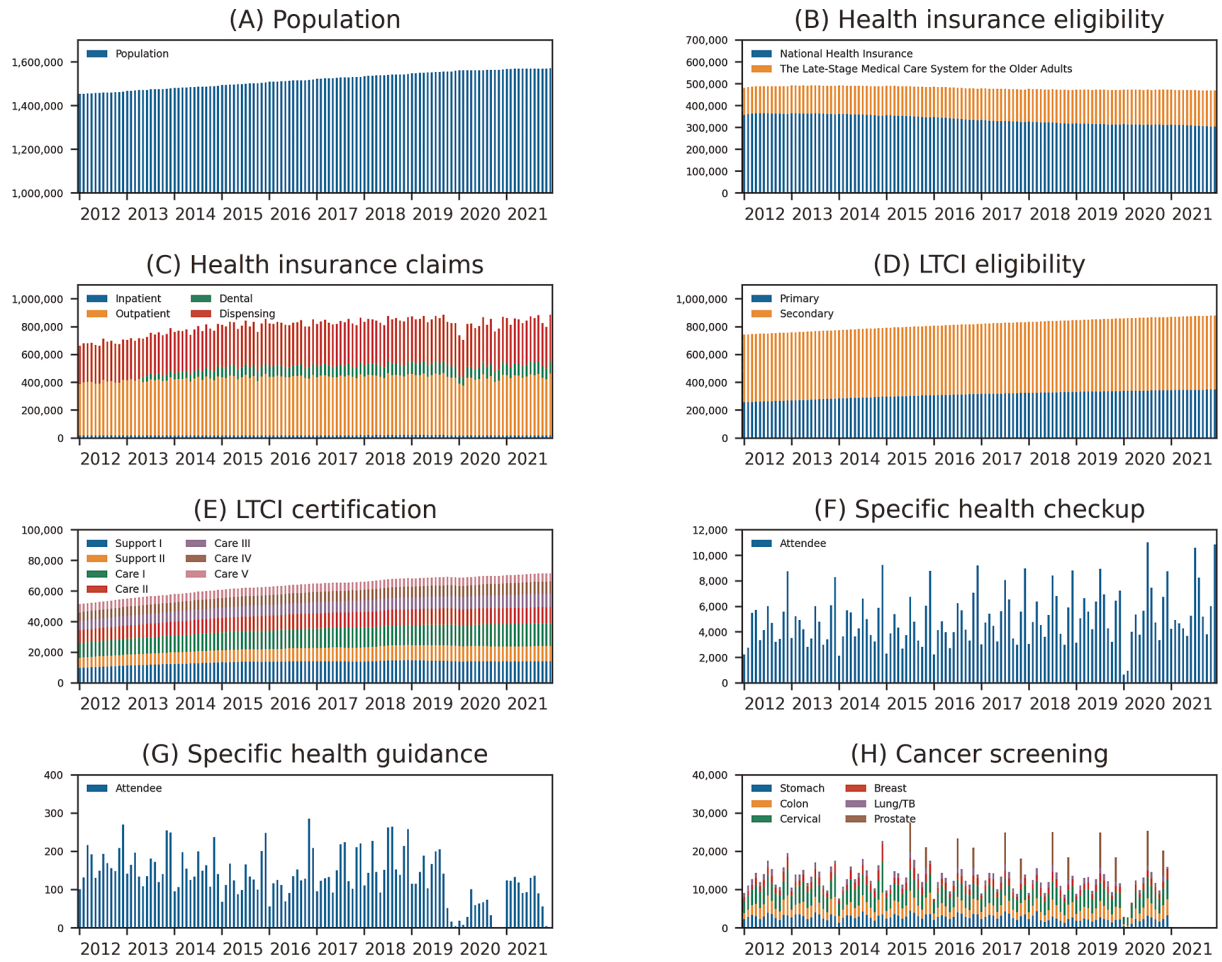

Fig. 3 **Number of records in data included in the platform.**

Each panel represents the number of records per month for the dataset listed in each title. The horizontal axes indicate the fiscal year, and the graduation marks represent April of each year. Due to differences in the turnaround and timing of data aggregation, the numbers do not necessarily correspond to the data officially published by Fukuoka City.
TB, tuberculosis.

insurance data shows the number of insured persons (Panel D) and the number of persons certified as requiring long-term care (Panel E). The number of persons insured by long-term care insurance increased in both Category 1 and Category 2, reflecting the increase in the population and also the aging of the population. The number of persons certified as requiring long-term care generally increased, except in the case of those requiring Care level 5. The number of persons receiving specific health checkups increased slightly over the period examined (Panel F). On the other hand, the number of persons receiving specific health guidance remained unchanged (Panel G), and a sharp drop in the number of individuals specific health guidance during the COVID-19 pandemic was observed. The number of individuals who received cancer screening is shown for six types of screening (Panel H). The number of records for the cancer screenings were generally unchanged in all screening tests. Records of cancer screening in FY 2021 were not received at the time of analysis.

In collaboration with several departments of the municipal government of Fukuoka City, the Kyushu University study team holds regular consultations on Fukuoka City's medical and health policies. These consultations are taken into account when determining the analysis policy on the platform. Several topics have already been analyzed, including specific health checkups, oral health, fractures and subsequent long-term care needs, and COVID-19 infection and lifestyle behaviors. Reports on these analyses are available on the Fukuoka City website [6].

DISCUSSION

This paper described the framework for the joint project between Fukuoka City and Kyushu University and the characteristics of the data platform including healthcare insurance, long-term care insurance, and health checkup databases. The advantages of the platform are that it is large-scale, with a population size of ~1.6 million, and that it allows different types of health information for an individual patient to be linked, and to be followed across time. The platform is thus valuable as an epidemiological database that enables longitudinal investigation of the complex association between various measures such as medical procedures, examinations, interviews, medical costs, long-term care certifications, and care costs.

Efforts to link multiple databases for health insurance, long-term care, and health checkups on a national scale include the National Database of Health Insurance Claims and Specific Health Checkups of Japan (NDB) and the Kokuho database (KDB). As compared to these databases, the platform described herein has the advantages of allowing analysis based on regional characteristics of the data. Also, similar efforts have been made to link healthcare databases held by single or multiple local governments [7–9]. Our project is based on a relatively large single database and can link data over a long period of time from 2012 to the present. The data are stored in a publicly standardized manner, making the findings highly comparable to the findings in other related studies.

The strengths of our project are that the platform is large-scale and allows for analysis of linked health insurance claim, long-term care, and health checkup datasets, and individuals can be traced longitudinally. The database is useful for policymakers to understand trends in healthcare resource utilization; people's access to healthcare; and quality of healthcare. Researchers can utilize this database for clinical studies, epidemiological studies, health services research, and health economics and policy research. In addition, the data were recorded in a standardized manner in accordance with laws and regulations.

Several limitations should also be noted. First, since the information is limited to one municipality, Fukuoka City, it is not necessarily representative of the Japanese population as a whole, limiting its generalizability. It will be necessary to interpret the data with particular attention to geographical characteristics and the fact that Fukuoka City is a relatively large, ordinance-designated city. Second, the claim data were limited to the claims of individuals insured by the National Health Insurance or the Late-Stage Medical Care System for the Older Adults. In addition, examination data in hospitals or clinics could not be obtained. Third, the participation rate of specific health checkups was low compared to the national average, which may have caused selection bias in the relevant findings.

In conclusion, this report introduced a joint project between Fukuoka City and Kyushu University with the goal of achieving policy advocacy through analysis of big data. The platform is expected to provide valuable information for public health because it is relatively large for a single database, and because it allows analysis of data from multiple domains and tracing of individuals over time. Working closely with Fukuoka City, the research team will continue to promote a number of studies to provide findings that contribute to public health.

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CONFLICT OF INTEREST

TN received a commissioned research fund for the Fukuoka City health promotion policy. TN is a member of the Fukuoka 100 Project Promotion Council of Fukuoka City. DY is a member of the Liaison Conference on Specific Health Checkups and Specific Health Guidance. The other authors have no competing interests to declare.

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