

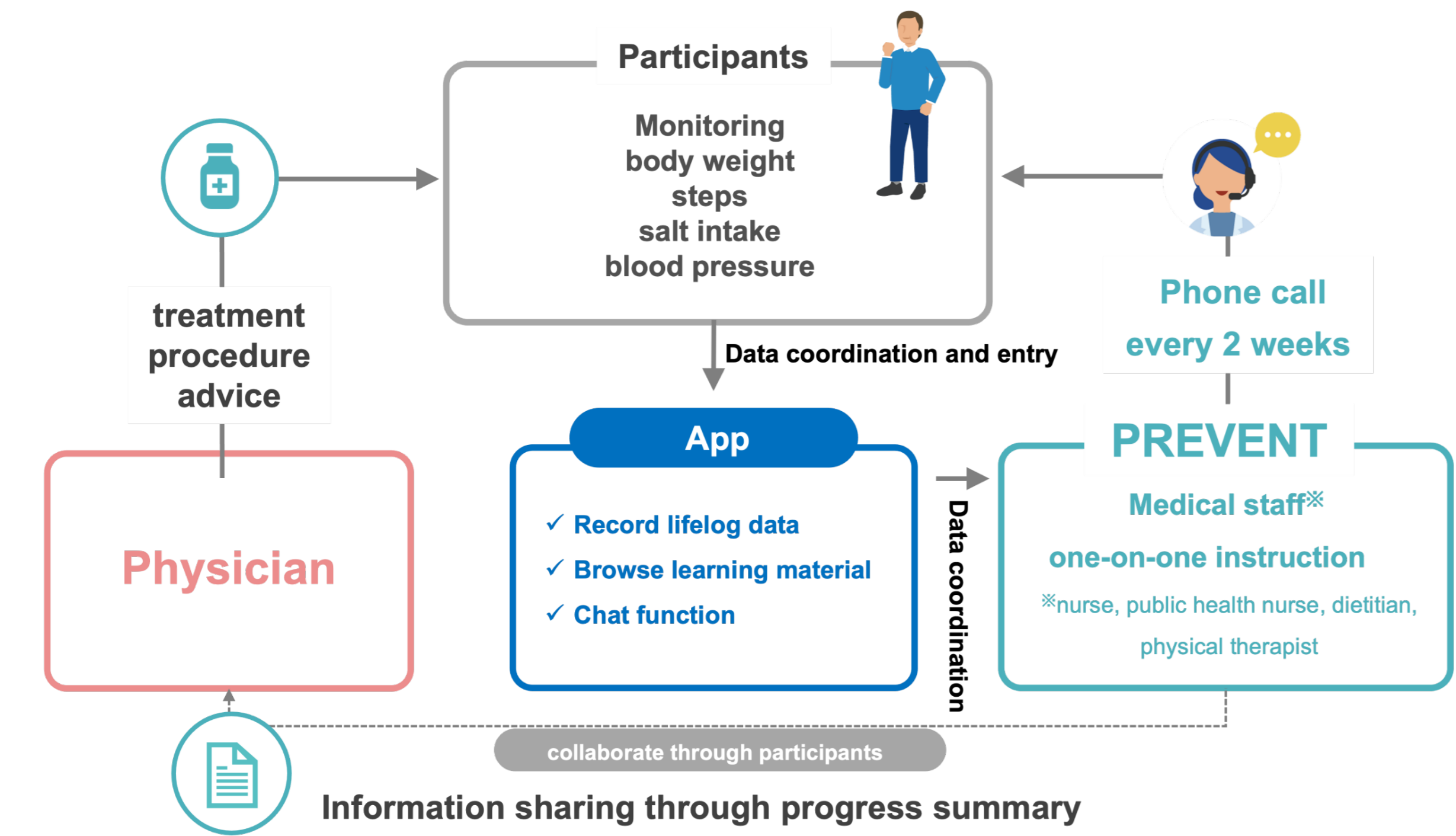
Effects of Mobile Health-Based Personalized Disease Management Program Intervened by Health Professionals Through a Mobile App and Telephone Interviews in Reducing Medical Costs

Kojiro Yamamoto¹, Kosuke Iwasaki², Yuta Hagiwara¹, Tomomi Takeshima²
¹Prevent Inc., Nagoya, Japan, ²Milliman Inc., Tokyo, Japan

Background

- Lifestyle modification is considered effective in preventing the occurrence and progression of diseases, and lifestyle interventions considering individual health status are desirable.
- A disease management program has been provided by Prevent Inc.(Figure 1).
 - ✓The program is a six-month intervention program to individuals with a history of hypertension, diabetes, or dyslipidemia to prevent progression and recurrence of the diseases.
 - ✓The program includes telephone interviews with health professionals every 2 weeks and chat communications through a dedicated mobile app.
 - ✓The app is also used for recording lifelog data (body weight, physical activity, salt intake, blood pressure) and distribution of education contents, which contribute to personalize the program.
 - ✓The participants self-monitor their health condition using the mobile app.
 - ✓The participants attend the program after obtaining approval from their attending physicians, and the program is implemented in collaboration with the attending physicians, including sharing a progress summary every 2 month.
- Although various mobile apps for disease management are available, adherence to disease management remains a challenge. Personalized programs may contribute to improve adherence compared to non-personalized programs, resulting in improving health status and reducing healthcare costs.
- We evaluated the effect of this program in reducing healthcare costs.

Figure 1. Overview of the disease management program



Based on Kanai, et al (2022) [1]

Methods

Study design

- Medical examination data from the program participants were analyzed to evaluate changes in excess medical costs.
- To estimate the excess medical costs in the program participants, a linear model explaining the relationship between the excess medical costs and medical examination data was developed using data from insureds of health insurance societies.

Participants and data collection

- Data from participants of the disease management program
 - ✓Participants of the program: people with systolic blood pressure (SBP) ≥ 140 mmHg, hemoglobin (Hb) A1c $\geq 6.5\%$, or high-density lipoprotein cholesterol (HDL-C) < 40 before the program.
 - ✓Data collection: medical examination data including body mass index (BMI), SBP, triglyceride, HDL-C, HbA1c, and estimated glomerular filtration rate (eGFR) were collected before and after the 6-month program.
- Same items of medical examination data and medical costs data were collected from insureds of health insurance societies.
- All the data were collected, managed, and provided by Prevent Inc.

Analysis

1. A model explaining the relationship with the excess medical costs was developed for each item of medical examination data.
 - ✓Excess medical costs per member per month (PMPM) were defined as excess costs over the average medical costs PMPM in the same age and sex of the insureds.
 - ✓The model was developed using a linear model with excess medical costs as an explained valuable and modified values of each item of medical examination data as explanatory variables.
 - ✓Modified value is a linear combination of each item in order to fit to the linear model.
 2. Excess medical costs for the participants before and after the program were estimated using the model. Missing data were imputed by the multiple imputation method using the SAS PROC MI.
 3. The change in the excess medical costs before and after the program was evaluated.
- SAS version 9.4 (SAS Institute, Cary, NC) was used for the analyses.

Results & Discussions

Participants

- Data from 1,703 participants were collected.
- Table 1 represents the medical examination data before and after the program.

Table 1. Medical examination data before and after the 6-month disease management program

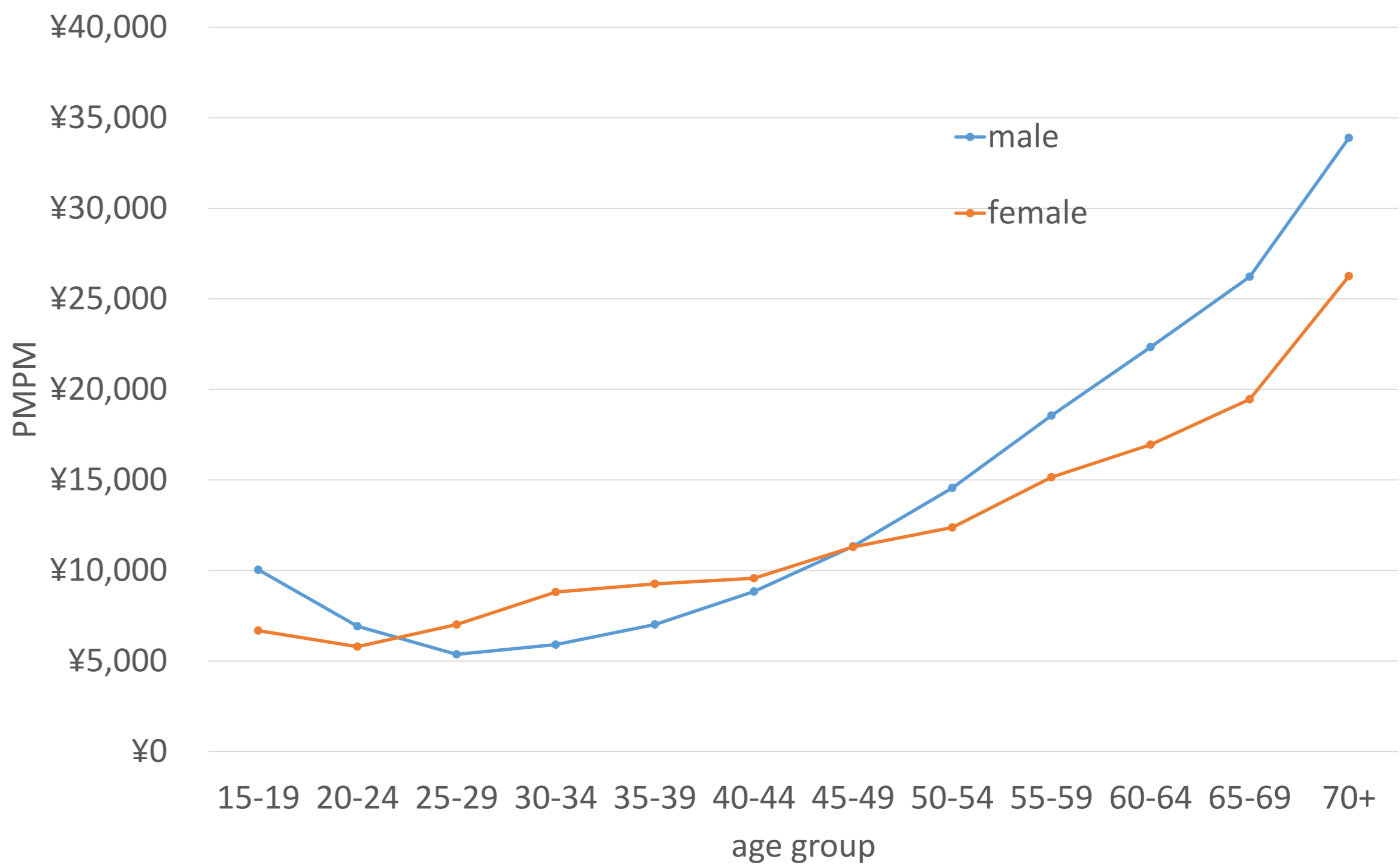
Items	Before	After
	Average (SD)	Average (SD)
BMI (kg/m ²)	27.5 (4.5)	27.0 (4.3)
SBP (mmHg)	132.3 (12.9)	129.7 (11.7)
HDL-C (mg/dl)	52.4 (12.9)	55.2 (12.6)
HbA1c (%)	6.98 (0.98)	6.69 (0.85)
eGFR (mL/min/1.73m ²)	75.2 (11.0)	74.3 (6.6)

BMI, body mass index; eGFR, estimated glomerular filtration rate; Hb, hemoglobin; HDL-C, high-density lipoprotein cholesterol; SBP, systolic blood pressure; SD, standard deviation.

Model to estimate the excess medical costs

- A total of 6,092,145 member months of data were obtained from the insureds to develop the model.
- The average medical costs PMPM by age and sex group were shown in Figure 2. The average of the costs for all insureds was JPY 12,100 (EUR 86.31, as of September 27, 2022).

Figure 2. Medical costs for insureds by demographic group



A change in the excess medical costs after the program

- A reduction in excess medical costs was estimated to be 1,098 JPY PPM (EUR 7.90).
- Assuming that the difference in excess medical costs before and after the program for the participants was similar for all age and sex groups, the amount of the reduction corresponds to 9.1% of the average medical costs of all insureds.

Limitations

- We estimated the change in the excess medical costs for participants as the subtraction of the two estimated excess medical costs, each of which was the output of the model with the medical examination values before or after the program. We could not directly calculate the change because the medical examination values were not associated with the cost in the dataset. As a result of that, the change might be overestimated, though it is reasonably expected that the change would be converged in the long run.
- Not all the change in the excess medical costs was caused by the program. It might include the effect of the regression to the mean or that more participants had already been motivated, but we cannot estimate each of them.

Conclusions

- A substantial effect on medical examination data was suggested for participants in the program which is associated with a predicted reduction in excess medical costs.

Reference

1. Kanai, et al. Circ Rep. 2022;4(7):322-329.

