

The Precision Healthcare

- *Use of Artificial Intelligence in the Medical Field* -

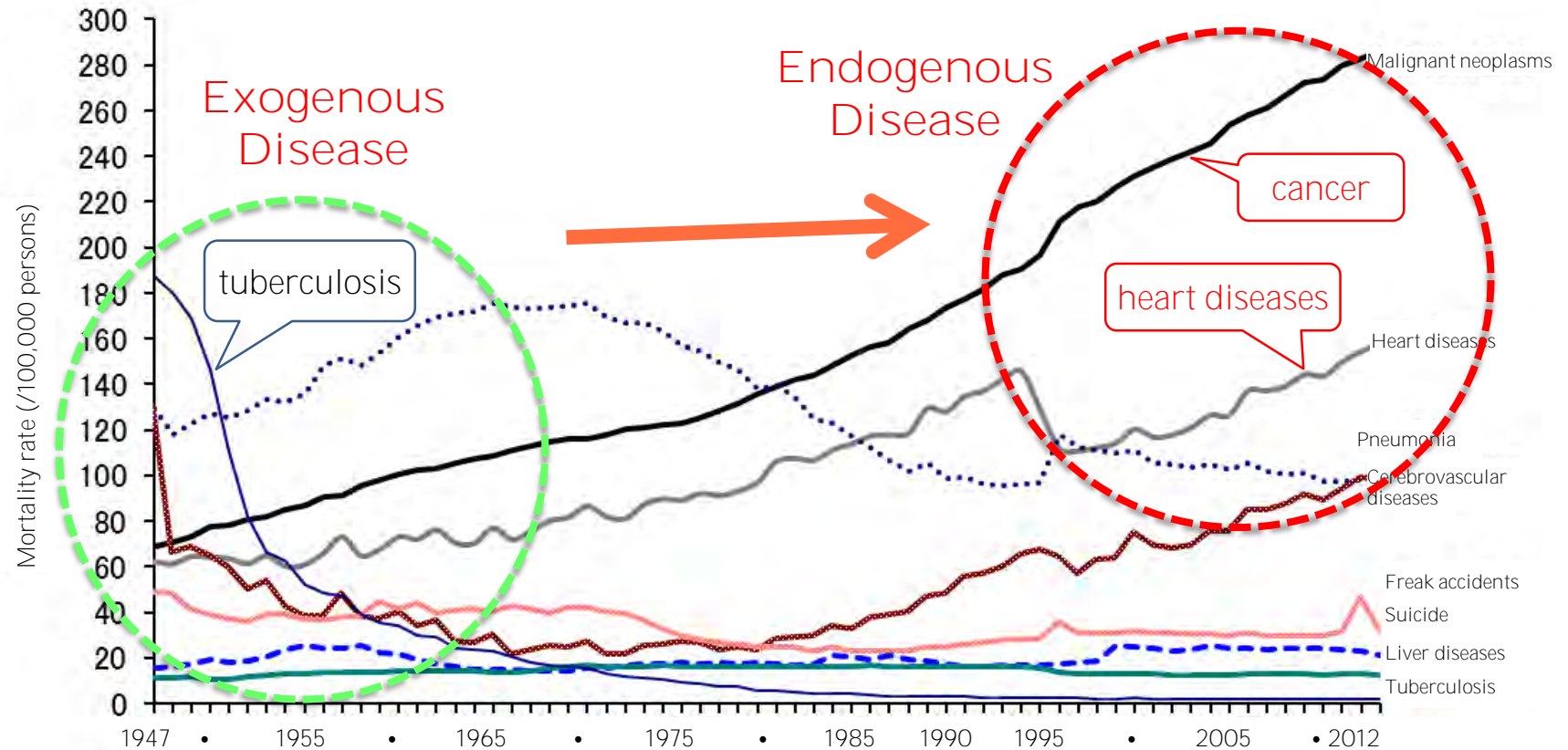
December 2019

Ministry of Economy, Trade and Industry

Commercial Affairs & Service Group

Annual Transition of Mortality Rates by Major Causes

- Use of antibiotics rapidly reduced tuberculosis (infection: exogenous) that had remained the leading cause of death.
- Generally, the diseases that are increasing recently are associated with aging (cell deterioration: endogenous).
- ☆ Treatment methods/treatment drugs should be developed on the basis of understanding that the characteristics of diseases are changing.



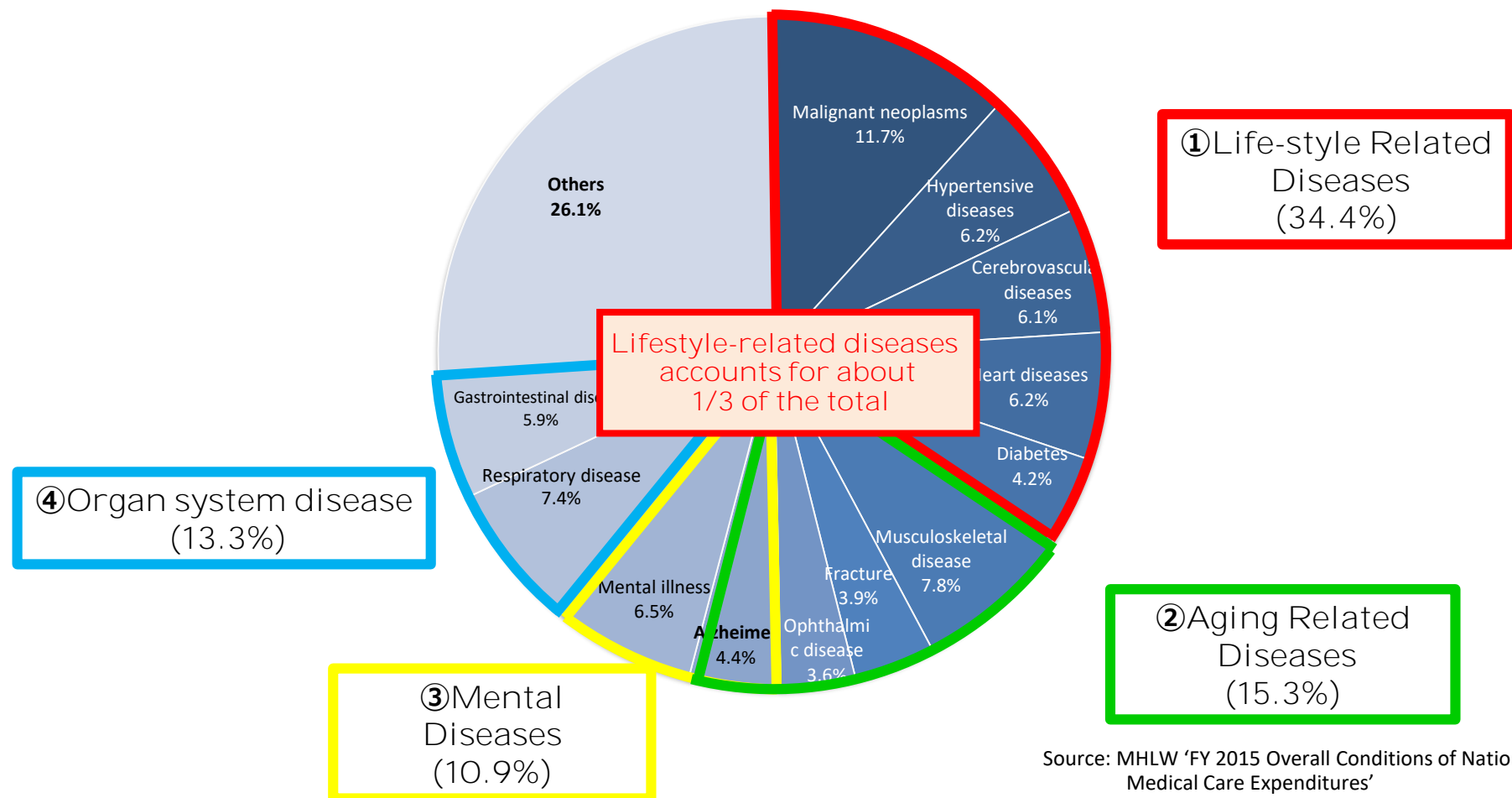
Note: 1) The mortality rate associated with heart diseases decreased in 1994/1995 probably because medical care providers had been informed about the instruction of 'do not record the terminal disease conditions such as heart failure and respiratory failure in the section of cause of death' before issuance of the notification about the change of death certificate form (postmortem certificate form) (enforced in January 1995).
2) The mortality rate associated with cerebrovascular diseases increased in 1995 mainly because of clarification of the ICD-10 mortality coding rules for selection of underlying cause of death (applied in January 1995).

(Source: MHLW 2012 Overall Condition of the Monthly Report/Annual Estimation of Vital Statistics (approximate number))

Breakdown National Medical Expenditures

- Treatment of lifestyle-related diseases accounts for about 1/3 (10.0 trillion yen) of medical treatment expenditures.
- This spending can be reduced and the medical care expenditure can be optimized by creating industries that provide disease prevention/health management services that are not covered by public insurance.

【National Medical Expenditures】



Source: MHLW 'FY 2015 Overall Conditions of National Medical Care Expenditures'

Future directions of healthcare systems

○ With the increased proportion of **endogenous disease (lifestyle/aging)**, we need to establish a new healthcare system focusing on prevention and progression control.

<Disease types>

<Main diseases>

<Treatment>

<Actions needed>

Conventional medicine

Exogenous

Single factor
disease

Infections

Genetic disorders

Cancer
(High specificity)

Cure

Standard
treatment

○ Development of safe and effective medicines

- Accurate & rapid **diagnostic methods**
- Conduct **Efficient clinical trials**, improve **production technology**
- Promotion of **regulatory science**

Endogenous

Multi-Factor
disease

Aging
related
diseases

Lifestyle
related
diseases

Cancer

Dementia

Hypertension

Diabetes

Early
diagnosis

Progress
control

Early
diagnosis

Prevention

Behavior
change

Varies according to conditions

○ Early detection of latent patients

○ Effective progression controls

- Develop **technology for early diagnosis**
- Medication and **lifestyle guidance**
- Establish **progression control methods** using **accumulated data**, etc.

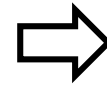
○ Early detection of latent cases

○ Preventive healthcare services

- Regular **screening** and **guidance**
- Develop healthcare **tools** using **IoT/AI**
- Strengthen the role of **pharmacist/nutritionists**
- Promotion of **self-medication**, etc.

Approach to Disease

Infectious disease



Lifestyle or age-related disease

<Before symptoms>

<Exogenous **single-factor**>

<Endogenous **multi-factor**>

vaccine

Prevention, progression control and management

Preemptive therapy
(Regenerative medicine)
(Gene therapy)

<After symptoms>

Relieve Symptoms and Observe

Identify the cause of the disease and remove it

Identify the cause of the disease and remove it

Replacement
(Organ transplantation)

Replacement
(Regenerative medicine)

- Establish system infrastructure for connecting and accumulating data collected through IoT, with the consent from patients (examination and implementation of the Agreement on the Exchange of Health Information and a form for exchanging health information)
- Using **HbA1c**, **validate the project's effect with a method used in clinical trial** (experimental research)



Lifestyle related diseases

Needs Data for AI

Participants of conventional preventive activities

Diabetes

[diabetes : under treatment]
Medication / dialysis

10M people

medication: 35M people
dialysis: 0.12M people

[diabetes (mild)]
HbA1c 6.5 and above
No medication

[preliminary groups]
HbA1c above 6.0 and below 6.5

10M people

[Healthy people]
HbA1c below 6.0

80M people

※ Population of 30 and above, excluding people with prediabetes

<Annual medical expenditure>
medication: \$4,000
dialysis: \$58,000

Other lifestyle related diseases
(Hyperlipidemia, hypertension, etc)

Establish basic algorithm based on quality data, and establish AI that can be used in the medical field

Diabetes : Tool making for Prevention of Lifestyle Diseases

- 8 teams with 1000 people implemented projects in 2016FY (Approx. 1.6 million total employees)
- Daily health data might be utilized effectively by participants
- The project will expand target population to 2000 in 2017FY

【Participant teams and population in 2016FY projects】

# of team	# of participants			Abstract
	Mild symptoms ※1	Preliminary ※2	Total employee ※3	
8 teams	662	401	Approx. 1.6 million	※1:HbA1c 6.5+ including people with medication ※2:HbA1c 5.6-6.5 including people with medication ※3:Total number of employees of participated companies

【An example of the result of projects: Change in HbA1c】

E.g., Team “Shichi-Fuku-Jin”	168	—	93 thousand	<ul style="list-style-type: none"> The team implemented the project in collaboration with 23 healthcare institutions and 2 organizations doing physical examination for employees by holding study groups to share tips.
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		At the beginning	3 months later	Change in HbA1c
W/O medication treatment	With intervention	6.99	→ 6.43	▲0.56
	W/O intervention	6.75	→ 6.60	▲0.16

- Data which will be exchanged through the **Agreement on the Exchange of Health Information (AEHI)**, include weight, blood pressure at home, active mass, HbA1c, blood pressure at health checks or hospitals.
- Preregistered information will be also collected.

<Preregistered information>

<Consortium>

- Consortium ID
- Name of Consortium

<Participant>

- Consortium ID
- Participant ID
- Birth date, Sex/Gender
- Start date, end date
- Address, Info of commuting
- Info of medication
- Info of measurement position

<Medical Examination Agency (MEA)>

- Consortium ID
- MEA ID, name of MEA
- Location of MEA

<HbA1c measurement method (MM)>

- MM code
- Classification of MM
- Name of MM

<Medical device>

- Manufacturer code
- Device model number
- Name of device
- Time correction
- Standards compliance
- Measurement accuracy

<Active mass device>

- Manufacturer code
- Device model number
- Data of active mass

<Data exchanged through the AEHI>

<Header information >

Version, sent date, consortium ID, participant ID

Health information

<Weight>

- Date of measurement
- Weight
- Device information

<Blood Pressure at home >

- Date of measurement
- Systolic/ diastolic blood pressure
- Pulse
- Device information

<Active mass>

- Date of measurement
- Steps
- Calories burned
- Distance
- Moderate intensity time
- Exercise
- Momentum
- Calories burned in total
- Device information

Examination Information

<HbA1c>

- Date of measurement
- HbA1c value

<Blood pressure at health checks or hospitals>

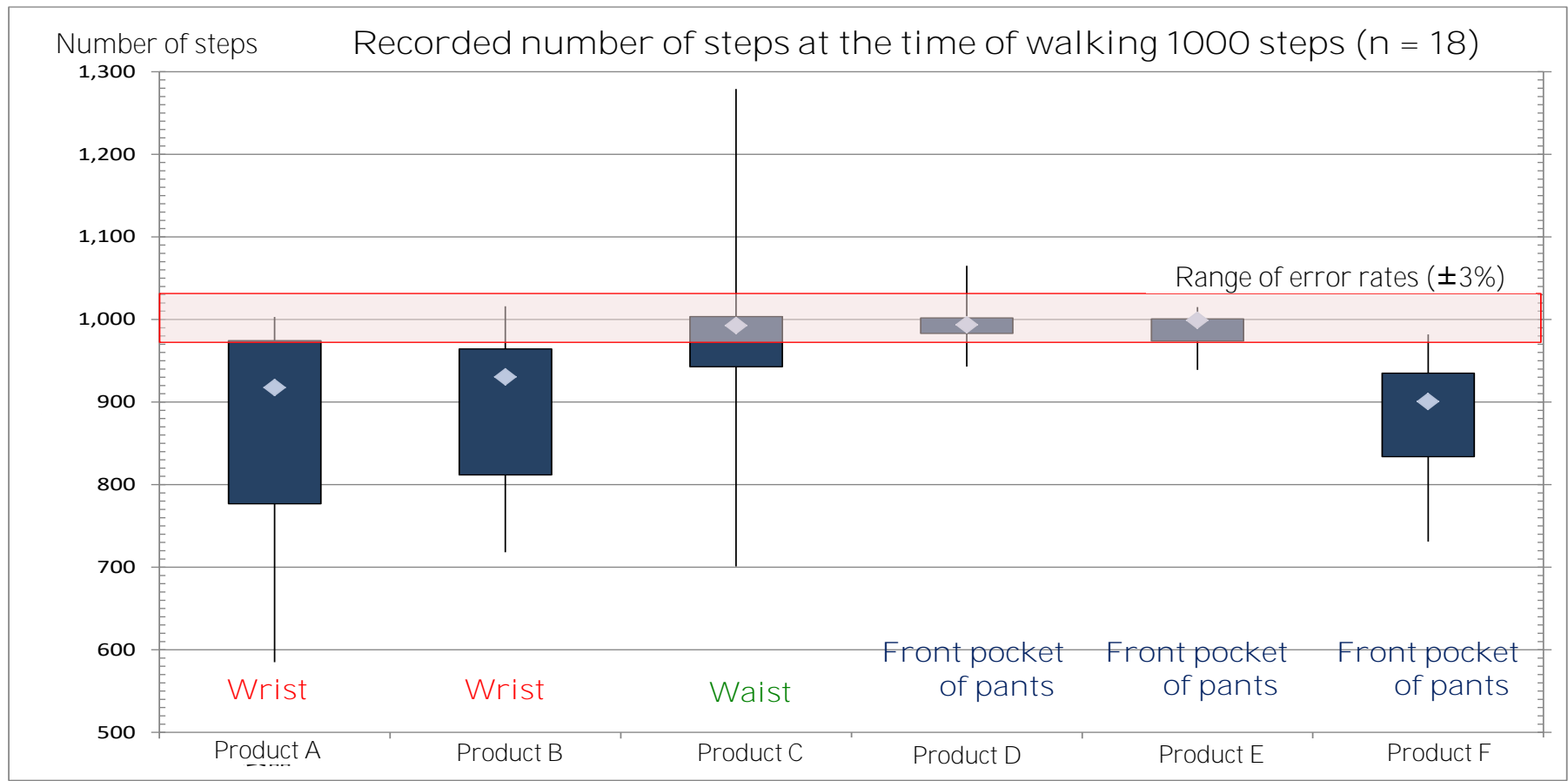
- Date of measurement
- Systolic/ diastolic blood pressure

Data for AEHI <Detailed>

Data	Expression	Digit	Required	Note
observation_time	Date	14	●	yyyyMMddHHmmss Date of measurement ※Entering 00 if observation time (second, minute, or hour) is not measured
step	Numeric Value	5	●	Unit: step, Integers
walk_time	Numeric Value	4	▲	Unit: minute, Integers ※Entering numbers if measured
moderate_intensity_activity	Numeric Value	4	▲	Unit: minute, Integers ※Entering numbers if measured
calories	Numeric Value	6	▲	Unit : kcal、XXXX.X ※Entering numbers if measured
total_calories	Numeric Value	6	▲	Unit : kcal、XXXX.X ※Entering numbers if measured
model_manufacturer_code	Character String	50	●	Manufacturer code ※If model number cannot be obtained from device, secretariat enters specific manufacturer code
model_number	Character String	50	●	Model number ※If model number cannot be obtained from device, secretariat enters specific model number ※In the case of smartphone apps, entering the name of app and its version Ex) HealthKit X.X
production_specification_serial	Character String	50	●	Production specification serial ※If serial cannot be obtained from device, secretariat enters specific serial.
total_active_duration	Numeric Value	4	●	Total time of active mass (minutes) ※Required for activity monitor
data_input_code	Character String	1	●	0 : System (device) input data, 1 : Data of manual input through application, 2 : Manually corrected device input data
measurement_position_code	Character String	2	▲	10 : Inside pocket (chest), 11 : Inside pocket (Abdomen), 20 : Suspended from neck, 21 : Suspended from belt, 30 : put on dominant hand, 31 : put on non-dominant hand, 40 : Inside bag, 50 : Others
origin_of_time_code	Character String	1	●	0 : Using time appeared on device , 1 : Correcting time by application
update_time	Date	17	●	yyyyMMddHHmmssSSS Data update time in app (database). Used for checking consistency with old data

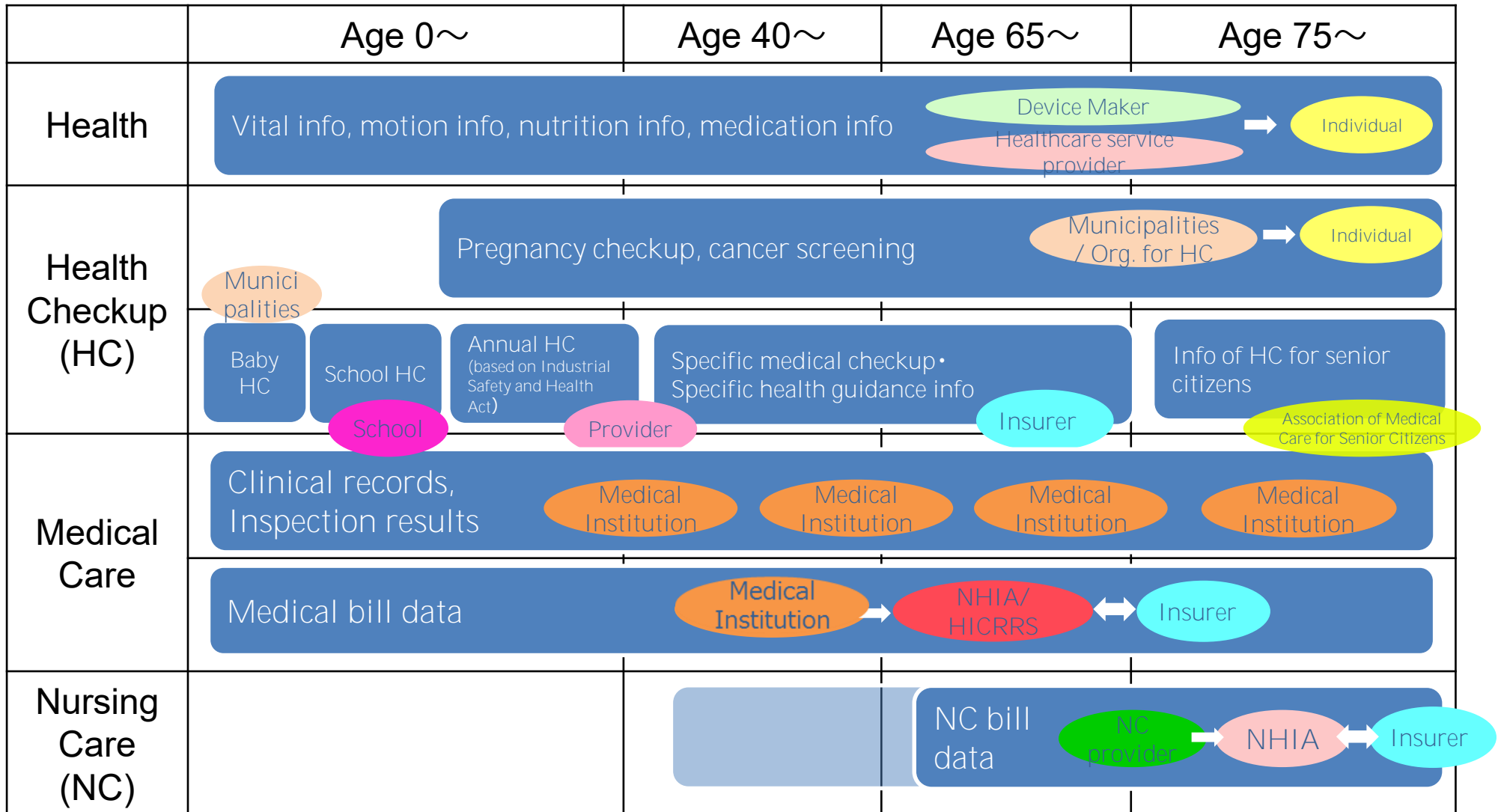
Accuracy of Monitoring Data

- Average error rates of all products were between -0.6% and -13.3%. Recorded number of steps were less than actual number.
- **Product D and Product E:** Error rates were within the standard range determined by JIS (Japan Industrial Standards).
- Product A and Product C: Differences of recorded numbers from actual numbers of steps were between 400 to 600 and significantly different by users.
- Product B and Product F: Almost recorded numbers of steps were between 800 and 900.



Life stage and healthcare information

○ In the area of health, health checkup, medical care, and nursing care (vertical axis), healthcare information of individuals in lifetime from infancy to late adulthood (horizontal axis) is collected, managed, and used.



Thank you for your attention.