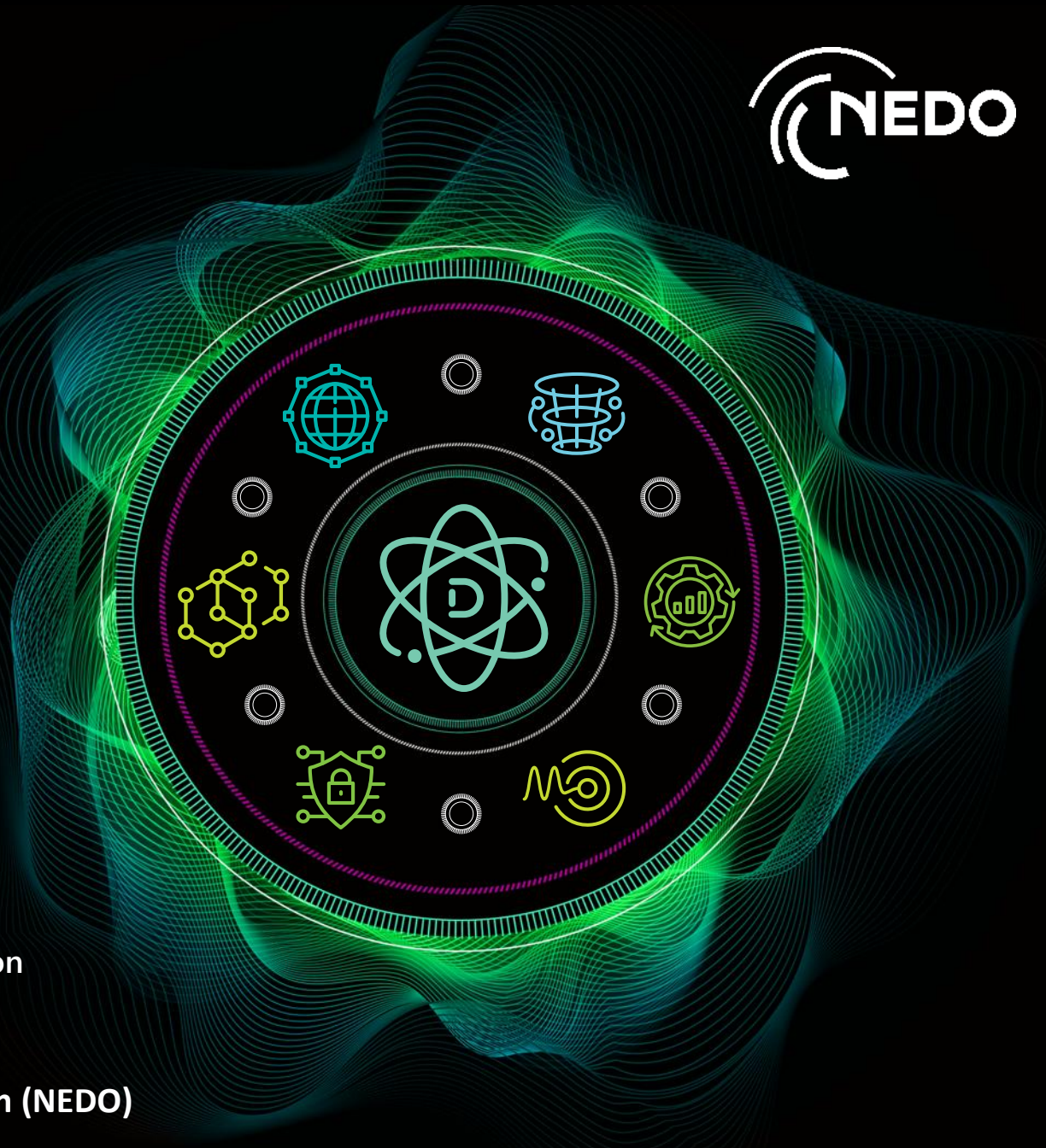
Quantum Computing Use Cases

# Medical preparedness based on infectious disease risk prediction



Promotion of SDGs with Quantum Technology

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New Energy and Industrial Technology Development Organization (NEDO)

# 感染症リスク予測に基づく医療確保
# Medical preparedness based on infectious disease risk prediction

NO IMAGE

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| **ユースケース概要**<br>**Use Case Overview** | エリア毎の感染症リスクを予測し、リスクに応じて医師・病床などを優先確保<br>Predict the infection risk by area and prioritize securing doctors and hospital beds according to the risk level. |
| **解決できる課題と効果**<br>**Issues to be addressed and their effects** | 高齢者や障碍者の支援技術の高度化とそれを通じた国の医療費削減<br>Support for the elderly and people with disabilities, and the reduction of medical costs through that support. |
| **量子技術の貢献**<br>**Contributions of quantum technology** | 多様かつ大量のヘルスケアデータを高速解析し、医療をマス・カスタム化<br>Rapidly analyze diverse and large amounts of healthcare data to customize medicine on a mass scale. |

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| **実現予想時期**<br>**Expected realization period** | (Year)2030～2035 |
| **産業分類**<br>**Industry classification** | ユーティリティ・通信<br>Utilities・Communications |
| **関連するQRAMI階層**<br>**Related QRAMI layers** | 情報層<br>Information layer |
| **関連する量子技術**<br>**Related quantum technologies** | 量子コンピュータ(FTQC)<br>Quantum Computer(FTQC) |

| | |
|---|---|
| **新規性**<br>**Novelty** | 軽微な改良<br>Minor improvements |
| **達成難易度**<br>**Difficulty of achievement** | どちらとも言えない<br>Neither |
| **社会貢献度**<br>**Social contribution level** | 特定の業種に貢献<br>Contributions to specific industries |
| **市場規模**<br>**Market size** | 見積困難<br>Difficult to estimate |

Detail

# Medical preparedness based on infectious disease risk prediction

## Issues to address

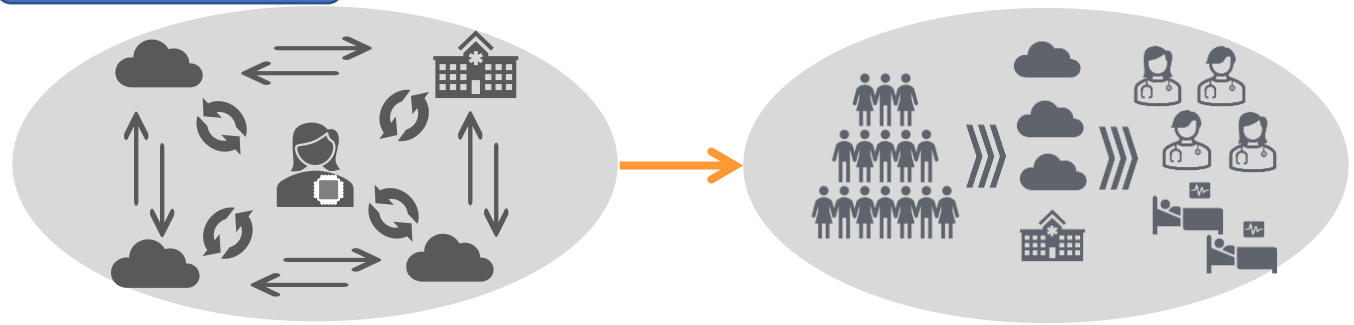
- Creating a society where everyone can live with peace of mind as they age (advancement of assistive technologies for seniors and individuals with disabilities)

## Use case overview

- Services that predict the risk of infectious disease onset in each area based on data accumulated by multiple services and medical institutions, and based on this, prioritize the allocation of doctors and hospital beds as countermeasures in accordance with the risk of onset

## Implementation vision

**Achievement target period: 2035**



- Quantum cryptography communication of a wide variety of healthcare data will enable exchanging and utilizing data between a large number of businesses including hospitals, enabling the accumulation of data on the entire population
- Gate-based quantum computers will enable mass customization services using a wide variety and large amounts of healthcare data.

## Expected benefits

- Promote health and significantly reduce national medical costs through high-quality group services leveraging personal healthcare data
- Improve the priority allocation of doctors and hospital beds as a measure against infectious diseases

## Action plan

| QRAMI hierarchy | Action |
|---|---|
| Business | Services for priority allocation of doctors and hospital beds and for emergency response support (not only for ambulances, but also for taxi services, etc.) |
| Functional | Develop an allocation system to optimize the number of beds, doctors, and medical devices for issuing medical capacity alerts and systems for secret quantum computation and distributed quantum computation |
| Information | Collect and manage disease onset risk data for entire population |
| Asset | Develop gate-type quantum computers, implantable devices, and non-invasive quantum sensors capable of measuring molecular-level protein changes |
| Policy aspect | Enable the use of the effective results of the function to forecast the risk of infectious disease onset as evidence for policymaking, etc. |

Roadmap

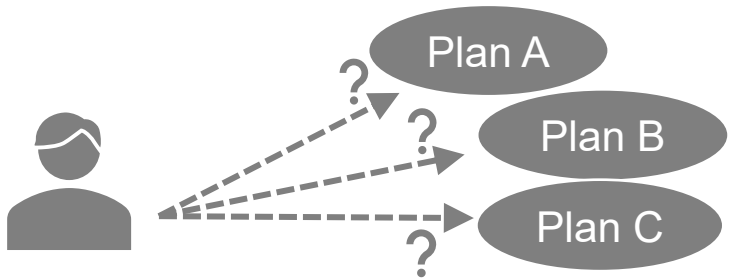
# Medical preparedness based on infectious disease risk prediction

## 2023
## Record of personal healthcare data

### PHR-based health prediction (1-to-1)



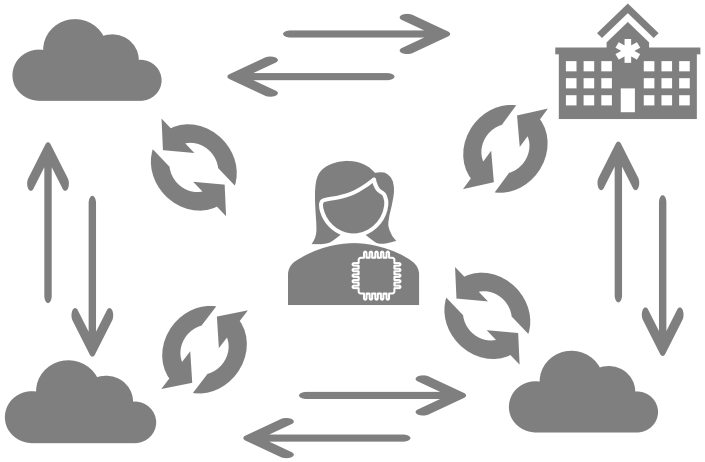
- ✓ Record and store vital data (weight, heart rate) from smart devices
- ✓ **Services for determining and predicting health status from vital data**




- ✓ The provision of health promotion services is not based on strict personal optimization, but rather on several typified patterns.

## Around 2025 to 2030
## Individualized services leveraging personal healthcare data

### 24-hour health concierge (1-to-N)



- ✓ Embedded device accumulates data without user being aware of it.
- ✓ Services that integrate 24-hour vital data with medical records and genomic data to assess and predict health conditions comprehensively
- ✓ Provide health promotion services created for each individual person

## Around 2035
## Group services leveraging personal healthcare data

### Prediction and mass customization based on disease onset risk for entire population (N-to-N)



- ✓ **Predict the risk of infectious disease onset in each area based on data accumulated by multiple services and medical institutions**
- ✓ Based on the above, take measures in accordance with the risk of disease onset (priority allocation of doctors and hospital beds, etc.)

Roadmap

# Medical preparedness based on infectious disease risk prediction

| | 2023 | 2025 | 2030 | 2035 |
|---|---|---|---|---|
| | **PHR-based health prediction** | **24-hour health concierge** | **Prediction and mass customization based on disease onset risk for entire population** | |
| **Business** | Health prediction services using smart devices | Concierge services by fitness providers, hospitals, drugstores, etc. | Support services for priority allocation of doctors and hospital beds<br>Emergency response support services | |
| **Interface** | Medical information retrieval API | Medical information retrieval API | Medical information retrieval API<br>Disease risk data retrieval API | |
| **Functional** | Diet plan presentation (choose from categorized plans)<br>Predicting the risk of arrhythmias | Develop life expectancy prediction system, disease onset risk simulation system, and longevity recommendation system | Medical capacity alerts (optimized allocation of beds, physicians, and medical devices)<br>Secret quantum computing and distributed quantum computing systems | |
| **Information** | Vital data | **24-hour vital data, disease-risk-related data (electronic medical records, genomic data)** | **Disease onset risk data for entire population** | |
| **Communication** | 4G and 5G communications | **QKD, PQC<br>Communication of confidential data** | Quantum Internet, PQC | |
| **Integration** | Engine, server, storage | Engine, server, storage | Engine, server, storage | |
| **Asset** | Sensor devices, inspection devices, smart devices, classic computers | **Implantable devices (smart contacts, chips, etc.), quantum computers** | **Quantum computers, implantable devices, non-invasive quantum sensors (capable of measuring molecular-level protein changes)** | |
| **Policy aspect** | Only a limited number of certified businesses can handle anonymously processed medical information | **Adoption of medical IDs<br>Expansion of certified businesses, enabling the handling of anonymously processed medical information at many companies** | **Effective results of the forecasting function are recognized and established as evidence for policymaking, etc.** | |

**More use cases are available on our website. We invite you to explore them.**
**https://www.quantum-computing-use-cases.nedo.go.jp/english/**

More Use Cases

**New Energy and Industrial Technology Development Organization (NEDO)**
**AI and Robotics Department (e-mail: quantum_ai@ml.nedo.go.jp)**

**This collection of use cases was obtained as a result of the work commissioned by the New Energy and Industrial Technology Development Organization (NEDO) "Cyber-Physical Development Business of Quantum/Classical Hybrid Technology/Study of Use Case of Quantum Technology" and the “Post-5G Information and Communications System Infrastructure Reinforcement R & D Project (Quantum Industrialization)/Comprehensive Study for Promoting the Industrialization of Quantum Computers ”.**