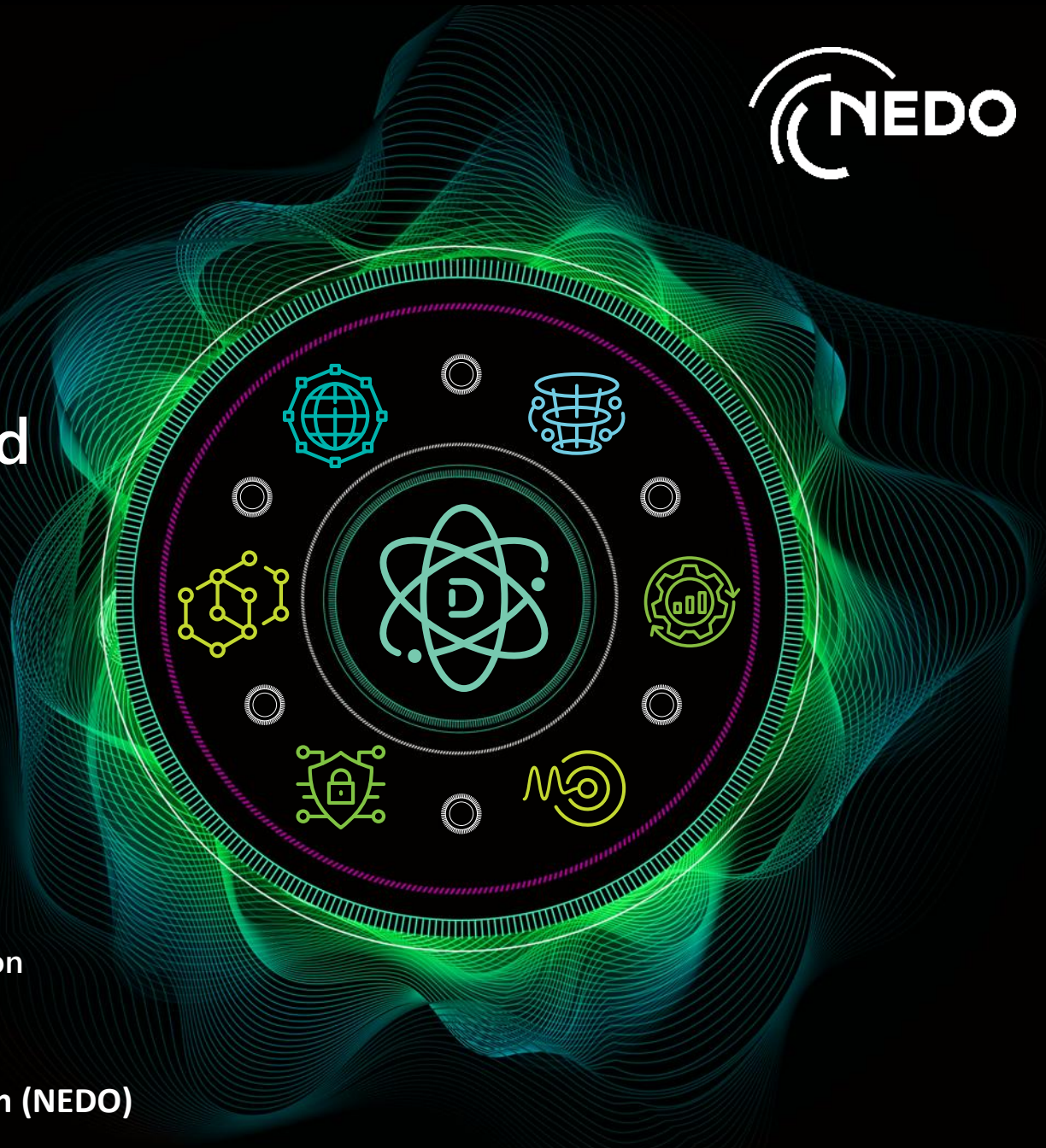
Quantum Computing Use Cases

Medical care utilizing genomic and environmental factor data



Promotion of SDGs with Quantum Technology

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New Energy and Industrial Technology Development Organization (NEDO)

ゲノム・環境因子データを活用した医療
Medical care utilizing genomic and environmental factor data

NO IMAGE

ユースケース概要 Use Case Overview	ゲノム情報やリアルタイムな環境因子の収集による最適な個人医療の提供 Providing optimal personalized medical care by collecting genomic information and real-time environmental factors.
解決できる課題と効果 Issues to be addressed and their effects	診断・治療の超高度化および医療格差の是正 Advanced diagnosis and treatment, and the correction of healthcare disparities.
量子技術の貢献 Contributions of quantum technology	高精度なデータ解析による診断の超高度化および未病状態での予兆検知 Super-advanced diagnosis through high-precision data analysis and early detection of pre-disease conditions.

実現予想時期 Expected realization period	(Year)2050～
産業分類 Industry classification	情報・金融・その他サービス Information・Financial・Other services
関連するQRAMI階層 Related QRAMI layers	機能層 Functional layer
関連する量子技術 Related quantum technologies	量子コンピュータ(FTQC) Quantum Computer(FTQC)

新規性 Novelty	軽微な改良 Minor improvements
達成難易度 Difficulty of achievement	困難 Difficult
社会貢献度 Social contribution level	特定の業種に貢献 Contributions to specific industries
市場規模 Market size	1~10兆円 1～10T¥

Detail

Medical care utilizing genomic and environmental factor data

Issues to address

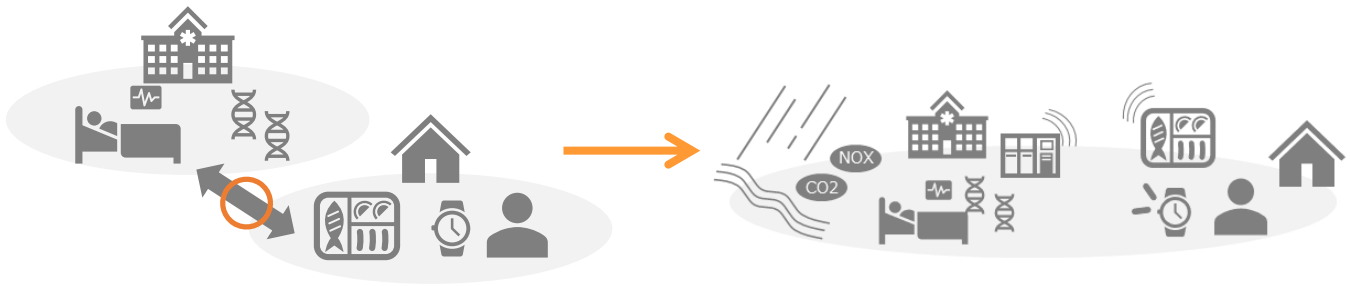
- Ultra-advanced diagnosis/treatment and eradication of unknown diseases (bridging cross-regional healthcare gaps)

Use case overview

- **Ability to provide optimal medical care based on personal healthcare data, genomic information, and real-time environmental factors**
- Possible to share information in real time with medical institutions and personal healthcare data

Implementation vision

Achievement target period: 2040–2050



- Ability to provide optimal medical care based on personal genome and healthcare data and real-time environmental factors (climate, air pollutants, etc.)
- Compact, high-precision devices enable the unconscious acquisition of a wide variety of personal healthcare data.
- Quantum cryptography communication will enable exchanging and utilizing a wide variety of healthcare data between hospitals and between hospitals and individuals.

Expected benefits

- High-precision diagnostics and early detection of pre-symptomatic conditions based on personal healthcare data, genomic data, and real-time environmental factors (climate, air pollutants, etc.)
- Early recovery from disease through real-time provision of personalized, optimal treatment
- Elimination of unknown diseases through advancement in medical research

Action plan

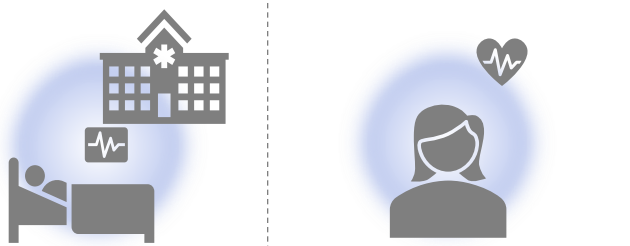
QRAMI hierarchy	Action
Business	Optimal medical services based on personal information (genome) and real-time environmental factors
Functional	Develop platform for linkage and analysis of healthcare-related data and environmental data
Information	Collect and manage examination data (full medical checkup information, etc.) from medical institutions, personal healthcare data, and real-time environmental factors
Communication	Exchange data between medical institutions and between medical institutions and individuals (communication of confidential data using QKD and PQC)
Asset	Develop compact sensors that can capture advanced healthcare data without the user being aware of it, and environmental sensors with location information
Policy aspect	Revise Medical Practitioners' Act, Pharmaceutical and Medical Device Act (former Pharmaceutical Affairs Act), etc. Expand scope of diagnosis and treatment that can be performed by non-physicians

Roadmap

Medical care utilizing genomic and environmental factor data

2023
Conventional medicine

Diagnosis/treatment at medical institutions



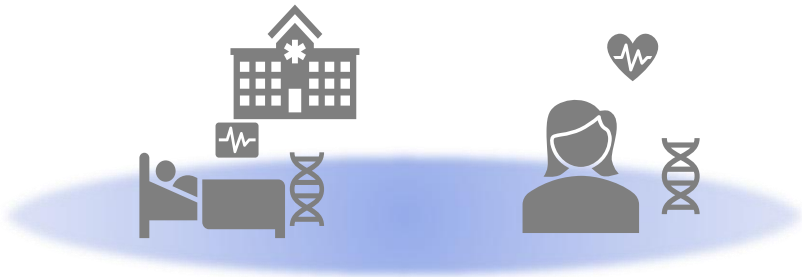
Data by medical institution

Personal healthcare data

- ✓ Data from medical institutions and healthcare data obtained through personal devices are independent.
- ✓ Going to medical appointments takes time, leading to a widening gap in healthcare access. Additionally, there are still many diseases that have yet to be elucidated.

Around 2030 to 2040
Acceleration of collaboration between medical institution and personal healthcare data

Advanced medical care using personal healthcare data



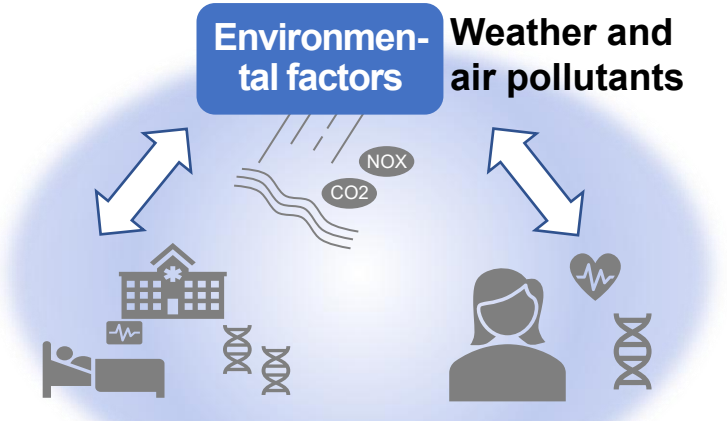
Data by medical institution

Personal healthcare data

- ✓ Sophistication of healthcare data (smell, brain wave, body condition, etc.) that can be obtained on a daily basis with personal devices and their use for diagnosis at medical institutions.
- ✓ Early detection of health abnormalities and stress, promoting research on the mechanisms of unknown diseases.

Around 2050
Real-time provision of ultra-advanced, personalized medical care

Ultra-advanced medical care utilizing individual genomic and healthcare data and environmental factor data



- ✓ Link all kinds of personal data with real-time information on environmental factors to provide ultra-advanced and individually optimized medical care in real time.
- ✓ Promote research on early signs of pre-symptomatic conditions and contribute to the eradication of unknown diseases.

Roadmap

Medical care utilizing genomic and environmental factor data

	2023	203x	204x	205x
	Diagnosis/treatment at medical institutions	**Advanced medical care using personal healthcare data**		**Ultra-advanced medical care utilizing individual genomic and healthcare data and environmental factor data**
Business	Conventional medical services	Services that enable diagnosis and treatment using personal information		Optimal medical services based on personal information (genome) and real-time environmental factors
Interface	Medical information retrieval API	Medical information retrieval API		Medical information retrieval API
Functional	Independent system for each medical institution	System that allows data exchange and utilization between medical institutions and personal devices		**Healthcare-related data and environmental data linkage and analysis platform (secure and systematic)**
Information	**Examination data of each medical institution (full medical checkup information, etc.)**	**Examination data of each medical institution (full medical checkup information, etc.) Healthcare data obtained individually**		**Examination data of each medical institution (full medical checkup information, etc.) Healthcare data obtained individually Real-time environmental factor data**
Communication	**Exchange of data from individual medical institutions Exchange of data in personal devices**	**Exchange of data between medical institutions and individuals (communication of confidential data using QKD and PQC)**		**Exchange of data between medical institutions and between medical institutions and individuals (communication of confidential data using QKD and PQC)**
Integration	Medical equipment (Examination/treatment equipment) Healthcare apps for personal devices	Standard that enables obtaining data directly from medical equipment (captured on the NW, not USB)		Various wearable terminal devices Home appliances that detect physical condition (refrigerator, TV)
Asset	**Specialized equipment in each medical institution Sensors in personal devices (accelerometers, gyro sensors, etc.)**	**Sensors capable of obtaining advanced information (Smell, brain wave, pain, gait, stress, etc.)**		**Compact sensors that can capture advanced healthcare data without the individual being aware of it Environmental sensors with location information**
Policy aspect	Promotion of PHR utilization Only a limited number of medical institutions can handle personal medical information	Integration of personal information and medical institution examination data through the adoption of medical IDs		Revision of Medical Practitioners' Act, Pharmaceutical and Medical Device Act (former Pharmaceutical Affairs Act), etc. Expansion of scope of diagnosis and treatment that can be performed by non-physicians

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 ”.