Enhancing the Trust in e-Health by Secure and Privacy-Preserving Identity Management

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digital enlightenment forum

About NTNU IIK and CCIS

NTNU

Kunnskap for en bedre verden

- Norges teknisk-naturvitenskapelige universitet – NTNU Largest Science and Technology University in Norway
- One of the “Nordic Five Tech”
- Institutt for informasjonssikkerhet og kommunikasjonsteknologi (IIK)

Center for Cyber and Information Security

- Based on IIK and collaborated with external partners

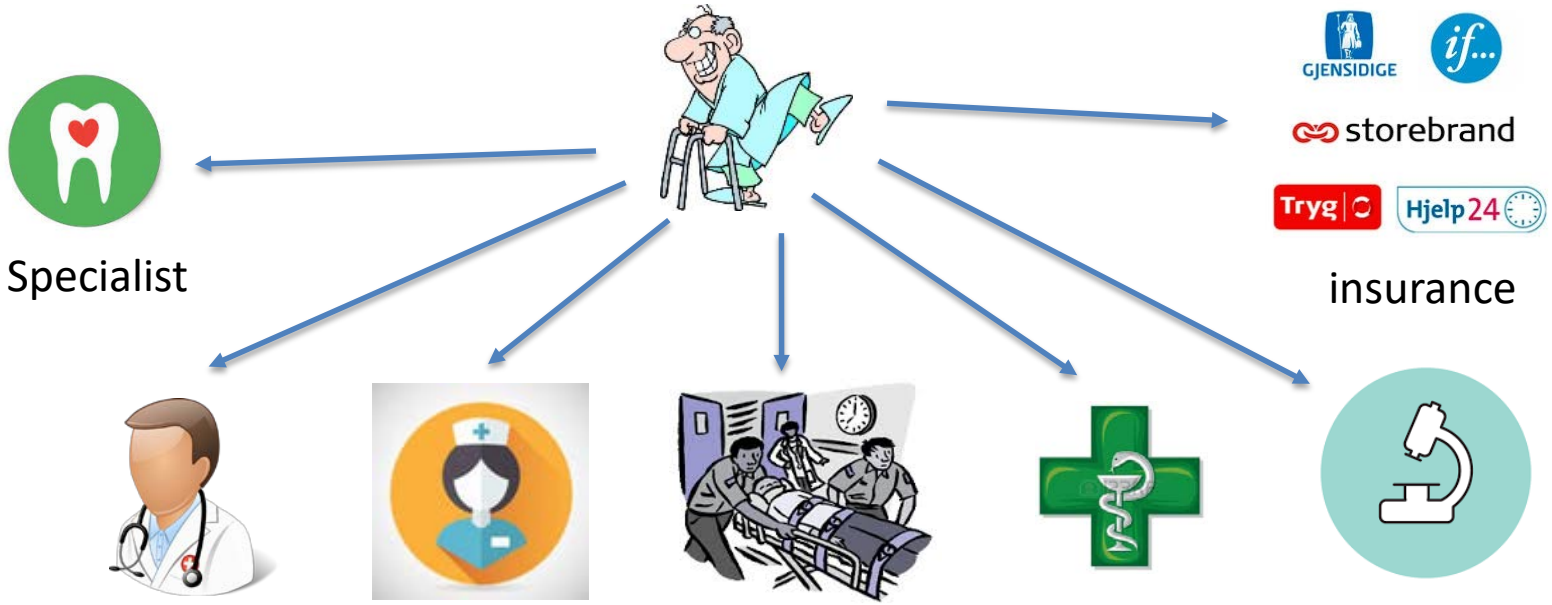
Data is the key to all

Data are generated from everywhere in e-health, for instance, but not limited to

- Paper-based medical records
- EMR
- EHR
- Patient-Generated Health Data (PGHD)
- PHR
- Health databases for scientific research
- Agreements (contract, consents, etc.)
- Operational data
  - Identities (patient, staff, technician, device, equipment, syste, etc.)
  - Transaction records (data sharing, payment, manual, etc.)
  - Logistic and work process logs and performance (equipment, staff, system, etc.)

Data is the key to all

Players in the health data eco-system

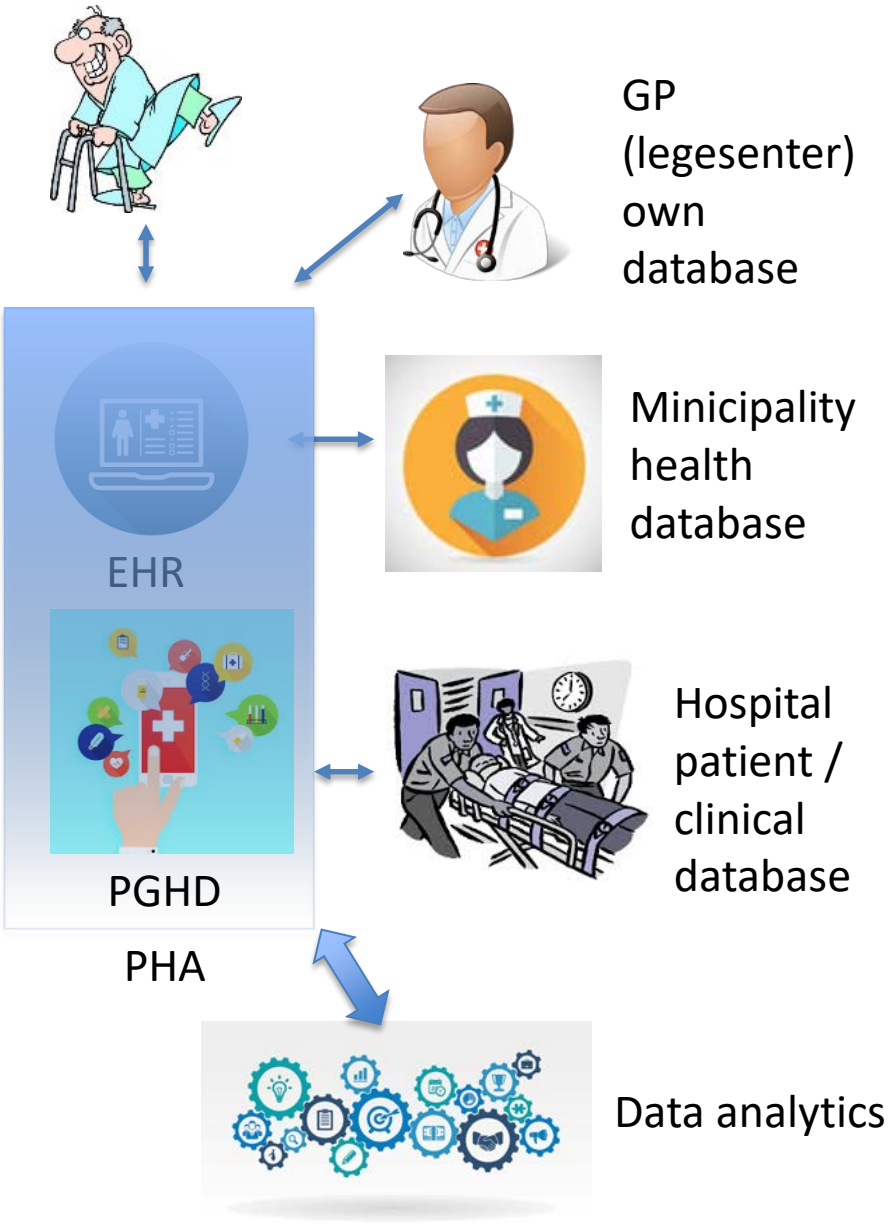


Data is the key to all

Challenges

- (Health 1.0) Electronic Medical Records (EMR) -> data silos
- (Health 2.0) Electronic Health Records (EHR) -> interoperability, consent and privacy management
- (Health 3.0) Personal Health Records / Accounts (PHR/PHA)

  -> patient-centred data management



Data is the key to all

Health 3.0 essentials

- Patient's full health data profile accessible
- Patient-centred data management, patient decides the data to be shared with
  - Whom
  - For what purpose(s)
  - At what time
  - For how long
  - Via which channel(s)
- Patient-centred privacy configuration
  - To which degree personal information can be shared (privacy impact assessment and best practice)
  - At which conditions the privacy configuration is to be changed

Relevance to Identity

- **Identity** (ISO 24760-1: 2011)

set of **attributes** related to an entity

- **Attribute** (ISO 24760-1: 2011)

characteristic or property of an **entity** that can be used to describe its state, appearance, or other aspects

- **Identifier** (ISO 24760-1: 2011)

unique identity

Relevance to Identity

Identity Management screnarios in healthcare

- Identity Proofing (ISO 29003)
  - establishing a new identity outside the trust domain (e.g., another hospital, regional health authority, member state, etc.)
  - Health notary (certification of medical / health records / transactions)
  - Professional medical certificates
- Patient identification (particularly those unconscious, elderly, and challenged)
  - Token based
  - Biometrics
- Person / device identity authentication (e.g., password, card, biometrics)

Relevance to Identity

Identity Management screnarios in healthcare

Privacy-Preserving Identity Management

Identity Proofing

- Selective disclosure and certification of identity attributes
- Anonymous attribute proofing / ownership verification

Related methods: Open Identity Exchange, zero-knowledge proof, homomorphic encryption, secure multi-party computation, etc.

Relevance to Identity

Identity Management screnarios in healthcare

Privacy-Preserving Identity Management

Identity Authentication

- Federated identities and Single-Sign-On (SSO)
- User-centric (e.g., OpenID, FIDO, GOV.UK Verify, etc.)
- Self-sovereignty identities (full under the control of the identity principals, able to create new identities by assembling certified attributes, etc.)

Related methods: biometric template protection, biometric-secret binding schemes, zero-knowledge proof, homomorphic encryption, secure multi-party computation, oblivious transfer, distributed ledger technologies e.g. blockchain, etc.

Relevance to Identity

Identity Management screnarios in healthcare

Privacy-Preserving Identity Management

Data Outsourcing for Analysis

- De-identification for data analytics
- Re-identification (GDPR's right to access, portability, and be forgotten)

Related methods: anonymisation, pseudonymisation, differential privacy methods, zero-knowledge proof, commitment schemes, etc.

Research efforts needed in …

- Privacy-preserving biometrics (ISO 24745)
  - Renewability
  - Irreversibility
  - Unlinkability
- Privacy-preserving attributes proofing
  - Selective disclosure
  - Selective property/value proofing
  - Anonymous ownership verification
- Distributed ledger technology
  - Flat structure to facilitate attribute certification
  - Trusted platform for creating self-sovereignty identities
  - Potential platform for data subjects to trade their data for profit

NTNU IIK involved in EU projects

Related to privacy-preserving identity management

- TURBINE (2008-2011): revocable biometrics
- FIDELITY (2012-2016): privacy-preserving passport life cycle
- PIDaaS (2014-2016): private identities as a service
- ORIGINS (2014-2017): breeder document security and identity proofing
- SMILE (2017-2020): privacy-enhancing land border control

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