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September 19th-23rd, Italy

A New Era for Health Research by Using AI

ARCHIVES:
BRIDGING THE GAP

9th Annual Conference of the
International Council on Archives

19-23 September 2022 | Rome, Italy

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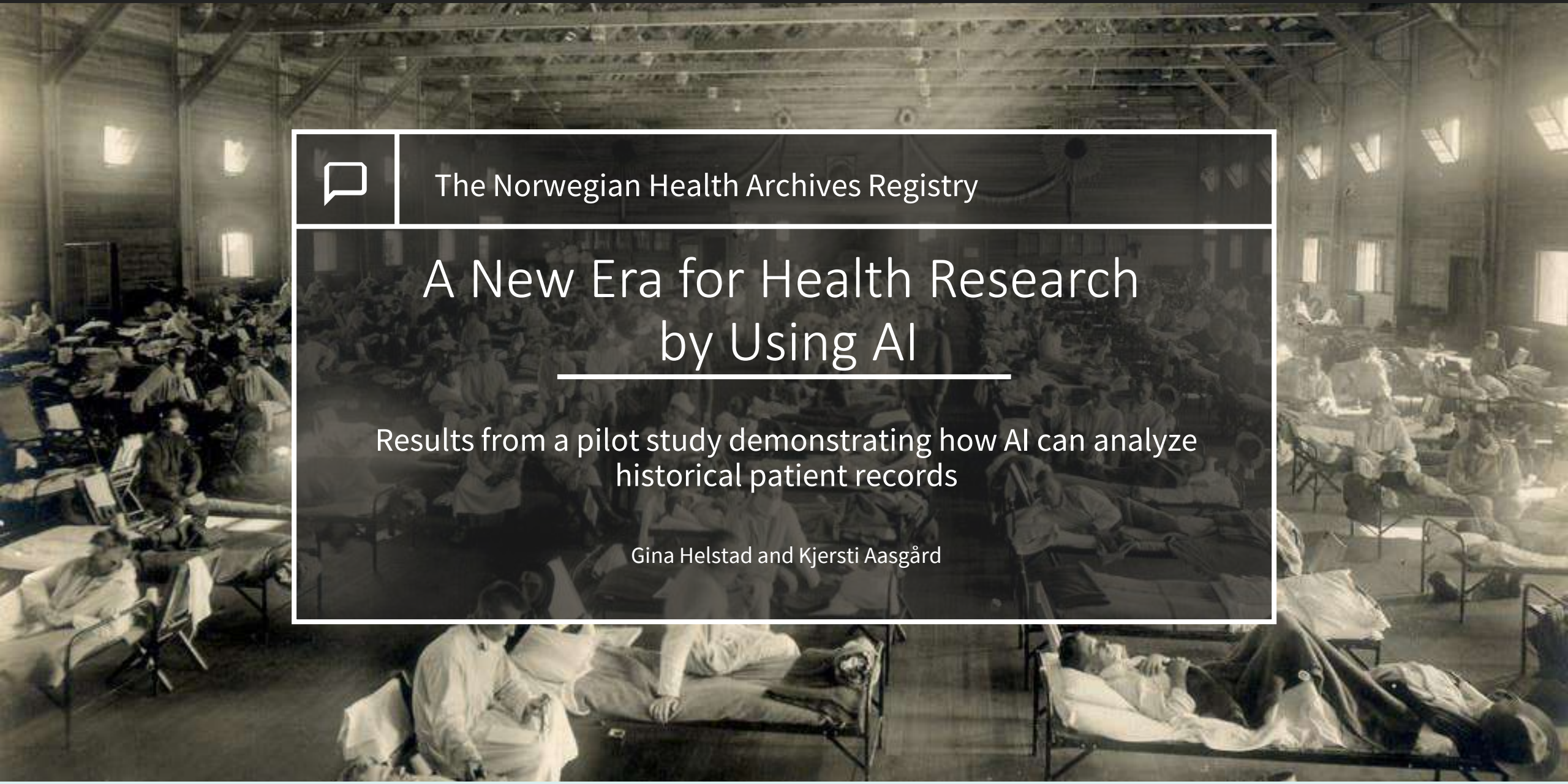
ARKIVVERKET



The Norwegian Health Archives Registry

A New Era for Health Research by Using AI

Results from a pilot study demonstrating how AI can analyze historical patient records

Gina Helstad and Kjersti Aasgård

Photo: Otis Historical Archives Nat'l Museum of Health & Medicine.

ARKIVVERKET
NORSK HELSEARKIV

Introduction

- Part of the National Archives of Norway
- Established in 2019
- Two purposes:
  - Making health data available for research
  - Securing and preserving patient records from deceased patients
- 36 million digitized pages pr year
- All hospitals are required by law to transfer all patient records to The Norwegian Health Archives after the patient is dead
- First national health archive in the world

Photo: The National Archives of Norway and Vegard Breie

To become a recognized health registry for new knowledge and better public health

Strategic goal

Photo: Pixabay

ARKIVVERKET

INPUT:

- 15 million paper-based patient records
- 150.000 shelf meters in total
- Electronic patient records: backlog of 2 million

PROCESS:

- Digitization and disposal of the paper
- Metadata registration:
  - Personal information
  - Diagnoses
- Digital preservation system
- OAIS compliant

OUTPUT:

- Digital access
- Statistics and complete records (images and OCR-text)
- Access only by application
- Researchers and next of kin

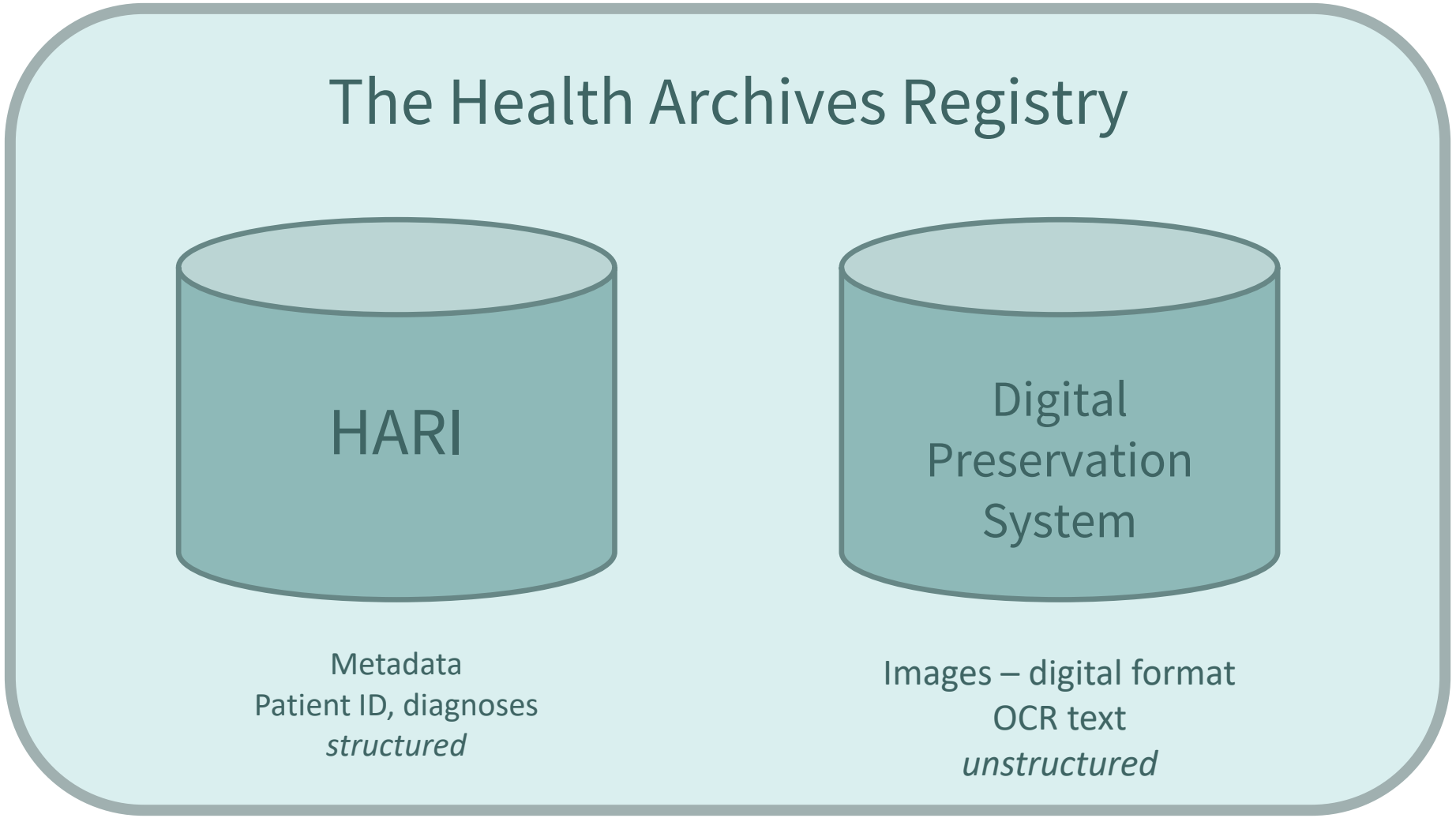
Photo: Trond Isaksen/Statsbygg

The Norwegian Health Archive Registry

Content overview September 2022

- **700 000 patient records**
- **53 hospitals**
- **3 700 000 diagnoses**
- **1871 – 2016: current time span**
- **244 million files**
- **100 TB data**
- **85 million pages digitized**

Photo: Vegard Breie

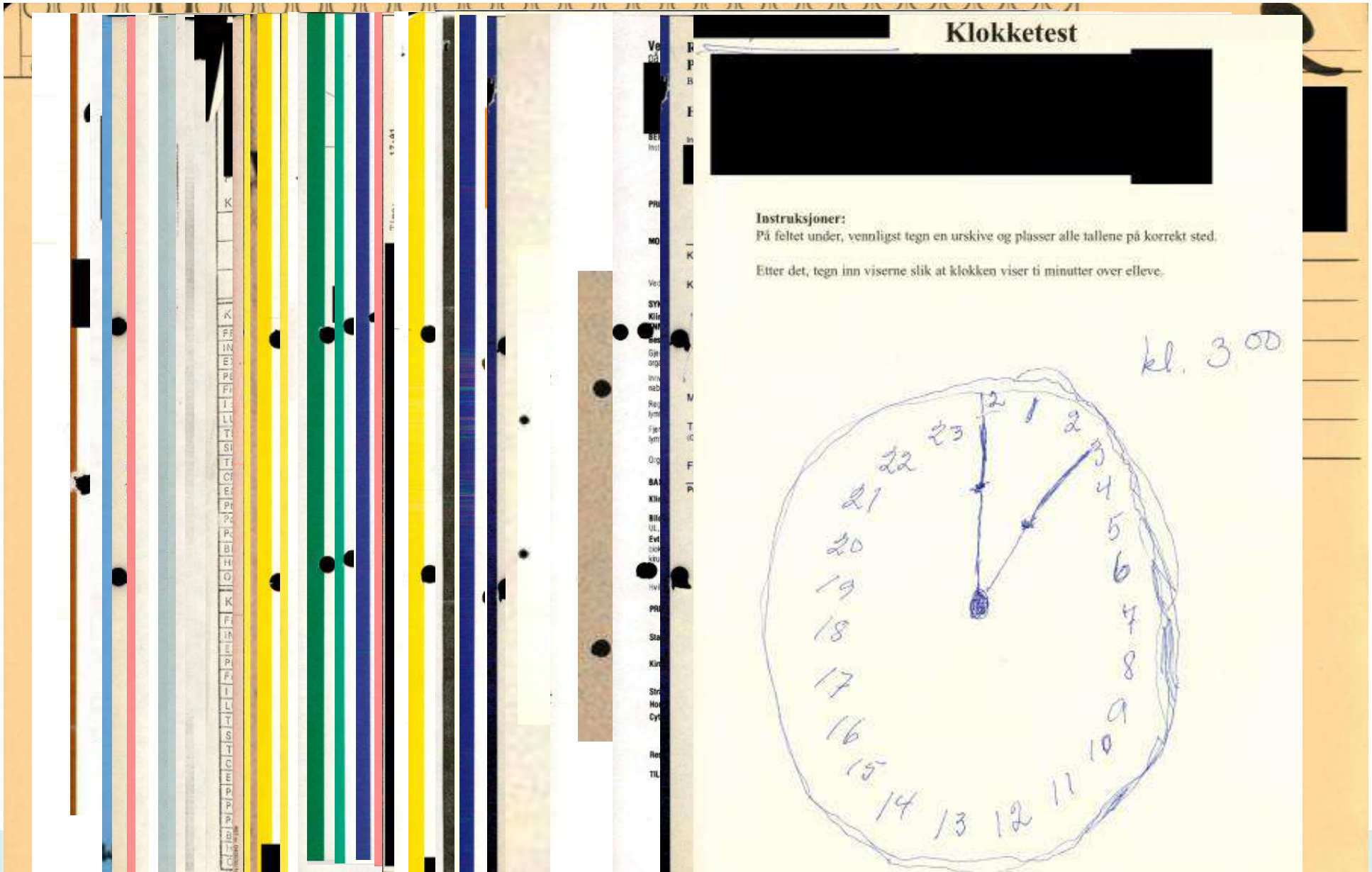


Figures: The Norwegian Health Archive Registry

The Health Archives Registry contains both **structured** and **unstructured data**

- The **structured** data are systemized, «tidy», easy to use and well suited for statistical analysis
- The **unstructured** data can be more challenging to handle and access, but that does not mean the data are less valuable

Photo: Pixabay and Makhbubakhon Ismatova



Klokketest

[redacted]

Instruksjoner:
På feltet under, vennligst tegn en urskive og plasser alle tallene på korrekt sted.

Etter det, tegn inn viserne slik at klokken viser ti minutter over elleve.

kl. 3 00

ARKIVVERKET
NORSK HELSEARKIV

ANZYZ

Innovation partnership with Anzyz Technologies

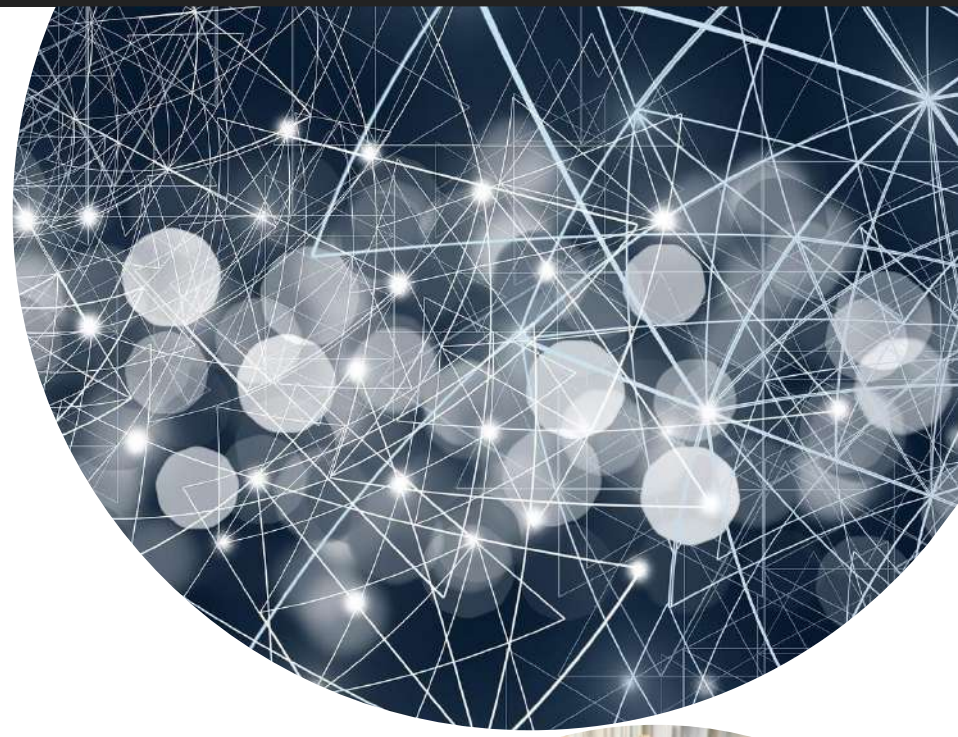
- Use artificial intelligence to find relevant information in big data
- Test and develop AI to find information that is irretrievable using metadata
- OCR is a prerequisite

FAKTA

Anzyz Technologies

- Norwegian AI
- Grown from the University in Agder
- Text analysis: Natural Language Learning (NLP)
- Language algorithm CCL
- Skilled in health data

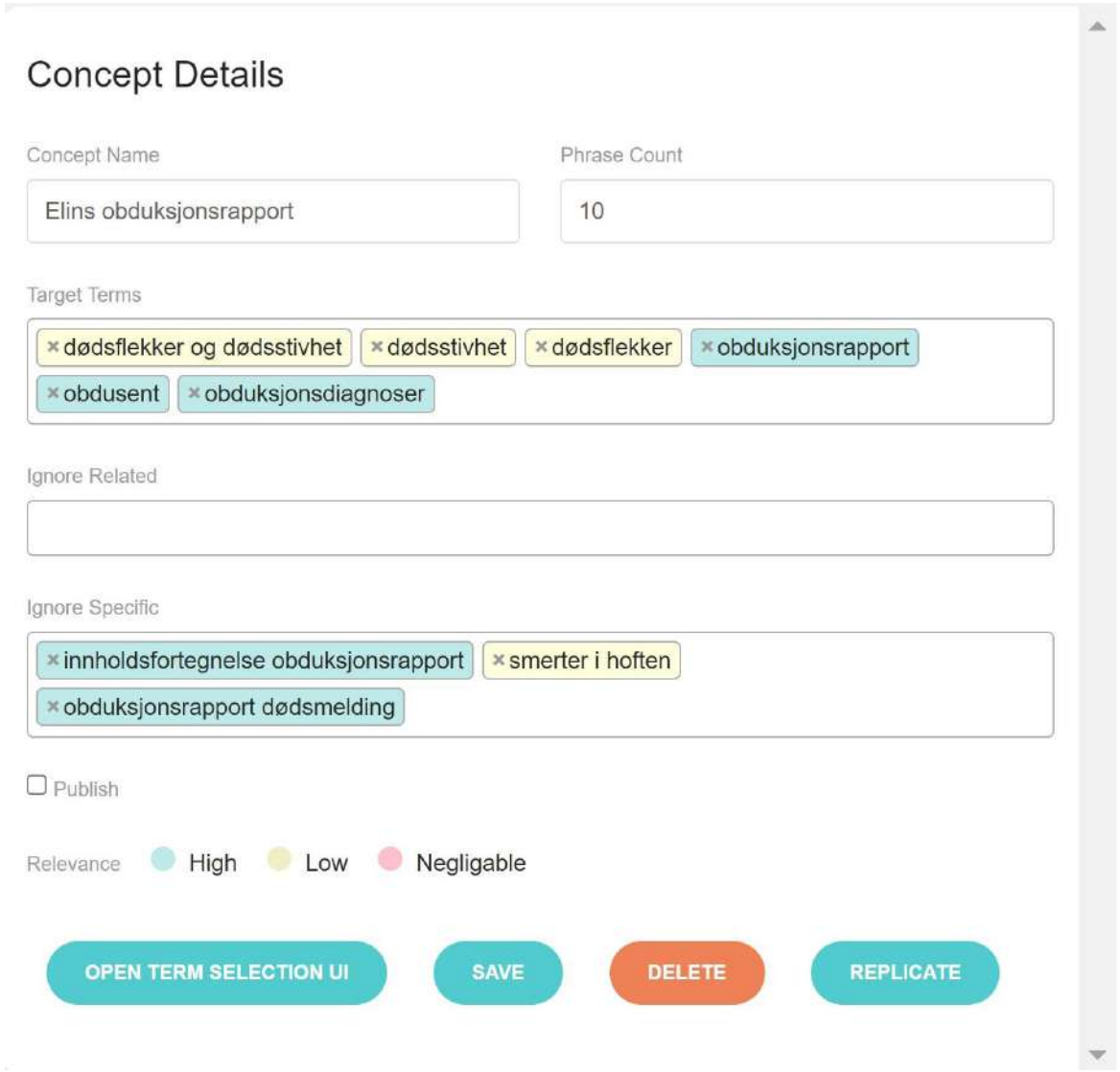
The pilot dataset and workflow



- 15 000 patient records from a university hospital
- Representative for the registry
- OCR-text is the input to the CCL algorithm
- AI-base established on random sample of data set
- Define statistical categories in the Anzyz Dashboard
- Output is a statistical report (.csv)

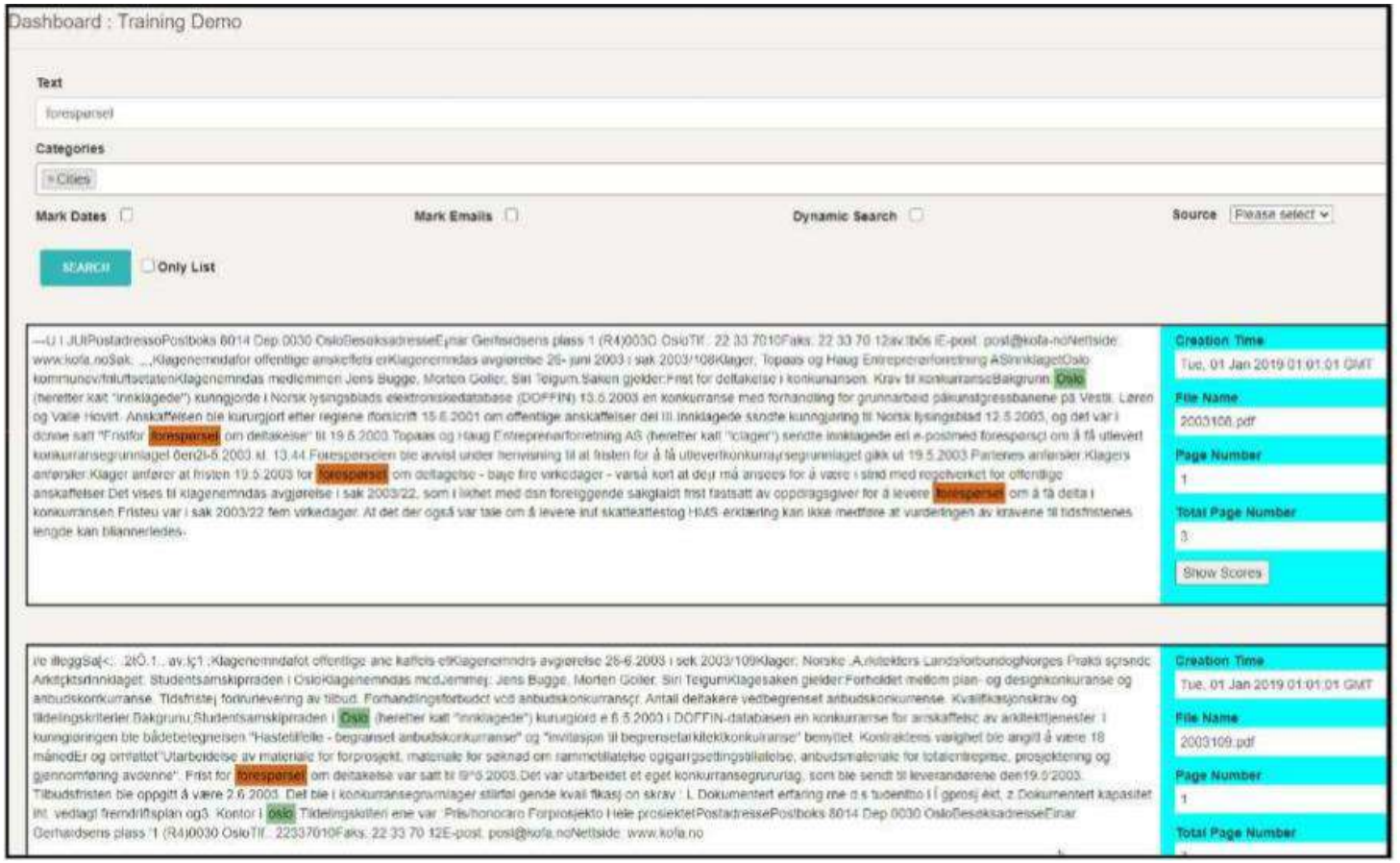
Photo: Ingrid Hemming and Pixabay

Build statistical categories



Figures: Anzyz Dashboard/ The Norwegian Health Archive Registry

Verify results and gain insight in the data set



Figures: Anzyz Dashboard/ The Norwegian Health Archive Registry

Autopsy reports

Penicillin allergy

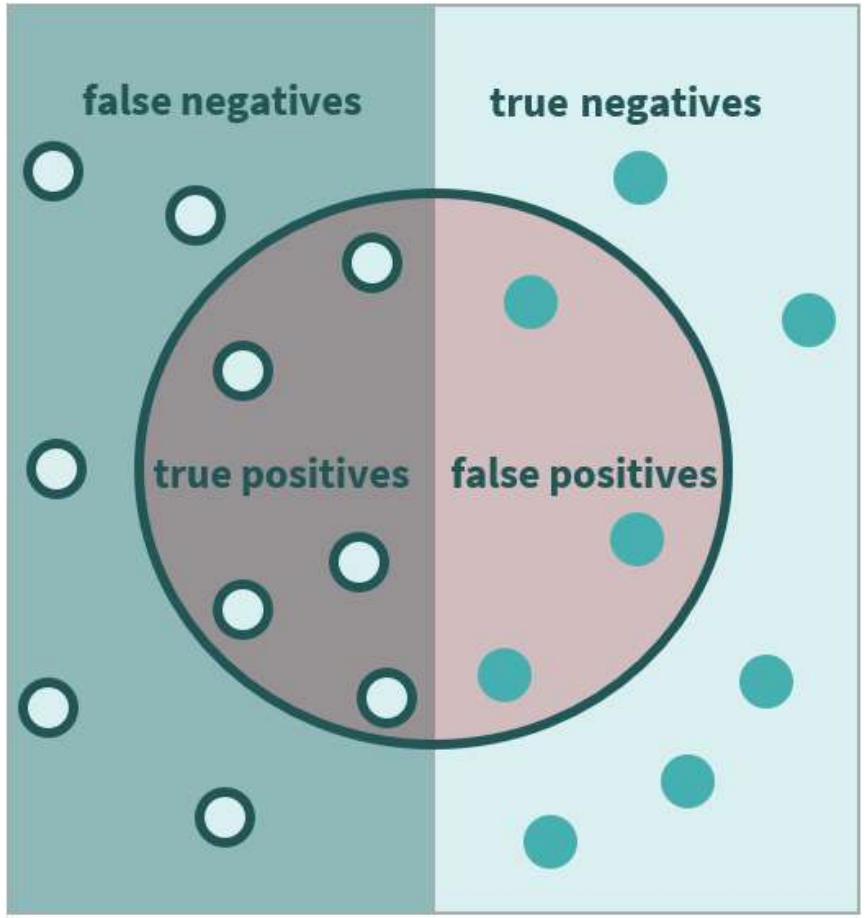
Antibiotic resistance

Urinary tract infection and antibiotic use

Autopsy reports

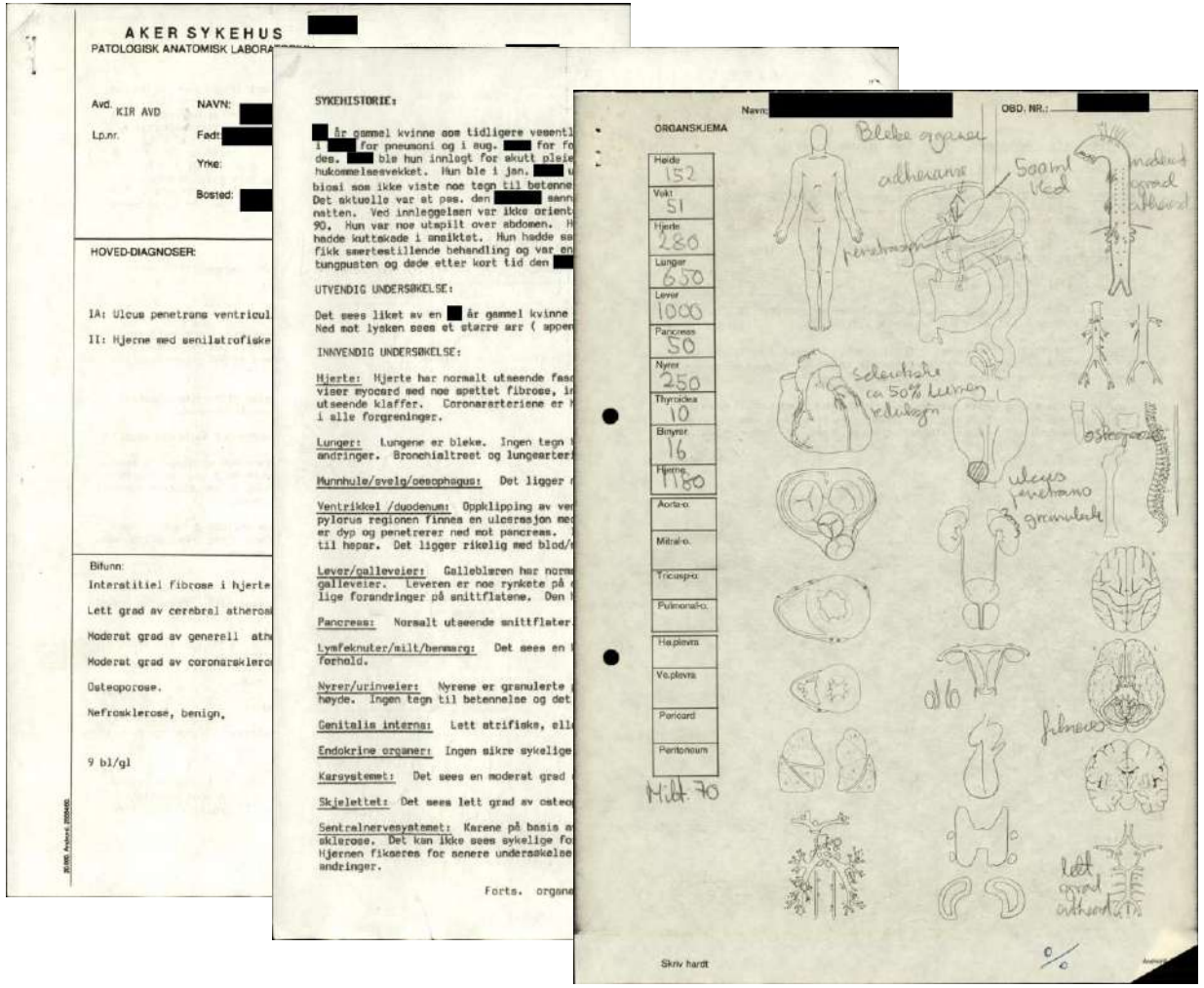
Results of statistical concept autopsy reports Total records in data set: 15 092	
CCL identified as autopsy reports	**669**
True autopsy reports	**86%**
False positives	**14%**
False negatives	**0%**
True negatives	**100%**

Type	Recall (%)	Precision (%)	F1-measure (%)	F2-measure (%)
PHR which included Autopsy reports	100	86	92	97



First PhD project hosted by The Norwegian Health Archives Registry

- An interdisciplinary project in three parts that combines:
  - resources and data from NHA
  - modern technology
  - public health knowledge.
- In the first article, AI technology will be further tested in regard to identifying autopsy reports in HARI.



Figures: The Norwegian Health Archive Registry

I hope to demonstrate how we can use AI methods to build relevant statistics and gain valuable insight into our extreme amounts of unstructured health data.

This way we can offer researchers better and more precise data products.

Elin Bjørnstad-Tuveng, PhD student

Photo: Vegard Breie

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