«Keeping patients out of hospital»
Capturing care trajectories

Care Trajectory

As experienced
As documented
As planned
As ... done
As per norm
As intended or wanted
As a collaborative process
As one among more
Keeping patients out of hospital

- Every hospitalization is a failure to prevent or treat the patients condition in the community.
- Hospitalization rates vary dramatically across municipalities.
- New health delivery models (chronic care model) -> patient centered delivery of evidence based care.
- The electronic medical record: Underused source of information.

<table>
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<tr>
<th>Region</th>
<th>Hosp. days/1000 inhab/year, avg. 2002-2006</th>
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1) Adjusted for age, gender, distance to hospital, mortality, education, low-income groups, home municipality state.
2) Adjusted for age, gender, distance to hospital, education, low-income groups, home municipality state.
Research questions

Methodological – Part A:
• Can we extract information from the EHR which allows a meaningful characterisation and realistic modelling of patient pathways?
• Can patient pathways information predict salient outcomes?

Health care research – Part B:
• Are patient pathways which adhere to Chronic Care model principles associated with higher quality of care/ lower hospitalization rates?
Objective: Trajectories of care vs. outcome

Tech & method development
- IE from EHR → Events
- Events ⊆ Trajectories
- Trajectory analysis
- Abstraction, clustering and visualization
- Simple variables

Do trajectories matter?
- Comparative effectiveness research
- Collaborative care
Are we interested in reality, or the documentation of it?

Is there a difference?

Can we make a mapping?
What is a good trajectory?

Methods development

Evaluation

Patient impression/opinion

Hospital Care?

Consent

Consenting Chronic patients

Total population

Gen Pract EHR

Chronic patients

National Patient Reg Hosp EHR

Consent

Information Extraction

Primary care

Specialist care

Survey

Gen Pract EHR
Trajectory in system vs. reality

Must establish common names, referents, for things, decisions, actions, events valid across systems and experience.
Trajectory technology

Capture & reasoning
- NLP
- Data quality and referent tracking.
- NER & events
- Anonymization
- Temporality, persistence and event reasoning

Alignment:
- Clustering & search
- Process models

Analysis:
- Query & visualization
- «Carelets»
- Care mapping for individual og group.

Evaluation – Properties of the good trajectory:
- User-understandable process features
- Composability
- Borders
- Simple criteria
Does trajectories exist?

- From a healthcare point of view?
  - No

- In one HIS?
  - Hardly, even with nice, global identifiers. Lots of noise and errors

- Across HIS?
  - Do not know

- Health data has ... low quality and validity, because noone uses them...
Keeping patients out of hospital
Patient Trajectories (Pastas)
Workshop, Stockholm 21 June 2012
Rune Sætre
Outline

• My Background
• My Pet Program
  – FastlegeVakten
• Demo
  – Patient Explorer
  – Brat / Stay
• Summary
CV

- 2003: MSc Computers: BusTUC @ atb.no
- 2006: PhD Computer Science NTNU
  - Natural Language Understanding (NLU): GeneTUC
- 2010: Postdoc University of Tokyo, TsujiiLab
  - Natural Language Processing (NLP): MedIE
- 2012: Postdoc NTNU: UbiCompForAll
  - End User Service Composition
- 2015: Postdoc NTNU
  - Keeping Patients Out of the Hospital
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## MinFastlege

### Søk etter fastlege

**Fylke:**
- Akershus

**Kommune/bydel:**
- Alle Kommuner

**Søk etter fastlege**

Oversikten viser alle lager i kommunen/bydelen. Listen kan sorteres ved å klikke på hver kolonnenoverskrift.

Jeg vil ha varsel hver gang det blir en ledig lege ved kontorene under:
**Min e-postadresse er:**

**Start Varsling**

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Knowledge representation:

- **BRAT:**
  - A1 format
  - Encoded Frames
  - Base: the subject (entity), or the predicate (events)
  - Arguments: object (entity or predicate)
  - identified by URIs
  - Example: *New York has a postal abbreviation which is NY*

```xml
<rdf:Description rdf:about="urn:states:New_York">
  <http://purl.org/dc/terms/" :alternative>NY</rdf:Description>
```

- **Universal Resource Identifier**
  - Ensure that concepts are tied to a unique definition that everyone can find on the Web
Demo

- Patient Explorer
- Brat
  - http://brat.nlplab.org/
Summary

• Keeping Patients out of Hospital
  – Patient Trajectories (Pastas)

• Analyze electronic patient records
  – Connect
    • written knowledge
    • structured knowledge
  – Find
    • Dates
    • Substances
    • Anatomy terms
    • Etc.