e-health – possibilities and challenges from a national and international perspective

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Overview of todays lecture 14.00-16.00

Introduction – who are we

Challenges when implementing eHealth

- *Short break* -

Electronic health records and interoperability

Health data, decision support and artificial intelligence

+ discussion and question between each section

eHealth Institute, Linnaeus University

Founded in 2002 (20 years!)

Research, evaluation, collaboration, and education in eHealth

Master programme in eHealth

Interdisciplinary

Medications one focus area

https://lnu.se/ehalsoinstitutet/

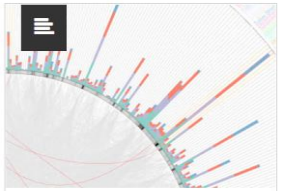
DISA

Linnæus University Centre
Data Intensive Sciences and Applications

Core technology

Data Intensive Software Technologies and Applications (DISTA)

Forskargruppen Data Intensive Soft… App… met… artif…



Information and Software Visualization (ISOVIS)

Forskargruppen Information and …

Deterministic and Stochastic Modelling

Forskningsområ… and Stochastic … Linnaeus Unive… Data Intensive S… Applications (DI… forskare med…

AdaptWise

Forskargruppen AdaptWise …rskning inom området …sande …rusystem. Fokus ligger …gen på: i) metoder i …tt kunna garantera …os…

High-Performance Computing Center (HPCC)

High-Performance Computing Center (HPCC) erbjuder beräknings- och lagringsresurser för att hjälpa forskare lösa stora beräknings- och big data-problem. Förutom…

Thematic areas

Data Intensive Digital Humanities

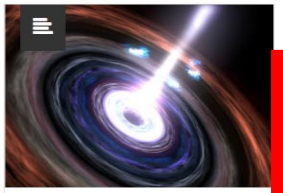
Forskningsområdet Data Intensive Digital Humanities inom…

Computational Social Sciences

Forskningen inom området Computational Social Sciences inom Linnaeus University Centre for Data Intensive Sciences and Applications (DISA) handlar om…

Forestry, Wood and Building Technologies

Inom forskningsområdet Forestry, Wood and Building Technologies…

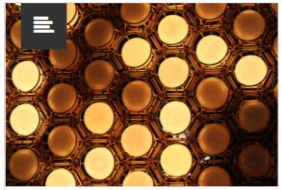


Data Intensive Astroparticle Physics

Forskningsområdet Data Intensive Astroparticle Physics inom Linnaeus University Centre for Data Intensive Sciences and Applications (DISA) spårar och studerar den…

E-health – Improved Data to and from Patients

Forskningen inom e-hälsoområdet vid Linnaeus University Centre for Data Intensive Sciences and Applications (DISA) kommer att resultera i nya metoder för…



Smart Industry Group (SIG)

Smart Industry Group (SIG) är en tvärvetenskaplig forskargrupp med expertis från datavetenskap och maskinteknik. SIG:s fokus är att göra produktion och produkter inom…

Linnéuniversitetet Kalmar Växjö

E-health and digital health to meet the societal and global challenges

Aging population

Limited resources

Lack of health care professionals

Equal care

Patient involvement

Mobility

Enablers for e-health

Technological development

Internet
Digital information technology
Smartphones, mobile applications
Health data
AI (artificial intelligence), machine learning
Sensors
IoT ”Internet of things”

Global Strategy on Digital Health 2020-2025

The purpose for a Global Strategy on Digital Health is to promote healthy lives and wellbeing for everyone, everywhere, at all ages. To deliver its potential, national or regional Digital Health initiatives must be guided by a robust Strategy that integrates financial, organizational, human and technological resources.

Challenges with digital health

Need for competence and education

- Digital health technologies strongly depend on uptake and appropriate use by healthcare professionals
- Competence important to be a part in the transformation, to be able to describe your needs
- Insufficient competence in digital health today
- Need to integrate in basic education as well as continuous competence development

Challenges with implementation of e-health

Linas presentation (separate file)

Electronic health records and interoperability

– medication management as an example

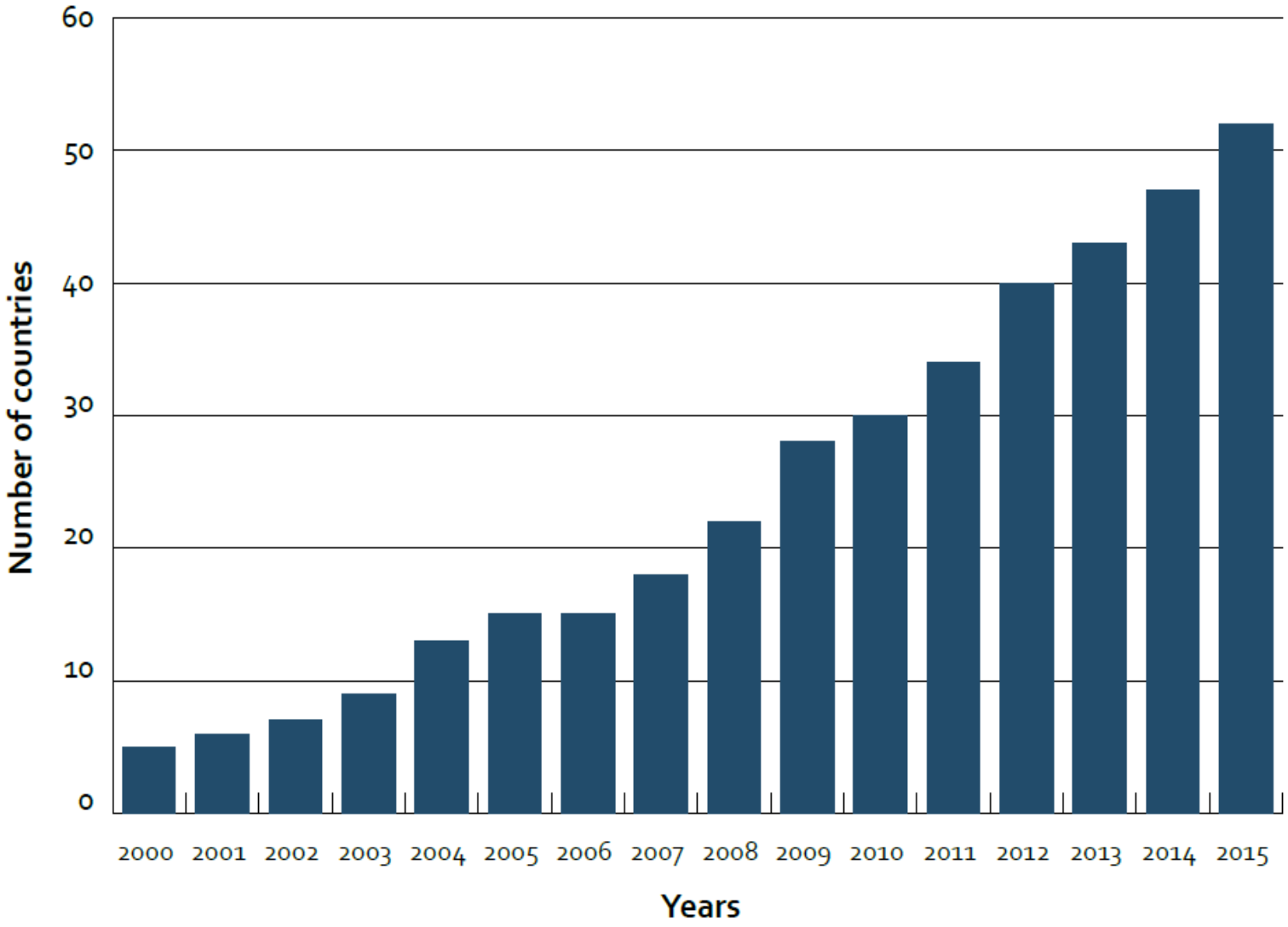
Electronic health records (EHR)

An electronic version of a patient's medical history

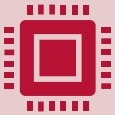
Maintained by the provider over time

May include demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data, and radiology reports …

Fig. 5.2 Countries with national EHR system, cumulatively by year of adoption (2000–2015)[a]



Interoperability



The ability of two or more systems or components to exchange information and to use the information that has been exchanged

Lack of interoperability brings challenges

Need high-quality datasets, seamless communication across IT systems and standard data formats

EHR in Sweden

All regions have EHR since many years

Differs between regions – they decide for themselves!

In some regions different parts of healthcare use different EHR

Many of the regions have chosen one EHR for both primary care, hospitals and psychiatry

Several are about to invest in new solutions

Prescribing of drugs

Prescribing of drugs is important for many disea

Most frequent medical intervention by doctors

Increasing use of drugs

Problems associated with drug treatment

Right medication
to the right patient
in the right amount
in the right time
in the right way

requires

Right information
to the right person
in the right amount
in the right time
and in the right way

Shared medication lists in Nordic countries

Drug-related problems can often be linked to information management issues

There have been several initiatives to implement Shared Medication Lists (SML)

Four Nordic countries, Denmark, Finland, Norway and Sweden, are all implementing an SML

Hammar T, Bergmo TS, Bülow C, Clausen SS, Manskow US, Timonen J, Jøsendal AV. Nationally Shared Medication Lists - Describing Systems in the Nordic Countries. Stud Health Technol Inform. 2023 May 18;302:207-211. doi: 10.3233/SHTI230104. PMID: 37203648.

E-prescibing in the Nordic countries

				
	Denmark	**Filnand**	**Norway**	**Sweden**
E-prescriptions	≥99%	≥99%	≥97%	≥99%
Electronic storing of prescriptions	Since 2006	Since 2010	Since 2013	Since 2005
Name of the SML	Fælles medicinkort (FMK	Prescription Service (ePS)	Pasientens legemiddelliste (PLL)	Nationella läkemedellistan (NLL)
Stage of implementation	Implemented	Implemented	Pilot testing in 1 region	Design/ early pilot

ePrescribing Europe

Cite this article: Brennan J, McElligott A, Power N. National health models and the adoption of eHealth and ePrescribing in primary care – new evidence from Europe. *J Innov Health Inform*. 2015;22(4):399-408.

http://dx.doi.org/10.14236/jhi.v22i4.97

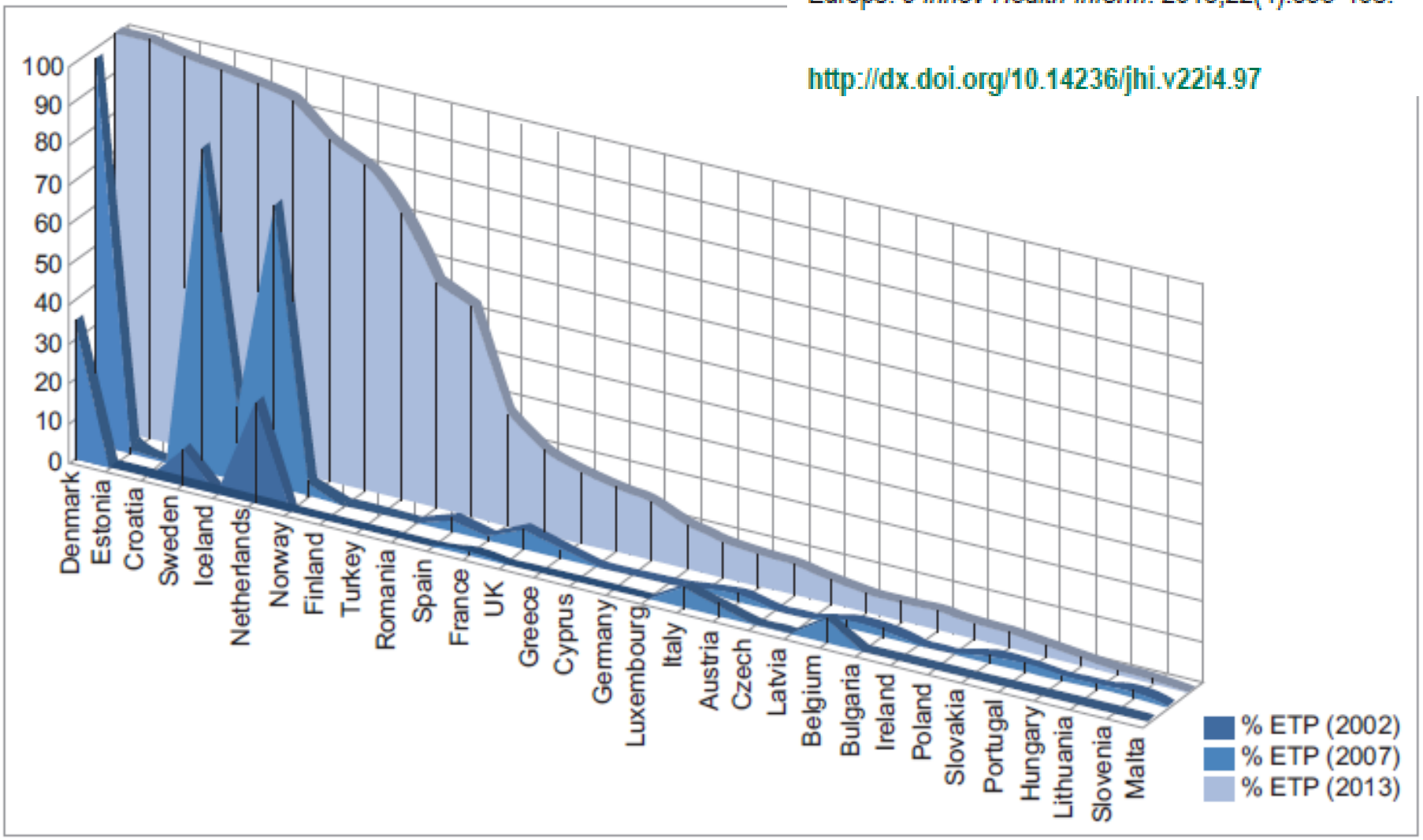
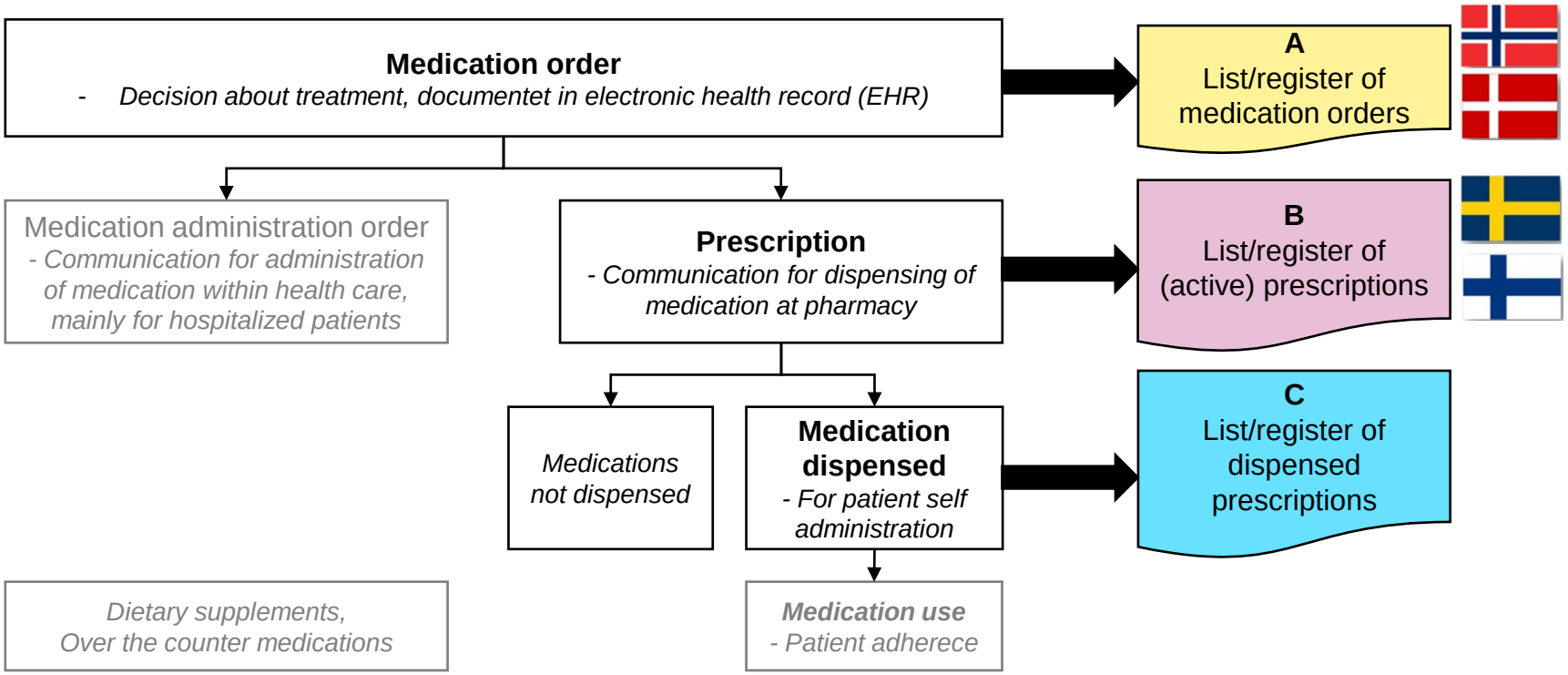


Figure 4 **The growth of ePrescribing in primary care in Europe from 2002 to 2013**

Shared medication lists

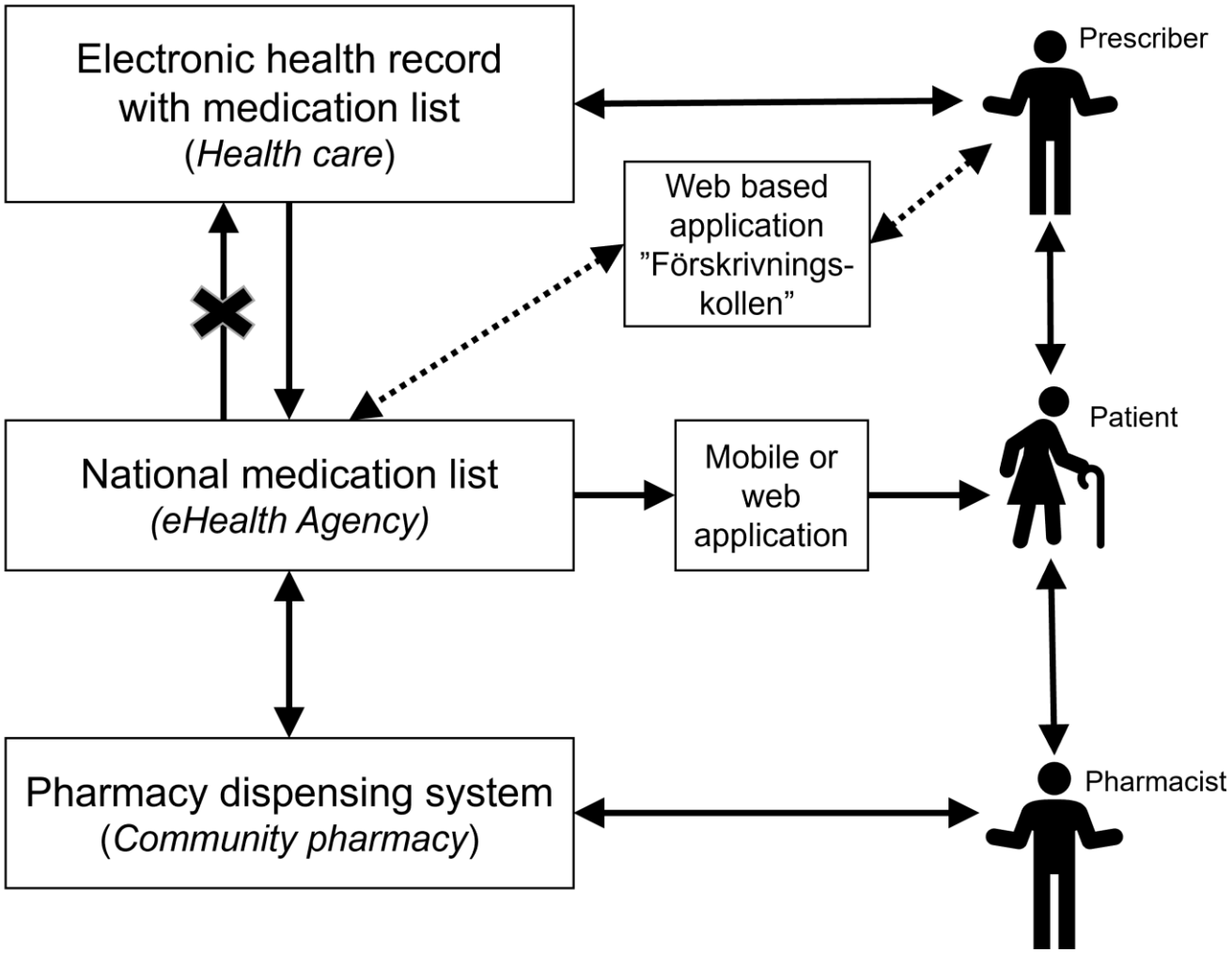


Status for shared medication lists in Nordic countries

- Shared medication list (SML) systems has potential to increase access to information and reducing discrepancies between lists
- Information in the SMLs is still not always up to date
- Unclear responsibilities
- Lack of citizen involvement

- Knowledge of any effects of SML systems is limited

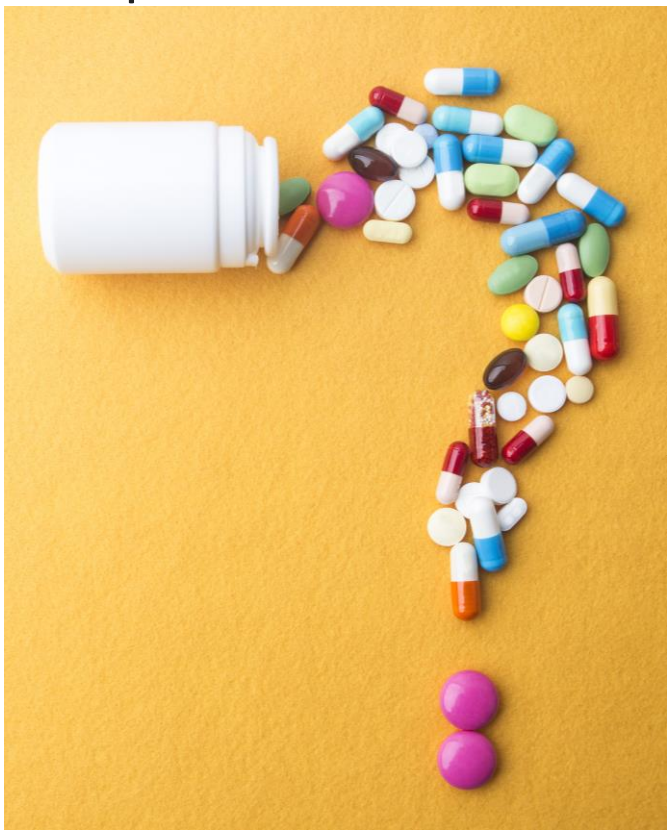
Electronic prescribing and shared medication list in Sweden



Challenges with Medication Management and the National Medication List in Sweden: An Interview Study from a Human, Organizational, and Technology Perspective

33 interviews during March to June 2020, before the 1st step of implementation of NLL

Informants	(n=33)
Patient (three or more medications)	10
Relatives (helping family with medication)	3
Pharmacist (community pharmacy)	8
Clinical pharmacist (health care)	2
Physician (health care)	7
Registered nurse (health care)	3



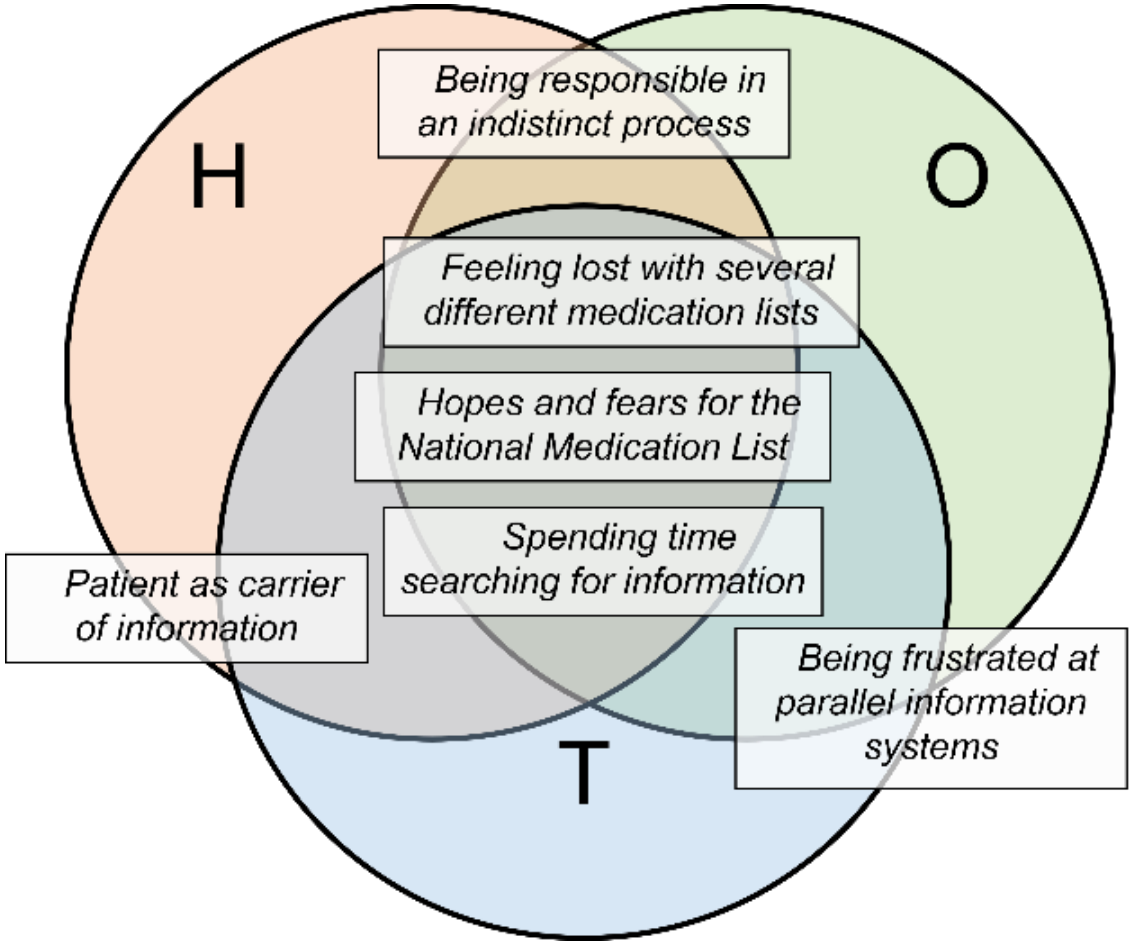
Hammar T, Hoffmann M, Nilsson L. Challenges with Medication Management and the National Medication List in Sweden: An Interview Study from a Human, Organizational, and Technology Perspective. Stud Health Technol Inform. 2023 May 18;302:287-291. doi: 10.3233/SHTI230120. PMID: 37203664.

Results

H = Human

O = Organizational

T = Technology



- NLL potential to improve
- Implementing a shared medication list is complex
- Challenges connected to a combination of human, organizational and technology aspects

Discussion

Your experiences with electronic prescribing?

Do you recognize the issues described?

Health data, decision support and artificial intelligence

Health data - vision

achieve more efficient, higher-quality, safer and more personalised care, and help improve healthcare delivery.

transform public health and revolutionize healthcare systems, enabling lifesaving healthcare improvements.

crucial role in speeding up the development of new medical products and treatments for patients who need them most.

The European Health Data Space (EHDS)

The European Health Data Space is a health specific ecosystem comprised of rules, common standards and practices, infrastructures and a governance framework that aims at:

1. Empowering individuals through increased digital access to and control of their **electronic personal health data,** at national level and EU-wide.
2. Fostering a single market for electronic health record systems, relevant medical devices and high risk AI systems.
3. Providing a trustworthy and efficient set-up for the **use of health data** for research, innovation, policy-making and regulatory activities (secondary use of data).

https://www.european-health-data-space.com/

Primary and secondary use of health data

Primary use of health data:

- To support individual patient care and improve health outcomes
- Health data, such as medical records, laboratory test results, and clinical assessments, are collected and analyzed to provide healthcare professionals with accurate and up-to-date information about a patient's health status
- This data is crucial for diagnosis, treatment planning, monitoring of progress, and ensuring continuity of care

Secondary use of health data:

- Utilizing health information for purposes other than direct patient care.
- It encompasses activities such as medical research, public health surveillance, health policy development, and quality improvement initiatives
- By analyzing aggregated and de-identified health data, researchers can uncover new insights, trends, and treatment outcomes to advance medical knowledge

Challenges with health data today

Interoperability

- People cannot always easily access their health data electronically, and if they want to consult doctors in more than one hospital or medical centre, they often cannot share the data with other health professionals.
- Health data is often still recorded on paper, untraceable and scattered across various places (hospitals, general practitioners' venues, medical centres, etc.).
- The situation becomes even more difficult when crossing national borders.

- Researchers, industry, policy-makers and innovators, face important obstacles in accessing the data they need to develop new products, to take informed decisions or to monitor the side effects of medicinal products over the long term, based on real-world evidence, with impact on patient safety.

We need…

Decisions and actions based on current best knowledge

- By professionals in clinical practice
- By individuals
- On population level

Evidence based medicine

a stronger scientific foundation for clinical work, so as to achieve consistency, efficiency, effectiveness, quality, and safety in medical care

Making Practice of Evidence-based Medicine

- Gaps between evidence and practice
- Common that patients do not get the best care possible

"… took an average of approximately five years for these guidelines to be adopted into routine practice"

"Moving toward more evidence-based practice has the potential to improve quality and safety while simultaneously reducing costs. We believe that implementation of computerized decision support through electronic medical records will be the key to actually accomplishing this."

(Bates et al 2003 Journal of Americal Medical Informatics Association)

Examples decison support medications

Janusmed interaktioner och riskprofil

Janusmed fosterpåverkan

Janusmed amning

Miljö och läkemedel

Janusmed kön och genus

Janusmed njurfunktion (inom SLL)

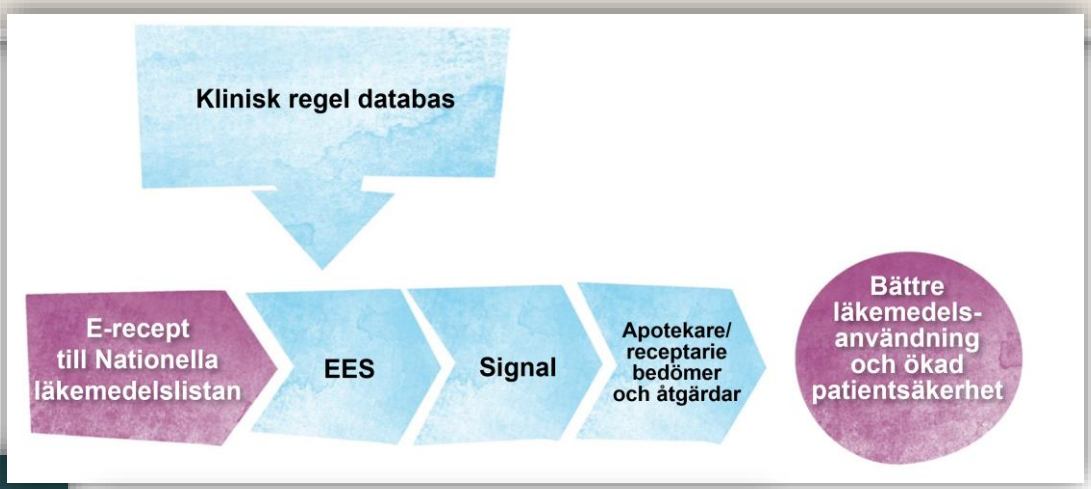
Kloka Listan

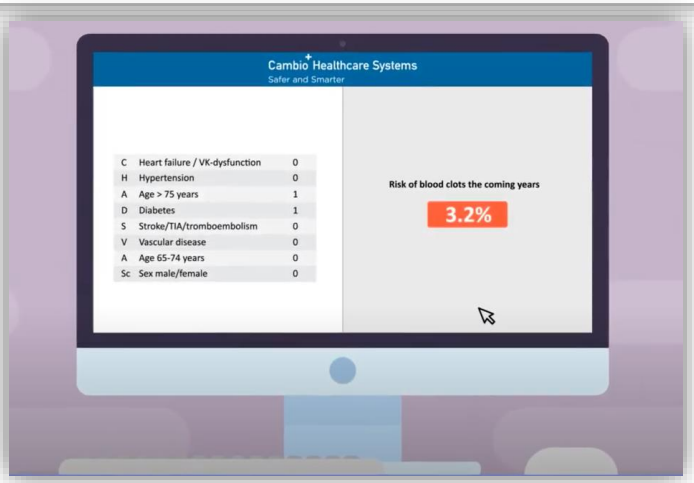
Sök i Kloka Listan

Kloka Listan 2017 är evidensbaserade rekommendationer av kostnadseffektiva läkemedel för vanliga sjukdomar i öppen och sluten vård.

FASS Vårdpersonal

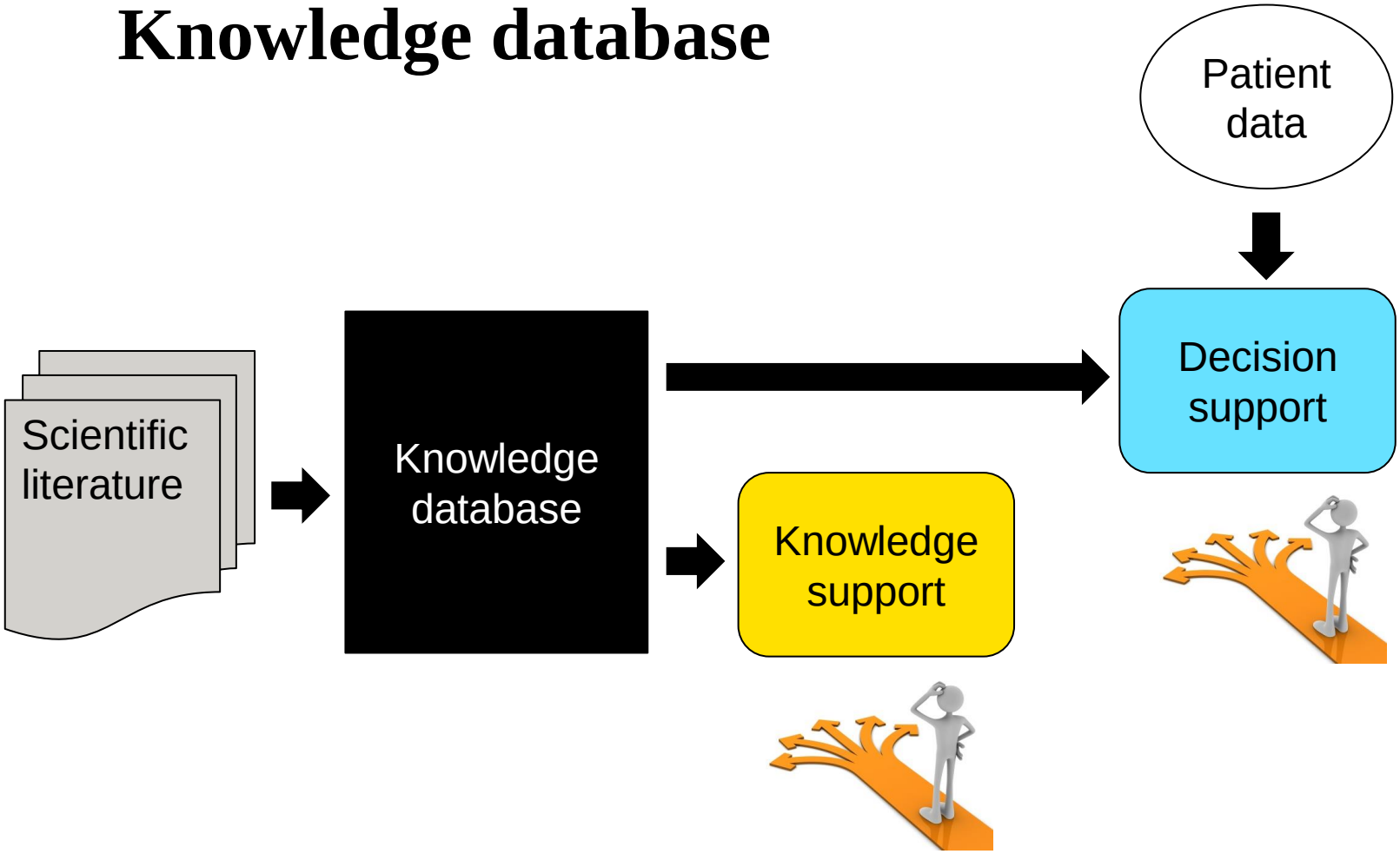
Sök på läkemedel, substans, ATC eller vnr





AI?

Knowledge database

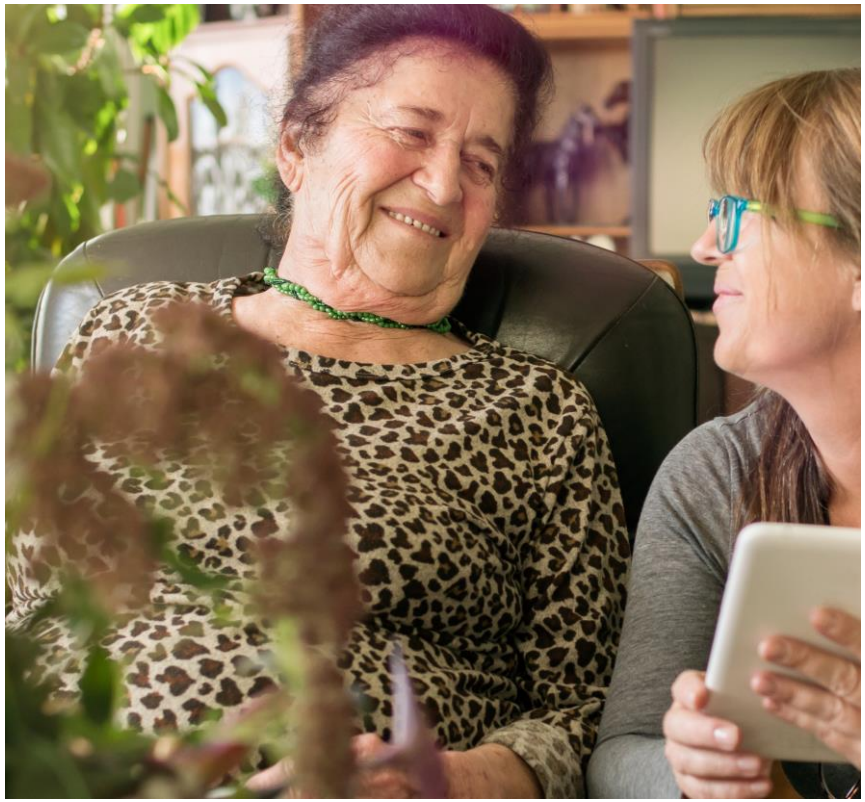


Supporting and involving the patient

- Most of the time patients are on their own

- Medication management that includes elderly patients can be particularly challenging
  - Increased prevalence of multi-morbidity
  - Common with many different medications
  - Changes in pharmacokinetics and pharmacodynamics
  - Difficulties handling their medication due to physical disability and cognitive impairment

- Not sufficient information
- Not sure who to contact and when
- Using many different sources of information, different quality
- Underused recource



What do we know about providing decision support to patients?

- Some patients want to check for DDIs themselves
- Numerous DDI services available
- Large variations regarding service quality ➔ potential safety issues
- Not established how well available DDI services
  - ✓ meet the needs of patients,
  - ✓ how they are used by patients, and
  - ✓ what the effects (if any) are from patients using them
- DDI information and management are complex areas, and making an incorrect decision has the potential to lead to serious consequences.
- Differences between patients, in terms of demands, literacy, and ability to use this kind of services
- Limited research about digital DDI services to patients (knowledge gap)

Hammar T, Hamqvist S, Zetterholm M, Jokela P, Ferati M. Current Knowledge about Providing Drug–Drug Interaction Services for Patients—A Scoping Review. *Pharmacy*. 2021; 9(2):69. https://doi.org/10.3390/pharmacy9020069

Clinical decision support systems for professionals – how well do they work?

- Can improve quality and efficiency
- Reduces the risk of errors, improves work processes, some improve outcomes for patients
- A lot of research but difficult to generalize
- Varying outcomes
- In most systems, most signals do not lead to change

Challenges clinucal decision support

Usability, fit with work pocess

Alert fatigue/
alert override

Clinical relevance

Integration and implementation

Access to relevant clinical data

Correct medication list

Usually no information about actions or decisions made by others related to the alert

Great potential with AI but new challenges
Transparency, explainable AI
Reliability

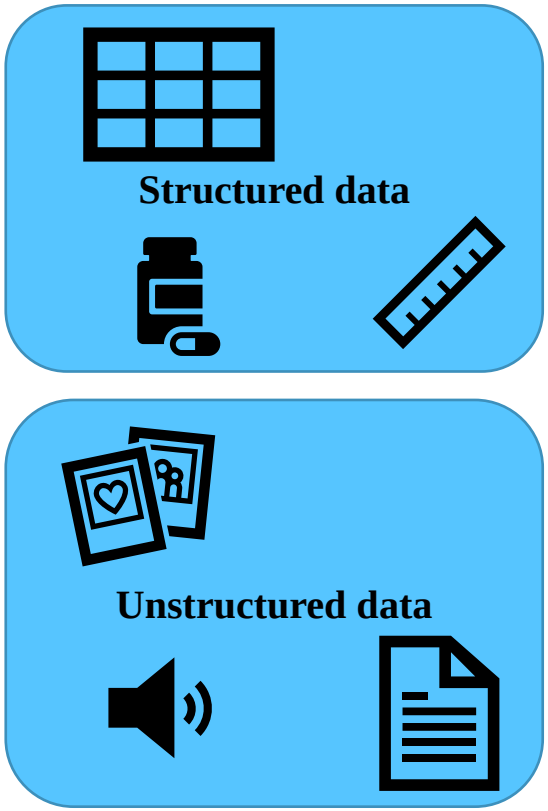
Artificial intelligence in health care – **Why?**

- eHealth and AI to meet global challenges
  - Ageing population, more chronic diseases and advanced treatments
  - Limited recources and lack of professionals with the right competence
  - Equal health and access to care

- Digitalization and AI brings new opportunities
  - Evidence based practice
  - Large quantities of data available
  - Complexity

Examples AI in health care

- Diagnostics using images
  - E.g. cancer diagnostics
  - Early adoption of AI?
- Understanding human language
  - E.g chatbots
  - Large quantities of free text documented in health care
  - Natural language processing (NLP)
- Assessing vitala parameters, movement or activity
  - Sensors
- Clinical decision support systems
  - E.g predicting (alerting) for drug-drug interactions
  - Mostly rule based systems (expert systems) today
  - Several limitations with current systems



Artificial intelligence (AI)

"Intelligence demonstrated by machines"

AI?

Expert systems

Rules programed by humans (experts)
By some definitions included in AI

Knowledge database + inference engine

Todays decison support in medication management are examples

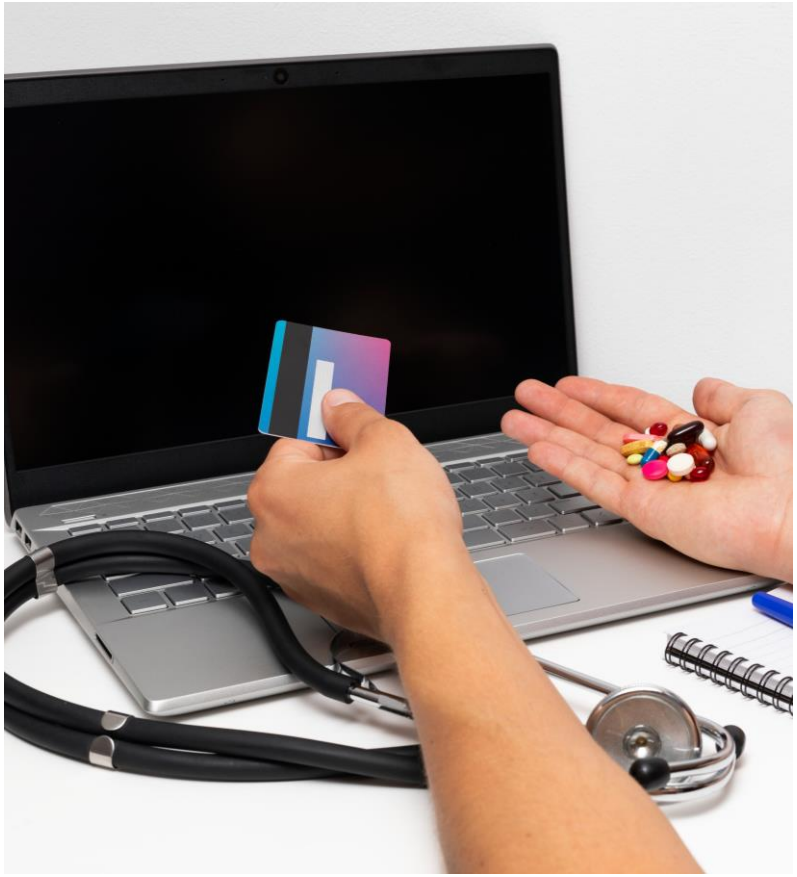
AI

Machine learning

type of artificial intelligence (AI) that allows software applications to become more accurate at predicting outcomes without being explicitly programmed to do so

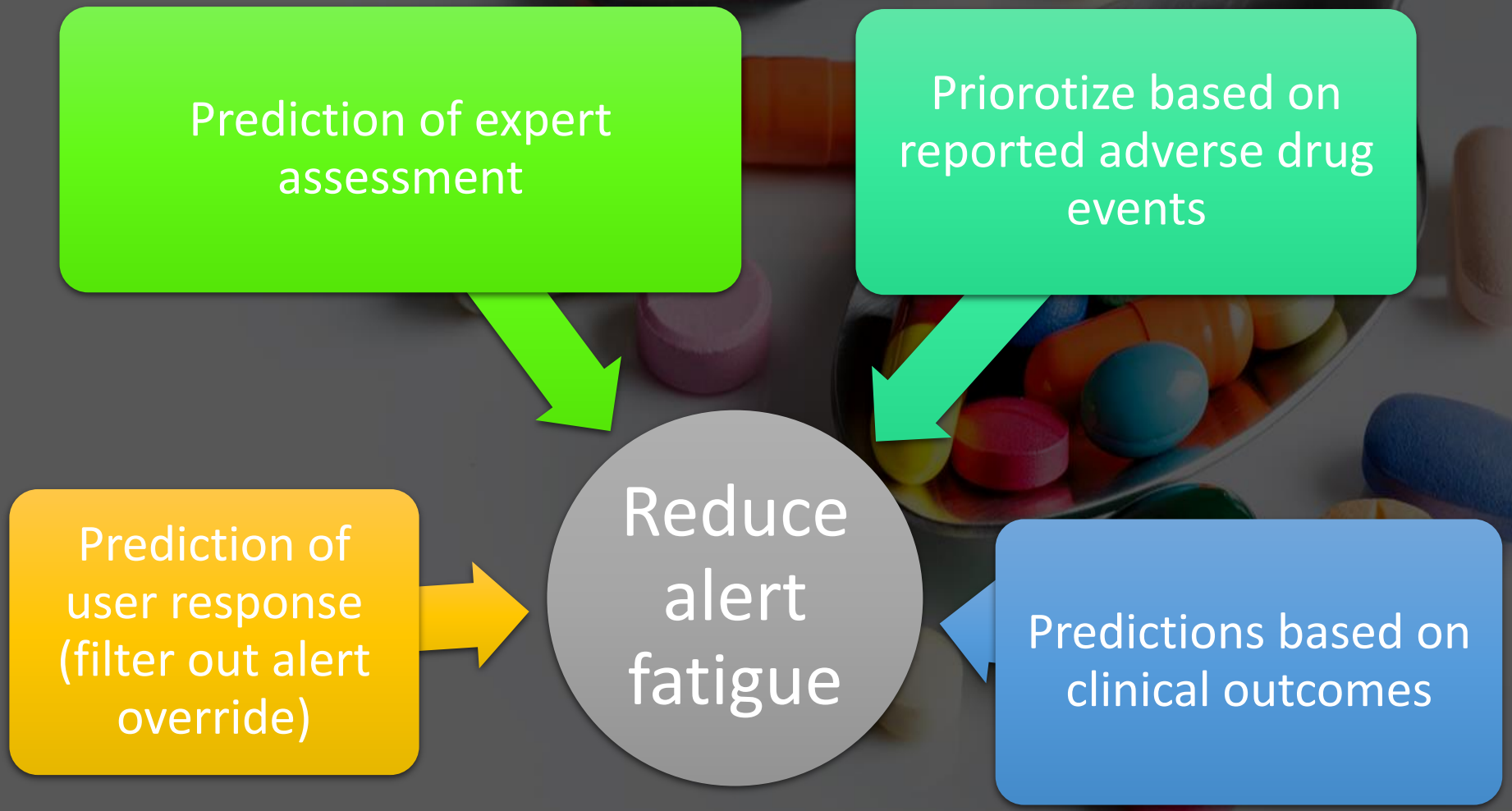
Important role in the future

Can AI improve clinical relevance and reduce alert fatigue



- Alert override >90%
- Many alerts are not clinically relevant and cause alert fatigue
- Different strategies

Machine learning to redice alert fatigue



Recommended reading

1. Cummins N, Schuller BW. Five Crucial Challenges in Digital Health. Front Digit Health. 2020 Dec 8;2:536203. doi: 10.3389/fdgth.2020.536203. PMID: 34713029; PMCID: PMC8521883.
2. World Health Organization. Ethics and governance of artificial intelligence for health. 2021 – (only page 11-16, summary)
3. Hammar, T. Bergmo, T., Bülow, C., Clausen, S., Manskow, U., Timonen, J., Jøsendal, A. Nationally shared medication lists – describing systems in the Nordic countries. MIE, Medical Informatics Europe, 2023. doi:10.3233/SHTI230104
4. Hägglund M, McMillan B, Whittaker R, Blease C. Patient empowerment through online access to health records BMJ 2022; 378 :e071531 doi:10.1136/bmj-2022-071531
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6. Lehne M, Sass J, Essenwanger A, Schepers J, Thun S. Why digital medicine depends on interoperability. NPJ Digit Med. 2019 Aug 20;2:79. doi: 10.1038/s41746-019-0158-1.

Thank you!

Questions?

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