Clinical decision support systems: too many expectations, too little evidence?
Problems and emerging solutions, through an EBHC lens

Per Olav Vandvik, on behalf of wonderful colleagues, for Sicily November 8 2019
Declaration of interests: Head of MAGIC Evidence Ecosystem foundation, hosting MAGICapp and BMJ RapidRecs
Imagine John, just hospitalized in Oslo with high risk TIA 59 yrs stressed engineer, acute dizzy with weak left arm and leg 8 hours How make sure John gets the right treatment, at the right time in 2019?

Cite this as: BMJ 2018;363:k5130

Recommendation 1: Dual vs single antiplatelet therapy

Clinical decision support system (CDS), one definition:
“Tools that incorporate established clinical knowledge and updated patient information to enhance patient care; they encompass an array of strategies supporting a variety of topics” (NIH)
CDS - A GPS on the learning healthcare system highway

Prevention, diagnosis, treatment, follow up

Patient/population level

Advice, alerts, reminders, order sets, infobuttons...

One/multi-dimensional

Automatic/on demand

Provider/patient directed
Problems with CDS in Electronic Health Records (EHRs)
EHRs designed for what purpose? To care for our patients? For EBHC?
CDS: 40+ years of huge investments, great promise + too many expectations?

“We just got an EHR in my hospital. I love it! For the first time I can understand the patient-notes from my colleagues”

Gordon Guyatt (anecdotal evidence;-)
CDS over 40 years – No evidence of progress
No clear learning curve, despite modern CMS (Roshanov BMJ 2013)
CDS interventions that work: Variable and uncertain effects
66 trials: Mostly low certainty evidence across 14 factors

https://doi.org/10.1186/s13012-018-0790-1

Providing CDS automatically

CDS combined with patient-oriented strategies

Moderate Quality evidence

Low quality evidence

N=3

N=5

N=10

11/8/2019
How can CDS go wrong? Killer features

The 4000 clicks a day problem  Hill, Am J Emerg Med 2013
*Physicians spend more time on computer than with patients*

Attention theft  Alsos, Stud Health Technol Inform 2008
*Inappropriately shifting focus of consultation*

Automation bias  Goddard, J Am Med Inform Assoc. 2012
*Negatively influenced treatment plan through inaccurate CDS*

Too much – too late situation  Hayward, J Am Med Inform Assoc 2013
*Fatigue alerts and CDS available too late in the workflow*

Too many expectations? YES! Too little evidence?  
Best current evidence: disappointing effects and unintended consequences 
Time to give it up?
Any emerging solutions?
Let us breathe and (literally) step back for a few minutes
Key problems with evidence, beyond CDS
Medical informatics just one siloed community, among others
Progress in evidence-based medicine: a quarter century on

Benjamin Djulbegovic, Gordon H Guyatt

Sythesize evidence
Relevant, timely, reliable and living systematic reviews

Produce guidance
Trustworthy HTA, guidelines and decision aids re-using same evidence and structured data

Produce evidence
Relevant and reliable primary research, real-world evidence and big data

Disseminate guidance to policy makers, clinicians and patients
Digital, multilayered and user friendly HTA-reports, guidelines and decision aids on all devices, plugged into portals, publications etc

Evaluate impact in practice
Quality improvement initiatives, population-based data in EHRs, dynamic registries, studies (e.g. RCTs)

Implement guidance and decision support
Personalized decision support in EHRs, pathways, registries, local protocols etc
CDS through trustworthy and computable recommendations being the entities, moving away from flat formats (e.g. PDFs) to be chopped up in CDS

www.magicapp.org
Some emerging solutions lending promise for CDS in EHRs

1. How to access and exchange patient data?

**FHIR**: Fast Healthcare Interoperability Resources

- International standard for accessing patient data from EHRs and other repositories

- EBM on FHIR, CPG on FHIR under development

- Allows sharing of data between systematic reviews, guidelines, CDS in the EHR ++, through interoperable platforms (e.g. Covidence, Revman, MAGICapp, EBMeDS)
2. Systematic implementation of guidelines with CDS GUIDES based on best current evidence on what works

THE CONTENT PROVIDES TRUSTWORTHY EVIDENCE-BASED INFORMATION

2.1

domain 2

Rationale

CDS-guided decisions about diagnosis, prevention, treatment and follow-up must be based on the best current evidence available, typically from clinical practice guidelines that meet standards of trustworthiness. It is important that CDS decision support is clear about the benefits and harms of the management options available, the certainty of the evidence, the importance of the outcomes for patients, and the acceptability and feasibility of the intervention.

Providing such information can help healthcare providers and patients to make better-informed healthcare decisions, and helps them to critically examine the decision support.

How to evaluate

Consider the following questions:

- Do the organisation(s) and people that developed the decision support have credibility?
- Is the advice supported by up-to-date scientific evidence and is the type and quality of this evidence clear to the user?
- Is the decision support clear on the benefits and harms of the different management options?

Examples

Positive examples could include:

- An expert panel is developing the decision support using trustworthy guidelines and a comprehensive review of the available evidence. Formal methods are helping the panel to reach consensus.
- The decision support is backed up by detailed recommendations that clearly communicate the strength of the recommendations and the balance between the desirable and undesirable effects of adherence to the management options.
- The methods to develop and update the decision support are explicitly described and can be used to assess information quality.
3. Trustworthy and computable guidelines plugged into CDS ++

BMJ Rapid Recommendations feeding the evidence ecosystem

How can John with high risk TIA get the right treatment at the right time?........
Trustworthy, accessible and timely guidelines and decision aids in innovative, multilayered formats disseminated globally for downstream use. Computable recommendations in MAGICapp allow plugging into EHRs as CDS.
Computable evidence plugged into practice
National guidelines, CDS (in combined pathway and registry) and other tools

And local quality improvement projects in hospitals
4. CDS for guideline implementation (EBMeDS)

**Individualized approach**, health impact of recommended actions

Patient data integrated with medical knowledge in structured EHRs

---

**Healthcare GPS Dashboard**

<table>
<thead>
<tr>
<th>Health Improvement Opportunities</th>
<th>Health Impact</th>
<th>Expand</th>
<th>Detailed view</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop smoking</td>
<td>7.2</td>
<td>Expand</td>
<td>Detailed view</td>
</tr>
<tr>
<td>Start statin</td>
<td>3.6</td>
<td>Expand</td>
<td>Detailed view</td>
</tr>
<tr>
<td>Start antihypertensive medication</td>
<td>3.3</td>
<td>Collapse</td>
<td>Detailed view</td>
</tr>
</tbody>
</table>

- Reduces risk of heart attack or stroke by 5.2% with a Relative Importance of **80** contributes a Health Impact gain of **4.1**.

- Side effects (e.g., dizziness, fatigue, passing out) in 7.0% with a Relative Importance of **12** contributes a Health Impact loss of **0.8**.

| Get physically active                            | 2.9           | Expand | Detailed view |
| Start aspirin                                    | 1.4           | Expand | Detailed view |

Linked to decision aids and integrated care plans for patient choices
4. CDS through the Health Benefit Analysis Suite (EBMeDS)

Population health approach

Analyze care gaps, prioritize and treat patients with most benefit

Case study Finland primary care: 17427 patients, structured EHR data into CDS

Type 2 diabetes: LDL cholesterol and statin medication - is statin medication cost-effective in my group practice?

Number of patients with type 2 diabetes

1,312

Starting statin medication for 389 people with type 2 diabetes would prevent

- 3 deaths
- 11 strokes
- 8 myocardial infarctions in 10 years

= 12.5 death equivalents (adjusting for importance of outcomes)

12.5 deaths are avoided for an average of 5 years = 62.5 QALY

Cost of statin for 10 years 160 000 – 300 000 €

Cost per QALY (if only drug cost considered) = 2500 – 5000 €.

In high-income countries, cost per QALY up to 80 000 € is considered acceptable
5. Countries realize need for new infrastructure and orchestration CDS in a learning health system, key actors lining up in the US right now. International focus, trustworthy guidance, aligned Evidence Ecosystem vision.

Synthesize evidence
Relevant, timely, reliable and living systematic reviews

Produce guidance
Trustworthy HTA, guidelines and decision aids re-using same evidence and structured data

Produce evidence
Relevant and reliable primary research, real-world evidence and big data

Disseminate guidance to policy makers, clinicians and patients
Digital, multilayered and user friendly HTA-reports, guidelines and decision aids on all devices, plugged into portals, publications etc

Evaluate impact in practice
Quality improvement initiatives, population-based data in EHRs, dynamic registries, studies (e.g RCTs)

Implement guidance and decision support
Personalized decision support in EHRs, pathways, registries, local protocols etc

Warrants that actors can explicitly agree on and make use of specific:

- **Standards**
- **Methods**
- **Platforms**
- **Processes**
New expectations and more unintended consequences for CDS?
Take home messages on CDS, through an EBHC lens

• Too many expectations? Yes!
• Too little evidence? Limited benefits/unintended consequences so far
• Problems with CDS but exciting times

• Emerging solutions for CDS, through advances for EBHC, guidelines and eHealth. Too little evidence here....

• Trustworthy, living CDS fully linked into the evidence ecosystem: Wouldn´t that be great?
• EBHC folks hook up with medical informatics folks to get it right?
On behalf of the MAGIC Evidence Ecosystem Foundation

www.magicproject.org    www.magicapp.org

Per Olav Vandvik
Head of MAGIC

Linn Brandt

Thomas Agoritsas

Gordon Guyatt

Anja Fog Heen

Lyubov Lytvyn

Reed Siemieniuk

Frankie Achille

Deno Vichas

Frankie Achille

Annette Kristiansen

Christopher Berntzen

Romina Brignardello

Alfonso Iorio

And our partners at The BMJ

Fiona Godlee

Helen Macdonald

Sophie Cook

Elizabeth Loder

Duncan Jarvies

Will Stahl-Timmins