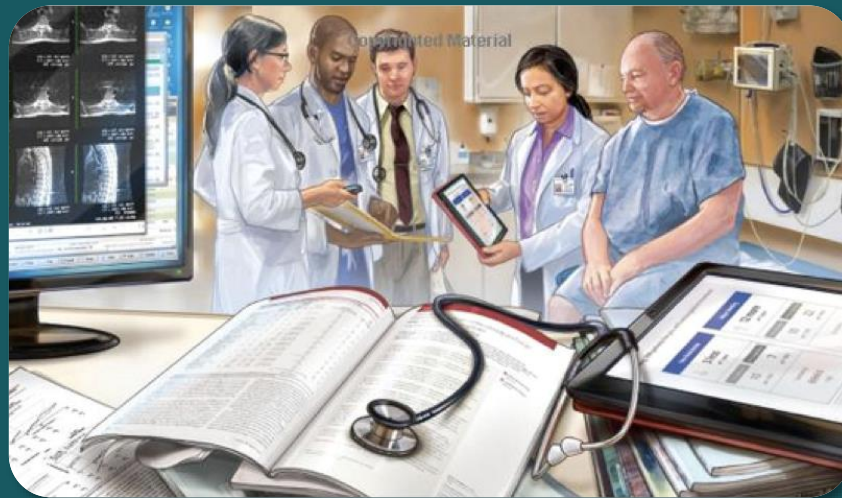


Clinical decision support systems: too many expectations, too little evidence?

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

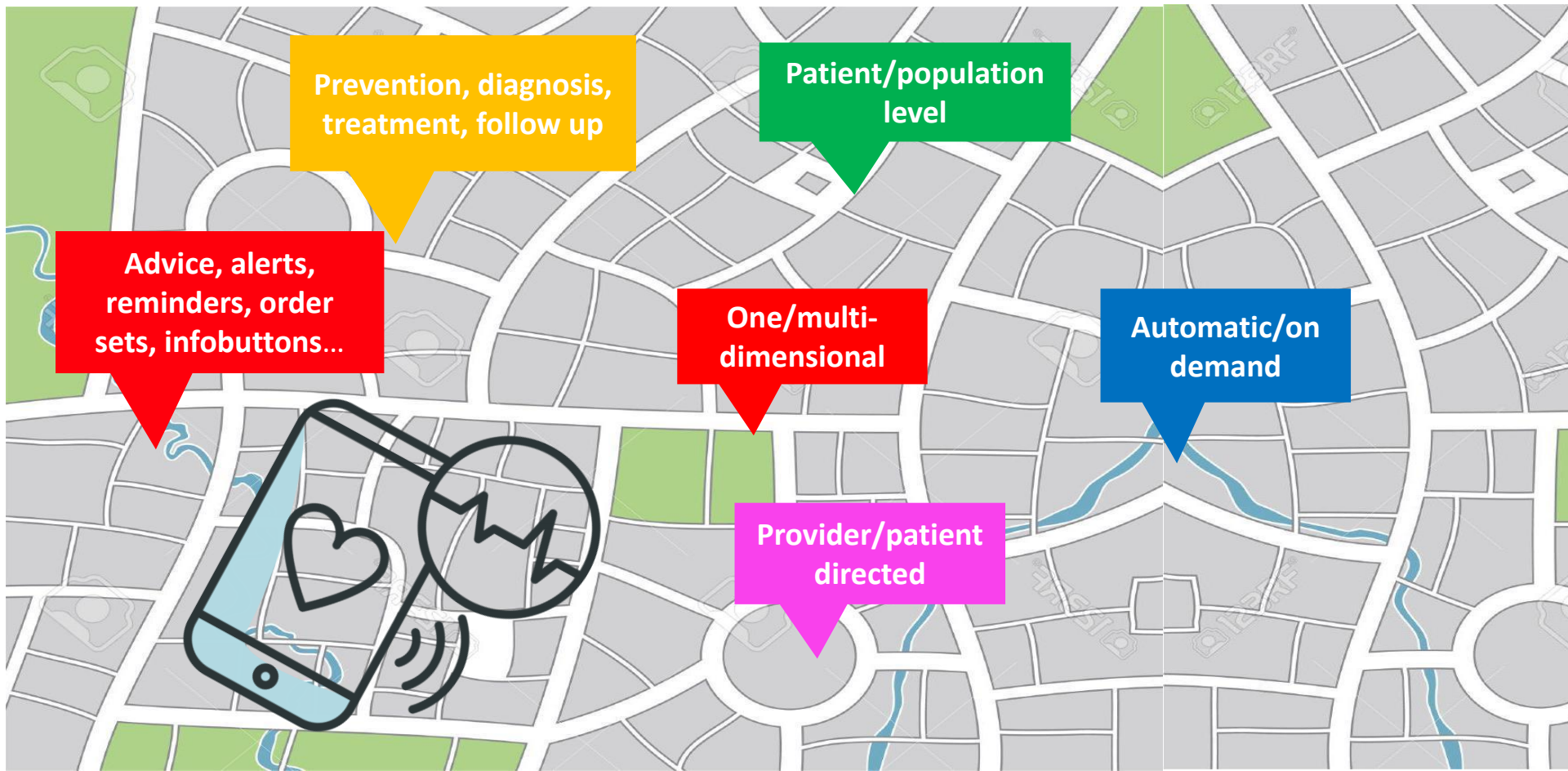
Recommendation 1: Dual vs single antiplatelet therapy



▶ See patient decision aids **MAGIC** app

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)

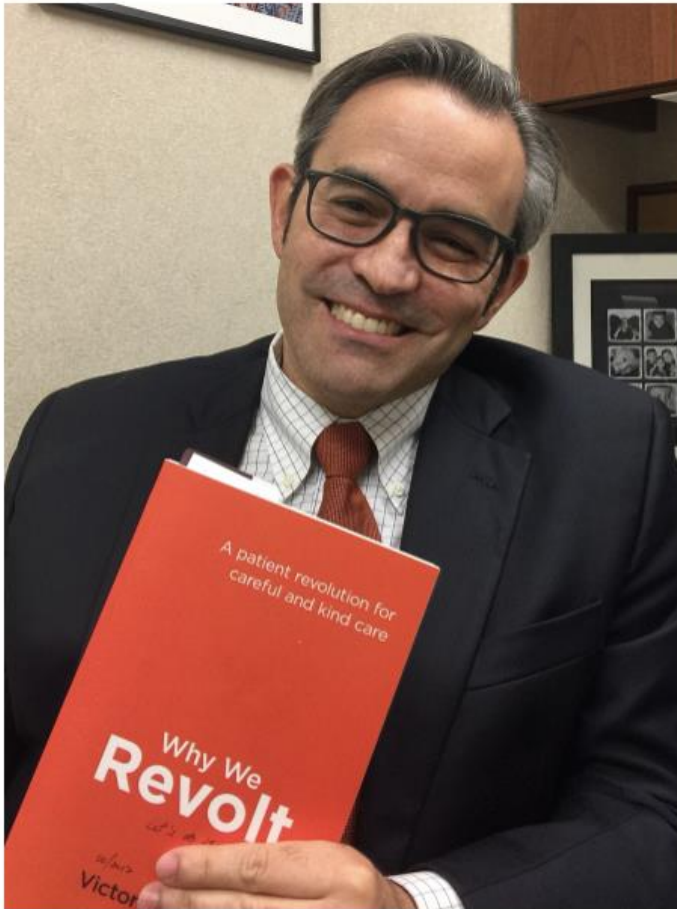
CDS - A GPS on the learning healthcare system highway



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)

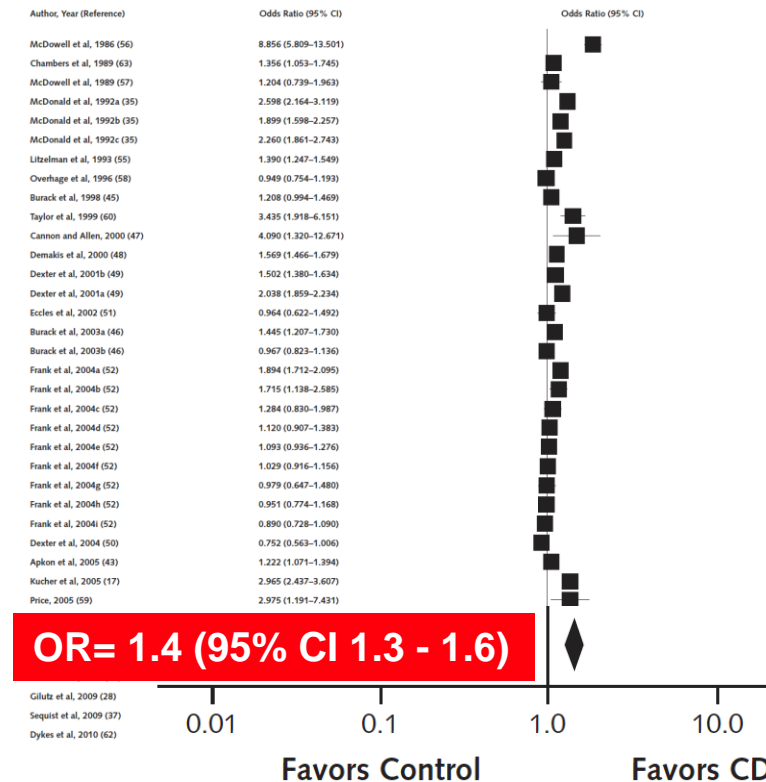
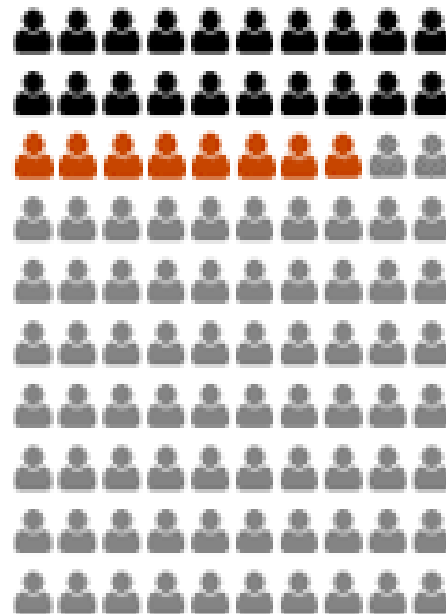
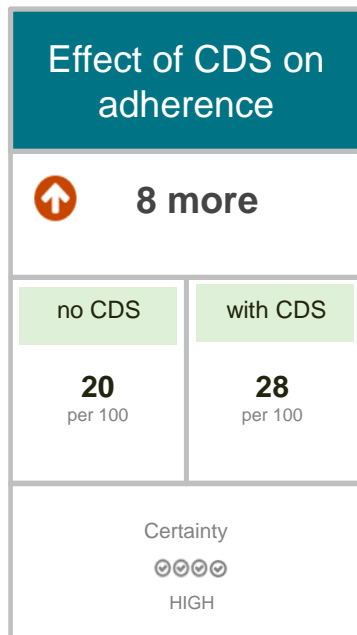
Annals of Internal Medicine

REVIEW

Effect of Clinical Decision-Support Systems

A Systematic Review

Tiffani J. Bright, PhD; Anthony Wong, MTech; Ravi Dhurjati, PhD; Erin Bristow, BA; Lori Bastian, MD, MS; Remy R. Coeytaux, MD, PhD; Gregory Samsa, PhD; Vic Hasselblad, PhD; John W. Williams, MD, MHS; Michael D. Musty, BA; Liz Wing, MA; Amy S. Kendrick, RN, MSN; Gillian D. Sanders, PhD; and David Lobach, MD, PhD

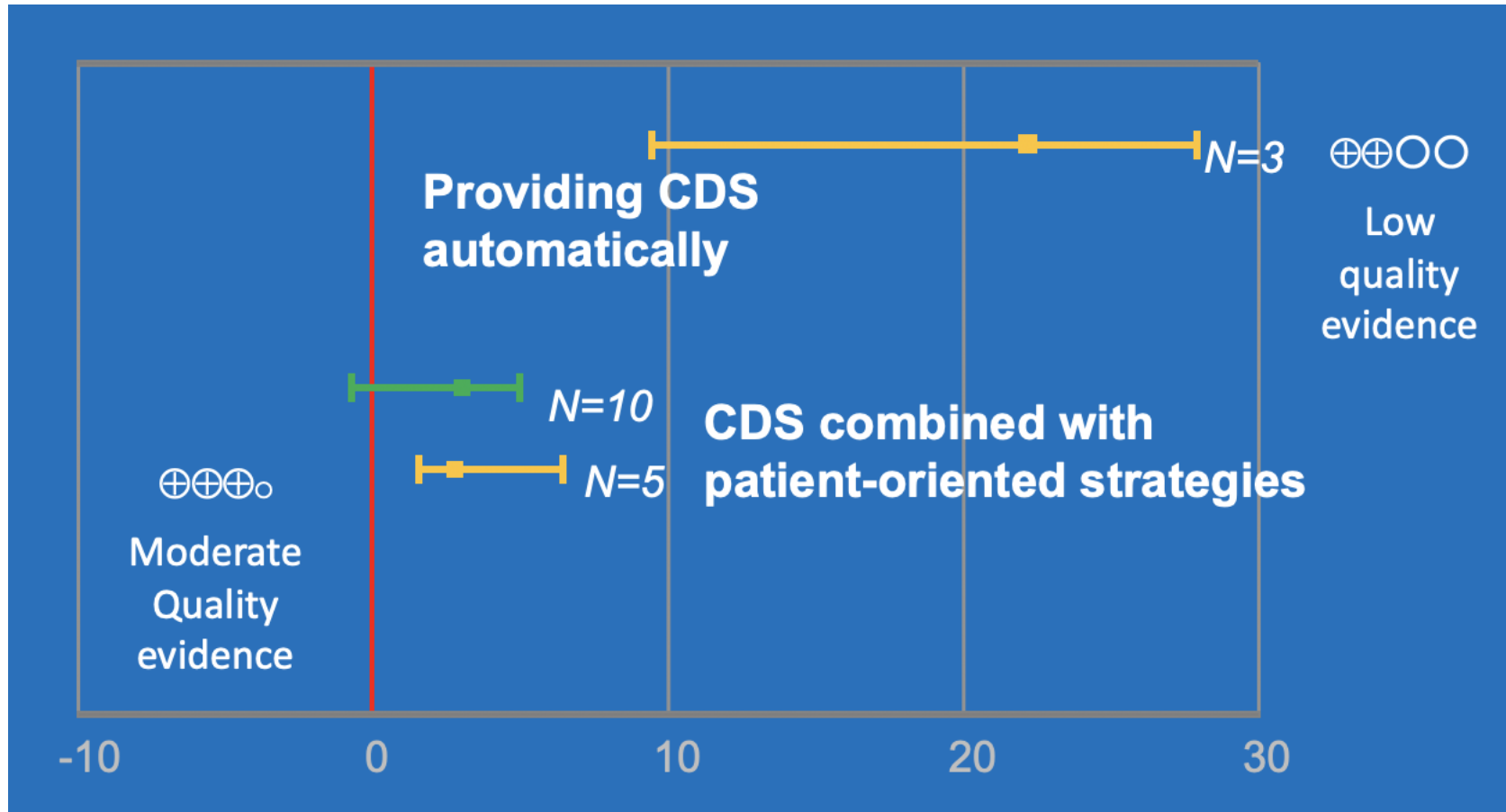


CDS interventions that work: Variable and uncertain effects

66 trials: Mostly low certainty evidence across 14 factors

Van de Velde et al. *Implementation Science* (2018) 13:114
<https://doi.org/10.1186/s13012-018-0790-1>

Implementation Science



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

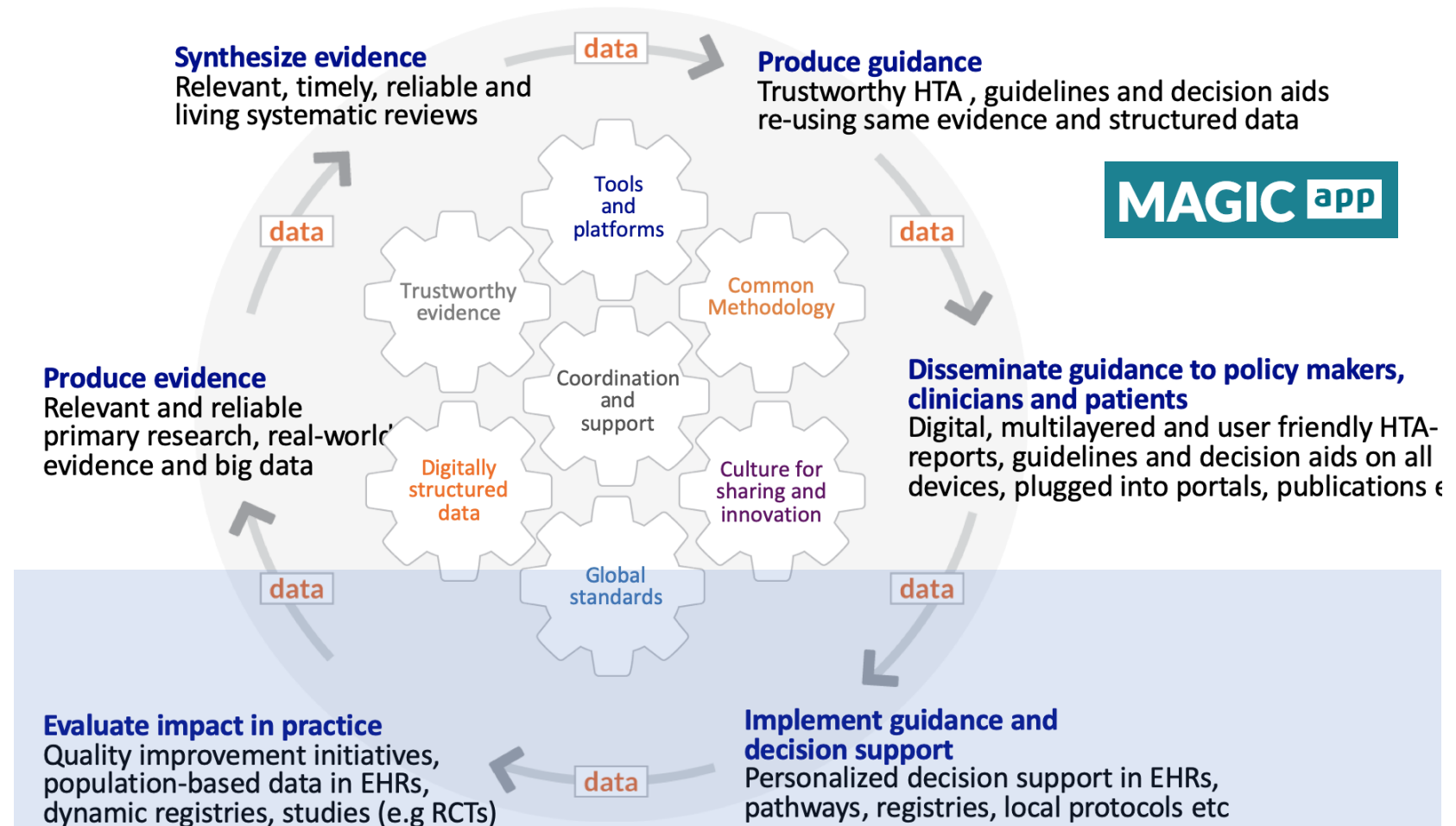


HIMSS 20



Progress in evidence-based medicine: a quarter century on

Benjamin Djulbegovic, Gordon H Guyatt



CDS through trustworthy and computable recommendations

being the entities, moving away from flat formats (e.g. PDFs) to be chopped up in CDS

MAGIC app

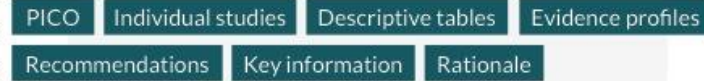
Guideline authoring and publication platform

M app



Guideline panel
Using MAGICapp

New evidence
Dynamic updating



Database
Structured and tagged content

Multilayered formats
For all devices



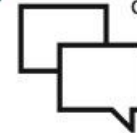
Integrated in the EMR



Adaptation
National and local or EBM textbooks



Decision aids
For patients and clinicians



Some emerging solutions lending promise for CDS in EHRs

1. How to access and exchange patient data?



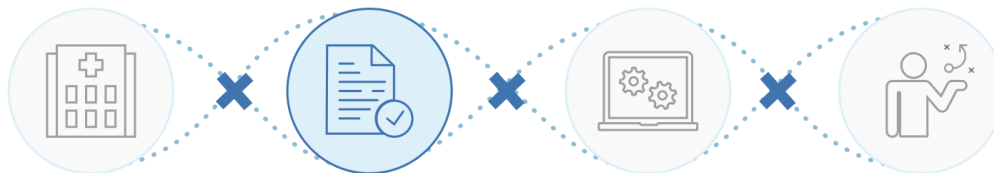
Home Getting Started Documentation Resources Profiles Extensions Operations Terminologies

Home

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.[79] 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.[79, 80]

Providing such information can help healthcare providers and patients to make better-informed healthcare decisions, and helps them to critically appraise 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 users can find this information easily.

Enabling CDS context

Appropriate CDS content

Effective CDS system

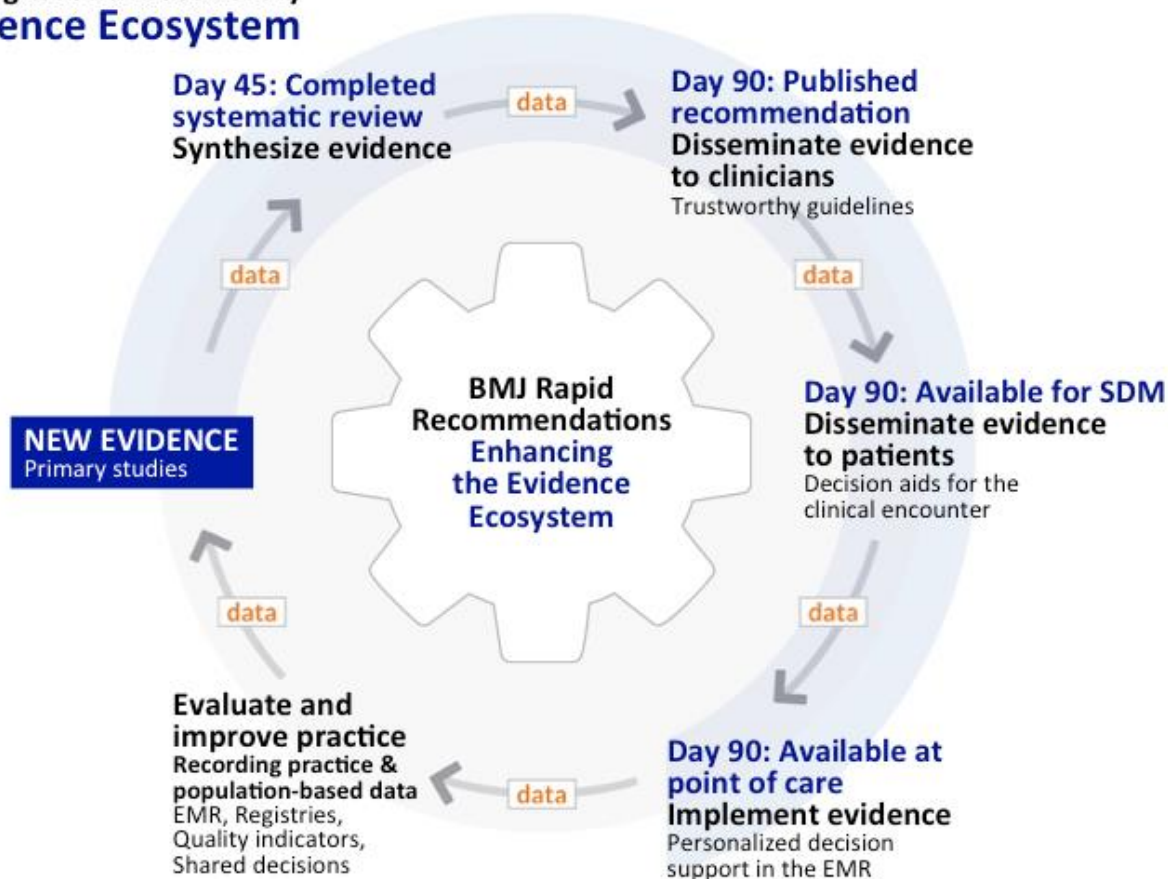
Effective CDS implementation

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?.....

The Digital and Trustworthy Evidence Ecosystem



Trustworthy, accessible and timely guidelines and decision aids in innovative, multilayered formats disseminated globally for downstream use

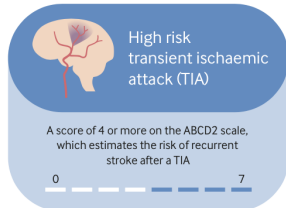
Computable recommendations in MAGICapp allows plugging into EHRs as CDS

Cite this as: *BMJ* 2018;363:k5130

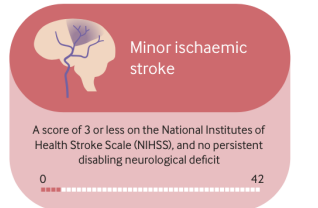
Recommendation 1: Dual vs single antiplatelet therapy

Population

Patients that have experienced:



OR



Interventions compared

Strong

Weak

Weak

Strong

We recommend dual antiplatelet therapy over single agent therapy. Start as soon as possible after index event.

More details

Comparison of benefits and harms

Within 90 days	Events per 1000 people		Evidence quality	More
	Favours dual antiplatelets	Favours single agent		
Non-fatal recurrent stroke	44	19 fewer	63	★★★★ High
All cause mortality	6	No important difference	5	★★★★ Moderate
Functional disability	128	14 fewer	142	★★★★ Moderate
Poor quality of life	55	13 fewer	68	★★★★ Moderate
Recurrent TIA	36	No important difference	40	★★★★ Moderate
Moderate or major bleeding	5	2 fewer	3	★★★★ Moderate
Minor bleeding	13	7 fewer	6	★★★★ High

See patient decision aids **MAGIC app**

See all outcomes **MAGIC app**

1 Clopidogrel plus aspirin versus aspirin alone for minor ischemic stroke or high-risk TIA

Strong recommendation

Benefits outweigh harms for almost everyone. All or nearly all informed patients would likely want this option. [Learn more](#)

In patients with high risk TIA and minor ischemic stroke, we recommend starting dual antiplatelet therapy using aspirin and clopidogrel as compared with single agent therapy within 24 hours of the index event.

[Research evidence](#) [Key info](#) [Rationale](#) [Practical info](#) **Decision Aids** [References](#) [Feedback](#)

Non-fatal stroke

Among a 1000 patients like you, with Clopidogrel and aspirin

19 fewer

Aspirin alone

63
per 1000

Clopidogrel and aspirin

44
per 1000

Certainty

✓✓✓✓

HIGH



Death

Poor functional outcome

TIA

Mild bleeding

Practical issues

Computable evidence plugged into practice

National guidelines, CDS (in combined pathway and registry) and other tools

The screenshot displays a clinical information system interface. On the left, a sidebar contains navigation options such as 'Behandlingsplan', 'Bestilling', 'Dokumentliste', and 'Henvisninger'. The main area shows patient information for 'DANSER, Line' (131169-00216, 49 år, Kvinne) and a list of documents. The right side features a 'Stroke panel' with a 'Status at admission' section containing various clinical checkboxes. Below this is the 'NIHSS (National Institutes of Health Stroke Scale)' section with input fields for scores and a 'Guideline day 1' button. The bottom section displays a 'Strong recommendation' for Clopidogrel plus aspirin versus aspirin alone for minor ischemic stroke or high-risk TIA, with a 'View section text' link.

Signert	Hendelsestid	Avdeling	Dokumentbetegnelse	Dokumenttype	Forfatternavn	Status	Ny versjon
✓	I dag, kl 15:01	MED	EKG fra GE Muse	Elektronisk EKG	Muse, Ekg	Godkjent	🔄
✓	I dag, kl 14:52	MED	Epikrise	Epikrise	Brandt, Linn	Ikke godkjent	
✓	9. aug kl 10:57	KIR	Poliklinisk notat	Poliklinisk notat	Vigorelli, Wenche Kristin	Godkjent	
✓	6. aug kl 13:16	KIR	bi Henvisning ekstern fysioterapi	bi Henvisning ekstern fysioterapi	Tømmervåg, Guri	Godkjent	
✓	6. aug kl 13:02	KIR	bi Sykmelding	bi Sykmelding	Tømmervåg, Guri	Godkjent	
✓	31. jul kl 09:35	MED	EKG fra GE Muse	Elektronisk EKG	Muse, Ekg	Godkjent	
✓	25. jul kl 10:02	MED	EKG fra GE Muse	Elektronisk EKG	Muse, Ekg	Godkjent	
✓	19. jul kl 08:08	MED	EKG fra GE Muse	Elektronisk EKG	Muse, Ekg	Godkjent	
✓	18. jul kl 08:11	MED	EKG fra GE Muse	Elektronisk EKG	Muse, Ekg	Godkjent	
✓	11. jul kl 11:07	MED	EKG fra GE Muse	Elektronisk EKG	Muse, Ekg	Godkjent	

Stroke panel

Status at admission

Bevishetsgrad ved innleggelsen

0 Våken
 1 Døsig, reagerer adekvat ved lett stimulering
 2 Døsig, reagerer først ved kraftig/gjentatt stimulering
 3 Reagerer ikke, eller bare med ikke-måttet bevegelse
 9 Ukjent

Fokale utfall

Facialisparese
 1 Ja
 2 Nei
 9 Ukjent

Beinparese
 1 Ja
 2 Nei
 9 Ukjent

Andre nye fokale slagsymptomer
 1 Ja
 2 Nei
 9 Ukjent

Hvilke fokale symptomer?

Dysartri
 Ataksi
 Sensibilitetsutfall
 Neglekt
 Dobbeltsyn
 Synsfeltutfall
 Vertigo
 Dysfagi

Sidelokalisasjon av symptomer
 1 Høyre
 2 Venstre
 3 Bilateral
 4 Ikke relevant
 9 Ukjent

NIHSS (National Institutes of Health Stroke Scale)

Angi totalscore akutt ved innkomst: Ikke utført

Angi totalscore ved 24 timer +/- 12 timer etter innkomst: Ikke utført

Guideline day 1

ABCD2 : 3 [calculator](#)

Clopidogrel plus aspirin versus aspirin alone for minor ischemic stroke or high-risk TIA

Strong recommendation

In patients with high risk TIA and minor ischemic stroke, we recommend starting dual antiplatelet therapy using aspirin and clopidogrel as compared with single agent therapy within 24 hours of the index event.

• Research evidence • Key info • Rationale • Practical info • Decision Aids • References • Feedback

Strong recommendation

In patients with high risk TIA and minor ischaemic stroke, we recommend administering dual antiplatelet therapy for 10-21 after the index event rather than continuing for longer than 21 days.

• Research evidence • Key info • Rationale • Practical info • Decision Aids • References • Feedback

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

[Change Patient Data](#)
(Predicted Cardiovascular Risk)

[Change Patient Values](#)
(Relative Importance of Outcomes)

[Expand All](#)

Health Improvement Opportunities

Health Impact

Stop smoking



7.2

[Expand](#)

[Detailed view](#)

Start statin



3.6

[Expand](#)

[Detailed view](#)

Start antihypertensive medication



3.3

[Collapse](#)

[Detailed view](#)

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?

N = 389
(care gap)

Number of patients with type 2 diabetes

1,312
Count

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

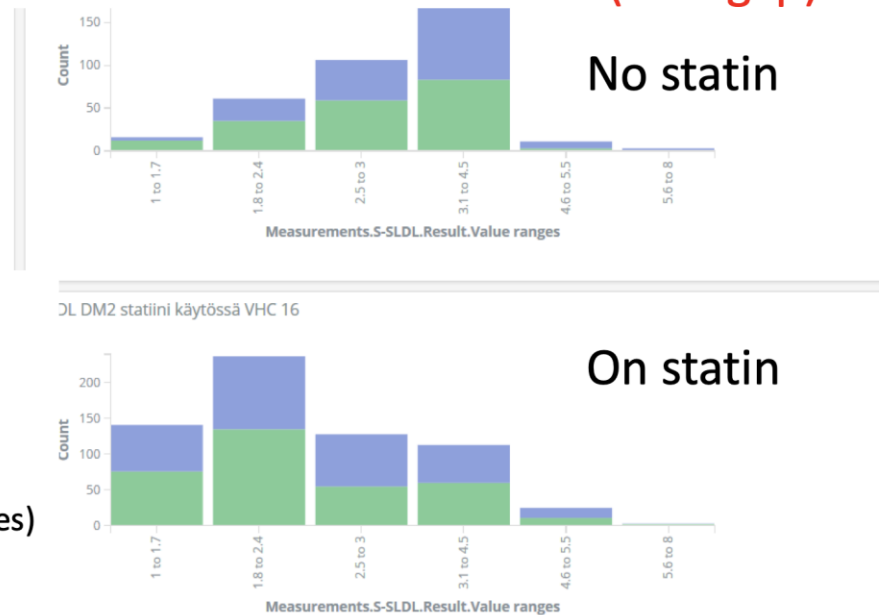
- 3 deaths
- 11 strokes
- 8 myocardial infarctions in 10 years

= 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 €.

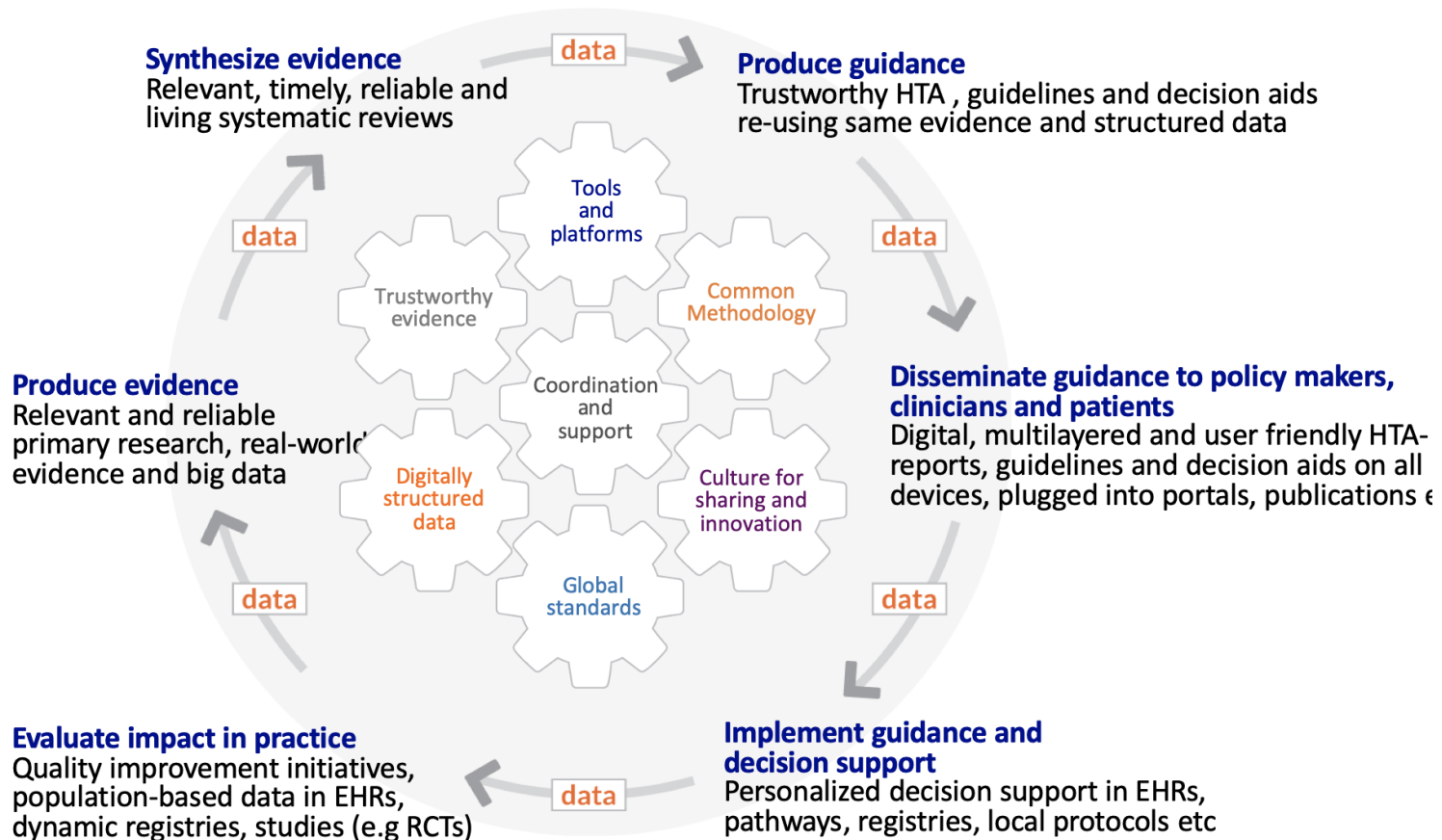


In high-income countries, cost per QALY up to 80 000 € is considered acceptable

5. Countries realize need for new infrastructure and orchestration

CDS in a learning health system, key actors lining up in the US right now

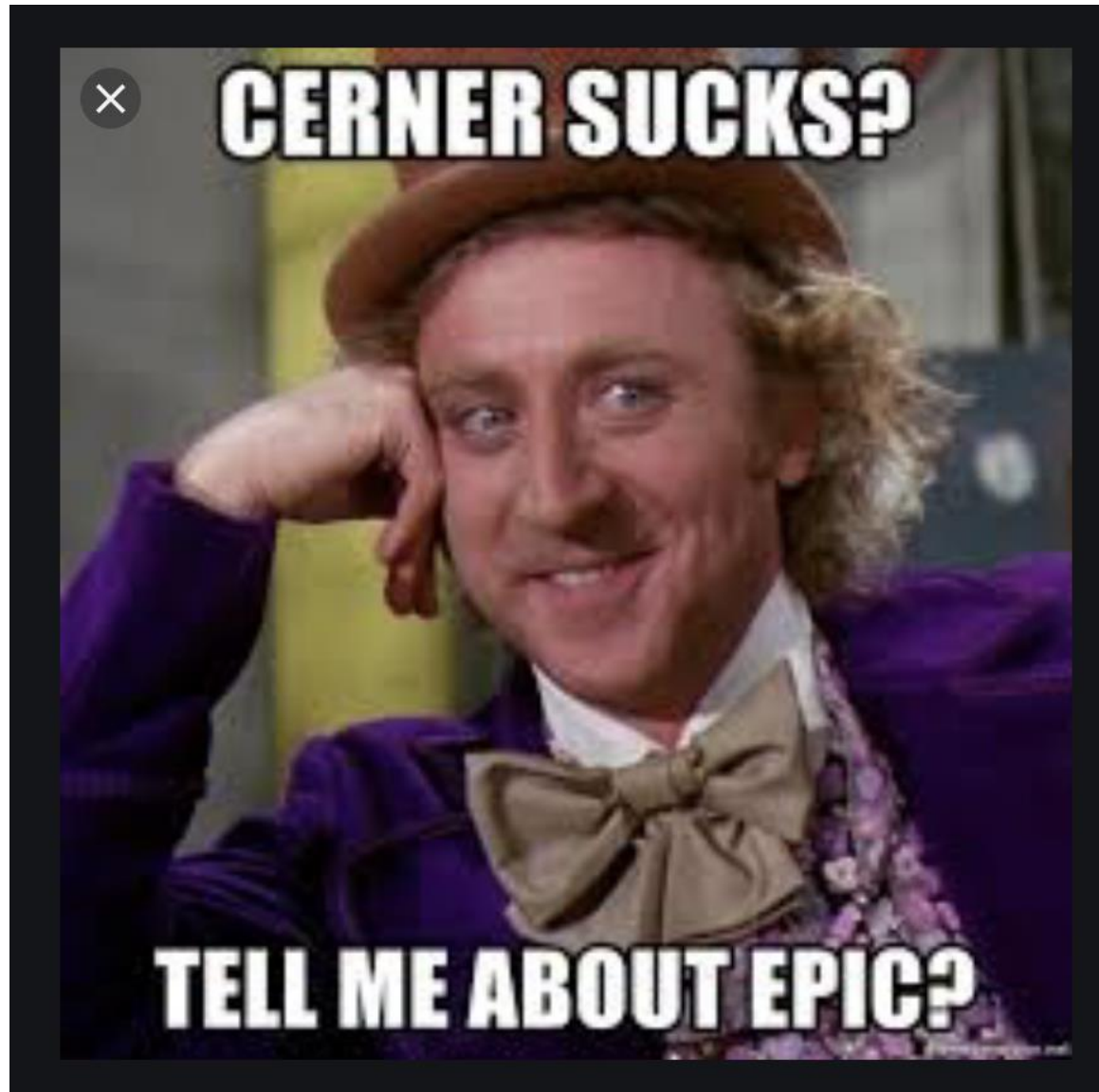
International focus, trustworthy guidance, aligned Evidence Ecosystem vision



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

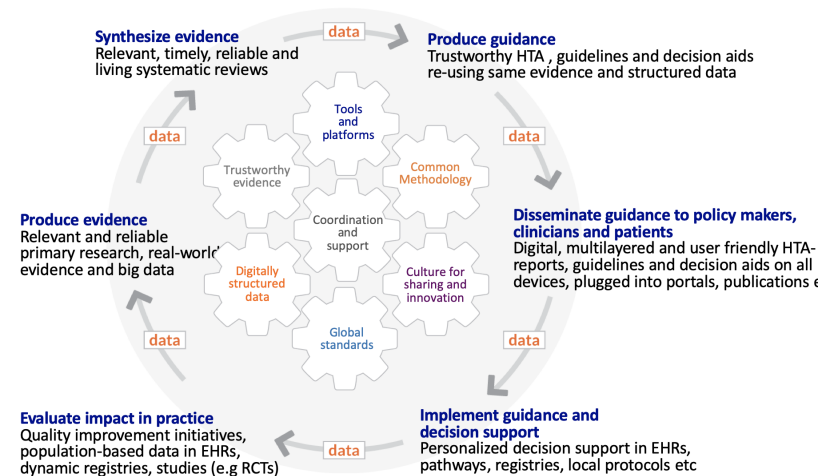
- Standards
- Methods
- Platforms
- Processes

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

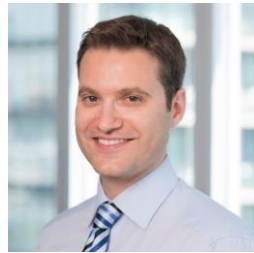
www.magicapp.org



Per Olav Vandvik
Head of MAGIC



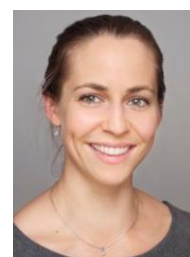
Linn Brandt



Thomas Agoritsas



Gordon Guyatt



Anja Fog Heen



Lyubov Lytvyn



Reed Siemieniuk



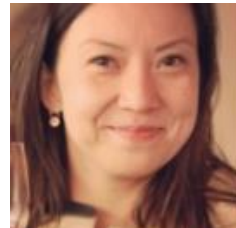
Frankie Achille



Deno Vichas



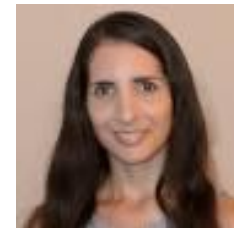
Frankie Achille



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