

Mobilising Computable Biomedical Knowledge (MCBK)

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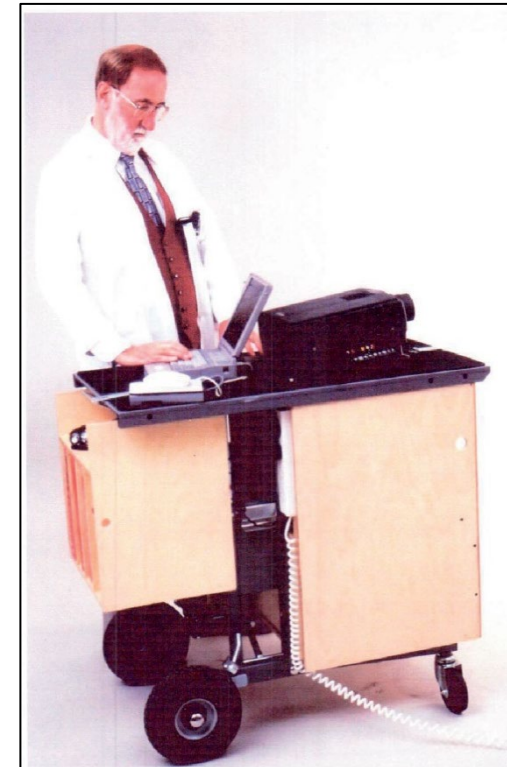
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Acknowledgments:

Philip Scott, Chair BCS Health & Care

Sackett DL, Straus SE. Finding and
applying evidence during clinical rounds:
the "evidence cart". JAMA. 1998



Human-readable computer-*based* knowledge versus computer-*executable* (“computable”) knowledge

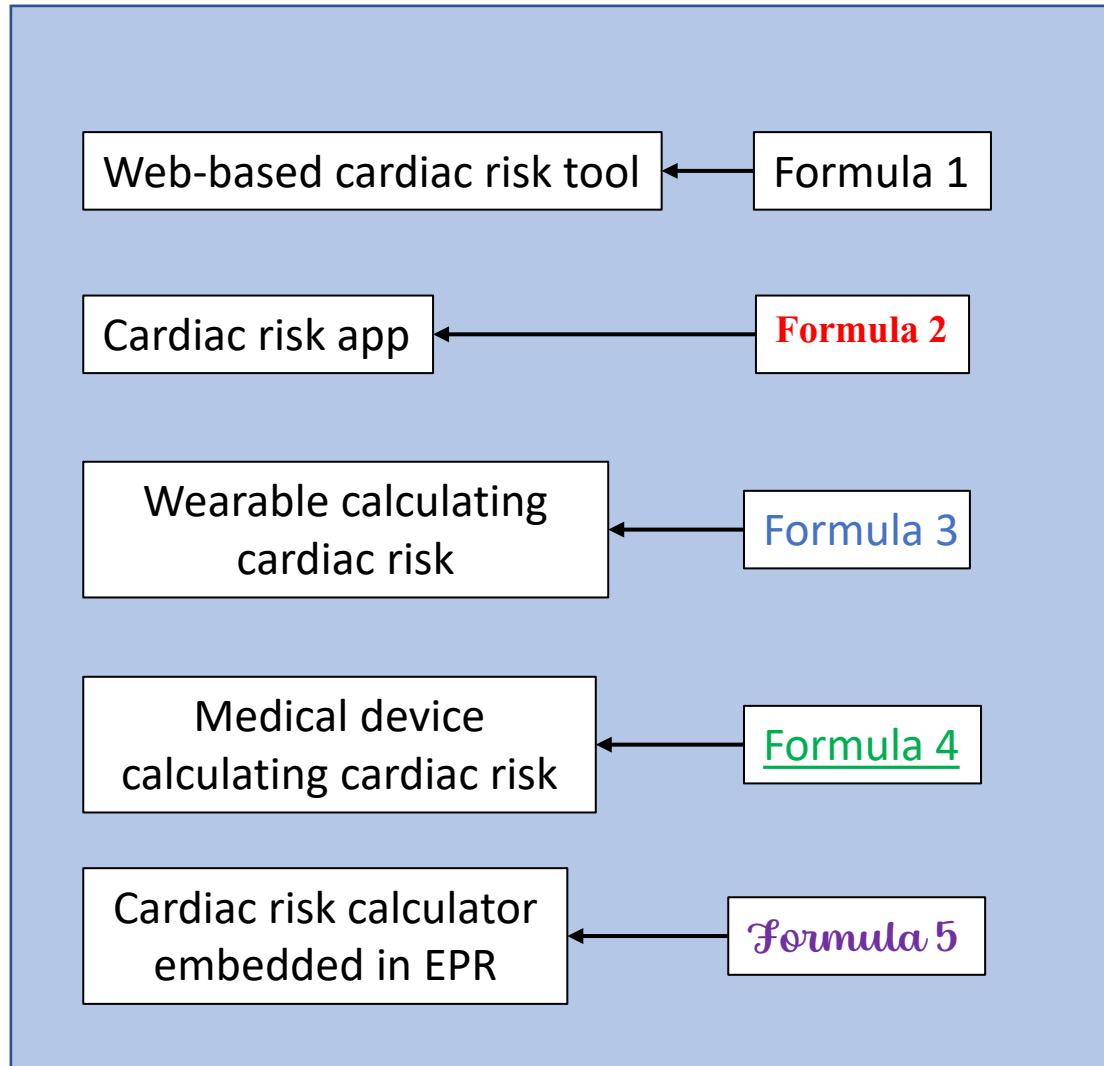
Human-readable knowledge: held and shared in text format for people to read (eg. paper, HTML or PDF patient leaflets or practice guidelines)

Computer-*executable* knowledge: held in machine-readable format for direct application by computer to support a clinical task, eg.:

- Calculating cardiac risk
- Interpreting results of a lab test, ECG or lung function test
- Displaying alert or reminder to clinician or patient
- Providing advice on diagnosis or warfarin dose
- Instructing an infusion pump or surgical robot

(Friedman et al, Learning Health Systems 2019)

The context: a cottage industry of knowledge system developers



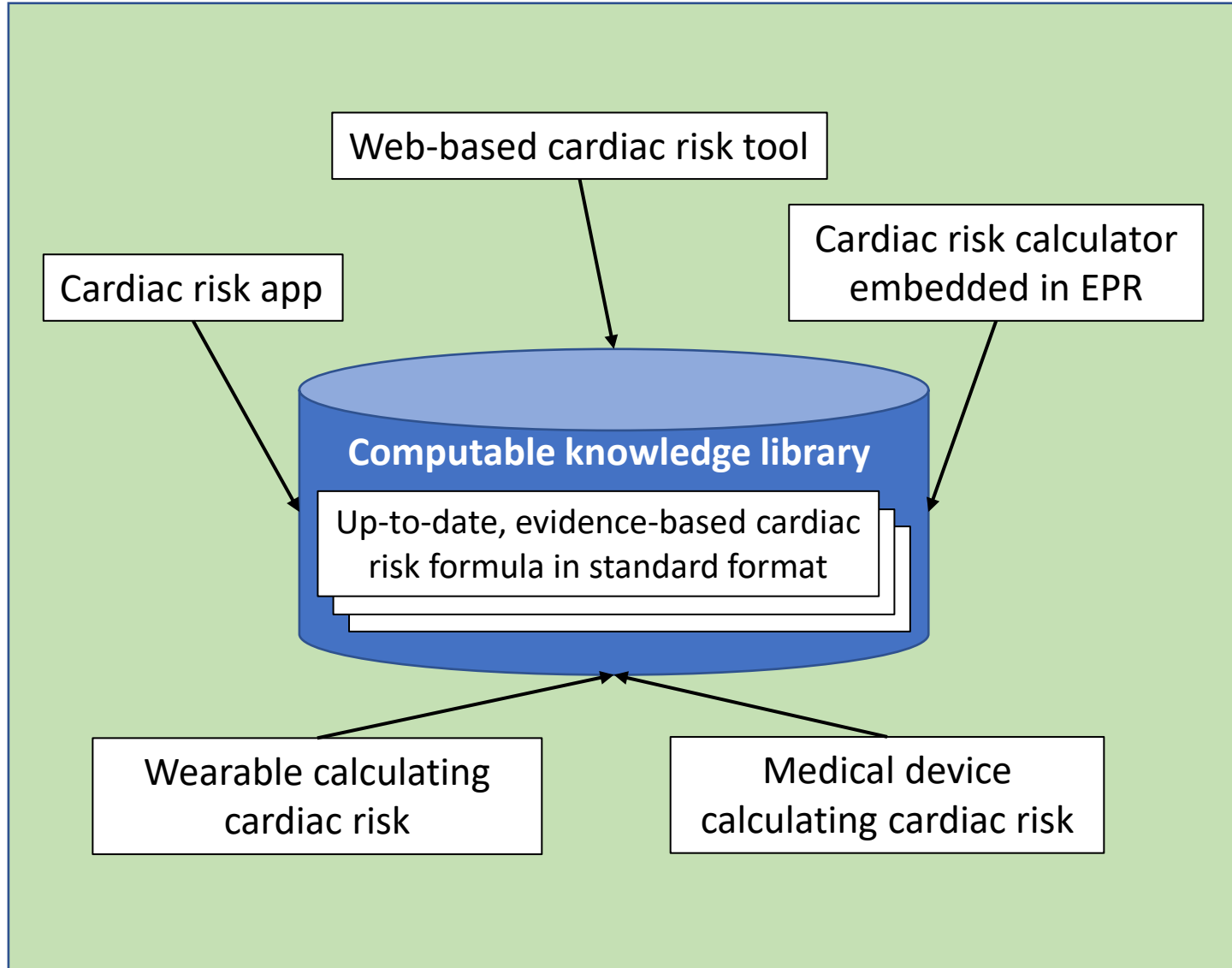
Challenges for developers:

- Sourcing knowledge retrospectively from guideline documents designed for humans
- Choosing between computable guideline languages: CQL, CGL, Gaston, GEM, GLIF, Protégé, Proforma...
- Validating the knowledge base
- Maintaining the knowledge base

Consequences:

- High cost for DSS developers
- Wasteful repetition: duplicate KBs in different formats
- Inaccuracy: not all are correct and up-to-date
- Fragmented care: different knowledge underlies systems in primary care, secondary care, self care...

Our solution: a CBK ecosystem to mobilise knowledge



Benefits:

- Done once & curated: one version to develop, validate and maintain
- Standardised, quality assured
- Single knowledge source drives knowledge systems across variety of clinical & care settings
- Lowers barrier to market entry for new knowledge system developers
- Gives guideline developers reason to record output in computable format
- Single destination for user comments and corrections

Proof of feasibility: Dutch computable guideline RCT

Computable guideline for cardiac rehabilitation captured prospectively by guideline formaliser Rick Goud using GASTON toolkit, working with Netherlands Heart Foundation & NL Cardiology Society (see Goud R, Comput Methods Programs Biomed. 2008)

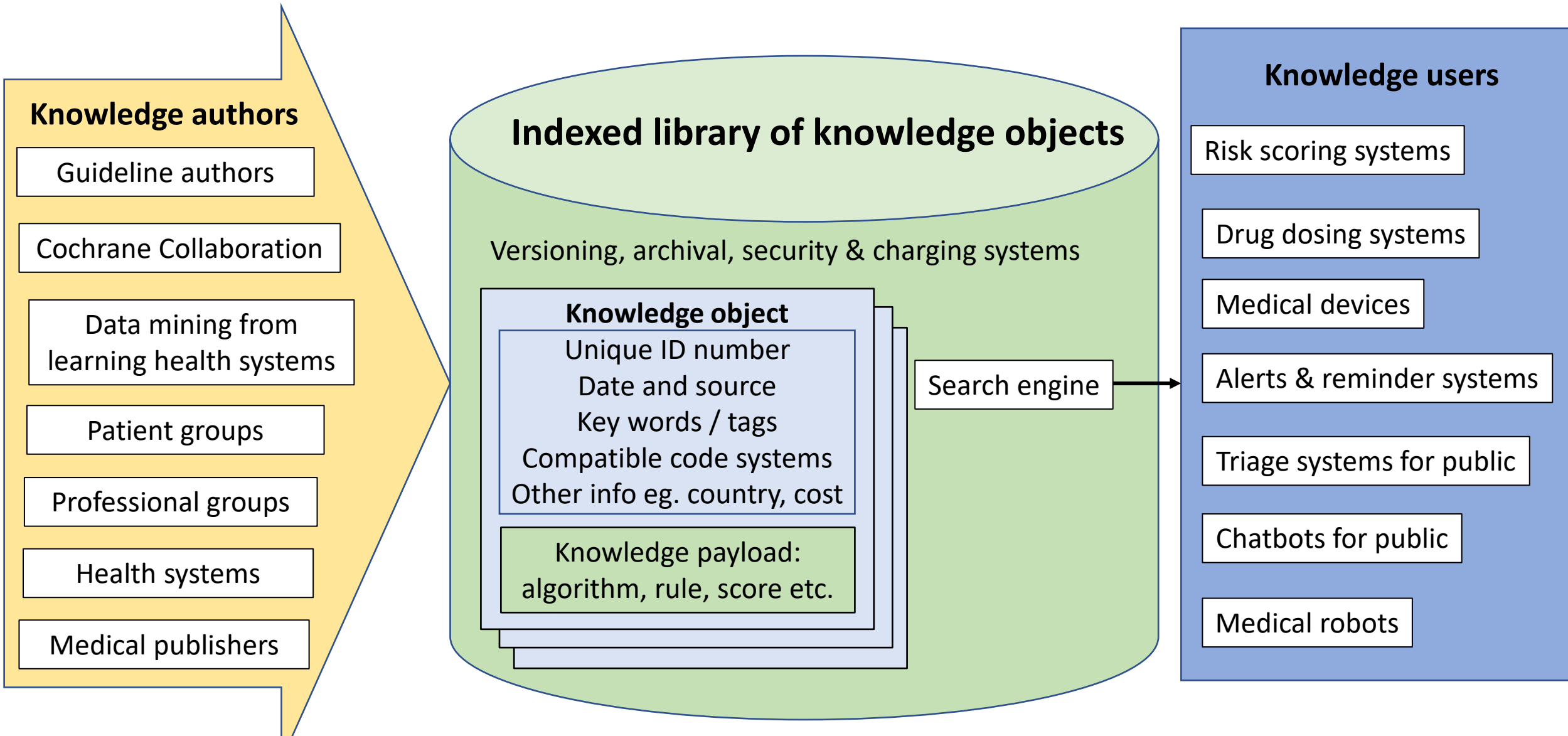
Cluster RCT of impact of guideline advisory system on cardiac rehabilitation team decisions in 21 centres (2787 post-MI patients)

Results:

Computerised guideline **increased concordance** with guideline-recommended decisions:

- Education therapy - by 26% (above baseline of 64%)
- Relaxation therapy - by 26% (baseline 34%)
- Exercise therapy - by 8% (baseline 85% - ceiling effect ?)

Vision of the global Mobilising Computable Biomedical Knowledge (MCBK) coalition



Some computable knowledge library challenges

1. Sustainability:

- a) Ensuring that knowledge objects are **FAIR** (findable, accessible, interoperable, reusable - <https://www.go-fair.org/fair-principles/>)
- b) Helping knowledge authors **justify work** of developing computable knowledge objects as well as human-readable text

2. Building trust of CDS developers & users in the library, by:

- a) **Validating knowledge objects** prior to acceptance & ongoing quality assurance (eg. by routing user comments back to knowledge object authors)
- b) Preserving **provenance, context and integrity** of individual knowledge objects; ensuring **safe re-use** of knowledge objects in systems using different semantics (QRisk2 example)
- c) Keeping knowledge objects **up-to-date** when new study or guideline published
- d) **Respecting the evidence hierarchy**: ensuring objects based on national guidelines or Cochrane reviews overrule objects based on single study, audit or clinical opinion
- e) Establishing **open governance** structures & mechanisms



Benefits for different stakeholder groups

Stakeholder group	Main benefits
Tax payers and the public	A more efficient, safer, evidence-based health and care system
Patients	Safer, faster care ; all parts of the service relying on the same core knowledge
Health professionals	Rapid access for all parts of a distributed team to the most recent high-quality health & care knowledge
NHS Trusts and Health Boards	Safer health care delivered by professionals at all levels following a consistent knowledge base . Improved working lives, helps clinical staff build confidence, provides learning with every experience. Lower rates of litigation and staff burnout
Clinical commissioners	Safer, more efficient, evidence-based care delivered by all professionals following a consistent knowledge base
Guidance producers	A simpler, faster, more reliable route to market for guidance products
Medical publishers and software developers	Access to a common core of health and care knowledge in standard format as a basis for value-added products; no need to develop own knowledge base
Regulators of clinicians, services & devices; courts of law	Easy access to a defined knowledge base of health and care , exactly as it was at the time of a specific incident in the past.
The UK Economy	Improved productivity via a new high-value knowledge ecosystem generating highly skilled jobs and opportunities for innovation, enterprise and global revenue

UK MCBK activity coordinated by British Computer Society Faculty of Health & Care

Led by Jeremy Wyatt & Philip Scott (Univ. of Wales Trinity St Davids)

Aim: To support UK organisations to adopt high quality computable knowledge and realise its benefits for patients, professionals and the health system, by:

1. Promoting networking between interested organisations & with MCBK North America
2. Developing a prioritised list of issues & actions to take and resources & leaders for these
3. Building on our 2019 launch workshop with annual meetings, workshops, educational activities, whitepapers etc.

See:

- MCBK UK home page: <https://www.bcs.org/membership-and-registrations/member-communities/bcs-health-and-care/reports-and-resources/mobilising-computable-biomedical-knowledge-mcbk/>
- Articles in BMJ Health & Care Informatics: <https://informatics.bmj.com/content/27/2>

Attend our free virtual global Mobilizing Computable Biomedical Knowledge conference, October 22nd/23rd !

Join colleagues from around the world who believe that human-readable knowledge alone cannot improve health and health care at scale, or achieve high-functioning Learning Health Systems.

New to MCBK? Attend the tutorial pre-meeting on Oct 22nd !

[Register free](#) to get access to both pre-meeting and main meeting. Sessions will be **entirely virtual** and scheduled at times to accommodate the global audience.



NICE and computable guidance

Shaun Rowark – Associate Director,
Data Access and Analysis

NICE National Institute for
Health and Care Excellence

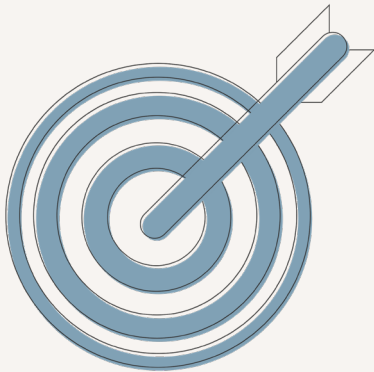


Useability is key to delivering NICE's purpose of helping practitioners and commissioners get the best care to people fast, while ensuring value for the taxpayer

We will continue to deliver high quality advice that is independent, rigorous and transparent, and add three new strengths which are:

1

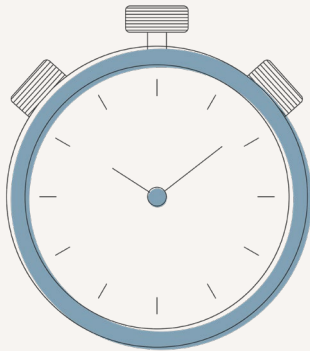
More relevant



...by focusing on what matters most.

2

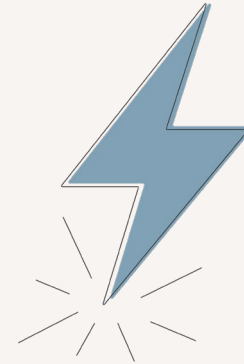
More timely and easy to use



...by providing useful and useable advice.

3

Increased impact



...by constantly learning from data and implementation.

What did we work on in 23/24

- Computable recommendations, “...a representation of written guideline recommendations in computer readable [interpretable] format...” Michaels M. Adapting Clinical Guidelines for the Digital Age: Summary of a Holistic and Multidisciplinary Approach.
- Since April 2023 this was led by data and analytics team, with a milestone to have developed an approach for defining core computable recommendations by March 2024.
- Focused on delivering a Digital Adaptation Kits for Chronic Kidney Disease quality standard.
- By March 2024:
 - Completed a DAK for CKD and initial feasibility testing
 - A model for future products
 - Initial learning on large language models for the DAK

What did we learn from this?

- Computability is not a stand-alone topic and needs to connect closely with other ongoing work within NICE. Therefore, we recommend the development of a Products and Channels strategy
- Computable principles should be applied from the beginning of guidance development, and we should prioritise new or update recommendations
- We need unique IDs
- Formalise external partnerships
- Align where possible to national and international approaches e.g. HL7 FHIR
- Audit what type of recommendations we make e.g. screening, diagnosis, interventions
- For our back catalogue potential use case for LLMs

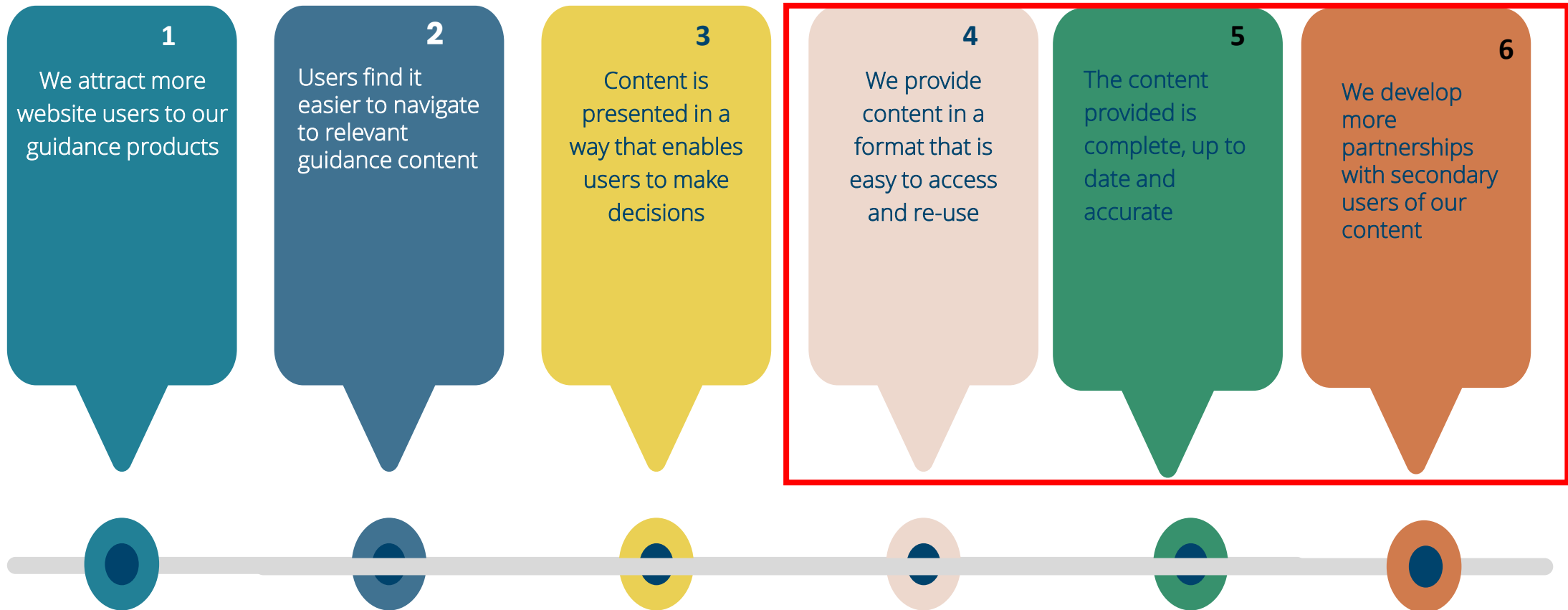
NICE and the useable product strategy 2025-27

We have set a timeframe of 2 years from December 2024 to deliver a new useable product strategy

This will allow NICE to put in place the process, technology, data architecture and operating models that will allow future product innovation but most importantly begin to create the guidance products that our users have asked for. The strategy will be refreshed in 2027, considering our progress in improving our useable product offering to make it easier for practitioners, commissioners and providers to make decisions, in the context of the wider environment.

The long-term vision is for NICE to provide a more useable guidance product offering that makes it easier for health & care practitioners, commissioners and providers to make decisions

Six aims to make guidance products more useable



NICE useable product strategy - What will be different by 2027?

For our primary audience (practitioners, commissioners and providers):

- More users will access NICE guidance on the NICE website
- More will report that they find it easy to find the information and advice they need from NICE
- They will have less unsuccessful journeys within guidance and increased engagement with the content
- More will report NICE products are their guidance of choice when making decisions about care

Through secondary content channels:

- Secondary content users will have access to a NICE syndication service/ API which provides complete and accurate content in a format that meets their needs
- Our primary audience will report they trust that the NICE guidance content in products developed by secondary content users is complete, up to date and accurate
- The impact and reach of NICE guidance to our primary audience is increased through successful partnerships with secondary content users

NICE useable product strategy – future state

- In future, our useable product offering for our primary audience (health & care practitioners, commissioners and providers) will have an equal emphasis on:
 - an integrated guideline product **and**
 - componentised content easily accessible for secondary content use
- Secondary content users will have efficient access to content at a recommendation level, using a standard narrative recommendation structure and taxonomy to ensure they are easily machine-readable. **We will not generate ‘computable’ recommendations (i.e. with associated clinical codes) as secondary content users will have significantly greater capacity and expertise , instead we will enable machine readable content for secondary content users through structured recommendations and frameworks**
- We will prioritise partnerships to maximise impact and reach of NICE guidance and safeguard fidelity. Partnership capability will be required to develop and manage commercial opportunities with secondary content users and potential partners, whilst enforcing best practice terms and conditions for third parties who only subscribe to our data interface

Structured recommendations - Core components

- We have identified the following core components to be included in a clinical recommendation as a minimum:

P Population

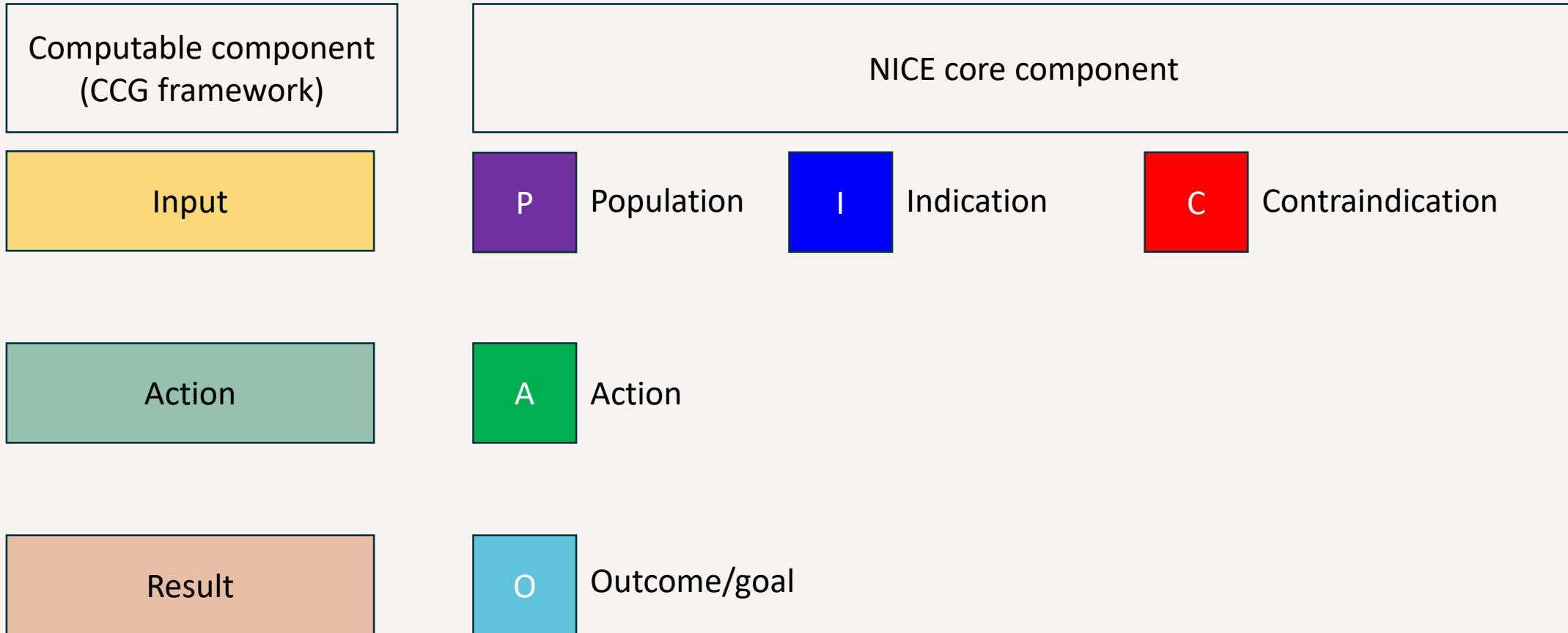
I Indication

C Contraindication

A Action

O Outcome

What components do computable recommendations need?



Our next steps

- Standardise the wording used within the components:
 - For example, NG101 shows the importance of setting a controlled vocabulary
 - This guideline uses early and locally advanced, but also invasive and locally invasive. CG81 uses advanced breast cancer to mean metastatic breast cancer.
- We will also be considering how our actions map to FHIR verbs:
 - We won't be able to write our outwardly facing recs in a machine-readable way and still maintain patient centred language, so we will need to use tagging/meta data to do this
- Consider how we display the “strength” of our recommendations
- Longer term – we will need to consider the structure of a guideline and any additional sections we may need to add or repurpose to house information we've stripped out of the recommendations