The ecosystem of evidence: the way forward

Nino Cartabellozza
GIMBE Foundation
Ecosystem

A community of **living organisms** in conjunction with the **nonliving components** of their **environment** (air, water, mineral soil), interacting as a system
An ecosystem influenced by:

- **Living organisms**: stakeholders, with their competition, collaboration and conflicts of interest
- **Environment**: social, cultural, economic, political context
- **Non living component**: evidence
The way forward

The way forward

The way forward

Generation

Synthesis

Translation
Evidence Generation

WHAT’S GOOD?
Avoidable waste or inefficiency in biomedical research

- Are research decisions based on questions relevant to users of research?
  - Low priority questions addressed
  - Important outcomes not assessed
  - More than 50% studies designed without reference to systematic reviews of existing evidence

- Appropriate research design, methods, and analysis?
  - Adequate steps to reduce bias not taken in more than 50% of studies
  - Inadequate statistical power
  - Inadequate replication of initial findings

- Efficient research regulation and management?
  - Complicit with other sources of waste and inefficiency
  - Disproportionate to the risks of research
  - Regulatory and management processes are burdensome and inconsistent

- Fully accessible research information?
  - More than 50% of studies never fully reported
  - Biased under-reporting of studies with disappointing results
  - Biased reporting of data within studies

- Unbiased and usable research reports?
  - More than 30% of trial interventions not sufficiently described
  - More than 50% of planned study outcomes not reported
  - Most new research not interpreted in the context of systematic assessment of other relevant evidence

Research waste
17 REWARD recommendations

- Relevance (1-4)
- Methodology (5-7)
- Regulation & management (8-11)
- Accessibility (13-14)
- Usability (15-17)
Increasing value and reducing waste in biomedical research: who’s listening?

David Moher, Paul Glasziou, Iain Chalmers, Mona Nasser, Patrick M M Bossuyt, Daniël A Korevaar, Ian D Graham, Philippe Ravaud, Isabelle Boutron

The biomedical research complex has been estimated to consume almost a quarter of a trillion US dollars every year. Unfortunately, evidence suggests that a high proportion of this sum is avoidably wasted. In 2014, The Lancet published a series of five reviews showing how dividends from the investment in research might be increased from the relevance and priorities of the questions being asked, to how the research is designed, conducted, and reported. 17 recommendations were addressed to five main stakeholders—funders, regulators, journals, academic institutions, and researchers. This Review provides some initial observations on the possible effects of the Series, which seems to have provoked several important discussions and is on the agendas of several key players. Some examples of individual initiatives show ways to reduce waste and increase value in biomedical research. This momentum will probably move strongly across stakeholder groups, if collaborative relationships evolve between key players; further important work is needed to increase research value. A forthcoming meeting in Edinburgh, UK, will provide an initial forum within which to foster the collaboration needed.

Lancet 2016; 387: 1573-86
Published Online
September 28, 2015
The James Lind Alliance

The James Lind Alliance (JLA) is a non-profit making initiative established in 2004. It brings patients, carers and clinicians together in Priority Setting Partnerships (PSPs) to identify and prioritise the Top 10 uncertainties, or unanswered questions, about the effects of treatments.

The aim of this is to make sure that health research funders are aware of the issues that matter most to patients and clinicians.
Towards evidence based research

To avoid waste of research, no new studies should be done without a systematic review of existing evidence, argue Hans Lund and colleagues

Hans Lund professor¹ ², Klara Brunnhuber product manager³, Carsten Juhl associate professor¹ ⁴, Karen Robinson associate professor⁵, Marlies Leenaars associate professor⁶, Bertil F Dorch director⁷, Gro Jamtvedt dean² ⁸, Monica W Nortvedt dean², Robin Christensen professor⁹, Iain Chalmers coordinator¹⁰
SPIRIT 2013 Statement: Defining Standard Protocol Items for Clinical Trials

An-Wen Chan, MD, DPhil; Jennifer M. Tetzlaff, MSc; Douglas G. Altman, DSc; Andreas Laupacis, MD; Peter C. Gøtzsche, MD, DrMedSci; Karmela Krleža-Jerić, MD, Dsc; Asbjørn Hróbjartsson, PhD; Howard Mann, MD; Kay Dickersin, PhD; Jesse A. Berlin, ScD; Caroline J. Doré, BSc; Wendy R. Parulekar, MD; William S.M. Summerskill, MBBS; Trish Groves, MBBS; Kenneth F. Schulz, PhD; Harold C. Sox, MD; Frank W. Rockhold, PhD; Drummond Rennie, MD; and David Moher, PhD

The protocol of a clinical trial serves as the foundation for study planning, conduct, reporting, and appraisal. However, trial protocols and existing protocol guidelines vary greatly in content and quality. This article describes the systematic development and scope of SPIRIT (Standard Protocol Items: Recommendations for Interventional Trials) 2013, a guideline for the minimum content of a clinical trial protocol.

The 33-item SPIRIT checklist applies to protocols for all clinical trials and focuses on content rather than format. The checklist recommends a full description of what is planned; it does not prescribe how to design or conduct a trial. By providing guidance for key content, the SPIRIT recommendations aim to facilitate the drafting of high-quality protocols. Adherence to SPIRIT would also enhance the transparency and completeness of trial protocols for the benefit of investigators, trial participants, patients, sponsors, funders, research ethics committees or institutional review boards, peer reviewers, journals, trial registries, policymakers, regulators, and other key stakeholders.


For author affiliations, see end of text.
This article was published at www.annals.org on 8 January 2013.
RESEARCH METHODS & REPORTING

Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation

Larissa Shamseer¹, David Moher¹, Mike Clarke², Davina Ghersi³, Alessandro Liberati (deceased)⁴, Mark Petticrew⁵, Paul Shekelle⁶, Lesley A Stewart⁷, the PRISMA-P Group

¹Ottawa Hospital Research Institute and University of Ottawa, Canada; ²Queen’s University Belfast, Ireland; ³National Health and Medical Research Council, Australia; ⁴University of Modena, Italy; ⁵London School of Hygiene and Tropical Medicine, UK; ⁶Southern California Evidence-based Practice Center, USA; ⁷Centre for Reviews and Dissemination, University of York, UK
Reproducibility and reliability of biomedical research: improving research practice

Symposium report, October 2015
**Data dredging**
Also known as p-hacking, this involves repeatedly searching a dataset or trying alternative analyses until a 'significant' result is found.

**Omitting null results**
When scientists or journals decide not to publish studies unless results are statistically significant.

**Underpowered study**
Statistical power is the ability of an analysis to detect an effect, if the effect exists – an underpowered study is too small to reliably indicate whether or not an effect exists.

**Issues**

**Errors**
Technical errors may exist within a study, such as misidentified reagents or computational errors.

**Underspecified methods**
A study may be very robust, but its methods not shared with other scientists in enough detail, so others cannot precisely replicate it.

**Weak experimental design**
A study may have one or more methodological flaws that mean it is unlikely to produce reliable or valid results.

**Open data**
Openly sharing results and the underlying data with other scientists.

**Pre-registration**
Publicly registering the protocol before a study is conducted.

**Collaboration**
Working with other research groups, both formally and informally.

**Automation**
Finding technological ways of standardising practices, thereby reducing the opportunity for human error.

**Open methods**
Publicly publishing the detail of a study protocol.

**Post-publication review**
Continuing discussion of a study in a public forum after it has been published (most are reviewed before publication).

**Reporting guidelines**
Guidelines and checklists that help researchers meet certain criteria when publishing studies.
As a condition of consideration for publication of a clinical trial report in our member journals, the ICMJE proposes to require authors to share with others the de-identified individual-patient data (IPD) underlying the results presented in the article (including tables, figures, and appendices or supplementary material) no later than 6 months after publication.
Clinical Trial Registration: A Statement from the International Committee of Medical Journal Editors
Around half of clinical trials have never been reported. This is the story of the campaign to find them—and to fix medicine.

Read the AllTrials story
ESSAY

Rationale for WHO's New Position Calling for Prompt Reporting and Public Disclosure of Interventional Clinical Trial Results

Vasee S. Moorthy*, Ghassan Karam, Kirsten S. Vannice, Marie-Paule Kieny

World Health Organization, Geneva, Switzerland

PLOS Medicine | DOI:10.1371/journal.pmed.1001819   April 14, 2015
Welcome to the WHO ICTRP

The mission of the WHO International Clinical Trials Registry Platform is to ensure that a complete view of research is accessible to all those involved in health care decision making. This will improve research transparency and will ultimately strengthen the validity and value of the scientific evidence base.

The registration of all interventional trials is a scientific, ethical and moral responsibility.
### Library for health research reporting

The Library contains a comprehensive searchable database of reporting guidelines and also links to other resources relevant to research reporting.

- **Search for reporting guidelines**
- **Not sure which reporting guideline to use?**
- **Reporting guidelines under development**
- **Visit the library for more resources**

### Reporting guidelines for main study types

<table>
<thead>
<tr>
<th>Study Type</th>
<th>Guideline</th>
<th>Extensions</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Randomised trials</td>
<td>CONSORT</td>
<td>Extensions</td>
<td>Other</td>
</tr>
<tr>
<td>Observational studies</td>
<td>STROBE</td>
<td>Extensions</td>
<td>Other</td>
</tr>
<tr>
<td>Systematic reviews</td>
<td>PRISMA</td>
<td>Extensions</td>
<td>Other</td>
</tr>
<tr>
<td>Case reports</td>
<td>CARE</td>
<td>Extensions</td>
<td>Other</td>
</tr>
<tr>
<td>Qualitative research</td>
<td>SRQR</td>
<td>COREQ</td>
<td>Other</td>
</tr>
<tr>
<td>Diagnostic / prognostic</td>
<td>STARD</td>
<td>TRIPOD</td>
<td>Other</td>
</tr>
<tr>
<td>Quality improvement studies</td>
<td>SQUIRE</td>
<td>Other</td>
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<tr>
<td>Economic evaluations</td>
<td>CHEERS</td>
<td>Other</td>
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</tr>
<tr>
<td>Animal pre-clinical studies</td>
<td>ARRIVE</td>
<td>Other</td>
<td></td>
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<tr>
<td>Study protocols</td>
<td>SPIRIT</td>
<td>PRISMA-P</td>
<td>Other</td>
</tr>
<tr>
<td>Clinical practice guidelines</td>
<td>AGREE</td>
<td>RIGHT</td>
<td>Other</td>
</tr>
</tbody>
</table>

See all 382 reporting guidelines.
WHAT'S GOOD?

- REWARD recommendations
- James Lind Alliance
- EBR Network
- Reporting guidelines for protocols (SPIRIT, PRISMA-P)
- Statement of AMS on reproducibility & reliability of research
- Trial registration: AllTrials, WHO and ICMJE statement, WHO ICTRP
- Sharing clinical trials data (ICMJE proposal)
- EQUATOR network
WHAT’S BAD?
What are funders doing to minimise waste in research?

*Mona Nasser, Mike Clarke, Iain Chalmers, Kjetil Gundro Brurberg, Hanna Nykvist, Hans Lund, Paul Glasziou

www.thelancet.com Vol 389 March 11, 2017

<table>
<thead>
<tr>
<th>Funding agency</th>
<th>Country</th>
<th>Are patients and the public involved?</th>
<th>New research requires systematic reviews of existing evidence?</th>
<th>Public access to full protocols for completed or ongoing research?</th>
<th>Funding to undertake “research on research”?</th>
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</thead>
<tbody>
<tr>
<td>National Institute for Health Research (NIHR)</td>
<td>UK</td>
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<tr>
<td>Medical Research Council (MRC)</td>
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<tr>
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<tr>
<td>l’Agence Nationale de la Recherche (ANR)</td>
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<td>Nederlandse organisatie voor gezondheidsonderzoek en zorinnovatie (ZonMw)</td>
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<td>Danske Regioner (DR)</td>
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<tr>
<td>Regional Health Authorities in Norway (RHA)</td>
<td>Norway</td>
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</tr>
</tbody>
</table>
Patient engagement in research: a systematic review

Juan Pablo Domecq¹,²,⁵, Gabriela Prutsky¹,²,⁵, Tarig Elraiyah¹,⁵, Zhen Wang¹,⁵,⁶, Mohammed Nabhan¹,⁵, Nathan Shippee¹,⁵,⁶, Juan Pablo Brito¹,⁴,⁵, Kasey Boehmer¹,⁵, Rim Hasan¹,⁵,⁸, Belal Firwana¹,⁵,⁸, Patricia Erwin¹,⁷, David Eton¹,⁵,⁶, Jeff Sloan¹,⁵,⁶, Victor Montori¹,²,⁴,⁵,⁶, Noor Asi¹,⁵, Abd Moain Abu Dabrh¹,⁵, and Mohammad Hassan Murad¹,³,⁵,⁶,*
The Cochrane Collaboration’s tool for assessing risk of bias

- Adequate sequence generation
- Allocation concealment
- Blinding (Subjective outcomes)
- Blinding (Mortality)
- Incomplete outcome data addressed (Short-term outcomes (2-6 wks))
- Incomplete outcome data addressed (Longer-term outcomes (> 6 wks))
- Free of selective reporting
- Free of other bias

Legend:
- Green: Yes (Low risk of bias)
- Yellow: Unclear
- Red: No (High risk of bias)
Avoidable waste of research related to inadequate methods in clinical trials

Youri Yordanov, 1, 2 Agnes Dechartres, 1, 3, 4 Raphaël Porcher, 1, 3, 4 Isabelle Boutron, 1, 3, 4, 5 Douglas G Altman, 6 Philippe Ravaud 1, 3, 4, 5, 7

Cochrane reviews included (n=205)

Trials included in meta-analysis for primary outcome (n=1286)

+ Trials had all domains at low risk (n=207; 16%)

? Trials had at least one domain at unclear risk, others being at low risk (n=523; 41%)

− Trials had at least one domain at high risk (n=556; 43%)

Risk of bias reassessment based on a random sample of 200 trials with at least one domain at high risk of bias
Panel 1: An example from Sweden of the bureaucracy involved in applications for central research ethics committee approval

In 2010, a group of researchers in Sweden wanted to pool data from several cohort studies to identify risk factors for subarachnoid haemorrhage. They identified about 20 studies, and spent about 300 h contacting all investigators and getting signed data-sharing agreements and data security processes agreed. Sweden has a central research ethics committee to approve projects. The team recorded the time taken for each step of the approval process. About 200 h of office time was spent on the ethics approval and resubmission process alone. The research ethics committee wanted to see all information that the participants of all cohorts had been given about the purpose of the study. These documents had to be provided as 18 copies and submitted manually. It took the team 6 months to collect all the information sheets from the 20 different cohorts, several of which began recruitment in the 1960s and for which little knowledge about what information was given by whom to whom in the recruitment phase was poor. The research ethics committee eventually had the team advertise in national newspapers about the pooling project, listing all original cohorts so that all individuals who did not want the team to use their data for this project could withdraw their consent for the study. Not one participant withdrew. It took more than 3 years to reach the stage of pooling data from the cohorts, ready for analysis.

Figure 1: Paperwork required for regulatory review of the research described in panel 1
Who's not sharing their trial results?

Trials registered on ClinicalTrials.gov should share results on the site shortly after completing, or publish in a journal. But many organisations fail to report the results of clinical trials. We think this should change. Explore our data (last updated October 2016) to see the universities, government bodies and pharmaceutical companies that aren't sharing their clinical trial results.

Trial sponsors

We've ranked the major trial sponsors with the most unreported trials registered on ClinicalTrials.gov. Click on a sponsor's name to find out whether it's getting better at reporting completed trials - or worse.

<table>
<thead>
<tr>
<th>Name of sponsor</th>
<th>Trials missing results</th>
<th>Total eligible trials</th>
<th>Percent missing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1    Sanofi</td>
<td>265</td>
<td>435</td>
<td>65.5%</td>
</tr>
<tr>
<td>2    Novartis Pharmaceuticals</td>
<td>201</td>
<td>534</td>
<td>37.6%</td>
</tr>
<tr>
<td>3    National Cancer Institute (NCI)</td>
<td>194</td>
<td>558</td>
<td>34.8%</td>
</tr>
<tr>
<td>4    Assistance Publique - Hôpitaux de Paris</td>
<td>186</td>
<td>292</td>
<td>63.7%</td>
</tr>
<tr>
<td>5    GlaxoSmithKline</td>
<td>183</td>
<td>809</td>
<td>22.6%</td>
</tr>
<tr>
<td>6    Mayo Clinic</td>
<td>157</td>
<td>312</td>
<td>50.3%</td>
</tr>
<tr>
<td>7    Yonsei University</td>
<td>139</td>
<td>194</td>
<td>71.6%</td>
</tr>
<tr>
<td>8    Seoul National University</td>
<td>131</td>
<td>207</td>
<td>63.3%</td>
</tr>
</tbody>
</table>

Trials by year

Since Jan 2006, all major trial sponsors completed 25,927 eligible trials and haven't published results for 11,714 trials. That means 45.2% of their trials are missing results.
Here’s what we found.

- 67 trials checked
- 9 trials were perfect
- 354 outcomes not reported
- 357 new outcomes silently added

On average, each trial reported just 58.2% of its specified outcomes. And on average, each trial silently added 5.3 new outcomes.

- 58 letters sent
- 18 letters published
- 8 letters unpublished after 4 weeks
- 32 letters rejected by editor

Learn why we did this, more about our methodology, or see the full results for every trial.
Search for reporting guidelines

Browse for reporting guidelines by selecting one or more of these drop-downs:

Study type  Clinical area  Section of report
Please select...  Please select...  Please select...

Or search with free text

Search Reporting Guidelines

Displaying 385 reporting guidelines found.
Consolidated standards of reporting trials (CONSORT) and the completeness of reporting of randomised controlled trials (RCTs) published in medical journals (Review)

Further emphasis on research in context

Panel: Research in context

Evidence before this study
This section should include a description of all the evidence that the authors considered before undertaking this study. Authors should state: the sources (databases, journal or book reference lists, etc) searched; the criteria used to include or exclude studies (including the exact start and end dates of the search), which should not be limited to English language publications; the search terms used; the quality (risk of bias) of that evidence; and the pooled estimate derived from meta-analysis of the evidence, if appropriate.

Added value of this study
Authors should describe here how their findings add value to the existing evidence (including an updated meta-analysis, if appropriate).

Implications of all the available evidence
Authors should state the implications for practice or policy and future research of their study combined with existing evidence.
WHAT'S BAD?

- Funders' low adherence to REWARD recommendations
- Lack of evidence on the best ways to engage patients in research
- Regulation and management: fragmentation and bureaucracy
- Low reproducibility of research
- Too many primary studies without SRs of available evidence
- Lack of results reporting of registered trials (TrialsTracker)
- Switching outcomes in clinical trials (COMPare)
- Reporting guidelines: too many, unknown impact
- Too little "research in context"
Evidence Synthesis

WHAT’S GOOD?
Figure 1: Hierarchy of evidence: traditional EBM versus GRADE
ORGANIZATIONS

More than 100 organizations from 19 countries around the world have endorsed or are using GRADE.

Welcome to the GRADE working group

From evidence to recommendations – transparent and sensible
• PRISMA Statement
• PRISMA-P (for developing review Protocols)
• PRISMA-IPD (Individual Patient Data)
• PRISMA-NMA (Network Meta-Analyses)
Guidelines International Network: Toward International Standards for Clinical Practice Guidelines

Amir Qaseem, MD, PhD, MHA; Frode Forland, MD, DPH; Fergus Macbeth, MD; Günter Ollenschläger, MD, PharmD, PhD; Sue Phillips, PhD; and Philip van der Wees, PhD, PT, for the Board of Trustees of the Guidelines International Network*
APPRAISAL OF GUIDELINES FOR RESEARCH & EVALUATION II

AGREE II

INSTRUMENT

The AGREE Next Steps Consortium
May 2009

UPDATE: September 2013

CLINICAL PRACTICE GUIDELINES WE CAN TRUST

INSTITUTE OF MEDICINE
OF THE NATIONAL ACADEMIES

Advancing the science of practice guidelines

Holger J. Schünemann, MD, PhD, MSc; Lubna A. Al-Ansary, MBBS, MSc; Frode Forland, MD, DPH; Sonja Kersten, MSc; Jorma Komulainen, MD, PhD; Ina B. Kopp, MD; Fergus Macbeth, MA, DM; Susan M. Phillips, BSc (Hons), DPhil; Craig Robbins, MD, MPH; Philip van der Wees, PT, PhD; and Amir Qaseem, MD, PhD, MHA, for the Board of Trustees of the Guidelines International Network*

WHAT'S GOOD FOR SYSTEMATIC REVIEWS?

- Cochrane handbooks
- PRISMA reporting guidelines and their extensions
- GRADE methods in Cochrane reviews
WHAT'S GOOD FOR CLINICAL PRACTICE GUIDELINES?

- Guidelines International Network (G-I-N)
- International standards: G-I-N, AGREE II, IOM
- Growing use of GRADE to formulate CPGs recommendations
- Reporting standards: AGREE II, RIGHT
WHAT’S BAD?
Original Investigation

The Mass Production of Redundant, Misleading, and Conflicted Systematic Reviews and Meta-analyses

JOHN P.A. IOANNIDIS

The Milbank Quarterly, Vol. 94, No. 3, 2016 (pp. 485-514)
The production of systematic reviews has reached epidemic proportions.

The large majority are unnecessary, misleading, and/or conflicted.

Good and truly informative systematic reviews are a small minority.
## Cochrane reviews and protocols published over last 12 months

<table>
<thead>
<tr>
<th>Issue</th>
<th>Total reviews</th>
<th>Total protocols</th>
<th>Total reviews and protocols</th>
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<td>7066</td>
<td>2523</td>
<td>9589</td>
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<td>11'16</td>
<td>7104</td>
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<td>7415</td>
<td>2572</td>
<td>9987</td>
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(Cochrane reviews and protocols published over last 12 months)

**Note:** The table above represents the total number of reviews, protocols, and combined reviews and protocols published from 10'16 to 9'17.
## Impact Factor for the CDSR

<table>
<thead>
<tr>
<th>Year</th>
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<td>2016</td>
<td>6.264</td>
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<tr>
<td>2015</td>
<td>6.103</td>
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<td>2011</td>
<td>5.912</td>
</tr>
<tr>
<td>2010</td>
<td>6.186</td>
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</tbody>
</table>
WHAT'S BAD FOR SYSTEMATIC REVIEWS?

- Contamination of "publish or perish" virus to SRs → epidemic production of useless, incomplete, outdated, methodologically flawed SRs
- Slow growth of Cochrane reviews and protocols
- Impact factor of CDSR substantially unchanged
- DARE, that collected high quality SRs, has no more been updated from March 2015
WHAT'S BAD FOR CLINICAL PRACTICE GUIDELINES?

- Too many CPGs on the same disease
- Low quality, outdated CPGs
- Influence of COIs
- Most of CPGs do not take account of multimorbidity
- Low usability of CPGs
- Lack of a central CPGs database searchable for quality criteria
WHAT’S GOOD?
The paths from research to improved health outcomes

ACP J Club 2005;142:A8-10

Evid Based Med 2005;10:4-7

Evid Based Nurs 2005;8:36-8
Myth, opinion, poor research

1. Research Synthesis, Guidelines, Evidence Journals,...

2. Bedside EBM

3. Clinical Quality Improvement

4. Decision Aids, Patient Education, Compliance aids

Systems (bottomline +/- ref)

Synopses (user summary of research)

Systematic Reviews & CATs (search; appraise; synthesis)

Studies (primary research studies: sound & unsound)
2. ACTION CYCLE

- Identify problem
- Identify, review, select knowledge
- Action cycle (Application)
- Adapt knowledge to local context
- Assess barriers to knowledge use
- Select, tailor, implement interventions
- Monitor knowledge use
- Evaluate outcomes
- Sustain knowledge use
WHAT'S GOOD?

- Excellent frameworks available, including all determinants, methods and tools for:
  - individual KT
  - systemic KT
- ...
- ...
- ...
- ...
WHAT’S BAD?
Evidence Translation

WHAT'S BAD?

- KT evidence too context-related $\rightarrow$ low applicability
- KT is a young science, not included in academic curricula
- Professional behaviors are influenced by habits and COIs, more than evidence
- Fragmented and not well-connected information systems
The way forward
Evidence Generation

THE WAY FORWARD

• More guidelines for reporting protocols: observational studies, diagnostic studies...
• More evidence about the impact of reporting guidelines
• Extending both WHO statement and ICMJE policies concerning clinical trials to register observational studies
• Exploring ways to reduce the extreme fragmentation of regulation issues
• Exploiting all opportunities to increase the reproducibility of biomedical research
THE WAY FORWARD

- We need less publications and more high quality evidence
  - Changing the ways to measure the impact biomedical research and to fund it
  - To increase the efficiency of basic research
  - To reach good balance among basic, translational, clinical and health service research
### Table. PQRST Index for Appraising and Rewarding Research

<table>
<thead>
<tr>
<th>Item in PQRST Index</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>P (productivity)</td>
<td>Number of publications in the top tier % of citations for the scientific field and year</td>
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<tr>
<td></td>
<td>Proportion of funded proposals that have resulted in ≥1 published reports of the main results</td>
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<td></td>
<td>Proportion of registered protocols that have been published 2 y after the completion of the studies</td>
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<tr>
<td>Q (quality of scientific work)</td>
<td>Proportion of publications that fulfill ≥1 quality standards</td>
</tr>
<tr>
<td>R (reproducibility of scientific work)</td>
<td>Proportion of publications that are reproducible</td>
</tr>
<tr>
<td>S (sharing of data and other resources)</td>
<td>Proportion of publications that share their data, materials, and/or protocols (whichever items are relevant)</td>
</tr>
<tr>
<td>T (translational influence of research)</td>
<td>Proportion of publications that have resulted in successful accomplishment of a distal translational milestone, eg, getting promising results in human trials for intervention tested in animals or cell cultures, or licensing of intervention for clinical trials</td>
</tr>
</tbody>
</table>
Assessing the impact of healthcare research: A systematic review of methodological frameworks

Samantha Cruz Rivera, Derek G. Kyte*, Olalekan Lee Aiyegbusi, Thomas J. Keeley, Melanie J. Calvert

Centre for Patient Reported Outcomes Research, Institute of Applied Health Research, College of Medical and Dental Sciences, University of Birmingham, Birmingham, United Kingdom

PLOS Medicine | https://doi.org/10.1371/journal.pmed.1002370  August 9, 2017
### Impact of Research:

<table>
<thead>
<tr>
<th>Timeframe</th>
<th>Impact Area</th>
<th>Key Activities and Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-term</td>
<td>Research and innovation outcomes*</td>
<td>- Publications &lt;br&gt;- Peer-reviewed articles (journal impact factor) &lt;br&gt;- Citation rates</td>
</tr>
<tr>
<td></td>
<td>Dissemination and knowledge transfer*</td>
<td>- Conferences, seminars, workshops and presentations &lt;br&gt;- Teaching &lt;br&gt;- Mass media</td>
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<tr>
<td></td>
<td>Capacity building, training and leadership*</td>
<td>- PhD and post-doc studentships &lt;br&gt;- Academic careers advancement &lt;br&gt;- Subsequent grants received</td>
</tr>
<tr>
<td></td>
<td>Academic collaborations, research networks and</td>
<td>- Collaborative research with industry &lt;br&gt;- Interdisciplinary research</td>
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<tr>
<td></td>
<td>partnerships</td>
<td></td>
</tr>
<tr>
<td>Mid-term</td>
<td>Level of policy-making</td>
<td>- Presentations to decision-makers &lt;br&gt;- Influence on public policy debate &lt;br&gt;- Information base for political and executive decision-making</td>
</tr>
<tr>
<td></td>
<td>Type and nature of policy impact</td>
<td>- Changes to legislations, regulations and government policy &lt;br&gt;- Influence and involvement in the decision-making process &lt;br&gt;- Changes to clinical or healthcare training, practice or guidelines</td>
</tr>
<tr>
<td></td>
<td>Evidence-based practice</td>
<td>- Improving diagnostics and response prediction &lt;br&gt;- Fulfilling previously unmet clinical needs</td>
</tr>
<tr>
<td></td>
<td>Quality of care and service delivery</td>
<td>- Improved health outcomes (QALYs) &lt;br&gt;- Patient satisfaction (PROMS) &lt;br&gt;- Making services more accessible for local communities &lt;br&gt;- Reduction in waiting times</td>
</tr>
<tr>
<td></td>
<td>Policy networks</td>
<td>- Cost containment and effectiveness &lt;br&gt;- Cost savings &lt;br&gt;- Increased service effectiveness &lt;br&gt;- Resource allocation</td>
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<tr>
<td>Long-term</td>
<td>Health literacy</td>
<td>- Activities to change health-risk behaviours such as strategies and campaigns</td>
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<tr>
<td></td>
<td>Health knowledge, attitudes and behaviours</td>
<td>- Increased levels of public engagement with science and research &lt;br&gt;- Outcomes from focus groups to assess changes in attitudes, behaviours and attitudes</td>
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<td></td>
<td>Improved social equity, inclusion or cohesion</td>
<td>- United Nations Millennium Development Goals &lt;br&gt;- Human rights</td>
</tr>
<tr>
<td></td>
<td>Economic impacts</td>
<td>- Attracting R&amp;D investment from NHS, medical charities and overseas &lt;br&gt;- Income from intellectual property &lt;br&gt;- Spill over effects &lt;br&gt;- Patents granted/licenses awarded and brought to the market &lt;br&gt;- Spin-out companies &lt;br&gt;- Research contracts and income from industry</td>
</tr>
</tbody>
</table>
THE WAY FORWARD FOR SYSTEMATIC REVIEWS

• International policies to converge efforts on Cochrane reviews
• New ICMJE Statement:
  - PROSPERO registration number mandatory for publication
  - Encourage Cochrane reviews → publication of a synthesis on affiliated ICMJE journals
• Centralized database for (non Cochrane) high-quality systematic reviews
THE WAY FORWARD FOR CLINICAL PRACTICE GUIDELINES

- International governance to avoid proliferation of low quality CPGs
- Better management of COIs according to G-I-N standards
- Exploring ways to include multimorbidity in CPGs recommendations
- Central CPGs database searchable for quality criteria (AGREE II, G-I-N, IOM)
- Improve usability: e.g. CDSS
THE WAY FORWARD

• More good quality evidence about: knowledge translation (KT), shared decision making, patient adherence

• Set standards for:
  - defining KT priorities at local level
  - developing care pathways, through local adapting of CPGs
  - assessing barriers and facilitating factors
THE WAY FORWARD

• Measuring performance
  - Using reliable process and outcome measures
  - Align performance measures and reward systems across different levels: professional → team → health organization → health care system
An ecosystem influenced by:

- **Living organisms**: stakeholders, with their competition, collaboration and conflicts of interest
- **Environment**: social, cultural, economic, political context
- **Non living component**: evidence

The ecosystem of evidence