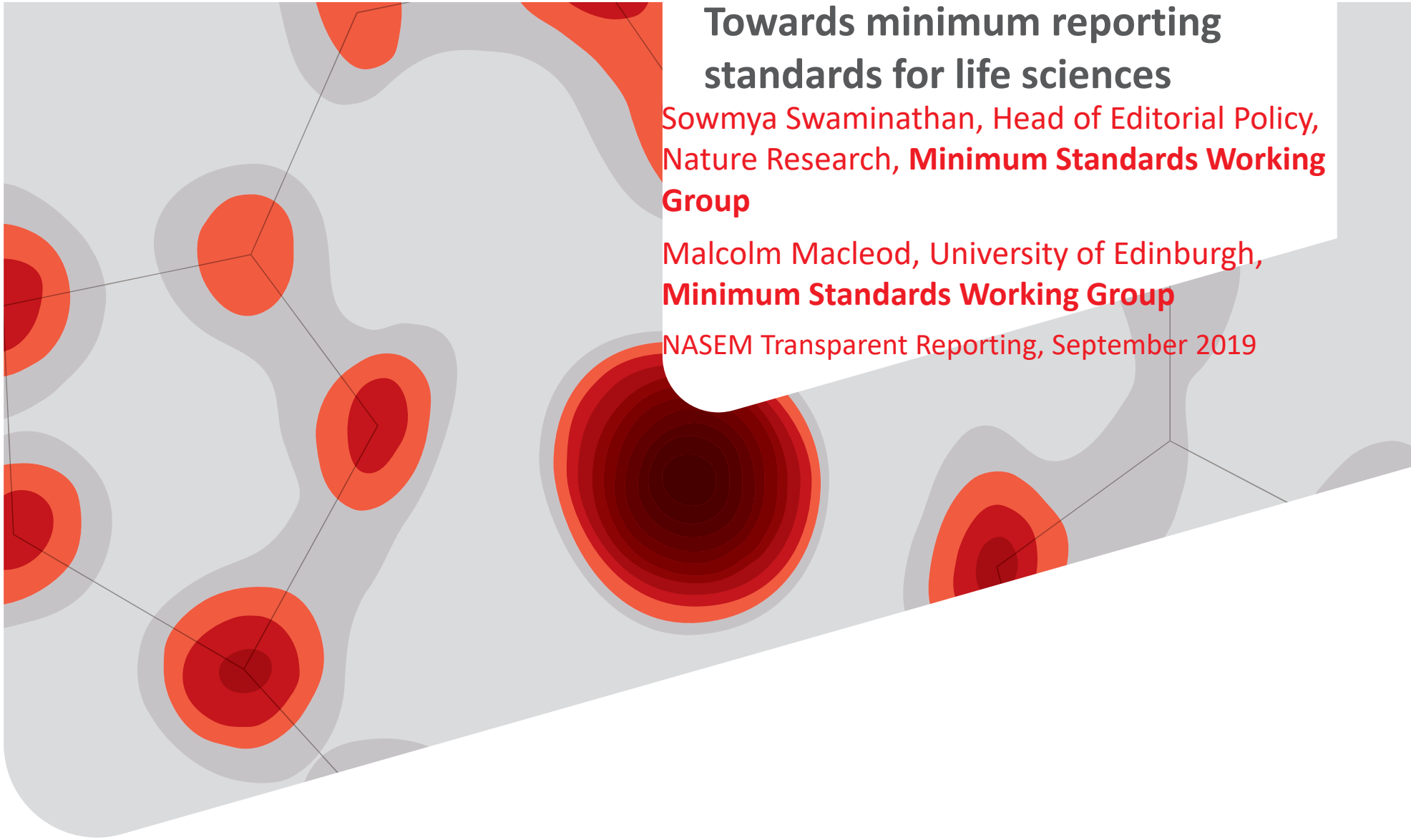


Illustration inspired by the work of Dorothy Hodgkin

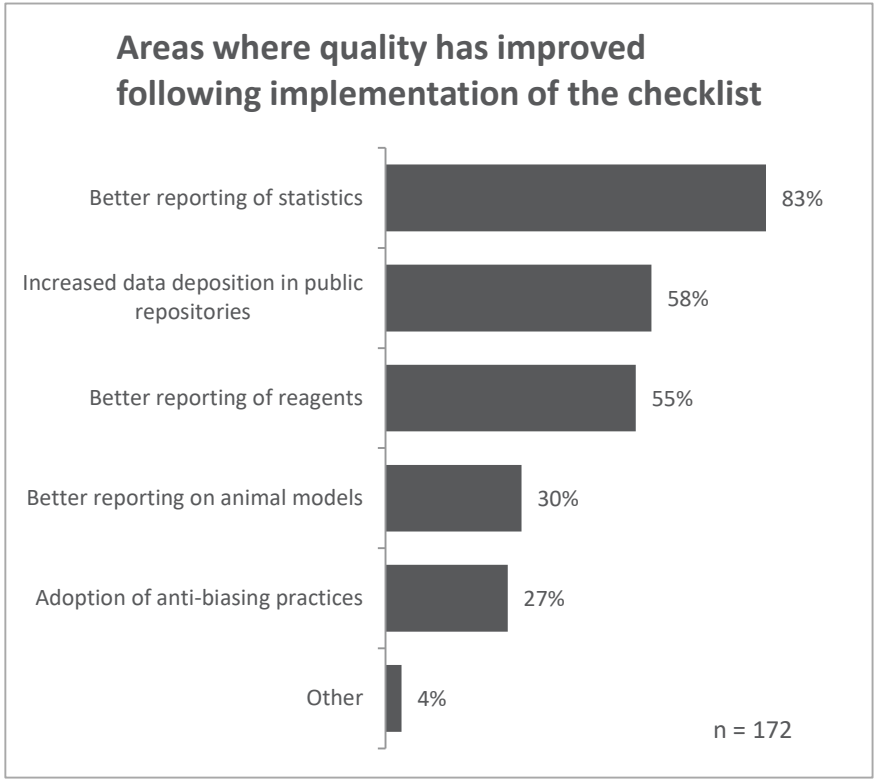
Towards minimum reporting standards for life sciences

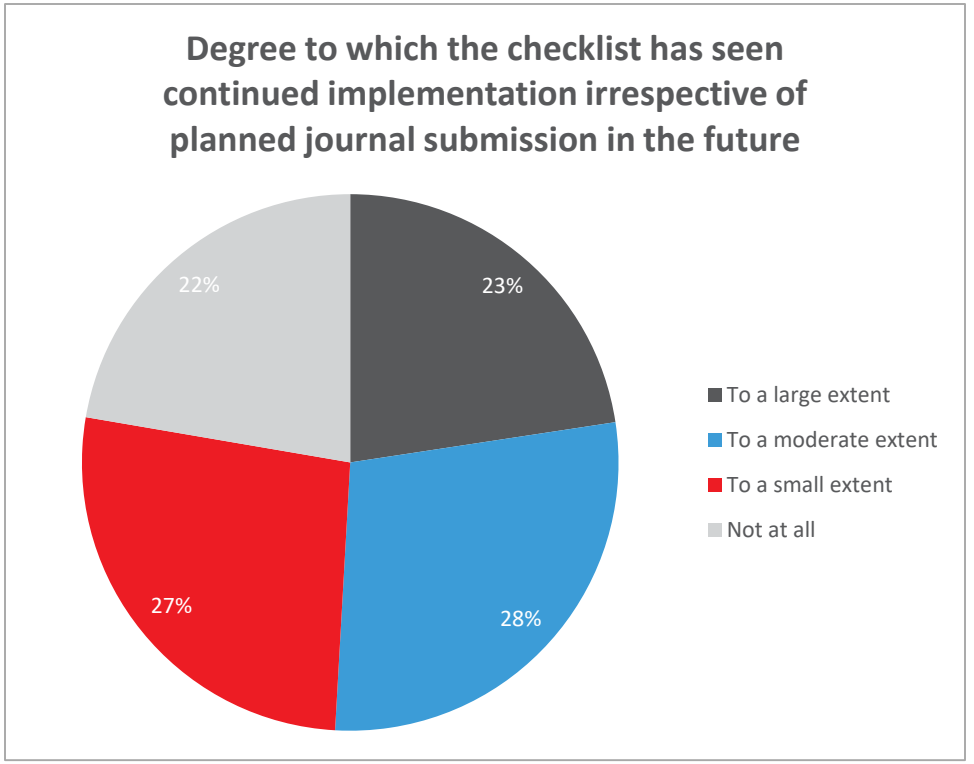
Sowmya Swaminathan, Head of Editorial Policy, Nature Research, **Minimum Standards Working Group**

Malcolm Macleod, University of Edinburgh, **Minimum Standards Working Group**

NASEM Transparent Reporting, September 2019

Impact of checklist on published papers and research practise





83% of surveyed Nature authors felt that the checklist had significantly improved reporting of statistics within papers published in *Nature* journals

78% of surveyed *Nature* journal authors continue to use the checklist at least to a small extent with their continued work

Roughly a quarter stating they were using it to a large extent.

From 2017 survey of published *Nature* journal authors; https://figshare.com/articles/Nature_Reproducibility_survey_2017/6139937Reproducibility

Toward minimum reporting standards for life scientists

"Minimum Standards" Working Group: Group of journal editors and experts in reproducibility and transparent reporting

Nature Research (Springer Nature), PLOS, Science (AAAS), Cell Press (Elsevier), eLIFE, Wiley, Malcolm MacLeod (Univ of Edinburgh); David Mellor (Centre for Open Science)

Statement of task: https://osf.io/preprints/metaarxiv/9sm4x/

AIM: Improve transparency and reproducibility by defining minimum reporting standards in life science (biological, biomedical, pre-clinical research)

- A "minimum standards" framework: minimum requirements for reporting across four core areas :Materials (including data and code), Design, Analysis and Reporting (MDAR) **https://osf.io/xfpn4/**
- A "minimum standards" checklist: tool to help journals and researchers in adoption of the framework

https://osf.io/bj3mu/

- An "elaboration document" or user guide: context for the "minimum standards" framework and checklist

https://osf.io/xzy4s/

Target audience and application:

- Journals and publishing platforms, other stakeholders including funders and institutions
- MDAR Framework and checklist can apply at any point in the research life cycle – during study design, grant submission or journal peer review and publication, pedagogical tool

Developing the MDAR framework and checklist

Guiding principles:

Interpreting, replicating or reproducing findings

Cover under-reported elements

Broad application

Reference material:

Journal checklists and policy frameworks (Nature checklists, Cell STAR, eLIFE, EMBO, PLOS, Equator Network, ARRIVE, TOP)

Meta-research, consensus study reports

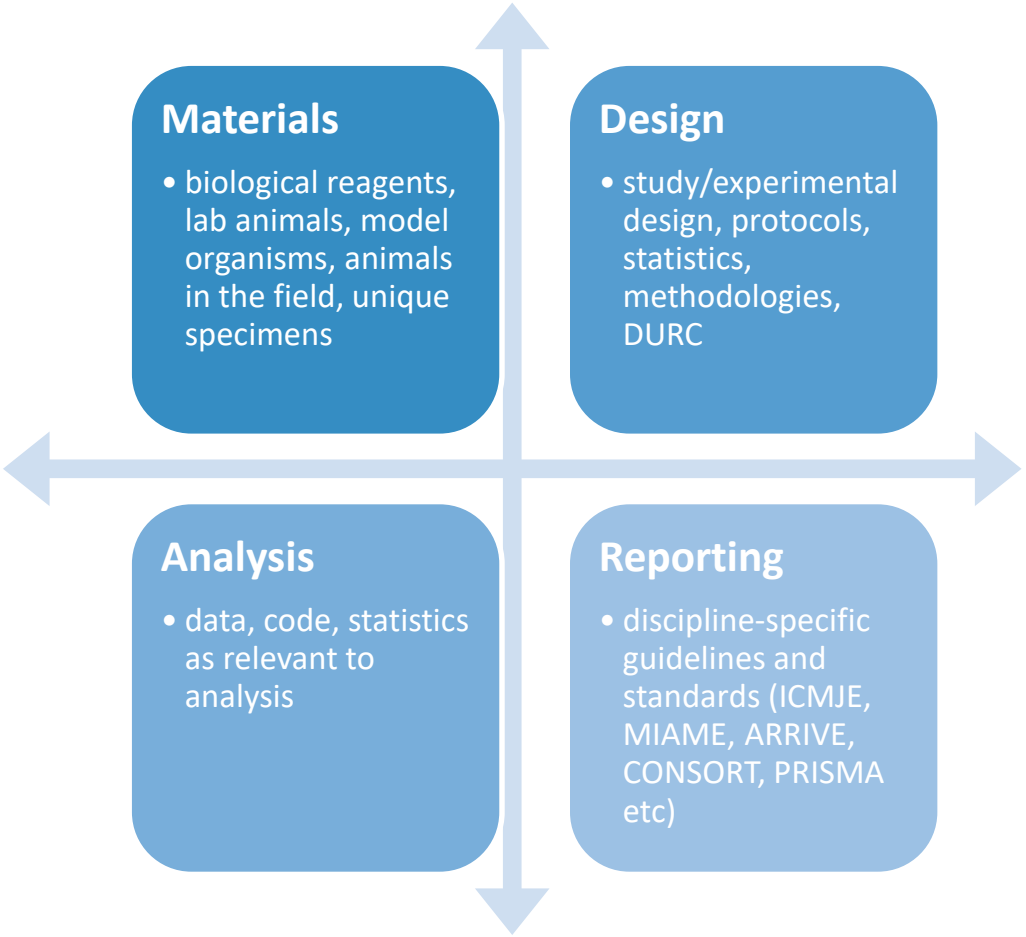
Process:

Steering group plus consultation with external experts

Prioritize elements based on journal experience and emerging consensus on reporting standards

Materials Design Analysis Reporting (MDAR) Framework

Reporting categories



Reporting levels

Accessibility
Identification
Minimum description/characterisation

Adoption of MDAR framework by is a commitment to include the minimum standards within individual journal (or other) policy framework.

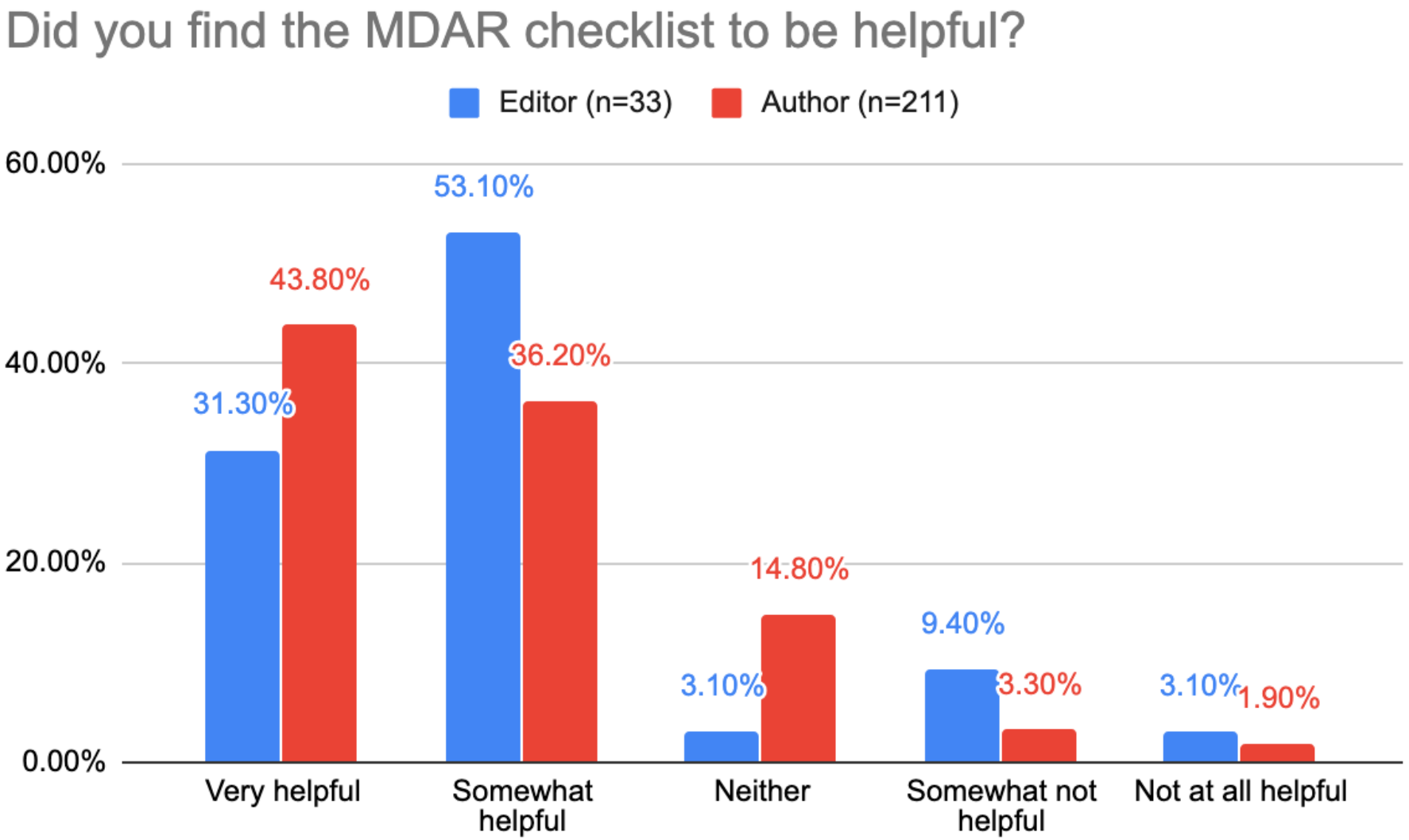
Testing the MDAR checklist with journals

13 journals from 10 publishers

211 authors

Science (AAAS), Scientific Reports (Springer Nature), BMC Microbiology (Springer Nature), PLOS Biology (PLOS), eLIFE (eLIFE), EMBO journals (EMBO Press), PNAS (NAS Press), Ecology & Evolution (Wiley), Microbiology Open (Wiley), Epigenetics (Taylor & Francis), Molecular Cancer Therapeutics (AACR), PeerJ, F1000R

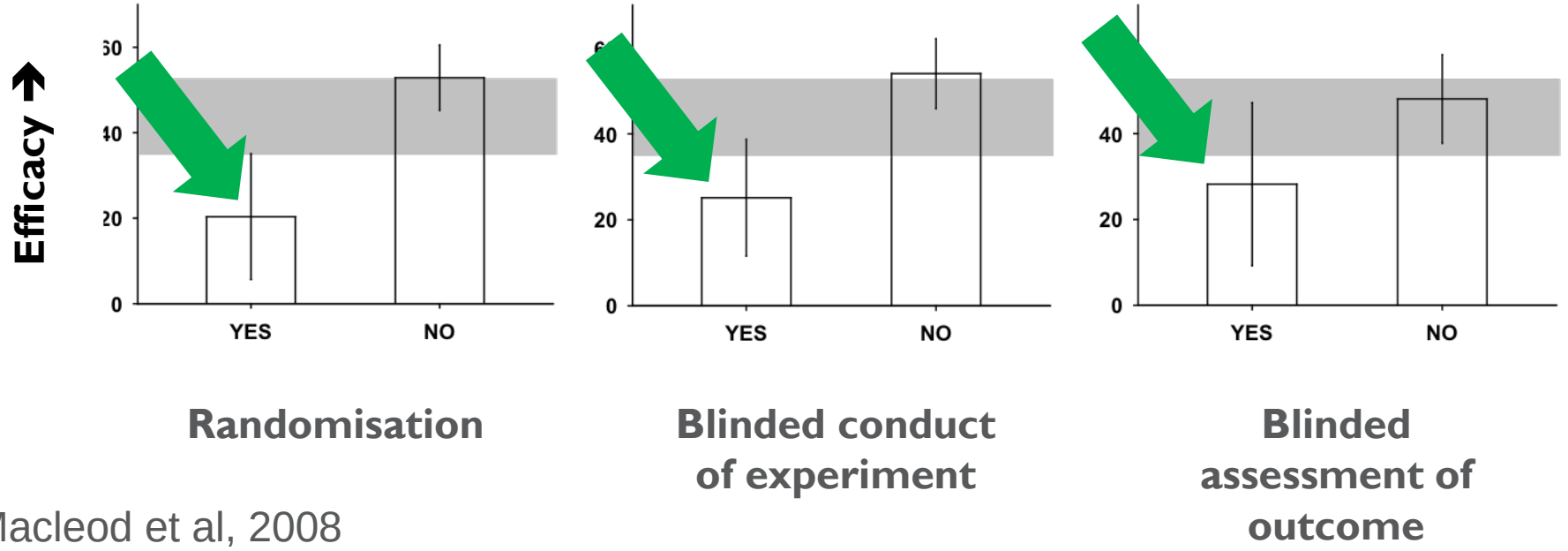
Understanding editor and author experience



Risk of bias in animal studies

The effect of NXY-059 in experimental stroke

- 11 publications, 29 experiments, 408 animals
- Improved outcome by 44% (35-53%)



Macleod et al, 2008

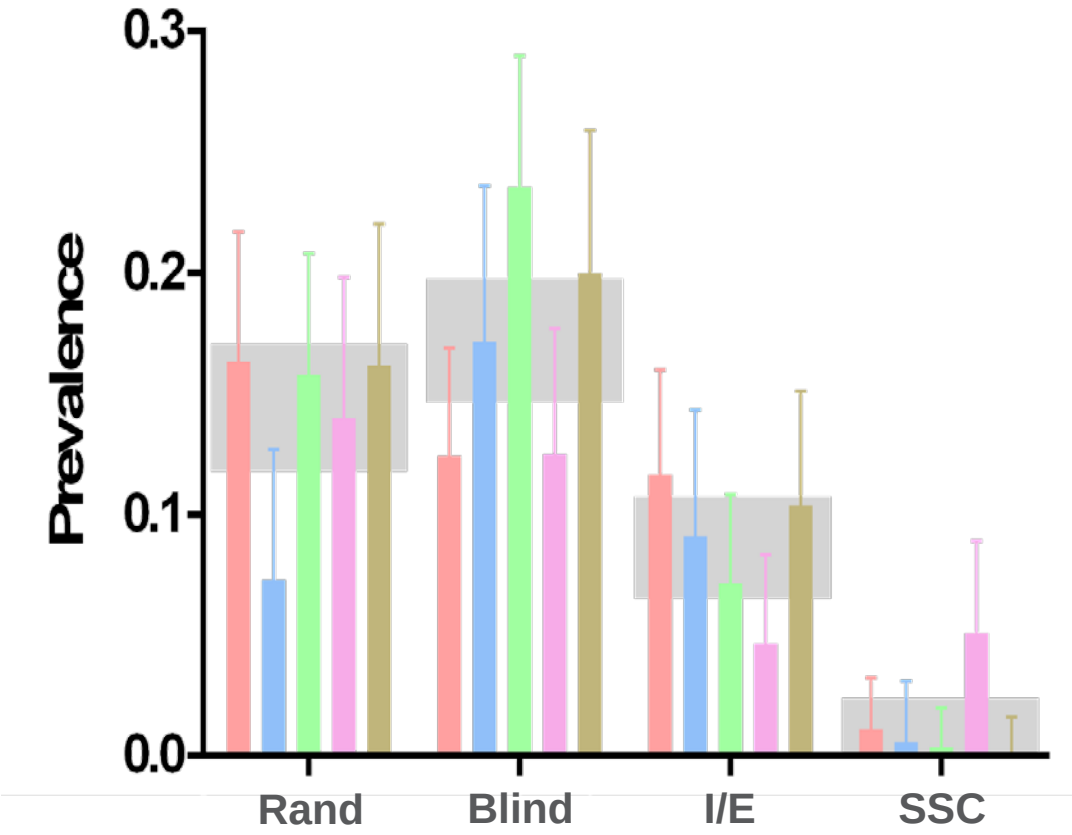
The scale of the problem
UK Research Assessment Exercise

rae2008
Research Assessment Exercise

"an outstanding contribution to the internationally excellent position of the UK in biomedical science and clinical/translational research."

"impressed by the strength within the basic neurosciences that were returned …particular in the areas of behavioural, cellular and molecular neuroscience"

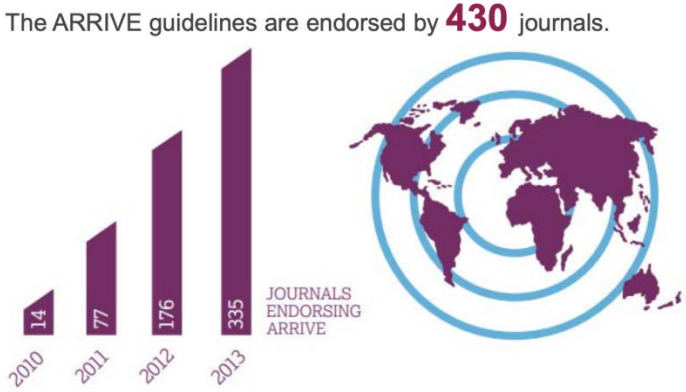
1173 publications using non human animals, published in 2009 or 2010, from 5 leading UK universities



Perspective

Improving Bioscience Research Reporting: The ARRIVE Guidelines for Reporting Animal Research

Carol Kilkenny[1]*, William J. Browne[2], Innes C. Cuthill[3], Michael Emerson[4], Douglas G. Altman[5]



Baker et al 2014

Leung et al 2018

PERSPECTIVE

doi:10.1038/nature11556

A call for transparent reporting to optimize the predictive value of preclinical research

Story C. Landis[1], Susan G. Amara[2], Khusru Asadullah[3], Chris P. Austin[4], Robi Blumenstein[5], Eileen W. Bradley[6], Ronald G. Crystal[7], Robert B. Darnell[8], Robert J. Ferrante[9], Howard Fillit[10], Robert Finkelstein[1], Marc Fisher[11], Howard E. Gendelman[12], Robert M. Golub[13], John L. Goudreau[14], Robert A. Gross[15], Amelie K. Gubitz[1], Sharon E. Hesterlee[16], David W. Howells[17], John Huguenard[18], Katrina Kelner[19], Walter Koroshetz[1], Dimitri Krainc[20], Stanley E. Lazic[21], Michael S. Levine[22], Malcolm R. Macleod[23], John M. McCall[24], Richard T. Moxley III[25], Kalyani Narasimhan[26], Linda J. Noble[27], Steve Perrin[28], John D. Porter[1], Oswald Steward[29], Ellis Unger[30], Ursula Utz[1] & Shai D. Silberberg[1]

Corresponding Author Name: _____

Manuscript Number: _____

Reporting Checklist For Life Sciences Articles

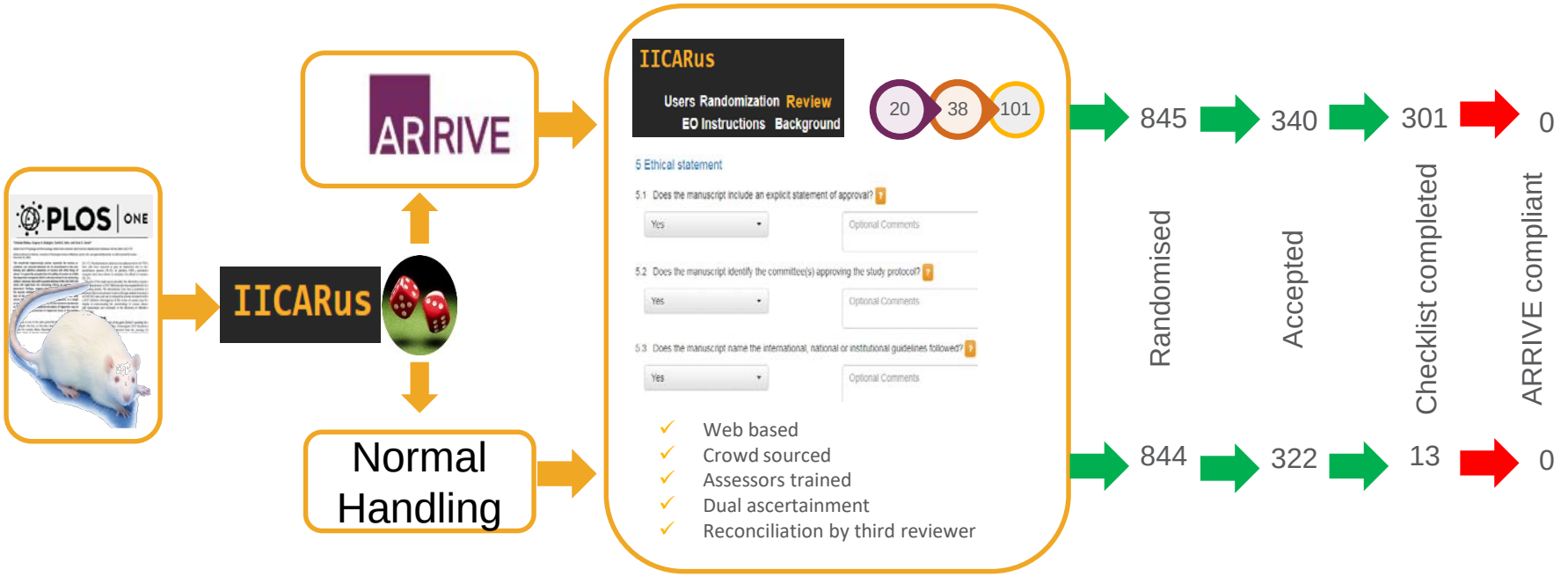
This checklist is used to ensure good reporting standards and to improve the reproducibility of published results. For more information, please read Reporting Life Sciences Research. List items are standard for all Nature journal articles but may not apply to all disciplines or manuscripts.

Figure legends

☐ Check here to confirm that the following information is available in all relevant figure legends (or Methods section if too long):

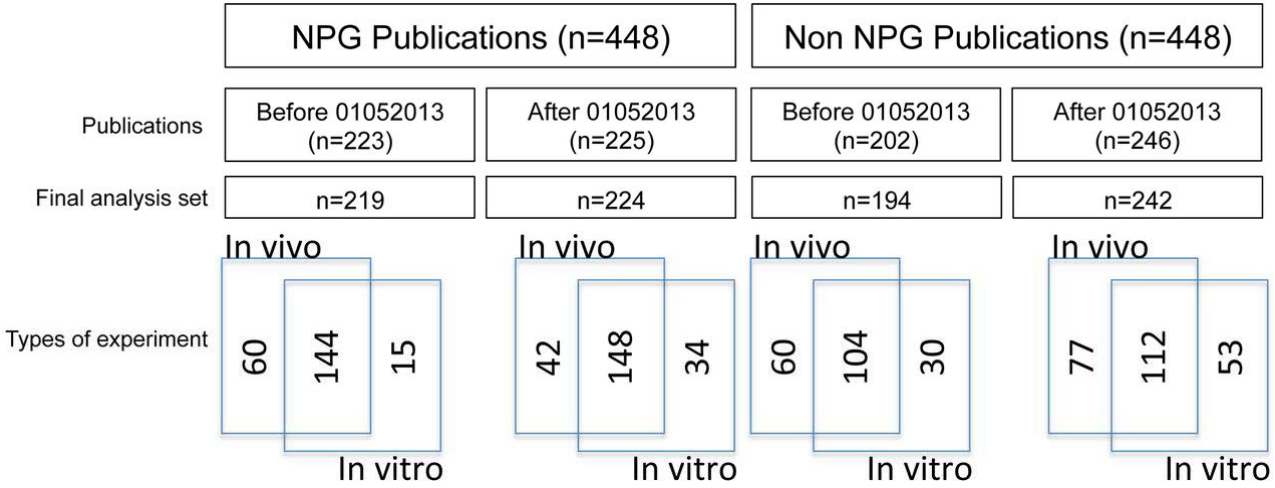
- the **exact sample size (*n*)** for each experimental group/condition, given as a number, not a range;
- a **description of the sample collection** allowing the reader to understand whether the samples represent **technical or biological replicates** (including how many animals, litters, culture, etc.);
- a **statement of how many times the experiment shown was replicated in the laboratory**;
- **definitions of statistical methods and measures**: (For small sample sizes (n<5) descriptive statistics are not appropriate, instead plot individual data points)
  - o very common tests, such as *t*-test, simple χ^2 tests, Wilcoxon and Mann-Whitney tests, can be unambiguously identified by name only, but more complex techniques should be described in the methods section;
  - o are tests one-sided or two-sided?
  - o are there adjustments for multiple comparisons?
  - o **statistical test results**, e.g., ***P* values**;
  - o definition of '**center values**' as **median** or **mean**;
  - o definition of **error bars** as **s.d.** or **s.e.m.** or **c.i.**

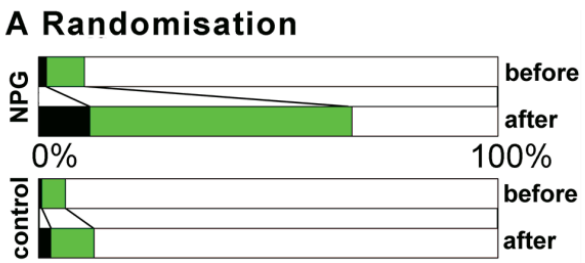
RCT of an Intervention to Improve Compliance with the ARRIVE guidelines (IICARus; PI Sena)

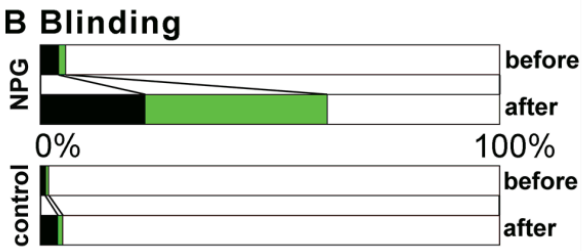


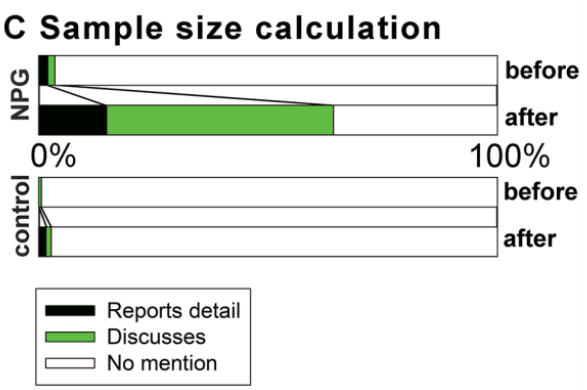
Protocol: Open Science Framework (February 2017)
Data Analysis Plan: Open Science Framework (September 2017)
Funding: MRC, NC3Rs, BBSRC & Wellcome Trust
Ethics: BMJ Ethics Committee

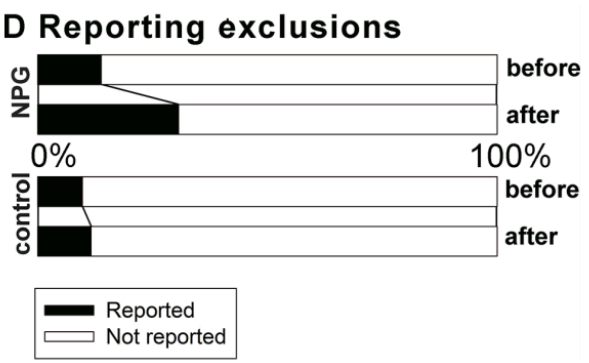
Impact of NPG checklist - the NPG Quality in Publication (NPQIP) study



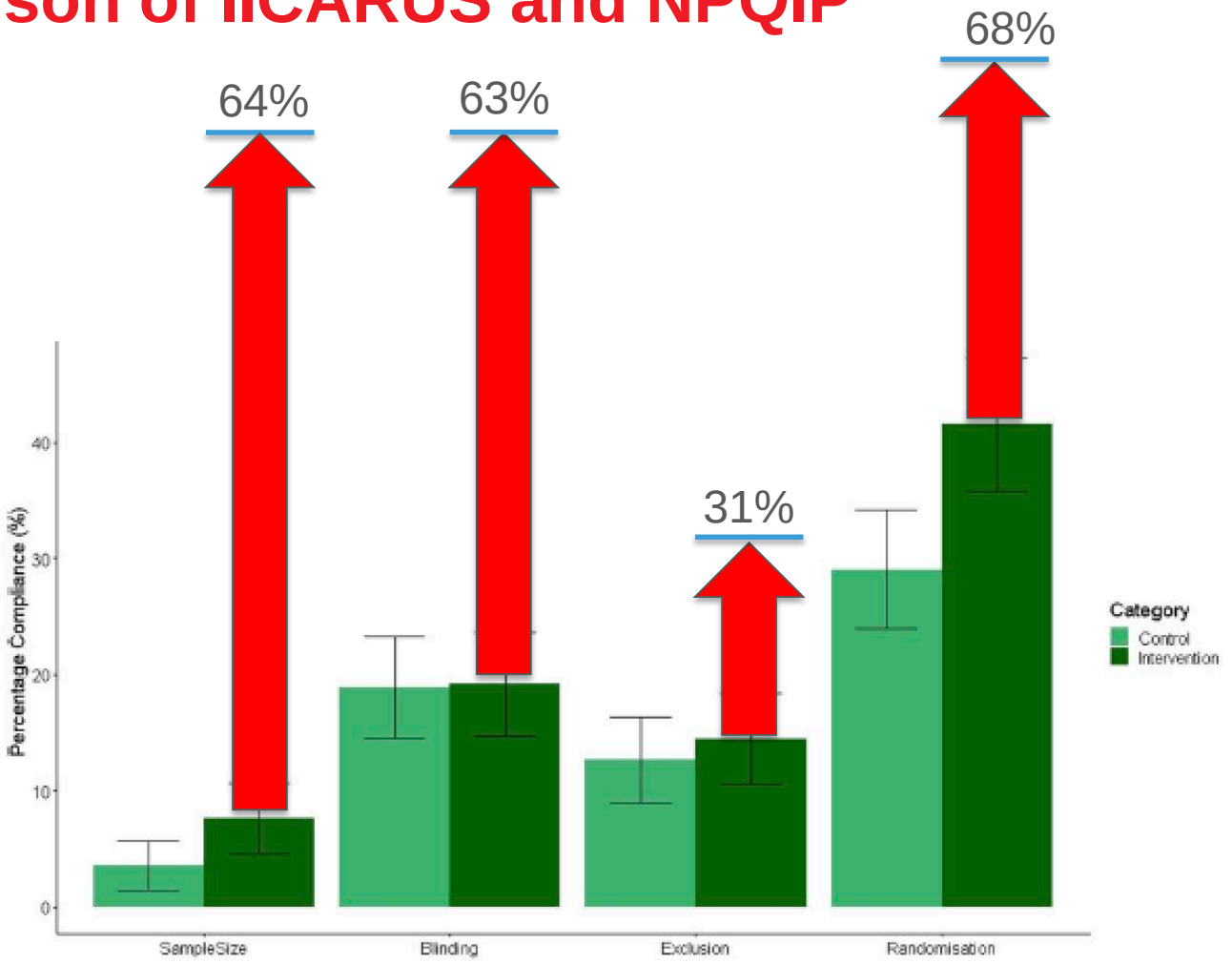








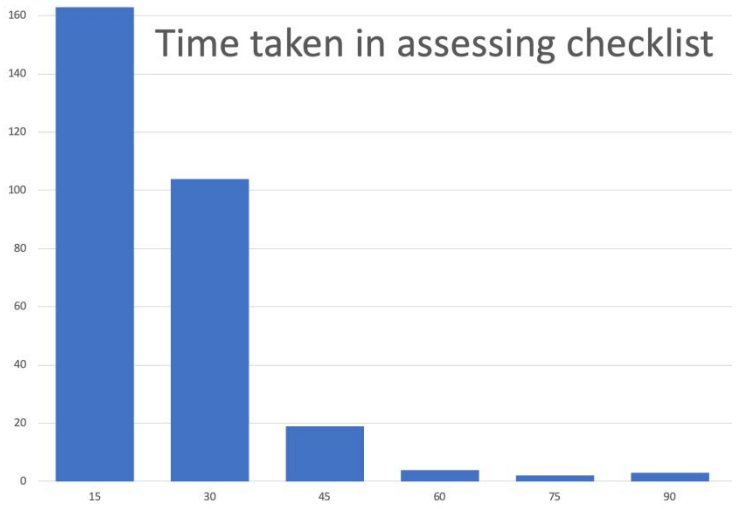
Comparison of IICARUS and NPQIP



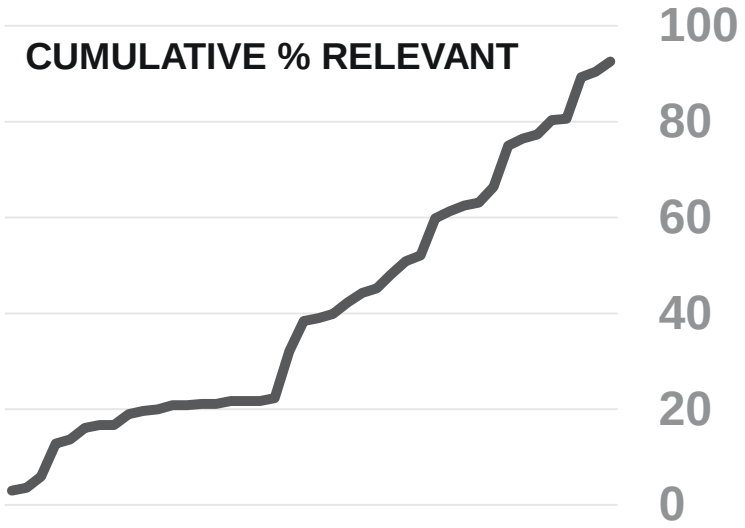
Conclusion: A checklist, on its own, is not enough

Evaluation of the MDAR Framework

- June- August 2019
- 13 journals, 289 manuscripts
- 89 manuscripts were dual assessed by 2 independent reviewers



Average 24 minutes

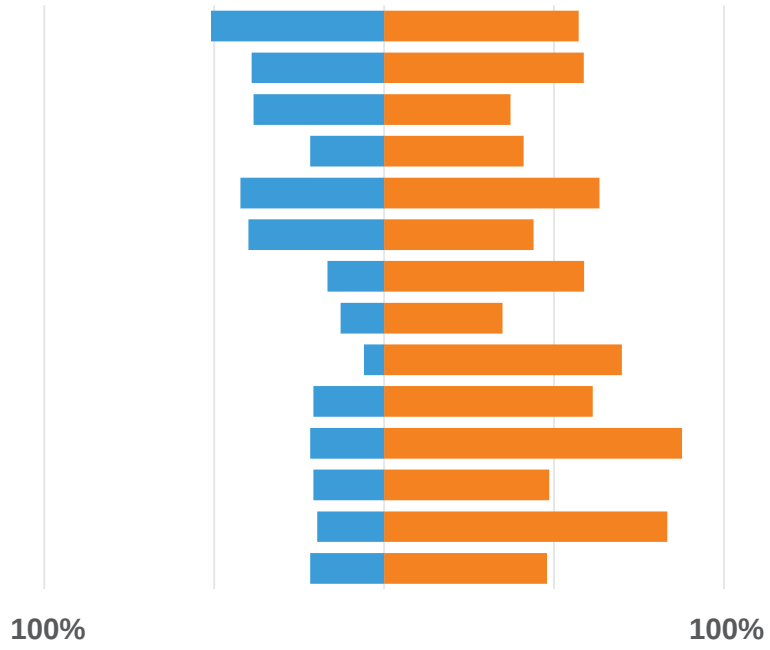


Only 15/42 items relevant to >50% of manuscripts

Relevance and prevalence of checklist items

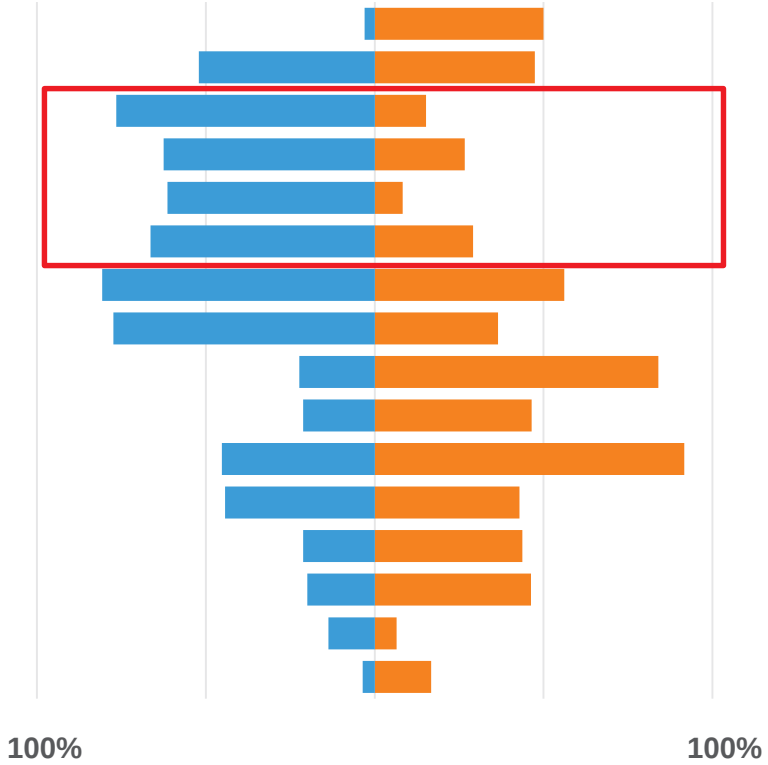
MATERIALS

< % RELEVANT | % REPORTED >



DESIGN

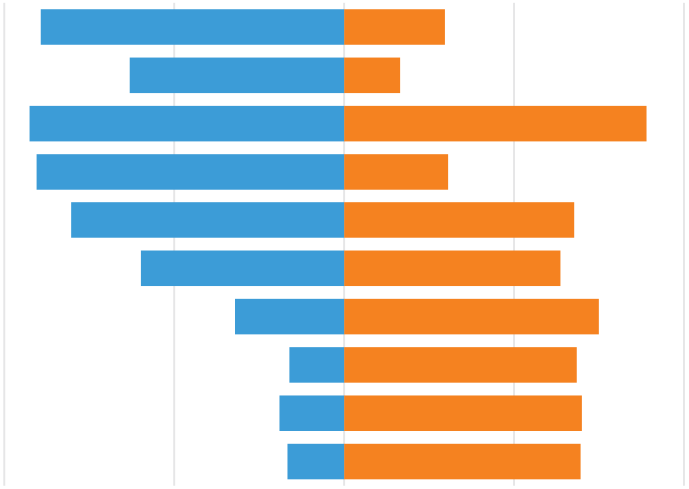
< % RELEVANT | % REPORTED >



Relevance and prevalence of checklist items

ANALYSIS

< % RELEVANT | % REPORTED >



100% 100%

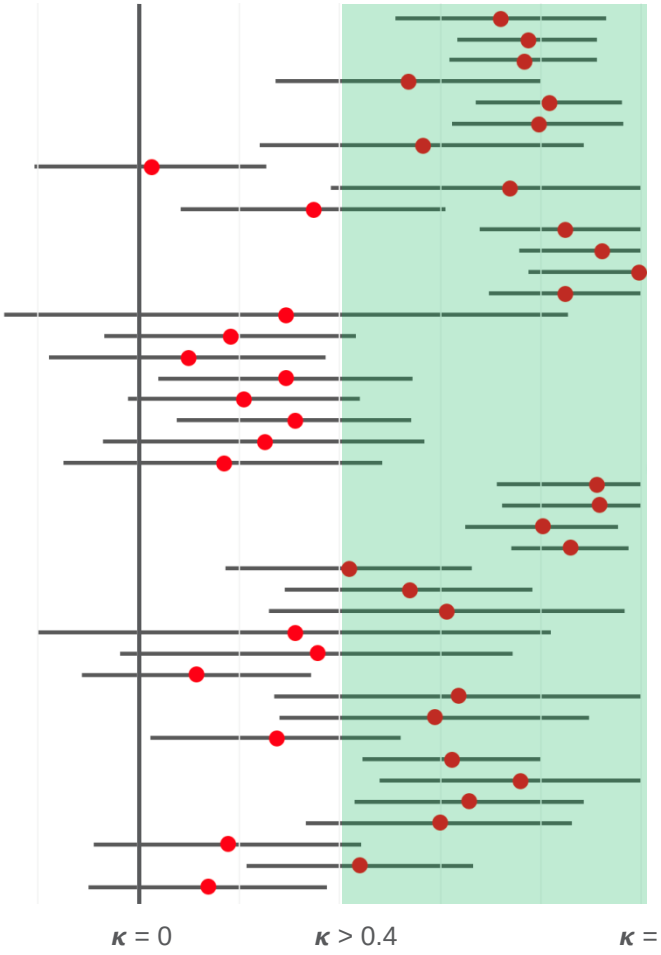
REPORTING

< % RELEVANT | % REPORTED >

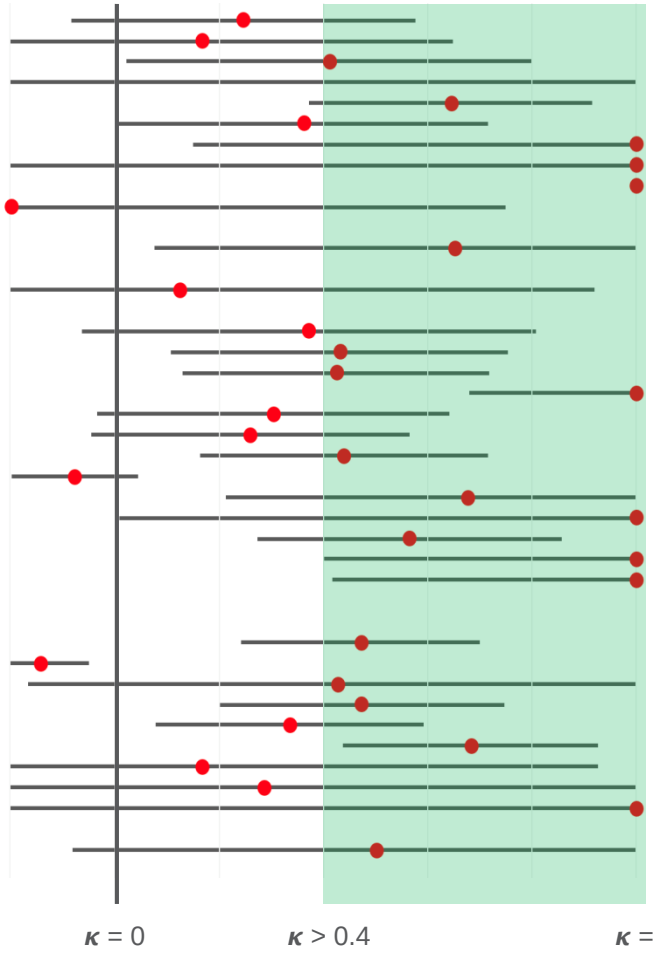
100% 100%

Agreement between observers – Kappa statistics

Is this item relevant?



If relevant, is it reported?



Agreement between assessors was limited, in some instances no better than chance

Summary, and Next steps

- **Authors and editors seem to like the checklist, and find it useful**
- **The time taken to check performance is short – mean 24 minutes**
- **Some checklist items are infrequently relevant**
  - Only 15 items relevant to > 50% of manuscripts
  - Suggests that a dynamic form – with fields being offered where relevant – may be useful
- **Agreement between assessors was limited, in some instances no better than chance**
  - The 95% Confidence Intervals for the Kappa scores are broad
  - This identifies items to be revised, or to be given greater attention in the Explanation and Elaboration document
- **Next steps**
  - Consultation with key stakeholders and interested individuals
  - Revision of checklist items, and Explanation and Elaboration document, and other materials, in the light of this feedback

Thank you!

MDAR journals' pilot participants

Minimum Standards Working Group

Karen Chambers (Wiley)

Andy Collings (eLIFE)

Chris Graf (Wiley)

Veronique Kiermer (PLOS)

Malcolm Macleod (Univ of Edinburgh)

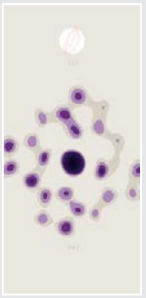
David Mellor (Centre for Open Science)

Sowmya Swaminathan (Nature Research)

Debbie Sweet (Cell Press)

Valda Vinson (Science)

The story behind the image



Dorothy Hodgkin (1910–1994)

Dorothy Hodgkin pioneered the application of x-ray crystallography techniques to determine the three-dimensional structure of biomolecules, helping to unravel how their atomic arrangements influence how they work in the body. She remains the only British woman scientist to have been awarded the Nobel Prize for Chemistry.