Registered Reports guidelines for reviewers and authors

Guidelines for reviewers

Registered Reports (RR) are a form of empirical article offered at Developmental Cognitive Neuroscience (DCN) in which the hypotheses, methods, and proposed analyses are pre-registered and reviewed prior to research being conducted. High quality protocols are then provisionally accepted for publication before either data collection (Primary RR), or analysis of already collected data (Secondary RR), commences. This format is designed to minimize publication bias and research bias in hypothesis-driven research, while also allows the flexibility to conduct additional exploratory (unregistered) analyses and report serendipitous findings. The term 'secondary' reflects that analyses are performed as a second step on already obtained data. Secondary RRs are expected to be particularly prevalent in DCN given the field's emphasis on large, longitudinal datasets (such as ABCD), and are encouraged as a method to increase transparency in research.

The review process for *Registered Reports* is divided into two stages. At Stage 1, reviewers assess study proposals before data are collected (Primary RR) or analyzed (Secondary RR). At Stage 2, reviewers consider the full study, including results and interpretation.

Stage 1 manuscripts will include only an Introduction, Methods (including proposed analyses), Pilot Data (where applicable), References, and Tables/Figures (if appropriate). In considering papers at Stage 1, reviewers will be asked to assess and provide recommendations for optimal design on:

1. The importance of the research question(s).
2. The logic, rationale, and plausibility of the proposed hypotheses.
3. The soundness and feasibility of the methodology and analysis pipeline (including statistical power analysis where appropriate).
4. Whether the clarity and degree of methodological detail is sufficient to exactly replicate the proposed study procedures and analysis pipeline.
5. Whether the authors have pre-specified sufficient outcome-neutral tests (e.g. baseline assessments, pretests for stimuli preferences, manipulation checks) for ensuring that the results obtained are able to test the stated hypotheses, including positive controls and quality checks.

Following Stage 1 peer review, manuscripts will be accepted, offered the opportunity to revise, or rejected. Manuscripts that pass peer review will be issued an ***in principle acceptance*** **(IPA)**, indicating that the article will be published pending successful completion of the study according to the pre-registered methods and analytic procedures, as well as a defensible and evidence-based interpretation of the results.

Following completion of the study, authors will complete the manuscript, including Results and Discussion sections. These Stage 2 manuscripts will more closely resemble a regular article format. The manuscript will then be returned to the reviewers, who will be asked to appraise:

1. Whether the data are able to test the authors' proposed hypotheses by satisfying the approved outcome-neutral conditions (such as quality checks, positive controls)
2. Whether the Introduction, rationale, and stated hypotheses are the same as the approved Stage 1 submission (required)
3. Whether the authors adhered precisely to the registered study procedures
4. Whether any unregistered *post hoc* analyses added by the authors are clearly identified as such, and also justified, methodologically sound, and informative
5. Whether the authors' conclusions are justified given the data

Reviewers at Stage 2 may suggest that authors report additional *post hoc* tests on their data; however, authors are not obliged to do so unless such tests are necessary to satisfy one or more of the Stage 2 review criteria. Please note that editorial decisions will not be based on the perceived importance, novelty, or conclusiveness of the results, including negative results.

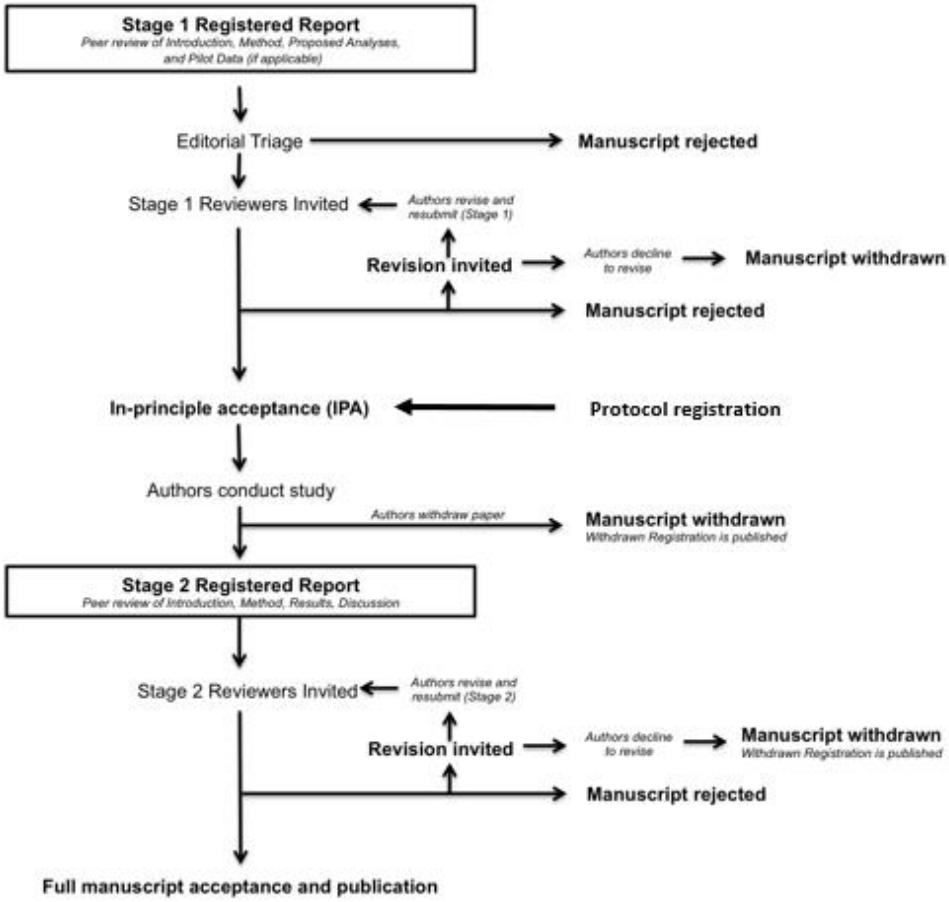
Guidelines for authors

Registered Reports are a form of empirical article in which the methods and proposed analyses are pre-registered and reviewed prior to research being conducted. This format is designed to minimize bias in deductive science, while also allowing complete flexibility to conduct exploratory (unregistered) analyses and report serendipitous findings.

The cornerstone of the Registered Reports format is that a significant part of the manuscript will be assessed prior to data collection (Primary RR) or data analysis (Secondary RR), with the highest quality submissions receiving *in principle acceptance*. Initial submissions will include a description of the key research question and background literature, hypotheses, study procedures, analysis pipeline, a data sampling plan (e.g. statistical power analysis or Bayesian equivalent, where relevant), pilot data (where applicable) and references for these sections.

Initial submissions will be triaged by a specialized editorial team for high scientific significance. Those that pass triage will then be sent for in-depth peer review (Stage 1). Following review, the article will then be either rejected or accepted in principle for publication. Following in principle acceptance (IPA), the authors will then proceed to conduct the study (data collection and/or analysis), adhering exactly to the peer-reviewed procedures. Additional analyses may be considered if deemed well-justified by previous reviewers, but are clearly identified as unregistered and *post hoc*. When the study is complete, the authors will submit their finalized manuscript for re-review (Stage 2). The paper will be sent back to the reviewers of the Stage 1 paper (if available) who will be asked to assess the paper according to the criteria in the ‘Guidelines for reviewers’ (below). Pending quality checks and a sensible interpretation of the findings, the manuscript will be revised and/or published regardless of the results.

The review process for *Registered Reports*



Stage 1: Initial manuscript submission and review

The editors will select only the most scientifically promising manuscripts for in-depth peer review. Stage 1 submissions should include the manuscript (details below) and a brief cover letter. Authors are welcome to submit pre-submission inquiries for advice on the likely suitability of a study as a Registered Report. However, please note that the editorial board will not agree to send manuscripts for in-depth review until a complete Stage 1 submission has been considered.

The cover letter should include:

- A brief scientific case for consideration. Authors are encouraged to refer to the likely replication value of the research. High-value replication studies are welcome in addition to novel studies.
- A statement confirming that all necessary support (e.g. funding, facilities) and approvals (e.g. ethics, where applicable) are in place for the proposed research. Note that manuscripts will be generally considered only for studies that are able to commence immediately; however, authors with alternative plans are encouraged to contact the journal office for advice.
- An anticipated timeline for completing the study if the initial submission is accepted.
- A statement confirming that the authors agree to share their raw data, any digital study materials/code, and laboratory log for all published results, to the maximum extent permissible under any legal or ethical restrictions. Exceptions are made for Big Data repositories that require special permission to access the data (e.g., ABCD, HCP-D).
- A statement confirming that, following Stage 1 *in principle acceptance*, the authors agree to register their approved protocol on the Open Science Framework (http://osf.io/rr/) or other recognised repository, either publicly or under private embargo until acceptance of the Stage 2 manuscript.
- A statement confirming that if the authors later withdraw their paper, they agree to the Journal publishing a short summary of the pre-registered study under a section *Withdrawn Registrations*.

Manuscript preparation guidelines – Stage 1

Initial Stage 1 submissions should include the following sections:

- Introduction
  - A review of the relevant literature that motivates the research question and a full description of the study aims and hypotheses. Please note that following IPA, the Introduction section cannot be altered apart from correction of factual errors, typographic errors and altering of tense from future to past (see below). If relevant new literature is released after IPA but before Stage 2, authors can include that literature in the discussion.
- Methods
  - Full description of proposed sample characteristics, including criteria for data inclusion and exclusion (e.g. outlier extraction). Procedures for objectively defining exclusion criteria due to technical errors or for any other reasons must be specified, including details of how and under what conditions data would be replaced.
  - A description of study procedures in sufficient detail to allow another researcher to repeat the methodology exactly, without requiring further information. These procedures must be adhered to exactly in the subsequent experiments or any Stage 2 manuscript can be rejected.
  - Proposed analysis pipeline, including all preprocessing steps, and a precise description of all planned analyses, including appropriate correction for multiple comparisons. Any covariates or regressors must be stated. Where analysis decisions

are contingent on the outcome of prior analyses, these contingencies must be specified. Only pre-planned analyses can be reported in the main Results section of Stage 2 submissions. However, unplanned exploratory analyses will be admissible in a separate section of the Results (see below).
    - When a data collection or analysis procedure must be changed due to consensus advancements in the field, this may be considered at Stage 2, but the justification must be included.
    - Authors are welcome to propose blinded analysis techniques that control bias without requiring detailed pre-specification of analyses (e.g. as discussed here and deployed here). Specification curve analysis (e.g. as conducted here) would also be a welcome proposal.
    - Studies involving Neyman-Pearson inference should include a statistical power analysis. Estimated effect sizes should be justified with reference to the existing literature or theory. Power analysis must be based on the *lowest* available or meaningful estimate of the effect size. Where relevant, the *a priori* power must be 0.8 or higher for all proposed hypothesis tests. In the case of highly uncertain effect sizes, a variable sample size and interim data analysis is permissible but with inspection points stated in advance, appropriate Type I error correction for 'peeking' employed, and a final stopping rule for data collection outlined.
    - For studies using Big Data, in which small effect sizes may have highly significant p-values, target effect sizes should be established and informed by the literature.
    - Methods involving Bayesian hypothesis testing are encouraged. For studies involving analyses with Bayes factors, the predictions of the theory must be specified so that a Bayes factor can be calculated. Authors should indicate what distribution will be used to represent the predictions of the theory and how its parameters will be specified. For example, will you use a uniform up to some specified maximum, or a normal/half-normal to represent a likely effect size, or a JZS/Cauchy with a specified scaling constant? For inference by Bayes factors, authors must be able to guarantee data collection until the Bayes factor is at least 6 times in favour of the experimental hypothesis over the null hypothesis (or *vice versa*). Authors with resource limitations are permitted to specify a maximum feasible sample size at which data collection must cease regardless of the Bayes factor; however to be eligible for advance acceptance this number must be sufficiently large that inconclusive results at this sample size would nevertheless be an important message for the field. For further advice on Bayes factors or Bayesian sampling methods, prospective authors are encouraged to read this key article by Schönbrodt and Wagenmakers.
    - Full descriptions must be provided of any outcome-neutral criteria that must be met for successful testing of the stated hypotheses. Such quality checks might include the absence of floor or ceiling effects in data distributions, positive controls, or other quality checks that are orthogonal to the study hypotheses.
    - Timeline for completion of the study and proposed resubmission date if Stage 1 review is successful. Extensions to this deadline can be negotiated with the Registered Reports editor.
    - Any description of prospective methods or analysis plans should be written in future tense.
- Pilot Data
    - Optional. Can be included to establish proof of concept, effect size estimations, or feasibility of proposed methods. Any pilot experiments will be published with the final version of the manuscript and will be clearly distinguished from data obtained for the pre-registered experiment(s).
- Primary vs Secondary Registered Reports: Analyses on New vs Existing Datasets

- Developmental Cognitive Neuroscience fully welcomes submissions proposing analyses of existing data sets (Secondary RR), where data has already been collected (e.g., data from the Adolescent Brain and Cognitive Development Study [ABCD]). The strongest submissions will supply sufficient evidence (e.g. self-certification; letter from an independent gatekeeper) to confirm that the authors have had not accessed or observed the data in question. In cases where authors are already in possession of the data, or have observed any part of it (as is expected to be the case with large multisite longitudinal studies like ABCD), authors are encouraged to ensure the submission includes a full description of how much data observation has taken place and the steps taken by the authors to control bias and overfitting. Authors may also seek advice on the eligibility of specific scenarios via a presubmission enquiry.

Stage 1 submissions that are judged by the editorial board to be of sufficient quality and scientific importance will be sent for in-depth peer review. In considering papers at the registration stage, reviewers will be asked to assess:

1. The importance of the research question(s).
2. The logic, rationale, and plausibility of the proposed hypotheses.
3. The soundness and feasibility of the methodology and analysis pipeline (including statistical power analysis where appropriate).
4. Whether the clarity and degree of methodological detail is sufficient to exactly replicate the proposed study procedures and analysis pipeline.
5. Whether the authors have pre-specified sufficient outcome-neutral tests for ensuring that the results obtained are able to test the stated hypotheses, including positive controls and quality checks.

Following Stage 1 peer review, manuscripts will be rejected outright, offered the opportunity to revise, or accepted. Proposals that exceed the highest standards of importance and scientific rigour will be issued an ***in principle acceptance*** **(IPA)**, indicating that the article will be published pending completion of the approved methods and analytic procedures, passing of all pre-specified quality checks, and a defensible interpretation of the results. Stage 1 protocols are not published in the journal following IPA. Instead they are held in reserve by the journal and integrated into a single completed article following approval of the final Stage 2 manuscript.

Authors are required to register their protocol on a recognised repository at the point of Stage 1 acceptance, either publicly or under temporary private embargo. The protocol must be registered unchanged from its accepted state and prior to the commencement of the proposed research. The journal recommends the use of the dedicated (free) registration mechanism for Stage 1 Registered Reports hosted by the Center for Open Science https://osf.io/rr/. However, authors are free to choose any recognized registry, such as Figshare, Harvard Dataverse, Dryad or Mendeley Data. Where authors choose to apply an embargo, it must be released no later than at the point of Stage 2 acceptance. Where authors elect to keep their protocol under embargo until Stage 2 acceptance (and thus private during the Stage 2 review process), the Stage 2 manuscript must include a direct view-only URL link to the registered protocol in order to ensure that the protocol is accessible to the Stage 2 reviewers. For protocols registered on the OSF, guidance is available here on how to make a privately registered protocol accessible to reviewers without making it public.

Authors are reminded that any deviation from the stated study procedures, regardless of how minor it may seem to the authors, could lead to rejection of the manuscript at Stage 2. In cases where the pre-registered protocol is altered after IPA due to unforeseen circumstances (e.g. change of equipment or unanticipated technical error, consensus advancements in the field), the authors must consult the editorial board immediately for advice, and prior to the submission of the manuscript

at Stage 2. Minor changes to the protocol may be permitted according to editorial discretion. In such cases, IPA would be preserved and the deviation reported in the Stage 2 submission. If the authors wish to alter the study procedures more substantially following IPA but still wish to publish their article as a Registered Report then the manuscript must be withdrawn and resubmitted as a new Stage 1 submission. Note that registered analyses must be undertaken, but additional unregistered analyses can also be included in a final manuscript (see below).

Stage 2: Full manuscript review

Once the study is complete, authors prepare and resubmit their manuscript for full review, with the following additions:

- Cover letter. The Stage 2 cover letter must confirm:
  - That the manuscript includes a link to the archive containing anonymized study data, digital materials/code and the laboratory log. This link must be accessible to the reviewers but need not be fully public until the point of Stage 2 acceptance.
  - That the manuscript contains a link to the approved and registered Stage 1 protocol on the Open Science Framework or other recognised repository.
  - That, for primary Registered Reports, no data for any pre-registered study (other than pilot data included at Stage 1) was collected prior to the date of IPA. For secondary Registered Reports, authors should confirm that no data (other than pilot data included at Stage 1) was subjected to the pre-registered analyses prior to IPA.

- The Stage 2 manuscript must contain a link to the registered protocol (deposited immediately following Stage 1 IPA) on the Open Science Framework or another recognized repository. If the protocol was deposited under an embargo, the embargo must be lifted at the point of Stage 2 acceptance to permit full public access. The Stage 2 submission must include a view-only link to the registered embargoed protocol so that it can be inspected by the editor and reviewers. The Editor will ensure that the protocol is made fully public before an accepted Stage 2 manuscript is allowed to enter Stage 2 review.

- Submission of raw data and laboratory log
  - Barring any legal or ethical restrictions, raw data and any digital study materials (e.g. stimuli etc.) must be made freely available in a recognised repository, either publicly or under a private embargo until Stage 2 acceptance. Any embargoed data and materials must be fully accessible to the reviewers. Data files should be appropriately time stamped to show that data was collected *after* IPA and not before. Exceptions to the availability of data or materials may be permitted on legal or ethical grounds at Stage 1 submission. Other than pre-registered and approved pilot data, no data acquired *prior* to the date of IPA is admissible in the Stage 2 submission. Raw data must be accompanied by guidance notes, where required, to assist other scientists in replicating the analysis pipeline. Authors are also expected to upload any relevant analysis scripts and other study materials that would assist in replication (e.g. stimuli & presentation code).
  - Any supplementary figures, tables, or other text (such as supplementary methods) can either be included as standard supplementary information that accompanies the paper, or they can be archived together with the data. Please note that the raw data itself should be archived (see above) rather than submitted to the journal as supplementary material.
  - The authors must collectively certify in the resubmission Cover Letter that all nonpilot data was collected (primary) or analysed (secondary) after the date of IPA. A basic laboratory log must also be provided outlining the range of dates during which data

collection took place. This log should be uploaded to the same public archive as the data, with a link provided to the log in the resubmission Cover Letter.

- Background, Rationale and Methods
  - Apart from minor stylistic revisions, **the Introduction cannot be altered from the approved Stage 1 submission, and the stated hypotheses cannot be amended or appended**. At Stage 2, any description of the rationale or proposed methodology that was written in future tense within the Stage 1 manuscript should be changed to past tense. Any textual changes to the Introduction or Methods (e.g. correction of typographic errors) must be clearly marked in the Stage 2 submission. Any relevant literature that appeared following the date of IPA should be covered in the Discussion.

- Results & Discussion
  - The outcome of all registered analyses must be reported in the manuscript, except in rare instances where a registered and approved analysis is subsequently shown to be logically flawed or unfounded. In such cases, the authors, reviewers, and editor must agree that a collective error of judgment was made and that the analysis is inappropriate. In such cases the analysis would still be mentioned in the Methods but omitted with justification from the Results.
  - It is reasonable that authors may wish to include additional analyses that were not included in the registered submission. For instance, a new analytic approach might become available between IPA and Stage 2 review, or a particularly interesting and unexpected finding may emerge. Such analyses are admissible but must be clearly justified in the text, appropriately caveated, and reported in a separate section of the Results titled "*Exploratory analyses*". Authors should be careful not to base their conclusions entirely on the outcome of statistically significant *post hoc* analyses.
  - Authors reporting null hypothesis significance tests are required to report exact *p* values and effect sizes for all inferential analyses.

The resubmission will most likely be considered by the same reviewers as in Stage 1, but could also be assessed by new reviewers. In considering papers at Stage 2, reviewers will be asked to decide:

1. Whether the data are able to test the authors' proposed hypotheses by satisfying the approved outcome-neutral conditions (such as quality checks, positive controls)
2. Whether the Introduction, rationale and stated hypotheses are the same as the approved Stage 1 submission (required)
3. Whether the authors adhered precisely to the registered study procedures
4. Whether any unregistered *post hoc* analyses added by the authors are justified, methodologically sound, and informative
5. Whether the authors' conclusions are justified given the data

Reviewers are informed that editorial decisions will not be based on the perceived importance, novelty or conclusiveness of the results. Thus while reviewers are free to enter such comments on the record, they will not influence editorial decisions. Reviewers at Stage 2 may suggest that authors report additional *post hoc* tests on their data; however, authors are not obliged to do so unless such tests are necessary to satisfy one or more of the Stage 2 review criteria.

Once accepted, the author must ensure that the protocol is publicly available. The Editor will ensure that the protocol is publicly available before the manuscript is allowed to enter production. For protocols registered on the OSF, guidance is available here on how to make a privately registered protocol publicly available.

Manuscript withdrawal and *Withdrawn Registrations*

It is possible that authors with IPA may wish to withdraw their manuscript following or during data collection. Possible reasons could include major technical error, an inability to complete the study due to other unforeseen circumstances, or the desire to submit the results to a different journal. In all such cases, manuscripts can be withdrawn at the authors' discretion. However, the journal will publicly record each case in a section called *Withdrawn Registrations*. This section will include the authors, proposed title, the abstract from the approved Stage 1 submission, a link to the publicly registered protocol, and brief reason(s) for the failure to complete the study. Partial withdrawals are not possible; i.e. authors cannot publish part of a registered study by selectively withdrawing one of the planned experiments. Such cases must lead to withdrawal of the entire paper. Studies that are not completed by the agreed Stage 2 submission deadline (which can be extended in negotiation with the editorial office) will be considered withdrawn and will be subject to a Withdrawn Registration.

Incremental Registrations

Authors may add experiments to approved submissions. In such cases the approved Stage 2 manuscript will be accepted for publication, and authors can propose additional experiments for Stage 1 consideration. Where these experiments extend the approved submission (as opposed to being part of new submissions), the editorial team will seek to fast-track the review process. This option may be particularly appropriate where an initial experiment reveals a major serendipitous finding that warrants follow-up within the same paper. In cases where an incremented submission is rejected (at either Stage 1 or 2), authors will retain the option of publishing the most recently approved version of the manuscript. For further advice on specific scenarios for incremental registration, authors are invited to contact Jennifer Pfeifer, the Associate Editor handling RRs at DCN, at jpfeifer@uoregon.edu or Bea Luna, the Editor-in-Chief of DCN, at lunab@upmc.edu.

Tips for Avoiding Desk Rejection at Stage 1

Many Registered Report submissions are desk rejected at Stage 1 prior to in-depth review for failing to sufficiently meet the Stage 1 editorial criteria. For submissions that are otherwise highly promising, the journal will sometimes desk reject with the option to resubmit. However, due to the increasing volume of submissions across all journals, desk-based reject-and-resubmit decisions are being deployed more selectively and many manuscripts with these problems will be desk rejected outright. To help minimize the chances of authors' submissions being desk rejected, we list below the top ten reasons why Stage 1 submissions are rejected prior to review. Authors are advised to consult this list carefully to increase their chances of proceeding immediately to Stage 1 in-depth

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1. The cover letter doesn't make necessary statements concerning ethics, data archiving, protocol registration and so forth (see above).

2. The protocol contains insufficient methodological detail to enable replication and prevent researcher degrees of freedom. One commonly neglected area is the criteria for excluding data, both at the level of participants and at the level of data within participants. In the interests of clarity, we recommend listing these criteria systematically rather than presenting them in prose.

3. Lack of correspondence between the scientific hypotheses and the pre-registered statistical tests. This is a very common problem. To maximize the clarity of correspondence between predictions and analyses, authors are advised to number their hypotheses in the Introduction and then number the proposed analyses in the Methods to make clear *which analysis tests which prediction*. Ensure also that power analysis, where applicable, is based on the actual test procedures that will be employed to test those hypotheses; e.g. don't propose a power

analysis based on an ANOVA but then suggest a linear mixed effects model to test the hypothesis. Where multiple hypotheses are being tested, each must be associated with a power analysis, Bayesian sampling plan or appropriate alternative, and all must achieve the minimum requirements (see 4).

4. Power analysis, where applicable, fails to reach the minimum level stated in journal policy (see above).

5. Power analysis is over-optimistic (e.g. based on previous literature but not taking into account publication bias) or insufficiently justified (e.g. based on a single point estimate from a pilot experiment or previous study). Proposals should be powered to detect the smallest effect that is plausible and of theoretical value. Pilot data can help inform this estimate but are unlikely to form an acceptable basis, alone, for choosing the target effect size due to risk of bias.

6. Intention to infer support for the null hypothesis from statistically non-significant results, without proposing use of Bayes factors or frequentist equivalence testing.

7. Inclusion of exploratory analyses in the analysis plan. Inclusion of exploratory "plans" at Stage 1 blurs the line between confirmatory and exploratory outcomes at Stage 2. Instead, such analyses can be included at Stage 2 and need not be pre-registered. Under some circumstances, exploratory analyses could be discussed at Stage 1 where they are necessary to justify study variables or procedures that are included in the design exclusively for exploratory analysis.

8. Failure to clearly distinguish work that has already been done from work that is planned. Where a Stage 1 proposal contains a mixture of preliminary/pilot work that has already been undertaken and a proposal for work not yet undertaken, authors should use the past tense for pilot work but the future tense for the proposed work. At Stage 2, all descriptions shift to past tense.

9. Lack of pre-specified positive controls or other quality checks, or an appropriate justification for their absence (See Stage 1 criterion 5). We recognise that positive controls are not possible with all study designs, in which case authors should discuss why they are not included.

10. Where applicable, lack of power analysis within proposed positive controls or manipulation checks that depend on hypothesis testing.