1. PROJECT DETAILS

1.1 Project title: Prevalence of transparent research practices in psychology: A cross-sectional study of empirical articles published in 2022

1.2 Contributors: Tom E. Hardwicke (ⓘD 0000-0001-9485-4952), Robert T. Thibault (ⓘD 0000-0002-6561-3962), Beth Clarke (ⓘD 0000-0002-7355-6718), Nicholas Moodie, Sophia Crüwell (ⓘD 0000-0003-4178-5820), Sarah R. Schiavone (ⓘD 0000-0002-8829-137X), Sarah A. Handcock, Fallon Mody (ⓘD 0000-0002-0596-7590), Simine Vazire (ⓘD 0000-0002-3933-9752)

1.3 Contact: Tom E. Hardwicke (tom.hardwicke@unimelb.edu.au)

1.4 Competing interests statement: All authors declare no conflicts of interest.

1.6 Ethics statement: Not applicable.

1.7 Transparency statement: All raw data, materials, and analysis scripts will be made publicly available on the Open Science Framework (https://osf.io/yck93/) under a CC0 1.0 Universal (CC0 1.0) Public Domain License. To facilitate reproducibility, this manuscript will be written by interleaving regular prose and analysis code and made available in a Code Ocean container which re-creates the software environment in which the original analyses were performed. We will adhere to the STROBE (Elm et al., 2007) and PRISMA-S (Rethlefsen et al., 2021) reporting guidelines.

2. OBJECTIVES

2.1 Rationale

Transparency is a core feature of an efficient, reproducible, and self-correcting, scientific ecosystem (Ioannidis, 2012; Munafò et al., 2017; Vazire & Holcombe, 2021). However, in practice transparent research practices are widely neglected across scientific disciplines (Hamilton et al., 2023; Hardwicke et al., 2020, 2022; Minocher et al., 2021; Serghiou et al., 2021; Towse et al., 2020). The purpose of the present study is to obtain contemporary prevalence estimates for the adoption of transparent research practices in the field of psychology.

Despite being in the vanguard of efforts to improve the quality and credibility of scientific research (Nelson et al., 2018), psychology has been slow to embrace transparency. In a previous study, we estimated the field-wide prevalence of transparent research practices by examining a random sample of psychology articles published between 2014 and 2017 (Hardwicke et al., 2022). We observed minimal adoption of preregistration (3%, 95% CI = [1%, 5%]); sharing of data (2% [1%, 4%]), analysis scripts (1% [0%, 1%]), or materials (14% [10%, 19%]); and moderately frequent disclosure of funding (62% [56%, 69%]) and conflict-of-interests (39% [32%, 45%]).

There are reasons to think that transparency has improved since 2017, but it is unclear how much. Repositories like the Open Science Framework report a growing number of users sharing and preregistering aspects of their research (Nosek et al., 2022). Some funders, journals, and other stakeholders have also enacted policies that encourage or require transparency when possible (Nosek et al., 2015). A few psychology journals, for example, have adopted mandatory open data policies, which appear to have been effective (Hardwicke et al., 2018; Nuijten et al., 2017). Nevertheless, these journals are in the minority; a recent assessment of 50 top-ranked and 40 randomly selected psychology journals

determined that the majority had no explicit policies related to a variety of transparency research practices (Nosek et al., 2022). Moreover, even when researchers report adopting transparent practices, implementation is often inadequate (e.g., preregistration deviations go unacknowledged, TARG Meta-Research Group et al. 2021; results cannot be reproduced despite access to raw data, Hardwicke et al. 2018). It therefore remains unclear to what extent transparency has improved since we last estimated field-wide prevalence in psychology in 2014 to 2017 (Hardwicke et al., 2022).

The goal of the present study is to obtain contemporary field-wide prevalence estimates for transparent research practices in psychological science by examining a random sample of articles. We will also examine prevalence in a random sample of articles published in prominent journals (top-ranked by Impact Factor), as these journals tend to have more stringent transparency policies than average (Nosek et al., 2022). When transparent practices are adopted, we will also perform basic quality checks (for example, checking if purportedly available data is actually available; Hamilton et al., 2023). The study, combined with the baseline estimates established by Hardwicke et al. (2022), will provide an overall empirical measure of progress for the various top-down and bottom-up initiatives intended to improve transparency (Morey et al., 2016; Nosek et al., 2015). These data will help to motivate, calibrate, and strategize further efforts to improve the transparency of psychology research.

2.2 Objectives

The goal of the study is description and estimation; we are not testing any hypotheses. Our objectives are to:

(1) Estimate the field-wide prevalence of transparent research practices in empirical articles published in psychology journals in 2022.

(2) Estimate the prevalence of transparent research practices in empirical articles published in prominent psychology journals in 2022.

(3) Describe whether reportedly available preregistrations, data, materials, and analysis scripts are actually available and where they are stored.

3. METHODS

The methods described here are adapted from Hardwicke et al. (2022).

3.1 Design

The study has a cross-sectional design. Variables measured by extraction and classification of information from articles are shown in Table 1. For statements that provide reasons for a lack of transparency, we will summarize those reasons using a data-dependent categorization scheme.

Table 1. Variables measured via manual extraction/classification.

Measured variable	Question/response options
Open access	
Definitions: "Open access" means that a version of the article can be accessed without going through a paywall (paywalled articles require payment on demand or via subscription). **Coder instructions**: Begin by trying to access the journal's version of record using the DOI and your institutional affiliation. Additionally, try to identify if there is an open access version of the article available, enter the DOI or title into the Open Access Button (https://openaccessbutton.org/). If nothing comes up, search for the title on Google Scholar and check the first ten results. If you find a match, click "All n versions", and check the first ten results to see if any are open access.	
Open access	Can you view an open access version of this article?

	- YES
	- NO
	  — I can only access the article through a paywall
	  — I cannot access any version of the article
	- OTHER
	  — [enter free text response]

Article version

All of the remaining questions in this form should be answered based on the version-of-record where possible. The version-of-record is the article available on the journal's website. If the version of record is unavailable, you can use an alternative open access version.

Please store the version of the article you are coding in this folder (preferably a PDF). For the filename, enter the article ID followed by an underscore and your initials. For example: "502_TEH.pdf"

Article version	Which version of the article are you coding? - Journal's version of record - Alternative open access version

Research design

Definitions: Articles without empirical data include editorials, opinion pieces, simulations, news, and reviews. Articles with empirical data include experimental and non-experimental studies that collected novel data, and secondary data analyses or synthesis, including meta-analysis.

Empirical data	Does the article report on empirical data? - YES - NO

Research design	What is the research design? (tick all that apply)
	☐ Experimental
	☐ Non-experimental
	☐ Meta-analysis

Preregistration

Definitions: "Preregistration" refers to the public specification of important aspects of the study (typically hypotheses, methods, and/or analysis plan) prior to commencement of the study.

Coder instructions: Aim to find a preregistration statement. Firstly, search the document for the keyword "regist" (to cover registration, preregistration, registered, etc). If insufficient information is found during the keyword search, manually examine specific sections where preregistration might be mentioned, e.g., front matter, abstract, methods, results, disclosure statements after the discussion section.

Preregistration statement	Does the article state whether or not the study (or some aspect of the study) was preregistered?
	• YES — the statement says that there is a preregistration — the statement says that there is no preregistration • NO — there is no statement about preregistration • OTHER — [enter free text response]
Preregistration statement verbatim	Copy and paste the verbatim statement. [enter free text response] How did you identify the statement? • Keyword search was sufficient

	• Manual search was needed • Other
Preregistration access method	How is the preregistration accessed (according to the statement)? • Open Science Framework • AsPredicted • ClinicalTrials.gov • Registered Report • OTHER — [enter free text response]
Preregistration accessibility	Can you access and view the preregistration (without contacting anyone)? • YES • NO • OTHER — [enter free text response]

Data sharing

Definitions: "data" refers to recorded information that supports the analyses reported in the article. For our purposes, we use "data" synonymously with "raw" or "primary" data, meaning recorded information at the level of sampling units (e.g., participants, homes, companies, etc). Summary level data does not count for our purposes. A "data availability statement" can be as simple as a URL link to a data file, or as complex as a written explanation as to why data cannot be shared.

Coder instructions: Aim to find a data availability statement or link to data. Firstly, search the document for the keyword "data" and then for the keyword "avail". If insufficient information is found during the keyword search, manually examine specific sections where data availability might be mentioned, e.g., front matter, author notes, abstract, methods, results,

disclosure statements after the discussion section, and supplementary material.	
Data availability statement	Does the article state whether or not data are available? ● YES — the statement says that the data are available — the statement says that the data are not available ● NO — there is no data availability statement ● UNCLEAR — a third party source is identified without any indication of availability ● OTHER — [enter free text response]
Data availability statement verbatim	Copy and paste the verbatim statement. [enter free text response] How did you identify the statement? ● Keyword search was sufficient ● Manual search was needed ● Other
Data access method	How are the data accessed? (according to the statement) ● Upon request from the authors ● Personal or institution website ● An online, third-party repository (e.g., OSF, FigShare etc.) ● Supplementary materials hosted by the journal ● Within the article (or appendices) ● From a third party ● OTHER — [enter free text response]

Data accessibility	Can you access, download, and view the data (without contacting anyone)?
	- YES - NO - OTHER — [enter free text response]

Materials sharing

Definitions: "materials" refers to any study items that would be needed to repeat the study, such as stimuli, survey instruments, and computer code/software used for data collection, presentation stimuli or running experiments (not including analysis scripts, see next section). For present purposes we do not consider supplementary data/findings (e.g., additional figures or tables) to be 'materials'.

Coder instructions: Aim to find a materials availability statement or link to materials. Firstly, search the document for the keyword "material" and then for the keyword "instrument". If insufficient information is found during the keyword search, manually examine specific sections where materials might be mentioned, e.g., front matter, author notes, abstract, methods, results, disclosure statements after the discussion section, and supplementary material. If a third-party source for the materials is identified without any indication about whether they are available, use the "other" option to document this.

Materials availability statement	Does the article state whether or not materials are available?
	- YES — the statement says that the materials are available — the statement says that the materials are not available - NO — there is no materials availability statement

	- UNCLEAR — a third party source is identified without any indication of availability - OTHER — [enter free text response]
Materials availability statement verbatim	Copy and paste the verbatim statement. [enter free text response] How did you identify the statement? - Keyword search was sufficient - Manual search was needed - Other
Materials access method	How are the materials accessed? (according to the statement) - Upon request from the authors - Personal or institution website - An online, third-party repository (e.g., OSF, FigShare etc.) - Supplementary materials hosted by the journal - Within the article (or appendices) - From a third party - OTHER — [enter free text response]
Materials accessibility	Can you access, download, and view the materials (without contacting anyone)? - YES - NO - OTHER — [enter free text response]

Analysis script sharing

Definition: "Analysis script" refers to specification of data preparation and analysis steps in the form of analysis code (e.g., R), syntax (e.g., from SPSS), or detailed step-by-step instructions for using point-and-click software.

Coder instructions: Aim to find an analysis script availability statement or link to analysis scripts. Firstly, search the document for the keyword "analysis script" and then for the keyword "analysis code". If insufficient information is found during the keyword search, manually examine specific sections where analysis scripts might be mentioned, e.g., front matter, author notes, abstract, methods, results, disclosure statements after the discussion section, and supplementary material. If a third-party source for the analysis scripts is identified without any indication about whether they are available, use the "other" option to document this.

Analysis script availability statement	Does the article state whether or not analysis scripts are available? • YES — the statement says that the analysis scripts are available — the statement says that the analysis scripts are not available • NO — there is no analysis script availability statement • UNCLEAR — a third party source is identified without any indication of availability • OTHER — [enter free text response]
Analysis script availability statement verbatim	Copy and paste the verbatim statement. [enter free text response] How did you identify the statement? • Keyword search was sufficient

	● Manual search was needed ● Other
Analysis script access method	How is the analysis script accessed? (according to the statement) ● Upon request from the authors ● Personal or institution website ● An online, third-party repository (e.g., OSF, FigShare etc.) ● Supplementary materials hosted by the journal ● Within the article (or appendices) ● From a third party ● OTHER — [enter free text response]
Analysis script accessibility	Can you access, download, and view the analysis script (without contacting anyone)? ● YES ● NO ● OTHER — [enter free text response]

Funding disclosure

Definition: "Funding" refers to any financial support related to the study or the researcher running the study.

Coder instructions: Aim to find a funding disclosure statement. Firstly, search the document for the keyword "fund" (to cover funder, funding, etc). If insufficient information is found during the keyword search, manually examine specific sections where funding statements might be mentioned, e.g., front matter, author notes, abstract, methods, results, disclosure statements after the discussion section, and supplementary material.

Funding statement	Does the article include a statement indicating whether there were funding sources?

	- YES — the statement discloses at least one source of funding — the statement says that there was no relevant funding - NO — there is no funding statement - OTHER — [enter free text response]
Funding statement verbatim	Copy and paste the verbatim statement. [enter free text response] How did you identify the statement? - Keyword search was sufficient - Manual search was needed - Other

Conflict of interest disclosure

Definition: "Conflicts of interest" or "competing interest" refers to self-serving factors (usually financial) that could potentially influence a researcher's conduct or decision-making.

Coder instructions: Aim to find a conflict of interest or competing interest disclosure statement. Firstly, search the document for the keyword "conflict" and then search for the keyword "competing". If insufficient information is found during the keyword search, manually examine specific sections where conflict of interest statements might be mentioned, e.g., front matter, author notes, abstract, methods, results, disclosure statements after the discussion section, and supplementary material.

Conflict of interest statement	Does the article include a statement indicating whether there were any conflicts of interest? YES

	— the statement discloses at least one conflict of interest
	— the statement says that there were no conflicts of interest
	● NO
	   — there is no conflict of interest statement
	● OTHER
	   — [enter free text response]

Conflict of interest statement verbatim	Copy and paste the verbatim statement. [enter free text response] How did you identify the statement? ● Keyword search was sufficient ● Manual search was needed ● Other

3.2 Sample

3.2.1 Target populations

The target populations are (1) **FIELD-WIDE:** all English-language empirical articles published in psychology journals in 2022 (and included in the Web of Science Core Collection database); (b) **PROMINENT:** all English-language empirical articles published in the top 50 top psychology journals ranked by Journal Impact Factor publishing empirical research in 2022 (and included in the Web of Science Core Collection database).

3.2.2 Sampling units

The sampling units are individual articles.

3.2.3 Target sample size and justification

We will aim for a sample of 200 eligible articles for each target population (i.e., 400 eligible articles in total). This target sample size was informed by precision analyses evaluating the margin-of-error for 95% Wilson confidence intervals based on an assumption that 50% of articles adopt a particular research practice. Note that 50% is not a prediction, it is the most conservative value to use in the precision analysis because it yields the largest sample size; in our previous study (Hardwicke et al., 2022), the observed proportion of relevant transparency indicators ranged from 1%-62%. The precision analyses yield a precision curve which illustrates diminishing returns as sample size increases (see Supplementary Information A). Assuming a proportion of 50%, a sample size of 200 articles yields a margin-of-error of 6.9%, which we consider to be reasonable precision.

3.2.4 Data sources

We used the Clarivate Web of Science platform to identify the articles. Web of Science only includes bibliographic items published in journals that have met 24 basic quality criteria, such as having a peer-review policy and publishing scholarly content (for details see https://perma.cc/C5J3-V7C4). Additionally, articles can be linked to specific research fields using Web of Science's subject area classification schema. These subject area classifications appear to be more accurate than alternative databases, such as Scopus (Wang & Waltman, 2016).

We used the Web of Science Application Programming Interface (API) to simultaneously search the Web of Science Core Collection databases; specifically, the Social Sciences Citation Index (SSCI), the Science Citation Index Expanded (SCIE), the Arts and Humanities Citation Index (AHCI), and the Emerging Sources Citation Index (ESCI). As we were only interested in published articles, we did not perform grey literature or registry searches.

We searched for bibliographic records pertaining to English language articles published in 2022 in the field of psychology. The search was performed on 2nd October, 2023. We accessed Web of Science via an institutional affiliation to the University of Melbourne. The specific search string was "WC=psychology and PY=2022 and DT=article and LA=english". We used the API to download all of the 75,683 bibliographic records returned by the search. Using R, we identified 26 records that had duplicate Digital Object Identifiers (DOIs) and removed the second row in each case (i.e., 13 records were removed). We then identified an additional 38 records that had duplicate abstracts and removed the second row in each case (i.e., 19 records were removed). Thus, after deduplication 75,657 records remained.

For the target population PROMINENT, we used Clarivate Journal Citation Reports to obtain a list of psychology journals ranked by 2022 Journal Impact Factors and determined whether these journals published empirical research until we had identified the 50-top ranked eligible journals. These determinations were based on reading information on journal websites, particularly aims/scope sections and "article types" sections in author instructions. Some degree of subjective judgment is involved in determining whether a journal publishes empirical research; if information provided by the journal was ambiguous, we examined

approximately ten most recently published articles to aid our judgment. Most of the judgments were made as part of another study (Hardwicke et al. in preparation; https://osf.io/nqj7b). As that study ranked journals by 2021 Journal Impact Factor, it was necessary to make additional judgments for any new journals in the list ranked by 2022 Journal Impact Factor.

3.2.5 Eligibility criteria

To be eligible, articles must be (a) accessible to at least one of the assigned coders or the first author (TEH; e.g., through their University library subscriptions); (b) classified as empirical; (c) written in English. An exception is the open access variable: articles that are not accessible will be included in measurement of this variable, as long as they relate to empirical data and are written in English (based on reading the abstract).

3.3 Procedure

1. Articles will be distributed to coders in two randomly shuffled lists, one for each target population. This will ensure random selection and random assignment to minimize coder drift. To create the article list for the target population FIELD-WIDE, we randomly shuffled the 75,657 deduplicated bibliographic items and selected the first 300 rows. To create the list for the target population PROMINENT, we filtered the 75,657 deduplicated bibliographic items to include only the 5,802 items published in the prominent journals. We then randomly shuffled this list and selected the first 300 rows. For both lists, we selected more than the target sample size of 200 articles to allow for non-eligible articles. One item appeared in both lists and was not replaced. An R script documenting the list creation is available at https://osf.io/yhnsv.

2. The transparency indicators (Table 1) will be extracted and classified (coded) using a Google Form (https://osf.io/hr68n). Coders will search for keywords (noted in Table 1) and, if necessary, manually examine key sections of articles to identify relevant information.

3. Two independent coders will fully code each article. Disagreements will be resolved by a third coder without discussion among the initial two coders.

3.4 Data analysis

For each measured variable (Table 1), we will report raw counts and percentages. For variables related to availability, we will also report 95% Wilson confidence intervals. Inter-rater reliability will be computed using Fleiss' Kappa only for "statement" variables in Table 1.

We do not anticipate any missing data. We do not anticipate performing any sensitivity analyses. We do not intend to perform any confirmatory hypothesis tests.

Note that ten articles were coded for piloting purposes before this protocol was preregistered; these articles will be included in the final results.

4. LIMITATIONS

4.1 Scope and clarifications

- We have focused on transparency indicators that we and others consider to be particularly important (Hardwicke et al., 2022; Munafò et al., 2017; Nosek et al., 2015); however, we do not claim to measure all possible transparent research practices.

- We will also check minimal quality criteria (e.g., are purportedly available data actually available), but recognize that more substantive checks can reveal deeper implementation problems, such as non-reproducibility (Crüwell et al., 2023; Hardwicke et al., 2018, 2021) or non-disclosure of

preregistration deviations (TARG Meta-Research Group, 2022; TARG Meta-Research Group et al., 2021).

- We recognize that transparency is not always possible when there are overriding legal, ethical, or practical concerns (Meyer, 2018). When articles state reasons for non-transparency, we will record and report those reasons.

- We are relying only on published information. It is likely that if we sent requests to authors, we would be able to obtain additional information; however, it has been demonstrated elsewhere that most requests of this kind only have a modest success rate and mostly go unanswered (Hardwicke & Ioannidis, 2018; Vanpaemel et al., 2015).

4.2 Potential sources of imprecision

- Our target sample size has been chosen to be tractable given our resources whilst still achieving reasonable precision (see section 3.2.4). Naturally, a larger sample size would improve precision, but this is beyond our resources at present.

4.3 Generalizability

- We expect our findings to generalize to the target populations; our study is not designed to support inferences about sub-populations of the target populations (e.g., specific subdomains or journals). Note that our definition of "psychology" is operationally constrained to articles included in the Web of Science Core Collection database and identified as belonging to the subject area "psychology". Other databases, such as Scopus (which we used in our prior prevalence study, Hardwicke et al., 2022), have different rules for content inclusion and categorisation; the extent to which our findings would generalize to these other contexts is

unknown. The reason to use Web of Science in the present study is its superior subject classification accuracy (Wang & Waltman, 2016) and our ability to use the API to automatically download large numbers of records from which to randomly sample.

- We recognize there is no consensus or objective definition of "prominent" journals and the extent to which our findings may generalize to alternative definitions of this population are unknown. We have used the Journal Impact Factor as an operational proxy for "prominent" as this avoids an entirely subjective or arbitrary definition and yields a collection of journals that we believe has good face validity.

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6. SUPPLEMENTARY INFORMATION

6.1 SUPPLEMENTARY INFORMATION A: Precision analyses for sample size planning

We performed precision analyses to evaluate the margin-of-error for 95% Wilson confidence intervals based on an expected proportion of 0.5. The result is a precision curve, which indicates diminishing returns as sample size increases (Supplementary Figure A1). The analysis code is available at https://osf.io/m8drs.
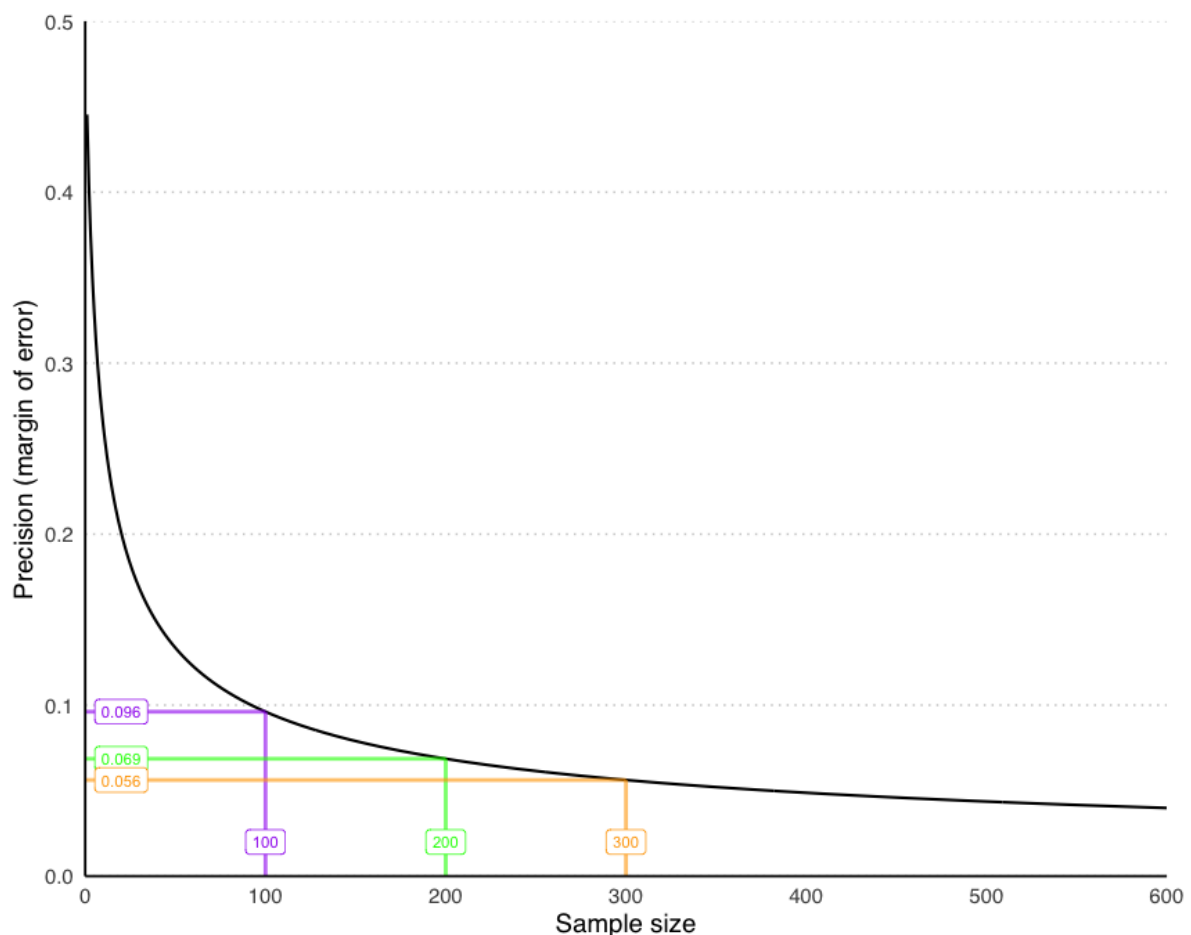
Supplementary Figure A1. Precision curve showing the expected margin-of-error for 95% Wilson confidence intervals as a function of sample size, assuming a proportion of 0.5. The margin of error for three specific sample size options are displayed.