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3 Registered Report Protocol: Survey on attitudes and experiences regarding
4 preregistration in psychological research

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12 **Abstract**

13 **Background:** Preregistration, the open science practice of specifying and registering details
14 of a planned study prior to knowing the data, increases the transparency and reproducibility of
15 research. Large-scale replication attempts for psychological results yielded shockingly low success
16 rates and contributed to an increasing demand for open science practices among psychologists.
17 However, preregistering one's studies is still not the norm in the field. Here, we propose a study to
18 explore possible reasons for this discrepancy.

19 **Methods:** In a mixed-methods approach, an online survey will be conducted, assessing
20 attitudes, motivations, and perceived obstacles with respect to preregistration. Participants will be
21 psychological researchers that will be recruited by scanning research articles on Web of Science,
22 PubMed, PSYINDEX, and PsycInfo, and preregistrations on OSF Registries (targeted sample size:
23 $N = 296$). Based on the theory of planned behavior, we predict that positive attitudes (moderated
24 by the perceived importance of preregistration) as well as a favorable subjective norm and higher
25 perceived behavioral control positively influence researchers' intention to preregister (hypothesis
26 1). Furthermore, we expect an influence of research experience on attitudes and perceived
27 motivations and obstacles regarding preregistration (hypothesis 2). We will analyze these
28 hypotheses with multiple regression models, and will include preregistration experience as control
29 variable.

30

31 **Introduction**

32 Ever since Ioannidis [1] argued that most published research findings are false and a
33 multitude of attempts failed to replicate previously significant effects (e.g., [2]), the reliability of
34 published research findings has been a subject of discussion across many scientific disciplines.
35 Summarizing these concerns, the term *replication crisis* [3] arose, where *replicability* refers to the
36 attempt to repeat an experiment to re-test the original effect [4]. When *Nature* [5] conducted a
37 survey of more than 1500 researchers of multiple disciplines, 70% of researchers reported that they
38 had failed to replicate studies by others, and more than 50% had failed to replicate their own studies.
39 Overall, 90% of researchers indicated their belief in a slight or even significant crisis [5]. In
40 psychology, multiple large-scale research projects attempted to replicate significant effects
41 published in top tier journals. Strikingly many attempts failed as shown by replication rates
42 between 36 [2] and 77% [6]. Among successfully replicated effects, the effect sizes were
43 considerably smaller than originally reported.

44 It has been reasoned that false positives, i.e., effects that are significant in studies but do not
45 exist in reality, contribute to low replicability [7]. The high rate of false positive research results
46 has largely been attributed to “questionable research practices” (e.g., see [8,9]), a collective term
47 for any “exploitation of the gray area of acceptable practice ... (which can) increase the likelihood
48 of finding evidence in support of a hypothesis” ([9] p. 524). Examples for these practices are the
49 failure to control for biases, selective reporting of significant results, *p*-hacking, or revising the
50 hypotheses to match the results, also known as HARKing (see [8,10–14 for details).

51

52 **Preregistration – on the rise?**

53 The preregistration of studies has been proposed to counter these questionable research
54 practices (e.g., see [15], and see [10] for an overview of other open science techniques). A
55 preregistration is a research plan that is time-stamped, created before the data has been collected
56 or examined, and most often submitted to a public registry, thus making planned study details
57 available to others (possibly after an embargo period) [15,16]. If the research plan changes
58 afterwards, either a new version needs to be added or the deviations will be apparent when
59 comparing the preregistration to the final manuscript. Thus, preregistration aims for a transparent
60 presentation of what was planned at a certain time point and what changes may have been made to
61 a study until its publication. Evidence from other scientific disciplines indicates that preregistration
62 indeed works, i.e., it increases the transparency of the research process, and reduces questionable
63 research practices and the rate of false positive findings (e.g., see [17,18]).

64 However, while preregistration is already well-established in other scientific disciplines and
65 is mandated, for example, in medicine [19], it has been frequently demanded as a means to counter
66 questionable research practices but is still not widely practiced in psychology.

67 On the one hand, in response to the replication crisis, many psychologists have committed
68 themselves to the advancement and promotion of open science techniques such as preregistration
69 (e.g., see [10,13,15,20–22]). For example, Nosek et al. [20] describe preregistration as “hard, and
70 worthwhile”, while Wagenmakers and Dutilh [22] posit “seven selfish reasons for preregistration”.
71 Indeed, the number of preregistrations in psychology is increasing. For instance, the number of
72 preregistrations on the Open Science Framework (OSF), a platform for sharing research materials,
73 has been approximately doubling every year between 2012 and 2017 [21], and in a survey which

74 was conducted in 2018, 44% of the sampled psychological researchers indicated having
75 preregistered a hypothesis or analysis until 2017 [23].

76 Yet, looking at the fraction of published studies that were actually preregistered paints a
77 different picture. In their recent study, Hardwicke et al. [24] found that only 3% of 188 examined
78 articles from 2014 to 2017 included a preregistration statement, which contradicts the more positive
79 outlook by [21] and [23]. Stürmer et al. [25] also found that when early career researchers were
80 asked about questionable research practices and open science, they deemed many open science
81 practices necessary, yet toward preregistration they expressed more reluctance: Only about half of
82 the participants found that preregistration was fairly necessary or very necessary, and even less
83 indicated that they planned to consider preregistering their studies in the near future.

84 A number of reservations are mentioned frequently when discussing preregistration in
85 psychology, including the fear that it leaves no flexibility during study administration and
86 eliminates the possibility to conduct exploratory analyses (as presented by e.g., [15,16]). Some
87 people are concerned that this might stifle discovery [26]. Others worry that someone might take
88 their preregistered and thus, publicly available, study idea and publish it before them (so-called
89 scooping, see [27]). Additionally, the time costs and effort are often seen as obstacles regarding
90 preregistration (e.g., see [16]). Besides these worries, some authors also express an overall critique
91 regarding the concept of preregistration. Szollosi et al. [28–31] argue that preregistration is
92 redundant when good theories are tested, and does not itself improve theories. Others argue that
93 preregistration cannot prevent some questionable research practices [32], or might not fit well with
94 all types of research (see [16]). Moreover, some studies found problems with the current
95 implementation of preregistration such as poor disclosure of deviations from preregistered plans in
96 finished manuscripts [33–35]. Although most of the listed arguments against preregistration are

97 counter-argued by supporters of preregistration (e.g., that exploratory analyses are still possible
98 [15,16,27]) and findings from other scientific disciplines underline its benefits (e.g., see [17,18]),
99 these reservations persist and some researchers remain skeptical.

100

101 **Aim of this survey**

102 While previous surveys inquired about preregistration in the more general context of open
103 science [23,25,36,37], to our knowledge no comprehensive study focusing on preregistration has
104 been conducted. We aim to close this gap by exploring thoughts, motivations, and perceived
105 obstacles of psychological researchers toward preregistration and how these are influenced by the
106 time someone has worked in research or actual experience with preregistration, that is, whether
107 someone preregistered a study in the past. For instance, we want to explore the data to find out
108 whether the low rate of preregistrations is caused by fear of the unknown or based on negative
109 experiences (and which ones), as well as whether the increase of preregistrations is driven by a few
110 active supporters while others reject or are indifferent toward it. Thus, we aim to shed light on the
111 outlined discrepancy of public support for preregistration on the one hand, and a low fraction of
112 preregistrations on the other, while also identifying possible roadblocks for preregistration in
113 psychology. Mixed-methods will be used, including both qualitative and quantitative approaches.

114 Additionally, we want to investigate two specific research questions: First, we want to
115 examine which factors facilitate or prevent preregistration (*research question 1*). The theory of
116 planned behavior [38,39] is a prolific, influential (e.g., see [40]) and well-researched (e.g., see [41–
117 46]) psychological theory that aims to predict social behavior and has been applied across various
118 contexts (e.g., health). According to this theory, the intention to perform a behavior can be seen as

119 a direct antecedent of the actual behavior. In this framework, the intention to preregister predicts
120 preregistration, and how the intention is formed may be informative for effectively promoting this
121 behavior. To our knowledge, this has not yet been studied in the context of preregistration or open
122 science. As described by Ajzen and colleagues [38,39], three aspects influence intentions which
123 are defined as follows: 1) Attitudes toward the behavior which result from the ratio of perceived
124 advantages to disadvantages of performing the behavior, 2) the subjective norm which represents
125 the perceived social pressure to perform or not perform the behavior, and 3) the perceived
126 behavioral control which focuses on the question if the subject has the resources and skills to
127 perform the behavior or not (also see [41–46] for meta-analytical support of this model, and [47]
128 for an overview). We will measure attitudes toward preregistration as well as subjective norms and
129 perceived behavioral control through items in an online questionnaire, and investigate how they
130 influence researchers' intention to preregister their studies in the future. Based on the model's
131 postulations, we expect that more favorable attitudes and subjective norms as well as higher
132 perceived behavioral control positively influence the intention to use preregistration. As the relative
133 importance of attitudes, subjective norms and perceived behavioral control differs in dependence
134 of considered behaviors, situations and populations [38,39], we want to test which of these is the
135 strongest predictor for the intention to use preregistration. We will also include the perceived
136 importance of preregistration as moderator for the strength of the influence of attitudes on intention,
137 and the preregistration experience as a control variable. Such an extension of the model will
138 compensate for potential non-attitudes (e.g., see [48]) and a potential sampling bias toward
139 researchers that have already preregistered, and is explicitly allowed by the theory of planned
140 behavior [38,47].

141 Regarding the intention formation, we have the following hypotheses:

142 1. The theory of planned behavior [38,39] can be applied to the context of preregistration to
143 significantly predict researchers' intention to preregister their studies in the near future,
144 using a moderated multiple regression model. We predict that:

145 1.1. More beneficial attitudes are a positive predictor for the intention to preregister.

146 1.2. The perceived importance of preregistration moderates the effect of attitudes on
147 intention positively.

148 1.3. The perceived importance of preregistration is a positive predictor for the intention to
149 preregister.

150 1.4. Beneficial subjective norms are a positive predictor for the intention to preregister.

151 1.5. Higher perceived behavioral control is also expected to be a positive predictor.

152 1.6. These predictors combined can significantly predict researchers' intention to
153 preregister.

154 Second, we want to examine whether research experience predicts attitudes and the
155 perceived intensity of motivations and obstacles (*research question 2*). Research experience will
156 be operationalized as the number of years someone indicates they have worked in psychological
157 research. Early career researchers are oftentimes seen as the driving force of the open science
158 movement (e.g., see [49]). We want to investigate if the research experience indeed has an influence
159 on researchers' responses about preregistration (a similar effect was reported by Abele-Brehm et
160 al. in a comparison of academic groups regarding hopes and fears toward open science [36]).

161 Regarding this second research question, the following hypotheses will be tested:

162 2. We predict that research experience, that is, the amount of time someone has already
163 worked in psychological research, has an influence on attitudes, motivation, and perceived
164 obstacles regarding preregistration. Specifically, we will conduct three multiple regressions
165 (including preregistration experience as control variable), and we posit the following non-
166 directional hypotheses:

167 2.1. Research experience is a predictor for attitudes regarding preregistration.

168 2.2. Research experience is a predictor for the strength of motivation to preregister.

169 2.3. Research experience is a predictor for how strongly obstacles to preregister are
170 perceived.

171 The present survey is aimed to sample the general population of psychological researchers
172 by recruiting participants whose articles appear on Web of Science, PubMed, PSYINDEX, and
173 PsycInfo, as well as the subgroup of researchers who have preregistered before and who will be
174 identified through their preregistration on OSF Registries.

175

176

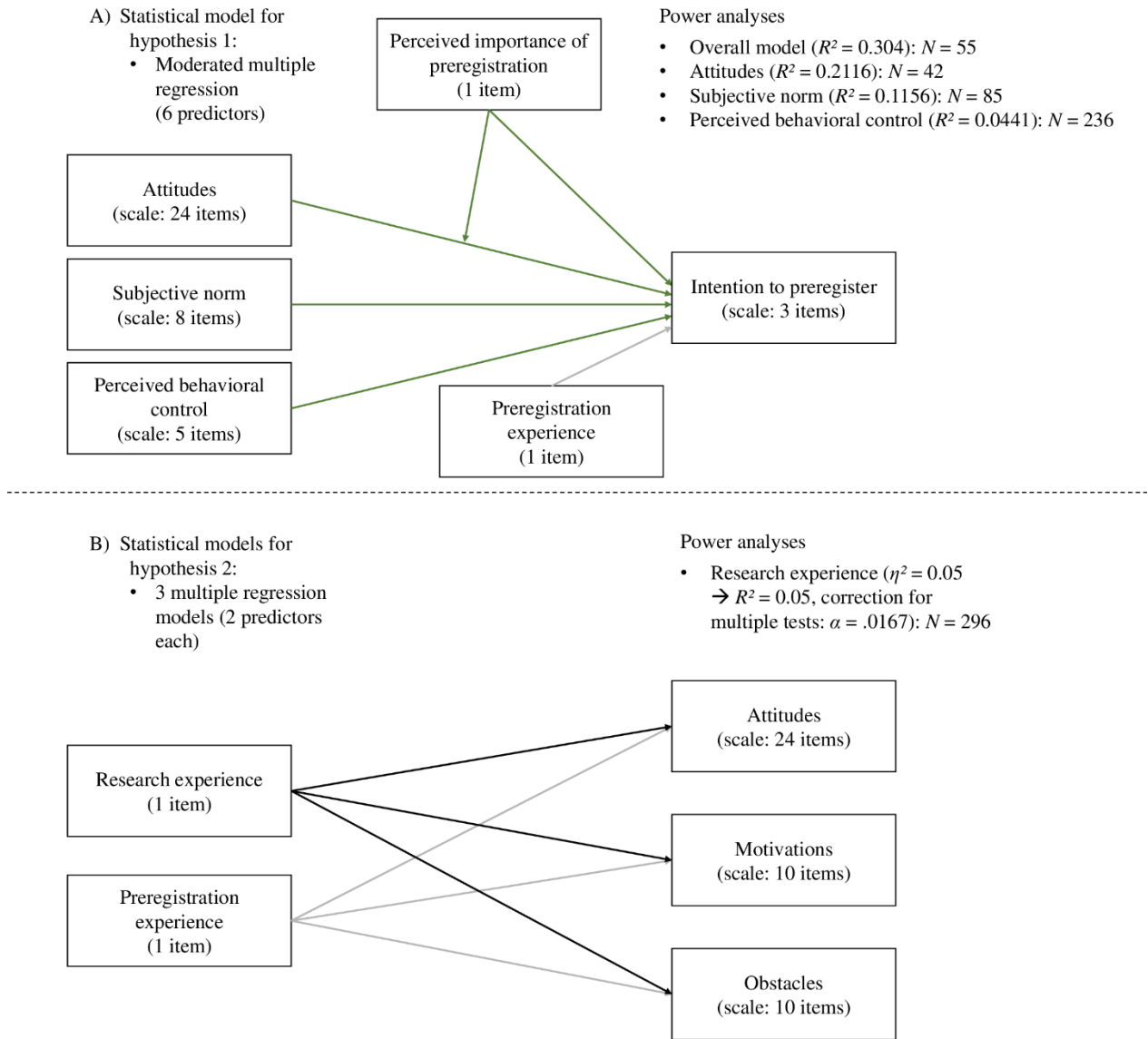
177

178 **Methods**

179 **Sampling procedure**

180 **Power analyses**

181 Data from psychological researchers at different career stages will be collected. The optimal
182 sample size reported below has been determined by using G*Power [50,51] in combination with a
183 thorough review of the existing literature as described in the following paragraphs. Each of the
184 power analyses described below was specified to achieve a statistical power of 95% at a given
185 significance threshold of 5% ($\alpha = \beta = .05$). All power analyses are displayed in Fig 1 and are also
186 included in the supporting information (see S1 Text).



187

188 **Fig 1. Overview of the power analyses.** The detailed statistical models and corresponding power
 189 analyses are displayed for A) the moderated multiple regression that will be computed for testing
 190 hypothesis 1 and B) the multiple regressions that will be used to test hypothesis 2.

191 To test which factors influence the intention to preregister (scale of three items, see
 192 *hypothesis 1*), a moderated multiple regression model will be computed based on the rationale of
 193 the theory of planned behavior, which includes six predictors: Attitudes (scale of 24 items),
 194 perceived importance of preregistration (one item in our questionnaire), attitudes x importance,

195 subjective norm (scale of eight items), perceived behavioral control (scale of five items) [38,39,47],
196 and preregistration experience (one item). The theory of planned behavior has been examined using
197 meta-analytical approaches in various contexts (e.g., health behavior). The percentage of variance
198 of intention that was explained by attitudes, subjective norm and perceived behavioral control
199 combined, ranged between $30.4\% < R^2 < 44.3\%$ [41,43–46]. We chose the lowest reported effect
200 size ($R^2 = 30.4\%$) as minimal effect size of interest. The power analysis for the overall regression
201 model yielded an optimal sample size of $N = 55$ to be able to detect the determined effect size given
202 the effect exists (see *hypothesis 1.6*). Additional power analyses were conducted to compute the
203 optimal sample size to test the individual predictors. As comparable effect sizes, R^2 based on the
204 averaged correlations of individual variables were searched for in the aforementioned meta-
205 analyses, and the smallest ones were chosen for each power analysis. This resulted in an optimal
206 sample size of $N = 42$ for testing attitudes (see *hypothesis 1.1*), $N = 85$ for testing subjective norms
207 (see *hypothesis 1.4*), and $N = 236$ for testing perceived behavioral control (see *hypothesis 1.5*) as
208 predictors for intention (with $\alpha = \beta = .05$). Since perceived importance and its interaction with
209 attitudes, as well as preregistration experience are not originally included in the model but added
210 by us, no comparable effect sizes are available and thus, no power analyses have been conducted
211 for these variables.

212 To investigate whether research experience has an effect on attitudes (see *hypothesis 2.1*),
213 and the perceived intensity of motivations (see *hypothesis 2.2*) and obstacles (see *hypothesis 2.3*)
214 regarding preregistration, three regression models will be computed, again including
215 preregistration experience as control variable. As comparable effect size, the smallest reported
216 effect size for group differences by Abele-Brehm et al. [36] was used, and the corresponding F
217 value was used to calculate R^2 for the power analyses. For these regression models, the alpha level

218 will be corrected using the Bonferroni-Holm method to account for multiple testing. Thus, the
219 power analyses were calculated for the smallest alpha of 1.67% (5% divided by 3). These power
220 analyses suggested an optimal sample size of $N = 296$ to test the influence of research experience
221 on attitudes (see *hypothesis 2.1*), perceived intensity of motivations (see *hypothesis 2.2*), and
222 perceived intensity of obstacles (see *hypothesis 2.3*) regarding preregistration.

223 As the optimal sample size for the regression models to test hypothesis 2 ($N = 296$) is the
224 highest computed necessary N , it will constitute the targeted sample size.

225 **Data collection and stopping rule**

226 To ensure that our sample contains researchers with varying research experience, a quota
227 sampling will be used to evenly collect data from researchers with different degrees, that is,
228 bachelor's degree, master's degree, doctoral degree, or habilitation or full professorship.
229 Specifically, a quota sampling will be used with a 25% quota for each subgroup. Yet, as it might
230 be the case that some quotas might not be filled, quotas are defined for a slightly bigger sample
231 than the necessary $N = 296$ to compensate for this eventuality. In particular, $N = 400$ will be the
232 basis for our quotas which will therefore be $n = 100$ for each group. This enables us to reach the a
233 priori computed power even if not all quotas can be filled, while still ensuring that no group is
234 overrepresented.

235 To recruit this sample, a method similar to the one by Field et al. [52] will be used. The term
236 “psychology” will be searched for on specified databases, and resulting hits will be sorted from
237 newest to oldest. These documents will be scanned for authors whose email addresses can be found
238 via institutional or personal websites linked to the respective work, or by searching for the author
239 via Google, Google Scholar, and ResearchGate. Duplicated email addresses that may be sampled

240 from different databases will be excluded. Identified persons will be invited to participate in the
241 survey via email.

242 For this search, the databases Web of Science (<https://apps.webofknowledge.com/>),
243 PubMed (<https://pubmed.ncbi.nlm.nih.gov/>), PSYINDEX (<https://www.psyindex.de/>), and PsycInfo
244 (<https://www.apa.org/pubs/databases/psycinfo>) will be used to recruit a representative sample of
245 psychological researchers.

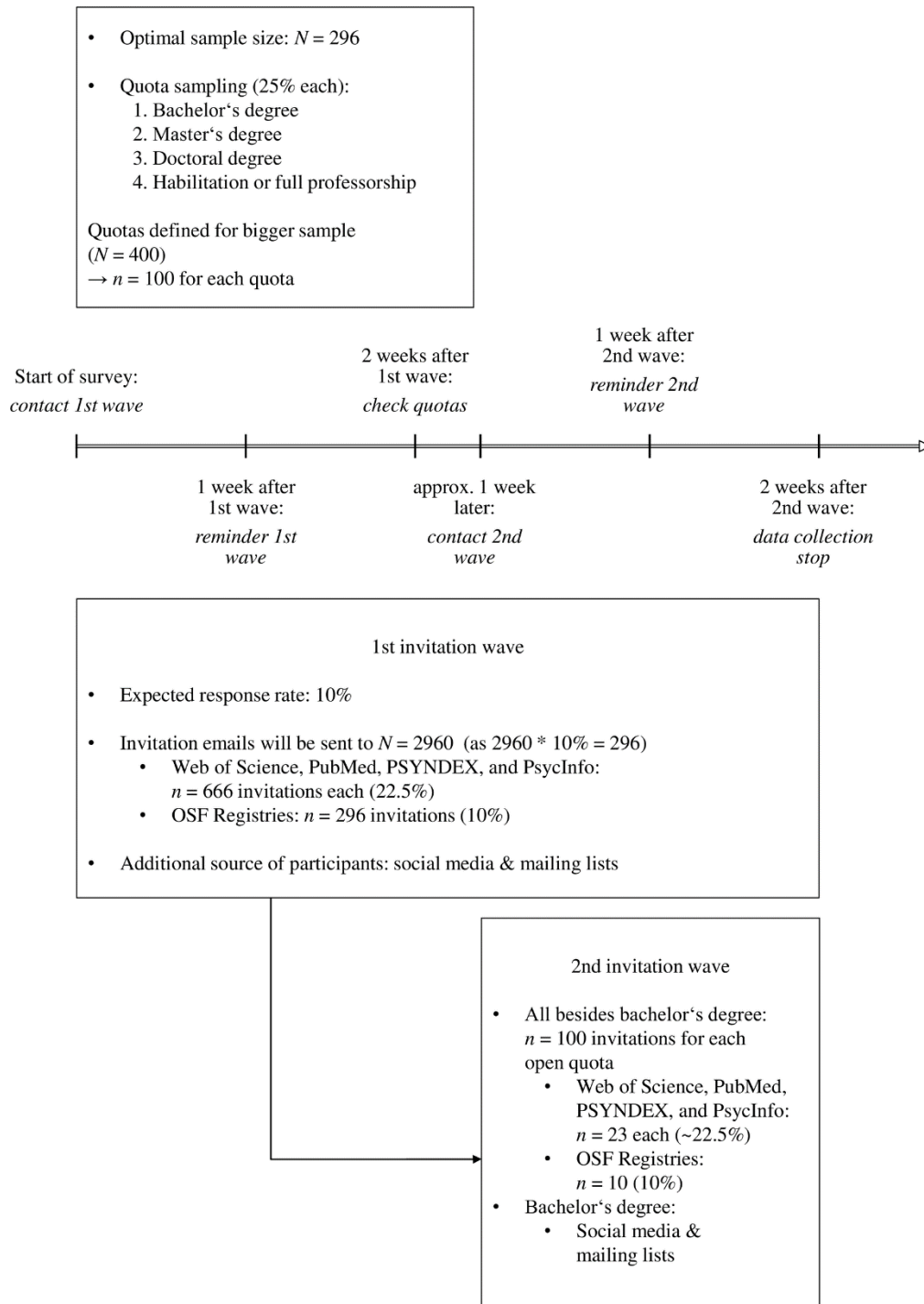
246 Based on the results by Hardwicke et al. [24], we anticipate that only a small proportion of
247 the research articles that will be found on the general databases will include a preregistration
248 statement, which might lead to a small number of participants with any preregistration experience.
249 Thus, we decided to send 10% of invitations to authors of preregistrations in order to ensure that
250 our survey will also include a sufficient number of participants who have preregistered before.
251 These participants will be identified via the preregistration platform OSF Registries
252 (<https://osf.io/registries>). As this may introduce a sampling bias towards researchers who lean more
253 positive towards preregistration, preregistration experience will be controlled for in the statistical
254 analyses aimed to draw inferences about the general population of psychological researchers.

255 A customized link will be distributed among participants of each database so that the
256 recruitment source can be inferred. The database participants were recruited from will be
257 considered in the analyses as described in the section *descriptive reports*.

258 Response rates were rather low in many studies that relied on researchers as sample (e.g.,
259 [9,25,36,37,52–54]). Based on these studies and based on the insights from our pilot study (see
260 section *pilot study*), we anticipate a response rate of around 10%. To compensate for this, we will
261 invite $N = 2960$ persons ($n = 666$ via Web of Science (22.5%), $n = 666$ via PubMed (22.5%), $n =$

262 666 via PSYINDEX (22.5%), $n = 666$ via PsycInfo (22.5%), and $n = 296$ via OSF Registries (10%)
263 to reach our target sample size of $N = 296$ (10% of 2960).

264 During data collection, a specific procedure will be followed as described in Fig 2, and in
265 more detail in the supporting information (see S2 Text). Invitations will be sent to potential
266 participants identified on Web of Science, PubMed, PSYINDEX, PsycInfo, and OSF Registries in
267 two waves. Individuals of the first wave will have approximately one month overall to participate
268 in the survey, individuals of the second wave will have two weeks to participate. Both groups will
269 receive a reminder email one week after invitation. Additionally, the survey will be advertised on
270 social media (Facebook, Twitter), and via student and researcher specific mailing lists, which will
271 be seen as additional sources of participants.



272

273 **Fig 2. Survey timeline and corresponding actions.** The arrow illustrates the timeline while the
 274 boxes contain details about the sampling procedure.

275 If the optimal sample size is achieved before the end of the set time frame (approximately
276 one month), the survey will still be accessible to participants that were already invited, but
277 recruitment will be discontinued. Data collection will be stopped after this time frame even if the
278 optimal N cannot be reached.

279 The collection of email addresses has started on January 4th, 2021. Emails will be sent once
280 our submission receives an in-principle-acceptance and 2960 email addresses have been collected
281 using the procedure described above.

282 Participants who completed the survey will have the possibility to participate in a lottery for
283 40 gift cards worth 50 € each. The survey was approved by the ethics committee of Trier University,
284 Germany.

285 **Exclusion and missing data**

286 All participants that indicate that their research or studies do not fall within the scope of
287 psychology or do not have at least a bachelor's degree in psychology, and thus, cannot be assigned
288 to the respective quota, will be screened out at the beginning of the survey. Thus, they will be
289 directed to an exit page rather than to the main body of the survey, will not be counted into the
290 quotas, and will not be considered for data analyses as the survey targets a sample from research-
291 oriented psychology.

292 At the end of the survey, participants will be asked whether they responded faithfully. Only
293 data of participants that indicated having at least a bachelor's degree in psychology, indicated
294 faithful participation, and completed all pages will be counted for quota fulfillment. By screening
295 the open text inputs, it will additionally be checked if participants included any inappropriate

296 responses like advertising or offensive comments. Those participants will be excluded from
297 analyses. Data from all participants who indicated faithful participation, who were not excluded
298 based on inappropriate answers, and completed all pages of the survey will be analyzed when
299 testing the planned hypotheses (see section *hypotheses tests*). Additionally, responses from
300 participants who were not screened out or excluded based on inappropriate responses, and
301 completed the survey only partially, will be used for calculating descriptive statistics where
302 applicable (see section *descriptive reports*). A sensitivity analysis will be performed to examine
303 whether and to what extent the exclusion of incomplete datasets for the hypotheses tests affects the
304 results.

305

306 **Material**

307 The online survey was created with the software SoSci Survey (version 3.2.24) [55] and
308 will be supplied via www.soscisurvey.de. It will be presented in English. Items of the survey can
309 be categorized in nine categories: 1) Sociodemographic questions, 2) items concerning the general
310 usage of preregistration, 3) an *attitude* scale consisting of 24 items indicating the overall attitudes
311 of participants regarding the concept of preregistration, 4) a *subjective norm* scale of eight items
312 representing perceived social norms and pressure, 5) a *perceived behavioral control* scale of five
313 items inquiring about researchers' perceived control over the potential preregistration of their
314 studies, 6) an *intention* scale of three items inquiring about researchers' intention to use
315 preregistration in the future, 7) items about motivations (a *motivation* scale including ten items
316 measuring how strongly participants agree with potential motivations to preregister, plus additional
317 more open items), 8) items about perceived obstacles (an *obstacle* scale featuring ten items

318 measuring how strongly participants agree with potential obstacles to preregister, plus additional
319 more open items), and 9) various open questions inquiring about suggestions for improving
320 preregistration. Some items were adapted from other surveys that focused on related topics [25,36]
321 and are complemented with additional items generated in reference to other theoretical and
322 empirical works on preregistration, open science [32,52,54,56], and the theory of planned behavior
323 [38,39,47,57]. These sources were selected based on their theoretical relevance to the topic at hand
324 (i.e., open science practices and theory of planned behavior). The identified items were either
325 adapted (i.e., wording was changed slightly to make them easier to understand or make them fit the
326 present topic, e.g., “I have more trust in research findings when the study has been preregistered.”
327 instead of “... when the respective data are published.” [36]) or new items were generated using
328 the concepts presented in the literature based on face validity. The items of the present survey as
329 well as the original items including references are available in the supporting information (see S3
330 Table). For most of the original items, no validity measures are given in the literature. Only for the
331 theory of planned behavior, predictive validity is considered in more detail [47]. However, since
332 none of the survey items were used in their original form but were adapted or newly created based
333 on the given concepts, no validity measures can be provided. Instead, only face validity is assumed.
334 This validity evaluation is based on Flake and Fried [58].

335 Different item formats will be included in the survey. All scale items (attitudes, subjective
336 norm, perceived behavioral control, intention, motivations, and obstacles) will be answered with a
337 seven-point labeled answer scale as recommended by Ajzen [38] (1 = “Strongly disagree”, 2 =
338 “Disagree”, 3 = “Slightly disagree”, 4 = “Neither agree nor disagree”, 5 = “Slightly agree”, 6 =
339 “Agree”, 7 = “Strongly agree”). Scales will be recoded from “1 to 7” to “-3 to +3” for data analyses
340 yielding a middle category which has absolute meaning. For the statistical analyses, the mean

341 scores of the scales will be used to measure how participants perceive 1) preregistration (attitude
342 scale), 2) subjective norms regarding preregistration (subjective norm scale), 3) their own control
343 about using preregistration or not (behavioral control scale), 4) their intention to use preregistration
344 in the future (intention scale), and 5) their motivations (motivation scale) and 6) obstacles to
345 preregister (obstacle scale). For each participant, the mean for each scale will be calculated and
346 used as the score.

347 Other items will include a single or multiple choice response format, or the option for open
348 text input. Whenever applicable, options are displayed in randomized order to eliminate potential
349 sequence effects.

350

351 **Procedure**

352 Participants will receive the link to the survey via personal email or social media call. After
353 the welcoming page, participation information will be displayed and informed consent needs to be
354 provided to proceed. Furthermore, a captcha (arithmetic task) needs to be completed as a safeguard
355 against bot responses. Then, participants will complete the main body of the survey which
356 successively focuses on the different item categories (sociodemographic questions, general usage
357 of preregistration, attitudes, subjective norms, perceived behavioral control, intention, motivations,
358 perceived obstacles, and suggestions for improvement). Before any items related to preregistration
359 are shown, a definition of preregistration is presented and correct understanding is checked, to
360 ensure that all participants answer the items with the same concept in mind. At the end of the
361 survey, participants will have the option to participate in the lottery and to sign up for receiving a
362 preprint of the survey results by entering their email address, which will be saved separately from

363 the other data. Lastly, a debriefing will follow that states the aim of the survey and the research
364 questions that are investigated. Overall, completing the survey will take about 20-25 minutes.
365 Screen recordings of the survey's procedure are available in the supporting information (see S4
366 and S5 Videos).

367

368 **Data analysis**

369 This Registered Report Protocol was written in *R Markdown* (version 2.2) [59,60]. R
370 (version 4.0.3) [61] and the R-packages *afex* (version 0.27-2) [62], *Amelia* (version 1.7.6) [63],
371 *beeswarm* (version 0.2.3) [64], *biotools* (version 3.1) [65], *car* (version 3.0-8) [66,67], *carData*
372 (version 3.0-4) [67], *corrplot2017* (version 0.84) [68], *dplyr* (version 1.0.0) [69], *emmeans* (version
373 1.4.7) [70], *forcats* (version 0.5.0) [71], *ggplot2* (version 3.3.2) [72], *gplots* (version 3.0.3) [73],
374 *heplots* (version 1.3-5) [74,75], *lattice* (version 0.20-41) [76], *lm.beta* (version 1.5-1) [77], *lme4*
375 (version 1.1-23) [78], *MASS* (version 7.3-53) [79], *Matrix* (version 1.2-18) [80], *MBESS* (version
376 4.7.0) [81], *mlbench* (version 2.1-1) [82], *MVN* (version 5.8) [83], *olsrr* (version 0.5.3) [84], *papaja*
377 (version 0.1.0.9942) [85], *popbio* (version 2.7) [86], *psych* (version 1.9.12.31) [87], *purrr* (version
378 0.3.4) [88], *Rcpp* (version 1.0.4.6) [89,90], *readr* (version 1.3.1) [91], *reshape2* (version 1.4.4)
379 [92], *rpanel* (version 1.1-4) [93,94], *sp* (version 1.4-2) [95], *SpatialEpi* (version 1.2.3) [96], *stringr*
380 (version 1.4.0) [97], *tibble* (version 3.0.1) [98], *tidyr* (version 1.1.0) [99], *tidyverse* (version 1.3.0)
381 [100], *tkrplot* (version 0.0-24) [101], and *writexl* (version 1.3) [102] will be used for the analyses.
382 Once the study has been conducted, StatTag (version 6.0.1) [103] will be used to insert the results
383 calculated in R into the manuscript. Scripts for preprocessing, assumption testing and all analyses
384 will be available in the supporting information (see S6, S7 and S8 Scripts). Additionally, all data

385 (including meta-data about variables and values) will be publicly accessible after study completion
386 in PsychArchives (<https://www.psycharchives.org/>), a platform for sharing psychological data sets
387 and other digital research materials.

388 **Preprocessing**

389 Data will be processed in the following way: Responses from all scale items will be recoded
390 as described in the section *material*, and polarity of negatively poled items will be reversed.
391 Additionally, multiple choice questions will be recoded (originally: 1 = “not checked” and 2 =
392 “checked”; new: 0 = “not checked” and 1 = “checked”), and single choice items will be transformed
393 into factors. Comments will be inspected. Furthermore, data will be screened for any inappropriate
394 responses (i.e., advertising, offenses) which would lead to an overall exclusion.

395 As a quality check, the attitude, subjective norm, perceived behavioral control, intention,
396 motivation, and obstacle items will be inspected with respect to floor or ceiling effects which will
397 then be excluded from the analyses (specifically, items for which $\geq 90\%$ of participants indicated
398 the lowest or highest category). Additionally, Cronbach’s alpha will be calculated as an indicator
399 for reliability for each scale, and items for which Cronbach’s alpha of the scale is at least .10 higher
400 if they are dropped will be excluded. The remaining items will be used to calculate mean scores
401 for the attitude, subjective norm, perceived behavioral control, intention, motivation, and obstacle
402 scale respectively for each participant. For this quality check, only complete datasets will be
403 considered. All preprocessing scripts are available in the supporting information (see S6 Script).

404 **Descriptive reports**

405 To describe the general behavior of participants when filling out the survey, we will
406 calculate the response rate, the number of screened out participants, the number of complete and
407 incomplete survey participations, the completion time (*M, SD, range*), and the database from which
408 participants were recruited.

409 We will further describe the composition of the obtained sample by providing frequency
410 tables or plots and descriptive statistics (*M, SD, range*) for selected sociodemographic information
411 (e.g., gender, age, country of residence, academic degree, main research topic, number of years
412 worked in research) separately for participants who preregistered in the past vs. participants without
413 preregistration experience. Means, standard deviations, and ranges for perceived importance of
414 preregistration and intention to preregister in the near future will be calculated. We will furthermore
415 compare these between researchers with different academic degrees. If the respective group means
416 do not differ as determined by a one-factorial ANOVA, we will report the overall mean, standard
417 deviation and range across groups.

418 To gain insight into how common preregistration is in the general population of
419 psychological researchers, we will report the mean proportion of participants who used
420 preregistration in the past and how many preregistrations they created on average, across the
421 sample obtained from the article databases, that is, excluding participants recruited from OSF
422 Registries.

423 Moreover, also including the sample recruited from OSF Registries, participants' responses
424 to the following questions will be listed as frequency tables or in the text: 1) Where did they learn
425 about preregistration, 2) what motivated them to create their first preregistration (only addressing
426 participants with preregistration experience), 3) what problems did researchers experience who

427 already used preregistration, and in turn, what worries do researchers report who have not
428 preregistered yet (and do these match?), 4) how often do participants read other researchers'
429 preregistrations, and 5) by whom is the researchers' decision to preregister influenced the most,
430 which is compared between researchers with different academic degrees. Wherever applicable, the
431 results will be compared between participants that have preregistered before or not.

432 Open text inputs of both the open "other" options of selection items and the open text input
433 items (i.e., what are benefits and drawbacks of preregistration, what might be positive and negative
434 consequences of mandatory preregistration, what are reasons against preregistration, how and why
435 did participants' motivation to preregister change, and what are suggestions for increasing the
436 motivation, decreasing obstacles, and for other improvements regarding preregistration) will be
437 analyzed to identify common themes. The following mixed-methods approach will be used: Two
438 to four coders will qualitatively identify themes mentioned by the participants and subsequently
439 categorize all responses accordingly in order to receive a frequency measure that will be analyzed
440 quantitatively. Specifically, open text inputs of each item will be shuffled and the first 10% of these
441 shuffled responses will be used to establish initial categories of themes. Coders will read the
442 responses and add each theme as a column in a coding sheet. It will be coded whether the respective
443 theme appears in the other responses (= 1) or not (= 0). If a coder encounters new relevant themes,
444 they will be added and coded later. Nonsense responses will be excluded during coding.
445 Ambiguities will be discussed and solved in pairs. If no solution can be found, a third coder will
446 be consulted. After all responses have been coded, the sums for each column (= theme) will be
447 calculated to obtain the frequency of how often a theme was mentioned over all responses. Results
448 from the open text input items will be displayed in frequency tables, and the results of the analysis
449 of "other" options will be added to the individual items' response presentations (see above). Again,

450 responses will be compared between participants with and without preregistration experience. Both
451 the coding sheets and the open text inputs will be published alongside the other data once the study
452 has been conducted. Furthermore, all analysis scripts will be included in the supporting information
453 (see S8 Script).

454 **Hypotheses tests**

455 In order to find out how the intention to preregister is formed, and whether research
456 experience has an impact on attitudes and the intensity of motivations and perceived obstacles
457 regarding preregistration, we will analyze participants' responses to the attitude, subjective norm,
458 perceived behavioral control, intention, motivation, and obstacle scale (see S8 Script for all
459 analyses). Only complete datasets (see section *exclusion and missing data*) will be considered for
460 these analyses. Before the analyses, the aforementioned scales will be inspected, and the mean,
461 standard deviation, and distribution of responses will be displayed per item in a table for easy
462 inspection. Next, means, standard deviations, and ranges will be computed for each scale.

463 A significance level of $\alpha = .05$ will be used for our hypotheses tests. Before conducting
464 statistical analyses, assumptions will be tested for each method (see S7 Script). If assumptions are
465 violated and tests are not robust against these violations, alternative methods will be used as
466 described below.

467 For hypothesis 1, we predict that attitudes, subjective norms, and perceived behavioral
468 control influence researchers' intention to preregister their studies in the near future. Perceived
469 importance of the topic of preregistration will be included as moderator for attitudes, and previous
470 preregistration experience will serve as a control variable. To test this hypothesis, a moderated
471 multiple regression model will be computed. Assumptions for this model include linearity,

472 uncorrelated predictors, independence and normality of residuals, and homogeneity of variance.
473 Linearity and uncorrelated predictors are assumed on a theoretical basis. Yet, there might be a high
474 multicollinearity for the product term (attitudes x perceived importance). This will be examined by
475 calculating the tolerance statistics as well as the variance inflation factor. If the multicollinearity is
476 too high for these two predictors (variance inflation factor > 10), importance will be aggregated
477 with the attitudes scale instead of including it as a moderator, since it might be just another aspect
478 of attitudes. In this case, the item concerning perceived importance would be included as another
479 item in the attitude scale which would now include 25 instead of 24 items. The mean score would
480 then be re-calculated and the new score would be included in the analyses. The independence of
481 residuals is furthermore achieved by the survey's design. Normality of residuals and homogeneity
482 of variance will be investigated by plotting the residuals (scatterplots, Q-Q plots and histograms).
483 A violation of the normality of residuals is not impactful with a high N , as it is the case with our
484 sample, thus a violation would not be problematic. If the assumption of homogeneity of variance
485 is violated, weighted least squares regression will be used instead of ordinary least squares.

486 After testing these assumptions, the regression model will be computed: The intention (i.e.,
487 mean score of three items) will be included as dependent variable. As predictors, the attitude scale
488 (i.e., mean score of 24 items inquiring about how positive preregistrations are perceived), perceived
489 importance of preregistration (one item), and their product term, the subjective norm scale (i.e.,
490 mean score of eight items inquiring about how beneficial participants perceive the social norm of
491 using preregistration), the perceived behavioral control scale (i.e., mean score of five items
492 inquiring about perceived controllability of the behavior), and previous preregistration experience
493 (one item: yes vs. no) will be included. We expect that higher scores on the attitude scale (i.e., more
494 positive attitudes, see *hypothesis 1.1*), higher scores on the subjective norm scale (i.e., higher

495 perceived social pressure, see *hypothesis 1.4*), higher scores on the perceived behavioral control
496 scale (i.e., higher perceived control, see *hypothesis 1.5*) are positive predictors for participants'
497 intention scores (i.e., higher intention to preregister their studies in the near future). Additionally,
498 we expect that perceived importance of preregistration is a positive predictor for intention (see
499 *hypothesis 1.3*), and also significantly moderates the strength of the influence of attitudes (see
500 *hypothesis 1.2*). Furthermore, we expect that the overall model including all predictors can
501 significantly predict researchers' intention to preregister their studies in the future (see *hypothesis*
502 *1.6*). Because of these directional hypotheses, the regression weights will be tested in a one-tailed
503 fashion. Standardized regression weights will be interpreted and compared. Preregistration
504 experience will be included into the model to control for a potential sampling bias. We have no
505 strong predictions regarding the direction of this effect, since it might be the case that a) researchers
506 who have used preregistration before are more likely to preregister again or b) that their
507 preregistration experiences were negative and they will less likely preregister again. Therefore, in
508 contrast to the other predictors, this effect will be tested in a two-tailed fashion.

509 If all main predictors (attitudes, subjective norm, perceived behavioral control, perceived
510 importance, and its interaction with attitudes) and the overall model are significant (*support for all*
511 *hypotheses 1.1–1.6*), we will conclude that the theory of planned behavior is indeed well suited to
512 be used to predict researchers' intention to preregister. If the overall model, but not all predictors
513 are significant (*support for hypothesis 1.6, no or partly support of hypotheses 1.1–1.5*), the theory
514 of planned behavior will still be seen as applicable, with the significant predictors being more
515 relevant in the context of preregistration than the non-significant ones. If the individual predictors
516 as well as the overall model are not significant (*no support for hypotheses 1.1–1.6*), it will be
517 concluded that the theory of planned behavior cannot be applied to the context of predicting

518 researchers' intention to preregister, but that it might be beneficial to test it again with other open
519 science techniques.

520 The second hypothesis predicts that research experience (i.e., the years someone has worked
521 in research) influences researchers' attitudes (see *hypothesis 2.1*) as well as motivations (see
522 *hypothesis 2.2*) and the perception of obstacles (see *hypothesis 2.3*). To investigate this, three
523 multiple regression models will be computed: Mean scores on the attitude scale (i.e., mean score
524 of 24 items inquiring about how positive preregistrations are perceived), motivation scale (i.e.,
525 mean score of ten items measuring how strongly participants agree with potential motivations to
526 preregister), and obstacle scale (i.e., mean score of ten items measuring how strongly participants
527 agree with potential obstacles to preregister) will serve as dependent variables in the respective
528 regression models, while research experience (i.e., the years someone has worked in research) and
529 the preregistration experience (control variable) will serve as predictors. As our hypotheses
530 regarding the impact of research experience on attitudes, and intensity of motivations and perceived
531 obstacles are non-directional, the regression weights will be analyzed with two-tailed tests. As three
532 regressions will be conducted to test one set of hypotheses, a Bonferroni-Holm correction will be
533 used to adjust the alpha level. The assumptions for these regressions will be tested in the same
534 manner as those of the regression model for hypothesis 1 (see above).

535 If all three regression models show significant effects (*support for hypotheses 2.1–2.3*), we
536 will conclude that research experience has an influence on how researchers perceive
537 preregistration, as well as its motivations and obstacles. If only one or two of the regression models
538 are significant (*partly support of hypotheses 2.1–2.3*), we will conclude that only for these scales,
539 research experience has an influence, while if no significant effects can be detected (*no support for*

540 *hypotheses 2.1–2.3*), we will conclude that, against our predictions, research experience has no
541 influence on attitudes, motivations, and perceived obstacles concerning preregistration.

542

543 **Pilot study**

544 A pilot study was conducted to estimate the response rate and to test the recruitment method
545 as well as the survey items. The pilot study featured mostly the same items as the main study but
546 additional items, prompting participants for feedback about comprehensibility via open text input
547 fields, were presented (“Did you have any problems answering the items of this page? Was
548 anything unclear?”). Some items were adjusted based on the results. Quotas were not applied.

549 We invited $N = 200$ participants to partake in the pilot study (100 were invited from OSF
550 Registries, 50 from Web of Science, and 50 from PubMed) and sent a reminder one week after the
551 initial invitation. Participations typically occurred shortly after each email contact. The pilot study
552 was accessible for one month overall. In this time, 29 participants started the survey of which 20
553 completed it, yielding an overall response rate of 10%. Out of these 20, 18 (90%) participants had
554 preregistration experience. No specific patterns in dropout behavior were found (e.g., dropping out
555 at a certain position). No floor or ceiling effects were found. Reliability analyses for the measured
556 scales were conducted, which showed a very high reliability for the attitude ($\alpha = 0.90$) and obstacle
557 scale ($\alpha = 0.87$), an acceptable reliability for the motivation scale ($\alpha = 0.77$), and a moderate
558 reliability for the subjective norm ($\alpha = 0.65$) and perceived behavioral control scale ($\alpha = 0.63$). One
559 item of the motivation scale correlated negatively with the remaining scale items and Cronbach’s
560 alpha increased by removing it (item M2, see S3 Table). Nevertheless, the item will remain in the

561 survey and will be checked again in the main study, since the pilot results are based on a very small
562 sample and can only be interpreted with caution.

563 After conducting the pilot study, the sampling strategy was revised by extending the
564 recruitment of participants to four instead of two general databases for psychological articles and
565 by inviting less participants via OSF Registries (10% instead of 50%). Moreover, some comments
566 indicated ambiguous interpretations which led us to slightly modify the wording of respective items
567 or to change categories (i.e., academic position was replaced by academic degree in the
568 sociodemographic part of the survey). Lastly, a few items were added, e.g., two items assessing
569 intention following a manual about constructing questionnaires based on the theory of planned
570 behavior [57].

571

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576

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850

851 **Supporting information**

852 **S1 Text. Power analyses.** Power analyses for both hypotheses are presented here. For hypothesis
853 1, power analyses were performed for the entire model as well as for the individual predictors.

854 **S2 Text. Data collection procedure.** The data collection procedure that is displayed in Fig 2 is
855 further specified. Particularly, the specific procedures for collecting contact addresses as well as
856 for inviting participants are described.

857 **S3 Table. Survey items.** The items of the survey are presented. If they were derived from other
858 studies, the original items as well as references are given.

859 **S4 Video. Screen recording of the survey procedure (version A).** This screen recording shows
860 the procedure of the survey for participants that responded with “yes” on the item “Have you
861 preregistered a study before?” (as this is a filter question for some of the following items) and who
862 answered the knowledge check of the preregistration definition correctly.

863 **S5 Video. Screen recording of the survey procedure (version B).** This screen recording shows
864 the procedure of the survey for participants that responded with “no” on the item “Have you
865 preregistered a study before?” (as this is a filter question for some of the following items) and who
866 were shown the definition of preregistration again due to errors in the knowledge check.

867 **S6 Script. Preprocessing script (preliminary).** This R script contains all steps of preprocessing.
868 The hereby processed data will be used for the assumption tests as well as for the descriptive reports
869 and hypotheses tests. If necessary, small changes may be made to enable correct functioning (when
870 variables have been inserted).

871 **S7 Script. Assumption testing script (preliminary).** This R script will be used for testing the
872 assumptions of the statistical models used to test hypotheses 1 and 2. If necessary, small changes
873 may be made to enable correct functioning (when variables have been inserted).

874 **S8 Script. Analysis script (preliminary).** This script will be used to conduct the descriptive
875 reports as well as the hypotheses tests of the survey. If necessary, small changes may be made to
876 enable correct functioning (when variables have been inserted). Furthermore, analyses might be
877 added if alternative approaches need to be used (due to assumption violation).