Registered Reports with Developmental and Secondary Data: Some Brief Observations and Introduction to the Special Issue

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Abstract

Registered reports are a relatively new type of journal article format in which the decision to publish an article is based on sound conceptualization, methods, and planned analyses, rather than the specific nature of the results. Registered reports are becoming increasingly instituted in journals across the sciences, but mostly in experimental contexts. Relatively few of these journals pertain directly to developmental research with adolescents, emerging adults, and adults, which tend to use more complex methods, or at least methods that involve a greater degree of flexibility. This article describes lessons learned through editing a special issue focused on registered reports based on analyses of a single existing dataset, the Emerging Adulthood Measured and Multiple Institutions 2 project. These observations should be helpful for researchers interested in preparing registered report submissions using developmental and secondary data.

Keywords

Registered Reports, Open Science, Preregistration, Replication, Emerging Adulthood

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The last decade has been a time of major disruption across psychological science and the sciences more broadly. This change was precipitated by a series of events, including the publication of research evidence for unfathomable claims (most notably extra-sensory perception, Bem, 2011), failures to replicate previously “established” findings (Open Science Collaboration, 2015), and outright fraud that led to dozens of retractions (e.g., social psychologist Diederik Stapel, see Callaway, 2011). While there are certainly many areas of psychological science that continue to produce rigorous, reliable research, these notable events and others have led to what has been variously referred to as the “replicability crisis,” “credibility revolution,” and the “open science movement” (see Gelman, 2016, Spellman, 2015, Spellman, Gilbert, & Corker, 2018, and Vazire, 2018 for reviews).

This “crisis” is an opportunity to reflect on our current research practices and work towards building a stronger science. Many reforms have been promoted and one practice with broad applicability is the use of preregistration plans when designing studies (Nosek et al., 2018). Preregistration refers to formally outlining and officially registering research hypotheses, study design, and analysis plans in advance. Preregistration allows for a clearer distinction between confirmatory and exploratory analyses and, in particular, constrains the use of questionable research practices (John et al., 2012), and eliminate the presentation of exploratory findings as though they are confirmatory (e.g., HARKing; Hypothesizing after the results are known; Kerr, 1998).

The value of preregistration rests in its ability to enhance transparency by specifying what the researchers intended prior to actually working with their data. In our view, the transparency afforded by preregistration is a necessary, but not sufficient behavior to ensure the *credibility* of reported research findings. Just because a study was preregistered does not mean the study is high quality, the analysis plan was ideal, or that the research produces the level of evidence needed to support the target claim. Preregistrations vary in terms of specificity from barely outlining a research question (“Construct X will be associated with Construct Y”) to highly specified plans involving simulated data.

Moreover, with preregistration plans the “map is not the territory”; that is, just because researchers specified a plan does mean that they actually followed the plan. Indeed, comparisons of preregistration plans to reported analyses indicate frequent unexplained deviations (Claesen et al., 2019; Li et al., 2018; Mathieu, 2009). To be sure, there can often be good reasons to deviate from the plan, as through the course of the study researchers can come to realize that they made errors in the plan or that an alternative analytic strategy would be a more suitable approach. Nevertheless, within the current system, journal editors and reviewers appear to generally not hold authors accountable to their preregistered plans, greatly diminishing their potential value. This is understandable given editorial workloads but this explanation does not change the reality that it is important to compare published findings and manuscripts to the associated pre-registration.

Within this context of the limits of preregistrations, a new article format has emerged: registered reports. Registered reports are a results-independent publishing format (Chambers, 2013; Nosek & Lakens, 2014). Rather than the traditional process of submitting a full research report to a journal for review, with registered reports authors submit only the Introduction, Method, and Planned Analysis sections. This *Stage 1 Proposal* is what is sent out to reviewers and is the basis of the primary editorial decision. The same general decisions apply: accept, reject, or revise and resubmit, but those decisions are based on the conceptualization and methodology of the study, not based on the actual findings, thereby curbing publication bias. The ultimate positive decision of a Stage 1 Proposal is an *in-principle acceptance*, which is basically a guarantee to publish the final report so long as the authors carry out the study as planned and are judged to have done so competently. This assurance of publication relieves the pressures of having to find a statistically significant effect that might otherwise lead researchers to questionable practices.

Upon receiving the in-principle acceptance, authors go ahead and conduct the full study and submit a *Stage 2 Report*, which resembles a traditional journal article. This report is sent to reviewers for evaluation of technical accuracy and adherence to the preregistered plan, but the actual nature of the findings is irrelevant to the evaluation. As with any preregistered study, it can consist of both planned confirmatory analyses and exploratory analyses that emerged through the course of the study. The only requirements are that the two are clearly differentiated and labeled in the final report, and that inferences based on exploratory analyses are appropriately calibrated.

Registered reports are increasingly adopted across scientific disciplines; as of June 2020, 244 journals accept registered reports as a regular submission or have featured registered reports in a special issue, including *Emerging Adulthood* (see <https://cos.io/rr/>). These journals span multiple disciplines, such as medicine, ecology, economics, and several sub-disciplines of psychology (personality, social, health, cognition). Relatively few of these journals, however, pertain directly to developmental research. Those few journals within developmental science that have adopted registered reports are skewed towards infant and child development studies, which tend to rely heavily on experimental methods (e.g., *Developmental Science*). Developmental research with adolescents, emerging adults, and adults tends to use more complex methods, or at least methods that involve a greater degree of flexibility. Much of this work also relies on secondary data analysis and/or large data sets collected by a single lab that can lead to multiple papers. Such situations often afford researchers a near-infinite amount of flexibility in their analyses (e.g., sample inclusion, data exclusion, measure creation, outcome selection, modeling choices). This flexibility leads to concerns about capitalization on chance thereby raising concerns about the robustness of findings.

The current special issue represents the first set of registered reports published in *Emerging Adulthood*. The collection is somewhat unique within the realm of registered reports, because not only are they all based on analyses of existing data, but they all come from the same dataset: the Emerging Adulthood Measured and Multiple Institutions 2 project (EAMMi2; <https://osf.io/te54b/>). The EAMMi2 project, described in more detail in Grahe et al. (2018), is a collaboration among 32 primarily U.S. institutions with a sample of over 4,000 emerging adult participants who completed a variety of measures of central relevance to emerging adulthood research (e.g., identity, relationships, media, attitudes). For the current special issue, authors submitted Stage 1 proposals for review based on variables included in the dataset, prior to working with any of the data.

Although there were certainly some bumps along the road, the project generally indicated to us that registered reports with secondary data are not only possible, but that they are desirable. Some of the considerations that arose in the five papers in this collection included how to fit measurement models (Faas et al., 2020), conducting power analyses when using subgroups of unknown size (Chalk et al., 2020), analyses based on multi-level models when the amount of variance at each level is not known (Grahe et al., 2020), creating a reasonable set of alternative models to compare to the target model (Barlett et al., 2020), and creating indices from items without knowing how well they will hang together (Leighton et al., 2020). In all cases, authors needed to rely on the best possible prior information to make informed decisions, but also to think through different contingency plans if that prior information did not comport with reality.

In addition to these specific issues, nearly all of the papers needed to address one or more of the following prior to conducting the analyses. We specify these issues here as they could be useful for future researchers preparing registered reports for submission:

1. Specification of hypotheses that are detailed and singular. It is not uncommon to come across a hypothesis that, if broken down, actually consists of multiple related independent or dependent variables within a similar conceptual set. Vague hypothesizing of this kind potentially allows for many different combinations of variables that could provide evidence in support of the hypothesis. Moreover, hypotheses of interactions should be specific about the type of interaction that is expected. An ideal would be to even sketch out the form of the interaction graphically. The basic issue is that researchers should describe how theoretical predictions will be operationalized with statistical tests in the registration.

2. Any test of a hypothesized model should also include a test of at least one plausible alternative model. Doing so is particularly important for cross-sectional data, where nearly any arrangement of variables in a process model (e.g., mediation) is plausible. Accordingly, discussion and interpretation of cross-sectional process models should clearly indicate that they do not constitute a strong test of the hypothesized process. Similarly, measurement models (e.g., confirmatory factor analysis [CFA]) should always include a range of possible factor solutions (e.g., 1 factor vs. 3 factors) to determine relative fit rather than testing a single target model against fit benchmarks.

3. There should be a clear description of the approach to statistical inference. For example, will supporting evidence be determined when a specific p-value threshold is reached, or a minimum effect of interest is observed? As a field we treat an alpha of .05 (usually with two-tailed tests) as a natural standard rather than an arbitrary choice. Be clear, and be specific. Given the large sample sizes of many secondary

dataset, the conventional $p < .05$ benchmark may not be the optimal choice especially when many tests are conducted. A minimum effect size of interest seems more promising but that standard also raises concerns as to when something is too small to matter in both theoretical and practical terms. These are complicated issues and researchers are well served to anticipate those issues in the registration.

4. The inclusion of covariates/control variables must always be justified. When covariates are justifiably included, the analyses should be done both with and without the covariates, and any discrepancies between the two models should be reported in the manuscript.

5. Missing data should be treated in accordance with currently accepted best practices, which involves the use of full information maximum likelihood or multiple imputation rather than listwise deletion. This is particularly important when the amount of missing data is moderate to large; if the amount of missing data is small, then listwise deletion may be justifiable on practical grounds given the ease of implementation in most statistical packages.

6. Preregistration does not obviate the need for basic descriptive analyses to give researchers and readers a context for more complicated analyses. Descriptive statistics and correlations for study variables should be thoroughly reported. In fact, most every paper should always have, as its “Table 1,” a matrix that includes means, standard deviations, and intercorrelations for all study variables.

The preceding list is by no means meant to be exhaustive, but rather a list of notable issues that came up through the course of this special issue and our other work on registered reports and preregistration. We urge readers to consult some of the more extensive articles describing preregistration and registered reports with secondary data (van den Akker et al., 2019; Weston et al., 2019).

Nosek et al. (2019) acknowledge that preregistration can be difficult, but note that it improves with practice. We agree. In that spirit, we urge authors to submit their work as registered reports to *Emerging Adulthood* to gain some experience with this tool. The journal has received *very* few registered reports submissions since the format was formally announced in October 2018. We believe strongly that registered reports are one of the major reforms that can make immediate and lasting impacts on the credibility of our science. To do so, however, we must all participate. And it is a process that should be at least somewhat familiar to researchers as it mimics the procedures used for many theses and dissertations (at least in the U.S.) - a proposal evaluation followed by an evaluation of the completed project.

As a final note, we find that registered reports provide for a more collaborative experience for editors, reviewers, and authors. The possibility of revising Stage 1 proposals, allows for editorial input that can improve the research plan to make for a stronger paper. Even a rejection at Stage 1 might feel less painful given that authors have not worked so hard to create an entire manuscript only to find that a journal does not find the topic or approach compelling enough to warrant consideration. The burden on reviewers and editors is spread over time given that Stage 1 submissions are about half as long as a traditional manuscript. And the opportunity to read the Stage 2 final report is a chance to find out the answers to the research questions posed in Stage 1, much like the excitement of picking up a story after a cliff-hanging chapter or episode. Indeed, we believe there is something inherently fun about registered reports and invite others to try it out.

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