**Factors relating to nonpublication and publication bias in clinical trials in Canada: a qualitative interview study**

Running title: Factors relating to clinical trial reporting

R L Morrow, senior research analyst, richard.morrow@ubc.ca,1 B Mintzes, associate professor, barbara.mintzes@sydney.edu.au,2 G Gray, associate professor, gcgray@uvic.ca,3 M R Law, professor, michael.law@ubc.ca,4 S Garrison, associate professor, scott.garrison@ualberta.ca,5 C R Dormuth, associate professor, colin.dormuth@ubc.ca1

Author information:

1. Department of Anesthesiology, Pharmacology & Therapeutics, University of British Columbia, Vancouver, BC, Canada
2. School of Pharmacy, University of Sydney, Sydney, NSW, Australia
3. Department of Sociology, University of Victoria, Victoria, BC, Canada
4. Centre for Health Services and Policy Research, School of Population and Public Health, University of British Columbia, Vancouver, BC, Canada
5. Department of Family Medicine, University of Alberta, Edmonton, AB, Canada

Corresponding author: Richard L. Morrow, University of British Columbia, 210-1110 Government St., Victoria, BC V8W 1Y2‎ Canada. Tele: 250-590-5955, Fax: 250-590-5954, email: richard.morrow@ubc.ca. (This email address can be published.)

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**WHAT IS ALREADY KNOWN ABOUT THIS SUBJECT**

Many clinical trials are not published and positive trials are more likely to be published than negative trials.

Reasons given for nonpublication in surveys of investigators, such as lack of time or low priority of study, are difficult to interpret.

Academic criteria for hiring and promotion often include the number of articles published and publication in prestigious journals.

**WHAT THIS STUDY ADDS**

Reporting practices are shaped by powerful incentives within the research system which favour publication of positive over negative trials.

Trial investigators more strongly associated positive clinical trials than negative trials with funding opportunities and academic promotion, bonuses, and recognition.

Research institutions tended to lack well-resourced, proactive policies and practices to ensure trial findings are reported in registries or journals.

**ABSTRACT**

**Aim:** To understand factors contributing to nonpublication and publication bias in clinical trials in Canada.

**Methods:** Qualitative interviews were conducted between March 2019 and April 2021 with 34 participants from the Canadian provinces of Alberta, British Columbia, and Ontario, including 17 clinical trial investigators, 1 clinical research coordinator, 3 research administrators, 3 research ethics board members, and 10 clinical trial participants. We conducted a thematic analysis involving coding of interview transcripts and memo-writing to identify key themes.

**Results:** Several factors contribute to nonpublication and publication bias in clinical trial research. A core theme was that reporting practices are shaped by incentives within the research system which favour publication of positive over negative trials. Investigators are discouraged from reporting by experiences or perceptions of difficulty in publishing negative findings but rewarded for publishing positive findings in various ways. Trial investigators more strongly associated positive clinical trials than negative trials with opportunities for industry and nonindustry funding and with academic promotion, bonuses, and recognition. Research institutions and ethics boards tended to lack well-resourced, proactive policies and practices to ensure trial findings are reported in registries or journals.

**Conclusion:** Clinical trial reporting practices in Canada are shaped by incentives favouring reporting of positive over negative trials, such as funding opportunities and academic promotion, bonuses, and recognition. Research institutions could help change incentives by adopting performance metrics that emphasize full reporting of results in journals or registries.

### Introduction

Clinical trials are essential for informing drug development and clinical practice, but many trials are not published and positive trials are more likely to be published than negative trials.1-3 A systematic review estimated the proportion of studies included in trial registries that were published as journal articles, based on studies of nonpublication assessing publication status after a minimum of 24 months from study completion.3 It found that only 54.2% of all registered studies and 60.3% of randomized controlled trials were published. Nonpublication and publication bias undermine our understanding of the efficacy and safety of treatments and lead to avoidable waste of research and health care resources.4-6

The United States (US) and European Union (EU) require results of many clinical trials to be reported within trial registries, and some noncommercial funders of health research similarly require grant recipients to report clinical trials results.7-9 However, compliance with US and EU regulatory reporting requirements has been low,7 9 and a study of top noncommercial funders globally by expenditure found that only a minority required all summary results to be reported and even fewer specified a timeline for reporting.8 Canada has not introduced similar regulatory requirements to publicly report clinical trial results. In addition, the Canadian Institutes of Health Research (CIHR) only recently introduced a requirement that trial investigators must report the results of trials funded by the agency within a specific timeframe of 12 months from completion of data collection on a trial’s primary outcome.10 11 12

Multiple factors likely contribute to nonpublication and publication bias in clinical trial research. Commercial incentives may contribute to selective reporting of industry-sponsored trials.12 Systematic reviews have examined factors contributing to nonpublication of biomedical and health-related studies, based on reasons provided by investigators.13 14 However, the ambiguity of reasons commonly given for nonpublication, such as a lack of time or the low priority of a study, make these studies difficult to interpret.14

While researchers have clearly documented the problem of selective reporting of clinical trials for over three decades,1-4 15-17 the range and interrelation of factors which contribute to nonpublication and publication bias are less well understood. We conducted a qualitative interview study to investigate factors related to clinical trial reporting in Canada. The analysis reported in this paper aimed to understand factors contributing to nonpublication and publication bias in clinical trials in Canada. We have separately published findings from these interviews relating to industry sponsor influence in clinical trial reporting.18

### Methods

Our study used a qualitative research design involving semistructured, in-depth interviews with clinical trial investigators, a clinical research coordinator, research administrators, research ethics board (REB) members, and clinical trial participants. 20-22Interview data were analyzed using thematic analysis.19 We aimed to improve reliability of the study through triangulation of data from different types of participants.20 The backgrounds of members of the research team included clinical trials, medicine, pharmacoepidemiology, pharmaceutical policy and regulation, qualitative methods, and sociology. The Standards for Reporting Qualitative Research (SRQR) checklist was used to guide reporting of this study.21 25

Sampling and recruitment

This study used purposive sampling to create a diverse sample of interview participants. We aimed to include clinical trial investigators from a range of fields, past trial participants from trials of treatments for a variety of medical conditions, and others involved in the conduct, administration or ethical review of clinical trials. We also invited participation from individuals in different provinces in Canada— Alberta, British Columbia (BC), and Ontario—to include a broader range of perspectives. Inclusion criteria for each type of study participant and the rationale for each of these criteria are shown in **Table 1**.

Past trial participants were recruited primarily through clinical research coordinators at two research centres in BC and one research centre in Alberta, who sought consent for us to contact past trial participants from their centres, and one trial participant was recruited through a newspaper advertisement in Victoria, BC. We followed up by email or telephone with anyone who consented to be contacted and the one trial participant who responded to our advertisement.

Some trial investigators were identified online in the ClinicalTrials.gov trial registry,22 the Canadian Clinical Trials Asset Map database,23 and websites of research centres identified through the CenterWatch clinical trial database.24 Research administrators and other trial investigators were identified online through two faculties of medicine, one university-industry liaison office, and four university-affiliated research centres or networks. Ethics board members were identified in online member lists of two ethics boards. We invited participation by email and also recruited four trial investigators and one REB member through snowball sampling. Trial participants and trial investigators were offered a $50 honorarium for participation.

Data collection and analysis

Interview data were collected between March 2019 and April 2021. Semistructured, individual interviews were conducted either in person or by telephone based on interview guides developed for each type of participant (see **Supplementary Appendix**). One interview involved both a trial investigator and clinical research coordinator. Interviews lasted approximately 45 to 60 minutes. Shorter follow-up interviews were conducted with 4 of 34 participants in our study. Additional interviews were conducted until data allowed for a thorough analysis of factors relating to nonpublication and publication bias. All interviews were audio-recorded and transcribed. One member of the research team (RM) conducted the interviews and coded the interview data.

We conducted a thematic analysis of interview data using ATLAS.ti qualitative software, version 8.19 25 26 Coding of interview transcripts involved developing provisional codes to characterize processes relating to clinical trial reporting and the meanings attached to them by interview participants. Subsequently, transcripts were re-analyzed to identify, retain and refine the most important codes. Coding and memo-writing informed the identification of key themes.

### Results

Interviews were conducted with 34 participants from the Canadian provinces of Alberta, British Columbia and Ontario. This included 17 clinical trial investigators, 1 clinical research coordinator, 3 research administrators, 3 REB members, and 10 clinical trial participants. (**Table 2**). Some interview participants were able to speak about their experiences as both trial investigators and research administrators or REB members. Specialties of participating trial investigators included cardiovascular medicine, endocrinology, hepatology, infectious diseases, oncology, psychiatry, and rheumatology. The majority of trialists interviewed (10) had been an investigator in at least one unpublished trial, and two additional trialists were investigators in trials that they aimed to publish in future but were currently unpublished after 3 or more years from trial completion.

We identified several themes in the study data relating to factors relating to clinical trial reporting. This includes themes relating to investigator incentives that contribute to nonpublication and publication bias: (1) Funding, promotion, bonuses, and recognition as rewards for publishing positive trials, and (2) Difficulty in publishing negative findings as a disincentive to publishing negative trials. It also includes themes relating to experiences and views of the policy context in which nonpublication occurs: (3) “Nobody making sure that my work is published”: a lack of policy at research institutions, (4) Views on nonindustry funder policies to improve clinical trial reporting, (5) Views on how research ethics boards could improve clinical trial reporting, (6) “There should be some mechanism”: views on regulating clinical trial reporting, and (7) Views on the importance of policy to address nonpublication. These themes are presented below, along with selected quotations from trialists (T1-T17), research administrators (A1-A3), and REB members (R1-R3).

Investigator incentives contributing to nonpublication and publication bias

Funding, promotion, bonuses, and recognition as rewards for publishing positive trials

Accounts from several interview participants suggested academic incentives to publish are stronger for positive than for negative trials due to funding opportunities, promotion, bonuses and recognition. An oncologist described how a positive trial may be more likely to lead to additional research funding: “If I have a positive . . . phase 2 study, that may well lead to a phase 3 study, which often ends up getting picked up by industry.” (T3) A research administrator and investigator in cardiovascular trials talked about recognition, promotion, and funding: “You're going to get a lot more recognition for a positive trial than you do for a negative trial. And that recognition is important for your own advancement as far as promotion and tenure purposes, but also advancement in terms of getting further grants.” (A1) Investigators described pressures to publish in prestigious journals, which was linked to promotion and faculty merit bonuses. As investigators commonly felt that positive findings were easier to publish in a high-impact-factor journal, positive trials were associated with not only recognition but also promotion and financial reward.

While reporting trials with positive findings may be more highly rewarded, some interviewees felt there were also rewards for reporting trials regardless of the trial outcome. Although some investigators commented on the emphasis on publishing in prestigious journals, a few investigators indicated that the number of articles an investigator had published would show academic productivity, which could help lead to promotion or be a contributing factor in merit bonuses. An REB member who conducted trials felt that in her field negative trials were valued, so she was not sure there was a stronger incentive to publish positive trials.

When asked about the possibility of changing incentives that may favour reporting positive trials, some investigators suggested that research institutions could play a role. An oncologist suggested that whether trials have been reported could be considered at the time of a faculty member’s annual review and could be tied to promotion. Similarly, an investigator in psychiatry suggested that reporting practices could be linked to “the system of rewarding the researcher for the work done,” such as withholding bonuses when findings are not reported. (T17) Two researchers indicated that changing the culture or communication within their research institutions could be beneficial, such as recognizing negative trials, rather than primarily positive findings, in faculty or hospital newsletters.

Difficulty in publishing negative findings as a disincentive to publishing negative trials

Many trial investigators felt it was more difficult to publish a negative trial than a positive trial, and several also believed it was more difficult to publish negative findings in a journal with a high impact factor. Some investigators noted that certain journals have policies to publish negative trials, or to not reject manuscripts based on importance, or that they had not had difficulty publishing negative findings. However, the challenge of publishing negative trials, particularly in prestigious journals, was a common theme. This was reflected in the comments of a research administrator who is also an investigator in cardiovascular trials: “I would like to stress that it can be sometimes extremely difficult to publish a negative study. . . . We did a study on a new compound, and the study was, I think, extremely well-conducted . . . but it came out to be negative, and all the big journals just weren't interested.” (A1) One investigator commented on the reason negative trials may be rejected for publication, based on her experience as a reviewer: “I'm a reviewer on many journals, and if there's no value add, trials aren't published. So they're not going to take a clinical trial if there's no value add . . . . It's not interesting. It doesn't change clinical care, it doesn't provide any extra information.” (T12) Given investigator perceptions of the difficulty of publishing negative findings in journals, it is notable that some interview participants highlighted the value of reporting in trial registries.

Experiences and views of policy context in which nonpublication occurs

“Nobody making sure that my work is published”: a lack of policy at research institutions

Investigator and research administrator accounts suggested their universities and research institutions tended to lack established, proactive policies and practices to ensure trial findings are reported. When asked whether his research group had any policy related to clinical trial reporting, an oncologist said he was not aware of one, and added: “Based on my past experience, there is nobody making sure that my work is published.” (T3) One administrator was involved with efforts to promote trial reporting through what he referred to as a “soft approach,” including an initiative to monitor whether registered trials were reported and remind investigators about trials with unreported results, and a pilot project facilitating the use of protocol development software that would make it easier to report findings within ClinicalTrials.gov. (A2) However, these efforts were preliminary and hindered by a lack of guiding policy and a lack of resources.

In contrast, a few oncologists described a more established, proactive approach toward promoting trial reporting at a national group which centrally facilitates cooperative group trials. This approach includes monitoring timelines and the possibility of transferring responsibility for writing a manuscript to another investigator if the principal investigator does not move forward with timely reporting. This process was perceived to be effective in ensuring reporting of at least most trials. One investigator suggested the national group needed to ensure trials were reported in order to secure funding renewals. In effect, the success of the national group’s approach may in part reflect the important role that research funders may play in incentivizing clinical trial reporting.

The comments of one administrator suggested research institutions may be unlikely to address the issue of unreported trials on their own, but might act in response to external pressure or policy creating the incentive for them to take action. The administrator’s institution was sensitive to “reputational risk of being identified as a nonpublisher” by the AllTrials campaign, but he highlighted it was difficult to convince his institution to dedicate resources to consistent monitoring of clinical trial reporting without further external pressure: “That's where I'd like to see us shore that up a bit more, but with 30 other competing priorities—without either media attention or a federal policy telling you have to do something—it slips.” (A2)

Views on nonindustry funder policies to improve clinical trial reporting

Research administrator accounts suggested nonindustry funders are in a position to influence reporting for trials they fund. One administrator highlighted that results of National Institutes of Health–funded clinical trials must be reported within ClinicalTrials.gov and nonreporting could be subject to enforcement actions. He suggested that if CIHR introduced a requirement that investigators must report findings from past trials in order to access future grants, this might change reporting practices. Similarly, another administrator commented that if CIHR required trial results to be reported as a condition for universities to hold CIHR funds, universities would become proactive in helping to ensure results from grant-funded studies were reported.

Views on how research ethics boards could improve clinical trial reporting

Accounts of interviewees suggested REBs did not typically play an active role in monitoring trial reporting or helping ensure trial results are reported. Among REB members, one felt REBs could monitor reporting of local trials but was concerned it might be too complicated to extend monitoring to international trials. The other two REB members interviewed were asked whether REBs could periodically audit whether trials the ethics boards had approved were reported in trial registries and publicly report their audit results. One REB member felt this would be valuable but highlighted REBs are overburdened and lack the necessary resources for this work. The other REB member, who was a university-based trial investigator, suggested it would be reasonable for REBs to audit trial reporting, if this were an institutional priority and adequately funded: “If the university as a whole feels that it is important, then we can advocate for it, and make the university pay for this decision and then do it.” (R2)

“There should be some mechanism”: views on regulating clinical trial reporting

Several investigators were supportive of regulators playing a role in ensuring clinical trials are reported. While Health Canada has not introduced clinical trial reporting requirements similar to those in force in the US or the EU, some investigators felt that requiring timely reporting within a trial registry would be a reasonable measure to help ensure dissemination of trial results. When asked about this type of requirement, one oncologist responded: “There should be some mechanism to ensure that . . . once your primary endpoint is met, then it's reported within a year.” (T12) An REB member felt it would also be reasonable to include potential fines in regulatory measures, as has been done in the US, as a consequence for failing to report results within a registry within the required time. However, some investigators were uncertain about whether Health Canada should play a role in ensuring clinical trials are reported, due to concerns about feasibility or whether it was important to address the issue of unreported trials.

Views on the importance of policy to address nonpublication

Several investigators felt it was important to address the issue that the results of many clinical trials are not reported in a journal or trial registry. Trial investigators and ethics board members expressed concerns regarding avoiding duplication of research or waste of resources, avoiding publication bias, and disseminating information on safety concerns. However, several investigators expressed uncertainty or ambivalence about the importance of addressing the issue of unreported trials. A few noted that they were uncertain about the extent of the problem or how much attention it required. A couple of investigators felt reporting trial results was important, but expressed skepticism about the value of trying to ensure that all trials are published. An oncologist noted that he was of “two minds.” He felt it was important to publish trial results for ethical reasons, but added: “My other view is that it didn't get published for a reason. Negative results, didn't really matter, nothing to learn from it per se. There should be some information somewhere about that trial . . . . If somebody tries to go back and do the same thing, they know not to.” (T1)

### Discussion

Several factors have contributed to nonpublication and publication bias in clinical trial research in Canada. Trial investigator accounts suggested some trials are not reported due to investigators placing a greater value on positive trials or perceiving it is less important to publish certain negative findings. However, a core theme emerging from this study is that reporting practices are shaped by incentives within the research system which favour publication of positive over negative trials. Investigators are discouraged from reporting by experiences or perceptions of difficulty in publishing negative findings, while they are rewarded for publishing positive findings in various ways. Publication of positive trials may be more likely to lead to funding from industry sponsors and nonindustry funders. Research institutions play a role in incentivizing publication of positive trials, by rewarding researchers who attract funding and publish in prestigious journals, through promotion, bonuses and recognition. Overall, policies and regulatory measures to promote trial reporting have been too weak and inconsistent to counterbalance the prevailing incentives which lead to nonpublication and publication bias. Research institutions and ethics boards tended lack proactive policies and practices to help ensure trials are reported. CIHR requirements to report clinical trial results did not previously specify a timeline for reporting. While regulatory requirements to report findings in registries similar to those in other jurisdictions could help promote reporting of trials, such measures have not been adopted in Canada.

Comparison with other studies

From early studies to more recent systematic reviews, studies examining reasons for nonpublication of medical and health-related studies have emphasized the role of investigators in nonpublication.13 14 27-30 This is reflected in two systematic reviews of studies which surveyed investigators on reasons for nonpublication.13 14 One suggested investigators are primarily responsible for nonpublication, as the majority of unpublished medical and health-related studies have not been submitted for publication.14 The other contended that investigators rather than journals are responsible for nonpublication of biomedical studies, because the expectation of journal rejection was not among the most common reasons given by investigators for nonpublication.13

In contrast, our study highlights that powerful incentives relating to recognition and career advancement may underlie investigator decisions on whether to submit a trial for publication. Among a range of other influences on clinical trial reporting, journals may play a role in shaping investigators’ reporting practices. A randomized controlled trial of reviewer behaviour suggested reviewers favour studies with positive results,31 although this finding differed from earlier observational studies of journal editorial decisions.32-34 On balance, these findings suggest journals may contribute to publication bias but likely play only a small direct role in the problem. However, any bias in the editorial review process of journals might also have indirect influence by deterring some investigators from submitting negative trials for publication.

In our interview study, the accounts of investigators and others connected to trial research associated positive trials with funding opportunities, promotion, bonuses, and recognition. Previous articles have noted that assessment of researchers for academic hiring and promotion often emphasizes the number and citations of articles published and publication in high-impact-factor journals35 36 and that research funders may rely on the impact factor of an investigator’s publications as an indirect measure of research quality.37 38 A critique of how value is assessed in biomedical research argued that scientists are rewarded for publishing novel, significant results, leading to nonpublication of high-quality studies with negative results.39 Our study strengthens empirical support for arguments that incentives within the research system contribute to nonpublication and publication bias. Our study also adds that positive trials may be more likely to lead to funding not only from granting agencies but also from industry sponsors. Our findings highlight that research institutions contribute to incentivizing publication of positive trials through not only promotion and hiring practices but also recognition of positive results in communications such as faculty and hospital newsletters. In addition, our study indicated research institutions and ethics boards tended to lack well-resourced, proactive policies to ensure trials are reported in journals or registries.

Policy implications

Policy actions to address nonpublication and publication bias may require changing incentive structures.6 35 37 39-41 This could involve research institutions adopting performance metrics that include an assessment of whether investigators have fully disseminated their research findings in journal articles or trial registries.6 35 37 39 40 Providing academic credit for posting results in a trial registry could help incentivize more timely reporting in registries.41 It may also be valuable for research institutions to implement programs to support researchers to report results in trial registries in a timely manner. This could be modelled on strategies used at some US medical schools to improve compliance with regulatory requirements to report clinical trials, which include dedicating resources, communicating with investigators, providing support and training, and monitoring compliance.42-44 REBs could support research institutions they are affiliated with to implement programs to support researchers to report results in trial registries, through sharing data they collect on trials to help monitor clinical trial reporting. Alternatively, REBs could promote reporting of clinical trials through periodic audits of clinical trials they have approved to contribute to quality improvement and increase accountability of research institutions and sponsors for reporting practices,45 although they would likely only be able to play this role if their responsibilities and budgets were adjusted to allow for this.

While research institutions have a role to play in helping ensure trial results are reported, our study suggested research institutions may be unlikely to address the issue of unreported trials in the absence of external pressure to take action. Moving toward full reporting of clinical trial results will likely depend on effective regulatory requirements to report trial results. Although compliance with regulatory requirements in the US and EU to report applicable clinical trial findings in trial registries has been low, it could likely be improved with consistent monitoring and enforcement of financial penalties.7 9 The FDA issued a notice of noncompliance to a trial sponsor for the first time in April 2021, and has stated it may pursue enforcement actions as necessary to help ensure trials are reported by responsible parties.46-48 Canada and other jurisdictions lacking similar regulatory requirements could promote clinical trial reporting by adopting such requirements, accompanied by monitoring and enforcement.

Nonindustry funder policies can play a role in helping ensure full reporting of trials through mandatory reporting requirements.8 37 38 CIHR recently introduced a requirement that principal investigators who receive clinical trial grant funding on or after January 1, 2022, must report trial results within 12 months of completion of data collection on the primary outcome to remain eligible for new CIHR funding.10 11 While the effectiveness of this policy will depend on whether it is consistently enforced, it is promising that the policy specifies a timeline and a meaningful consequence for noncompliance.

Strengths and weaknesses of the study

The qualitative design of the study allowed for an open-ended inquiry into nonpublication and publication bias in clinical trials through the accounts of clinical trial investigators and others connected to trial research. It was strengthened by the inclusion of participants from different provinces and trial investigators from a range of medical specialties. However, the study had limitations. The study included individuals involved in the conduct, administration or ethical review of trials, but did not include representatives of funders, journals, or regulators. Individuals who agreed to be interviewed might differ from those who did not, such as placing a higher value on full reporting of trials. As the study involved only participants in Canada, it is uncertain to what extent our findings are generalizable to other jurisdictions.

Conclusion

Clinical trial reporting practices in Canada are shaped by incentives favouring reporting of positive over negative trials, such as funding opportunities and academic promotion, bonuses, and recognition. Canadian universities and research institutions could help change incentives by more widely adopting performance metrics that emphasize full reporting of trial results in journals or registries. Health Canada could also play a central role in changing incentives by adopting regulatory measures to require timely reporting of results within a recognized clinical trial registry.

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**Data availability statement:** To preserve the privacy of interview participants, we are unable to share the interview data collected for this study.

**Author contributions:** Conception of study: RM. Substantial contributions to design of the work: RM, BM, GG, ML, CD. Acquisition and analysis of data: RM. Interpretation of data: RM, BM, GG, ML, SG, CD. Drafting the work: RM. Revising the work critically for important intellectual content: RM, BM, GG, ML, SG, CD. Final approval of the version to be published: RM, BM, GG, ML, SG, CD. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved: RM, BM, GG, ML, SG, CD.

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**Transparency statement:** The lead author affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as originally planned have been explained.

**Permissions statement:** Table 1, Table 2, and the interview guides in the Supplementary Appendix were created by the authors. Versions of these tables and the interview guides have previously been published, and they are reprinted with permission.

**Principal investigator statement:** Not applicable. This study did not involve an intervention with human participants beyond research interviews to collect data on their experiences and views.

### References

1. Canestaro WJ, Hendrix N, Bansal A, et al. Favorable and publicly funded studies are more likely to be published: a systematic review and meta-analysis. *J Clin Epidemiol* 2017;92:58-68. doi: https://dx.doi.org/10.1016/j.jclinepi.2017.08.004

2. Scherer RW, Meerpohl JJ, Pfeifer N, et al. Full publication of results initially presented in abstracts. *Cochrane Database Syst Rev* 2018;11:MR000005. doi: https://dx.doi.org/10.1002/14651858.MR000005.pub4

3. Schmucker C, Schell LK, Portalupi S, et al. Extent of non-publication in cohorts of studies approved by research ethics committees or included in trial registries. *PLoS One* 2014;9(12):e114023. doi: 10.1371/journal.pone.0114023 [published Online First: 2014/12/24]

4. Chalmers I. Underreporting research is scientific misconduct. *JAMA* 1990;263(10):1405-8.

5. Chalmers I, Glasziou P. Avoidable waste in the production and reporting of research evidence. *Lancet* 2009;374(9683):86-9. doi: https://dx.doi.org/10.1016/S0140-6736(09)60329-9

6. Chan AW, Song F, Vickers A, et al. Increasing value and reducing waste: addressing inaccessible research. *Lancet* 2014;383(9913):257-66.

7. DeVito NJ, Bacon S, Goldacre B. Compliance with legal requirement to report clinical trial results on ClinicalTrials.gov: a cohort study. *Lancet* 2020;17:1-9. doi: https://dx.doi.org/10.1016/S0140-6736(19)33220-9

8. DeVito NJ, French L, Goldacre B. Noncommercial funders’ policies on trial registration, access to summary results, and individual patient data availability. *JAMA* 2018;319(16):1721-23. doi: 10.1001/jama.2018.2841

9. Goldacre B, DeVito NJ, Heneghan C, et al. Compliance with requirement to report results on the EU Clinical Trials Register: cohort study and web resource. *Bmj* 2018;362:k3218. doi: https://dx.doi.org/10.1136/bmj.k3218

10. New CIHR requirements for registration and public disclosure of results from clinical trials [updated Feb 8, 2022. Available from: https://cihr-irsc.gc.ca/e/52810.html accessed Mar 19, 2022.

11. CIHR Policy Guide – Requirements for Registration and Disclosure of Results from Clinical Trials [updated Feb 8, 2022. Available from: https://cihr-irsc.gc.ca/e/52820.html accessed Mar 19, 2022.

12. Lexchin J. Sponsorship bias in clinical research. *Int J Risk Saf Med* 2012;24(4):233-42. doi: https://dx.doi.org/10.3233/JRS-2012-0574

13. Scherer RW, Ugarte-Gil C, Schmucker C, et al. Authors report lack of time as main reason for unpublished research presented at biomedical conferences: a systematic review. *J Clin Epidemiol* 2015;68(7):803-10. doi: https://dx.doi.org/10.1016/j.jclinepi.2015.01.027

14. Song F, Loke Y, Hooper L. Why Are Medical and Health-Related Studies Not Being Published? A Systematic Review of Reasons Given by Investigators. *PLOS ONE* 2014;9(10):e110418. doi: 10.1371/journal.pone.0110418

15. Hopewell S, Loudon K, Clarke MJ, et al. Publication bias in clinical trials due to statistical significance or direction of trial results. *Cochrane Database Syst Rev* 2009(1):MR000006. doi: https://dx.doi.org/10.1002/14651858.MR000006.pub3

16. Simes RJ. Publication bias: The case for an international registry of clinical trials. *Journal of Clinical Oncology* 1986;4(10):1529-41.

17. Song F, Parekh-Bhurke S, Hooper L, et al. Extent of publication bias in different categories of research cohorts: a meta-analysis of empirical studies. *BMC Med Res Methodol* 2009;9:79. doi: https://dx.doi.org/10.1186/1471-2288-9-79

18. Morrow RL, Mintzes B, Gray G, et al. Industry Sponsor Influence in Clinical Trial Reporting in Canada: A Qualitative Interview Study. *Clinical therapeutics* 2021 doi: https://dx.doi.org/10.1016/j.clinthera.2021.11.019

19. Guest G, MacQueen KM, Narney EE. Applied thematic analysis. Thousand Oaks: Sage Publications 2012.

20. Creswell JW. Qualitative inquiry & research design: choosing among the five approaches. Thousand Oaks, CA: Sage Publications 2013.

21. O'Brien BC, Harris IB, Beckman TJ, et al. Standards for reporting qualitative research: a synthesis of recommendations. *Academic medicine : journal of the Association of American Medical Colleges* 2014;89(9):1245-51. doi: https://dx.doi.org/10.1097/ACM.0000000000000388

22. ClinicalTrials.gov: United States National Library of Medicine; [Available from: https://clinicaltrials.gov/ accessed Mar 24, 2019.

23. Canadian Clinical Trials Asset Map: Canadian Clinical Trials Coordinating Centre; [Available from: https://www.cctam.ca/ accessed Mar 23, 2019.

24. CenterWatch Falls Church, VA [updated Sep 15, 2022. Available from: https://www.centerwatch.com/ accessed Sep 15, 2022.

25. ATLAS.ti [program]. 8 version: ATLAS.ti Scientific Software Development GmbH.

26. Charmaz K. Constructing grounded theory. 2nd ed. Los Angeles: SAGE 2014.

27. Dickersin K, Chan S, Chalmers TC, et al. Publication bias and clinical trials. *Control Clin Trials* 1987;8(4):343-53.

28. Dickersin K, Min YI, Meinert CL. Factors influencing publication of research results. Follow-up of applications submitted to two institutional review boards. *JAMA* 1992;267(3):374-8.

29. Hoeg RT, Lee JA, Mathiason MA, et al. Publication outcomes of phase II oncology clinical trials. *Am J Clin Oncol* 2009;32(3):253-7. doi: https://dx.doi.org/10.1097/COC.0b013e3181845544

30. Timmer A, Hilsden RJ, Cole J, et al. Publication bias in gastroenterological research - a retrospective cohort study based on abstracts submitted to a scientific meeting. *BMC Med Res Methodol* 2002;2:7.

31. Emerson GB, Warme WJ, Wolf FM, et al. Testing for the presence of positive-outcome bias in peer review: a randomized controlled trial. *Arch Intern Med* 2010;170(21):1934-9. doi: https://dx.doi.org/10.1001/archinternmed.2010.406

32. Lee KP, Boyd EA, Holroyd-Leduc JM, et al. Predictors of publication: characteristics of submitted manuscripts associated with acceptance at major biomedical journals. *Med J Aust* 2006;184(12):621-6.

33. Okike K, Kocher MS, Mehlman CT, et al. Publication bias in orthopaedic research: an analysis of scientific factors associated with publication in the Journal of Bone and Joint Surgery (American Volume). *J Bone Joint Surg Am* 2008;90(3):595-601. doi: https://dx.doi.org/10.2106/JBJS.G.00279

34. Olson CM, Rennie D, Cook D, et al. Publication bias in editorial decision making. *JAMA* 2002;287(21):2825-8.

35. Moher D, Naudet F, Cristea IA, et al. Assessing scientists for hiring, promotion, and tenure. *PLOS Biology* 2018;16(3):e2004089. doi: 10.1371/journal.pbio.2004089

36. Rice DB, Raffoul H, Ioannidis JPA, et al. Academic criteria for promotion and tenure in biomedical sciences faculties: cross sectional analysis of international sample of universities. *Bmj* 2020;369:m2081. doi: https://dx.doi.org/10.1136/bmj.m2081

37. Macleod MR, Michie S, Roberts I, et al. Biomedical research: increasing value, reducing waste. *Lancet* 2014;383(9912):101-4.

38. Tijdink JK, Schipper K, Bouter LM, et al. How do scientists perceive the current publication culture? A qualitative focus group interview study among Dutch biomedical researchers. *BMJ Open* 2016;6(2):e008681. doi: https://dx.doi.org/10.1136/bmjopen-2015-008681

39. Ioannidis JP, Khoury MJ. Assessing value in biomedical research: the PQRST of appraisal and reward. *JAMA* 2014;312(5):483-4. doi: https://dx.doi.org/10.1001/jama.2014.6932

40. von Elm E, Meerpohl JJ. Trial results reporting: FDA Amendments Act Final Rule needs enforcement. *The Lancet* 2020;395(10221):316-17. doi: https://doi.org/10.1016/S0140-6736(20)30105-7

41. Zarin DA, Fain KM, Dobbins HD, et al. 10-Year Update on Study Results Submitted to ClinicalTrials.gov. *New England Journal of Medicine* 2019;381(20):1966-74. doi: https://dx.doi.org/10.1056/NEJMsr1907644

42. Keyes A, Mayo-Wilson E, Nuamah P, et al. Creating a Program to Support Registering and Reporting Clinical Trials at Johns Hopkins University. *Acad Med* 2021;96(4):529-33. doi: https://dx.doi.org/10.1097/ACM.0000000000003806

43. O'Reilly EK, Hassell NJ, Snyder DC, et al. ClinicalTrials.gov reporting: strategies for success at an academic health center. *Clin Transl Sci* 2015;8(1):48-51. doi: https://dx.doi.org/10.1111/cts.12235

44. Snider SH, Flume PA, Gentilin SL, et al. Overcoming non-compliance with clinical trial registration and results reporting: One Institution's approach. *Contemporary clinical trials communications* 2020;18:100557. doi: https://dx.doi.org/10.1016/j.conctc.2020.100557

45. Savulescu J, Chalmers I, Blunt J. Are research ethics committees behaving unethically? Some suggestions for improving performance and accountability. *Bmj* 1996;313(7069):1390-93. doi: 10.1136/bmj.313.7069.1390

46. FDA Takes Action For Failure to Submit Required Clinical Trial Results Information to ClinicalTrials.Gov: United States Food and Drug Administration; [updated Apr 28, 2021. Available from: https://www.fda.gov/news-events/press-announcements/fda-takes-action-failure-submit-required-clinical-trial-results-information-clinicaltrialsgov accessed May 15, 2021.

47. Piller C. In a first, FDA cites violation of clinical trials reporting law. *Science*. https://www.sciencemag.org/news/2021/04/first-fda-cites-violation-clinical-trials-reporting-law.

48. US Food and Drug Administration. Notice of noncompliance issued pursuant to 42 U.S.C. 282(j)(5)(C)(ii) [updated Apr 27, 2021. Available from: https://www.fda.gov/media/148036/download?utm\_medium=email&utm\_source=govdelivery accessed Sep 18, 2021.

49. Rochon PA, Sekeres M, Hoey J, et al. Investigator experiences with financial conflicts of interest in clinical trials. *Trials* 2011;12(1) doi: 10.1186/1745-6215-12-9

**Table 1.** Types of interview participants and inclusion criteria

|  |  |  |
| --- | --- | --- |
| Participant type | Inclusion criteria | Rationale |
| Clinical trial investigator | Conducted ≥1 clinical drug trial | Will have experience relevant to trial reporting |
| Clinical research coordinator | Coordinated ≥1 clinical drug trial | May have experience relevant to clinical trial reporting |
| Research administrator | Knowledge of policy and practice related to dissemination of clinical trial findings and/or relations with trial sponsors | Contribute experience, knowledge and views from policy or administrative perspective |
| Clinical REB member | ≥1 year of experience as clinical REB member | Experience in ethical review and familiarity with practice and policy relating to clinical trial reporting |
| Past trial participant | Participated in ≥1 clinical drug trial while at least 18 years of age; participation in the 5 years prior to interview, but has now ended | Will have experience related to trial participation and trial reporting |

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**Table 2.** Interview participant characteristics

1. Trialists

|  |  |  |  |
| --- | --- | --- | --- |
| Characteristica |  |  | Trialists (n=17) |
| Primary appointment |  |  |  |
| University or academic teaching hospital |  |  | 10 |
| Other (e.g., private practice, cancer centre) |  |  | 7 |
| Experience in role |  |  |  |
| <=5 years |  |  | 0 |
| >5 years |  |  | 17 |
| Province |  |  |  |
| Alberta |  |  | 0 |
| British Columbia |  |  | 9 |
| Ontario |  |  | 8 |
| Types of funding |  |  |  |
| Nonindustry only |  |  | 0 |
| Industry only |  |  | 0 |
| Both industry and nonindustry |  |  | 17 |
| Most senior role |  |  |  |
| Principal Investigator for site |  |  | 3 |
| Principal Investigator for trial |  |  | 14 |
| Trial type |  |  |  |
| Single site only |  |  | 0 |
| Multiple site only |  |  | 1 |
| Both single and multiple site |  |  | 16 |
| Trialist has been an investigator in one or more unpublished trialsb |  |  | 10 |

a Classifications were based on those used for an investigator survey by Rochon et al (2011).49 Table 2 was created by the authors. This table has previously been published, and it is reprinted with permission.18 bTwo additional trialists were investigators in trials that were not published 3 or more years after trial completion but they aimed to be publish in future.

1. Research administrators, research ethics board members and clinical research coordinators

|  |  |  |  |
| --- | --- | --- | --- |
| Characteristic | Research administrators (n=3) | REB members (n=3) | Research coordinators (n=1) |
| Primary appointment |  |  |  |
| University or academic teaching hospital | 3 | 1 | 0 |
| Other (e.g., private practice, cancer centre) | 0 | 2 | 1 |
| Experience in role |  |  |  |
| <=5 years | 0 | 1 | 0 |
| >5 years | 3 | 2 | 1 |
| Province |  |  |  |
| Alberta | 1 | 1 | 0 |
| British Columbia | 0 | 2 | 1 |
| Ontario | 2 | 0 | 0 |

Research coordinator=clinical research coordinator REB=research ethics board

**Table 2.** Interview participant characteristics (continued)

1. Past trial participants

|  |  |  |  |
| --- | --- | --- | --- |
| Characteristic |  |  | Past trial participants (n=10) |
| Sex |  |  |  |
| Female |  |  | 7 |
| Male |  |  | 3 |
| Age |  |  |  |
| <=65 years |  |  | 5 |
| >65 years |  |  | 5 |
| Education, highest level completed |  |  |  |
| Elementary |  |  | 1 |
| Secondary |  |  | 3 |
| Community college |  |  | 1 |
| University |  |  | 5 |
| Province |  |  |  |
| Alberta |  |  | 3 |
| British Columbia |  |  | 7 |