Factors predicting publication of Cochrane reviews

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Potential competing interests

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Background: Cochrane reviews are regarded as being scientifically rigorous, yet the proportion of Cochrane protocols that are published as reviews and the average time to publication remains unclear. If the time to publication of Cochrane reviews is affected by factors such as statistically significant results, this may lead to inaccurate decisions. We aimed to identify the frequency of published Cochrane reviews, determine their time to publication, and examine the factors associated with time to their publication.

Methods: Retrospective cohort study of Cochrane protocols published in Issue 2, 2000. The publication status of these reviews was tracked up to Issue 1, 2008 in The Cochrane Library. The time from protocol publication to the first review publication and review factors predicting the time to publication were analyzed via univariate and multivariate analyses.

Results: There were 130 new Cochrane protocols published in Issue 2, 2000. After excluding 12; 25/118 (21.2%) were unpublished and 93/118 (78.8%) were published as Cochrane reviews. Thirty-seven reviews (39.8%) were updates. The median time to publication was 1.6 years (range: 0.1-7.3 years). An author change between the protocol and final review was associated with longer time to publication (p=0.002), while an updated review was associated with shorter time to publication (p=0.03).

Conclusions: Only 80% of Cochrane protocols were published as final Cochrane reviews. The median time to publication was 19 months yet some reviews took much longer. Strategies to decrease time to publication should be considered, such as providing support to reviewers when a change in authorship occurs.

Introduction

Publication bias occurs when studies with certain characteristics (e.g., study funding) have a greater likelihood of being published (1), and being published quicker (2), than studies without these characteristics. Previously we examined publication bias of systematic reviews (SRs) through a retrospective cohort study and found that the majority of them (301/372; 81%) were published after 8 years of follow-up (3). A shorter time to publication was associated with the review being updated (hazard ratio: 1.80 [95% confidence interval: 1.39 to 2.33 years]) while a longer time to publication was associated with the review having two published protocols, indicating changes to the review plan (hazard ratio: 0.33 [95% confidence interval: 0.12 to 0.90 years]). We did not examine the *review factors* (e.g., statistically significant results) in our previous study. As such, we conducted this study to examine the association between review factors and the time to publication of Cochrane reviews.

Methods

All new protocols published in Issue 2, 2000 of the Cochrane Database of Systematic Reviews were selected. Their status was tracked through searching The Cochrane Library until January 23, 2008 (Issue 1, 2008) and contacting corresponding authors or the Cochrane Review Group coordinator. Cochrane protocols that were split into more than one Cochrane review, taken over by another review group, published in the same issue as the final Cochrane review, published later than the review publication or not published for the first time in Issue 2, 2000 were excluded (3).

A comprehensive data abstraction form was developed and pilot-tested. The form was used to abstract review characteristics (e.g., number of authors), methodology used

by the reviewers (e.g., number of primary outcomes, inclusion of unpublished material, assessment of publication bias), and other factors (e.g., funding, number of updates).

In addition, the SR results and conclusions were classified using a system reported elsewhere (4). Briefly, results were classified as being non-statistically significant negative (e.g., unfavourable towards treatment intervention and $p>0.05$), statistically significant negative, neutral (i.e., effect size between 0.95 and 1.05 and the confidence interval crosses 1), non-statistically significant positive (e.g., favourable towards treatment intervention and $p>0.05$), statistically significant positive, and indeterminate (i.e., unable to judge; e.g., the SR lists 10 primary outcomes, all of which have different results). The conclusions were classified as being positive (i.e., authors stated that there is evidence of effectiveness), neutral (i.e., no evidence of effectiveness or they reported no opinion), negative (i.e., authors advised against use of the intervention or it was not recommended) or indeterminate (i.e., stated that there is insufficient evidence or that more research is required).

Published Cochrane reviews were analyzed via univariate and multivariate analyses. This was conducted by taking the log of the time between the "most recent substantive amendment date" of the protocol and subsequent review. Variables chosen for the univariate and multivariate analyses were based on *a priori* consideration. Statistical analyses were conducted with SAS, version 9.0 (SAS Institute, Cary, North Carolina).

Results

There were 130 new Cochrane protocols in Issue 2, 2000. After excluding 12; 25/118 (21.2%) were unpublished and 93/118 (78.8%) were published as Cochrane reviews (Figure).

A primary outcome was reported in 80.6% (75/93) of the reviews, the majority included all languages of publication (52.7%, 49/93), as well as published and unpublished material (74.2%, 69/93; Table 1). Publication bias was found to affect the results in only 11.1% (1/9) of the reviews. The majority of Cochrane reviews that performed a meta-analysis of the primary outcome had statistically significant positive results (31.5%, 17/54) while the majority of the conclusion statements were indeterminate (43.0%, 40/93). Only 38.7% (36/93) of the reviews were subsequently updated. A not-for-profit funding source was the most commonly reported funder (50.0%, 37/74).

The median time to publication was 1.60 years (range: 0.15 to 7.31 years). Four factors significantly predicted publication (univariate analysis): the review having two protocols, being subsequently updated, an author change between the protocol and review, and number of included studies (all $p<0.05$). An additional four factors were included in the multivariate analyses due to *a priori* consideration: results, conclusions, funding, and number of authors. Of the 8 factors, an author change between the protocol and review was associated with longer time to publication ($p=0.002$), and an updated review was associated with shorter time to publication ($p=0.03$; Table 2).

Discussion

Our results indicate that for every four published Cochrane reviews, one will remain unpublished. Furthermore, a longer time to publication was associated with a change in authorship between the Cochrane protocol and subsequent review. The Cochrane Collaboration should consider strategies to improve the publication rate of Cochrane

reviews as well as decrease their time to publication. These may include providing additional support to reviewers when an author change occurs.

Our study identified a large proportion of unpublished SRs. An international survey of systematic reviewers identified a 12.4% non-publication rate of SRs (5). In a retrospective cohort study of the protocol factors predicting publication of Cochrane reviews, only 13% (9/68) of the unpublished SRs were published elsewhere (3). This implies that a large amount of potentially meaningful data is missing from the literature and implies enormous wasted time and resources.

Our results are inconsistent with research examining publication bias of individual studies (e.g., trials) (2;6-10). In these studies, statistically significant results and funding were associated with publication of SRs. Since our study did not find such an association, it is apparent that differences exist in publication patterns between SRs and trials.

As reported elsewhere, our study has some limitations (3). Only one investigator abstracted all of the data, which could have led to inaccuracies. Assessing the primary outcome, results, and conclusions of the Cochrane reviews was often difficult and may have also led to error (4).

In conclusion, only about 80% of Cochrane protocols were published as complete Cochrane reviews within 19 months and some reviews took much longer to be published. Strategies to decrease time to publication should be considered, such as providing support to reviewers when a change in authorship occurs.

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Author contributions:

ACT conceptualized the research, obtained the sample of Cochrane reviews, designed the data abstraction form, abstracted all of the data from the reviews, verified the quality of the data, analyzed the results, wrote the manuscript, and approved the final version of the manuscript. ACT had full access to all the data in the study and takes full responsibility for the integrity of the data and the accuracy of the data analysis. DM conceptualized the research, designed the data abstraction form, edited the manuscript, and approved the final version of the manuscript. MHC verified the quality of the data, helped analyze the results, edited the manuscript, and approved the final version of the manuscript. RD helped obtain the sample of Cochrane reviews, edited the manuscript, and approved the final version of the manuscript.

Figure: Study Flow

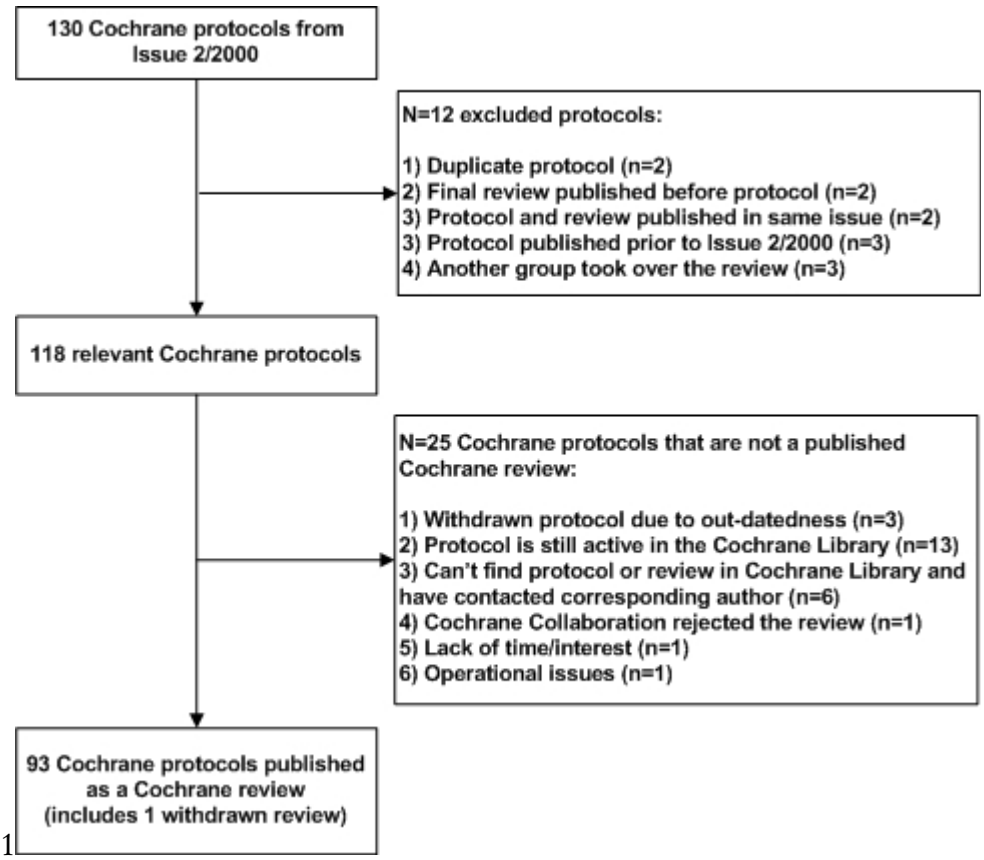

Table 1: Cochrane review characteristics

Item	Total: 93 published reviews
Descriptive characteristics	
Country of conduct: n (%)	
United Kingdom	36 (38.7)
Australia and New Zealand	20 (21.5)
Canada	7 (7.5)
United States of America	7 (7.5)
India	4 (4.3)
Italy	3 (3.1)
Netherlands	2 (2.2)
Denmark	2 (2.2)
Thailand	2 (2.2)
Other	10 (10.8)
Population examined: n (%)	
Neonates only	7 (7.5)
Children only	1 (1.1)
Adults only	20 (21.5)
Women only	13 (13.9)
Men only	1 (1.1)
Children and adolescents	1 (1.1)
Adolescents and adults	1 (1.1)
Adolescents, adults and elderly	1 (1.1)
Adults and elderly	1 (1.1)
All	47 (50.5)
Number of authors: median (range)	3 (1, 8)
Author change between protocol and corresponding review: n (%)	49 (52.7)
Review had two protocols: n (%)	2 (2.1)
Review had two "unique" Cochrane identification numbers: n, (%)	9 (9.7)
Number of studies included: median (range)	5 (0, 84)
Overall number of participants included: median (range)	410 (0, 109394)
Number of pages of pdf review file: median (range)	23 (5, 183)
Methodological characteristics	
Type of reports included in the review: n (%)	
Observational only	0 (0)
Experimental and quasi-experimental only	89 (95.7)
Both	4 (4.3)
Number of databases searched: median (range)	4 (1, 17)
A primary outcome was reported: n (%)	75 (80.6)
Number of primary outcomes: median (range)	1 (1, 20)
Languages included: n (%)	
English only	0 (0)
Mixed languages only	2 (2.1)
All languages	49 (52.7)
Not reported	42 (45.2)
Status of study report included: n (%)	
Published material only	2 (2.2)
Published and unpublished material	69 (74.2)
Not reported	22 (23.6)
Meta-analysis of the primary outcome was conducted: n (%)	54 (58.1)
Publication bias was assessed: n (%)*	9 (16.7)

Publication bias affected the results: n (%)*	1 (1.9)
Heterogeneity assessed: n (%)*	54 (100.0)
Heterogeneity affected the results: n (%)*	8 (14.8)
Results and conclusions classification	
Results*	
Indeterminate	9 (16.6)
Non-statistically significant negative	10 (18.5)
Statistically significant negative	0 (0)
Neutral	7 (13.0)
Non-statistically significant positive	11 (20.4)
Statistically significant positive	17 (31.5)
Conclusions	
Indeterminate	40 (43.0)
Negative	10 (10.8)
Neutral	24 (25.8)
Positive	19 (20.4)
Other factors	
Gender of corresponding author: n (%)	
Female	32 (34.4)
Male	48 (51.6)
Unclear	13 (14.0)
Corresponding author was a healthcare provider: n (%)	25 (26.9)
Number of reviews that were updated: n (%)	36 (38.7%)
Number of updates per review: median (range)	1 (1, 3)
Number of reviews with funding: n (%)	74 (80.0)
Type of funding source: n (%)†	
Government only	17 (23.0)
Not-for-profit organization only	37 (50.0)
Government and not-for-profit organization	19 (25.7)
For-profit and government and not-for-profit	1 (1.3)

Notes: * Denominator is number of reviews for which a meta-analysis was conducted (n=54), † denominator is number of reviews with funding (n=74).

Table 2: Factors associated with the time to publication of Cochrane reviews from the multivariate analysis

Factor	Estimate*	Standard error	p-value
Two protocols (no vs. yes)	-0.810	0.467	0.086
Author change (no vs. yes)	-0.426	0.134	0.002 †
Number of authors	0.034	0.051	0.504
Funding (no vs. yes)	0.280	0.167	0.097
Number of included studies	0.007	0.005	0.145
Results (favourable vs. unfavourable)	0.018	0.274	0.948
Results (all others vs. unfavourable)	-0.167	0.244	0.495
Conclusions (negative vs. positive)	0.059	0.276	0.832
Conclusions (all others vs. positive)	-0.109	0.188	0.562
Update (no vs. yes)	0.305	0.138	0.030 †

Notes: * Negative value indicates longer time to publication and positive value indicates shorter time to publication, † $p<0.05$

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