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Be positive - if you want to be cited

A systematic review and meta-analysis of citation bias

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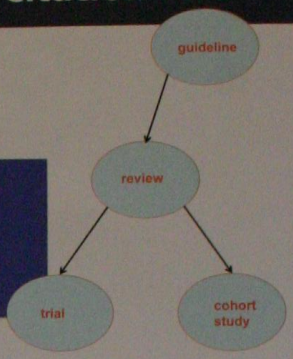
Background: selection biases

Reporting bias: Positive results have a higher chance of being reported in a articles than negative results.

Publication bias: Positive articles have a higher chance of being published in a journal than negative articles.

Citation bias: Positive articles have a higher chance of being cited by others than negative articles.



Introduction

What do food regulations, medical interventions, and measures against climate change have in common?

- They depend on science based decision-making.
- This decision-making may be biased in different ways (see blue box).
- Citation bias leads to biased knowledge development: part of the evidence is systematically ignored.
- Citation can be driven by different determinants that affect knowledge development and decision-making in varying degrees

Systematic Review

Aim : give an overview of the citation bias literature

A systematic search strategy was applied to the Web of Science Core Collection and Medline in November 2016. All publications containing data on the association between study outcome and citation count were included. A total of 47 publications were identified across scientific disciplines (Fig 1).

Other determinants of citation in these publications were also extracted (Fig 2).

***Figure 1**: Number of publications on citation bias*

Scientific discipline	Found support for citation bias			Total in review
	Yes	Mixed / unclear	No	
Social	6	1	0	7
Biomedical	21	8	7	36
Natural	0	2	1	3
Multiple	0	1	0	1
Total	27	12	8	47

***Figure 2**: Table with determinants of citation, as found within the citation bias literature.*

Determinant	Included in analysis	Shows effect (Shows no effect)	Percentage that shows effect
Article Results	46	26 (8)	76 %
Impact Factor	19	16 (2)	89 %
Sample Size	19	4 (10)	29 %
Research Design	11	4 (4)	50 %
Research Topic	10	6 (1)	86 %
Author Country	10	5 (4)	56 %
Research Quality	8	1 (5)	17 %
Number of Authors	7	4 (1)	80 %
Funding Source	7	4 (1)	80 %

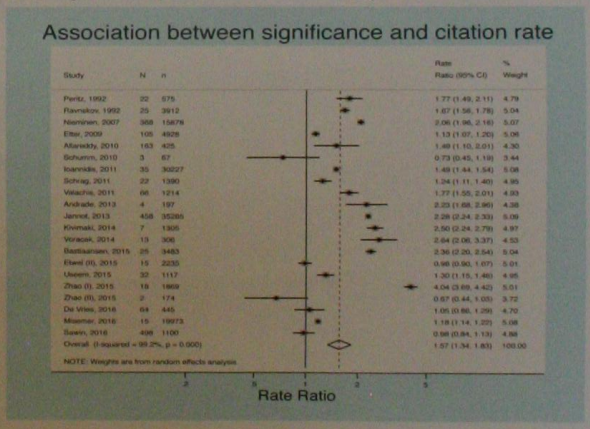
Meta-analyses

Aim : quantify the likelihood of citation for positive articles (compared with negative articles)

For the meta-analyses all 25 publications were included for which the citation rate ratio could be calculated between positive and negative articles. (Rate ratio > 1 : positive articles are cited more often.)

An article was considered positive if its results were statistically significant (Fig 3). Additional meta-analyses focused on the impact of direction, direction + significance, and authors' conclusion (not reported).

***Figure 3**: Forest plot on relation between statistical significance and citation rate*



Findings

- Most research on citation bias has been performed within the biomedical field, but also within ecology, psychology and management science. (Figure 1)
- Article results and impact factor drive citation more often than more justified determinants like study quality and sample size. (Figure 2)
- Articles with significant results are cited 60% as often as those with non-significant results. (Figure 3)
- Articles in which the authors conclude that their hypothesis is supported, are cited 2.7 times as often. Expected direction: 2.1, direction + significance: 1.8 (results not shown)

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