Forty Years of Confirmation Bias in Social Science: Two Case Studies of Selective Citations

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Abstract

Objectives: To provide a further test of possible hypothesis conformity or confirmation bias in science based on differential citations of two sets of articles published between 1979 and 2011 that concerned same-sex parenting, as part of a larger issue of similar biases in all sciences and medical research in general.

Methods: Two sets of articles used here formed nearly perfect natural experiments because the articles were from the same university team of scholars, published about the same time, often concerned the same samples, with some being published in the same scholarly journal. Differences in citation rates might typically be related to article quality, but with these two sets of articles, research value was usually similar. Based on Google Scholar citations, citation rates were compared using binomial tests, including normal approximation z scores, and one-sample chi-square tests.

Results: For both sets of articles, those that presented findings more favorable to same-sex parenting were cited far more often than those with significant but less favorable results. Some authors disregarded their own significant research findings in later articles.

Conclusions: Confirmation bias or hypothesis conformity, considered to be a questionable research practice (QRP), have existed in at least one area of the sciences for as long as four decades. Even when noticed and reported, such QRPs have continued, almost certainly leading to errors in reviews of the literature in such areas, errors – if accepted - that could lead to incorrect policy decisions. However, scholars who dare to challenge incorrect scholarly "consensus", report fraudulent research, or who dare to dispute widely accepted findings may have their professional careers destroyed. Without better policing of QRPs, the value of social science research for society may decline even if it continues to benefit those who engage in QRPs. However, our observations are only a narrow slice of a much larger problem of various kinds of bias in science and medical or public health research in general.

Keywords: Citation rates, confirmation bias, hypothesis conformity, social science, research methodology, literature reviews, questionable research practices (QRP), lesbian mothers, LGBT, same-sex parenting

1. Introduction

There are many types of research fraud, including data fabrication, data falsification, plagiarism, authorship fraud, publication fraud, and grant fraud, otherwise known as research misconduct or questionable research practices (QRPs)[1]. Every kind of research misconduct leads to a distortion of the scientific record. Kostoff[2] states that "If the literature is distorted, then future research can be misguided, and health policy recommendations can be ineffective or worse" (p. 12). Kostoff further observed, citing Oreskes and Conway[3] that for several highly sensitive issues, such as "smoking, climate change, acid rain, ozone hole, and DDT" prominent scientists and front organizations had promoted disinformation on those topics, including influencing the scientific literature in a biased way. For a current example, it has already been noted that retraction rates are "exceptionally high" for research on COVID-19[4] "compared to other related research topics in viral epidemics/pandemics and surpasses the basal level of about 4 in 10,000 papers." Yeo-Teh and Tang's[4] work "serves as a reminder and caution against lapses" in research standards, particularly when consequential policy decisions depend upon research findings.

Kleck[5] details many ways to sabotage research, one of which is by overciting sources friendly to one's point of view and ignoring or trashing research less friendly to one's point of view. We agree with Kleck that one major problem is a human tendency to do as little work as necessary to "prove" one's point of view, without taking the time and making an effort to discredit one's point of view, as if one were an outside critic. As Kleck says "Among ideologues involved in research, the common practice is to do just enough research to support the conclusions they personally favor on emotional grounds, and then to stop." (p. 33). Better researchers look at results from more than one side. "As a result", Kleck notes, "good research is more likely to reflect reality, while bad research tends to reflect the biases of its authors" (p. 33). Kleck observed that the phenomenon is widespread in medical journals, not only in social science. Another way to distort the literature is to apply more difficult standards to disliked research and easier standards to liked research, even though this creates a "double standard." Speculative criticisms can also be employed to undermine disliked research, that is, criticisms with no evidence, but which suggest that "if" there were evidence, "then" it would be damaging. Speculations are seldom possible to be tested and thus avoid the risk of being falsified.

Kleck[5] goes on to point out how "the simplest way to give a biased impression of a body of evidence is to leave out any findings the reviewer finds uncongenial" (p. 38). This, of course, is where the practice of biased citations arises. Kleck cites numerous medical studies guilty of this particular QRP. Researchers can selectively cite research to support their preferred hypotheses; they can also cite their own research selectively in the same way. Another approach is to try to maintain an appearance of being even-handed by citing one or two disagreeable studies, while ignoring a host of others. Yet another approach is to argue that there is little evidence on a topic (even though there may be numerous studies) as a way of avoiding disagreeable results. A similar approach is "magnanimous

neutrality" (p. 44) where one concludes that the results are "mixed" even if most studies dispute one's position. Kleck lists numerous other ways to create bias in an area of science. Likewise, Kates, Schaffer, Lattimer, Murray, and Cassem[6] reviewed similar issues in the medical field with respect to gun control research, who stated that "True scholarship normally requires that opposing data and views be expressly cited and [if possible] refuted" (p. 536) rather than merely dismissing opposing views as having been "discredited" (p. 539). They further noted that "An atmosphere in which criticism in general, and peer review in particular, comes from only one perspective not only allows error, but promotes it" (p. 530).

The entire issue of *Psychological Inquiry* in March 2020 was dedicated to bias in modern science, with commentary following a lead article by Clark and Winegard[7] whose basic argument was that loyalty to certain ideas or groups (and expected rewards/punishments from those groups, labeled "ingroup value reinforcement") might take priority, among some scientists, over the pursuit of truth. The idea is that scientists may "treat congruent [with their values] information more favorably and charitably and treat incongruent information less favorably and more critically (p. 4)". Likewise, they might pay less attention to potential or actual counterarguments to their positions, ignoring plausible alternative hypotheses. Some of the sacred values of liberal scholars are identified as "the only reason groups differ is because of prejudice and discrimination" and "we can and should make all groups equal in society" (p. 10). Thus, liberal researchers may "often dismiss hypotheses that appear to cast disadvantaged groups in an unflattering light" (p. 13) other than from stigma and prejudice. They warn that the public may "begin to lose confidence in the impartiality of experts and expert knowledge" (p. 15) because of such bias, which can allow "some ideas to flourish without subjecting them to rigorous criticism while silencing and ignoring other ideas without offering them a fair hearing" (p. 16).

Numerous scholars weighed in, with mixed reactions. Haas[8] quoted Thomas Jefferson (1820) "…. We are not afraid to follow truth wherever it may lead, nor to tolerate any error so long as reason is left free to combat it." - and was troubled by deviations from that approach. Honeycutt and Jussim[9] developed a model of the causes of bias. Others[10-12] disagreed with various aspects of Clark and Winegard's ideas, while others were more supportive[13-15]. In reply, Winegard and Clark[16] insisted that sometimes scholars do "prioritize social acceptance and status attainment over truth" (p. 96), but that "the truth has a great record of improving the lot of humanity…. Therefore, we need to emphasize that truth, whatever the momentary discomfort it might cause, is the best lodestar for the social sciences. Although it might guide us through troubling paths from time to time, it has ultimately led us to a better destination than any of its sometimes more alluring alternatives" (p. 100).

Although only one of many possible QRPs, citation bias is especially likely to skew scientific literature, and has been well established as an important problem.[17-19] Schofield[20] noted that publication and citation bias were well known[21-23] in science. A subset of citation bias is hypothesis conformity[17], also known as confirmation bias, which has been a

significant problem in the social sciences and in medicine. As Duyx et al.[17] has noted, "Citation bias is considered to be a questionable research practice (QRP). QRPs are suboptimal and undesirable behaviors of scientists that lie between responsible conduct of research and research misconduct or fraud (fabrication, falsification, and plagiarism). (p. 92)" Even if unintentional, QRPs "may have a strong negative impact on the development of knowledge (p. 92)"[17] Grant-Mejer has discussed this problem as well as the current senior author.[24-25]

Our examples will offer a variation on hypothesis conformity. Schofield[20] observed that it was "unusual to have publication bias operate in favor of small nonsignificant effects" (p. 19). However, here we highlight cases where non-significant results are the politically or legally desirable outcome, rather than significant positive results. Duyx et al.[17] point out that "The scientific process stands or falls by a balanced representation of the available research. Citation bias distorts this balanced representation and may lead to false beliefs (p. 98)." The standard solution, to rely on systematic reviews, may also become "flawed and even misleading (p. 98)", citing Ioannidis.[26] Our own review of reviews found that none of the 72 reviews assessed (published between 2001 and 2017) cited more than 50% of the literature available at the time of publication.[27] Fanelli has also indicated that citation bias can distort "the cumulative record of studied phenomena, which can mislead scientific and social agendas", a problem that may be "worsening rapidly (p. 702)."[18] Citation bias can also lead readers to "develop a certain belief system that is not in line with the available evidence… By systematic overrepresentation of and exposure to positive results, gradually a shift toward an unfounded belief system might be made (p. 95)", which could become "particularly problematic when scientific consensus is being used as a basis for clinical guidelines, legislation, industry decisions, or future research funding" (p. 96)".[19] In addition to study outcomes, other possible sources of citation bias may include author gender, journal prestige (impact factor), research quality (sample size), affiliations involved in the article, authors' reputations, number of references cited, hedge factors, or whether the article title includes its conclusions, although most of those are beyond the scope of this report.[19]

2. Objectives

The objective of this study was to see if confirmation bias could be tested statistically across a set of medical or social science journal articles. Such bias might exist for authors or for the scientific community in general. While both publication bias and citation bias are known to exist in the scientific community, it's possible that citation bias might reflect little more than publication bias – published results being more likely to be cited than unpublished results. Our approach will permit examining whether citation bias can occur after publication, among published results.

3. Methods

The ideal 'data' to provide a test of confirmation bias would be a set of articles identical in every meaningful respect, except for the alleged desirability of the findings in relation to a highly sensitive topic per Oreskes and Conway[3]. If favorable (or unfavorable) results are cited more (or less) frequently, but

the quality of research and prestige are similar across the favorable (or unfavorable) publications, we hypothesize that the difference in citation rates is due to some form of confirmation bias. Put differently, articles of identical "research value" ought to be cited with similar frequency regardless of whether the findings are perceived as favorable or unfavorable to a particular political or legal policy question. Statistically, we frame it as follows: the frequency of citation for articles of identical "research value" should follow a binomial distribution, where favorable (or unfavorable) articles have roughly the same probability of being cited every time at least one article is cited.

It is difficult to find articles of identical "research value" since that value is derived from a complex vector of characteristics including the research question or topic, author(s), university or research center, publication venue (impact value), year of publication, and more. But occasionally sets of articles which are plausibly very similar in "research value" present themselves in medical or social science journals. Candidates would include small sets of articles published by the same authors, using the same data, in similar or identical journals, in the same (or nearly adjacent) years, with findings which differ in perceived favorability. Such clusters do appear from time to time. When they do, they can be considered to constitute a near "natural experiment" for the purpose of checking the balance of citation rates.

For this study, two sets of papers (described below) which meet these criteria were used to derive a statistical test of citation bias. The papers relate to same-sex parenting, a topic which is politically sensitive enough to make a determination of what counts as a favorable/unfavorable finding. These papers were selected, and known to us, due to our familiarity with the literature on the issue, each of the present authors having published previously on the topic[29-31].

The objective outcome measure used for comparing the papers within each set was the Google citation count per article as of 01 June 2020. Two analytic approaches were used. First, a one-sample chi-square test was used to test the null hypothesis that papers were cited with similar frequency regardless of the favorability of the findings (50/50 in the case for comparing two articles). Second, setting a binomial probability to 0.500 (comparing two articles) or to 0.333 (comparing three articles), a binomial test was used to test the null hypothesis that the papers with favorable and unfavorable findings would be cited with similar frequencies. In both cases, the alternative hypothesis was that the papers with findings favorable to same-sex parenting would be cited more than those which were less favorable. Binomial tests were performed from a website calculator (www.socscistatistics.com) while we used SPSS to calculate one-sample chi-square tests.

3.1 Set One—Early 1980s Troika of Papers on Lesbian Mothers

Between 1979 and 1981, three articles were published by the same research group at the same university in the United States, all dealing with the same or partial samples of the same data set derived from the self-reports of lesbian mothers.[32-34] These articles are Mucklow and Phelan[32] (henceforth, MP79), Miller, Jacobsen and Bigner[33] (MJB81), and

Miller, Mucklow, Jacobsen and Bigner[34] (MMJB80). Two of the articles, MP79 and MMJB80, were published in the same journal, *Psychological Reports*. The lesbian mothers had been recruited from a lesbian recreation center while the heterosexual mothers were from Parent-Teacher meetings. Thus, the comparison of the outcomes, numbers of cites, comes unusually close to a natural experiment where the initial conditions (authors, dates of publication, research quality, journal prestige, authors, samples, university affiliation) of the three articles were very similar. Since the "research value" of these papers is nearly identical, differences in citation rates may plausibly be related to favorability of outcomes for lesbian mothers, that is hypothesis conformity or confirmation bias. As early as 2010, this troika of articles was noted.[35]

Two of the articles, MP79 and MJB81, reported favorable information in the results, highlighting the positive capabilities of lesbian mothers.[32-33] These papers found few (1 of 15) significant differences between the same 34 lesbian mothers and 47 heterosexual women with respect to how they would respond to a child's behavior or described themselves as mothers.[32-33] In contrast, one of the articles, MMJB80, did not report favorable findings and instead discussed some negative associations with the experiences of lesbian mothers.[34] For instance, MMJB80 noted that the lesbian mothers (N = 34) were significantly less likely to have respect for their fathers ($p < .01$) or their mothers ($p < .05$, depending on the test used) compared to the sample of 31 heterosexual women, and held negative feelings about men in general, "negative, to the point of being repulsive" (p. 1130).[34] Nevertheless, MMJB80 concluded that "proportionately more lesbian mothers reflected a child-oriented stance than their heterosexual counterparts" (pp. 55-56), even though they did not control for significant differences between their samples in education, employment status, income, and divorce rates.[34]

3.2 Set Two—2011 Pair of Papers on Lesbian Mothers

A pair of articles both published in 2011 formed another near-natural experiment. The articles were by the same three authors, based on the same data set, the U.S. National Longitudinal Lesbian Family Study, and published in the same year in similarly prestigious journals. The first, Goldberg, Bos, and Gartrell36 published in the Journal of Health Psychology (henceforth, GBG-JFP) found that rates of illegal drug use were 59.2% among children of same-sex parents compared to 20.5% for a control group of presumably heterosexual parents (chi-square (df = 1) = 24.1, $p < .001$; $r = .396$, $p < .001$; odds ratio = 5.63, 95% CI, 2.75 to 11.50, $p < .001$;Cohen's $d = 0.86$).[36] The other article, Gartrell, Bos, and Goldberg[37] published in the Archives of Sexual Behavior (GBG-ASB) found that 19% of the adolescent daughters of lesbian mothers were bisexual compared to only 2.7% of the adolescent sons, although a later article published in 2019 by Gartrell, Bos, and Koh38 found much higher rates for the same adolescents at an older age. We take the first article, GBG-JFP, to be the less favorable finding, since illegal drug use is a vastly more negative outcome than bisexuality.

4 Data and Results

4.1 Set One—Early 1980s Troika of Papers on Lesbian Mothers

A data set was created with every observed citation for the three articles from 1979 to present. These citations were then counted in two ways: unadjusted (as pulled directly from Google scholar); and adjusted. Adjusted counts *removed* citations for the three articles which occurred following (and including) Schumm[35] which cited the three articles for the purpose of highlighting research bias. For instance, from 2010 to the present, the more negative article MMJB80 was cited only three times for research purposes, but nine times for the purpose of drawing attention to bias. Thus, the unadjusted (12 cites) v. adjusted (3 cites) distinction matters for statistical significance. We consider the adjusted data to be the correct approach for this study, but analyses which follow will reflect both adjusted and unadjusted data.

As noted above, the null hypothesis was that the number of citations for these papers of similar "research value" would be similar regardless of the favorability of the findings. To render the tests even closer to a natural experiment, a second set of tests were performed comparing the citation counts for only the two articles published in the same journal, *Psychological Reports*, one with positive outcomes versus the one with negative outcomes.

Figure 1 presents the unadjusted cite counts by year for the three articles from 1979 to present, with total counts for MP79[32], MJB81[33], and MMJB80[34], in this period at 88, 120 and 15, respectively. Figure 2 presents the adjusted cite counts by year for the three articles in the same time period, with adjusted counts at 83, 115 and 6 respectively. Both figures show the distinctive finding: when research on same-sex parenting picked up in the mid-1990s, the more favorable MP79[32] and MJB81[33] articles (green, and blue respectively) begin to be cited with great frequency, as often as six, seven or eight times per year. In contrast, MMJB80[34] (red) is cited only three times between 1983 and 1995, and then it is ignored completely until Schumm[35] called attention to it in 2010.

Unadjusted. When we doubled the 15 citations for MMJB80[34] to 30 and performed a binomial test for the chances of getting 30 or fewer citations out of the total of 223, with an underlying p = 0.50, we obtained $z = 10.85$ ($p < .00001$); the corresponding one-sample chi-square test ($df = 2$), we obtained a chi-square value of 77.9 ($p < .001$). If we used 15 citations out of 223 but set the underlying probability to p=0.3333, then we obtained $z = 8.36$ ($p < .00001$). In every test, the null hypothesis of even citation patterns is overwhelmingly rejected.

If we restricted the comparison to the two articles published in the same journal and setting the underlying p =0.50, we obtained $z = 7.09$ ($p < .00001$); the corresponding one-sample chi-square ($df = 1$) test value was 51.74 ($p < .001$). The null of even citations is again rejected.

Adjusted. When we doubled the 6 citations for MMJB80[34] to 12 and performed a binomial test for the chances of getting 12 or fewer citations out of the total of 204, with an underlying p = 0.50, we obtained $z = 12.53$ ($p < .00001$); the

corresponding one-sample chi-square test (*df* = 2), we obtained a chi-square value of 79.4 ($p < .001$). If we used only 12 citations out of 204 but set the underlying probability to p = 0.3333, then we obtained $z = 8.24$ ($p < .00001$). These results again reject the null hypothesis soundly.

Restricting the comparison to the two articles published in the same journal and set the underlying p = .50, we obtained $z = 8.06$ ($p < .00001$); the corresponding one-sample chi-square (*df* = 1) test value was 72.5 ($p < .001$). The null is again rejected in favor of the alternative.

4.2 Set Two—2011 Pair of Papers on Lesbian Mothers

As of 01 June 2020, the less favorable GBG-JHP[36] had been cited just 25 times, compared to 142 citations for the more favorable GBG-ASB.[37] Setting the underlying p = .50, our binomial test yielded $z = 8.98$ ($p < .00001$) while a one-sample chi-square test (*df* = 1) = 81.97 was significant ($p < .001$). As for the early 1980s troika, the null hypothesis is rejected in favor of the alternative: that findings less favorable to lesbian mothers are cited less frequently than even chances would suggest.

These papers do not lend themselves to an adjusted count as the first set did, but we did examine the cites for any observable patterns in citations. Although 24% of the citations for the less favorable GBG-JHP[36] were by conservative scholars, as compared to only 12% for the more favorable GBG-ASB[37], the difference was not significant, with chi-square = 2.59 with *df* = 1 ($p < .11$). Removing *all citations* by known conservative scholars for both articles didn't change the fundamental pattern of skew in the citations, and changed the analysis results only slightly to a chi-square test (*df* = 1) of 78.03 ($p < .001$) and $z = 8.75$ ($p < .001$).

4.3. Additional Analyses.

After running the above analyses, we investigated whether the authors of the sets of articles were biased in citing their *own research*. We did not find later articles by some of the authors but did find some by Bigner and the GBG team. Of the 22 times those authors cited their earlier articles, we found 17 citations of the more favorable papers and 5 for the less favorable. That difference was significant by a one-sample chi-square test, 6.55, $p < .02$ and by a binomial test, $z = 2.35$, $p < .01$ (one-tailed). One might also ask if authors were more likely or not to cite their own more negative results than others but this test could only be performed for the GBG studies, for which the *authors* cited their more negative study 5/20 times (25%) compared to 20/122 (16.4%) for other citers, yielding an odds ratio of 1.7 (n.s.), a result that was not significant even for a one-sided Fisher's Exact Test ($p < .26$). Thus we found that even authors may practice selective citations of their own work.

4.4 Overall Results

For each set of articles, the articles more favorable to lesbian mothers were cited at vastly higher rates than the less favorable articles, even after controlling for citations by conservative scholars. Though our data were more limited, we found that some scholars were more likely to cite their own favorable findings. Our results don't prove that all such

research on same-sex parenting or similarly sensitive issues in medicine and social science has been cited selectively or in a biased manner, but it shows at least two strong instances where such bias may have occurred. Our results also indicate that citation bias can occur above and beyond any publication bias, extending Schofield's concerns[20].

5. Discussion

When articles are cited, not for their scientific quality as much as providing desired outcomes for political or other purposes, areas of science may become further and further distorted, until the extreme case where an apparent scientific consensus[39] may be incorrect.[28,29,40,41] Incorrect consensus can be a result of misinterpretation of research in journal articles[42] , fraudulent research[43,44] , of poor quality literature reviews[27], or of tendencies for positive results to be cited more than negative findings.[17-19] Challenging fraudulent research, poor quality research, or scientific consensus can be dangerous[25] for one's professional career; one scholar was recently banned for life from his primary professional annual conferences on a charge of bullying someone, even though ordinary optics might suggest that some degree of negative sentiment override was at work because of the author's controversial research. There are also reports of multiple scholars[31], whose research challenged consensus views, being "discredited" in legal hearings because of their alleged religious bias. The consequences for the profession may be devastating. Schumm[35] has expressed concern that the "field of social science itself is biased (p. 379)." If this is true, it may reduce the credibility of any alleged consensus more than would the low quality research of any one researcher.

As we noted at the beginning of this report, "Citation bias is considered to be a questionable research practice (QRP). QRPs are suboptimal and undesirable behaviors of scientists that lie between responsible conduct of research and research misconduct or fraud (fabrication, falsification, and plagiarism). (Duyx et al.[17] p. 92)" The examples provided here, especially in Figures 1 and 2, show exactly how, over time "the development of knowledge" (Duyx et al.[17] p. 92) can become powerfully skewed, distorting "the cumulative record of studied phenomena, which can mislead scientific and social agendas" (Fanelli[18] p. 702).

Figure 1.

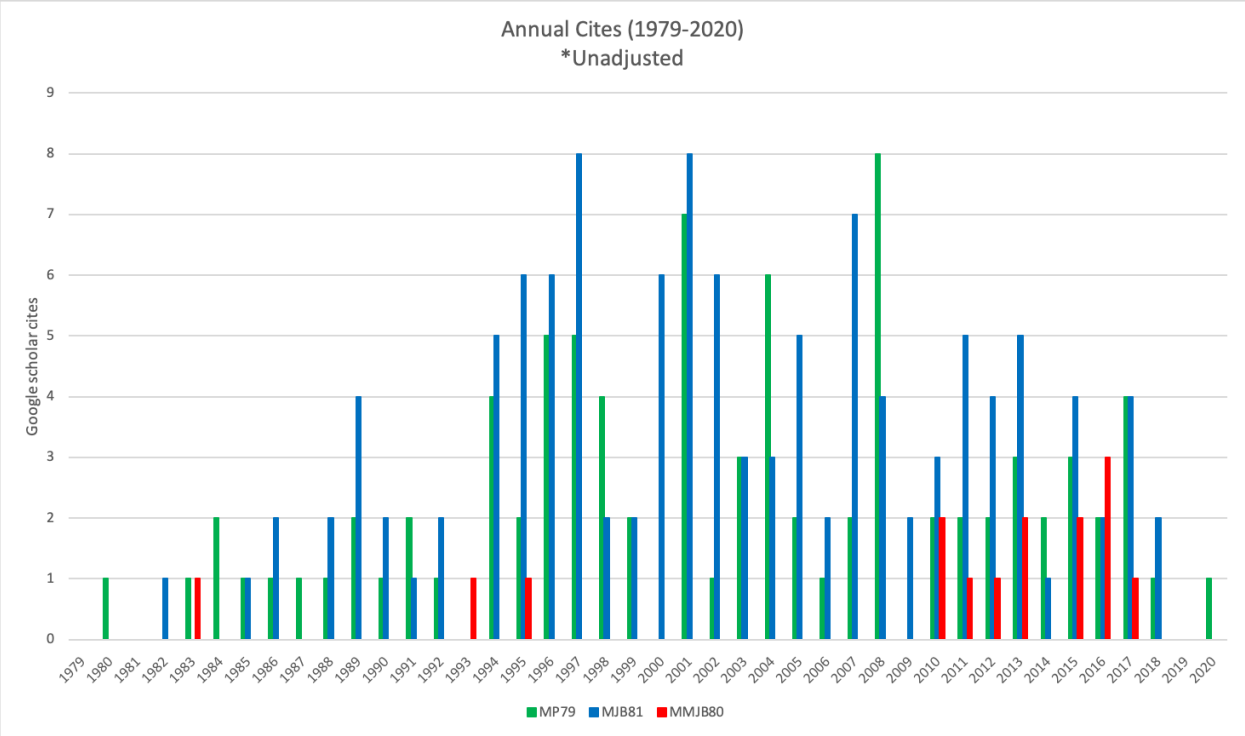
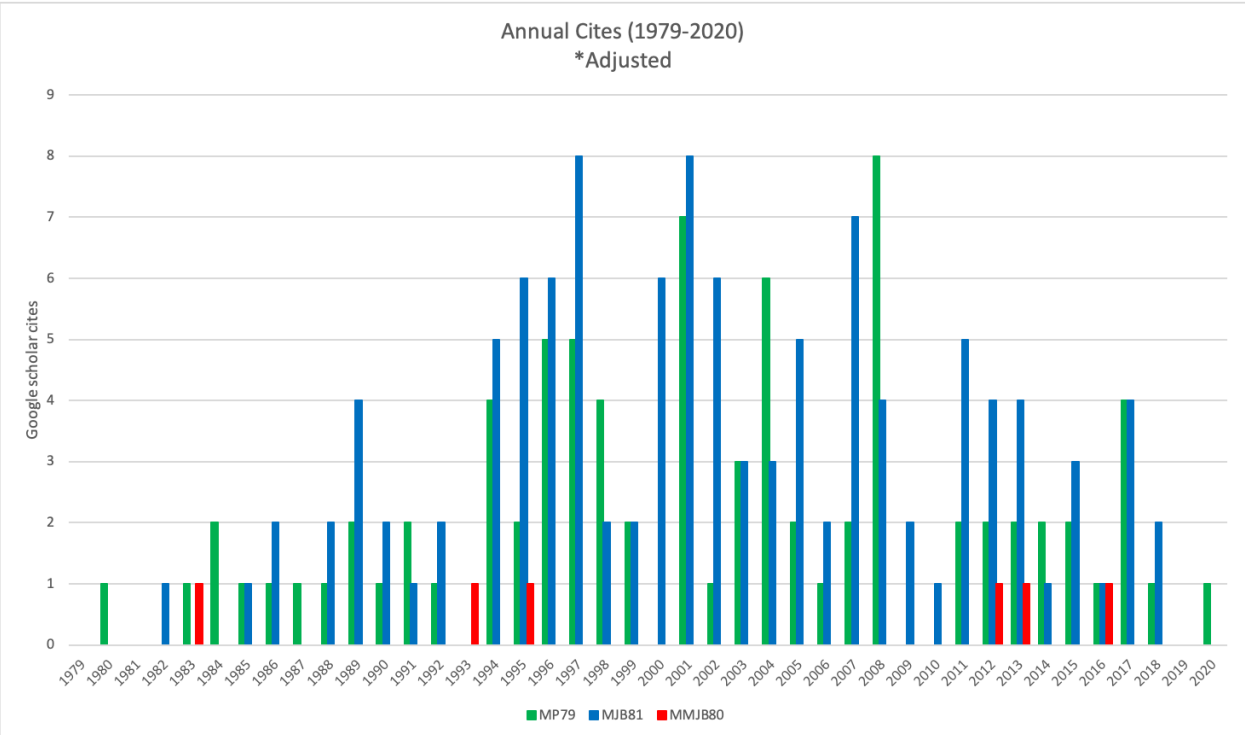


Figure 2.



Our observations are only a narrow slice of a much larger problem of various biases in the sciences. Our research adds to the BIASS [Bipartisan Ideological Awareness in the Social Sciences][7,15] movement in which we have provided additional evidence that some scholars and many of those who cite them have been more likely to cite what they deem favorable information about their own values than to cite alternative information that might seem unfavorable to their own values. This has been especially true in the topic of same-sex parenting, though the issue seems to involve the whole of social science and medicine as well. Our methodology may add the twist of seeing how authors preferentially cite their own publications as a function of preferred outcomes, as biased citation rates by others have been observed for a long time[32]. We concur with Tong and Hippel[14] that "Science corrects itself through disagreement…" (p. 23). We also agree with Winegard and Clark[7] and with Haidt[15] that, in search of truth, scholars should be willing, if not eager, to falsify their own hypotheses and to test alternative, competing (not just "straw man") hypotheses, as well as to welcome criticism[45,46], even if that would put their own popularity and status within their own favored community (tribe) at risk.

As did Schofield[20] we have particular concern with respect to literature reviews. If such reviews cite only articles favoring one side of a given argument when there might be multiple points of view, their conclusions will likely not only be biased, but incorrect, and a weak, if not poor, foundation for implementation in law or public policy. We fear that what we have located with these two sets of articles may be only the tip of the iceberg in social science and medicine in terms of politically correct areas of research. Furthermore, review articles published in either area of science are likely to be cited in the other area, extending their biases into other areas. It seems possible that these QRPs have led to severely biased literature reviews and inaccurate applications of further research and/or policy decisions that were not based on accurate scientific evidence. It should be kept in mind that post-publication bias concerns only part of the scientific dissemination process; bias in the acceptance or rejection of papers for reasons other than scientific merit may also be in play, though more difficult to investigate. We hope that by bringing such matters to the attention of fellow scientists, in all areas of research, confirmation bias or hypothesis conformity will be reduced in the future and not be used to lead us down errant pathways in various applications in law, public policy, or medicine. One advantage of this research is that it can be re-evaluated every five or ten years to determine if citation bias has remained the same, increased, or decreased.

Acknowledgements: Appreciation is extended to Emma Wilenta for her support of the analyses.

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