

Running Head: BIBLIOMETRICS: A POTENTIAL

Bibliometrics:

A potential decision making aid in
hiring, reappointment, tenure and promotion decisions

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Abstract

The assessment of scholarship assumes a central role in the evaluation of individual faculty, educational programs and academic fields. Because the production and assessment of scholarship is so central to the faculty role, it is incumbent upon decision makers to strive to make assessments of scholarship fair and equitable. This paper will focus on an approach to the assessment of the quantity and impact of the most important subset of an individual's scholarship – peer-reviewed journal articles. The primary goal of this paper is to stimulate discussion regarding scholarship assessment in hiring, reappointment, tenure and promotion decisions.

Introduction

A substantial portion of academic life focuses on the assessment of scholarship. For instance, in their roles as editors, editorial board members, consulting editors, guest reviewers, reviewers for conference submissions, book proposal reviewers, external reviewers and grant proposal reviewers, as well as their service on hiring, reappointment, tenure and promotion committees, faculty assess the work of others. The assessment of scholarship assumes a central role in the evaluation of individual faculty, educational programs and academic fields (e.g., Baker & Wilson, 1992; Bloom & Klein, 1995; Jayaratne, 1979; Kirk, 1984; Lindsey, 1976; 1978a; Pardeck, 2002; Sansone, Bedics & Rappe, 2000; Thyer & Bentley, 1986). Scholarship has assumed an increasingly important role in promotion and tenure decisions (e.g., Gibbs & Locke, 1989; Green, 1998; Harrison, Sowers-Hoag & Postley, 1989; Marsh, 1992). Scholarship is important enough in social work to have prompted the creation of Virginia Commonwealth University's *Doctoral Faculty Decade Publication Project* which contrasts schools of social work in terms of their scholarship (e.g., Green, Baskind & Conklin, 1995; Green, Baskind, Best & Boyd, 1997; Green, Baskind & Bellin, 2002; Green & Hayden, 2001; Green, Karfordt & Hayden, 1999).

Because the production and assessment of scholarship is so central to the faculty role, it is incumbent upon decision makers to strive to make assessments of scholarship more informed, more fair. This paper focuses on a particular subset of faculty: full-time, tenured and tenure-track faculty with (or seeking) appointments in colleges and universities where scholarship is an expectation. The focal points of the paper are

meaningful in instances of hiring, reappointment, tenure and promotion decisions in which individuals have amassed a body of scholarship that can be assessed (e.g., the entire approach proposed below will likely not be relevant for hiring at the Assistant Professor level).

The motivation for this review of the area originated from our collective experiences in the assessment of individuals across a variety of academic settings and situations. The level of subjectivity observed in these assessments can be distressing (cf., Garfield, 1983a; Klein & Bloom, 1992; Lindsey, 1999; Singer, 2002). These are the most important decisions in academics' lives. They should be as free from bias as possible. But that is not what happens in untold instances. Furthermore, these concerns are not new. Kirk, Wasserstrum and Miller (1977) began their study of 76 tenure and promotion decisions in 27 schools of social work with the sense that "schools have developed refined methods of applying vague generalities" (p. 89) and found little evidence to disconfirm this notion. From what we have observed (an admittedly restricted view), little seems to have changed in the past 25 years. In our own experience, stellar candidates for tenure and promotion are rejected outright on occasion; others, with more production of spin than knowledge, easily pass at times.

How can we move beyond this situation? Obviously, these decisions about potential and current full-time colleagues involve more than an assessment of their scholarship. Typically, these assessments involve teaching and service as well. But, poor instructors should be eliminated prior to tenure decisions, and service has typically had

a tertiary role in this triumvirate of factors. While decisions regarding teaching and service are important, they are beyond the scope of this paper.

Seipel (2003) commented that:

Because standards and expectations for tenure vary from school to school, a universal and objective standard is not feasible. However, an assessment of the values placed on the publication record of tenure candidates can prove helpful to everyone who is involved in the process. . . . All publications are not alike, and therefore each should be evaluated according to its merits (p. 87).

Not only are all publications not alike (e.g., journal articles vs. books), there is variation within types of publication. This paper will focus on assessment of the quantity and impact of what many would argue is the most important subset of an individual's scholarship – peer reviewed journal articles (e.g., Kirk, 1991; Kostoff, 1996). This claim of primary importance of journal articles was most recently supported by the results of Seipel's (2003) survey of full-time social work faculty.

Bibliometrics

The idea of more quantified evaluations of faculty seeking promotion has existed for some time (e.g., Garfield, 1983a; 1983b). How can this idea be enacted? Bibliometrics are research techniques that are used across a wide variety of fields to study publications and their byproducts (Baker, 1991; Norton, 2000; Sellen, 1993; Twining, 2002). A detailed review of bibliometrics and their use in social work have been presented in this issue, along with a new example of their use (Holden, Rosenberg & Barker, 2005; Rosenberg, Holden & Barker, 2005). *Citation analysis* is a bibliometric

technique that involves assessment of the connections between publications. There have been indications over time that citations of an individual's scholarship are important in the assessment of social work and non-social work (e.g., Hargens & Schuman, 1990) faculty. For instance, the social work deans surveyed in Euster and Weinbach's (1986) study reported that citations were the 4th most important out of 15 factors in assessing the quality of journal publications (behind whether or not the journal was 1) peer reviewed or 2) major; and whether or not the article was 3) full length). A related finding from this series of studies (Euster & Weinbach, 1983; 1994) was that while publication was ranked as the second most important faculty activity in their 1981 survey (behind teaching), it was ranked as most important in the 1992 survey. While citation analysis has primarily been used within social work to examine the quantity and the impact of the work of individuals and academic institutions, some have employed the technique to answer other research questions regarding scholarship related to social work (e.g., Baker, 1991; 1992; Bush, Epstein & Sainz, 1997; Cheung, 1990; Howard & Howard, 1992; Jones, & Jones, 1986; McMurty, Rose & Cisler, 2003; Rothman, Kirk & Knapp, 2003; Wormell, 2000a; 2000b).

In one of the most direct forerunners of the work reported here, Klein and Bloom (1992) also sought to help the profession reduce the level of subjectivity in tenure and promotion decisions. They reported four studies using citation analysis. In the first study of social work experts (authors in the *Encyclopedia of Social Work*), they found that in 1987, on average, these experts were cited 9.4 times per person. Among academics, full professors (13.7) were cited more than associate professors (7.6) and assistant

professors (4.7). In their second study, Klein and Bloom found that the 99 deans and directors of CSWE accredited programs were cited an average of 2.9 times in 1987. In their third study of a convenience sample of four U.S. schools of social work, they found that full professors were cited more frequently in 1989, but that the rankings were mixed for associate and assistant professors. They found generally lower rates of citation on average for faculty in these four schools compared to the expert and deans samples. In their fourth study of three individual faculty, Klein and Bloom provided a more in-depth assessment of these scholars' work using statistics such as lag time that have been incorporated into the approach that is proposed below. Subsequently, Bloom and Klein (1995) studied 344 faculty from the top 13 schools identified in the Thyer and Bentley (1986) study. Overall, they found that 29.7% of these faculty had a publication listed in the Social Science Citation Index and that 76.6% of these faculty had been cited. The average rate of publication for these faculty was .56 and the average number of citations per faculty was 9.55 in 1992.

More recently, Green and Hayden (2001) examined the number of published articles and citations for the ten most productive social work faculties during the 1990-1997 period. The average faculty member in this group published 4.4 articles during the period with those articles being cited 3.27 times on average. Perhaps most revealing was that non-social work journal articles were much more frequently cited (4.22 times per non-social work vs. 1.69 times per social work article).

In summary, scholarship is a very important factor in promotion and tenure decisions. Scholars inside and outside of social work have examined ways to quantify

the scholarship of individuals. This paper presents a proposal for an approach that attempts to extend the pioneering work of our colleagues. The primary goal of this paper is to stimulate discussion regarding scholarship assessment in hiring, reappointment, tenure and promotion decisions.

The proposed approach

How can the data available to us through the use of bibliometric techniques be used to increase the standardization of hiring, tenure and promotion decisions? Table 1 provides an example using the approach we are proposing. Most of the data for the proposed approach were obtained from the Institute for Scientific Information's Web of Science (WoS; <http://isi2.isiknowledge.com/portal.cgi/WoS>). In early 2004, the WoS provided integrated coverage of approximately 8500 leading journals from three databases (*Science Citation Expanded*, *Social Sciences Citation Index*, and *Arts & Humanities Citation Index*). These three databases can be searched separately or concurrently in the WoS. The searches below were performed using the General Search feature on all three databases concurrently, in order to capture authors' publications outside of social science venues.

The proposed approach begins with an examination of the list of articles on the candidates CV. Next one does a General Search on the WoS, covering all three databases simultaneously, using the candidate's last name and first initial with a wildcard (to capture any instances when a middle initial might have been used). Then one confirms that all the articles on the CV that are in journals covered by the WoS (for that year of publication) are in fact in the databases (omissions should be reported to

the WoS). Next, one records the number of authors, and the candidate's position in that array of authors.

Lindsey (1978b) proposed the *corrected quality ratio*, which combined the n of publications and n of citations (using a variety of adjustments). Although it has been infrequently used (e.g., Glanzel & Moed, 2002), it points to the need to understand the combination of quantity and impact of a set of articles. The *Multiple Author Qualifier* (MAQ) is our attempt to address the multiple authorship problem. Given the lack of empirical data regarding how authors in social work decide on authorship, this must be considered an initial attempt that is designed to produce discussion and refinement (this issue will be addressed in more detail in the Discussion). Beginning with the assumption that each article and each citation should only be counted once (a debatable assumption), one must next decide how each author will be credited. Table 2 details the MAQ values when using the $\frac{1}{2}$ rule. That is, each subsequent author in the authorship list receives $\frac{1}{2}$ of the credit of the preceding author. Other proportions are possible, yet the optimal one, if it exists, has not been determined. Using the $\frac{1}{2}$ rule the MAQs for a four author article would be .53336, .26668, .13334 and .06667 for the first through fourth authors. These values are similar to those obtained by Wagner, Dodds & Bundy (1994) in their study of how authors value particular research tasks and determine order of authorship. While the MAQ is selectively applied in Table given because of space limitations, its effect can clearly be seen. This approach may have been attempted previously although we have yet to uncover it in the literature.

Age of the article is computed by subtracting the year of publication from the current year (2003 in this case) and adding .5. The .5 was added to make the age estimate a better estimator of the age of the typical article. If an article was published in 2000 and the analysis was done in Dec of 2003, the age of the article might be estimated as $2003 - 2000 = 3$ yrs. The article could in reality be anywhere from almost four years old (1/00 - 12/03) to only slightly over three years old 12/00 - 12/03. In terms of lag time the same applies. If an article was published in 2000 and was first cited in 2003, the lag time to citation might be estimated as $2003 - 2000 = 3$ yrs. The time between publication and first cite could be anywhere from almost four years old (1/00 - 12/03) to only slightly over three years 12/00 - 12/03. Therefore, given that we were doing our analysis during December 2003, we added .5 years in each instance to make this a better estimator of the elapsed time.

Next the total number of references on the reference list of the article is recorded (this is provided in the WoS database). The Price Index is the proportion of articles that are five years or less old (Schoepflin & Glanzel, 2001). In this approach, the Price Index for both serials and non serials is computed. The next statistic is lag time, computed as noted above. Next is persistence which is the total number of years in which an author's work has been cited. Persistence is obviously more difficult to interpret the younger the article. The Price indices, lag times, and persistence may not be of interest to some review committees (and could be dropped from their analyses).

Aksnes (2003) states that "[a] self-citation is usually defined as a citation in which the citing and the cited paper have at least one author in common" (p. 235). He goes on

to distinguish between *synchronous self-citations* (when the author cites her past work in the article that is being studied) and *diachronous self citations* (when the article that is being studied is cited by the author in one of her subsequent articles). The proposed approach focuses on citations received by target papers and therefore *diachronous self citations* -- those received by the target paper from subsequent papers authored by one or more of the authors on the target paper are of most interest. Regardless, the proportion of synchronous self-citations in the target paper are also recorded (as done by Snyder & Bonzi, 1998), as they might differ from the proportion of diachronous self-citations a paper receives.

In terms of diachronous self citations - the proposed approach uses two statistics: cited by self and cited by co-authors on the original article (cf., Fortune, 1992; Porter, 1977). Citations by others and total cites are also recorded. Each of these four statistics is also adjusted for the age of the article. Cronin and Overfelt (1994) used the amount of time since first faculty appointment to adjust their raw citation counts, but noted it was a potentially flawed indicator due to the possibility of pre-appointment scholarship. The approach in the current study avoids this problem by using the age of the article to adjust the citation count for that article. This has been referred to as the citedness rate (Borgman & Furner, 2002). One issue arises from separating literal self-citation and citation by co-authors on the original paper. When a target scholar's article (article A) is cited in a subsequent article written by a group of authors that includes the target scholar and any of their co-authors on article A, this is recorded as a literal self-cite only.

Insert Table 1 about here

Insert Table 2 about here

Ten articles by one of the authors of this article (GH - although all of us contributed to this set of articles to some degree) are assessed in Table 1. Because this is a selection of a subset of data for demonstration purposes, two of the statistics in Table 1 are not accurate for this author (n of publications, n of publications per year studied). There were 10 articles included in the analysis or .91 articles per year for the time period studied (1990-2001). The MAQ adjusted number of articles was 4.3. All of these articles were cited and all of them were cited by individuals other than the target author (GH) or his co-authors on that article.

The typical article had four authors and this author's median position in this array was 1.5 (medians are used because of non-normal distributions). The MAQs for this set of articles ranged from .06667 to 1. This typical article was nine years old, had 48 references of which 65% were to serials. Forty percent of the references to serials and 47% of the references to non-serials were five years old or less. The proportion of synchronous self-citations ranged from .00 to .15, with a median of .00 and a mean of .04.

In terms of diachronous self citation and citation by others, the typical article was first cited two and one half years after publication and has been cited in three and one half different years after it was published. That typical article is self cited by this author one time, has not been cited by any of the co-authors on that article and is cited 5.5 times by others. Overall, this set of articles was cited 129 times (24 times by this author, 0 times by co-authors, 105 times by others). The MAQ adjusted total number of cites was 83. Three articles accounted for 74% of the citations. These three also represent three of the four oldest articles in the selected set.

Controlling for time since publication (citedness rate) it can be seen from Table 1 that the typical article is self cited by this author .1 times per year (not at all by co-authors), and is cited .83 times per year by others. The median number of MAQ adjusted total cites per year was .313.

Problems with bibliometrics

There are potentially problematic issues involved in the use of bibliometrics (e.g., Baker, 1990; Cnaan, Caputo & Shmuelly, 1994; Garfield, 1996; 1997; Kirk, 1984; Krueger; 1993; 1999; Lindsey, 1978a, 1980; 1982; 1989; MacRoberts & MacRoberts, 1989; 1992; Narin, Olivastro & Stevens, 1994; Phelan, 1999; vonUngern-Sternberg, 2000). It is clear that citation analysis may not reflect the impact a journal article has on professionals who are reading it (but not writing and citing it).

Some of the criticisms of bibliometrics are not relevant to the approach we are proposing. For instance, this approach goes beyond the simple counting of the number of articles published and examines other aspects of the quantity and impact of a

scholar's work. The approach proposed here does not restrict the set of journals studied (a critique of some studies), beyond our use of the WoS databases. Although these databases have limitations (e.g., some journals are not included and some volumes of some included journals are not included in WoS) they are the best available at this time. For individuals who publish both in and outside of social work, they allow simultaneous coverage of multiple fields.

While the *submission to publication* and *publication to first cite* time lags may have influenced some studies, any committee member with reasonable publishing experience should be aware of how these phenomena may have impacted on the candidate who is being reviewed. Long lag times (and the existence of few older publications early in one's career) do mean that the citation aspects of our approach may have more utility for later promotion decisions and the hiring of senior faculty or deans than for initial hiring or tenure decisions (cf., Cole, 1983; cited in Garfield, 1983a).

The skewed distributions seen in many studies (e.g., many faculty rarely publish) are only a problem if those interpreting the data forget that fact. The problem with self-report data that arises in some studies is not relevant here. The self-reported data in the form of the scholar's CV is actually a benefit, because it allows the reviewers to potentially capture articles that might be missed in a WoS search due to factors such as change of institutional affiliation, change of name or initials, etc.

It also seems reasonable that citations may not be equivalent and that the types of citations vary. Some have noted that citations can occur for non-scientific reasons or they may not be positive or central to the issue being discussed. This possibility might

be examined using citation context and content analyses (Garfield, 1983b) although it would probably be too resource intensive for most committees. It has also been suggested that authors may be more likely to reference work that is, for example, indexed in more commonly used databases, is more easily available to them, is written in the language they speak, or is newer, to name a few instances. In addition, authors may be referencing work that is incorrect, not referencing the best work, or not correctly referencing work. Although any or all of these possibilities may occur, we have seen no evidence that they are major problems in social work and therefore believe that they should be seen as measurement error in a non-perfect system until empirical research supports an alternative view.

Variations in citation patterns across fields, nations, time period studied or publication outlets present a potential problem for approaches such as the one proposed here. Cole (cited in Garfield, 1983a) recommends comparison of a scholar's record to "faculty members who have been promoted or granted tenure at equal caliber departments in the last several years" (p. 360). Garfield states that "[a]ll citation studies should be normalized to take into account variables such as field, or discipline, and citation practices" (1999, p. 979; c.f., Narin, Olivastro & Stevens, 1994). Yet, normalization is easier said than done (Kostoff, 2002) and given difficult problems such as this, it is clear that our approach needs substantial testing and refinement.

Another criticism is that citation analysis is narrow and shallow (e.g. Krueger, 1999). Citation analysis is a restricted view of a scholar's output (cf., Gastel, 2001). Yet, it focuses on the output that many would argue is the most important (journal articles)

and one type of impact resulting from that output. Yes, secondary analysis of any type can be trivial with no real impact on the profession. But primary analysis can be as well.

Journal coverage and technical limitations have been raised regarding the WoS. It seems logical that the level of journal coverage by the WoS will continue to increase with time, as should the capabilities of its software and interface. Similarly, alternative databases to the WoS will likely appear, allowing greater flexibility for the bibliometric researcher. Conversely, new databases will likely illuminate old problems and lead to new ones (Whitley, 2002).

Some have noted that citation analysis may be biased against high quality work that is published in very specialized journals that are read by relatively few scholars. Lindsey and Kirk (1992) found that during the 1981-89 period, although *Social Work* went to over 100,000 individuals and *Social Service Review* went out to approximately 2600, *Social Service Review* had 67% of the impact that *Social Work* had (as measured by citations in the form of impact factor scores over nine years). While this bias against work in specialized journals may exist in social work we have not found a clear demonstration of it yet.

A related concern involves these impact factor scores. A journal's impact factor is computed by "dividing the number of citations in year 3 to any items published in the journal in years 1 and 2 by the number of substantive articles published in that journal in years 1 and 2" (Saha, Saint & Christakis, 2003, p. 43). While Saha, Saint and Christakis report evidence supporting the use of impact factors as indicators of journal quality, Frank (2003) cautions us that because of inter- and intra-journal variations, citations to a

scholar's articles are a better indicator of that scholar's work than the impact factor of the journals in which they are published (cf., Furr, 1995; Garfield, 1996; 1999; Seglen, 1997; Whitehouse, 2001).

The concern that authors may be referencing themselves and thereby inflating citation rates has often been voiced. First, this critique of self-citation should not go unchallenged. We strongly agree with those who have emphasized the importance of replication in social science research (e.g., Bornstein, 1990; Neulip & Crandall, 1990; Rosenthal, 1990; Schafer, 2001). Some researchers do direct replications or replications and extensions of their prior work. In those instances it seems quite appropriate that one cite oneself in order to fully explain the research program to the reader. This should not be simply dismissed as gratuitous self-citation, but rather considered as appropriate scientific behavior. This position is indirectly supported by Klein and Bloom (1992). Second, the proposed approach distinguishes synchronous and diachronous self-citations, breaks down diachronous self citations into several categories and adjusts these statistics for the age of the article (Borgman & Furner, 2002; Cronin & Overfelt, 1994). This adds a statistic (citations by co-authors on original article) that has not, to our knowledge, been directly addressed in the literature. This dichotomization should provide review committees clarification regarding the role of self- and co-author citation. Was self-citation a major problem in this group of articles examined here? The mean proportion of synchronous self-citations in this group of articles was .04 ($Mdn=.00$). Snyder and Bonzi (1998) examined synchronous self-citations in journals in a total of six fields from the humanities, physical sciences and social sciences for the

1980-1989 period. Across all disciplines, the proportion of synchronous self-citations was .09 (.06 in economics and .07 in sociology).

Slightly under twenty percent (18.6) of the 129 citations received by the group of articles in the current study were diachronous self-citations. Aksnes (2003) studied over 45,000 science publications from Norway for the 1981-1996 period and found a diachronous self-citation rate of 21% (minimum: 17%; maximum: 31%). It appears that the rates of synchronous and diachronous self-citation observed in the articles examined here are similar to the limited normative data that is available.

Just as there are issues among authors in assigning credit for authorship (e.g., Gibelman & Gelman, 1999), researchers have discussed how multiple authorship should be handled in citation analysis. Kirk and Rosenblatt (1980) found an increase in the percentage of articles by more than one author in their study of five social work journals in the 1934-1977 period. Grinnell and Royer (1983) similarly found an increase in the 16 social work journals they examined (from initial publication through 1/1/79). Subsequently, Gelman and Gibelman (1999) found an increase in multiple authorship in four social work journals between 1973-77 and 1993-97 (cf., Endersby, 1996; Rubin & Chang, 2003; Seaberg, 1998)

The problem created by multiple authorship in citation analysis was described over 20 years ago in social work although no consensus on the handling of the issue has been reached (e.g., Green, Hutchison & Sar, 1992; Harsanyi, 1993; Lindsey, 1978a; 1980). The following discussion assumes that a sole authored article should receive the same credit as a multiply authored article (i.e., one credit). This may not be a reasonable

assumption as there is some preliminary evidence that indicates multiply authored articles are cited somewhat more frequently (e.g., Lindsey, 1978a; Oromaner, 1974).

Normal counts (aka whole counts), inflate productivity estimates because multiple individuals receive full credit for a single article. *Straight counts*, which only include the article once and give all credit to the first author are unfair to the other authors. *Adjusted counts*, of various types have been used to award proportions of credit to coauthors (c.f., Cronin & Overfelt, 1994; Vinkler, 2000). For instance, Lindsey (1976) proposed an *adjusted total articles* measure (“summation of all of the author’s articles, each divided by the number of authors”, p. 802). This is the approach followed by the Council on Social Work Education in their annual report on the field and some researchers in this area (e.g., Lennon, 2002; Rothman, Kirk & Knapp, 2003). While this adjusted measure controls for the bias introduced into total number of article comparisons, it apportions credit equally to all authors of a multiply authored article. Johnson and Hull (1995) created a system which they said reflected “in part, the authors’ sense of the reward system currently operative in U.S. colleges and universities” (p. 360-1). For both journals and books/monographs, this system gave sole authors 10 points and for multiple authored articles awarded the following: first (9); second (8); third (7); fourth or more (6). While this system apportions credit relative to order of authorship, it has the same problem of over-crediting multiply authored articles (as with normal counts).

Endersby (1996) in his examination of collaborative research in the social sciences points out that whereas some fields require or tend to list authors alphabetically, the rules are clearest in psychology. While these ethical standards have been refined

slightly since Endersby reviewed them, the relevant point to this discussion remains the same: “[p]rincipal authorship and other publication credits accurately reflect the relative scientific or professional contributions of the individuals involved, regardless of their relative status” (APA, 2002, no p., emphasis added). We believe the direction of this approach is the most appropriate. In our own experience with multiply authored articles it is clear that equivalence of contribution across authors is rarely if ever achieved.

Although resolution of the multiple authorship problem is beyond the scope of this article, we offer some alternatives to understanding this phenomenon. First, we simply recorded the number of authors on each article and the candidate’s position in that array. In the summary of the articles assessed here it is easy to see that this author had from 0-5 co-authors on his articles and he typically fell between the first and second in that array. Second, we introduced the MAQ, which attempts to divide a publication or citation into proportions based on the number of authors, giving higher ranked authors a larger proportion of the credit. The single author receives one credit for each article she writes or citation she receives. The second author on a two author article receives a count of .33333 for that article, as well as a count of .3333 for each citation the article receives.

While this is a different approach from Lindsey’s (e.g. 1978b; 1980) early efforts, we think it roughly echoes his and others’ attempt to more equitably apportion credit for the contribution made by individuals. For instance, if normal counts of the number of publications were applied to the sample of articles examined here, a count of ten

articles would have been recorded for the candidate, which overemphasizes his contribution. Using straight counts would have resulted in a total of five. Perhaps that is more reflective, but the counting of first authors only is inherently limited. Applying the MAQ to this set of articles results in a publication count value of 4.31. The MAQ does assume a single descending rate of credit ($1/2$) for each article, which is obviously an estimate that will not apply in each case. Yet, the MAQ maintains a value of 1 for the article (unlike normal counts); takes all authors into account (unlike straight counts), and gives greater credit to higher ranked authors (unlike the adjusted total articles approach). Obviously, computation rules other than $1/2$ could be used for the MAQ (e.g., $3/4$, $1/3$, $1/4$, etc.) and this seems to be area worth some exploration.

Some faculty reading this may be concerned that analyses such as this will lead to even more administrative intrusion upon academic freedom by facilitating increased monitoring. Our view is that the "audit culture" is already here and growing (e.g., Davenport & Cronin, 2001; Kostoff, 1996). Some faculty need to study and take control of such analyses so they are less likely to be used as weapons against faculty. Before administrators consider using bibliometrics to evaluate faculty they should remember Franck's admonition. "As a rule, however, understanding scientific facts, problems and theories is not trivial. This is why only those personally working in the respective field are competent to judge the value of a piece of scientific information" (2002, p.6). In other words, scholars with sufficient competency to understand the applicant's content area and with sufficient competency to perform the analyses of the applicant's scholarship should have primary responsibility for hiring, retention, tenure and promotion

decisions. The adoption of bibliometrics in academic employment decisions in social work merits further discussion.

Conclusion

In summary, we began with the assertion that the assessment of scholarship is a central feature of academic life. We provided a brief background on bibliometrics, presented our proposed approach and detailed potential issues that might impact on such bibliometric analyses. The approach that was presented solves or avoids a number of the problematic issues and has the potential to add standardization to hiring, reappointment, tenure and promotion decisions. Some critics may be reading this and thinking - yes - but the problems that remain are so serious that these analyses should not be used. As Garfield (1983a; 1983b) noted years ago, and ISI still clearly states in its guidelines for citation analysis: "these methods should be used as supplement and not as replacement for careful consideration by informed peers or experts" (ISI, 2003, p. 1).

Given the importance of scholarship in the academy, it is imperative that the assessment of scholarship receives serious attention. Whether or not social work adopts part or all of the approach that has been proposed here is unimportant. What is important is that these vitally important decisions in academia become more informed, more fair.

References

- APA (2002). Ethical principles of psychologists and code of conduct 2002. Retrieved 11/16/02 from: http://www.apa.org/ethics/code2002.html#8_12
- Aksnes, D. (2003). A macro study of self-citation. *Scientometrics*, 56, 235-246.
- Baker, D. R. (1990). Citation analysis: A methodological review. *Social Work Research & Abstracts*, 26, 3-10.
- Baker, D. R. (1991). On-line bibliometric analysis for researchers and educators. *Journal of Social Work Education*, 27, 41-47.
- Baker, D. R. (1992). A structural analysis of the social work journal network: 1985-1986. *Journal of Social Service Research*, 15, 153-168.
- Baker, D. R., & Wilson, M. V. K. (1992). An evaluation of the scholarly productivity of doctoral graduates. *Journal of Social Work Education*, 28, 204-213.
- Bloom, M., & Klein, W. C. (1995). Publications & citations: A study of faculty at leading schools of social work. *Journal of Social Work Education*, 31, 377-387.
- Borgman, C. L., & Furner, J. (2002). Scholarly communication and bibliometrics. In B. Cronin (Ed.), *Annual Review of Information Science and Technology*, 36 (pp. 3-72). Medford, NJ: Information Today.
- Bornstein, R. F. (1990). Publication politics, experimenter bias and the replication process in social science research. In J. W. Neulip (Ed.) *Handbook of Replication Research in the Behavioral and Social Sciences* (pp. 71-82.). Corte Madera, CA: Select Press.

- Bush, I., Epstein, I. & Sainz, A. (1997). The use of social science sources in social work practice journals: An application of citation analysis. *Social Work Research, 21, 1*, 45-56.
- Cheung, K. M. (1990). Interdisciplinary relationships between social work and other disciplines: A citation study. *Social Work Research and Abstracts, 26, 3*, 23-9.
- Cnaan, R. A., Caputo, R. K. & Shmueli, Y. (1994). Senior faculty perceptions of social work journals. *Journal of Social Work Education, 30*, 185-199.
- Cronin, B. & Overfelt, K. (1994). Citation-based auditing of academic performance. *Journal of the American Society for Information Science, 45, 2*, 61-72.
- Davenport, E. & Cronin, B. (2001). Knowledge management, performance metrics, and higher education: Does it all compute? *The New Review of Academic Librarianship, 7*, 51-65.
- Endersby, J. W. (1996). Collaborative research in the social sciences: Multiple authorship and publication credit. *Social Science Quarterly, 77*, 375-392.
- Euster, G. L. & Weinbach, R. W. (1983). University rewards for faculty community service. *Journal of Education for Social Work, 19*, 108-114.
- Euster, G. L. & Weinbach, R. W. (1986). Deans' quality assessment of faculty publications for tenure/promotion decisions. *Journal of Social Work Education, 3*, 79-84.
- Euster, G. L. & Weinbach, R. W. (1994). Faculty rewards for community service activities: An update. *Journal of Social Work Education, 30*, 317-324.

- Fortune, A. E. (1992). More is not better – manuscript reviewer competence and citations: From the Past Editor-in-Chief. *Journal of Social Work Education. Research on Social Work Practice*, 2, 505-510.
- Frank, M. (2003). Impact factors: Arbiter of excellence. *Journal of the American Medical Library Association*, 91, 4-6.
- Franck, G. (2002). The scientific economy of attention: A novel approach to the collective rationality of science. *Scientometrics*, 55, 1, 3-26.
- Furr, A. L. (1995). The relative influence of social work journals: Impact factors vs. core influence. *Journal of Social Work Education*, 31, 38-45.
- Garfield, E. (1983a). How to use citation analysis for faculty evaluations, and when is it relevant? Part 1. *Current Comments*, 44, 5-13.
- Garfield, E. (1983b). How to use citation analysis for faculty evaluations, and when is it relevant? Part 2. *Current Comments*, 45, 5-14.
- Garfield, E. (1996). How can impact factors be improved? *BMJ*, 313, 7054, 411-413.
- Garfield, E. (1997). Validation of citation analysis. *Journal of the American Society for Information Science*, 48, 962-964.
- Garfield, E. (1999). Journal impact factor: A brief review. *Canadian Medical Association Journal*, 161, 979-80.
- Gastel, B. (2001). Assessing the impact of investigators' work: Beyond impact factors. *Canadian Journal of Anesthesia*, 48, 941-945.

- Gelman, S. R., & Gibelman, M. (1999). A quest for citations? An analysis of and commentary on the trend toward multiple authorship. *Journal of Social Work Education, 35*, 203-213.
- Gibelman, M., & Gelman, S. R. (1999). Who's the author? Ethical issues in publishing. *Arete, 23, 1*, 77-88.
- Gibbs, P., & Locke, B. (1989). Tenure and promotion in accredited graduate social work programs. *Journal of Social Work Education, 25*, 126-133.
- Glanzel, W., & Moed, H. F. (2002). Journal impact measures in bibliometric research. *Scientometrics, 53, 2*, 171-193.
- Green, R.G. (1998). Faculty rank, effort, and success: A study of publication in professional journals. *Journal of Social Work Education, 34*, 415-427.
- Green, R. G., Baskind, F. R., & Conklin, B. (1995). The 1990s publication productivity of schools of social work with doctoral programs: "The times, are they a-changin'?" *Journal of Social Work Education, 31*, 388-401.
- Green, R. G., Baskind, F. R., Best, A. M. & Boyd, A. S. (1997). Getting beyond the productivity gap: Assessing variation in social work scholarship. *Journal of Social Work Education, 33*, 541-553.
- Green, R. G., Baskind, F. R., & Bellin, M. H. (2002). Results of the doctoral faculty publication project: Journal article productivity and its correlates in the 1990s. *Journal of Social Work Education, 37*, 135-152.

- Green, R. G., & Hayden, M. A. (2001). Citation of articles published by the most productive social work faculties in the 1990's. *Journal of Social Service Research*, 27, 3, 41-56.
- Green, R.G., Hutchison, E. D., & Sar, B. K. (1992), Evaluating scholarly performance: The productivity of graduates of social work doctoral programs. *Social Service Review*, 66, 441-466.
- Green, R. G., Kvarfordt, C. L. & Hayden, M. A. (2001). The middle years of the Decade Publication Project: 1994-97. *Journal of Social Work Education*, 35, 2, 195-202.
- Grinnell, R. M. & Royer, M. L. (1983). Authors of articles in social work journals. *Journal of Social Service Research*, 3/4, 147-154.
- Hargens, L. L. & Schuman, H. (1990). Citation counts and social comparisons: Scientists' use and evaluation of citation index data. *Social Science Research*, 19, 205-221.
- Harrison, D. F., Sowers-Hoag, K. & Postley, B. J. (1989). Faculty hiring in social work: Dilemmas for educators of job candidates. *Journal of Social Work Education*, 25, 117-125.
- Harsanyi, M. A. (1993). Multiple authors, multiple problems – bibliometrics and the study of scholarly contribution: A literature review. *Library & Information Science Research*, 15, 325-354.
- Holden, G., Rosenberg, G., & Barker, K (2005a). Tracing thought through time and space: A selective review of bibliometrics in social work. *Social Work in Health Care*.

- Howard, M. O. & Howard, D. A. (1992). Citation analysis of 541 articles published in drug and alcohol journals: 1984-1988. *Journal of Studies on Alcohol*, 53, 427-434.
- ISI (2003). *Interpretation*. Retrieved 1/13/04 from:
<http://esi-topics.com/interpreting.html>
- Jayaratne, S. (1979). Analysis of selected social work journals and productivity rankings among schools of social work. *Journal of Education for Social Work*, 15, 3, 72-80.
- Johnson, H. W., & Hull, G. H. (1995). Publication productivity of BSW faculty. *Journal of Social Work Education*, 31, 358-368.
- Jones, J. F. & Jones, L. M. (1986). Citation analysis as an approach to journal assessment in social work. *National Taiwan University Journal of Sociology*, 18, 207-219.
- Kirk, S. A. (1984). Methodological issues in the comparative study of schools of social work. *Journal of Social Service Research*, 7, 3, 59-73.
- Kirk, S. A. (1991). Scholarship and the professional school. *Social Work Research & Abstracts*, 27, 3-5.
- Kirk, S. A. & Rosenblatt, A. (1980). Women's contributions to social work journals. *Social Work*, May, 204-209.
- Kirk, S. A., Wasserstrum, K., & Miller, D. A. (1977). Publish and perish: A study of promotion and tenure in schools of social work. *Journal of Social Welfare*, Winter, 90-7.
- Klein, W. C. & Bloom, M. (1992). Studies of scholarly productivity in social work using citation analysis. *Journal of Social Work Education*, 28, 291-299.

- Kostoff, R. N. (1996). Performance measures for government sponsored research: Overview and background. *Scientometrics*, 36, 281-292.
- Kostoff, R. N. (2002). Citation analysis of research performer quality. *Scientometrics*, 53, 1, 49-71.
- Kreuger, L. W. (1993). Should there be a moratorium on articles that rank schools of social work based on faculty publications? Yes! *Journal of Social Work Education*, 29, 240-246.
- Kreuger, L. W. (1999). Shallow science? *Research on Social Work Practice*, 9, 108-110.
- Lennon, T. M. (2002). *Statistics on social work education in the United States: 2000*. Alexandria, VA: CSWE.
- Lindsey, D. (1976). Distinction, achievement and editorial board membership. *American Psychologist*, 31, 799- 804.
- Lindsey, D. (1978a). *The scientific publication system in social science*. San Francisco: Jossey-Bass.
- Lindsey, D. (1978b). The corrected quality ratio: A composite index of scientific contribution to knowledge. *Social Studies of Science*, 8 3, 349-354.
- Lindsey, D. (1980). Production and citation measures in the sociology of science: The problem of multiple authorship. *Social Studies of Science*, 10, 145-162.
- Lindsey, D. (1982). Further evidence for adjusting for multiple authorship. *Scientometrics*, 4, 5, 389-395.
- Lindsey, D. (1989). Using citation counts as a measure of quality in science: Measuring what's measurable rather than what's valid. *Scientometrics*, 15, 189-203.

- Lindsey, D., & Kirk, S. A. (1992). The role of social work journals in the development of a knowledge base for the profession. *Social Service Review, 66*, 295-310.
- Lindsey, D. (1999). Ensuring standards in social work research. *Research on Social Work Practice, 9*, 115-120.
- MacRoberts, M. H. & MacRoberts, B. R. (1989). Problems of citation analysis: A critical review. *Journal of the American Society for Information Science, 40*, 342-349.
- MacRoberts, M. H. & MacRoberts, B. R. (1992). Problems of citation analysis. *Social Work Research & Abstracts, 28*, 4.
- Marsh, J. C. (1992). Should scholarly productivity be the primary criterion for tenure decisions? Yes! *Journal of Social Work Education, 28*, 132-134.
- McMurty, S. L., Rose, S. J., & Cisler, R. A. (2003). Identifying and administering the most-used rapid assessment instruments. Presentation at the Seventh Annual Society for Social Work & Research Conference, Washington, DC.
- Narin, F., Olivastro, D., & Stevens, K. A. (1994). Bibliometrics/theory, practice and problems. *Evaluation Review, 18*, 1, 65-76.
- Neulip, J. W., & Crandall, R. (1990). Editorial bias against replication research. In J. W. Neulip (Ed.) *Handbook of Replication Research in the Behavioral and Social Sciences* (pp. 85-90). Corte Madera, CA: Select Press.
- Norton, M. J. (2000). *Introductory concepts in information science*. Medford, NJ: Information Today, Inc.
- Oromaner, M. (1974). Collaboration and impact: The career of multiauthored publications. *Social Science Information, 14*, 147-155.

- Pardeck, J. T. (2002). Scholarly productivity of editors of social work and psychology journals. *Psychological Reports, 90*, 1051-1054.
- Phelan, T. J. (1999). A compendium of issues for citation analysis. *Scientometrics, 45*, 1, 117-36.
- Porter, A. L. (1977). Citation analysis: Queries and caveats. *Social Studies of Science, 7*, 257-67.
- Rosenberg, G., Holden, G., & Barker, K (2005). What happens to our ideas? A bibliometric analysis of articles in *Social Work in Health Care* in the 1990s. *Social Work in Health Care*.
- Rosenthal, R. (1990). Replication in behavioral research. In J. W. Neulip (Ed.) *Handbook of Replication Research in the Behavioral and Social Sciences* (pp. 1-30). Corte Madera, CA: Select Press.
- Rothman, J., Kirk, S. A., & Knapp, H. (2003). Reputation and publication productivity among social work researchers. *Social Work Research, 27*, 105-115.
- Rubin, R. M., & Chang, C. F. (2003). A bibliometric analysis of health economics articles in the economics literature: 1991-2000. *Health Economics, 12*, 403-414.
- Saha, S., Saint, S., & Christakis, D. A. (2003). Impact factor: A valid measure of journal quality? *Journal of the Medical Library Association, 91*, 42-46.
- Sansone, F. A.; Bedics, B. C., & Rappe, P. T. (2000). BSW faculty workload and scholarship expectations for tenure. *The Journal of Baccalaureate Social Work, 5*, 2, 27-46.

- Schafer, W. D. (2001). Replication in field research. ERIC Digest. ERIC Identifier: ED458217. Retrieved 2/17/03 from:
<http://www.ericfacility.net/ericdigests/ed458217.html>
- Seaberg, J. R. (1998). Faculty reports of workload: Results of a national survey. *Journal of Social Work Education, 34*, 7-19.
- Sellen, M. K. (1993). *Bibliometrics: An annotated bibliography, 1970-1990*. New York: G. K. Hall & Co.
- Schoepflin, U. , & Glanzel, W. (2001). Two decades of "Scientometrics": An interdisciplinary field represented by its leading journal. *Scientometrics, 50*, 301-312.
- Seipel, M. M. (2003). Assessing publication for tenure. *Journal of Social Work Education, 39*, 79-88.
- Seglen, P. O. (1997). Why the impact factor of journals should not be used for evaluating research. *BMJ, 314*. Retrieved 2/17/03 from:
<http://bmj.com/cgi/content/full/314/7079/497>
- Singer, M. [pseudonym] (2002, November 20). Collegiality and the weasel clause. *Chronicle of Higher Education*. Retrieved 11/22/02 from:
<http://chronicle.com/jobs/2002/11/2002112001c.htm>
- Snyder, H. & Bonzi, S. (1998). Patterns of self-citation across disciplines (1980-89). *Journal of Information Science, 24*, 431-435.
- Thyer, B. A., & Bentley, K. (1986). Academic affiliations of social work authors: A citation analysis of six major journals. *Journal of Social Work Education, 22*, 67-73.

Twining, (2002). Bibliometrics: An overview. Retrieved 11/10/02 from:

<http://www.du.edu/~jtwining/LIS4326/bibliometrics.htm>

Vinkler, P. (2000). Evaluation of the publication activity of research teams by means of scientometric indicators*. *Current Science*, 79, 602-612.

vonUngern-Sternberg, S. (2000). Scientific communication and bibliometrics. Retrieved 11/14/02 from: <http://www.abo.fi/~sungern/comm00.htm>

Wagner, M. K., Dodds, A., & Bundy, M. B. (1994). Psychology of the scientist: Assignment of authorship credit in psychological research. *Psychological Reports*, 74, 179-187.

Whitehouse, G. H. (2001). Citation rates and impact factors: Should they matter? *The British Journal of Radiology*, 74, 1-3.

Whitley, K. M. (2002). Analysis of SciFinder Scholar and Web of Science citation searches. *Journal of the American Society for Information Science and Technology*, 53, 1210-1215.

Wormell, I. (2000a). Bibliometric analysis of the welfare topic. *Scientometrics*, 48, 203-236.

Wormell, I. (2000b). Critical aspects of the Danish Welfare State – as revealed by issue tracking. *Scientometrics*, 48, 237-250.

References for articles used to demonstrate proposed approach

Cuzzi, L. F., Holden, G., Grob, G. G., & Bazer, C. (1993). Decision making in social work: A review. *Social Work in Health Care*, 18, 2, 1-22.

- Holden, G. (1991). The relationship of self-efficacy appraisals to subsequent health related outcomes: A meta-analysis. *Social Work in Health Care, 16, 1*, 53-93.
- Holden, G., Barker, K., Meenaghan, T. & Rosenberg, G. (1999). Research self-efficacy: A new possibility for educational outcomes assessment. *Journal of Social Work Education, 35*, 463-76.
- Holden, G., Bearison, D., Rode, D., Rosenberg, G., & Fishman, M. (1999). Evaluating the effects of a virtual environment (STARBRIGHT World) with hospitalized children. *Research on Social Work Practice, 9*, 365-82.
- Holden, G., Moncher, M. S., Schinke, S. P., & Barker, K. M. (1990). Self-efficacy of children, and adolescents: A meta-analysis. *Psychological Reports, 66*, 1044-46.
- Holden, G., Rosenberg, G., Barker, K., Tuhim, S., & Brenner, B. (1993). The recruitment of research participants: A review. *Social Work in Health Care, 19*, 1-44.
- Mailick, M., Holden, G., & Walthers, V. (1994). Coping with childhood asthma: Caretakers' views. *Health & Social Work, 19*, 103-11.
- Rosenberg, G. & Holden, G. (1997). The role for social work in improving quality of life in the community. *Social Work in Health Care, 25*, 9-22.
- Showers N., Simon, E.P., Blumenfield, S. & Holden, G. (1995). Predictors of patient and proxy satisfaction with discharge plans. *Social Work in Health Care, 22*, 19-35.
- Spitzer, W., Holden, G., Cuzzi, L. C., Rutter, S., Chernack, P., & Rosenberg, G. (2001). Edith Abbott was right: Designing fieldwork experiences for contemporary health care practice. *Journal of Social Work Education, 37*, 1-12.

Table 1. Demonstration of the proposed system.

Article	n of authors	position in order of authors	MAQ	Age	N of references	Proportion of references to serials	Price Index ¹ : Serials	Price Index ¹ : Non-Serials	% of Synchronous self-cites ²	Lag time (to first cite)	Persistence	Cited by self ³	Cited by co-authors ³	Cited by others	Total cites ³	MAQ adjusted total cites ³	Mean n of cites per yr. by self ³	Mean n of cites per yr. by co-authors ³	Mean n of cites per yr. by others	Mean n of total cites per yr. ³	MAQ adjusted total cites per yr. ³
Spitzer, Holden, Cuzzi, Rutter,, Chernack & Rosenberg (2001).	6	2	.25392	2.5	52	.48	.44	.15	.15	1.5	1	0	0	1	1	.254	0	0	.40	.40	.102
Holden, Barker, Meenaghan & Rosenberg (1999).	4	1	.53336	4.5	72	.64	.65	.65	.11	3.5	2	2	0	1	3	1.60	.44	0	.22	.67	.356
Holden, Bearison, Rode, Rosenberg & Fishman (1999).	5	1	.516	4.5	51	.65	.61	.67	.06	1.5	3	2	0	5	7	3.61	.44	0	1.11	1.56	.803

Article	n of authors	position in order of authors	MAQ	Age	N of references	Proportion of references to serials	Price Index ¹ : Serials	Price Index ¹ : Non-Serials	% of Synchronous self-cites ²	Lag time (to first cite)	Persistence	Cited by self ³	Cited by co-authors ³	Cited by others	Total cites ³	MAQ adjusted total cites ³	Mean n of cites per yr. by self ³	Mean n of cites per yr. by co-authors ³	Mean n of cites per yr. by others	Mean n of total cites per yr. ³	MAQ adjusted total cites per yr. ³
Rosenberg & Holden (1997).	2	2	.33333	6.5	36	.50	.67	.33	.00	3.5	2	0	0	4	4	1.33	0	0	.62	.62	.205
Showers, Simon, Blumenfield & Holden (1995).	4	4	.06667	8.5	32	.81	.23	.67	.06	2.5	4	0	0	6	6	.400	0	0	.71	.71	.047
Mailick, Holden & Walthers (1994).	3	2	.28572	9.5	27	.67	.22	.44	.00	2.5	6	0	0	9	9	2.57	0	0	.95	.95	.271
Holden, Rosenberg, Barker, Tuhrim & Brenner (1993).	5	1	.516	10.5	163	.96	.33	.43	.00	2.5	8	1	0	22	23	11.9	.10	0	2.1	2.19	1.13

Article	n of authors	position in order of authors	MAQ	Age	N of references	Proportion of references to serials	Price Index ¹ : Serials	Price Index ¹ : Non-Serials	% of Synchronous self-cites ²	Lag time (to first cite)	Persistence	Cited by self ³	Cited by co-authors ³	Cited by others	Total cites ³	MAQ adjusted total cites ³	Mean n of cites per yr. by self ³	Mean n of cites per yr. by co-authors ³	Mean n of cites per yr. by others	Mean n of total cites per yr. ³	MAQ adjusted total cites per yr. ³
Cuzzi, Holden, Grob & Bazer (1993).	4	2	.26668	10.5	71	.79	.61	.67	.00	2.5	2	1	0	3	4	1.07	.10	0	.29	.38	.102
Holden (1991).	1	1	1.0	12.5	45 ³	.51	.35	.50	.00	3.5	10	9	0	38	47	47	.72	0	3.04	3.76	3.76
Holden, Moncher, Schinke & Barker (1990).	4	1	.53336	13.5	6 ³	.17	0	.40	.00	.5	9	9	0	16	25	13.3	.67	0	1.19	1.85	.988

	n of authors	position in order of authors	MAQ	Age	N of references	Proportion of references to serials	Price Index ¹ : Serials	Price Index ¹ : Non-Serials	% of Synchronous self-cites ²	Lag time (to first cite)	Persistence	Cited by self ³	Cited by co-authors ³	Cited by others	Total cites ³	MAQ adjusted total cites ³	Mean n of cites per yr. by self ³	Mean n of cites per yr. by co-authors ³	Mean n of cites per yr. by others	Mean n of total cites per yr. ³	MAQ adjusted total cites per yr. ³
Min. - max.	1-6	1-4	.06667 - 1.0	2.5 - 13.5	6-163	.17-.96	0-.67	.15-.67	.00-.15	.5-3.5	1-10	0-9	0	1-38	1-41	.254 - .47	0-.72	0	.22-3.04	.38-3.76	.047 - 3.76
Mean	3.8	1.7	.431	8.3	55.5	.62	.41	.49	.04	2.4	4.7	2.4	0	10.5	10.7	8.30	.25	0	1.06	1.31	.776
SD	1.5	.95	.25	3.7	42.7	.22	.22	.18	.06	.99	3.3	3.6	0	11.8	12.3	14.4	.29	0	.89	1.07	1.12
Median	4.0	1.5	.425	9.0	48	.65	.40	.47	.00	2.5	3.5	1.0	0	5.5	5.5	2.09	.10	0	.83	.83	.313
Total												24	0	105	129	83.0					

Note.

¹Price Index = the percentage of references on a paper that are not older than five years (target article publication year - referenced article publication year < 6). Price Index computed for both serials and non-serials here.

²Synchronous self-citations as operationalized here do not include research groups listed as authors.

³These statistics are or include types of diachronous self-citation.

⁴The n for these articles does not reflect the studies used in the meta-analysis although they appear in a reference list.

⁵These statistics not accurate for this author's overall work because this was a selected subset of articles.

Table 2. MAQ using the rule of 1/2 (for each subsequent author) for determining portion of credit for a publication or citation.

N of authors	Credit distribution	Formula	1 x =
2	.66667 .33333	$2x + 1x = 1$.33333
3	.57144 .28572 .14286	$4x + 2x + 1x = 1$.14286
4	.53336 .26668 .13334 .06667	$8x + 4x + 2x + 1x = 1$.06667
5	.516 .258 .129 .0645 .03225	$16x + 8x + 4x + 2x + 1x = 1$.03225
6	.50784 .25392 .12696 .06348 .03174 .01587	$32x + 16x + 8x + 4x + 2x + 1x = 1$.01587

Note. The credit distribution does not equal 1 due to rounding in a number of instances.