



Commentary

Dealing with Misquotations Constructively

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Introduction

In a recent university lecture I attended, a specific article by Sackett et al. (1976) was used to support the claim that the management of hypertension was influenced by the physician's year of graduation from medical school. As a clinician, I considered whether my year of graduation could really affect my decision-making, and it triggered an interest in finding more details on the matter. After all, Sackett is one of the pillars of evidence-based medicine (EBM). In the process of my investigation, I asked the library services to provide me the article quoted in the lecture. When I received and read it, I was surprised to find that it included no reference to the quoted statement. While I would not expect that type of error from

a university tutor, it was clear that anybody could be affected by trusting a source and not checking it as diligently as any piece of information should be before presenting to others. Furthermore, the fact that the misquotation referred to a respected figure such as Sackett made it more likely to be accepted without question because of all the papers he has written on EBM.

In consequence of this particular misquotation, two broad questions came to mind: If trust in reputable sources is broken, what should be the responsible answer and what can be done to reduce the incidence of misquotations?

Information is presented constantly, whether in journals or at conferences, and on many

occasions it is not first hand, but referenced to previous publications. In the majority of cases the link between the fact and the reference is clear, and additional understanding of the subject can be achieved by reading the primary source. Unfortunately, misquotations are common: De Lacey, Record, and Wade (1985) reported a level of 24% among six medical journals, while more recently Jergas and Baethge (2015) estimated no less than 6.7% in their meta-analysis.

A major misquotation is “said to occur if the reference contradicted, failed to substantiate, or was irrelevant to the author’s assertion in the article” (Luo, Li, Domingo Malina, Andersen, & Panchbhavi, 2013). No author should accept a secondary reference without checking the original document, and if the information required is not confirmed, a process is suggested in this paper to deal with the matter constructively and to reduce the incidence of future misquotations.

Citation-Mapping Review (CMR) Technique

The process of finding a valid reference for a piece of information that has been misquoted and uncovering the extent of a particular misquotation is here called *citation-mapping review (CMR)*, and the two steps involved are as follows.

The starting point is identifying an article that has been misquoted, such as the article by Sackett et al. (1976) already mentioned. Since authors should be aware of high levels of misquotations, primary sources should always be fully checked, never relying on secondary sources alone. If the information claimed to be in that article is not there, then there is a wrong to be righted. The approach when misquotations are found should be not just to disregard the alleged source and to look for an alternative source of information, but rather to make a statement about the fact that a misquotation has been found. It is an important fact that should be shared to prevent further misquotations to

the same article.

The second step is to use a modified forward citation chaining approach. Forward citation chaining is a research technique described by Ellis (1989) and very commonly used nowadays (George et al., 2006) to identify articles or other materials that cite a specific source. However, in the current application its purpose has been adapted so that the purpose is not to find additional information on the subject, but rather to determine if those other articles are presenting the same misquotation by referring to a source that has not been checked adequately for the data being presented. Additionally, the process can be used to check if the information itself is valid and whether a different source can be used to sustain it. This process could even be used to expose plagiarism or self-plagiarism, understood as failing to indicate when the wording in the article has been transcribed directly from another paper (Mudrak, 2017). To do so, the analysis of papers found has to be carried out in chronological order so that it could indicate how the misinformation was disseminated originally.

Authors using this process could not only be writing a much stronger manuscript but also sharing a more complete picture of known facts. The following describes the CMR process using a practical example, as the technique is better shown through tracing a real misquotation.

CMR in Action

In the specific article by Sackett et al. (1976) cited during the lecture I attended, I found that rather than stating that the management of hypertension was influenced by the physician’s year of graduation from medical school, Sackett was discussing the different attitudes in hypertension management between a family physician and an industrial physician and the fact that patient’s characteristics (e.g., blood pressure, age, and some of the indexes of organ damage) explained no more than 20% of the variability encountered in prescribing.

Therefore, the article was the source of a major misquotation as defined by Luo et al. (2013) when used to consider how year of graduation affects hypertension treatment, or any treatment if a generalization was aimed for.

To identify how far this misquotation had made its way into the scholarly literature, and whether it was just a single casual mistake by the person giving the lecture or a spread of misinformation appearing in multiple sources, a bibliometric database that allowed forward chaining was required. The citation search was based Google Scholar, which has coverage similar to Scopus and the Web of Science (Harzing & Alakangas, 2016), but can be used without an access fee.

As of August 2018, Google Scholar found that the Sackett paper has been cited on 54 occasions. The results differed between the access at the start of the project (50 citations) to the final check. There were several inaccuracies noted on Scholar, with some broken links (unaccessible documents), or citations with the wrong order of authors, or the wrong title but the same journal and pages, and also duplication of entries.

Within these I clearly identified a total of 42 unique articles (29 in English, 9 in Chinese, 2 in Spanish, 1 in Italian, and 1 in German) and 3 books. I excluded a small number of articles from analysis because of access limitations or language barriers; I only examined articles in English and Spanish as no translator was needed for those languages. This left a total of 30 citations to consider for this case study.

When analyzing the citation itself I noted two key findings. First, that all 30 papers were referring to an incorrect year of publication using 1977, rather than the correct year 1976. This included those articles of which Sackett was a co-author (Cooke & Sackett, 1996; Evans et al., 1986; Rosenberg & Sackett, 1996; Sackett & Rosenberg, 1995a, 1995b, 1995c), although in one of them the comment "Abstracted" to the citation was included (Evans et al., 1986), which is a more accurate description of the paper itself

for its shortness. Second, most papers cited the page number improperly: in the printed version the correct page is 648A not just 648 (though it was cited correctly by three papers: Devlin et al., 1992; Bellamy et al., 1994; and Werk et al., 2000). In all cases it was referred to as a single page, not suggesting the possibility of a longer version of the article, which in any case would be expected to focus on the same analysis of differences between practices of family physicians and industrial physicians, and not on a different matter like the influence of year of graduation on treatment choices.

After identifying an appropriate forward chain of citations, it was essential to compare what Sackett had written originally with how it had been interpreted and modified. For the CMR process, it is important to understand the ways information has been turned into different accounts. For this case study, I conducted the analysis by year of publication, exploring the possibility of articles referencing intermediary articles, and then using the intermediary articles' references as their own. In this respect, the forward chaining concept described by Ellis (1989) is given an added layer: textual criticism, linking articles through time.

First the original article: Sackett et al. (1976) stated that "family physicians decided to treat 49%, and industrial physicians 76%, of referred hypertensives" (p 648A), but they made no mention of year of graduation of clinicians, just of the fact that "the combined effect of all [the] clinical features explained only 20% of the variance in the decision to start treatment" without an explanation of what factors were more relevant.

Six of the initial eight citations that occurred up to 21 years later were made by the original group of authors (Cooke & Sackett, 1996; Evans et al., 1986; Rosenberg & Sackett, 1996; Sackett & Rosenberg, 1995a, 1995b, 1995c). Among the information provided in these early articles, authors indicated that "Previous work by our group documented important deficiencies in the

care of hypertensive patients, including decreased likelihood of treatment by older physicians of patients with high blood pressure (Sackett et al., 1977 [sic])” (Evans et al., 1986, p. 501). Evans et al. (1986) also proved no benefit from a mailed education program and indicated “previous work by our group documented [...] a very strong negative correlation ($-.55$, $P<.001$) between the time since a physician' graduation and his or her knowledge of hypertension” (p. 501). The source for that statement was Evans et al. (1984), which was confirmed.

Devlin, Bellamy, and Bayliff (1992) clearly pointed out that “Drug prescribing habits may also be, in part, a function of year of graduation from medical school” (p. 23), similar to Bellamy, Brooks, Campbell, Drane, and Dupen (1994) describing “It has been demonstrated that year of graduation is one of the determinants of prescribing practice” (p.215), both wrongly quoting Sackett et al. (1976). Later in 1995 three separate articles stated the exact same words “in one study of actual clinical behaviour, the decision to start antihypertensive drugs was more closely linked to the number of years since medical school graduation in the doctor than to the severity of target organ damage in the patient (Sackett et al., 1977)” (Sackett & Rosenberg, 1995c, p. 621; Sackett & Rosenberg, 1995a, p. 250; Sackett & Rosenberg, 1995c, p. 331).

CMR Example Positive Findings

This assessment exercise was effective in providing an accurate resource for the statement misquoted at the “start point”, the focus on finding if it was true that the management of hypertension was influenced by the physician's year of graduation from medical school. The initial citation from the 1976 Sackett article did not provide the evidence to sustain that fact, and there was a need for clarity, for confirming the information from a different source, or for considering the possibility yet unconfirmed. The CMR process was successful in this particular example. It was possible to endorse the finding,

based on a different article by members of Sackett's research team: there is a confirmed correlation between decline in medical knowledge and years since graduation from medical school (Evans et al., 1984).

Further Misquotation from the Example

The next step in the process could be to unmask further misquotations for the benefit of other readers looking at this subject, so that as an author it could be possible to determine and expose the degree of inadequate information in other papers, providing strength to the author's own manuscript. Further misquotations are shown below:

Roche and Richard (1991) stated “It is interesting to note in other health areas, e.g. treatment of hypertension, that doctors have been found to retain the style of practice learned during their early medical training, even when later evidence dictates that they should change” (pp. 1058-59) quoting Sackett et al. (1976). Roche, Stubbs, Sanson-Fisher, and Saunders (1997) referred to “medical practitioners become relatively fixed in their clinical style soon after qualifying” (p. 78), but then cited not only Sackett et al. (1976) but two others, including Byrne & Long (1976) and Maguire, Fairbairn, and Fletcher (1986a, 1986b); these later papers were found to be focused into the quality of training and its effects on diagnosis.

In a paper from Grimes and Learman (1996), the 1976 Sackett citation was used but it did not refer to any text in the article, an indication not of misquotation but of possible editorial error. In the following years, authors continued referring to Sackett's 1976 article:

- Brouwers and Browman (1999) indicated “a strong negative relation between years since graduation and a provider's knowledge of important advances in the detection, evaluation, and management of clinical problems, such as hypertension” (p. 1236).

- Daya (2001) expressed “The decision to initiate treatment is more closely linked to the number of years since the physician’s graduation than to the severity of the target-organ damage in the patient” (p. 382).
- MacDermid (2004) likewise indicated “clinical behaviors could be predicted more accurately from the number of years a clinician had been out of school than from the severity of the target organ damage in patients with hypertension” (p. 105).
- Samarkos (2006) similarly mentioned “the decision to start antihypertensive medication was more closely associated with the time from medical school graduation rather than the degree of target organ damage” (p.30).

Other papers follow a different route, adding also Evans et al. (1986) as a reference and using very similar words or paraphrasing:

- Irvine and Hunt (2001) wrote “...The disparity between our increasing diagnostic skills and clinical judgement and our declining mastery of contemporary knowledge (Evans et al., 1986) and clinical performance (Sackett et al., 1977)” (p.2).
- Spanish author Gutiérrez Sougarret (2001) indicated that the disparity between our diagnostic skills and clinical judgment, which increases with experience and our up-to-date knowledge (citing Evans et al., 1986) and clinical performance (citing Sackett et al., 1977) that are in decline.
- De Leon (2005) indicated “The disparity between our diagnostic skills and clinical judgment, which increases with experience, and our up-to-date knowledge (Evans et al., wrongly dated 1996 rather than 1986) and clinical performance (Sackett et al., 1977) which decline” (p.73).

- “The disparity between our diagnostic skills and clinical judgement, which increase with experience, and our up-to-date knowledge [(Evans et al., 1986)] and clinical performance [(Sackett et al., 1977)], which decline (Zaidi et al., 2007, p. 556; Koh et al., 2010, p 3)
- Virgilio et al. (2007) wrote “As their clinical judgment and diagnostic skills improve, their knowledge of current diseases and treatments often declines (Evans et al., 1986; Sackett et al., 1977)” (p. 295).

Ramsey et al. (1991) found a negative correlation between knowledge and years since medical graduation, and the reference is used with the 1976 Sackett misquotation and a different wording by:

- Berg (1998) indicating that “Year of graduation from residency is an important predictor of the drug formulary used by the average physician” (p. 217).
- Robinson et al. (2000) pointing out that “changes in medical knowledge over time are related to insufficient acquisition of up-to-date knowledge after graduation from medical school” (pp. 347-348).
- Stamp and Kruzins (2001) stating that “knowledge and practice of up-to-date care was found to be negatively associated with the years since graduation” (p. 19).

Werk et al. (2000) were more thorough, summarising “These findings are consistent with observations that awareness and adoption of expert recommendations deteriorates with time elapsed from medical school (Sackett et al., 1977; Evans et al., 1986; Ramsey et al., 1991)” (p. 589), with one of the three references wrong.

This misdirection was also found in Sutherland (2003, 2008a, 2008b), stating with the same words that “a study of hypertension showed

that the main factor determining whether doctors decided to prescribe antihypertension drugs was not the severity of organ damage, as would be expected, but the number of years since the doctor graduated from medical school (Sackett et al., 1977, 1998)" (Sutherland 2008b, p. 112).

More recent references to Sackett et. al can be found as well:

- Ahmadi et al. (2013) wrote that "Early exposure to evidence-based medicine has been shown to have significant effects on future clinical decision-making (Sackett et al., 1977)" (p. E101).
- Spanish author Echeverry-Raad (2015) wrote that health training in Colombia, as in other latitudes, is not providing this human talent with tools that allow them to self-actualize and learn long term, as they gain experience, a phenomenon that has been alerted for more than 40 years, citing Sackett et al., 1977, as well and Shin et al. 1993, as evidence.

In summary, I found many statements regarding how year of graduation of the clinician was linked to a decline in knowledge, but discovered the information was generally misquoted, although I did find two valid references. The most relevant collateral finding was that no article referred to data actually present in the original 1976 Sackett et al. paper, on the perceived management differences between a family physician and an industrial physician, and more on the other quite relevant work that Sackett has published over the years on evidence based medicine, for which he needs to be remembered as a pioneer.

Discussion

New researchers are advised on using citations properly. No author should accept a secondary reference without checking the original document, and if the information required is not

confirmed, a process like the one described here should be followed to provide clarity on the matter. When conducting a literature review, if a misquotation is found or suspected, it is possible to use CMR to find an alternative, more authoritative source. A positive finding cannot be guaranteed, and neither are we able to provide a probability of success. However, since misquotations are common, it is important to have the confidence not only to attempt to match a statement to a valid reference but also to expose the problem, and to stop the spread of misinformation.

The CMR process is like a detective job, in that it is hard work but it can provide valuable results. Going through articles chronologically can give some indication of how the misinformation progressed. More importantly, it can strengthen an article if it is used to clarify misquotations, presenting both the inappropriate and the adequate citations, and in a way alerting future readers of previous errors, potentially putting a stop to the spread of the misquotation.

Misquotations should be recognised, so "the truth, the whole truth, and nothing but the truth" is published. We consider that focusing on this technique can help to further knowledge, to provide certainty regarding the primary sources of information, and to expand on them. Ideally an *conscientious* author should write or present the information found in the example in a very different format, such as the following:

There is a correlation between decline in medical knowledge and years since graduation (Evans et al., 1984; Ramsey et al., 1991), information that has been misquoted to Sackett et al. (1976) by as many as 30 papers between 1986 and 2015 (the latest three being De Leon, 2005; Ahmadi et al., 2013; and Echeverry-Raad, 2015).

Strengths and Limitations of the CMR process

This case study is based on an article with a small number of forward citations, which were easily manageable. It serves as an example to explain better how the CMR process takes place, and how the findings are linked to a particular misquotation. From this example, a clear picture emerges of how the original misquotation persisted through decades. Using a single example in this case allows for a focus on the technique and a suggested presentation on findings, whereas a considered analysis of multiples misquotations could make this paper too long and distract from the process.

The CMR process takes a considerable amount of time, and doing it for several references while writing a single article could be considered to be too much work, but there may be no need to apply the analysis to all citations, but only to ones that when checked initially appear to be misquotations. One goal of this approach is that the number of misquotations should go down over time. Although it was possible to find more adequate sources for the statement of interest, it has to be appreciated there will be examples of assertions misquoted in literature that cannot be as easily linked to alternative articles. In those circumstances it would require a considerable amount of time for a different benefit, stopping the spread of misinformation.

At present there are electronic tools to make citation easier and cross-reference citations, such as Citethisforme (<http://www.citethisforme.com>), Reciteworks (<http://reciteworks.com>), or Citationmachine (<http://www.citationmachine.net>), but misquotations can still be found. Identifying and correcting misquotations remains a slower process.

Conclusions

The power of reviewing all cited sources thoroughly, through the CMR or a similar

process, cannot be overestimated. This process is one of the tools a researcher can use to stop misquotations from propagating further. The right ethical conduct for a researcher should be to expose found misquotations so we enrich our knowledge. The CMR process is a different approach to looking at information misquoted in scientific journals. It is not only about finding the right link between a relevant piece of information and its source, but also assessing, for a particular paper, how often it is referred to on the contained information and how often it is misquoted. If a new culture of research included not only presenting valid sources but also commenting on misquotation findings, a better understanding of the issues presented would result.

Two steps are suggested, a simple 'start point' which includes analysing the article found to be misquoted, to be certain nothing has been missed, and a follow-up 'modified forward chaining' to assess a number of articles that followed that misquotation to assess the extent of the problem. How thorough is the assessment is to be decided by the researchers, but sharing that piece of work in their papers would benefit us all.

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