

What is a “mapping study?”

I. Diane Cooper, MSLS, AHIP

See end of article for author's affiliation.

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You are familiar with those short literature reviews in the introduction of research studies. The author provides a brief background to the study, highlighting related research. You also know about review articles in which writers describe a batch of articles that they have selected. If there were a “reliability” spectrum of review articles, both of these would be on the low end—not because they are necessarily inaccurate, but because they were selected by the writer and may be biased.

On the other end of the spectrum is the systematic review, which, if done correctly, eliminates (or greatly reduces) possible bias. So it is felt to be the most reliable.

These types of reviews deal with the substance of the article's content. Something is studied, and the focus is on the results: “Here is what we found.” The review discusses the findings.

Mapping studies are also reviews, but they do not discuss the findings. They are based on the concept that published articles not only represent findings, but, indirectly, represent activity related to the finding. For example, an article that presents findings of a study at a community center of an education intervention to improve health represents not only the study results, but it also represents that research on community health education took place. The article also indicates where the research took place and, of course, in what journal it was published. So mapping collects data on kinds of activity, locations where it occurs, and media where it is published.

On the spectrum of reliability, mapping, if done correctly, is on the higher reliability end of the spectrum but still has some vulnerability: decisions about “core,” zones, and limits are arbitrary.

So, what is mapping? It is a review that seeks to identify, not results, but linkages. Mapping focuses on characteristics such as where the activity took place, where the funding came from, and in what journal or other medium it was presented. Mapping often focuses on published items but need not; some

mapping studies include other media (e.g., books, newspapers, grant proposals).

Some definitions say mapping follows the flow of information through publications. The weakness of this definition is that citations may refer to established information, such as a laboratory test designed years ago; such citations do not represent flow of information. The information has been sitting in the researcher's information bin for years.

“Mapping” also sometimes refers to “concept maps,” which are visual tools that organize and display knowledge in a visual way, such as using flow charts, graphs, and Venn diagrams.

“Scoping reviews” also track down published studies but are more similar to systematic reviews. Compared to systematic reviews, scoping reviews do focus on findings but do not always have quality as an initial requirement to be included, and synthesis of data is typically more qualitative [1].

EXAMPLES OF MAPPING

Mapping research is performed in many disciplines. The method is sometimes called a systematic mapping review.

Have you ever wondered about the distribution of social content in Wikipedia? A mapping study found that the highest percent of articles, 30%, dealt with culture and the arts. The next 3 topics, in order, were “people and self,” geography and place, and society and social sciences. Health and fitness was eighth, taking up 2% of the social content articles [2]. This study was led by Aniket Kittur, an expert in human-computer interaction, social computing, and social networks.

Have you ever wondered about agricultural research in India? (You might, if you were a government policy advisor.) Most publications are on plants of economic interest, and the greatest subtopic is “Pests, pathogens and biogenic diseases of plants,” according to a mapping study by Subbiah Arunachalam, an editor and scientometricist. The

professor added, "This macroscopic analysis not only provides an inventory of India's publications, but also gives an idea of endogenous research capacity. If appropriately linked with public policy, it can help restructure the nation's research priorities" [3].

If you wondered about the state of research about physical activity programs for adolescents, you would appreciate another recent mapping study. It found that most researchers used randomized controlled studies (about 80%), and most studies used self-report, although a third used pedometers or accelerometers [4]. They also found that research on the topic had increased recently.

MAPPING IN LIBRARY SCIENCES

Have you ever wondered about where clinical laboratory science and medical technology literature is published? A typical library science mapping study was done by Frances Delwiche. She found that the Cumulative Index to Nursing and Allied Health Literature was the only database with complete coverage of the key journals. Delwiche said her study's goals were "to identify the predominant format of literature used in this field, the currency of the literature most frequently used, the core journals of the field, and the level of indexing coverage of the core journals by the major bibliographic databases. The results will serve as a valuable aid to librarians responsible for collection development in the field" [5].

In library science, many mapping studies focus on finding journals that publish the greatest number of related papers. These journals would be of higher priority for purchasing. The list may also be instructive to faculty, for example, to scan tables of contents.

HOW DOES IT WORK?

Here is an example to illustrate the literature mapping process. This is an imaginary exercise, and the data are made up. Suppose you want to map the literature of pediatric podiatry research. What this means is, you want to describe where the published research is coming from.

First, you identify the major journals related to pediatric podiatry. You ask people who use pediatric podiatry information what they think are the key or most important research journals for them. There are

other ways to find major journals: For example, impact factors might be used; however, a journal's impact factor may be due to its publication of articles not related to pediatric podiatry. Regardless of the method used to select major journals, the process is a judgment call. Usually, you decide there are a handful of major journals.

Then you search the major journals for every article related to pediatric podiatry published in the past 3 years. You find 100 articles. From these articles, you extract all the references that they cite. This becomes your database. Each article has about 7 end-of-article reference citations, so you have 700 items.

For each of the 700 items (citations) in your database, you have or can find the name of the journal it was published in (its origin), the location of the researchers, and the source of funding. You can group your items by any characteristic you wish. Perhaps you want to know where the research is coming from: you group by location of the researchers. Perhaps you want to know where the funding comes from: you group by funding source. We are librarians, so we group by the title of the journal.

You then have a database, a list. Each row will have the journal name and the number of articles in that journal that were cited by articles related to pediatric podiatry in the major journals. For example, the *Journal of Podiatry* might be at the top of the list, as it was the source journal for 100 citations in the major journals. The next highest number might be 50, associated with the *Annals of Podiatry*. The third might be *Pediatric Orthopedics* (a surprise to you) with 25 citations. These 3 journals accounted for 175 or one quarter of the total. You want to find the journals that are sources for much of the work, which is usually about a third of the database items, so you add 4 more journals to your list until you reach 233 total citations (1/3 of 700). You label these 7 journals as in Zone 1 for journals that provide important information as defined by having many articles cited in a major journal.

Now, you want to define Zone 2. You go down your list until you find journals that were sources for another 233 citations. There will undoubtedly be more than 7 journals, following Bradford's Law of Scattering (Figure 1). Bradford's Law does not provide a prescriptive formula: journals can be moved in and out of Zone 1 to make the map fit the

Bradford's Law of Scattering is not a law at all. It is a model that describes the distribution of observable phenomena and can be seen in many situations. It is a Pareto distribution. As used here, it describes this observable phenomenon: Journals that publish the most target articles publish a *lot more* of them than other journals. It is a nonlinear distribution that usually follows a describable pattern. The distribution is weighted to the core journals. If 4 journals publish 20 target articles, it might be that one has to search 12 more journals to find another 20 articles, that is, 3 times as many. The Bradford number would be 3. This would identify Zone 2 journals. To find another 20 articles, the researcher probably would have to search 36 (3x12) journals. This would be Zone 3. Beyond this, the odds that a particular journal will have a relevant article are very small, so the journal is probably not worth being in the collection. Bradford's Law is not a law of statistics and does not set cut offs but provides a model for examining and understanding the distribution of publications on the studied topic.

Figure 1

Bradford's Law of Scattering

pattern. In this case, there are 14 more journals, and you label them as being in Zone 2.

You can now advise librarians that two-thirds of important literature related to pediatric podiatry will likely be in journals that are in the 21 (7+14) journals that are in Zone 1 or Zone 2 of your list.

If you had done the sorting by researcher location, you might have said that most of the research came from large Midwestern states or something like that.

If you had done the sorting by funding source, you might have said that most of the funding came from the National Institutes of Health, and second was the Pediatric Podiatry Foundation.

The Nursing and Allied Health Resources Section mapping review process is described in a separate article (See Perryman: "Mapping Studies," this issue).

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AUTHOR'S AFFILIATION

I. Diane Cooper, MSLS, AHIP, jmlaeditorbox@gmail.com, Editor-in-Chief, *Journal of the Medical Library Association*

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