ABSTRACT: Within the field of communication sciences and disorders, there is a need for systematic reviews. This need is driven by the demand for accountability of the quality of intervention that is provided by speech-language pathologists. Systematic reviews offer a summary of what is known about a given intervention and suggest the supporting research that might serve to advance the delivery of high-quality services. As insurance companies, families, researchers, and clinicians seek scientific evidence of effective therapy techniques, the need for systematic reviews will increase. R. J. Light and D. B. Pillemer (1984) argued that as more research is conducted, systematic reviews can help both the clinician and the researcher understand procedures, trends, and results that will not likely be found in any single study.

KEY WORDS: evidence-based practice, systematic review, meta-analysis

CITATION: Contemporary Issues in Communication Science and Disorders, Volume 33, 74–78, Spring 2006 © NSSLHA 1092-5171/06/3301-0074

Lessons Learned:
The Student Experience

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As future professionals in the field of communication disorders, students have the responsibility to understand the nature of research and its clinical application. We hope that the preceding articles have whet your appetite to better understand both the process and the results of systematic reviews in advancing the evidence-based practice of our field. The following is a brief story of some of the challenging situations we as students faced when first attempting a systematic review and meta-analysis. We realize the task may seem daunting at first, but if approached in an organized and systematic manner, the review process can be interesting and rewarding. We hope to give you our unique perspective as three students who have worked on systematic reviews for the past year. We want to share what we found to be helpful tips, unexpected problems, and successes. We share our experience and lessons learned by following the same order of activities in which we engaged while conducting our reviews. These are not meant to be the only issues we faced, but they are certainly among the most remarkable of our “lessons learned.”

Lesson 1: Topic Selection

The first issue you must tackle when attempting a systematic review is finding a viable topic. How to choose a topic and ask a viable and answerable question was more difficult than it seemed for some. We found that three major themes regarding topic selection were important for the successful engagement in a systematic review:

- topic importance
- production feasibility
- client needs

Topic Importance

At a very practical level, we considered whether or not the area in which we were interested occurred frequently enough in our clinical experience to warrant a summary of research. If the disorder was very rare (e.g., elective mutism), we decided that although the problem was important, we wanted to review interventions for higher prevalence disorders (e.g., phonemic training). At least we believed that the findings might have a broader application...
If the intervention was used more frequently.

A reviewer may choose to address a common problem in the field for which there is contradictory evidence of intervention efficacy. Not only would such research provide information on one or two “effective” interventions, but it would also provide an evidence base for using or not using specific interventions.

Last, but maybe most important, we found that the reviewer’s own personal interest in the topic was crucial to the decision. In some cases, we worked on topics that were clinically important and that occurred frequently in clinical experience but were really not of primary interest to the reviewer. The demand involved in conducting a systematic review requires that the reviewer be committed to the topic at a very personal level.

Production Feasibility

When we considered feasibility, we asked ourselves several questions: (a) Is there likely to be a sufficient number of studies that would have usable data? (b) Can the studies be accessed readily? (c) How long would it take to complete the review? For the past 12 months, some of us have been able to collect, code, analyze, and present the results of our review. Others are still in the process of identifying potential studies to include in a review. Although production feasibility is partly a function of the topic importance, it is also important to try to assess feasibility in more practical terms of data accessibility and time to complete.

You may find when you begin to research your chosen topic that you have chosen a title that is too narrow, and there are not enough studies to provide useful data for analysis. The absence of sufficient reviewable research does not mean that a review cannot be undertaken. One of the main purposes of a systematic review is to map the research landscape and offer specific direction for future research. The opposite may also be the case. When a topic is so broad that there is too much information to include in one’s review, it may be difficult to focus on a priority of the review. You may need to decide what ages your study will include and why. What diagnosis will be included? Too broad a topic means you may need to narrow the topic just to be able to finish the review and produce a usable product.

Client Needs

The primary recipient of a speech-language pathologist’s services is the client to whom the intervention is applied. If the client does not think that the intervention goal is important, a systematic review of the effects of an intervention are likely to be dismissed or ignored. Whether or not the results of a summary of intervention effects meet the needs of the individuals we treat and their families is often overlooked. Sackett, Straus, Richardson, Rosenberg, & Haynes (2000) argued that it is important to consider which question is most important to the patient’s well-being. We think it is important to consider the usefulness of the systematic review product in terms of how the consumer will benefit.

Once a potential topic for review was selected, we found it helpful to talk with professionals who were experienced in that particular area of interest. This helped us gather information about leading researchers, controversial issues, potential data sources, and general interest in the topic across the profession.

A final important recommendation is that before making a final decision about a topic for review, you should do some preliminary investigation about the published research on the topic. You do not need to find all of the studies on a topic, but a cursory search of an appropriate database (e.g., ERIC, PSYCHINFO) or even Google (http://scholar.google.com/) can give you a sense of the importance and accessibility of research to be reviewed. Likewise, you should search the Campbell Collaboration (www.campbellcollaboration.org) or Cochrane Collaboration (www.cochrane.org) web site to see if the topic has already been accepted for review—no need to do a review that someone else is doing or has done.

Overall, appropriate and effective topic selection is the first step in generating a systematic review that will help provide evidence that supports “what works” and helps to clarify what does not. It may not be conducive to choose extremely rare topics for which it would be difficult to find an adequate supporting body of literature. It is important that the researcher choose a topic that he or she feels will encourage change, provide evidence, or clarify an otherwise “gray area” in the literature or practice.

LESSON 2: REVIEW JUSTIFICATION

After the topic has been chosen, if you register the topic with the Campbell Collaboration or Cochrane Collaboration, you will need to justify the necessity of the meta-analysis. The implications of a systematic review and meta-analysis can stretch over a broad spectrum, from professionals in the field to the concerned public. It may have importance to professionals in the field because of implications for treatment of their clients. In addition, your review may have policy or programmatic implications. Consider that if your review finds very limited or no significant clinical impact, questions arise regarding both the economic and ethical issues for clinical use of the intervention.

There may also be internal political reasons that impact your review. Some students submitted reviews to outside groups and were advised that no new reviews were being accepted or that the topic was not of interest to the group. Because there is not a specific outlet for reviews in the area of speech-language pathology, you may be trying to convince a group of professionals, such as physicians or social workers, that your topic is influential and worthwhile. Your topic may be valuable to the field of speech-language pathology, but, these professionals may simply not be aware of the need for this review in our area of specialty. You should be prepared to explain why your topic is important to your field and become your own advocate. You may need to make the case for the impact and significance of this topic area in order to find an appropriate dissemination source.
LESSON 3: INFORMATION RETRIEVAL

The next lesson we learned had to do with finding and retrieving the studies needed to conduct the review. Lipsey and Wilson (2001) pointed out that the purpose of a systematic review and meta-analysis is to identify and retrieve every study possible. It is the “every study” part that was the most frightening and difficult. Too often, we approached the task of finding studies using far too narrow a standard. We found the channels of communication helpful in organizing our information retrieval strategies. Cooper (1998) defined three channels of information retrieval: informal, formal, and secondary. Informal channels include personal contacts with individuals working in the area of interest; use of the worldwide web; and soliciting information about studies from organizations, scholars, and researchers. Formal channels include conference presentations, electronic journals, and research report reference lists. Secondary channels include specialized database registries or bibliographies and other reference databases. These were all sources we had never really thought of for information retrieval. In addition to these sources, we relied on the database resources that were available through our university library.

Searching electronic sources has become part art and part science. First, it is crucial that the researcher become familiar with the intricacies of electronic databases. Each database has benefits and drawbacks, and each functions slightly differently. These electronic databases, such as ERIC, PsycInfo, and MEDLINE, are extremely useful, but it can be difficult to determine which databases may be useful for your topic. For instance, ERIC focuses on educationally based articles and journals, whereas MEDLINE is medically based. However, they are very sensitive to search terms used. It is crucial to exhaust all possible terms that could relate to your topic area. We found that we had to consult with a librarian with expertise in study retrieval strategies for the databases we were interested in searching. Knowing how the database uses each search term you enter will allow you to adjust search terms in other sources to be searched. There was a wide array of sources of which we had never thought for information retrieval but were important to ensure that we were thorough in the study retrieval process.

One way to confirm that you have conducted a thorough search is to check the references of the articles and studies that apply to your review (Lipsey & Wilson, 2001). Then check the references of those references and so on until you have either exhausted all of the studies you can find or the same references keep recurring. If you are including non-English-language studies (e.g., German, Dutch, or Chinese), you will need to find someone who can translate so that the needed information can be retrieved. We were surprised to learn that there were a number of studies directly on target for our reviews that were written in other languages.

A key element to the systematic review process is what is referred to as transparency. The documentation of the process should be sufficient so that anyone can duplicate your findings. It is crucial to keep track of (a) the databases used and dates searched; (b) the search terms used in each database; and (c) the date, quantity, and title of studies identified for each search done. Sackett et al. (2000) suggested using a flow chart of a search strategy where you outline your clinical problem, define your question, select the resources where you are most likely to find information, design a search strategy, summarize the evidence, and finally apply what you have found. Whatever system of organization you use for study retrieval, keeping track of who, what, where, and how will make the process more useful and efficient.

LESSON 4: CODING STUDY CHARACTERISTICS

The next lesson we learned centered on extracting from each study the important pieces of information that were needed to make the review useful. We found that we had to learn to recognize key words of articles for cues as to the quality and details of the research methodology. We had to learn how to recognize the language cues of the study to determine the design, participant, statistical, and methodological features of the study. We learned that it is sometimes a “treasure hunt” to be able to extract the salient facts from studies. It is important to look for terms regarding method of assignment, blinding, attrition, method of sampling, unit of assignment, or unit of analysis to determine the characteristics to code and analyze for the study results. In our studies, we were interested only in randomized control trials (RCTs) in which the participants were “randomly assigned” before the intervention. We found that different authors used a variety of terms such as “assigned by diagnosis” or “assigned by age” and then implied that this was done using a random procedure. Then we had to try to assess if there was something in the text that at least gave us a clue if the group assignment was randomized and could then be included in our review. In some cases, we had to go further and contact the author directly to get that information.

An important piece of knowledge that we gained from this lesson is that nothing can be assumed in a systematic review. If the information is not stated in the article, you cannot assume the answer you think would be most logical. For example, we wanted to determine if the reported intervention was administered by a certified speech-language pathologist. The article may state, “therapy was administered by the first author,” but unless it explicitly states the author’s credentials, you cannot assume that that person is a certified speech-language pathologist.

Another lesson we learned about coding study information is that the intervention procedures used often are not as explicit as we assumed. Did everyone who was pretested receive the intervention? Was everyone in the intervention included in the posttest condition? Attrition, or participants dropping out of a study, may be a significant problem. If too many participants do not complete the intervention, the strength of the results is questionable.
The process of coding information in studies is a key to the smooth transition into the data analysis portion of the systematic review process. It is crucial that reviewers develop a working model of a coding sheet (or codebook) that best fits the needs of the topic under study. We learned that a well-tailored coding sheet is one of the most valuable tools within a systematic review. The coding sheet is what the researcher uses to pull the critical elements/information from each study in an organized, systematic format for later use. This involves categorizing and summarizing the data from each study, such as how the study was performed, where the intervention was conducted, who delivered the intervention, how long the intervention lasted, the number of sessions for which the participants were treated, and the length of each session. Participant characteristics such as age, gender, and severity of disorder are also important to identify. The outcomes measured, method of measurement, and examiner characteristics (e.g., gender, blinding) are among the information that was important to determine the context of the interventions’ effect (Cooper, 1998). Coding each study thoroughly helps flag studies with missing information and inadequate data, and even provides further information for editing the working model of the coding sheet to include newfound information.

It is important during the coding process to ask yourself questions about the how and why of the observed intervention effect. Although this task may seem tedious, it was our experience that it helped us to focus on the potential explanations of the intervention effects when we got to the data analysis task.

A coding form is an ever-changing document that is used over the course of your review. It may be changed many times in order to make the coding process as comprehensive as possible. Code all the information you can from the study. This will save you from having to go back later to recode information. Recording page numbers where the data are found is a timesaving tool. When you have multiple studies, it may be complicated to remember the exact details from each study. The coding form helps summarize and organize all of your data and ensures that you have been thorough. When you begin data analysis, the coding form will be vital and time saving so that you have all of the information at your fingertips.

Last, coding of the articles must be done by more than one person. The lesson we learned here, as you might guess, it that not everyone sees the same information in the same way. The use of more than one coder is important for checking the reliability of the information coded and maintaining a degree of quality control over the process. You need to collaborate in this step as a check and balance system in the data collection (Lipsey & Wilson, 2001). When there is disagreement, you need to have a plan for resolving differences. We used a third party to arrive at an inclusion/exclusion decision.

**LESSON 5: DATA ANALYSIS**

The process of data analysis (sometimes referred to as meta-analysis) involves the reduction and aggregation of individual data units into a summary statement of the magnitude of the intervention effect (Cooper, 1998). Many regard the analysis of the systematic review as the “meat and potatoes” of the review. Once the studies collected yielded the desired information, we then reduced the information to data points that could be statistically analyzed to arrive at a result. We were surprised to find that there are often multiple questions and variables that can be explored within a given topic using the data collected. Thus, analysis is often a process containing many different levels or tiers of evidence.

Sometimes, one analysis simply generates more questions, which further analysis can sometimes answer. You can analyze the data of these different variables separately to see the possible effects of the variables on the statistical findings. You may see how age groupings, location, or social economic status affect the results. You can also evaluate how much the intervention affects the results, not just a clear yes or no answer.

Another lesson we learned at the analysis stage is that the process of summarizing and aggregating requires little mechanical expertise—we could enter the data in a dedicated computer program and learn how to run the program to produce the effect sizes related to the intervention. However, the interpretation of the output required learning a new, albeit related, statistical vocabulary (e.g., Q statistic, I², publication bias). The positive side of the task was, once we learned the basics, we could understand other reviews and the statistical analyses they reported. The basic statistical concept of effect size and the meta-analysis procedure was not as daunting as it appeared at the outset of our systematic review.

**CONCLUSION**

After reading all of this, you may be overwhelmed by the thought of undertaking a systematic review. However, it is amazing to know that, as students, we have the opportunity to generate such valuable information—information that has the potential to establish change and challenge our field. We have learned the value of working with colleagues on a collaborative level. It is no small undertaking to attempt your first systematic review. The systematic review is time consuming and involved, but it is doable by students. The key to a successful review is organization, determination, and collaboration. One of the most important lessons we learned is patience, especially when things do not go smoothly or when new ideas are difficult to understand. Here is our prescription for conducting a systematic review:

1. Choose a strong and interesting topic.
2. Keep clear records of literature searches.
3. Do not make assumptions about what the authors mean.
4. Be transparent in all aspects of the review.
5. Set deadlines.
6. Be patient.
Working on this type of research has been an unparalleled learning experience. You will make mistakes and run into problems, but the key is to persevere. Participating in a systematic review has given us invaluable experience not only as students, but also as future speech-language pathologists. We encourage determined students to dive into the field of systematic reviews and contribute to the knowledge base of our field.

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