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Research Synthesis in Behavior Analysis I: An Introductory Guide to Conducting Systematic Reviews

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Abstract

As a data-driven science, the field of behavior analysis necessitates accumulating evidence for research and theory development and clinical intervention. The most comprehensive evidence will come from systematic review and meta-analysis of a given topic. Systematic reviews are comprised of an established set of methods of collecting and synthesizing a body of research to identify trends, examining the strength of evidence and potential sources of bias, and identifying areas in need of further investigation. Despite their utility and widespread use in other disciplines, systematic reviews are under-utilized in many behavior analysis domains. This technical report is part of a series on research synthesis methods in behavior analysis, with Part 1 focusing on systematic reviews and Part 2 focusing on meta-analysis. In Part 1, we provide a step-by-step guide to conducting systematic reviews using current best practices and adhering to international guidelines. Examples of tables and figures commonly included in these types of reviews are also provided. We conclude by emphasizing the importance of these reviews for behavior analysis research, practice, and theory and calling for increased numbers of published systematic reviews in behavior analysis. Finally, we provide annotated references to additional in-depth methodology resources for the interested behavior analyst.

Keywords

Behavior analysis; evidence-based practice; research methods; systematic review

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Introduction

Behavior analysis, as a science and a practice, is data driven; empirical evidence is used to guide decision-making. Whether the data come from a single subject or a group of participants, the focus remains the same – to use empirical data to draw conclusions, advance theory, and guide interventions. Whether the focus is on single-case design, clinical interventions, or broad scale, multicomponent research studies, a comprehensive synthesis of the literature related to the topic of focus will enhance theory, research, and clinical work. This is done via systematic reviews and meta-analyses. While single studies provide necessary steps in the process of advancing science, examining a broader literature at an aggregate level can provide more convincing evidence. Synthesizing previously published research is necessary to identify patterns, investigate the extent of the effects of given interventions, and to determine areas in which the research is insufficient, biased, or otherwise inconclusive. In other words, systematic reviews and meta-analyses can be used to develop evidence-based practice (Slocum et al., 2014). As we seek to scale upwards and outwards as a science, and to focus on diversity and equity in our research, these methods are more important than ever.

There are several reasons why a behavior analyst might want to ascertain the state of the research on a given topic. A researcher may want to determine the extent to which there is agreement on a theory or to determine logical next steps in a line of inquiry. A clinician might want to identify best practices for a specific treatment or the strength of its effects. These queries may be answered, in part, via a brief narrative review of the literature, but that may not provide scientists with the full story since narrative reviews may lack a systematic approach. To this end, King et al. (2020) discuss the limitations of narrative reviews and outline the importance of transparent and comprehensive search and selection strategies in behavior analysis. Systematic review methods are intended to comprehensively synthesize a literature base using a rigorous and transparent methodology. These methods allow not only for extensive overview of a given topic, but a determination of research quality. They are useful in establishing a consensus when findings from different narrative reviews are contradictory (King et al., 2020). Facilitating communication with other disciplines through systematic reviews is an additional benefit and a crucial step in increasing uptake of behavioral analytic principles and communicating the value of our science to a broader audience.

Despite their utility, there exists a dearth of published systematic reviews in peer-reviewed behavior analytic journals focused on the experimental analysis of behavior. While some behavior analytic journals have a longer history of publishing systematic reviews and reviews of behavior analytic topics may be and have been published outside of behavior analysis journals, systematic reviews are not as commonly published in the *Journal of the Experimental Analysis of Behavior*. A search for the phrase “systematic review” in the article title or abstract returned four publications in *JEAB*, all published in the last 5 years (Gelino et al., 2024; King et al., 2024; Odum et al., 2020; Saini and Mitteer, 2020). For behavior analysts for whom *JEAB* is their primary source of emerging research, increasing the number of reviews conducted and published in this and other behavior analytic journals will serve to promote readership among colleagues.

By increasing the prevalence of systematic reviews, researchers in our field will be advancing several important goals. Advancing from the “what works” paradigm, systematic reviews can allow researchers and practitioners to pinpoint what interventions or experimental manipulations work, for whom, and under what conditions. First, the comprehensive and systematic synthesis of literature informs best practice (“what works”), whereas brief and narrative reviews do not offer sufficiently rigorous methodology to afford such conclusions. For example, Odum et al. (2020) found strong evidence for both state- and trait-like qualities of delay discounting. Second, completed systematic reviews have identified gaps in research (“for whom, and under what conditions”); results of a systematic review may show a strong evidence base under one condition (e.g., a given intervention in a laboratory setting or among a WEIRD [White, Educated, Industrialized, Rich, Democratic] sample) but no such evidence in a different condition (e.g., applied settings or among non-WEIRD samples). For example, Saini & Mitteer (2020) found a strong evidence base for traditional operant renewal effects (a form of behavioral relapse) in controlled human laboratory settings but highlighted that little research has investigated this effect in clinical contexts. In another example, Gelino et al. (2024) conducted a systematic review and meta-analysis of the published literature on test-retest reliability of delay and probability discounting measures. Their meta-analysis indicated that discounting showed moderate test-retest reliability overall, but reliability was higher for delay discounting of monetary rewards in adult samples. This illustrates how systematic review and meta-analytic methods can reveal what works for whom and under what specific experimental conditions and task configurations. Finally, systematic reviews communicate the state of the literature via a language that has been extensively adopted by other fields. This will function as one method of effective communication across other fields, thus improving dissemination and collaboration.

Goals of this technical report

The results of the preceding literature searches suggest that although the use of systematic reviews and meta-analysis techniques in behavior analyses is becoming more common, the adoption of these approaches is not yet widespread. Behavior analysis journals have explicitly encouraged researchers to conduct systematic reviews and meta-analyses. In particular, the Editor-in-Chief of the *Journal of Experimental Analysis of Behavior* noted in a recent editorial that the journal, “strongly supports the publication in JEAB of reviews that are systematic, which may or may not include meta-analyses” (Mitchell, 2024, p. 149). One way to increase this momentum is to build technical skills among behavior analysts who may be hesitant to embark on a resource-intensive review process. The goal of this technical report is to help a new research reviewer (hereafter referred to as “researcher”) in their journey and to provide a roadmap of practices and procedures. This report is intended for and geared towards behavior analysts. Several high-quality papers exist for general best practices in systematic reviews and meta-analyses across the sciences (e.g., Rosenthal & DiMatteo, 2001; Siddaway et al., 2019). We begin by providing definitions of each type of review, followed by a step-by-step guide to conducting systematic reviews using typical, accepted methods. What follows is a discussion of the value of these approaches for behavior analysis and priorities for increasing their use in the field. The goal is to provide a high-level summary, with the acknowledgment that researchers who wish to embark on

a systematic review may require additional training. To facilitate this learning, particularly relevant readings for those interested are denoted in the reference list. Although we mention several helpful commercial software packages or database tools that we have used in our published reviews, these recommendations should not be considered an official endorsement of any commercial product by the authors or the authors' respective institutions.

The present technical report is part of a two-part series which provides guidelines for conducting systematic reviews (Part 1) and meta-analyses (Part 2, forthcoming) in behavior analysis. These reports have been designed to be digestible by a broad audience of practicing behavior analysts and behavioral research scientists but are written with a focus toward graduate students and early career investigators.

What is a systematic review

A systematic review is a review of published literature on a certain research topic. What differentiates systematic reviews from generic literature reviews is its systematic nature. Cochrane describes its library of systematic reviews as “attempts to identify, appraise and synthesize all the empirical evidence that meets pre-specified eligibility criteria to answer a specific research question” and state that “researchers conducting systematic reviews use explicit, systematic methods that are selected with a view aimed at minimizing bias, to produce more reliable findings to inform decision-making” (Cochrane Library, retrieved from <https://www.cochranelibrary.com/cdsr/about-cdsr>). Procedures for conducting the review includes preliminary identification of a research topic, a dedicated search strategy and search terms, comprehensive reviews of articles as well as forward and backward searches of cited papers, and methods for determining quality of the research designs. Ensuring that best practices are implemented at each stage increases the rigor and overall quality of the systematic review. To illustrate this point, Maggin et al. (2017) conducted a comprehensive analysis of systematic review quality indicators for over ten years of reviews published in *Behavioral Disorders*. Their review identified areas where published reports consistently follow best practices and revealed instances where the field needs to increase transparency in rigor. These priority areas are identified in the following sections, but we recommend that readers consult the Maggin et al., (2017) paper for a detailed analysis.

Systematic Reviews: The following section provides a step-by-step guide to conducting systematic reviews, from conception to dissemination. A flowchart outlining these steps is shown in Figure 1.

Steps in a Systematic Review: Before conducting the review

Consult Field Standard Guidelines. Before conducting a systematic review, it is necessary to become familiarized with field standards and guidelines. Scientific journals are increasingly requiring researchers conducting systematic reviews and meta-analyses to follow international guidelines when performing and writing the review (and authors are commonly required to specify which guidelines they followed in the methods section of their manuscript). One of the most common and well-respected field standards is the Preferred Reporting Items for Systematic reviews and Meta-analyses (PRISMA; Page et al., 2021). PRISMA provides guidelines, checklists, and supplemental material, with the goal

of helping researchers to maximize transparency in their reporting methods and ensuring that the review is truly systematic in nature (visit <https://www.prisma-statement.org/> to view the most recent PRISMA guideline materials). The Synthesis Without Meta-analysis (SWiM) reporting items can be used for synthesizing intervention data in systematic reviews that do not include a meta-analysis and is intended to be employed as an extension to PRISMA guidelines (Campbell et al., 2020). A Measurement Tool to Assess systematic reviews (AMSTAR) provides an overview and appraisal of systematic review methodology and analysis (Shea et al., 2017). Finally, Cochrane provides a handbook for conducting systematic reviews (Higgins et al., 2019). It is up to the researcher's discretion which guidelines to choose to follow and may differ based on the type of review being conducted. Regardless of the choice, that decision must be made at the outset, and researchers must commit to those guidelines throughout.

Define and Refine the Research Question. The next step is to select, refine, and ultimately define the research question and area(s) of focus. To help narrow the preliminary research question, consider conducting a preliminary search through the existing published literature via Google Scholar, or a similar search engine, to get a sense of what exists in the area of interest. This will help determine whether there is need to expand or contract your search. The initial question may be much too narrow, with too few primary research studies in the area, to warrant a systematic review. Alternately, the initial question may be much too broad and extensive to effectively summarize in one systematic review. This preliminary search can also help identify initially relevant search terms to use when conducting the review. Finally, the preliminary search will often reveal whether a similar systematic review or meta-analysis already exists for the topic of interest. The existence of a similar systematic review or meta-analysis does not automatically mean that the planned review is not necessary; rather, it may indicate the need for an updated review with more recent published literature. The research question of interest may also be more nuanced and distinct. This preliminary search is useful in providing a determination about what questions (if any) may be necessary, and how to go about conducting the search, before going through the entire process. After settling upon and defining the research question for the systematic review, write it down. Return to this question often. Database searching and study selection for systematic reviews often expose other tangential and interesting topics. However, bearing down such “rabbit holes” can result in distraction from the central question. Returning frequently to the clear, well-defined research question in the process provides a prompt to attend only to stimuli directly relevant to that topic.

Build a Detailed Protocol. After defining the research question, researchers can begin to build a protocol for the systematic review steps. Developing a technological protocol is highly important to maintain transparency and the possibility for replication (Baer et al., 1968) by requiring methods be defined in advance. Preregistering the systematic review protocol is also useful in providing a contingency to maintain consistent methods throughout the review process. One such registry is the Open Science Framework. Another popular free registry for preregistering systematic review protocols is PROSPERO (<https://www.crd.york.ac.uk/prospero/>), which includes forms for registering reviews of human studies and animal studies with relevance to human health. An advantage of PROSPERO

is that the protocol will be assigned a unique identifier and a stable URL which can be included in the methods section of the manuscript. Where changes to the protocol may be unavoidable or necessary, it is important to denote those changes in detail and to provide a rationale for doing so. Components of a systematic review protocol include: the research question, literature search terms, inclusion and exclusion criteria, and databases to search. We expand upon each of these areas below. Before proceeding further with the review, we recommend sharing protocol with a trusted colleague or other third party to ensure that the protocol is replicable. Ask them to perform the steps of the protocol and see if they return the same studies for inclusion as your research team.

Determine Inclusion and Exclusion Criteria for Studies. Determining which studies will be included and which studies will be excluded from a review is critical step to ensure that the resulting review is comprehensive and unbiased. Carefully conceived criteria also establish the boundaries of the review for the reader and increase the replicability of the process (Maggin et al., 2017). The central importance of this step is supported by the analysis by Maggin et al., (2017) who found that the application of inclusion and exclusion criteria was the methodological domain with the greatest adherence across the published reviews they examined. Several factors should be considered when determining inclusion and exclusion criteria for a systematic review (e.g., O'Connor et al., 2008; Meline, 2006). One of the first questions to answer is whether to include unpublished theses, dissertations, or other “gray literature” (see Paez, 2017), to restrict inclusion to articles published in peer-reviewed journals? A second question to answer is whether to restrict the review only to papers published in the English language, or to include publications in other languages for which translations may be required? (for a critical analysis of translation options for systematic reviews, see Rockliffe, 2022). Third, will the search be limited only to papers published within a certain time frame or will the search be opened to all publications regardless of publication year? Finally, what are the required methodological criteria for inclusion (e.g., participant population, research design, diagnoses/conditions, task-based measures)?

Consideration of the research question and the maturity of the literature base will impact the decisions across each of these factors. For example, a less-mature research base may warrant inclusion of all relevant papers regardless of year, and inclusion of gray literature. In contrast, a systematic review that is an update on the field since a previously published review, or a review that covers a very mature research base, may necessitate a limited range of publication years and a restriction to only peer-reviewed published studies. The process for deciding upon inclusion and exclusion criteria may be an iterative one. We recommend collaborating with other members of the study team and trusted colleagues with expertise in the research question or topic area; ask them to review the criteria and offer feedback. Best practices are to finalize the criteria before the study screening begins. However, in some instances, deciding on inclusion and exclusion criteria may be an evolving process. For example, Siddaway et al. (2019) note that an initial unfamiliarity with the research area may preclude researchers from determining the ideal criteria before they begin to explore the studies to be screened in greater detail. In such cases, it is crucial to define these processes in

the systematic review manuscript. All inclusion and exclusion criteria should be finalized, at the latest, prior to final study selection.

Steps in a systematic review: Conducting the review

Database Searches and Search Criteria. After defining your research question, devising a protocol, and finalizing inclusion and exclusion criteria, it is time to conduct the systematic review. The first step is to search databases. Research librarians can serve as highly useful tools during this process, providing hands-on support and feedback. Their services are often free if any member of the research team is affiliated with a university. Consulting with a research librarian can save valuable time, effort, and mistakes in the search process. The appropriate databases to search for the systematic review will be based on the research question. Some common databases for psychological and behavior analytic research include PsycINFO (via EBSCO), PubMed (via Medline), Embase, Web of Science, and Cochrane Library, but other databases exist. Researchers should determine what databases will yield the most exhaustive and relevant literature based on the discipline and specific research question. This can be another decision point to engage the expertise of a research librarian who can provide suggested databases based on the review topic. Searching multiple databases will help ensure that all relevant articles for the review are identified (Stevenson & Lawlor, 2004). Access to these databases and to the full-text articles should be available via University institution libraries. For those without access to an academic library, it may be necessary to request full text articles from the authors. Consult with a research librarian or trusted colleague if questions arise. Research librarians affiliated with a university can also request full text access to any articles that the university may not have in their system; simply fill out a request form with the library.

These search databases offer the option to conduct a “basic” or an “advanced” search. The “advanced search” tool will allow researchers to use Boolean search terms to identify relevant articles. Boolean search terminology involves using “AND”, “OR”, and “NOT” statements to narrow the pool of returned papers. As one might imagine, it is important to note that using “OR” will inflate the search, potentially generating substantially more results that must be screened, whereas using “AND” will narrow the search, potentially at the risk of being overly restrictive. For example, searching for [“alcohol” AND “nicotine”] will return only those articles that include *both* terms in the manuscript. On the other hand, searching for [“alcohol” OR “nicotine”] will return articles that include *either* of those terms in the manuscript (as well as articles that include both terms). Searching [(“alcohol” OR “nicotine”) AND “demand”] will return articles that reference *either* alcohol or nicotine in the body of the manuscript, and *all* articles returned will reference the term “demand”. Another tool to use when searching for articles is the use of “wild card” searches. In a wild card search, a researcher can use asterisks to search for a variety of similar terms. For example, searching for “reinforce” will return only studies that include the word “reinforce” exactly as it is spelled. However, searching for “reinforc*” will return studies that use the term “reinforce”, “reinforcement”, “reinforcing”, and “reinforcer”.

Thus far, example searches have been for terms that exist across the entire body of the article. For many systematic reviews, this method of searching will return far too

many irrelevant papers and will inhibit efficiency. For example, a researcher interested in conducting a systematic review that uses search terms that may return an overwhelming number of studies (e.g. “reinforce” and “alcohol”) may choose to search just the article’s title or title and abstract. Options to do this, as well as options to search in specific journals or for specific author names, are available in each of the databases.

Article Management. Once a set of search criteria has been decided upon, screening of articles can begin. If possible, we recommend using systematic review software, such as Covidence (www.covidence.org), for managing article reviews. Although there is a cost associated with some of these software packages, we have found that university libraries sometimes have negotiated subscriptions available for researchers at the institution. Systematic review software provides a permanent product of each step of the process, automatically removes duplicate articles that may be returned from searching multiple databases, and keeps all articles organized. If no one in the research team has access to systematic review software, we strongly recommend using some form of electronic tracking database (e.g., we have successfully performed complete reviews using well-organized, color-coded Excel spreadsheets). After importing studies into the software or database, the next step is to screen articles by title and abstract. Reviewing the titles and abstracts of each study is an efficient first step in identifying studies that clearly do not meet inclusion criteria. After removing ineligible studies from this step, the next stage will be a full text review. For each step, employ at least 2 independent reviewers to screen articles. Where conflicts arise and a consensus cannot be reached, we recommend bringing in a third independent reviewer or member of the research team to make the final decision. Keep track of all votes, including discrepancies for calculating inter-observer agreement (IOA), as the research team will need to report these statistics as part of the methods section (see Documenting the Steps).

Returning to the analysis by Maggin et al., (2017), it is worth emphasizing that the process of selecting and coding studies was identified in their paper as an area with inconsistent documentation in published systematic reviews. In particular, it is essential to describe any procedures for training coders who were responsible for selecting studies and to provide details on how discrepancies were identified and ultimately resolved. Reporting these details increases transparency and trust in the mythological rigor of the review process.

Comprehensive Final Search. After arriving upon a list of articles to include from the title/abstract and full text screening steps, researchers should conduct a “snowball search”: search the reference list of each included article to determine whether any references cited that were not previously returned via the search terms may warrant inclusion in the review. Additionally, conduct a forward search of the included articles. This can be done by copying and pasting the article information into Google Scholar or a similar scholarly search engine and selecting the “cited by” hyperlink. This will return any articles published after the included study. Those articles can then be independently screened to determine which, if any, meet inclusion criteria.

Steps in a systematic review: Documenting the Steps: Documenting the steps of the systematic review is critical to ensure transparency and rigor of your methodology. The 27-item PRISMA Checklist provides a guide for what is typically documented (see

<https://www.prisma-statement.org/prisma-2020-checklist>). Reporting the comprehensive list of articles included in the review is the next stage of the systematic review process. If the total number of excluded articles is manageable, it can be helpful to include a table of individual citations and reasons for excluding each article in a table published in online-only supplemental materials. This provides transparency, allowing readers to determine exactly how researchers arrived at the final number of articles. Report inclusion and exclusion criteria and list the databases searched and the Boolean terms used. Additionally, report any forward or backward (“snowball”) screening. Next to be reported are the stages of article screening (e.g., total articles returned by searches; number of duplicates removed; title and abstract screening; full-text screening; final included articles), which can be efficiently detailed using a PRISMA flowchart. An example of a PRISMA flowchart is shown in Figure 2, adapted from Weinsztok, Reed, et al. (2023). Key aspects of PRISMA flowcharts are the documentation of excluded studies and the rationale for exclusion.

Steps in a systematic review: Results and Analysis

Grouping Studies. Unlike meta-analyses, results of systematic reviews are reported mainly in narrative form, without inferential statistics of effect size analysis. In addition to narrative form, the use of tables and figures can be helpful tools for displaying results. The first step of the narrative overview of results is to appropriately group studies based on your research question. For example, a review of the utility of contingency management procedures on abstinence from substance use may be best grouped across substance type. On the other hand, a review of best practice procedures for maintaining abstinence may result in grouping studies based on types of procedures utilized. It is ultimately up to one’s discretion as the researcher, in collaboration with colleagues and co-authors, to determine how to group the included studies. An example of studies grouped by reinforcer parameter manipulation is shown in Table 1.

Data Inclusion. The next step of reporting results is to determine what components of the included studies’ results to report. Included studies may have many experimental and analytical components, some more relevant to the research question than others. This underscores the importance of devising and maintaining a consistent research question throughout the systematic review process. This research question will guide what components of each study to report. Also consider what the readership of this review will find to be the most useful takeaways from this review, especially if the review has clinical implications. As is the case with primary research papers, some information can be more clearly depicted via tables and figures rather than in narrative review. Table 1 shows an example of including data from a systematic review in table format, grouped across categories.

Research Quality Indicators: While published systematic reviews frequently include the components mentioned above (listing inclusion and exclusion criteria, outlining study identification process via PRISMA flowcharts or similar, etc.), fewer provide details about or analysis of methodological quality of the included studies (Maggin et al., 2017). This is an area in which more consistent reporting is warranted. Introducing a section in the results of a systematic review that discusses quality indicators will improve the impact of reviews

in behavior analysis in several ways. First, it enhances the rigor of the review, providing additional analysis and highlighting limitations present in the included studies. By exposing these limitations or areas where methodological quality falls short of rigorous, readers can identify when the generality of takeaways should be limited. Second, it reveals areas of importance for future research, prompting researchers to accumulate necessary additional evidence.

Research quality indicators will vary based on the type of research that is the focus of the systematic review. A systematic review that focuses on group designs will have different quality indicators than one that focuses on single case research designs. Checklists exist for assessing research quality in both single case and group designs. Some of the checklists were developed specifically for those conducting systematic reviews, such as Cochrane's collaboration tool for assessing risk of bias for randomized trials (Eldridge et al., 2016). Others include guidelines for conducting and reporting primary research, such as the Consolidated Standards of Reporting Trials (CONSORT) checklist to verify reporting standards (for randomized trials/group designs; Moher et al., 2001), the Strengthening the Reporting of OBservational studies in Epidemiology (STROBE) checklist (for cohort, case-control, and cross-sectional observational studies; von Elm et al., 2007) and the Council for Exceptional Children standards for evidence-based practices (for group or single-case designs; Cook et al., 2014). A MeaSurement Tool to Assess systematic Reviews 2 (AMSTAR 2) is a tool for assessing the quality of a systematic review; however, it includes guidelines regarding assessing bias and other aspects of data quality among included studies (Shea et al., 2017)

Selecting the types of quality indicators to assess will ultimately be up to the discretion of the researchers conducting the review. Some systematic reviews may not require a detailed interpretation of methodological quality (i.e., if not central to the research questions; Maggin et al., 2017); however, all systematic reviews should incorporate some synthesis of the limitations of the included studies (Cumming et al., 2023). As with other results, quality indicators may be explored narratively or may be more clearly depicted in tables or figures.

Steps in a systematic review: Dissemination: Just as important as conducting a high-quality systematic review is the dissemination of the results. This will usually involve submitting the review to a peer-reviewed publication in a relevant journal. In this section, we provide recommendations on how to organize the manuscript and offer tips on what to include. Manuscripts reporting the results of primary research tend to have a typical flow: abstract, introduction, methods, results, discussion. The same is true for a systematic review. Reporting guidelines such as the PRISMA Checklist clearly outline the required elements in each section. In the introduction of the systematic review, discuss the background and purpose behind the review. This is much like a primary research manuscript. The methods section should include finalized research topic, inclusion and exclusion criteria and corresponding rationale, and comprehensive search strategy (see "Documenting the Steps" above). The results section of the manuscript will include the results of the systematic review. Reporting the results involves not only answering the primary review question but also identifying any gaps and limitations in the published literature base. Do not neglect the title and abstract of the manuscript—after all, a significant amount of time was just

spent screening titles and abstracts of candidate studies. PRISMA guidelines and the author instructions of many journals specify that the manuscript title should explicitly identify the study as a systematic review or meta-analysis. Similarly, the PRISMA guidelines provide a 12-item checklist specifically for what should be included in an abstract of a systematic review or meta-analysis (see <https://www.prisma-statement.org/abstracts>). Finally, consider creating supplemental materials with additional details (e.g., for full list of excluded articles and rationale; see “Documenting the Steps” above).

Conclusion

Systematic reviews and meta-analyses allow for comprehensive synthesis of a literature base and a transparent overview of the state of research in a given area. Conducting a systematic review and meta-analysis in behavior analysis can be used to establish evidence-based practices, identify gaps in research areas, and to help disseminate behavior analysis to broader audiences. Despite the benefits of these methods and the rich data common in behavior analytic literature, systematic reviews and meta-analyses are not frequently published in many behavior analytic journals. This technical report was intended to serve both as primer and a step-by-step guide to conducting systematic reviews in behavior analysis, while including additional resources for further learning and exploration. Ensuring the rigor and transparency of each step of the process increases the reproducibility of the review and trust in the overall results obtained.

We believe that the field of behavior analysis would benefit greatly from increasing rates of conducting and publishing systematic reviews and meta-analyses. The benefits of the methods over narrative reviews, which are historically more common in behavior analytic research, are that they by nature provide a more transparent and unbiased account of a research area. We argue that narrative reviews should be forgone in favor of these systematic methods of literature review. Beyond systematic reviews, the uptake of meta-analytic methods for both single case and group design research would add a rich depth of understanding to many behavior analytic research areas. In addition, systematic reviews and meta-analyses expose researchers in our field to the importance of transparency and completeness when publishing and disseminating data. By further popularizing these methods, we expect to observe an improvement the rigor and quality of primary research manuscripts in our field. Through this report, we call on researchers to use these methods to propel our science forward and to harness the rich datasets inherent in behavior analytic research methods to determine effect sizes and provide conclusive evidence in these research areas. For applied research, this may serve as the “evidence” in “evidence-based practice”. These methods also expose stones that remain unturned; the presence of possible publication bias or lack of diversity of participant backgrounds in the published literature can be highlighted as areas ripe for further research and a focus for allocation of attention and resources.

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Note: Bolded references represent seminal and authoritative texts on systematic reviews for readers who are seeking deeper learning.

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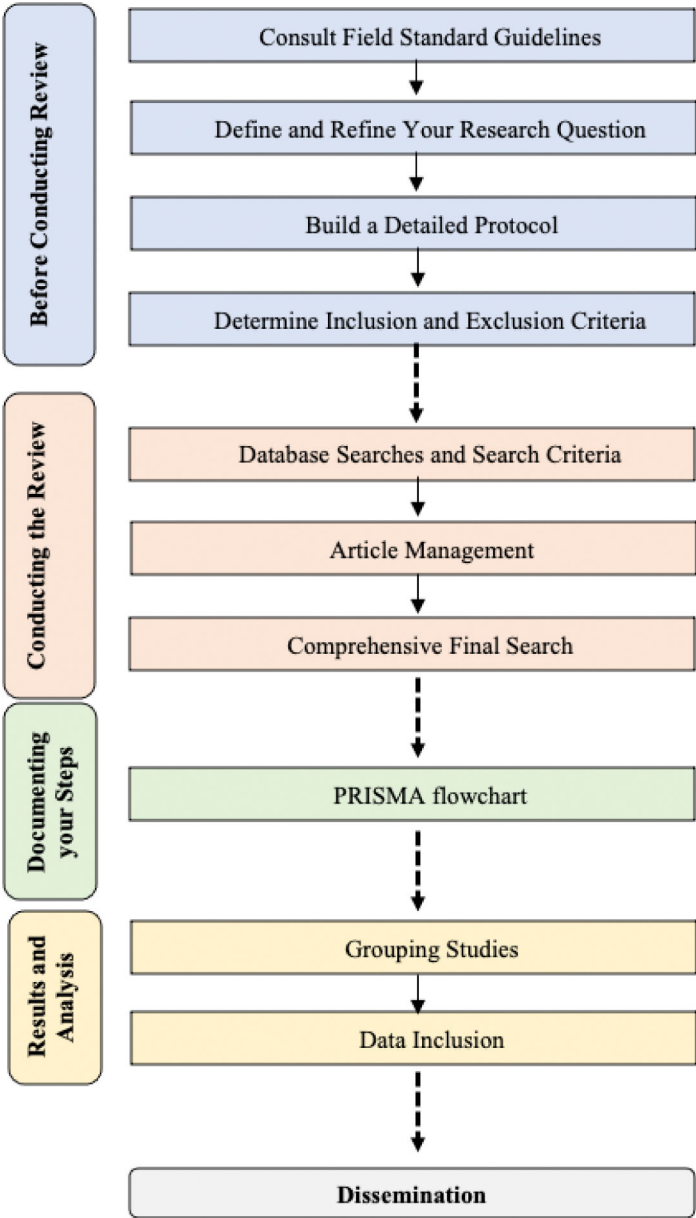


Figure 1: Overview of Steps in a Systematic Review
Schematic representation of the key steps involved in conducting a systematic review, organized into four broad phases. Specific steps within each phase are described in separate sections in this report. *Abbreviations.* PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

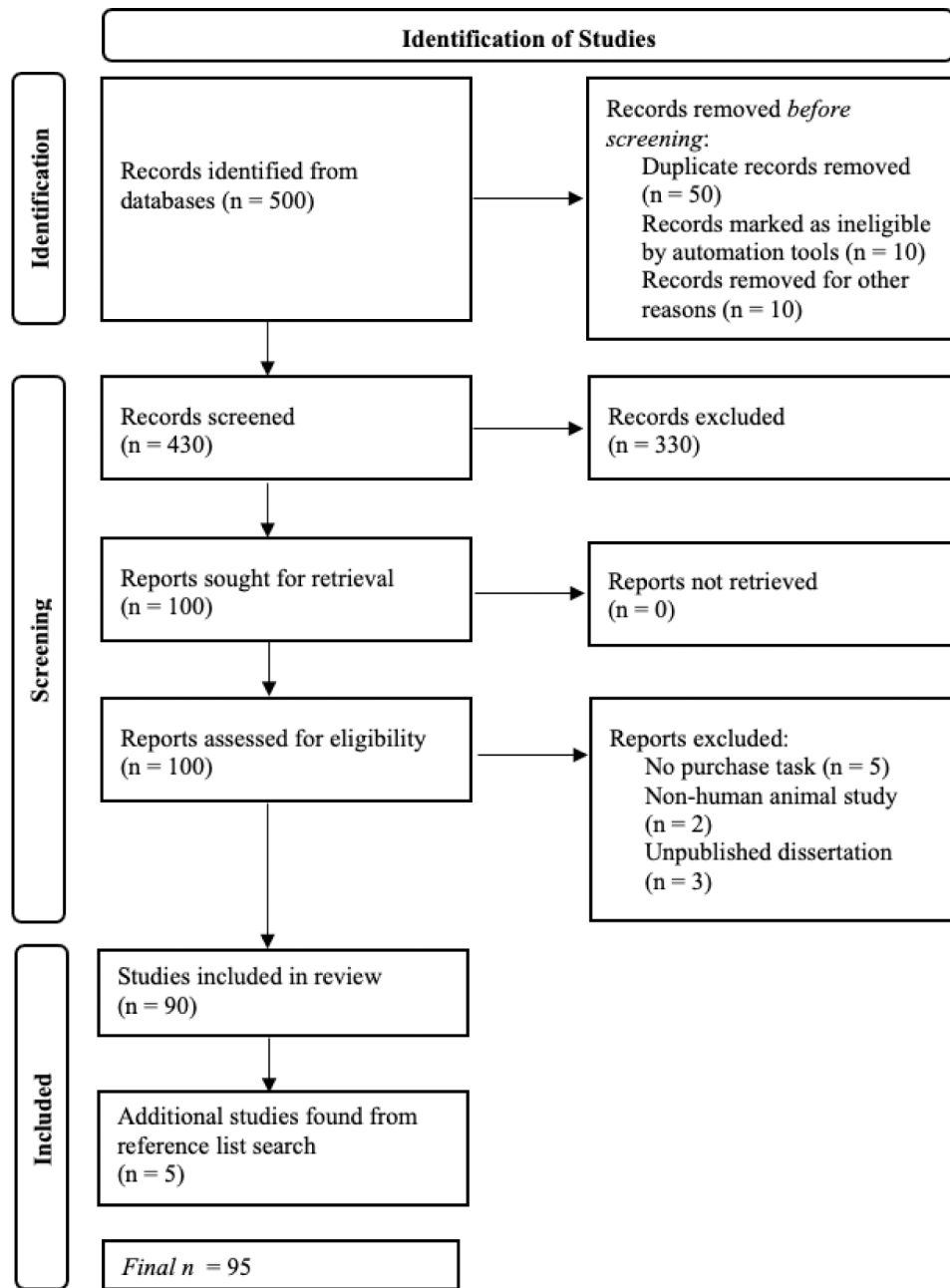


Figure 2: Representative PRISMA Flowchart

A PRISMA flowchart outlines the steps of record identification, record screening processes, and lists the final included studies for a sample systematic review. Note that excluded studies are listed in text boxes to the right alongside a rationale for exclusion. This flowchart was adapted from Weinsztok, Reed et al., (2023).

Table 1:
Efficiency Analysis of Reinforcer Parameter Manipulations on Acquisition Rate

Reinforcer Parameter Manipulation	Intervention	# Participants	More Efficient (at any point)	Never More Efficient	% More Efficient All Participants
Differential Outcomes (DO)	<i>DO</i> vs. No DO	20	15	5	75%
Accumulated and Distributed Reinforcement	<i>Accumulated reinforcement</i> vs. Distributed reinforcement	12	9	3	75%
Immediate vs. Delayed Reinforcement	<i>Immediate</i> vs. Delayed	10	7	3	70%
Reinforcer Choice	<i>Choice</i> vs. No choice	5	2	3	40%
Reinforcer Magnitude	<i>High magnitude</i> vs. Low magnitude	15	6	9	40%

Quantitative information derived from systematic review results, such as counts and percentages, are oftentimes more clearly depicted in table or figure form. This table shows the impact of reinforcer parameter manipulations on efficiency of acquisition across participants. Table and data adapted from Weinsztok, Goldman et al. (2023) (data present in the table have been changed and differ from the actual results presented in (Weinsztok, Goldman et al. (2023)).