SEMP
SOCIETY OF EMERGENCY MEDICINE PHARMACISTS

Research Toolkit

A Practical Primer for Emergency Medicine Pharmacy Research

SEMP RESEARCH COMMITTEE 2025-2026

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A Practical Primer for Emergency Medicine Pharmacy Research

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Intended audience

This toolkit is written for pharmacists, pharmacy residents, and pharmacy students who are planning, conducting, writing, or presenting emergency medicine pharmacy research. The methods and frameworks described apply broadly to quality improvement, observational research, and small-scale interventional studies typical of the practicing emergency department pharmacist.

Disclaimers

Not medical advice. Nothing in this toolkit constitutes medical, pharmaceutical, legal, or regulatory advice. Clinical judgment, institutional policy, and applicable law supersede any suggestion made here. Readers must apply their own training and seek appropriate expert review before making patient care decisions.

Not peer-reviewed scholarship. This toolkit is a practical primer, not a peer-reviewed publication. Statements represent the authors' best understanding of research methodology at the time of writing. Readers should consult primary sources, institutional review boards, statistical consultants, and journal-specific style guides for definitive guidance.

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External guidelines. This toolkit cites and summarizes published external guidelines, including, but not limited to, ICMJE recommendations, CONSORT and STROBE statements, journal peer-review guidance, and institutional IRB policies. Readers should consult those primary sources directly; summaries here are original prose and may not capture every nuance.

Reporting errors

If you find a factual error, broken citation, or outdated reference, email **research@empharmacists.org** with the chapter, section, and a brief description. Corrections will appear in the next revision.

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Preface

Emergency medicine pharmacy practice is built on decisions made in seconds. The research that informs those decisions is built over months and years, often by clinicians who never trained as researchers, squeezing projects around overnight shifts, residency duties, and the everyday chaos of the emergency department.

The SEMP Research Committee assembled this toolkit because the path from a clinical observation to a published paper is opaque to too many of our members. Each of us has stared at a blank IRB application, rewritten a manuscript methods section, or wondered how to respond to a reviewer comment that felt unfair. We have also watched talented residents abandon otherwise excellent projects simply because no one walked them through the path from idea to publication.

From the committee (Deborah Booth, Chair)

Research is one of the fundamental pillars of pharmacy practice. Research and evidence-based practice drive the care we provide every day, ranging from new therapies and treatment pathways to comparing existing therapies and looking back to see how a medication was used. There are many frameworks and methods to conduct your research, as this is a complex process. Research projects can set the foundations of project management and clinical excellence. Learning how to do research involves clinical activities that let you assess, analyze, and share that knowledge with others.

Projects start with an idea. That idea grows into a proposal and subsequently into designing a project. The next steps are implementing that project, conducting data collection and management, analyzing the information, and disseminating your research. Each step of this process can be daunting and overwhelming at times.

The toolkit covers the topics below to help guide you on your research journey:

- IRB and CITI training
- Background literature
- Reference and citation management tools
- Research design
- Data collection tools
- Data analysis
- Putting together a poster
- Preparing a manuscript
- Peer review

We hope that this toolkit will help provide some guidance through your research process. We hope to be able to read and hear about your research in the future.

What this toolkit is

A practical primer. We describe the common shapes of EM pharmacy research projects, the steps to plan and execute them, the writing and publication process, the peer-review experience (from both sides), and where to find funding and mentorship.

What this toolkit is not

A statistics textbook. A clinical reference. A guarantee that any particular project will succeed or publish. A substitute for your institution's IRB guidance.

How we hope you use it

Read the chapter that maps to your current step. Skip what you already know. Come back to it when the next step arrives. Email us at **research@empharmacists.org** when we get something wrong.

This toolkit will evolve as the committee receives feedback from members, as our field's methods mature, and as new authors contribute. Thank you for being part of SEMP, and for taking the time to do this work. Emergency medicine pharmacy is better when more of us publish what we learn.

SEMP Research Committee, 2025-2026

Foreword

A professional society earns its place by lowering the barrier to meaningful work. For the Society of Emergency Medicine Pharmacists, that means many things, advocacy, education, conference programming, but few of them matter more than helping our members publish.

Research in emergency medicine pharmacy is not optional. It is how we demonstrate, quarter after quarter, that embedding a pharmacist in the ED changes outcomes. It is how we refine the interventions we already perform. It is how we earn the next position, the next credentialing pathway, the next line item in a hospital's budget. Every peer-reviewed paper written by an SEMP member is, in a small way, a defense of our practice.

And yet, for too many of our members, especially early-career pharmacists, residents, and students, the path from an interesting clinical observation to a published paper is opaque. They do not lack curiosity or clinical acumen. They lack a map.

This toolkit is that map. The 2025-2026 SEMP Research Committee, chaired by Deborah Booth with Vice Chair Leah Clark, has done something genuinely difficult: distilled the collective experience of eleven working committee members into pragmatic, stepwise guidance. They describe the process as it actually works in practice, not as textbooks describe it in theory.

I am particularly glad that this toolkit covers the full arc, not only planning and study design, but also the less-discussed realities of responding to reviewers, equitable peer review, grant writing, and conference presentation. These are the places where good projects fail, and the places where a single mentor conversation can be the difference between publication and abandonment.

As this toolkit evolves, and it will, my hope is that it becomes a living document: updated as our members' experiences teach us, expanded with case studies and templates contributed by the committee, and complemented by the monthly writing-and-research hour the committee is standing up.

Read it when you need it. Share it with a resident. Send your corrections to the authors. And write something worth citing.

Christopher J. Edwards, PharmD, BCPS, FASHP Author and Executive Board Liaison, SEMP Research Committee

Acknowledgments and Contributors

This toolkit exists because of the SEMP Research Committee's sustained effort across writing sessions and reviews from October 2025 through February 2026.

SEMP Research Committee, 2025-2026

Listed in academic-citation order, ranked by primary writing, editing, and feedback contribution.

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07	Reference & Citation Management	Christopher J. Edwards	Deborah Booth, Elizabeth Adetobi
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11	Research Design Essentials	Stacy Henry	Deborah Booth, Christopher J. Edwards, Research Committee
12	IRB & CITI Training	Deborah Booth	Elizabeth Adetobi
13	Data Analysis	Deborah Booth	Elizabeth Adetobi
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Where a chapter has more than one named contributor, the authors agreed to treat the chapter as jointly contributed for purposes of ICMJE authorship review.

Founding context

Christopher J. Edwards, PharmD, BCPS, BCEMP, FASHP chartered the SEMP Research Committee toolkit project and serves as the committee's Executive Board Liaison. The 2025-2026 committee was assembled under his guidance, and the toolkit's scope, structure, and editorial direction reflect his leadership across writing sessions and reviews from October 2025 through February 2026.

Publication support

Jimmy L. Pruitt III, PharmD, BCPS, BCCCP, BCEMP — President, Society of Emergency Medicine Pharmacists (SEMP) — provided the publication infrastructure for this toolkit, including the build pipeline that produces the EPUB and PDF artifacts, the LearnDash course infrastructure that mirrors this toolkit as in-browser lessons on empharmacists.org, and the distribution logic that delivers the toolkit to active SEMP members.

External references and standards

This toolkit cites publicly available guidance, including:

- The International Committee of Medical Journal Editors (ICMJE) Recommendations
- The Committee on Publication Ethics (COPE) core practices and discussion documents
- The EQUATOR Network's reporting standards (CONSORT, STROBE, SQUIRE, PRISMA, COREQ, SRQR, STARD, CARE)
- The "Key Guidelines for Responding to Peer Reviewers" reference document (F1000 Research, 2024)
- The "DEI in Peer Review" reference document (XGE, 2023)
- Federal regulations (45 CFR 46) and OHRP guidance documents

These sources are cited and summarized; readers should consult the primary documents for definitive language.

Member reviewers

We thank every SEMP member who submitted feedback during the review cycle. Errors that remain are the contributing authors' responsibility alone.

How to be acknowledged in future revisions

Contribute a chapter, submit a substantive correction, peer-review a future draft, or contribute a template or institutional resource that benefits members. Email **research@empharmacists.org**. Contributors meeting ICMJE authorship criteria are listed on the author line of future editions.

THE TOOLKIT | CHAPTER

Background Literature & Literature Review

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Background Literature and Literature Review

Background literature evaluation is one of the key steps to take when starting the research process. A solid understanding of the current environment and existing published knowledge is essential. As you begin your research journey, you must first identify the question being asked by reviewing and analyzing the current literature. Obtaining the literature that you need for your research will start with various research databases such as Medline, PubMed, or Google Scholar. As you conduct your search, you may also need to look at the National Institutes of Health clinical trials registry. If unsure where to start, consider authoritative sources that corroborate what you do know, such as textbooks or guidelines. These sources also include citations which may be another avenue to find additional references.

Consider discussing your search strategy with additional personnel such as a mentor/preceptor, or a drug information specialist. Some institutions or academic settings have a librarian and can assist with searches and obtaining literature and articles.

The literature review will always start off broad, but as you start reading you will start to narrow down your search to a specific question. As you obtain this information you may have a plethora of literature or there may be significant gaps and deserts of information. You will want to notice patterns and holes as you begin devising your own clinical question, it will be important to stay organized, as there may be a significant amount of reading. There are several strategies you can use to synthesize, organize, and summarize, one strategy is to use a literature matrix. This can help you piece together the whole parts of the knowledge that is available.

As you begin collecting themes and the key components of the research to further organize information, you begin building a synthesis matrix. The synthesis matrix helps ensure that your literature review fits the criteria of your research and background analysis. Once you have this completed this can be the foundation of an outline for your background portion of an article.

Examples of a literature matrix are listed below. These can be customized to your specific research project or piece of information you are trying to evaluate. With the literature search you may be looking for broad information and the below table is an example of general information you may utilize (table 1). These are most commonly the PICO questions (patient, intervention, comparison, outcome). Some literature reviews are very specific and evaluate articles for certain pieces of information (table 2). In addition there are various methods to highlight key take-aways from each article including using various functions in software you may have such as bolding, highlighting, or coloring a cell. You can create this in a word document with a table or use excel with each column as your area of focus for each article.

Table 1. General literature matrix

A general literature matrix captures the broad PICO elements of each article. Add one row per article and customize columns to your project.

Citation / Author, Year	Study type, population, site	Design or treatment / control	Result	Conclusion / outcomes	Limitations	Theme

Table 2. Topic-specific literature matrix

A topic-specific matrix targets a narrower question, for example an adverse drug reaction in a specific population.

Citation / Author, Year	Specific population	Exposure	Adverse reaction	Treatment

As you fill out this table some tips you should use to summarize this information:

- Write and summarize in your own words in short concise phrases/sentences
- Write out your full reference, you will thank yourself later so you don't have to find the article again to reference it (or use reference management software)

After you piece together your literature review, you can begin building a synthesis matrix by taking the overarching themes or common threads to tie them together. There may be a few bullet points for each article as you do your literature review. This can be the start of your background for a manuscript and the beginnings of your IRB submission documentation. The synthesis matrix then takes all of those key overarching themes and creates a table and places the articles with those statements (see table 3).

Table 3. Synthesis matrix

The synthesis matrix groups articles by overarching themes. Mark each article that supports each statement:

Theme	Article 1	Article 2	Article 3
Statement 1		x	
Statement 2	x		x
Statement 3	x	x	x

References

Vordenbert SE, Irwin AN, Mai Y et al. Laying the foundation for success: a guide to pharmacy residency research projects. JAPHA. 2025. https://doi.org/10.1016/j.japh.2025.102358

Smith K. Building upon existing evidence to shape future research endeavors. AJHP. 2008; 65(18):1767-1774. https://doi.org/10.2146/ajhp070176

Examples of excel versions

https://library.thechicagoschool.edu/c.php?g=1296999&p=9655839

PICO: https://pmc.ncbi.nlm.nih.gov/articles/PMC3430448/

https://libguides.reading.ac.uk/pharmacology-research-project-guide/literature-review

THE TOOLKIT | CHAPTER

Reference & Citation Management

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Reference & Citation Management

Managing citations and references is often a frustrating and daunting task for newer researchers. Mastering reference management early is one of the most effective ways to reduce the stress of scientific writing.

Several Reference Management Software (RMS) options exist, including Zotero, Mendeley, and EndNote. These programs serve as a digital library where you can store papers and, most importantly, automate the formatting of citations and bibliographies. Instead of manually typing out references, these tools use browser extensions to "clip" papers and citations directly from journals and other websites. These programs typically have plugins for Word or Google Docs that allow citations to be inserted into a manuscript with a single click.

Zotero is a very popular option. It is free, easy to use, and offers plugins for most browsers that allow for quick acquisition of complete references, and for most word-processing programs, allows for insertion of in-line citations.

The most critical technique for effective reference management is adopting a **"clean as you go"** workflow. Scientific databases often export messy metadata; titles might be in all caps, or journal abbreviations that might be inconsistent. If you don't correct these errors when you first import the paper, they will reappear as typos in your final manuscript's bibliography. Spend the time upfront to verify the author names, year, and publication title immediately after saving a source, or at least make sure to clean these up before submitting a manuscript.

Additionally, utilize tagging and folders as you import papers. Rather than just sorting by "Topic," try tagging papers by their function in your paper, such as "Background", "Methodology", or "Discussion". This will make retrieving specific evidence much faster during the drafting phase.

Finally, integrate your software into your actual writing process through the **"Cite While You Write"** approach. Many researchers make the mistake of leaving the bibliography for the end, which leads to "citation amnesia" where you forget which paper supported which claim. If not using RMS, you can do this by simply putting the first author's last name and the year of the publication after the sentence with the citation (Booth, 2026). Do not add reference numbers to in-line citations until the very end of your final draft. If you use reference numbers and then move sections around, you will have to renumber citations, which can be a time-consuming and frustrating task. An RMS plugin allows you to insert placeholders as you write each sentence, which automates the tedious task of renumbering citations. Mastering these tools early doesn't just save time; it ensures your work meets the professional standards of accuracy and consistency required for high-impact publication.

THE TOOLKIT | CHAPTER

Research Design Essentials

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Research Design Essentials

Pharmacists are increasingly expected to generate, evaluate, and apply evidence to justify new services, improve patient outcomes, and inform policy and practice change. Pharmacy practice research is essential to advancing the profession by demonstrating that expanded pharmacist roles are feasible, acceptable, cost-effective, and capable of improving both patient and health system-level outcomes. Research also allows pharmacists to substantiate the value of innovative practices, influence policy decisions, and drive meaningful improvements in clinical care. While traditional quantitative and qualitative approaches, such as randomized controlled trials, observational study designs, and survey-based research remain foundational, pharmacy research continues to evolve with the introduction of more complex and novel methodologies. As a result, pharmacy practice researchers must be prepared to appropriately select, apply, and interpret study designs based on the research question, investigator expertise, data availability, and funding considerations. Competency in research methodology is essential for pharmacists seeking to generate high-quality evidence that supports and sustains the evolving role of pharmacy practice. This document summarizes core research design concepts and practical considerations for clinical pharmacists.[1,3]

Starting With the Research Question

All research activities should begin with a specific research question, because the question drives design selection, methods, outcomes, and analytic plans.[1] In clinical research, the central task is evaluating an association between two or more variables.[1] The dependent variable is the outcome of interest, and the independent variables are the predictors/exposures/interventions being evaluated.[1]

A practical way to structure research questions, especially for residency projects and time-limited work, is to use established frameworks:

- PICO (Population, Intervention, Comparison, Outcome): particularly useful for intervention-focused questions.[3]
- FINER (Feasible, Interesting, Novel, Ethical, Relevant): helps determine whether a question is actionable and likely to yield meaningful conclusions within constraints.[3]

A well-formed question supports downstream decisions like sample size planning, questionnaire pretesting (if applicable), and statistical test selection.[3]

Next, clinical research relies on empirical data, which is information observed in nature and begins with background research in preparation for choosing a question or idea.[1] See the section on background literature/literature review for more information.

Internal and External Validity

The credibility of findings depends on both internal and external validity:

- Internal validity: the degree to which observations accurately reflect what they are intended to measure and can be threatened by systematic error (bias and confounding) and random error (chance).[1]
- External validity: the extent to which internally valid findings can be inferred back to the population of interest (and potentially other populations).[1] External validity improves when the sample accurately reflects the target population and the study is executed in a way that minimizes internal error.[1]

When thinking about causality, Hill's criteria can strengthen arguments for causal relationships when supportive elements are present, but design and execution still matter because association alone does not prove causation.[1] The following nine viewpoints are commonly assessed to prove causation in epidemiology: strength of association, consistency, specificity, temporality, dose-response, plausibility, coherence, experiment, and analogy.[5]

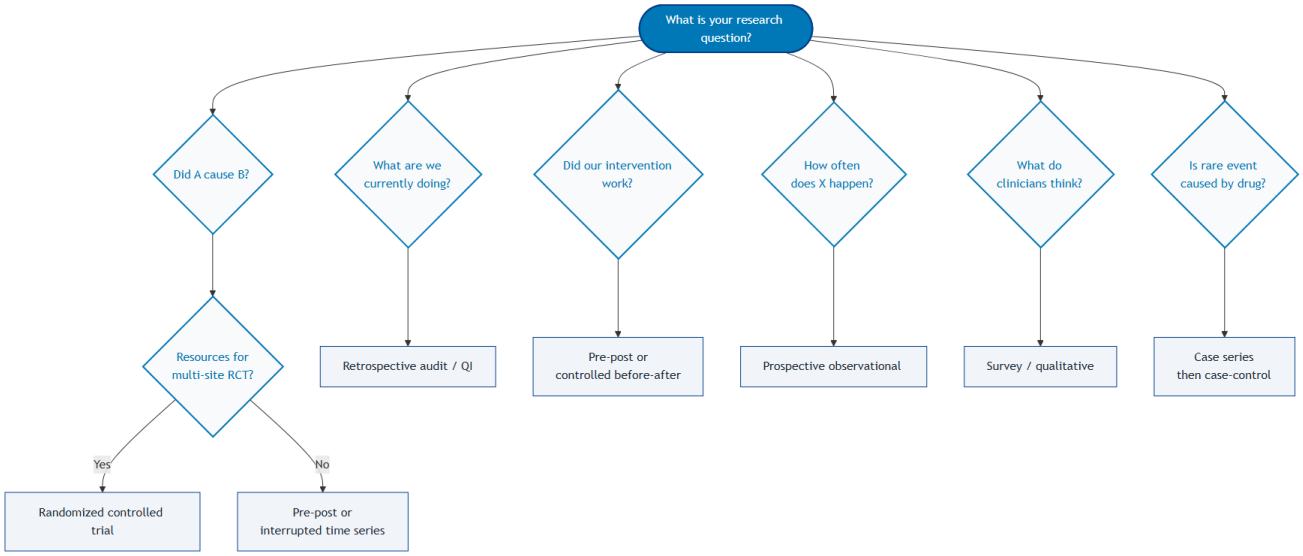

Figure 1: Study design decision tree based on research-question type.

Chance, Bias, and Confounding

Chance (random error) refers to the likelihood that an observed finding is due to random variation.[1] Even well-designed studies can produce misleading results if sample sizes are too small or event rates are low.

Bias (systematic error) is a non-random distortion of the true association (or lack of association) between predictor and outcome variables.[1] Two common categories include:

- Selection bias: systematic differences in who is included or retained in a study.[1]
- Information bias: systematic differences in measurement or classification of exposure/outcome.[1]

A classic example of information bias is recall bias, which occurs when subjects have differential recollection of key variables that are related to their study group allocations.

Confounding occurs when the observed association between exposure and outcome is partly or fully mediated by a third factor.[1] In experimental research, randomization is the most powerful tool to control confounding.[1] In observational research, common approaches include:

- Design phase: restriction and matching
- Analysis phase: stratification and multivariable analysis (commonly used because it can adjust for multiple variables simultaneously).[1]

Broad Categories of Clinical Research Design

Clinical research designs are broadly categorized as observational or experimental.[1] From a time-orientation perspective, many designs can also be considered retrospective or prospective, based on whether the investigator is looking back at existing events/data or collecting forward-going outcomes.[1,2]

Observational Designs

In observational research, the investigator does not intervene; they observe natural phenomena and evaluate associations.[1,2] Observational designs are often more feasible in routine pharmacy practice due to reduced time and expense compared with experiments, but they generally face more threats to validity.[1]

Cohort studies Cohort studies follow groups through time, either prospectively or retrospectively, to determine development of an outcome (real or "virtual" follow-up using records).[1] This design is well-suited for estimating incidence and evaluating temporal relationships between exposure and outcome.[1]

Case-control studies Case-control studies work backward from outcome to exposure. They are efficient when the outcome is rare but are particularly susceptible to selection and information bias. Results are commonly expressed as odds ratios (ORs), which can approximate relative risk but may marginally over or underestimate risk when the cumulative incidence of the outcome is less than 10%.[1]

Specialized case-control studies Some case-control approaches incorporate elements of other designs, such as nested case-control and case-crossover studies. Nested case-control studies are embedded into existing prospective cohort studies and are useful when additional data collection is needed. In case-crossover studies, the subjects are randomized to treatment for a period of time and then crossover into the placebo group to serve as their own control.[1]

Cross-sectional studies Cross-sectional designs assess exposure and outcome simultaneously and can be considered a "snapshot in time." These are often descriptive studies which describe a population or sample in terms of distribution of the variables, not analytical, which identifies risk factors, associated factors, mediating factors, etc. Therefore, this type of study cannot show if a specific exposure led to an outcome.[1,2]

Experimental Designs

In experimental research, the investigator intervenes for the purpose of evaluation.[1,2]

Randomized controlled trials (RCTs) RCTs are considered the gold standard for medical evidence because, when properly executed, they effectively eliminate confounding and minimize bias.[1] Key elements include:

- Randomization: random assignment to treatment vs control helps prevent selection bias and balances confounders across groups.[1] True random methods such as random-number generators are preferred; predictable/non-random methods (eg, alternating enrollment, day of week) should be avoided.[1] Permuted block randomization can prevent large group imbalances during enrollment.[1]
- Blinding: reduces information bias (eg, subjects' behavior changes and investigator detection bias).[1] Placebos can help preserve blinding and reduce Hawthorne effects, which are behavior changes because subjects know they are being studied.[1]
- Intent-to-treat (ITT) analysis: analyzes all randomized subjects in their assigned groups regardless of adherence, which helps address attrition bias and preserves the advantages of randomization; it often yields conservative estimates of effect.[1]

Noninferiority trials Noninferiority trials evaluate whether a new treatment is therapeutically equivalent (within a predefined margin) to an established therapy by reversing the typical null/alternative hypothesis.[1] In this context, the null hypothesis is that a difference exists, and the alternative is that no meaningful difference exists.[1] Because ITT can dilute differences (making it easier to conclude noninferiority), per-protocol analyses are commonly recommended as particularly important in noninferiority designs.[1]

Quasi-experimental designs Quasi-experimental studies blend experimental and observational elements and involve an intervention but are used when randomization is inappropriate or impossible.[1,2] These are common in health-system and pharmacy service evaluations where ethical, operational, or logistical constraints prevent random assignment.[2]

Matching the Design to Pharmacy Practice Needs

Pharmacy practice research often aims to demonstrate that new services or roles are feasible, acceptable, cost-effective, and improve health outcomes.[2] Well-designed studies can confirm value, inform policy, and drive practice changes.[2]

A helpful way to classify pharmacy research methodologies is by multiple orientation lenses:[2]

- Time orientation: retrospective vs prospective.[2]
- Study purpose: descriptive vs analytical.[2]
  - Descriptive designs describe distributions and frequencies without a comparison group (eg, case reports/series, cross-sectional studies, surveillance, ecological studies).[2]
  - Analytical designs (experimental or observational) test hypotheses about risk factors, associated factors, mediators, etc.[2]
- Investigator orientation: experimental vs quasi-experimental vs observational.[2]
- Question orientation: quantitative vs qualitative vs mixed-method designs.[2]

Across these categories, pharmacists conducting research should be competent in selecting, designing, applying, and interpreting the chosen methods.[2]

Practical Lessons from Residency Research Projects

Residency research is a common training pathway for building research skills, yet projects are often presented at meetings and less frequently published, with recurring barriers including limited time, limited research/publication expertise, and insufficient programmatic resources.[3] Aligning goals among the resident, preceptors, and institution, and planning early, can improve feasibility and impact.[3]

Key project management concepts for residents and preceptors include:[3]

- Set shared goals and expectations: define the minimum requirements for accreditation, but consider higher-value goals such as publication and quality improvement impact.[3]
- Build a team and gather resources: offer necessary expertise with subject matter, institutional policy/operations, and research design. Don't be hesitant to engage your colleagues or your community for help or to make project decisions regarding resources needed to complete the project.[3]
- Create a realistic timeline: right-size the question for a one-year window, check in regularly, and plan dissemination with the end in mind (poster, platform presentation, manuscript).[3]
- Execute and maintain the literature review: develop the review alongside question formation and update it throughout the year to avoid duplicating existing work and to incorporate new evidence. Evaluating literature for methodology can also assist the resident with their own project planning.[3]
- Mitigate bias proactively: consider sources of bias early in the protocol and build methods to reduce them.[3]
- Use reporting guidance: EQUATOR reporting guidelines can help ensure protocols capture key study elements.[3]

Since 2017, the American Pharmacists Association (APhA) has provided a forum to highlight the value of residency research through an annual special issue initially published in the Journal of the American Pharmacists Association (JAPhA), and now JAPhA Practice Innovations which provides guidance for residency research success.

Literature Reviews as a Research Methodology

Literature reviews are foundational to nearly all research, but they can also be a standalone research methodology that synthesizes findings at a meta-level, identifies gaps, and supports theory development or policy/practice decisions.[4] Traditional narrative descriptions may lack systematic rigor, which can obscure what studies collectively show.[4]

Common Review Types

Different review types fit different purposes and question scopes:[4]

- Narrative/semi-systematic reviews: useful when topics are conceptualized differently across disciplines or when understanding development over time is the goal.[4]
- Integrative reviews: aim to critique and synthesize perspectives and may propose new frameworks or concepts rather than exhaustively covering all literature.[4]
- Systematic reviews: use strict, transparent, reproducible search and selection methods to identify empirical evidence meeting predefined criteria; often considered the gold standard among reviews for a narrow question.[4]
- Meta-analysis: statistically combines results across studies using common metrics, enabling pattern detection and weighted comparisons; can be difficult to perform and requires compatible data.[4]
- Qualitative systematic reviews: systematically reviews qualitative findings rather than quantitative outcomes.[4]

Conducting and Reporting a High-Quality Review

High-quality reviews are rigorous, replicable, and useful to scholars and practitioners.[4] A common process can be thought of in phases: designing the review, conducting the search, analysis, and writing the review.[4] Common pitfalls that reduce publishability include failing to describe methods in enough detail, restricting searches too narrowly for convenience (reducing rigor), unclear presentation of results, and failing to make a meaningful contribution.[4]

Pulling It All Together

Across all settings, strong pharmacy research is built on the same fundamentals:

1. Start with a focused, feasible research question.[1,3]
2. Choose a design aligned to the question (observational vs experimental vs quasi-experimental; retrospective vs prospective; descriptive vs analytical).[1,2]
3. Anticipate threats to internal validity (chance, bias, confounding) and incorporate controls in the design and analysis plan.[1]
4. Consider generalizability and whether the sample reflects the target population and practice environment.[1]
5. Build the literature review early and update it throughout the project; consider whether a structured review methodology is needed.[3,4]
6. For residency and operational projects, pair methodological rigor with realistic timelines, appropriate resources, and a clear dissemination plan.[3]

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THE TOOLKIT | CHAPTER

Data Collection Tools

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Data Collection Tools

Data collection can be one of the more daunting parts of a research project, but with the right tool and intentional design, there are ways to streamline the process and considerations that you can make as you start the process.

Ideally, you should engage your research team to determine what data should be collected, how the data could be collected, and if there are any local recommendations that they have. During this phase, you should start to consider what information you need to describe your patient population, to analyze your outcomes, and to explore any potential confounding factors.

When you are setting up your data collection tool, these are some things you should consider:

- Data Accessibility
  - You may need to put in requests for access to certain parts of a chart or views to be able to fully capture the data that you need
  - Along with building the right tool to collect your data, it is also important to consider how and what data you can access.
    * While some institutions may have access to resources to pull your datasets for you, for others, you may be pulling your dataset yourself.
    * Some common practices to pull a dataset include International Classification of Disease (ICD) codes, medication administration records, laboratory results, or even blocks of time.
- Tracking your exclusion criteria
  - Ideally, your initial patient list includes all patients who meet your inclusion criteria
  - As you go through the list you should track if you are including that patient or excluding that patient.
  - When you track the exclusion, you should identify why the patient was excluded. This will be helpful in describing your patient population in the eventual poster or manuscript.
- Standard units of measurement
  - Many journals will utilize the International System of Units (SI) which may require conversions. For example:
    * Converting weight from pounds to kilograms
    * Reporting creatine clearance as mL/s/m^2 instead of mL/min/1.73m^2
  - References such as the American Medical Association Manual of Style 11th edition has resources for converting units of measurement.
    * For example: When reporting acetaminophen concentrations, the conventional unit of mcg/mL should be multiplied by 6.614 to get the SI unit of micromol/L.
  - Nominal/categorical data may need to be represented numerically prior to analysis or importation into some statistical software
    * Some data collection tools are able to do this automatically when exporting your data.
    * For others, you may want to consider building a data dictionary where you pre-assign a numeric value to individual categories.
    * For example, if assigning a numeric value to eye color, a data dictionary might say brown = 1, blue = 2, green = 3, other = 4
- Date and Time endpoints
  - Certain endpoints such as time to antibiotic administration or door to needle time, may require collecting multiple time points, such as time ordered, verified, and administered.
  - If your system doesn't record time between events, you may need to consider how this will be calculated, whether in the collection tool with a formula or manually inputted.
  - Be mindful that date and time fields are sometimes challenging for unintentional reformatting in spreadsheets.
- Privacy, Protection, and Data Integrity

  - Some data collection tools are compliant with the Health Insurance Portability and Accountability Act (HIPAA), while others will require additional actions, such as deidentification or not collecting protected health information.
  - Check with your local institutional review board if they have standards for data collection as well as the language needed for the IRB application.
  - It is important to protect the time and energy on your research efforts.
    * If auto-save is not on, you should consider saving your work every thirty to sixty minutes
    * Also consider creating backup copies to prevent losing work due to technical issues.
    * If you have many individuals who have access to your data collection tools audits are essential for data quality monitoring.

- Codebook
  - As you collect data you will need to have definitions for codes used in data collection
    * For example, many dichotomous variables will be coded into 0s and 1s.
    * Using codes helps keep your data clean.
    * The codebook provides the definitions of what those values mean.
    * This can be done automatically in some data collection tools or may have to be written.
    * In a spreadsheet this can be done in a separate sheet or can be done in the column title if there is sufficient room.
      · For example, in a spreadsheet, the column title could be Gender (F=0, M=1)
      · This could work for larger groups, such as race (0=White, 1= African American, 2=Asian, 3=Hispanic, 4=Other), but as the number of groups increases, using a separate sheet may be cleaner than using column headers

Where to Collect Your Data

The choice of what data collection tool to use will depend on the type of data being collected, what tools are available, how familiar you are with the tool, whether multiple people will be doing data collection, and what tools are allowed to be used at your institution, particularly if PHI is being collected.

The simplest version of a data collection tool is a spreadsheet. Spreadsheets can be set up with columns labelled for data points and rows for individual study participants. Spreadsheets also have additional features such as formula-based calculations, data randomization and validation tools, both data sheet and range protection, and the ability to perform basic statistical testing. Drop-down lists can also be built to reduce answer variability and allow for easier filtering and analysis. Microsoft Excel and Google Sheets are the two most common spreadsheet applications; however, use caution when adding PHI to these platforms if the data is stored on a cloud outside your organization.

For survey or questionnaire-based research, data collection tools such as Microsoft Forms, Google Forms, or Qualtrics XM allow for multiple question formats and the ability to be directly shared to potential study participants. These tools allow the survey to be built in a user-friendly format that is conducive to distribution to the target population. They also allow for the extraction of the survey results in a way that allows for importation into a spreadsheet or statistical software.

While some data collection tools are better suited for observational or survey-based research, REDCap (Research Electronic Data Capture) is a tool with the ability to do both. REDCap is a widely used research data collection tool. REDCap is a secure, web-based application with an intuitive user interface allowing for data entry with real-time validation rules, automatic calculations, and branching logic. In addition to data entry, REDCap can be used as a tool for building and managing online surveys. REDCap allows for easy data collection and allows for automated export to common programs, including Excel, SPSS, Stata, and R. Many universities offer access to REDCap, so if you have a university affiliation through a local college of pharmacy, you may be able to access this useful resource.

When using a new tool or a new feature of a tool, make sure to give yourself time to practice using it, such as inserting formulas or branching trees. You may also want to consider a few practice patients to ensure that the order of your data points aligns with what data can be found in similar areas in the electronic health record and that if multiple individuals are collecting data, everyone's assessments align.

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THE TOOLKIT | CHAPTER

IRB & CITI Training

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IRB & CITI Training

Before you start your research involving human subjects, you will need to go through the training dictated by your Institutional Review Board (IRB).

The IRB plays a critical role in ensuring that research involving human subjects is conducted ethically and in compliance with federal regulations. The primary purpose of the IRB is to protect the rights, safety, and welfare of participants by reviewing research protocols before studies begin. This oversight helps minimize risks, ensures informed consent is properly obtained, and verifies that the benefits of the research outweigh potential harms. Without IRB approval, research could expose participants to unnecessary risks or violate ethical standards, which could lead to legal consequences and loss of public trust in scientific research.

IRB documentation and forms may change frequently; ensure that all forms are the most up-to-date version. IRBs may have specific verbiage and language that you should incorporate. Reach out to your IRB coordinator for questions.

Research Training

Most institutions will require CITI (Collaborative Institutional Training Initiative) training, as this is one of the most utilized training programs for research knowledge. This knowledge encompasses the information necessary to conduct studies responsibly and in accordance with ethical principles and regulatory requirements. The training covers topics such as informed consent, confidentiality, risk assessment, and the protection of vulnerable populations. Exact CITI training requirements can vary depending on site, so be sure to check if your training is up to date if starting a project a new institution. CITI training usually requires renewal every 4 years.

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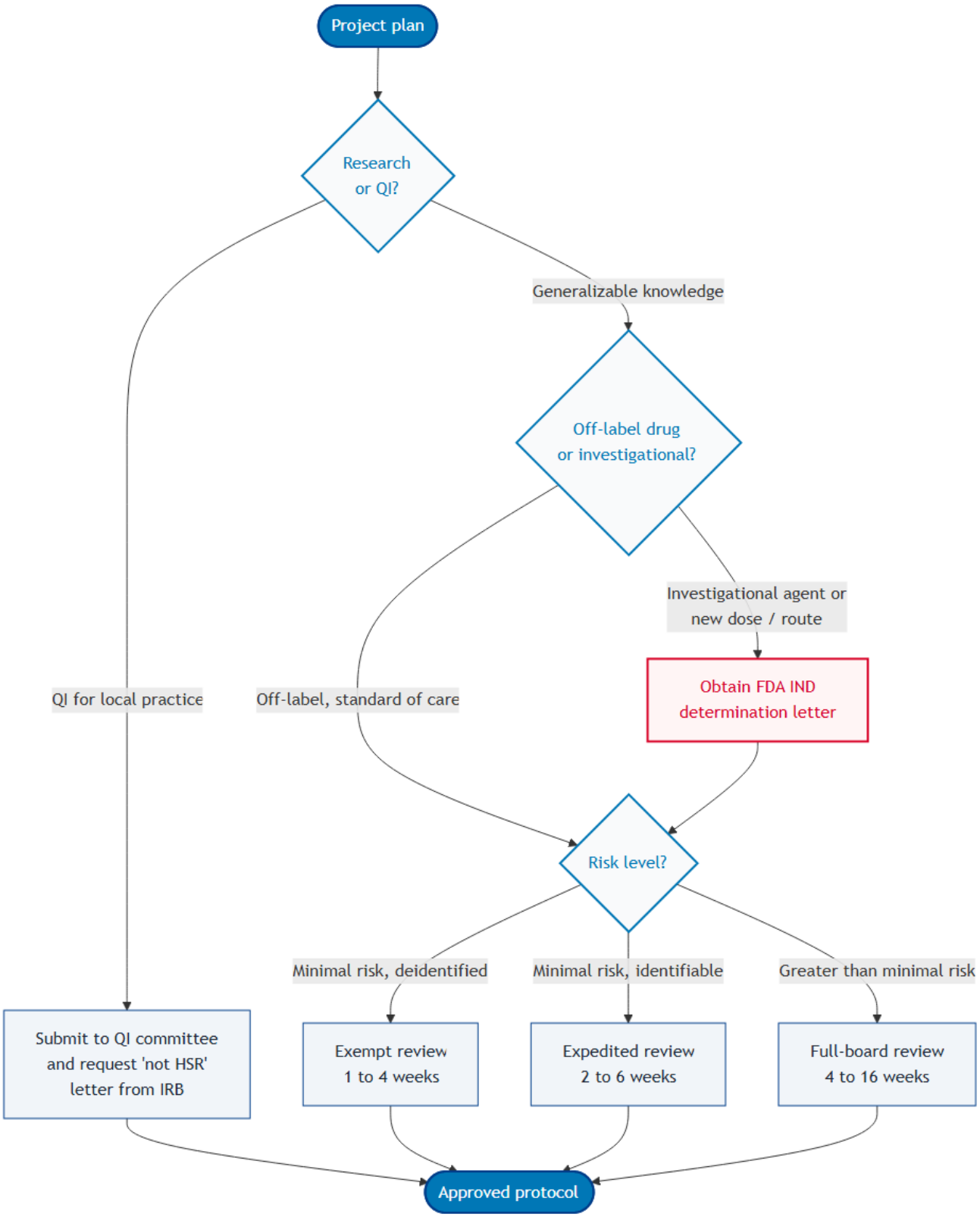

Figure 2: IRB review-level decision tree (exempt vs. expedited vs. full board).

THE TOOLKIT | CHAPTER

Data Analysis

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Data Analysis

Data Analytics, Variables, and Basics of Statistical Information

Data analysis is often one of the most daunting steps for newer researchers. Generally speaking, the data analysis plan should be developed before the study begins (a priori). Variables should be collected that will be included in this pre-planned analysis, along with some additional variables that can help describe the study population or explain confounders. Your variables are data points used to describe and evaluate primary and secondary endpoints.

The data analysis plan will depend on the type of data being collected and may need to be adjusted if certain conditions are not met once the data has been collected. For example, if the data analysis plan was to do a student's t-test for a continuous variable under the assumption that the data would be normally distributed, but after collection, the data is found to be non-normally distributed, the analysis may require using of Mann-Whitney U testing for this non-parametric data.

Data analysis can be tricky, which is why biostatistics is a separate field. In an ideal world, the best practice is to engage a biostatistician in the planning stages of any study. Biostatisticians are experts in data analysis and will be very helpful in developing a data collection and analysis plan that ensures any statistical testing is appropriately performed. They can also help to ensure all data that is being collected is necessary and all necessary data is being collected. This can save a lot of time in both data collection and analysis. If a biostatistician is not available, someone knowledgeable in statistics should be engaged during the planning phase for these same reasons. If no one on your team has these skills, consider expanding your team to find someone with these skills. Faculty at colleges of pharmacy and medicine tend to have at least basic skills in this area and are often open to collaboration. If there is no one available to help with biostatistics, put a lot of intentional thought into each of these elements before you begin data collection.

Once you have your data, you will likely need to ensure that it is clean (see data collection tools for more information). This means checking for extreme outliers that might signal a typo (for example, an adult with a weight of 2 kg), checking for missing values, and ensuring that data points were collected consistently (for example, Yes, yes, Y, y, and 1 will all be counted as different results even if you know they "mean" the same thing). Once you have a clean data set, you are ready to start crunching numbers. Statistics are a tool to organize, analyze, and display data. The types of data collected will determine what types of statistics are used, and may include descriptive and inferential statistics.

Types of Variables

A variable is a way to study, measure, and present data elements. There are many types of variables and they fall into two groups: qualitative or categorical and quantitative or numerical. Qualitative is used to describe the variables you have or what type of category they fall into while quantitative gives a numeric value to them.

Qualitative (Categorical)

Further divided into Nominal, Dichotomous, and Ordinal.

Nominal: Divides categories into specific groups or categories. Categories can be used to group data with no specific order or rank. Examples would be hair color, gender, race, country of origin, etc. This has a fixed number of responses. Descriptive statistics include frequencies and percentages of the group.

For example, race is commonly reported as a demographic characteristic in research. In this situation, race is a nominal variable, described as an absolute number and as a percentage of the total patient population.

Characteristics	Total Patient Population (N=33)
Race, n (%)	
White	15 (45%)
Hispanic	10 (30%)
Black	3 (9%)

Characteristics	Total Patient Population (N=33)
Asian	5 (15%)
Other	0 (0%)

Nominal variables can be dichotomous (binary), where data points have two responses (e.g., yes/no, alive/deceased, positive/negative, male/female). Descriptive statistics can be displayed as frequency tables or bar charts. Binary variables may be seen in data collection as 0s or 1s to assign value.

For example, a data collection sheet may have 1 = adult and 0 = not adult. If there were 10 patients and 5 were coded as 1 (for adult), you could display only the adults in a table or chart as the alternative can be inferred.

Total Patients (n=10)	
Adult patients, n (%)	5 (50%)

If you had 2000 patients, half male and half female, the data could be displayed as a frequency table:

Gender	Frequency	Relative Frequency (%)
Male	1000	50
Female	1000	50
Total	2000	100

Frequency tables are also commonly used to report outcomes. For example, if you have 2 groups of 100 people each, and group A received a medication while group B received placebo, drug exposure could be your grouping variable. Then, if you had an outcome variable such as mortality, you could set up a 2x2 frequency table to describe this data:

Group	Alive	Dead
Exposed (Group A) (n = 100)	74 (74%)	26 (26%)
Unexposed (Group B) (n = 100)	38 (38%)	62 (62%)

Ordinal: Ordinal data is categorical; however, it differs from nominal data in that ordinal data has a specific, logical rank or order (e.g., Likert scales, risk categories, etc.). Categories do not have consistent intervals between values (e.g., the difference between very satisfied and somewhat satisfied may be different from somewhat satisfied and neutral). There are a fixed number of responses. Descriptive statistics include frequencies and percentages of the group or histograms.

Risk Category	Total Patients (N=30)
High risk, n (%)	15 (50%)
Medium risk, n (%)	10 (33.3%)
Low risk, n (%)	5 (16.7%)

These data types can be displayed in tables or frequency graphs. These types of data can be used for baseline demographics or outcomes.

Quantitative (Numerical)

Further divided into continuous and discrete.

Continuous: Data that is measured and reported in a specific order or a sequence. These have minimum and maximum values based on the scale of measurements. Examples include values such as age, weight, height, or laboratory

values. Descriptive statistics can be utilized to evaluate the central tendency (such as mean, median, or mode) and distance from the central tendency (standard deviation, interquartile range, etc.). These variables are measured, not counted and can have infinite possibilities including fractions and decimals. The difference between values is consistent.

Sub-categories include interval which does not have a true zero (i.e. temperature in C/F) and ratio, which does have a true zero (i.e. distance/weight).

Example:

	Drug A given (N=50)	Placebo given (N=50)
Age (years), mean ± SD	78.6 ± 4.2	73 ± 2.3

Discrete: The variables are defined in numbers of counts from a set. Discrete variables cannot have partial numbers and can only be countable/whole numbers (for example number of children, the number of vials of medication available). For discrete variables, mean, median, and mode can be applied. While these numbers cannot be split, the mathematical calculation, such as the mean, of a discrete variable can be represented as a partial number (Drug A column below).

Example:

	Drug A given (N=50)	Placebo given (N=50)
Number of NSAIDs doses taken during the study, mean ± SD	3.5 ± 0.2	7 ± 2.5

Basic Statistics

If you have some basic statistical knowledge, you and a preceptor/mentor may be able to perform some basic statistical testing in a spreadsheet program like Microsoft Excel or Google Sheets. There are more advanced statistical programs, such as SPSS, STATA, or R. These are widely utilized for research projects, but are a bit more complicated and may be associated with licensing fees. Many clinician researchers use STATA or SPSS as they allow for the selection of statistical tests from drop-down menus, whereas R requires the user to input code to run specific tests. The statistical program used, along with the version number, should be reported in the methods section of your protocol and manuscript.

Measuring Central Tendency

You should always plot your data graphically to see your data to assess your data points, especially for outliers. Visualizing your data and looking for the central tendency may identify outliers or typographical errors. It is always best to clean your data before performing any calculations.

- **Mean:** mathematical average
  - Add up all values then divide by the total number of values
  - There can only be one mean and the data can be easily skewed from outliers
  - Ex. Grades on an exam are 80, 90, 100.
    - Mean is 90 (270/3)
- **Median**
  - The midway/middle point in your data set, where you split your data into two and find the center number.
  - There can only be one median
  - More resistant to skewed data points
  - Ex. Data set: 1,2,3,4,5,6,7,8,9,10,11,12,13

    - Median is 7

- **Mode**
  - Most commonly occurring number
  - There might be no mode, there might be several modes
  - Most useful value when there are clusters of data
  - Ex. 1,1,1,1,1,2,2,3,4,5,5,5,7,8,8,9
    - Mode is 1

Specific measures of central tendency can only be used on certain types of data. The table below lists the type of data for which each measure of central tendency is appropriate.

Type of Data	Mean	Median	Mode
Nominal data	No	No	Yes
Ordinal data	No	Yes	Yes
Continuous data	Yes	Yes	Yes
Discrete data	Yes	Yes	Yes

Measures of Variation

- **Distribution**
  - Approximates where most of the population will lie
  - Normal (parametric): When graphed on a histogram, data is bell shaped or Gaussian curve
  - Non-normal (non-parametric) distribution: Data is not normally distributed when graphed on a histogram. Can be skewed, bimodal, or flat.
  - Skewness
    - When the bell-curve is skewed to the right or left
    - This sometimes may be due to unclean data (double-check your work)
- **Range**
  - Difference between the lowest and highest values
  - Only looks at the extremes but gives no descriptions on what happens between
  - This is severely affected by outliers or extremes
  - Example: you have the following variables, “1,2,3,4,5”, the range is 1-5
- **Interquartile range**
  - Describes values within 25% and 75% of the median
  - Less sensitive to outliers
  - Displayed as median (interquartile range)
  - Example: You have variables “1,2,3,4,5”, the IQR would be (2, 4)
- **Standard deviation (SD)**
  - Shows the distance away from the mean
  - This can be affected by outliers and skewed data
  - Described as the mean +/- SD
  - Mean +/- 1 SD encompasses 68% of samples, +/- 2 SD 95%, and +/- 3 SD over 99%
- **Standard Error of the Mean (SEM)**
  - Estimates the reliability of a sample related to the population or the true mean of the population
  - The true mean of the population will be within 2 SEM 95% of the time
  - Different from the standard deviation in that standard deviation looks at the variability in a sample, while the SEM is looking at how far the true mean is likely to be from the measured mean. SEM will always be less than the SD.

- **Confidence Interval (CI)**
  - Reflects the margin of error
  - This assesses the probability that the population's true value is contained in the interval
  - The width of the CI depends on the SEM and the degree of confidence (usually 95% is the most common value).
  - The CI gives you a range that is broad enough that if you could study the entire population, that 95% of the time the population mean would fall into that CI
  - CI = Mean +/- 1.96 * SEM
  - Ex. The mean weight of a sample population of newborns in the US is 3.8 kg, 95% CI = 2.2-4.5 kg. The true mean of the total population of newborns in the US is 95% likely to be between 2.2-4.5 kg.

Statistical Testing

Inferential statistical testing can be performed to determine if a difference between groups is likely to be due to chance or due to a real difference existing between groups.

- **Null Hypothesis (Ho):** There is no difference between groups
- **Alternative Hypothesis (Ha):** There is a difference between groups

An experiment can lead to one of two outcomes. If the null hypothesis is accepted, the study found that there is no difference between the groups. If the null hypothesis is rejected, the study is claiming that there is difference between groups.

If the null hypothesis is true (that there is no difference) and the study finds that there is no difference between groups, then the correct decision was made! Similarly, the correct decision was made if a difference truly exists and the null hypothesis is false and is appropriately rejected.

If no difference exists but the null hypothesis was rejected, or if a difference does exist, but the null hypothesis was not rejected, an error was made.

Errors

- **Type I Error:** Reject the null when it is true. Found a difference when in reality there is no difference between groups. False positive.
  - Probability of making a type I error is α (alpha) or the p value (0.05 is usually acceptable)
- **Type II Error:** Null hypothesis was accepted as true in error, saw no difference. False negative.
  - Probability of making a type II error is β (beta) (0.2 is usually acceptable)

Null Hypothesis is:	True	False
Rejected	Type I error / False positive / Probability = α	Correct decision / True positive / Probability = 1-β
Not rejected	Correct decision / True negative / Probability = 1-α	Type II error / False negative / Probability = β

Statistical Significance - The P-value

- Likelihood the result was due to random occurrence
- P value is compared to alpha to determine statistical significance
- Alpha is usually set to 0.05, sometimes set to 0.01
- If p < alpha (typically 0.05), then the result is considered statistically significant

- If statistically significant, null hypothesis should be rejected
- One tailed vs Two tailed
  - One tailed looks at the difference on the bell curve for an increase or a decrease
    - Provides more power to detect an effect
    - Misses the other side of the bell curve
    - Appropriate if the untested side is negligible or would be unethical
    - Less common outside of vaccine research
  - Two tailed looks for a change (either increase or decrease)
    - ½ the p value for each tail
    - The mean is considered significantly different if the test statistic is in the top 2.5% or bottom 2.5% of its probability distribution, resulting in a p-value less than 0.05.
    - Much more common in medical research

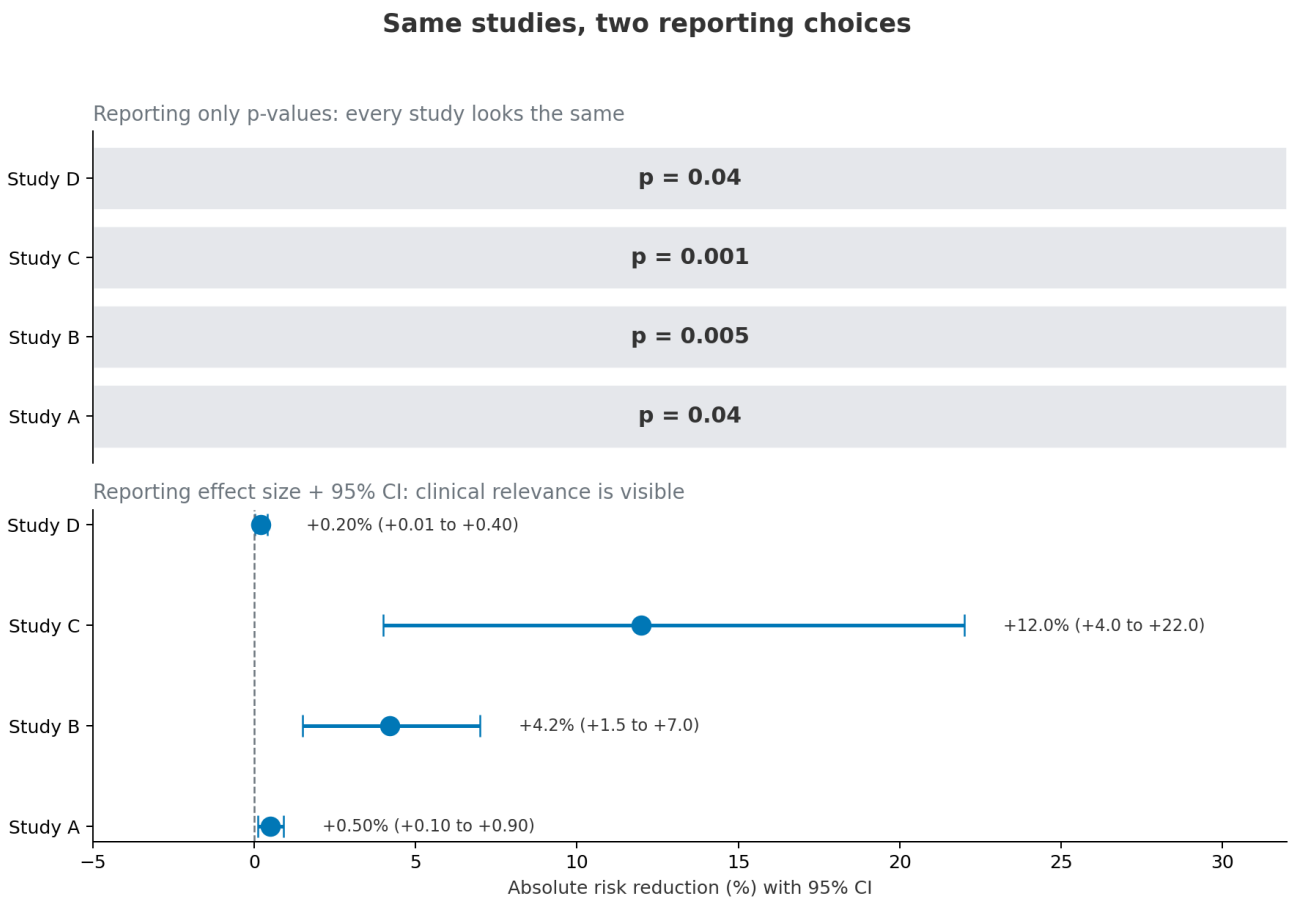

Figure 3: p-values alone are misleading; effect size + 95% CI shows clinical relevance.

Power

- Ability to detect a predetermined effect size between groups
- Power = 1-beta
- Beta is usually 0.2, power is typically 80%
  - For example Beta was set to 0.2, with 100 patients in each group the study would be 80% powered to detect a 10% difference in mortality between groups with an alpha of 0.05.

- Power increases, decrease chances of type II error
- Determined by sample size, number of events occurring (ideally based on previous data), and statistical significance criteria
- If possible, you should ask your biostatistician to conduct a power analysis, this will require you to understand your literature to identify what difference you want to see
- As sample size increases, generally able to detect smaller statistically significant differences between groups

Clinical Significance

- Does the result truly matter in terms of outcomes? Is there clinical benefit?
  - Ex. Drug A lowers blood pressure compared to drug B by 1mmHg $p<0.001$, this is statistically significant but probably not clinically significant
- Was there a large effect size or compelling trend that did not reach statistical significance?
  - Ex. Mortality in group A was 29%, mortality in group B was 14%, $p = 0.06$
  - Finding was not statistically significant, but an absolute risk reduction of 15% may be clinically significant, particularly if no alternatives exist

Testing for Differences: Statistical Tests

Definitions

- **Parametric**
  - Only valid when the characteristic studied follows a normal distribution
  - Can be applied to most interval and ratio data
  - More powerful than non-parametric tests
- **Non-parametric**
  - Applied to non-normally distributed data
  - Not continuous, not normally distributed, doesn't met parametric test assumptions.
- **Paired:** Matching data points ex. Twins, adjacent lands, same liters of animals
- **Unpaired:** Different baseline characteristics
- **Independent Variable:** experimental, predictor, object being manipulated
- **Dependent Variable:** outcome variable, dependent on independent variable

Parametric Tests

- **Student's t-test**
  - Determines if the mean of value is different between two independent groups (2 sample t-test), or between one group and a population value (1 sample t-test), or between the same group at different times (paired t-test)
  - Uses mean, standard deviation, and number of samples
- **Pearson Product Correlation Coefficient**
  - Test of correlation and association between continuous variables
  - If r=1.0 means data is complete positively correlated
  - If r=-1.0 means the data is completely negatively correlated
- **Analysis of Variance (ANOVA)**
  - Compares one continuous variable across 3 or more independent groups
  - Also known as an F ratio
    - Analysis of Covariance (ANCOVA)
      - Adjusts for other variables including baseline characteristics

Non-Parametric Tests

- **Chi-Squared**
  - Compares two or more groups
  - Useful when the data is binary (dichotomous)
  - Two-by-Two table is standard
  - If any number is less than 5 use the Fisher's exact test
  - With more than 3 variables use a contingency table
- **Mann-Whitney U test**
  - Analogous to the Student's t-test for non-parametric data
  - Compares a dependent variable across two independent groups to determine if a difference exists
  - Can use for ordinal data
- **Kruskal-Wallis Test**
  - Uses rank of ordinal data to determine if there is a difference
  - Compares an independent variable across 3 or more groups
  - Similar to Mann-Whitney U Test but for comparing 3 or more groups

Statistical test by outcome type and design

The table below summarizes the test families most often used in EM pharmacy research, organized by outcome type and study design. Always confirm the assumptions of the chosen test before reporting.

Table 4. Statistical test selection by outcome type and design.

Outcome type	Two independent groups	Paired or matched	Multiple groups	Adjusted for covariates
Continuous, normal	t-test	Paired t-test	ANOVA	Linear regression
Continuous, non-normal	Mann-Whitney U	Wilcoxon signed-rank	Kruskal-Wallis	Linear regression (log)
Binary	Chi-square or Fisher	McNemar's	Chi-square	Logistic regression
Count or rate	Poisson test	—	—	Poisson / neg binomial regression
Time-to-event	Log-rank	—	Stratified log-rank	Cox proportional hazards
Ordinal	Mann-Whitney U	Wilcoxon signed-rank	Kruskal-Wallis	Ordinal logistic regression

This information is a guide for some of the most common types of statistical information and how variables are incorporated into your research. This should be done with the help of mentors, preceptors, or statistical professionals. As you continue to work on your research journey, this can help you improve on your understanding of data, reporting data, and understanding data and how its used in research.

References

1. Barratt A, Wyer PC, Hatala R, et al. Tips for learners of evidence-based medicine: Relative risk reduction, absolute risk reduction and number needed to treat. CMAJ. 2004;171:353.
2. Daniel W W & Cross CL. Biostatistics: A foundation for analysis in the health sciences. 10th Edition. ISBN 978-1-118-30279
3. Sullivan LM. Essentials of Biostatistics in Public Health. Third Edition. Jones & Bartlett Learning. ISBN 978-1-284-108194

THE TOOLKIT | CHAPTER

Preparing a Manuscript

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Preparing a Manuscript

Writing a Manuscript

Things to consider when choosing a journal

- PubMed indexing
- Scope (broad vs specialty journal)
- Audience (physicians, pharmacists, residents?)
- Journal quality (impact factor)
- Open access and costs

Where to start?

- https://journalfinder.elsevier.com/ or https://jane.biosemantics.org/
- Look at similar studies and use that as a framework
- Look at previous publications of the journal you chose. Is it a good fit?
- Look at recently published on similar topic to see where they were published
- Look at journal Table of Contents
- Keep track of discussion points throughout the process
  - Strengths
  - Limitations
- Format manuscript appropriately for each journal you submit to!
- Get feedback from all team members

Who gets to be the first author?

International Committee of Medical Journal Editors (ICMJE) recommends that authorship be based on the following criteria:

1. Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work

AND

2. Drafting the work or revising it critically for important intellectual content;

AND

3. Final approval of the version to be published

AND

4. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Anatomy of the Research Article

- Title
- Authorship
- Conflict of Interest Declarations
- Abstract
- Introduction
- Methods
- Results
- Discussion
- Conclusions
- References

Abstract

- Provide a short background for context background and the study's purpose statement
- Methods, design, setting, sample, intervention if applicable, measures, and analysis
- Results with a focus on main findings
- Conclusions

Three Paragraph Introduction

- Referenced background on the nature of the problem, significance, rationale, and study purpose

1. What is the general problem or current situation?
2. What is the specific problem or controversy?
3. How will this study help?

Methods

- Clarity should be the guiding principle of the Methods section
- The following should be included in the Methods section:
  - Selection and description of participants
  - Primary and secondary objectives
  - Technical descriptions of methods used to answer the research question
  - Statistical analysis
- The methods should be sufficiently comprehensive to allow reproducibility by other investigators
- The Methods section should include only information that was available at the time the plan or protocol for the study was being written; all information obtained during the study belongs in the Results section.
- The Methods section should include a statement indicating that the research was approved or exempted from the need for review by the responsible institutional review board.

Results

- Logical sequencing should be the guiding principle of the Results section.
- Provide the results for the main or most important findings first.
- Emphasize or summarize only the most important observations.
- Provide data on all primary and secondary outcomes identified in the Methods section.
- Do not repeat all the data in the tables or figures in the text.
- Give numeric results not only as percentages but also as the absolute numbers.

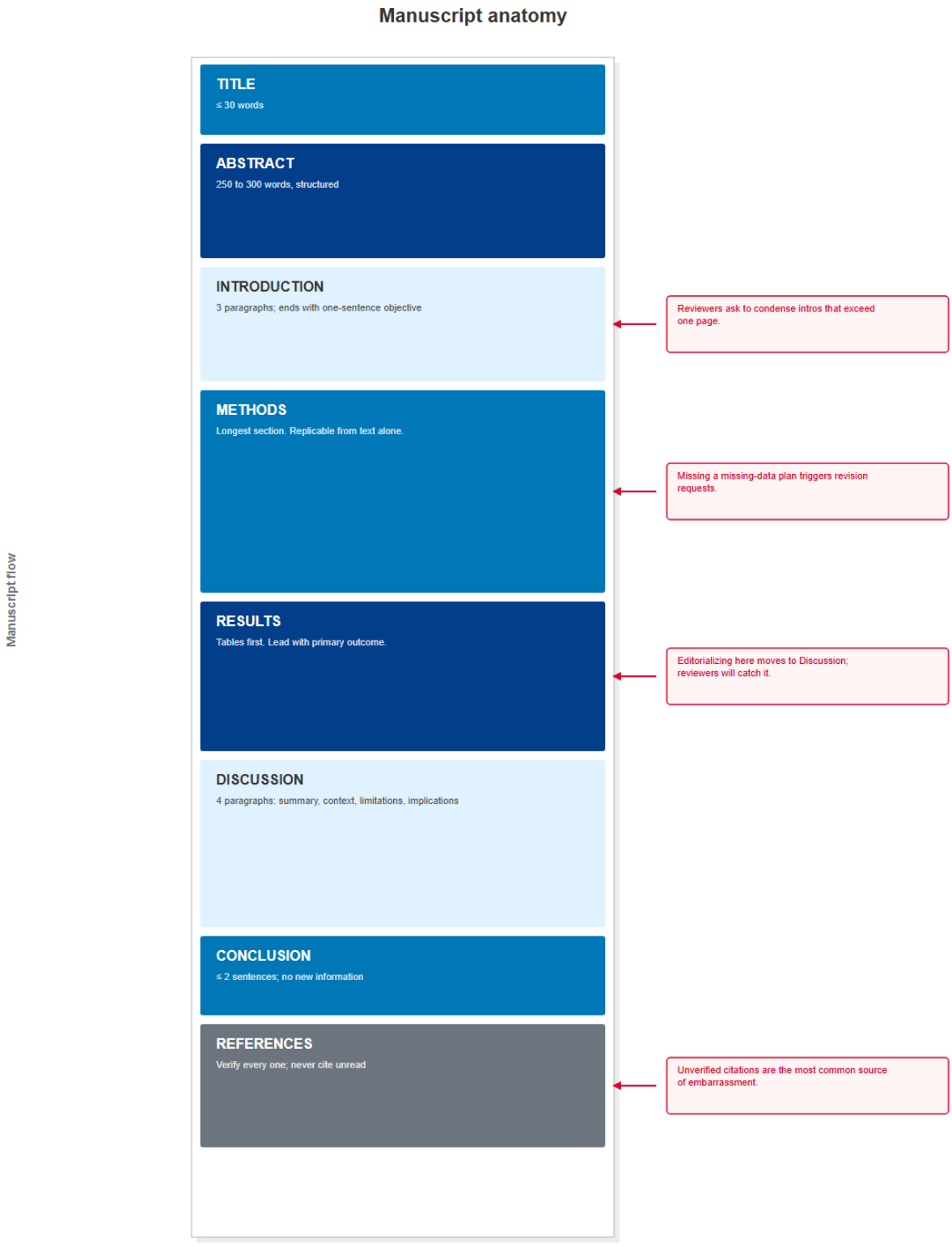

Figure 4: IMRAD anatomy with reviewer-comment hotspots.

- Limit tables figures and graphs to those needed to explain the argument of the paper and to assess supporting data.
- Do not duplicate data in graphs and tables

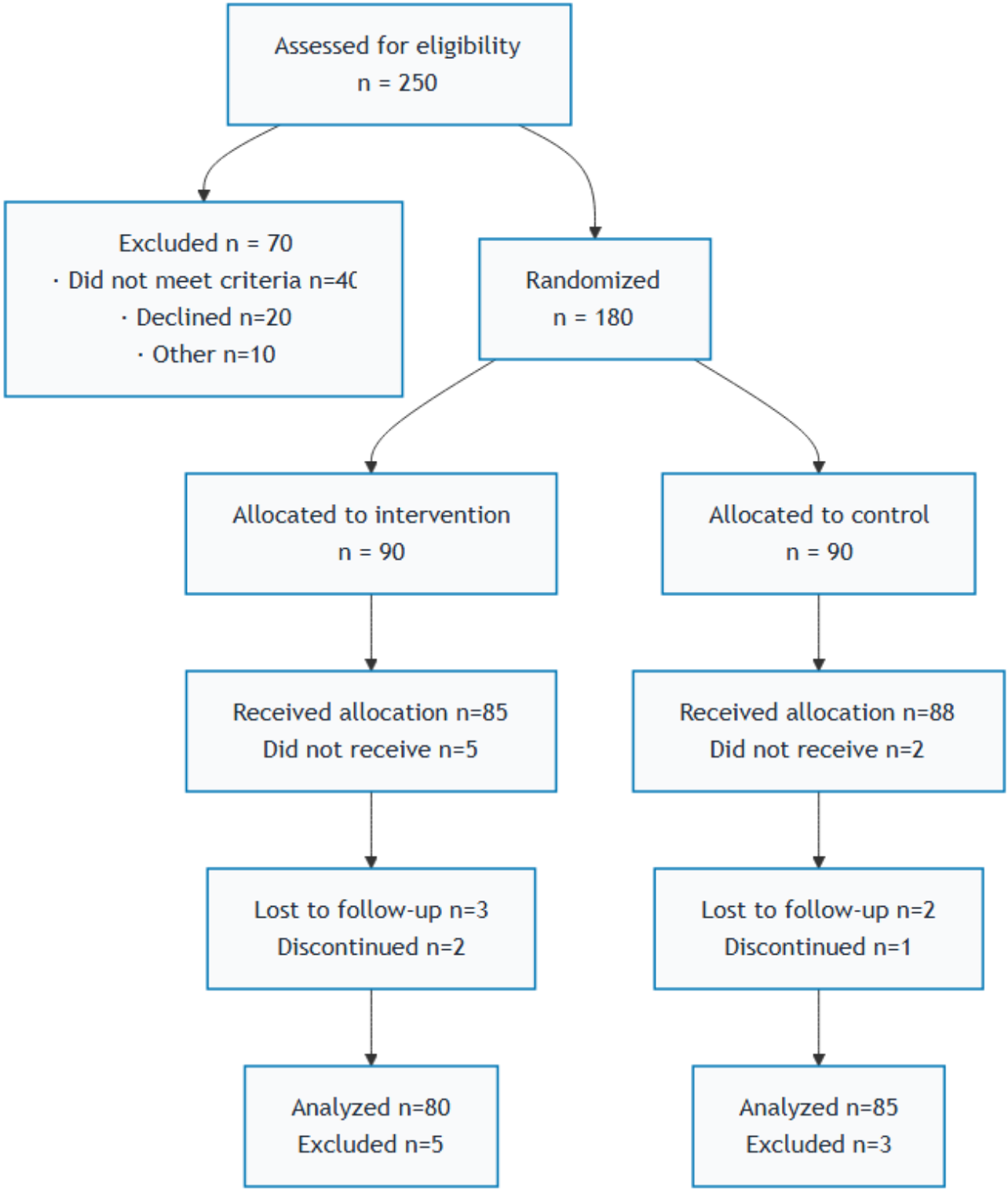

Figure 5: CONSORT participant-flow example.

Discussion

- Summarize the main findings.
- Discuss possible reasons, explanations, or mechanisms for the findings.
- Emphasize the new and important aspects of your study.
- Provide context for your findings based on the existing evidence in the field.
- State the limitations of your study
- Discuss the implications of your findings for clinical practice, future research, and/or policy.
- Do not repeat in detail data or other information given in other parts of the manuscript.

Conclusion

- Link the conclusions with the goals of the study but avoid unqualified statements and conclusions not adequately supported by the data or the methods.
- Distinguish between clinical and statistical significance.

Tips for success

- Carefully review and follow the journal's authorship instructions.
- Become familiar with CONSORT (RCTs), STROBE (observational studies), and PRISMA (systematic reviews) guidelines.
- Dedicate sufficient time to writing and revising the abstract, it will be the first, and possibly the only, section of your manuscript that editors and reviewers read.
- Do not attempt to undertake a comprehensive review of the topic in the introduction or the discussion.
- Select a journal that is most appropriate for your article based on scope, rigor of the design and methods, and strength of the findings.
- Throughout the manuscript (especially in the methods) think carefully about nomenclature and keep a table to ensure consistent use of terms.
- It is your responsibility as an author to strike the balance between being concise and complete in the methods section.
- Consider using flow diagrams for complex methods.
- Make the results short and focused.
- Do not try to avoid disappointing results (e.g., survey response rates in the results).
- Get feedback. Revise and edit! Get feedback! Revise and edit! Get feedback! Revise and edit!
- For more information: https://www.icmje.org/recommendations/browse/manuscript-preparation/preparing-for-submission.html

THE TOOLKIT | CHAPTER

Peer Review Guide

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Peer Review Guide

A practical handout for reviewing clinical and pharmacy research manuscripts.

Purpose of Peer Review

Peer review is a critical process that ensures:

- The research is scientifically valid, methodologically sound, and ethically conducted.
- The manuscript contributes meaningfully to the pharmacy and healthcare literature.
- Errors, bias, or misinterpretation are identified before publication.
- Authors receive constructive feedback to improve clarity, rigor, and impact.

What Editors Expect

Peer review is a structured, confidential evaluation of a manuscript's rigor, clarity, validity, and relevance before publication. Journals expect reviewers to:

- Assess scientific soundness and clinical relevance, not just novelty.
- Identify major limitations and suggest concrete, actionable improvements.
- Maintain confidentiality and declare any conflicts of interest.
- Deliver a timely, balanced report with a clear recommendation (accept/revise/reject).

Ethics & Professional Standards

- **Confidentiality:** Do not share or use ideas/data from the manuscript.
- **Conflicts of interest:** Financial, academic, personal, or competitive relationships must be disclosed to the editor; recuse if necessary.
- **Objectivity & fairness:** Evaluate the work, not the authors; avoid biased or derogatory language.
- **Co-reviewing:** Obtain the editor's permission before involving a trainee or colleague; ensure they uphold confidentiality and are named to the editor.
- **Predatory practices:** Be alert to journals with poor editorial standards or opaque peer-review processes.

Before You Accept the Invitation

Ask yourself these important questions:

- **Fit:** The topic and methods match your expertise (or you can review specific sections only).
- **Time:** You can meet the deadline (typically 1–3 weeks) or promptly request an extension.
- **COI check:** Confirm no conflicts that could reasonably bias your judgment.

How to Read - A Two-Pass Approach

First Pass (high-level triage):

- Skim title/abstract, question, design, primary outcome(s), and key findings.
- Ask: Is the question important for pharmacy/clinical practice? Do conclusions match the data?
- Note top 3 strengths and top 3 concerns to anchor the review.

Second Pass (deep dive): evaluate each section in turn.

Title and Abstract

- Does the title accurately reflect the study?
- Is the abstract clear, structured, and aligned with the main findings?

Introduction

- Defines the gap and specifies a focused, testable objective or hypothesis.
- Is the background sufficient to justify the study?
- Is the research question or hypothesis clearly stated?

Methods

- Is the design appropriate (RCT, cohort, case-control, systematic review)?
- Setting, participants (inclusion / exclusion criteria), eligibility, recruitment, and sample size or power are clear.
- Randomization or blinding explained (if applicable).
- Outcomes pre-specified and clinically meaningful; primary vs. secondary distinguished.
- Statistical plan appropriate (assumptions, multiplicity, missing data, sensitivity analyses).
- Ethics approval and consent stated; registration for trials or systematic reviews provided.
- Data availability and protocol transparency addressed when relevant.

Results

- Participant flow (enrollment to analysis) described; consider a CONSORT flow diagram.
- Baseline characteristics balanced or adjusted as needed.
- Effect sizes with precision (CIs) emphasized, not p-values alone.
- Prespecified analyses separated from exploratory or subgroup analyses.
- Adverse events and safety outcomes fully reported where applicable.
- Sample size and response or dropout rates reported.
- Any selective reporting or missing data?

Discussion

- Interprets results in light of limitations, risk of bias, and prior evidence (not spin).
- Clinical significance and implications for pharmacy practice addressed.
- Generalizability discussed, including patient diversity and care settings.
- Results compared with existing literature.

Conclusion

- Is the conclusion supported by the data?
- Avoids speculation beyond the study scope.

Tables, Figures, and References

- Figures are legible and support claims; tables are non-duplicative.
- Citations are current, relevant, and balanced (avoid citation bias).

Rapid Triage - Potential Red Flags

- No protocol/registration for trials or systematic reviews without justification.
- Outcome switching or post-hoc hypotheses without transparency (HARKing).
- Statistical issues: selective reporting, p-hacking, or absence of effect sizes/precision.
- Inconsistencies between text, tables, and figures; implausible data patterns or duplication.
- Ethics gaps: missing IRB/consent statements; trial registration absent when required.

Reporting Guidelines to Check

Match the manuscript type to an appropriate checklist (use the EQUATOR Network):

- **Randomized trials** — CONSORT (2010; extensions as applicable).
- **Systematic reviews/meta-analyses** — PRISMA 2020.
- **Observational studies** — STROBE.
- **Case reports** — CARE.

Find checklists at the EQUATOR Network: https://www.equator-network.org/reporting-guidelines/

Writing Your Review (Structure & Tone)

Structure of Your Review

1. **Summary (2-4 sentences)**
    - Briefly describe what the study did and key findings (What was studied, how, main findings, overall quality).
    - Shows the editor you understood the paper.
    - Do not include or allude to your decision regarding publication in the summary or comments to the author, only in the private recommendation to the editor.
2. **Major Comments**
    - Focus on methodology, validity, ethics, and interpretation.
    - Discuss high-impact issues: inappropriate statistical methods, unclear inclusion criteria, insufficient discussion of limitations, design flaws, risk of bias, unsupported claims.
3. **Minor Comments**
    - Language, organization/formatting, clarity of figures/tables, reference style.
4. **Confidential comments to editor:** Discuss ethical concerns, originality, or feasibility issues.
5. **Recommendation to Editor**
    - Accept / Minor revision / Major revision / Reject, and why.
    - Your recommendation is confidential; authors only see comments.

Provide comments that are professional, specific, and constructive. Critique the work, not the authors.

Template - Paste Into Your Journal Portal

```
Summary (2–4 sentences):


Major Comments (numbered):

1)

2)

3)


Minor Comments:

1)

2)

3)


Confidential Comments to the Editor:


Recommendation (Accept / Minor Rev / Major Rev / Reject):
```

Tips for Providing Constructive and Actionable Feedback

- **Be professional and courteous:** Start with positives (e.g., "The study design is innovative"). Use phrases like "Consider adding…" instead of "This is wrong."
- **Organize Comments:**
  - **Global Comments:** Overall strengths and major improvements.
  - **Specific Comments:** By section, with page/line numbers.
  - **Confidential to Editors:** Suitability, ethical concerns, or plagiarism suspicions.
- **Focus on Content:** Prioritize science over grammar (unless it impairs clarity). Provide actionable, evidence-based suggestions.
- **Avoid Bias:** Remain objective; treat the manuscript as you would your own.
- **For Revisions:** If reviewing a revised manuscript, check if comments were addressed adequately.
- **Examples of Actionable Feedback**
  - **Actionable:** "Please provide a prespecified primary outcome and sample-size calculation; as written, the study is underpowered for the composite endpoint."
  - **Vague (avoid):** "Methods are weak."

Clinical & Pharmacy-Specific Checks

- **Therapeutic context:** Doses, dosing intervals, renal/hepatic adjustments, and monitoring parameters align with labeling or guidelines; justify deviations.
- **Safety:** Adverse events collection and grading methods are clear; any safety signals are contextualized.
- **Comparators:** Active comparator dosing is fair and guideline-concordant to avoid biased comparisons.
- **Endpoints:** Patient-centric outcomes (e.g., mortality, quality of life, readmissions) prioritized; surrogate endpoints justified.

- **Practice impact:** Implementation feasibility, resources, and pharmacist scope of practice considered.
- **Pharmacoeconomics:** Are cost-effectiveness claims substantiated?
- **Therapeutic Rationale:** Are interventions supported by guidelines and pharmacology principles?
- **Patient-Centered Care:** Does research address adherence, SDoH, disparities, or real-world practice?
- **Interprofessional Relevance:** Could findings influence collaboration with physicians, nurses, or other health-care providers?

Quick Reviewer Checklist

- Title and abstract are accurate and complete.
- The research question is clear and relevant.
- Methods are appropriate, ethical, and reproducible.
- Results are clear, consistent, and statistically sound.
- Discussion is balanced, with limitations acknowledged.
- Conclusion matches the data (not overstated).
- Tables/figures are clear and not duplicative.
- References are current and balanced.
- Writing is clear, concise, and professional.
- Implications for pharmacy practice are meaningful.

Best Practices for Reviewers

- **Be constructive, not destructive:** phrase critiques respectfully.
- **Be specific:** Instead of "methods are unclear," write "Please clarify how medication adherence was measured."
- **Disclose any limitations in your own expertise.** Avoid accepting reviews outside your expertise, especially in specialized pharmacy areas like oncology or infectious diseases.
- Avoid over-focusing on non-essential issues like formatting.
- **Maintain confidentiality:** Do not share or use data from the manuscript.
- **Keep timeliness:** submit your review within the journal's deadline.

References & Further Reading

- COPE Ethical Guidelines for Peer Reviewers
- COPE Ethical Guidelines for Peer Reviewers (PDF)
- ICMJE Recommendations: Disclosure of Financial and Non-Financial Relationships and Conflicts of Interest
- ICMJE Recommendations (Full PDF)
- EQUATOR Network: Reporting Guidelines Library
- CONSORT 2010 Checklist (DOC)
- CONSORT Reporting Guideline (EQUATOR)
- PRISMA 2020 Checklist
- PRISMA 2020 (EQUATOR page)
- STROBE (EQUATOR page)
- CARE (Case Report) Guideline

THE TOOLKIT | CHAPTER

Putting Together a Poster

WRITTEN BY

SEMP Research Committee, 2025-2026

Joint authorship by the committee members listed on the toolkit title page

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Putting Together a Poster

After you have completed your research project, one of the many ways to share your data is to present a poster. A well-done poster will describe your project, including background, methods, results, a discussion of how these results fit into the broader evidence around this topic, and a conclusion. Below are some of the key steps that you should take before you start putting your content onto your poster:

Before you start

1. Ask for a previous template or example

- There are many templates online, but your specific institution may have an already developed template. In addition, having a template or example gives you an idea of formatting and specific content that should be included.
- Templates may include specifics from your marketing team, including brands, logos, or color schemes that help make your poster more visually appealing.

2. Where are you printing your poster?

- Check if the printing company has specific file requirements for your poster. This is especially important when you are doing any type of fabric poster.
- If you are using a standard PowerPoint Template, you may have to adjust the slide size to fit that format.
- A common poster size is W: 36" and H: 48" (this is the standard size if you ever had to make a tri-fold poster board). Check the location you are going to present your poster at for any specifics on formatting poster sizes and the maximum size.

3. Confirm authorship

- Double-check authorship display and make sure all authors agree on the order. Make sure all the authors and individuals on the poster are involved in the review process.

General principles for putting together a poster

Once you figure out your formatting and poster sizing, you should start putting together your poster content. General principles for putting together a poster include:

1. Content should be short and concise

You are presenting the key highlights of your research. You do not necessarily have to write out full sentences, but your ideas should be complete. You can and should use bullet points to split up key pieces of information.

2. Formatting consistency with your poster

- Font types and styles
- Color schemes and patterns
- Punctuation should be consistent
- Spacing and alignment of your poster
- Avoid copying and pasting graphics into your poster because when it prints on a large scale, the image may become blurry. Use tables/graphs created in the poster to prevent blurry visuals.
- Avoid being wordy and filling up the poster with blocks of text and words.

- Use spell check.
- If you are copying text from other document locations, check if symbols copy over correctly.

3. Visually represent information when possible

- Graphical representation of results can make your poster stand out and highlight your key data.
- Flow diagrams, charts, tables, and graphs are more interesting and easier to quickly digest than large blocks of text.
- Graphics generated for a poster can be used later if a manuscript is developed for the project.

Key components to add to your poster

1. Title and Authors

This should be clear, descriptive, and explain the clinical question and your patient population. Underneath should have the author's information and affiliations displayed.

2. Background / Introduction

Should include brief highlights of the disease state or medication you are evaluating, and a rationale for the study or the objective of your study.

3. Methods

This should describe what you did to do your research. This would include your study design, inclusion and exclusion criteria, data analysis plan, etc.

4. Results

Use graphics and tables to describe your data. Make sure your data is labeled correctly, and it is titled. If you listed your endpoints/outcomes in your methods, use the same language in your results as well. Double-check how your data is displayed and be consistent with your statistical displays.

5. Discussion

Describe your results and how they fit into the existing evidence around this topic. Include strengths and limitations in this section.

6. Conclusion

What are the takeaways from your project? How does this impact practice?

7. References

If you are technologically savvy and have a lot of references, you can use a QR code to link to your reference list. Feel free to use an abbreviated reference list.

8. Disclosures and acknowledgements

This may be in varied location on your poster, usually based on your template.

Final review and presentation prep

After your poster has been written, you should send it to all authors, along with any preceptors and mentors for edits. Ensure that all authors on your poster have reviewed the poster before printing/submission.

After you have made your poster and have it printed, mentally prepare shortened versions of your presentation. Your "elevator pitch" if you have 30 seconds to present and a slightly longer version, 1-2 minutes, for a little more in-depth talk about your poster.

References & Further Reading

External resources cited or recommended by the SEMP Research Committee in the source documents that make up Volume 1. Verify URLs and citations directly with the publisher; web addresses change. This list is not an exhaustive bibliography — it consolidates the references the committee writers actually placed in their chapters and the general resources called out in the Research Tool Kit Outline.

Reporting guidelines

- **EQUATOR Network** (comprehensive library of reporting guidelines): https://www.equator-network.org/ — also: https://www.equator-network.org/reporting-guidelines/
- **CONSORT** (randomized trials, 2010): https://www.equator-network.org/reporting-guidelines/consort/ — also: http://www.consort-statement.org/
- **CONSORT 2010 Checklist** (DOC): https://www.equator-network.org/wp-content/uploads/2017/05/CONSORT-2010-Checklist.doc
- **PRISMA 2020 Checklist**: https://www.prisma-statement.org/prisma-2020-checklist
- **PRISMA Statement** (EQUATOR page): https://www.equator-network.org/reporting-guidelines/prisma/ — also: http://prisma-statement.org/
- **STROBE** (observational studies): https://www.equator-network.org/reporting-guidelines/strobe/
- **CARE** (case reports): https://www.equator-network.org/reporting-guidelines/care/

Peer review and publication ethics

- **COPE Ethical Guidelines for Peer Reviewers**: https://publicationethics.org/guidance/guideline/ethical-guidelines-peer-reviewers
- **COPE Ethical Guidelines for Peer Reviewers** (PDF): https://publicationethics.org/sites/default/files/ethical-guidelines-peer-reviewers-cope.pdf
- **ICMJE Recommendations: Disclosure of Financial and Non-Financial Relationships and Conflicts of Interest**: https://www.icmje.org/recommendations/browse/roles-and-responsibilities/author-responsibilities--conflicts-of-interest.html
- **ICMJE Recommendations** (full PDF): https://www.icmje.org/icmje-recommendations.pdf
- **ICMJE Recommendations — Preparing for Submission**: https://www.icmje.org/recommendations/browse/manuscript-preparation/preparing-for-submission.html

IRB and research training

- **CITI Program** (Collaborative Institutional Training Initiative — research ethics and human subjects training): https://about.citiprogram.org/

Reference and citation management software

- **Zotero**
- **Mendeley**
- **EndNote**

Journal-selection tools

- **Elsevier JournalFinder**: https://journalfinder.elsevier.com/
- **Jane (Journal/Author Name Estimator)**: https://jane.biosemantics.org/

Cited literature — Background literature & literature review

- Vordenberg SE, Irwin AN, Mai Y, et al. Laying the foundation for success: a guide to pharmacy residency research projects. *J Am Pharm Assoc (2003).* 2025;65(3):102358. https://doi.org/10.1016/j.japh.2025.102358
- Smith K. Building upon existing evidence to shape future research endeavors. *Am J Health Syst Pharm.* 2008;65(18):1767-1774. https://doi.org/10.2146/ajhp070176

Cited literature — Data collection

- Saczynski JS, McManus DD, Goldberg RJ. Commonly used data-collection approaches in clinical research. *Am J Med.* 2013;126(11):946-50. PMID: 24050485; PMCID: PMC3827694. https://doi.org/10.1016/j.amjmed.2013.04.016

Cited literature — Data analysis & biostatistics

- Barratt A, Wyer PC, Hatala R, et al. Tips for learners of evidence-based medicine: 1. Relative risk reduction, absolute risk reduction and number needed to treat. *CMAJ.* 2004;171(4):353-8. PMID: 15313996; PMCID: PMC509050. https://doi.org/10.1503/cmaj.1021197
- Daniel WW, Cross CL. *Biostatistics: A Foundation for Analysis in the Health Sciences.* 10th ed. ISBN 978-1-118-30279.
- Sullivan LM. *Essentials of Biostatistics in Public Health.* 3rd ed. Jones & Bartlett Learning. ISBN 978-1-284-108194.

Cited literature — Research design essentials

- Hartung DM, Touchette D. Overview of clinical research design. *Am J Health Syst Pharm.* 2009;66(4):398-408. PMID: 19202050. https://doi.org/10.2146/ajhp080300
- Awaisu A, Mukhalalati B, Mohamed Ibrahim MI. Research designs and methodologies related to pharmacy practice. In: Babar Z-U-D, ed. *Encyclopedia of Pharmacy Practice and Clinical Pharmacy.* Elsevier; 2019:7-21. ISBN 978-0-12-812735-3. PMCID: PMC7149347. https://doi.org/10.1016/B978-0-12-812735-3.00602-6
- Snyder H. Literature review as a research methodology: an overview and guidelines. *J Bus Res.* 2019;104:333-339. https://doi.org/10.1016/j.jbusres.2019.07.039
- Shimonovich M, Pearce A, Thomson H, Keyes K, Katikireddi SV. Assessing causality in epidemiology: revisiting Bradford Hill to incorporate developments in causal thinking. *Eur J Epidemiol.* 2021;36(9):873-887. PMID: 33324996; PMCID: PMC8206235. https://doi.org/10.1007/s10654-020-00703-7

Cited literature — General research training resources (Tool Kit Outline)

- Personet HA, Hammond DA, Frazee EN, Skrupky LP, Johnson TJ, Schramm GE. Road map for research training in the residency learning experience. *J Pharm Pract.* 2018;31(5):489-496. PMID: 28847231. https://doi.org/10.1177/0897190017727382

Background literature — supplemental online examples

- Chicago School Library — literature matrix examples: https://library.thechicagoschool.edu/c.php?g=1296999&p=9655839
- PICO framework primer (PMC): https://pmc.ncbi.nlm.nih.gov/articles/PMC3430448/
- University of Reading — pharmacology research project guide, literature review: https://libguides.reading.ac.uk/pharmacology-research-project-guide/literature-review

General resources

- **University of Washington Health Sciences Library** research guides: https://guides.lib.uw.edu/hsl
- **Society for Academic Emergency Medicine — Research Learning Series**: https://www.saem.org/research/research-learning-series

A note on citations in this toolkit

This toolkit cites external sources by title, author, journal, and year as supplied by the SEMP Research Committee writers. Where the committee submitted an incomplete or inconsistent citation, the editor performed a multi-source verification (PubMed, CrossRef, Semantic Scholar, NCBI ID converter, Elsevier ScienceDirect) to confirm or correct the entry. Three committee citations were corrected against authoritative sources:

- Saczynski 2013, year corrected from 2023, end-page added (PubMed PMID 24050485).
- Barratt 2004, issue and end-page added (PubMed PMID 15313996).
- Awaisu 2019, full chapter DOI and page range confirmed via Semantic Scholar plus NCBI ID converter (PMCID PMC7149347).

When you write your own manuscript, every reference must be verified against the primary source — not paraphrased from memory and not assumed from a title. This is both a professional and an ethical standard.

About SEMP

The Society of Emergency Medicine Pharmacists (SEMP) is a professional society dedicated to advancing emergency medicine pharmacy practice and optimizing pharmacotherapeutic care in emergency departments. SEMP serves pharmacists, pharmacy residents, pharmacy students, and allied health professionals working in emergency and acute care settings.

What SEMP does

- **Member education.** Clinical and professional development programming through webinars, the annual EMPoweRx conference, and committee-led resources such as this toolkit.
- **Advocacy.** Representing the emergency medicine pharmacy practice to broader pharmacy and medical organizations, payers, and regulators.
- **Communication.** A members-only forum, newsletter, and social channels for practice-focused discussion.
- **Research support.** The SEMP Research Committee produces toolkits, matches members with statisticians and mentors, and maintains a project-ideas exchange.
- **Community.** Connecting practitioners across institutions, career stages, and regions.

The SEMP Research Committee

The Research Committee serves SEMP members at every research stage, from first-project residents to mid-career investigators pursuing external grants. Current committee activities include:

- Maintaining this Research Toolkit and revising it annually.
- A monthly writing and research accountability hour, open to all members.
- Peer review of abstracts before submission.
- Matching members with statisticians, mentors, and potential co-investigators.
- Maintaining a running list of research project ideas contributed by members, available to preceptors and residents looking for topic seeds.
- Offering support for first-time poster and podium presenters.

Contact the committee at **research@empharmacists.org**.

Joining SEMP

Membership is open to pharmacists, residents, students, and allied health professionals active or interested in emergency medicine pharmacy. Membership provides access to this toolkit, the full member forum, the EMPoweRx conference discount, and all committee services.

Join at empharmacists.org.

Staying connected

- **Website:** empharmacists.org
- **LinkedIn:** empharmacists
- **Instagram:** @empharmacists
- **X:** @EMpharmacists
- **Facebook:** Society of Emergency Medicine Pharmacists
- **YouTube:** SEMP channel

Contributing to future editions

This toolkit is a living document. Members can contribute by:

1. Submitting corrections to **research@empharmacists.org**.
2. Proposing a new chapter or sidebar (submit a 1-paragraph pitch; the committee will respond with feedback and scope).
3. Volunteering for peer review of future drafts.
4. Contributing templates, checklists, or institutional resources that would benefit other members.

Contributors meeting the ICMJE criteria for authorship are listed in future editions' acknowledgments.

SEMP leadership

Current committee leadership, including Research Committee chair and incoming chair, is listed on the SEMP website's governance page. Elections occur annually; committee turnover typically follows the EMPoweRx conference cycle.

Licensing and use

From the Committee

You have reached the end of the first edition.

We wrote this primer because the path from a clinical observation to a published paper is opaque to too many of our members, and we wished someone had handed us a version of it when we started. If even one chapter helps you take the next step, this toolkit has done its job.

Now we ask the same of you. Take what you learned. Run a project. Write it up. Submit it. Respond to reviewers. Present the poster. Then come back and tell us what was missing, what was wrong, what would have helped sooner. Each correction makes the next edition better for the resident behind you.

Coming in Volume 2

The committee plans to expand the toolkit with chapters that did not make this first edition:

- Planning an EM pharmacy research project, end to end
- Diversity, equity, and inclusion in peer review
- Finding funding and grant writing
- Responding to peer reviewers (the author side of peer review)
- Templates and checklists you can adapt
- A glossary of research-methods terminology

If you would like to contribute a chapter or sidebar to Volume 2, email **research@empharmacists.org** with a one-paragraph pitch. Contributors who meet ICMJE criteria are listed on the author line of the next edition.

Quick reference

When you are deep in a project and need a single page, these are the figures and tables most members reach for:

- **Study design decision tree** — Chapter on Research Design Essentials
- **IRB review-level decision tree** — Chapter on IRB & CITI Training
- **Statistical-test selection table** (Table 4) — Chapter on Data Analysis
- **CONSORT participant-flow example** — Chapter on Preparing a Manuscript

A closing note

Thank you for being part of SEMP, and for taking the time to do this work. Emergency medicine pharmacy is better when more of us publish what we learn. We hope to read about your research in the future.

SEMP Research Committee, 2025-2026

SEMP
SOCIETY OF EMERGENCY MEDICINE PHARMACISTS

From idea to publication.

A practical primer from the SEMP Research Committee for emergency medicine pharmacists, residents, and students.

This toolkit walks you through every step of an emergency medicine pharmacy research project, from background literature and study design through IRB approval, data analysis, manuscript preparation, peer review, and conference presentation.

It was written for the pharmacist who has a clinical question and needs a map. Each chapter was authored by a working SEMP committee member who has lived the workflow it describes.

INSIDE THIS VOLUME

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