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## ASHP Foundation FYI Research Tips for Pharmacy Residents

Dear Residency Program Director:

The ASHP Research and Education Foundation has developed a series of tips for conducting quality research during a pharmacy residency program.

As part of its mission, the ASHP Foundation provides leadership and conducts education and research activities that foster the coordination of interdisciplinary medication management leading to optimal patient outcomes. In keeping with this mission statement, the ASHP Foundation has identified new investigator development as a priority.

**Research Tips for Pharmacy Residents** is composed of practical suggestions for successful completion of pharmacy resident research. When available, links to web resources are included as a resource for more in-depth information. Topics that are addressed include timeline development, writing specific aims and hypothesis statements, power calculations and statistical analysis, data presentation, developing surveys, working with the IRB, and grant development.

So, here are the first tips for this residency year! Encourage residents in your program to seek grant funding for their research projects through the **ASHP Foundation's Pharmacy Resident Health Services Research Program**. This grant program will support practice-based research in medication use conducted by residents in ASHP-accredited pharmacy residency programs and residents in pharmacy residency programs that have submitted an application for ASHP accreditation. Visit the "Funding Opportunities" section of the ASHP Foundation Web site for more information, including applications and application instructions. **The submission deadline is November 1<sup>st</sup> of each year.**

There are several important steps to take to successfully complete a residency research project. These include the following:

- ✓ Identify potential resident projects even before the residents arrive.
- ✓ Establish a timeline.
- ✓ Maintain a narrow focus for the resident's project. Ask only one study question as the project needs to be feasible.
- ✓ Ask a relevant question. National health care priorities are one potential source of study questions. For example, the ASHP Health System Pharmacy 2015 Initiative goals and objectives provide guidance on priorities for the improvement of pharmacy practice in health systems. These goals and objectives can be located at <http://www.ashp.org/2015/>.

Another example of key national health care priorities is the 8th Medicare Quality Improvement Organization (QIO) Statement of Work. Medication-related priorities include:

- Improved disease-specific therapy.
- Better patient education and medication self-management.
- Improved prescribing with a focus on avoidable drugs in the elderly, clinically important drug interactions, and generic prescribing ratios.

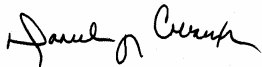
Information on the 8th Medicare QIO Statement of Work can be found at [http://www.ahqa.org/pub/189\\_817\\_5174.cfm](http://www.ahqa.org/pub/189_817_5174.cfm).

- ✓ For resident projects, the use of retrospective data is usually easier, given the limited time available for study completion.
- ✓ Identify senior investigators in your institution who may have a feasible project idea that could be undertaken by the pharmacy resident.
- ✓ Establish a research team composed of the investigators who will be responsible for study completion.
- ✓ Establish relationships and get support from those departments and individuals who are key to completion of the study.
- ✓ Hold frequent team meetings to monitor the progress of the research and to plan next steps. The resident and their research advisor should meet regularly to discuss the study.
- ✓ For prospective studies, consider completing the project over 2 residency years.
- ✓ Encourage the resident to stay focused on the study and complete a small amount of the work each week. The residency director and resident should discuss allocating time specifically for completion of the research project.
- ✓ Maintain documentation of all decisions regarding the study.

In her presentation at the 2006 ASHP Midyear Clinical Meeting entitled “Conducting Research: Where Do I Begin?”, Dr. Kim Coley of the University of Pittsburgh School of Pharmacy discussed practical aspects of conducting research. Coley’s presentation, which can be found at <http://www.cmccg.com/media/synch/261203/276-L04/>, is a good primer for residents as they begin their research journey. Click on the link above and scroll to “Conducting Research: Where Do I Begin?”

If you have any questions or would like to suggest topics for “Tips for Conducting Quality Pharmacy Residency Research,” please contact me at [dcobaugh@ashp.org](mailto:dcobaugh@ashp.org).

Sincerely,



Daniel J. Cobaugh, Pharm.D., FAACT, DABAT  
Director of Research and Program Development  
ASHP Research and Education Foundation

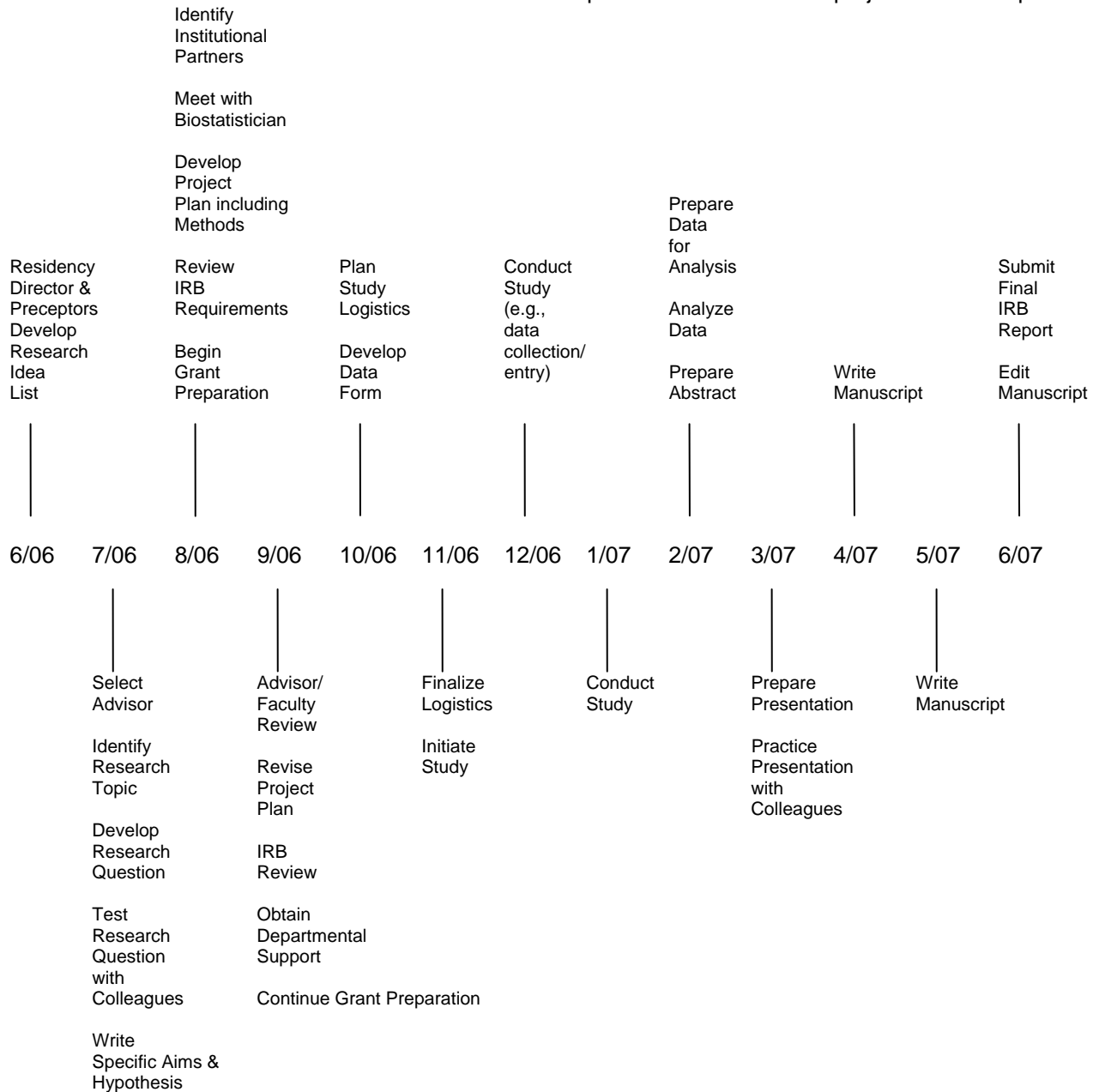


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### Establishing Timelines

One of the most important aspects of conducting quality research – especially during a pharmacy residency – is establishment of a reasonable timeline. The research advisor should work with the resident to develop a realistic timeline that will enable completion of a quality project while undertaking the primary training responsibilities associated with the residency program. A graphic or tabular timeline should be used to track milestone components of the research project. For example:





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### Developing the Research Question

Succinctly defining the research question is key to a successful resident research project. The research question should be defined as early as possible in the residency year. In their book, *Designing Clinical Research*, Hulley and Cummings describe the use of the mnemonic FINER<sup>1</sup> in developing the research question.

#### Feasible

- Adequate number of subjects
- Adequate technical expertise
- Affordable in time and money
- Manageable in scope

#### Interesting to the investigator

#### Novel

- Confirms or refutes previous findings
- Extends previous findings
- Provides new findings

#### Ethical

#### Relevant

- To scientific knowledge
- To clinical and health policy
- To future research directions

Once the research question is drafted, it should be circulated to experienced researchers associated with the residency program for review. One forum for review of the research question, and other components of the proposed study, is a regular research seminar that is attended by the residents and the residency faculty, including those with research experience.

1. Cummings SR, Browner WS, Hulley SB. Conceiving the Research Question. In: Hulley SB, Cummings SR, eds. *Designing Clinical Research*. Vol 1. 1 ed. Baltimore: Williams & Wilkins; 1988:12-17.



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### **Research Tips for Pharmacy Residents**

#### **Developing the Research Question**

The research question should be identified as early as possible in the residency year. Selection of an appropriate research question is one of the greatest challenges confronting pharmacy residents and their research advisors. The residency year provides a relatively short period of time to conduct quality “research” and the execution of the project must be balanced with the training priorities of the pharmacy residency. It is imperative that the resident and the advisor select an appropriately narrow research question that addresses an important practice issue. For resident projects, the use of retrospective data is usually easier, given the limited time available for study completion.

In preparing to formulate the study idea, the resident and advisor can consider national health care priorities. For example, the ASHP Health System Pharmacy 2015 Initiative goals and objectives provide guidance on priorities for the improvement of pharmacy practice in health systems. These goals and objectives can be located at: <http://www.ashp.org/2015/>. Another example of key national health care priorities is the 8th Medicare Quality Improvement Organization (QIO) Statement of Work. Information can be found at [http://www.ahqa.org/pub/189\\_817\\_5174.cfm](http://www.ahqa.org/pub/189_817_5174.cfm).



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### Writing Specific Aims

Along with the research question, well-defined specific aims or objectives are key to the successful completion of a research project. The specific aims should answer the question “What are you going to do?” For a residency project, the research team should not be overly ambitious with the aims as this will affect project viability. The resident’s project should probably be limited to 1-2 specific aims. However, these specific aims can be designed to increase the value of the study. For example, a study that addresses outcomes data, rather than process data, could have an important impact on practice. The National Institute of Allergy and Infectious Diseases provides guidance on writing specific aims at [http://www.niaid.nih.gov/ncn/grants/write/write\\_j1.htm](http://www.niaid.nih.gov/ncn/grants/write/write_j1.htm). Similar to the review of the research question, the specific aims should be reviewed by experienced researchers associated with the residency program.



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#### **Hypothesis Statements**

Hypothesis statements are developed primarily to provide a basis for statistical analysis. The null hypothesis states that there is no difference. In a study comparing a medication and placebo for treatment of a disease, the null hypothesis would predict no difference in measurable effect between the two interventions. Hypothesis statements are not required in descriptive studies.

The National Institute of Allergy and Infectious Diseases provides more detailed information on generation of a hypothesis statement at [http://www.niaid.nih.gov/ncn/grants/plan/plan\\_c1.htm](http://www.niaid.nih.gov/ncn/grants/plan/plan_c1.htm).



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#### **Data Sources**

In an earlier Research Tip, it was mentioned that the use of retrospective data is usually easier, given the limited time available for study completion by a resident. In a presentation at the 2004 ASHP Midyear Clinical Meeting, Dr. Beth Devine of the University of Washington discusses a number of internal and external data sources. Internal resources that she discusses include medical records, adverse event reports, prescription claims data, and purchasing data. External resources that she discusses include both public and proprietary data sets such as the Healthcare Cost and Utilization Project from the Agency for Healthcare Research and Quality. To hear Devine's discussion of available data sources, click on <http://media.ashp.org/foundation/gprpart2/index.html> and select Quality Practice Research, Part 2. In this discussion, she also provides many other useful tips for conducting research during the residency year.



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### Study Design

In his presentation at the 2004 ASHP Midyear Clinical Meeting, Lee Vermeulen of the University of Wisconsin emphasized that study design is the most important part of conducting quality research. He went on to say that “while a well-designed study does not ensure good results, a poorly designed study guarantees poor results.” Vermeulen emphasized that a well-designed study enables the researcher to respond to a research question with accurate, objective and valid methods. The study design that is chosen should employ the best approach to establishing a causal relationship between the intervention and the measurable outcome(s). To hear Vermeulen’s discussion of study design, click on <http://media.ashp.org/foundation/qprpart1/index.html> and select Quality Practice Research, Part 2.

The Oxford Centre for Evidence Based Medicine provides brief descriptions of advantages and disadvantages of several different study designs at:

[http://www.cebm.net/study\\_designs.asp#control](http://www.cebm.net/study_designs.asp#control)



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#### **Survey Research**

Well-designed survey research enables an investigator to systematically gather, summarize, and generate conclusions about data to answer a research question. Often residents chose to conduct a survey to answer a research question. It is important to help the resident understand that, in order to reach valid conclusions, the scientific method must be followed in the design and implementation of survey research. At the 2006 ASHP Midyear Clinical Meeting, Michael Miller, R.Ph., Dr.P.H., of Drake University College of Pharmacy, discussed numerous aspects of survey research, including its purpose and role, important process steps, variable measurement and sample selection. Click here to listen to Dr. Miller's discussion of the science of survey research: <http://www.cmcgc.com/media/synch/261203/276-L04/>.



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#### **Gaining Institutional Support**

Securing departmental and institutional support for a potential research project is critical to the project's success. Most studies require some level of logistical support from within the researcher's department and the institution. Practice research almost always benefits from multidisciplinary involvement. As the methods for the proposed study are being developed, the research team should assess each component of the methods to determine the impact on different departments within the institution. After this assessment has been completed, an organized plan for gaining support from each of the involved departments should be developed. This plan should also address logistical issues that are critical to execution of the study. For example, will the pharmacists need education regarding the protocol? Do other departments require review by their departmental research committee prior to IRB submission? If medical records review is involved, have all HIPAA implications been addressed with the medical records department prior to the IRB submission? The study methods should be revised as required to reflect the logistics discussions that occur. Along with positively impacting execution of the study, these efforts to engage other departments will be beneficial as the study is being reviewed by the IRB and by the institution's office of grants administration if a grant submission occurs.



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#### Biostatistics

Consultation with a biostatistician can dramatically impact the quality of the resident's research project. In his biostatistics presentation at the 2005 ASHP Midyear Clinical Meeting, Dr. James DeMuth identified the key steps in the statistical analysis:

- ✓ Establish research question.
- ✓ Formulate a hypothesis.
- ✓ Identify primary and secondary outcomes. Make sure that data are available to measure the primary outcome.
- ✓ Select an appropriate test.
- ✓ Sample correctly.
- ✓ Collect data.
- ✓ Describe data.
- ✓ Perform test.

To hear DeMuth's discussion of study design, click on <http://media.ashp.org/foundation/qprpart1/index.html> and select Quality Practice Research, Part 3.

A brief primer on descriptive and inferential statistics, entitled "Statistics at Square One," can be found at <http://bmj.bmjournals.com/collections/statsbk/>

The National Institute of Allergy and Infectious Diseases provides insight into what grant reviewers are looking for in terms of statistical analysis. Click on [http://www.niaid.nih.gov/ncn/grants/write/write\\_m4.htm](http://www.niaid.nih.gov/ncn/grants/write/write_m4.htm).



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### **Research Tips for Pharmacy Residents**

#### **Human Subjects Protections**

Institutional Review Board (IRB) review and approval is imperative to the ethical conduct of research, to the protection of human subjects and to assure compliance with federal regulations governing research. In the early stages of project planning, the investigators should incorporate IRB processes into the research timeline. This provides a good opportunity for residents and other new investigators to become acquainted with the IRB's procedures and review requirements. The ASHP Foundation requires evidence of IRB approval before it funds research projects and a large number of scientific journals require similar evidence prior to publication. A review of the history of IRBs and their role in overseeing research, by Wesley G. Byerly, Pharm.D., can be found on the ASHP Foundation Web site at <http://media.ashp.org/foundation/gprpart2/index.html>.

Information on federal regulations regarding IRBs can be found at <http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.htm>.

The resident should give serious consideration to attending an institutional program on conducting human subjects research.



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### **Research Tips for Pharmacy Residents**

#### **Human Subjects Protections**

In a previous edition of Tips for Conducting Quality Pharmacy Resident Research, the role of the IRB was addressed. Protection of human subjects is addressed under Title 45, Part 46, of the Code of Federal Regulations. One of the questions that investigators raise frequently is what type of review – expedited or full – will occur or if a study will be exempted from review. The Code of Federal Regulations §46.101(b) contains information on those types of studies that are exempted from review. This can be found at <http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.htm#46.101>.

Federal regulations that address expedited review can be found at <http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.htm#46.110>.

A list of research categories that the Secretary of the Department of Health and Human Services has determined may be reviewed through an expedited review procedure can be found at <http://www.hhs.gov/ohrp/humansubjects/guidance/expedited98.htm>.

The National Institutes of Health also provides guidance on developing the human subjects section of a research plan. This can be found at <http://grants.nih.gov/grants/funding/phs398/HumanSubjects.pdf>

It is critical that the resident and his or her research advisor discuss the IRB review process with representatives of the institution's IRB.



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#### **Data Collection, Display and Manipulation**

As residents collect data from their studies, it is important that they enter and organize the data in a manner that will ease analysis. The data collection form and methods should be developed and tested before initiation of the study. Residents and preceptors should also discuss the processes that will be used for data entry and display prior to study initiation. This should include a determination of quality checks that will be included. If a biostatistician is available, he/she can help verify that all required data are being collected. The biostatistician can also provide invaluable guidance on data display.

At the 2006 ASHP Midyear Clinical Meeting, Almut Winterstein, Ph.D., of the University of Florida College of Pharmacy, discussed data display and organization. Winterstein's presentation, "Making Sense of Research Findings: Data Manipulation and Presentation," can be found at <http://www.cmcgc.com/media/synch/261203/276-L04/>. Click on the link above and scroll to "Making Sense of Research Findings: Data Manipulation and Presentation."

Statistics at Square One provides a primer on several issues related to data display and summary. Included are brief discussions of nominal, ordinal and interval scales as well as information on data display, including dot plots and histograms. Click on <http://www.bmj.com/statsbk/1.dtl> to access this primer.



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#### **Grant Submissions**

For most new investigators, the entire grant submission process can be overwhelming. However, the quality of the grant application will have a major impact on funding decisions. Organization is critical to the process. If your residents decide to pursue funding, such as the ASHP Foundation Pharmacy Resident Health Services Research Grant Program, direct them to immediately read the entire application and make a list of each step required for completion of the application. This should be followed by a discussion between the resident and preceptor that focuses on a timeline for development of the application. The resident needs to understand that quality specific aims and study methods take time to develop and refine. As mentioned in earlier e-mails, garnering institutional support and the grants administration process also take significant amounts of time and should be factored into the grant submission timeline. Although the National Institute for Allergy and Infectious Diseases tutorial on grant writing is geared to development of a National Institutes of Health grant submission, it still provides valuable information for any grant writer. This tutorial can be found at <http://www.niaid.nih.gov/ncn/grants/write/index.htm>. The quality of the application can be enhanced greatly by seeking review by experienced researchers who are not involved with the study.



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#### **Grant Submissions**

Although it is impossible to adequately discuss all aspects of grant writing through these tips, there are several areas that new investigators should pay attention to as they write an application. In this tip, a few key aspects of grantsmanship – adherence to instructions, budget justifications, and timeline development - will be addressed.

One important aspect of grant submission is adherence to the application instructions. When the resident reviews the application and instructions to develop the grant preparation timeline, guide them to also pay close attention to issues such as page limits and font size. In many cases, funding agencies will return, without review, applications that do not adhere to application instructions. If a grant application has a budget justification section, the applicant should carefully justify requested funds in relation to the project. Rather than simply listing a research assistant, the budget justification should explain their role on the project to the reviewer. If the grant program requires a timeline for the project, provide a tabular or graphic timeline that describes key activities on a monthly basis. Reviewers do not find statements such as “the study will be completed over a 12-month period” to be adequate timeline descriptions.



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#### **Grant Submissions**

One of the most common mistakes made by grant applicants is underestimation of the time required to complete each of the institutional steps required for a successful application. Investigators often underestimate the time required for review by the investigator team, submission of the protocol and consent to the IRB, requesting letters of support, and submission of the entire grant application to the institution's grants management office. Many new investigators are often unaware that a grants administration process exists in their institution. However, this is a critically important piece that cannot be overlooked. All grant applications should be submitted to the grants administration office in advance of submission to the funding agency. The research team should allow adequate time for completion of the grants administration process. If this process is overlooked, it can delay or prevent submission of the grant. If the research team determines that a grant will be pursued, the resident and the research advisor should meet with a grants officer early in the process to learn about the institution's policies and procedures related to grants administration. The grant officers can also offer expertise about numerous aspects of sponsored projects accounting that must be addressed when a grant application is submitted, such as budget preparation and indirect cost rates.



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#### **Research Presentations**

Presentation of research findings in a public forum is often intimidating for new investigators. Along with anxiety about speaking to a large audience, new investigators also need to develop an ability to concisely present their study findings in as little as 10-15 minutes. A relatively short platform presentation does not allow for a lengthy discussion of the background for the research. In preparing the background slides, there may be time for only one or two bullet points along with the study objectives. The primary and secondary study objectives should be stated clearly and succinctly.

Another challenge is incorporating complex study methods into a few slides. Flow diagrams are a very effective method of describing methods. In a platform presentation, graphic presentation of results is most effective. In presenting results, avoid busy tables that the audience will not be able to read or fully grasp in a short period of time. The brief platform presentation will not allow significant time for discussion of the findings.

The presenter will be challenged to identify the most salient points that should be discussed. Take time to discuss the limitations of the study. Otherwise, the audience will point them out to you in the question-and-answer session. If time limitations preclude the inclusion of some data in your presentation, prepare slides with those data and have them available in case an applicable question is raised by the audience.

Visit the ASHP Foundation Web site to listen to Susan Skledar, R.Ph., M.P.H., of the University of Pittsburgh Medical Center discuss presentation and publication of research findings. To hear Skledar's presentation, click on <http://media.ashp.org/foundation/qprpart2/index.html> and select Quality Practice Research, Part 4.



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#### Submitting a Manuscript

Many new investigators, and even seasoned researchers, become overwhelmed by the process of submitting a manuscript to a biomedical journal. Successful manuscript development requires an organized approach and an understanding of the roles of each section of the paper – introduction/background, methods, results, discussion, and conclusions. A key first step is review of the desired journal's author instructions to understand the submission requirements. Also, starting early will allow for a more manageable process. The background and methods sections can be written even before the study results are available. Consider reading Welch's "Preparing Manuscripts for Submission to Medical Journals: The Paper Trail" (<http://www.acponline.org/journals/ecp/mayjun99/welch.htm>). This article provides a practical, step-by-step discussion of the manuscript preparation process.

Often, a resident's first journal submission will involve a case report. The October 1, 2006 issue of the *American Journal of Health-System Pharmacy* includes an excellent primer, by Henry Cohen, Pharm.D., entitled "How to Write a Patient Case Report" (<http://www.ajhp.org/cgi/content/abstract/63/19/1888>). This article also includes a list of criteria for publishable case reports.