**Appendix 1. Case Vignettes and Suggested Timeline for Examples of Incorporating Learners into Research or QI Projects**

Scenario 1: Learner with limited to no research experience

**Situation:** WH is a PGY1 pharmacy resident who is excited to be involved in a clinical research project and gain practice-based research experience.

**Background:** WH has not engaged in any research activities during pharmacy school. They seem enthusiastic about the opportunity and learning new skills. The topic area of interest is pain management. An initial meeting has been scheduled to further discuss the project idea and WH’s goals.

**Assessment:** While WH lacks prior experience and will be starting from scratch in terms of research knowledge and skill, they are proactive in seeking out opportunities to learn. WH is eager to get the research process off the ground to improve their chances of securing a PGY2 or potentially a fellowship. To support WH in gaining research knowledge and skills, we recommended the following:

**Recommendation (Mentor):**

*The opportunity exists to engage WH in offshoots of the mentor's main projects or on new areas of interest. Mentors can explain research methodology in a systematic, step-by-step approach or also utilize a near-peer or layered approach to provide more experienced learners’ leadership and mentoring experience:*

* Initial Project Meeting:
  + Send overview of the project or list of potential projects ahead of the initial meeting so WH can develop questions or identify projects of interest.
  + Discuss process in developing a research question and impetus for this research project.
  + Provide a clear overview of what research entails, including all steps from conceptualization to publication, the workload, the time commitment, and the objectives of the project.
  + Encourage WH to ask questions and express concerns about anything being discussed.
  + Rather than committing to a specific project today, ask WH to spend some time reading about the proposals and to follow up with you afterwards.
* Research Contract:
  + Once a project is identified, collaborate on crafting timelines for each step of the research process and include regular check-in meetings.
  + Develop mutually agreed upon deadlines, objectives and learning outcomes.
  + Ask WH to complete CITI training and send you the final certificates.
  + Be open about potential authorship role for yourself and WH as well as venues for project dissemination.
  + Have all involved learners and mentor sign the research contract if terms are agreeable.
* Background Research and IRB submission:
  + Provide resources and guidance on conducting literature reviews.
  + Include specific instructions on what information to keep track of while reading (e.g., findings, outcomes measured, and data collection points)
  + Encourage WH to note any questions.
  + Describe the IRB process, walk through the documentation required, and assist with the completion.
* Data Collection:
  + Discuss the importance of data collection, consistency, clarity, and relevance to the research question.
  + Demonstrate navigation of the electronic medical record (EMR) to find relevant information.
  + Explain any data collection tools to be used (e.g., Excel vs REDCap) and how to collect data in a way that will facilitate analysis (e.g., numbers vs text), and how to safeguard protected health information (PHI)
  + Following data collection for the first 5-10 patients, review data entry for accuracy and completeness. Address any concerns or discrepancies with WH.
* Data Analysis:
  + Introduce basic concepts of data analysis and statistical methods.
  + Recommend resources for WH to familiarize themselves with.
  + Offer guidance on selecting appropriate statistical tests based on the research question and data type.
  + Provide opportunities for hands-on experience with statistical analysis under your supervision or involve biostatistician early in the process.
* Dissemination:
  + Discuss the importance of dissemination and potential avenues for abstract submissions, posters presentations, and publication based on WH’s goals.
  + Provide examples of abstracts, posters, and manuscripts as you reach each step.
  + Connect WH with any writing resources at their institution (e.g. writing lab or local university resources)
  + Offer guidance and detailed written and verbal feedback through the drafting process.

**Recommendation (Learner):**

* Initial Project Meeting:
  + Express your enthusiasm for learning about research and gaining experience.
  + Share your research goals and express any concerns about your lack of prior experience.
  + Ask questions to ensure clear understanding of requirements/expectations associated with the research.
* Research Contract:
  + Be honest about your thoughts after thinking about the project proposals and commitment.
  + Determine realistic timelines based on your availability and other commitments.
  + Request guidance on time management strategies to ensure successful completion of the project alongside other responsibilities.
  + Complete CITI training and share your final certificates with your mentor.
* Background Research and IRB submission:
  + Seek resources or recommendations for conducting literature reviews.
  + Read assigned articles and actively highlight/note important information.
  + Compile a list of questions to discuss with your mentor regarding any unclear concepts or unfamiliar terms.
  + Reach out when questions arise regarding the IRB submission process.
* Data Collection:
  + Ask for guidance on accessing and navigating EMR or other data collection tools. Take notes and ask questions to ensure understanding.
  + Request assistance as needed and check in with mentor after collection of a few patients so any necessary corrections can be made early on.
* Data Analysis:
  + If your mentor is having a statistician complete the analyses or doing the analyses themselves and you are interested in learning:
    - Express your willingness to learn about data analysis methods and ask for hands-on experience.
    - Ask for resources and guidance.
    - Attempt to determine the appropriate statistical tests or to conduct the analyses for your project based on what you have learned/researched and discuss with your mentor.
* Dissemination
  + Share your long-term goals so your mentor can help identify appropriate avenues for dissemination of your work.
  + Ask for examples of abstracts, posters, and manuscripts as you get to each step.
  + Ask for guidance and feedback during the drafting process.

Scenario 2: Learner with some research experience and short timeline

**Situation:** SO is a 4th year pharmacy student on your APPE rotation during August. During the initial rotation meeting, they mention that one of their goals is to increase exposure to practice-based research in the hospital setting prior to the residency application cycle.

**Background:** SO participated in a summer research experience during the summer after their 2nd year of pharmacy school. The project was led by a faculty member and involved creating and distributing surveys to students that resulted in presenting a poster at the state association meeting. SO was responsible for developing the survey in an electronic tool, analyzing responses, writing an abstract, and presenting the poster. They enjoyed the experience and would like to participate in a practice-based research project to get a better understanding of what research looks like during a residency year. SO would like to participate in a project where most of the work can be completed during their rotation with you. The project you have in mind is a quality improvement project in antimicrobial stewardship (AMS).

**Assessment:** SO has a strong interest in research and experience with analyzing and reporting data. You are involved in a quality improvement project where an AMS intervention has been implemented the previous summer and are now responsible for following up on the impact of the project; however, because of other responsibilities, you have not been able to complete the necessary chart review or analyze the data. You already have access to the necessary dashboards, patient lists, and demographic data, but the project requires some manual chart review for additional data collection. The student has some knowledge of the topic, and the project will not require formal IRB approval as it has already received designation as a quality improvement project. To support SO in expanding research knowledge and skills and to best align with the project you currently have, we recommended the following:

**Recommendation (Mentor):**

*The opportunity exists to have SO assist with a project that the preceptor has been unable to complete given multiple responsibilities. Create ways to enhance SO’s experience and ownership of the project given a limited time for direct interaction through various methods:*

* Initial Project Meeting:
  + Provide an overview of the project including context for the QI intervention and expected workload involved.
  + Evaluate need for CITI training based on institution requirements for QI projects.
  + Establish student goals and expectations. Be open about potential authorship role for yourself and SO given significant work already put in by preceptor.
  + Discuss feasible timelines given time limit of EMR access (only available during rotation period).
  + Create a supportive environment for student. Allow SO the opportunity to process the workload and bow out if unable to commit to the project requirements.
* Research Contract:
  + Create a time management strategy for research time during the rotation, which may include research days when the preceptor has other responsibilities or is on leave.
  + Draft a timeline with weekly data collection targets.
  + Assist SO with a project timeline including deliverables, responsibilities following the rotation, and communication methods.
  + Have everyone sign the research contract if terms are agreeable.
* Background Research and IRB Submission:
  + Due to the short timeline for data collection, provide background about intervention development and goals for the project.
  + IRB has designated this project as quality improvement so no formal submission for expedited or full review needed. Learner may need to be added as a project participant depending on institution.
* Data Collection:
  + Review data collection tool and any associated abbreviations or definitions.
  + Determine site of data collection (e.g., Excel vs REDCap) based on institutional resources and expertise.
  + Emphasize importance of protecting PHI.
  + Describe how to find each data point from manual chart review and how the data should be reported (e.g. numbers, text, yes/no). This may be verbal or written (e.g., data if there are complicated steps to identify data points.
  + Following data collection for the first 5-10 patients, review data entry for accuracy and completeness. Address any concerns or discrepancies with SO.
* Data Analysis:
  + Introduce basic statistical analysis concepts applicable to the current project. Provide resources for further learning on statistical methods.
  + Evaluate and provide feedback on SO’s data analysis plan.
  + Conduct statistical analysis with SO present to facilitate an understanding of statistical software, if feasible.
  + Provide critique on SO’s interpretation of results and help identify key points.
* Dissemination:
  + Discuss opportunities for dissemination including institutional committee presentations, posters, and publications based on SO’s goals, expectations, and availability.
  + Provide examples of each type of deliverable involved in the project.
  + Offer frequent feedback according to established timelines. This may be done via email or conferencing platforms if more detailed or extensive feedback is needed.

**Recommendations (Learner):**

* Initial Project Meeting:
  + Be prepared to describe research experience and clear goals for current research interest.
  + Discuss feasibility of research goals given limited time on rotation. Consider your availability and willingness to stay involved after the rotation.
  + Ask questions to ensure a clear understanding of the scope, expectations, and time commitment of your involvement in the project. Do not be afraid to decline the opportunity if unable to commit at this time.
* Research Contract:
  + Thoroughly review expectations and reflect on desire to participate in the project.
  + Create a timeline with weekly data collection targets during rotation & specific touchpoints after the rotation ends to ensure follow up to meet research goals.
  + Establish preferred communication methods and turnaround time for feedback and edits for both the preceptor and you.
* Background Research and IRB Submission:
  + Review information provided by the preceptor and set aside time to ask any clarifying questions of the preceptor.
* Data Collection:
  + Ensure all data points are clear including where to find information and how it should be documented to facilitate data analysis. Data needs to be collected in a systematic, reproducible fashion to avoid misclassification errors.
  + Request assistance if there are any troubles navigating the EMR or understanding aspects of the chart review process.
* Data Analysis:
  + Create a statistical analysis plan including variables to be analyzed & statistical test to be used. If resources haven’t been provided, request from preceptor.
  + If time allows, participate in the statistical analysis with the preceptor.
  + Review all data & statistical results to determine the impact of the project. Create a list of key points to highlight when disseminating the data.
* Dissemination:
  + Discuss your goals with the preceptor to determine appropriate presentation venues including ability to attend conferences or participate in manuscript writing process.
  + Proactively address author order for each deliverable. If you feel the initial plan is no longer fair given additional responsibilities or activities you undertook, have an open discussion with the preceptor and provide your reasoning.
  + When submitting abstracts or manuscripts, ensure the contact information provided will still be active at the time you expect to be contacted. The preceptor may be a better corresponding author as they will have a permanent email address as opposed to a student email that may terminate following graduation.
  + Ask for examples of abstracts, posters, and manuscripts as you get to each step.
  + Expect several rounds of feedback for each deliverable. This should be incorporated in your timeline.
  + Maintain open communication with the preceptor including any unexpected delays or obligations that arise which may impact timelines or availability.

Scenario 3: Learner with high level of research experience

**Situation:** RD is a third-year student pharmacist who has reached out to you with interest in starting a clinical research project with you. They are seeking to gain more experience in practice-based research and to make themselves competitive for post graduate training following graduation.

**Background:** RD has ample benchtop research experience from their undergraduate program and has already completed a structured research elective in the pharmacy program. You recall that RD has always been an engaged student in the classroom and seems to be highly proactive. The project that you had in mind is a retrospective cohort study on the topic of cardiology and so you hold an initial meeting to discuss prior experience, goals, logistics, and the initial project idea.

**Assessment:** At the initial project meeting, it is clear that RD has the foundational knowledge and skills to be successful, and they are actually far more advanced in research knowledge compared to most students who start a project with you. RD does not know much about the topic you have selected beyond what they have learned in didactic coursework but is eager to learn more. You get them started on working on background research, IRB writing, and data collection plan. Additionally, you describe expectations for communication and deliverables with a timeline constructed with RD’s input. To help take RD’s research to the next level, we recommended the following:

**Recommendation (PI):**

*The opportunity exists to have RD take a higher level of ownership for this project given their experience and apparent proactivity. Create ways to enhance RD’s ownership and knowledge of the project through various methods:*

* Initial Project Meeting:
  + Request CITI training evidence, goals, and curriculum vitae in advance of meeting.
  + Provide pertinent background information on the topic as appropriate.
* Research Contract:
  + Since RD already has some experience of what to expect, engage them in crafting timelines for deliverables and publication plans for the contract to increase project ownership.
  + Discuss authorship with RD along with expectations and align responsibilities accordingly.
  + Although RD has an understanding of the time commitment, still outline parameters for exit from the project as life circumstances may change.
* Background Research and IRB Submission:
  + Assign RD relevant readings or ask to complete a literature search and discuss findings.
  + Ask RD to create a list of data collection points and draft a data collection sheet, hypothesis, and outcomes of interest. Meet to review and create pre-plan for statistical analysis.
* Data Collection:
  + Review EMR and data collection sheet; review special needs and keys for data collection by drawing direct linkages to how data will be analyzed.
  + Construct data collection sheet in data management software as applicable to institutional requirements.
* Data Analysis:
  + Consider having RD complete descriptive statistics and summarize data prior to formal statistical analysis depending on their comfort level.
  + Set meeting to further assess RD’s statistical knowledge and desire to learn more; ask RD to come prepared with list of data points to analyze and which tests they think are most appropriate as a starting point.
  + Pending your comfort and RD’s engagement, consider running statistical tests alongside RD versus sending to biostatistician thus empowering RD to learn basics of statistical software. This may be highly variable depending on the complexity of data, your comfort, and the learner.
* Dissemination:
  + Aligning with RD’s targeted poster presentation venue, have RD identify a journal and backup journal for publication, then, draft abstract and assign poster sections for investigators to work on as well as create updated timelines for deliverables and poster printing.
  + Work together on an outline for manuscript together and assigned sections.
  + Consider having RD take ownership of manuscript submission. Discuss corresponding author responsibilities and determine whether RD will assume these duties.

**Recommendation (Learner):**

* Initial Project meeting:
  + Come prepared to the meeting with concise description of past experience and very clear goals for the research experience including why you want to complete a research experience.
  + Be prepared to refine a research-focused SMART goal.
* Research Contract:
  + Review your course calendar and major commitments, and draft or edits timelines for when is feasible for what you can commit to.
  + Create a time-management strategy for how you will carve out time for the research project in addition to your other studies and responsibilities.
  + Do not be afraid to bow out of a project if conditions outlined in the research contract for exit from the project are met (e.g. major life circumstances).
* Background Research and IRB Submission:
  + Read and highlight relevant articles.
  + Prepare a list of questions of items you do not understand.
* Data Collection:
  + Focus time on learning the EMR and data collection tool.
  + If you are unfamiliar with MS Excel or other systems, self-directed learning in these areas may help you be more efficient.
* Data Analysis:
  + This may be new to you or the most unfamiliar piece of the research process. Ask your PI to sit down with you to talk through some of the tests you will run, and even to run them together. Working through data analysis is the best way to increase understanding.
  + Additional reading or resources to refresh on basic biostatistics may be helpful.
* Dissemination:
  + Consider the time of year you are working on the project and upcoming conferences- Are there any you hope to attend? Is there a conference that would help meet a goal or enhance your learning or networking? Ideally, determine this at the start of the project to reverse engineer a timeline for writing your abstract. Note that some conferences may allow for student “works in progress” versus some may require complete data analysis at the time of abstract submission.
  + Work with your PI on drafting and outlining. It is also a good idea to ask for examples of writing styles to match for your abstract and manuscript.
  + Ask for examples of abstracts, posters, and manuscripts as you get to each step.