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CONSCIOUS WRITING

Five Pitfalls to Avoid When Crafting the Study Question for a Research Manuscript

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ABSTRACT

The study question is the most fundamental part of a research manuscript. This question engages readers by piquing their curiosity and guiding them into the next part of the story. Yet, many medical writers will craft a study question that fails to accomplish one or both of these tasks, which weakens the story. To craft a persuasive study question, medical writers can use a helpful formula that ensures they accomplish both tasks. This formula will also help medical writers overcome five common pitfalls that weaken the question and the research story. These pitfalls include focusing on the objectives of the study, only stating what was done in the study, reversing the order of the formula in the study question, focusing on the hypothesis of the study, and summarizing the key findings of the study.

In the medical field, most research manuscripts follow the IMRaD format—Introduction, Methods, Results, and Discussion.[1] This format has become a valuable formula for crafting research manuscripts that have a consistent story structure. However, the IMRaD abbreviation fails to call attention to the most fundamental part of the research story: the study question.

The study question has the important job of engaging readers in the story. This question piques readers' curiosity by stating a gap that the study aims to fill. The study question is also the guiding star to which every other section in a research manuscript needs to point. The Introduction guides readers through the study's background to frame the question. Then the Methods explain the approach used to answer the question, and the Results describe data that help to answer the question. Then the Discussion frames the data and that answer in the context of what is already known.

The importance of the study question is more clearly highlighted in the STACR story structure—Setup, Tension, Action, Climax, Resolution—that maps onto the IMRaD story structure of a research manuscript (Figure 1).[2] The STACR structure emphasizes the importance of the study question as the Tension part of the structure. This emphasis helps medical writers ensure that they craft a good Tension—or study question—for a research manuscript.

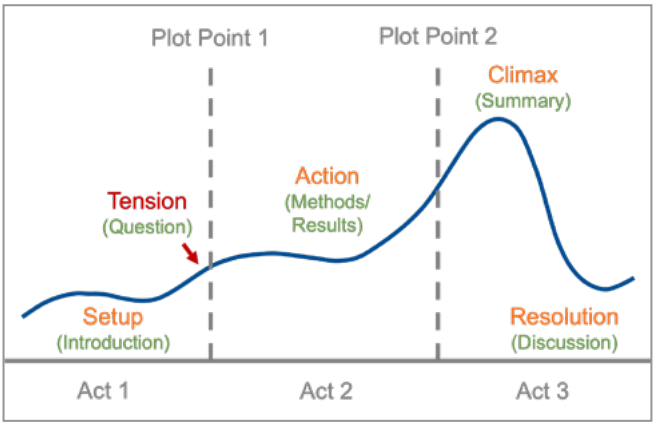

Figure 1. The STACR and IMRaD story structures. The STACR (Setup, Tension, Action, Climax, and Resolution) story structure maps onto the standard IMRaD (Introduction, Methods, Results, and Discussion) story structure of research manuscripts. The Tension (red) is the study question that sparks readers' curiosity and motivation to keep reading the story.

WHAT MAKES A GOOD TENSION?

A good Tension states the gap you aim to fill in the study by framing a question and then lays out an approach to answer that question. In essence, a good Tension boils down to the formula, "To learn X, we did Y."[3] The "to learn X" part frames a question that sparks readers' curiosity and motivates them to keep reading the story. The "we did Y" part lays out an approach that helps to guide readers into the Action part of story. This combination is a powerful way to persuade readers and lead them through the research story.

The "To learn X, we did Y" formula is readily apparent in the following example:

Example 1

To determine the effectiveness of methotrexate in treating chronic kidney disease, we examined serious adverse events in adults with chronic kidney disease who were treated with high and low doses of methotrexate.

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In other words, "To learn whether methotrexate effectively treats chronic kidney disease, we did an analysis of serious adverse events in adults with chronic kidney disease who were treated with this drug."

Importantly, the "To learn X, we did Y" formula is not always so clear-cut. For example, this formula can also be found woven into the following example:

Example 2

In this study, we sought to develop a diagnostic scoring system for assessing extubation readiness in patients undergoing neurosurgery. To develop this system, we surveyed physicians to understand what factors influenced their decisions to delay extubation in patients who were mechanically ventilated during neurosurgery. We then developed a diagnostic scoring system and evaluated its usefulness in predicting extubation success in patients undergoing neurosurgery.

In other words, "To learn information to develop a system, we did a survey of physicians and then developed and tested a system."

WHAT ARE COMMON PITFALLS IN CRAFTING TENSIONS?

The "To learn X, we did Y" formula is a helpful tool for crafting a persuasive Tension for your research manuscript. But many medical writers stumble over common pitfalls when crafting the Tension (Figure 2). These pitfalls weaken the Tension, which weakens the story.

Figure 2. Common pitfalls that weaken the study question in a research manuscript.

Pitfall 1: Focus on the Objectives

Many medical writers craft Tensions that only use the "to learn X" part of the formula. In these cases, medical writers focus on highlighting the objectives with phrases like "we aimed to" or "we sought to." Although these phrases spark readers' curiosity, they do not guide readers into the story. Without the "we did Y" part of the formula, readers are forced to jump from the Tension into the Action of the story without a clear bridge to get there.

To strengthen the power of the Tension, include the "we did Y" part of the formula.

Example 3

Avoid: In this study, we aimed to understand the perspectives of physicians who use the intervention to manage acute heart failure.

Preferred: To understand the perspectives of physicians who use the intervention to manage acute heart failure, we collected quantitative and qualitative feedback from physicians after usability testing of the intervention.

Example 4

Avoid: Our objective was to review published randomized controlled trials on the safety and effectiveness of nonpharmacologic treatments versus no treatment for children with functional constipation.

Preferred: In this study, our objective was to evaluate the safety and effectiveness of nonpharmacologic interventions for children with functional constipation. For this evaluation, we completed a systematic review and meta-analysis of randomized controlled trials that tested nonpharmacologic treatments in children with functional constipation.

Pitfall 2: Only State the Approach

Some medical writers craft Tensions that omit the "to learn X" part of the formula and only use "we did Y." This approach focuses on what was done in the study with phrases like "we measured" or "we assessed." These phrases help to guide readers into story. However, without the "to learn X" part of the formula, you are assuming that readers know the question. And assuming is risky. You are also not sparking readers' curiosity, draining the persuasion from the Tension in your manuscript.

To pique reader's curiosity and motivation to keep reading the story in the manuscript, include the "to learn X" part of the formula in the study question.

Example 5

Avoid: In this study, we analyzed the relationship between neuropsychological function and disease biomarkers in people with Alzheimer's disease.

Preferred: To determine the relationship between neuropsychiatric symptoms and glial markers in Alzheimer's disease, we analyzed the association between neuropsychological function and disease biomarkers in people with Alzheimer's disease.

Example 6

Avoid: In this study, we analyzed data from an observational prospective trial that included patients who underwent different surgical procedures at a single center.

Preferred: In this study, we aimed to dissect the risk factors for postoperative delirium that affect older patients' length of stay in the intensive care unit and in the hospital. To this end, we analyzed data from an observational prospective trial that included patients who underwent different surgical procedures at a single center.

Pitfall 3: Reverse the Formula

Some medical writers include both parts of the formula, but they reverse the order to "we did Y to learn X." Although this format includes both parts of the formula, the reversed order does not follow a logical flow, which can create more cognitive work for readers or even confuse them. This logical flow relates to the question-answer format. We need to ask a question before we answer it. But the "we did Y to learn X" order states the answer—or the approach to finding the answer—before stating the question.

To craft a study question that logically guides readers into the story, use the "to learn X, we did Y" order.

Example 7

Avoid: In this study, we analyzed data from an ongoing cohort study of women of reproductive age to examine the potential association between adverse pregnancy outcomes and energy drink intake during pregnancy.

Preferred: To examine the potential association between adverse pregnancy outcomes and energy drink intake during pregnancy, we analyzed data from an ongoing cohort study of women of reproductive age.

Example 8

Avoid: In this study, we evaluated data on patients who had positive test results for SARS-CoV-2 and underwent a computed tomography scan or radiograph of the chest while in the hospital. Our goal was to calculate the rates of intrathoracic complications in patients with COVID-19, determine the clinical predictors of these complications, and assess the association of these complications with patient outcomes.

Preferred: In this study, our goal was to calculate the rates of intrathoracic complications in patients with COVID-19, determine the clinical predictors of these complications, and assess the association of these complications with patient outcomes. To achieve this goal, we evaluated data on patients who had positive test results for SARS-CoV-2 and underwent a computed tomography scan or radiograph of the chest while in the hospital.

Pitfall 4: Feature the Hypothesis

Some medical writers will omit the "To learn X, we did Y" formula entirely and only state the hypothesis. Hypotheses are an important part of the scientific method, and many fields believe that a hypothesis must be stated to consider the work research. But hypotheses convert your question into a prediction that lacks persuasion. Without the study question, you do a disservice to the study by not piquing readers' curiosity.

To craft a persuasive Tension, state the study question with the "To learn X, we did Y" formula, and then you can follow that question with your hypothesis.

Example 9

Avoid: We hypothesized that physical activity in young adulthood would be associated with a lower likelihood of nonalcoholic fatty liver disease in middle age.

Preferred: In this study, we aimed to identify the association between physical activity in young adulthood (ages 18 to 25 years) and the prevalence of nonalcoholic fatty liver disease in middle age (ages 43 to 55 years). To this end, we analyzed data from an ongoing prospective observational cohort trial. We hypothesized that physical activity in young adulthood would be associated with a lower likelihood of nonalcoholic fatty liver disease in middle age.

Example 10

Avoid: We hypothesized that ventricular volume expansion would be greater in patients who carry genetic mutations for frontotemporal dementia than patients who do not carry these mutations.

Preferred: In this study, we set out to determine the utility of ventricular expansion as a measure of early or presymptomatic disease in genetic frontotemporal dementia. For this purpose, we examined the ventricular volume expansion in patients who did and did not carry genetic mutations that cause frontotemporal dementia over 1 year. We hypothesized that ventricular volume expansion would be greater in

patients who carry genetic mutations for frontotemporal dementia than patients who do not carry these mutations.

Pitfall 5: Summarize the Key Findings

Another common pitfall is not related to the "To learn X, we did Y" formula but rather to what comes after the formula. Some medical writers will use the "To learn X, we did Y" formula and then immediately follow the formula with a summary of the key findings (and even the conclusions) of the study. They believe that including this summary in the Tension is a conventional standard. But including this summary in the Tension is a missed opportunity to tell a compelling story. When you summarize the key findings immediately after the study question, you are giving away the story. Rather than entice readers to keep reading the manuscript, you immediately satisfy their curiosity, thereby draining their enthusiasm to keep reading the paper.

If you find yourself wrapped up in convention and hesitating to adopt this practice, you can find more formal support in the *AMA Manual of Style*. In section 19.1.2, the manual discourages writers from summarizing the study findings at the end of the Introduction section: "Results or conclusions do not belong in the Introduction section of a manuscript."[4]

To craft a Tension that captures readers' attention, resist the temptation to summarize the study findings immediately after the study question. Instead, reserve these details for the Climax part of your Discussion section.[2]

Example 11

Avoid: To determine whether 6q deletions are associated with breast cancer outcomes, we probed for 6q with a microarray containing tissue from more than 1000 patients with breast cancer. We found that the 6q deletion was often present in breast cancer tissue, but the deletion was not associated with the prognosis of patients with breast cancer. Thus, analysis of the 6q deletion may not be a valuable proxy to predict clinical outcomes in patients with breast cancer.

Preferred: To determine whether 6q deletions are associated with breast cancer outcomes, we probed for 6q with a microarray containing tissue from more than 1000 patients with breast cancer.

Example 12

Avoid: To assess the association between bleeding and a new diagnosis of cancer, we examined the number and proportion of new cancers diagnosed in patients with gastrointestinal or genitourinary bleeding after beginning treatment with antithrombotic drugs for atherosclerosis. We found that gastrointestinal and genitourinary bleeding were associated with patients at a high risk of being given a new cancer diagnosis, particularly for gastrointestinal and genitourinary cancer. These findings support that health care providers should carefully search for undiagnosed cancer in patients receiving antithrombotic drugs.

Preferred: To assess the association between bleeding and a new diagnosis of cancer, we examined the number and proportion of new cancers diagnosed in patients with gastrointestinal or genitourinary bleeding after beginning treatment with antithrombotic drugs for atherosclerosis.

SUMMARY

The study question is the most fundamental part—the guiding star—of a research manuscript. This question engages readers by sparking curiosity and creating tension in the research story. By avoiding common pitfalls in crafting a study question, medical writers can create a good Tension that persuades readers to keep reading and guides readers into the next part of the story.

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