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| RESEARCH ARTICLE

Fundamentals of Research and Statistics for Physicians

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| ABSTRACT
Although there is a constant need for clinicians to understand research, there are few opportunities in the medical curriculum that teaches us how to approach research. There is a growing importance of understanding the approach to research papers and introductory statistics for early clinicians pursuing a career in psychiatry. In our manuscript, we provide guidance to make this process more manageable and efficient by comparing research papers to the standardized clinical subjective, objective, assessment, and plan (SOAP) notes while defining statistical significance.

| KEYWORDS
Clinicians; medical curriculum; psychiatry

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1. Introduction

While teaching an introduction to research course to students over the past 4 years, I found my students often were overwhelmed as they learned to read research papers. The most common feedback I received typically focused on students' lack of understanding of basic statistics. Although the medical field encourages physicians to keep up with or even pursue research, there are few places within the medical curriculum that teaches clinicians how to understand and critically review research papers. In this viewpoint, I will discuss the basics of understanding and reading a research paper. First, we will compare the difference between a research paper to a traditional clinical SOAP note. Through this comparison, I will illustrate how certain sections of the paper can be prioritized over others in an objective manner. It is important to remain objective as well as efficient when reviewing a large amount of data. Second, I will explain how to understand the methods and results section. In these sections, it is important to understand the common statistics used, as well as how to appreciate them in terms of statistical relevance. My goal is to help both physicians-in-training as well as practicing physicians an easier way to find, sort, and understand the data in any given paper in a manageable fashion.

1. Breaking Down Papers: Comparing Research Papers to a SOAP Note
   Common mistake individuals make is reading the entire paper. Most papers are divided into several sections: abstract, introduction, methods and materials, results, discussion, and conclusion. This is a similar structure to a clinical SOAP note, which focuses on the Subjective, Objective, Assessment and Plan. In reviewing a patient's medical record, the abstract is most similar to the initial snapshot page, in which you can find the overall picture of the patient. Next, the "Introduction" section is comparable to the clinical "Subjective" section. In this section, a paper's authors illustrate the most relevant history along with the newest information regarding this case. After that, the "Methods" section is analogous to the clinical objective section. Similar to how clinicians write the process and findings of visual and physical evaluation of a patient in the "Objective" portion of the SOAP note, in a research paper, the methods section demonstrates the "how" of data collection. The "Results" and "Discussion" sections are analogous to the "Assessment" portion of the SOAP note. Here, a paper's authors describe the data, the data's highest conviction, the reasoning behind the conclusion reached, and the study limitations. Ruling out differential diagnoses is very similar to reviewing the limitations of a study. Finally, the

"Conclusion" is similar to the "Plan". This is where the author describes the clinical or research significance and the next steps, just as a physician writes the studies and treatments to target a given malfunctioning physiologic process.

When initially perusing a research paper, the most important sections to start with are the "Methods," "Results," and "Discussion." Just as in a SOAP note, where the "Assessment" and "Plan" are often reviewed first. In fact, there are ongoing discussions to rearrange the SOAP note format into APSO[1], as the "Assessment" and "Plan" sections provide the most critical information. While there is no similar discussion to rearrange the layout order of a research paper, this demonstrates the importance and value of the methods, results, and discussion.

2. Understanding Statistical Significance

When reviewing the results section, there are a few items for psychiatrists to consider. First, always assess the number of patients involved. Because it is often difficult and costly to study the entire population, researchers will often use a subset of the population, known as a sample size, to represent a population. In the "Methods" section, researchers often include inclusion and exclusion criteria. It is important to review these criteria to determine if the sample size is representative of the population as a whole. In addition, the larger the sample size, the more likely the results are statistically significant.

Second, there are many different statistical tests that are used: t-test, ANOVA, chi-squared test, et cetera. The choice of the test is determined based on population parameters, and the variables studied, whether they are numerical or categorical. Regardless of the type of study, a p-value is often used to demonstrate statistical significance. The p-value validates the paper's hypothesis, as it represents the likelihood of results that are due to chance. While researchers (and readers) want the sample size as large as possible, the p-value should be as small as possible. For results to be statistically significant, the p-value has a goal of < 0.05. This translates to a result due to a chance of less than 5% of the time. Recent literature suggests further decreasing the p-value to <0.005 for new discoveries[2]. Oftentimes in clinical research papers, the focus is on the few variables that were considered statistically significant, usually based on the p-value.

Finally, the most important concept to understand in research is that correlation does not equal causation. This is especially important in examining clinical research, where different variables frequently will be correlated to one another. It is easier and hence more common to demonstrate correlation than causation due to the difficulty of demonstrating the latter. For two variables to be causational, Hill's criteria are often used [3]. Hill's criteria take into account a variety of factors to demonstrate causationality. For example, are the results consistent? Is there a temporal sequence between the two? Is there a dose response? Although Hill's criteria are not applicable to every study, it does provide a basic framework for understanding how correlation can differ from causation.

Although the study of statistics is an incredibly complex topic, the fundamentals of statistics are not. In a field like psychiatry, where associations and causations are easily misinterpreted, it is critical that a reader understand these statistics fundamentals. And by recognizing the similarities between a SOAP note and a research paper, students will be less overwhelmed and have an easier time understanding how correlation does not equal causation.

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