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Scientific Writing: Discriminating Good from Bad

Part II: Surveys

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In part I of this series, you tested your skill as a critical reader of medical/chiropractic literature. Some of the flaws were obvious; some may have eluded you. Now let's look at the basic types of study designs and some of their strengths and weaknesses. Then we'll begin to develop a method of dissecting scientific studies systematically, searching for flaws and evaluating their real meaning.

Cross-Sectional Surveys

Cross-sectional surveys are sometimes referred to as static studies because, as the name implies, they attempt to evaluate a group or population at a single moment in time. In a sense they measure a population at risk and the prevalence of the disease or condition they are at risk for at the same time. Thus, they can provide information about potential risk factors such as age, gender, occupation and so on. We might, for example, measure the prevalence of lumbar disc degeneration in an urban setting and find that the highest prevalence is seen in sedentary workers. But, while it is tempting to speculate further on this relationship, the cross-sectional survey can do no more than establish a link between employment and disc degeneration. It would be impossible to know if people with disc degeneration had sedentary jobs as a consequence of the disorder or if the disorder was more a consequence of sedentary work. Nevertheless, the cross-sectional study is an effective, quick and inexpensive way to identify risk factors which can be explored later and in more detailed longitudinal surveys.

Longitudinal Surveys

As the name implies, a longitudinal survey studies a group or population over a period of time. This time period might be several weeks or, as seen in more ambitious studies, a lifetime. In contrast to cross-sectional studies, longitudinal surveys are said to be dynamic. In this type of study we might look back into time or

forward into the future. These studies are primarily designed to look at etiological questions of cause and effect. Longitudinal surveys may be divided into prospective and retrospective studies depending on the direction we are looking in.

In a prospective study, referred to also as a cohort study, subjects are followed forward in time. In a typical study of this kind the study group or cohort selects themselves into a number of subgroups. This selection process may be deliberate or due to factors beyond their control. The researchers can then subdivide this cohort into risk categories that they intend to watch. The subjects that develop the disease or condition can then be compared based upon their particular risk factors. A familiar example of this type of study is the Framingham heart study. Researchers were able to establish a direct link with several risk factors (such as smoking, obesity, hypercholesterolemia, etc.) and heart disease.

While a cross-sectional study can provide information concerning the prevalence of a disease (i.e., the number of people afflicted at any given time), a prospective study can provide information about the incidence of that disease (i.e., the amount of occurrences). It is probably safe to say that the prospective study is the ideal type for measuring diseases/disorders and their risk factors. Unfortunately, this type of study is also expensive and labor intensive. And, if you intend to measure a relatively rare condition such as ossification of the posterior longitudinal ligament (OPLL), you will need an incredibly large sample size. If a condition occurs in 1:100,000 people and your sample size is 100,000, the chances are that only one or two (or none) of your subjects will develop the condition. Any common risk factors that you might find in two patients will not be statistically significant anyway.

A retrospective study looks back in time. This type of study is easier to perform than a prospective study and would be most useful in the previous example of OPLL. Here we could survey radiology centers, collect a number of established cases and then conduct our study with that group. Retrospective studies are frequently referred to as case-control studies because researchers compare the potential risk factors in patients who have developed the disease or condition with those of control groups who do not have the condition.

There are, however, several potential shortcomings with this type of study. For one thing, patients' memories of events and details of years past may be foggy. They may either forget, overestimate or consciously lie about past events. For example, mothers of children with birth defects will be more likely to recall any and all minor illnesses that they had during their pregnancy than the mothers of healthy children.

This problem, called "recall bias," takes many forms and must always be considered. Although we cannot eliminate it entirely, we can account for its potential effect.

Another problem with retrospective studies is the selection of controls. If the cases and controls are not comparable (aside from the obvious fact that cases have the condition and controls don't) the study may be hopelessly flawed. If a disease occurred predominantly in middle-aged Asian males and we selected middle-aged white, black and Hispanic males for our control group, the results would be meaningless. Similarly, we must be careful to match for age and gender. And when designing a study, we must try to identify potential risk factors so that they can be accounted for. Several years ago, several researchers were studying a peculiar birth defect found in Chinese immigrants. Because the researchers had the foresight to inquire as to the patients' place of birth, they were eventually able to stumble upon an important commonality in these people. In the several years before their birth, an industrial plant in China had dumped tons of toxic chemicals into a river from which several municipalities obtained their drinking water. The mysterious thread joining these immigrants was that their mothers had all lived in coastal municipalities down river. This study led to other important epidemiological studies which were conducted in China in subsequent years which uncovered a higher incidence of several other forms of disease in those people consuming this polluted water.

In part III of this series, we will explore the general framework of clinical trials.

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