Bias: Linking Evidence With Practice

If you ask an epidemiologist for a definition of bias, you will get something like, “A systematic deviation of the sample parameter estimate from the population value.” Unless you are also an epidemiologist, this is unlikely to be helpful. Broken down into more accessible language, it would look something like, “A difference [deviation] in a particular direction [systematic] between the results of a study [parameter estimate] and what happens in real life [population value].”

Put another way, bias means that the information in front of us gives an incorrect impression of what is really going on. Note that bias is different from error. Random error occurs because the way we measure things—whether by observation, questionnaires, interviews, measurement tools, or images—is never perfectly accurate (FIGURE). Later Evidence in Practice articles on measurement will discuss this issue.

Any information can be biased, whether it comes from research, clinical experience, professional courses, colleagues/peers, the media, etc. The first Evidence in Practice article in the series explained some of the biases related to information from clinical experience. Bias tends to overestimate effects. For example, treatments appear more effective than they will be in practice, diagnostic tests appear more accurate than they really are, and prognostic factors more strongly predict outcomes. In the clinic, it is easy to see how overestimation of the effectiveness of a treatment could influence management. Overestimation of the accuracy of a diagnostic test could lead a clinician to weight the results of that test more highly than is warranted. Information from a study with a biased estimate of prognosis could lead to inaccurate advice and expectations.

Some Types of Bias
There are many, many different types of bias. A few that apply to research (and sometimes to clinical experience) are below.

Selection Bias Consider 2 studies, (1) a randomized controlled trial in which patients with back pain are randomly allocated to receive either an exercise intervention or an information booklet, and (2) a comparative study in which patients with low back pain receive either exercise or the booklet, based on the choice of a treating clinician. Estimates of comparative effectiveness can be derived from either study by looking at the difference in outcome between the exercise group and the booklet group. It is not difficult to imagine that the treating clinician would choose the exercise intervention in study 2 for the patients the clinician thought would benefit most from exercise; after all, that’s what would happen in practice. But there are likely to be important differences between the people who get the exercise intervention and those who get the booklet in study 2, which means the estimate of treatment effectiveness may be biased. The randomization in study 1 would overcome such risk of selection bias.

Performance Bias Often, the people involved in a study, particularly therapists and participants, will have a “horse in the race,” that is, a belief that one or another treatment is better and therefore a desire for the study results to fall a certain way. For example, a physical therapist might hold a strong belief that exercise is necessary for these patients, and should not be replaced by a simple information booklet. Similarly, a patient might be quite disappointed if he or she receives just a booklet instead of an exercise program. If this is the case, then the physical therapist might not deliver the 2 interventions with equal enthusiasm and confidence, and participants might not read and follow the information in the booklet. Therapist blinding and patient blinding overcome performance bias, but blinding is often difficult or impossible in physical therapy trials. The risk of performance bias can be reduced by ensuring that the
control intervention appears as credible and worthwhile as the index intervention. **Detection Bias** The beliefs that the treating clinicians and participants have about the treatments can also result in bias when it comes to measuring outcomes. If a treating clinician is collecting outcome measures and knows which treatment a participant received, then he or she may subconsciously interpret or score outcomes in a way that favors the intervention group. If a participant feels discouraged about being in the control group, then he or she may form a more negative appraisal of his or her symptoms, or express disappointment with scores on self-reported outcomes. Detection bias is overcome by blinding the outcome assessors. However, this is difficult for patient-reported outcomes, as, essentially, the patient is also the outcome assessor. As in the case for performance bias, researchers attempt to reduce the risk of detection bias by ensuring that the intervention and control treatments are equally credible.

**Attrition Bias** No matter how well a study is run, there will be participants who drop out and others who do not complete all the follow-up measures. The fundamental issue is that we do not know what happened to the people who did not complete all the outcome measures. We cannot just assume that, on average, they are the same as the people who stayed in the study. The likelihood that dropouts and missing data introduce bias into a study depends on a number of factors. These include the proportion of participants who completed the study, the balance of dropouts between groups, the comparability of dropouts and completers, and the way that the statistical analyses were performed. Ensuring a high follow-up rate (greater than 85%) and conducting intention-to-treat analysis are ways of reducing the risk of attrition bias.

**Summary**

All studies are at some risk of bias. The idea of assessing risk of bias is to provide a basis for giving more or less weight to that piece of information: if a study is at higher risk of bias, then we should be less confident about the findings. The same goes for information from clinical experience. When risk of bias is low, we think the information is closer to “the truth”; when bias is high, we think the opposite.

Clinical practice involves collecting relevant information from various sources and boiling it down to make a decision. In doing so, you should pay more attention to information that is less likely to be biased. 

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