As we were reading through the January and then the March 2018 issues of *IJATT* (Volume 23, Issues 1 and 2), we reflected on the number of Critically Appraised Topics (CATs) that were included in those issues (4 articles of about 14 total). We are pleased with this consistency; CATs were the first new manuscript format that we introduced to *IJATT* in 2014,1 shortly after taking over as Co-Editors-in-Chief*.2 Today, we see a steady flow of high-quality CATs being published in *IJATT* and we are proud to bring these brief evidence-based critiques to our readers. Keep them coming!

On that note, we would like to further expound on the “critical” and “critique” part of CATs, and the appraisal that is an essential skill set for an evidence-based practitioner and consumer of the scientific literature. Specifically, we are highlighting bias—that word that has strong negative connotations, signifying poor research methods, unfavorable clinical practices, and/or unfair societal effects. Bias is something that is truly fascinating, not just for research, but also in clinical practice, education, and life.

Bias in Research

When critically appraising the external evidence, we have already discussed the hierarchy and levels of evidence,3,4 striking a balance between control and generalizability;5 and the symbiotic relationship between internal and external evidence.6 From a research perspective, we have to be aware of factors that affect the “truthfulness” of the study. In other words, how strongly can we believe and trust the results of a study? One factor that influences the truthfulness of a study is random error. Random error tends to increase the variability of the study results by adding noise. As a result, this type of methodological error will tend to decrease the strength of the results, leading to smaller effect sizes, larger, nonsignificant *p*-values, weaker correlations, etc. Alternatively, there is systematic error. Systematic error is a specific error signal introduced to the data; this type of methodological error tends to decrease the variability and increase the strength of the results. Larger effect sizes, smaller, significant *p*-values, and stronger correlations tend to be the consequence of systematic error.

Sometimes systematic error can come from impartial sources, such as the instruments we use to collect data. For example, if a digital goniometer is poorly calibrated and off by 5 degrees, this error may be carried over across the entire data collection session. This is a form of systematic error that can be mitigated by ensuring that instruments we use are calibrated and accurate for capturing relevant data within a research study. In contrast, another form of systematic error is bias. Bias is when we hold prejudicial views (conscious or subconscious) that can affect any aspect of our research (and we are specifically talking about bias in research for now). Bias in research can occur on many levels, from the development of a study to data collection, data analysis, the interpretation of results, and even to the publication of manuscripts. We take certain steps in the research process to control for our own biases through processes such as with randomization and blinding, when appropriate. While controlling for systematic error is certainly an important part of the research process, it is also important to realize that our biases can, and do, affect the way that we design studies, collect and process data, as well as how we analyze and interpret results. The key point we want to make is that bias is not inherently “bad”. We should not ascribe a value to bias. Bias always exists, and allows us to make sense of our research world. Our prior knowledge—previous research experiences as well as our academic, clinical, and educational experiences—influences how and why we make the research decisions we do.

That is not to say that bias should be ignored! We should (must) be able to (1) identify (recognize) potential sources of bias in the research we, and others, perform. Identification—the recognition of specific biases—tends to be a fairly objective assessment. We should also be able to (2) make a judgment as to the seriousness of the bias. This is a more subjective assessment. We have to use our own information (and biases!) to determine if the identified bias in a research study is too influential to consider the research to be valid in our own practice or research. That being said, we can also see that it may be perfectly valid for someone else’s area of work. With these two crucial steps (identification and judgment of bias), we are able to better critically appraise the literature we read and also to design better research studies.

Bias and the Hierarchy of Clinical Research Evidence

In the discussion of critical appraisal, the Hierarchy of Clinical Evidence pyramid (Figure 1)9 is often invoked, and used to assign a value to clinical research designs. Within the levels of evidence, systematic reviews and meta-analyses are at the top; anecdotal evidence is at the bottom. Randomized controlled trials (RCTs) are right near the top.4 However, we have to remember that research at the top is not inherently “good”; research at the bottom is not inherently “bad”. Research at the bottom has the tendency to be less controlled, increasing the risk of bias. Research toward the top has the tendency to be more controlled, decreasing the risk of bias. We
have specifically italicized the words tendency—because the level of control is not always true—and also risk—because bias can exist in any research design regardless of the level of control.

Bias in Clinical Practice (Clinician’s Perspective)

We also have to consider our own biases as clinicians. At times, we select interventions with which we have seen success and/or are comfortable and familiar using. These are perfect examples of bias in clinical practice. These biases are not inherently bad, if the clinician identifies these biases and makes a judgment as to why these biases are held. It is necessary to use this internal evidence (clinician expertise—the things we know and believe). Discounting this internal evidence is throwing away a vast amount of the information that could, and should, be used when making clinical decisions. We cannot go into each situation (clinical or research) as a complete clean slate; this is an inefficient way of choosing courses of action and is prone to mistakes. The following is a situation to explain this.

In our Athletic Training Education program at Ithaca College, we use a model to explain clinical reasoning, a process through which we progress from novice to expert clinician. Part of this model describes how a novice will use information to make a clinical decision compared to a more experienced clinician. A novice clinician tends to use a strategy that involves Information Gathering—picking up pieces of information, and having a difficult time filtering what is relevant from what is irrelevant. A highly-experienced clinician tends to use a strategy called Case-Pattern Recognition. Through Case-Pattern Recognition, the experienced clinician can efficiently, and correctly, filter the relevant information from the irrelevant, and streamline the clinical decision-making process. Of course, there is a chance for mistakes (there always is), but a true expert is able to filter in a way that relevant information comes in clearly, and can also zero in on pieces of seemingly irrelevant information that may become relevant as the context of the evaluation changes. Case-Pattern Recognition is an example of bias in clinical practice—the expert clinician is using extensive education and previous experience to filter this information. This method is completely acceptable, if used appropriately and with the clinician asking “how” and “why” throughout the process. This strategy could backfire, if a clinician is defaulting only to what they “know” without asking the critical questions of “how” and “why”—in other words, not acting as an evidence-based practitioner.

Bias in Clinical Practice (The Patient’s Perspective)

Our patients have biases (Oh my! Who knew? . . . Just kidding.). Their previous experiences, previous treatments, education and educational level, ethnicity, geographical region, previous injury, health status, previous experience with certain clinicians and practitioners, exercise status, family history, sex, occupation, family status, age, gender (should we go on?) all bias the way that they will approach the intervention that the clinician suggests. It is up to a good clinician to discuss the patient’s viewpoints to educate (thus, adding another influence to the patient’s/client’s biases), and to provide the “whys” and the “hows”, as necessary, in a way that the patient can understand. In this way, the patient’s own biases help to provide context into their preferences and values in the framework of evidence-based practice. A good clinician does not attempt to control the biases the patient holds, but rather capitalizes on them to foster better clinical decision-making.