“He Said, She Said”

How to Analyze Fitness Research

Compiled by Dr. Jonathan Fass, PT, DPT, CSCS for the Personal Trainer Development Center (theptdc.com)

You can also find this Ebook published in full at http://www.theptdc.com/2014/06/analyze-fitness-research/

The fitness industry is rife with lies, dishonesty, but most of all, unfounded claims. It's become commonplace to use cherry-picked, biased, and misinterpreted research to back up promises and marketing.

Some of today's controversial fitness and health subjects include:

- CrossFit
- The use of steroids in sport (or for aesthetics)
- The efficacy of the Functional Movement Screen (FMS)
- Whether vaccines are good or bad for children
- The benefits vs. Drawbacks of steady-state cardio
- And a host of diets and workout plans for putting on muscle or burring fat

I commissioned Dr. Jonathan Fass to write this Ebook because the problem is getting out of hand and I'm not proud to admit that it's the fault of many trainers who either knowingly or unknowingly perpetuate dogma as fact. Instead of debating one side, we're here to help you come to your own conclusions.

This is a must read by every serious fitness professional, everywhere. Complete with terminology and cheat sheets, it will show you how to disseminate whether a claim is legitimate or not.

Please take your time with it. Print it out. And share it with other fitness professionals.

To your success,
Jonathan Goodman
Head coach / founder of the Personal Trainer Development Center

Table of Contents

Introduction ---- 4
Analyzing Ms. Buckley's Article ---- 9
Analyzing Mr. Kompf's Article ---- 14
Terminology Cheat Sheet ---- 23
(Cheat Sheet) Six Steps to Evaluate a Claim ---- 28
References ---- 30
About the Author ---- 32

Introduction

Congratulations, you're now a research scientist! You now can read and interpret research like an expert, to analyze statistics, evaluate methods, and come to reasoned and informed conclusions about the world of health & fitness!

If only it were that simple. The fact is, understanding and being comfortable with research takes an incredible amount of time, effort, and commitment to learning. The good news, however, is that there are things that you can do *right now* to make you instantly better at understanding the basics of evaluating arguments and research -- and you're going to learn how to right now.

In this article, I'm going to show you how I quickly analyze claims, using a simplified version of the approach that I use on my podcast, The Strength of Evidence, to evaluate evidence to help you make better choices and better use of the information at your fingertips. Best of all, although it will take practice to become entirely comfortable with reading research, learning the basics shouldn't take much more than the time that it takes you to read through this article.

To become truly comfortable with research, you'll need to put in time and effort. At just under 6000 words (with an additional 2000 more, counting the terms cheat sheet and reference guide!), even this "introductory" article is one of the longest ever to run on the PTDC.

Don't let that frighten you off: the information and techniques that you'll learn here are extremely important and can help you become better at every aspect of your job as a trainer/ coach, a nutritionist, physical therapist, or general gym jock looking to make some sense out of the often contradicting information that floats around the internet.

The analysis that we'll perform together will come from two recent articles published on the PTDC: Justin Kompf's "Is Posture Important," and Ellen Buckley's rebuttal article, "When Does Posture matter?" If you haven't read them already, you should familiarize yourself with both:

understanding each argument is key to being able to accurately evaluate their opinions and the evidence that does -- or does not -- support those positions.

In his article, Mr. Kompf makes the case that the typical personal training assessment, one that includes static postural assessments, may not be as valuable as we're made to believe. He argues that the evidence doesn't support general static posture assessments and describes research indicating that posture offers little information regarding things that would be of interest to most personal trainers, including pain. He also argues that popular movement screens such as the FMS may offer limited value for most personal trainers that work with general populations vs. the athletic populations that the FMS appears most valid for.

In response, Ms. Buckley indicates that the evidence does in fact support postural assessments, and rather than being essentially useless, they can be used to predict things such as low back pain. She argues that Mr. Kompf's evidence was cherry-picked and that better evidence -- where specific traits are used to classify and subgroup within populations -- shows that posture assessment are still important. She offers her own expertise as a physical therapist as well as personal experience along with a number of studies.

Before we get started with our analysis, however, you're going to ask yourself a question, something that you should do whenever you're about to receive information on a subject: "what's my bias?"

Bias, if you're unfamiliar with the term, is defined as "a tendency to believe that some people, ideas, etc., are better than others that usually results in treating some people unfairly" (1). Bias is the sum of our emotions, experiences, beliefs, and intuitions. It influences our decision-making by causing us to prefer some explanations or ideas to others before we openly consider new information.

In fact, research methods themselves are an attempt to reduce the effect of bias on our

observations. A carefully controlled study has a much lower risk of bias confusing an outcome than does, say, a casual observation of an event. By understanding your own bias before you begin, you're helping to guard against being prejudiced against information that contradicts your beliefs, even when that information is valid.

Full disclosure: my bias sides with Mr. Kompf's take on the subject of postural assessments; he even quoted me in his article! Knowing this, I must be very careful in how I analyze these two papers:

- Am I applying criticism fairly to both articles?
- Am I pointing out a flaw in one that I am forgiving of in the other?
- Am I choosing to focus on a point of disagreement that allows me to maintain my beliefs even though, in fact, that point is either weak or entirely irrelevant?

Whatever your bias is, you also need to consider what kind of information would cause you to abandon that belief and take the opposite position. Scientists do this all the time: rather than trying to "prove" beliefs -- a terrible way to corrupt data through bias as well as being beyond the power of any single paper or even group of papers -- researchers actually try to *disprove* their hypotheses. When a hypothesis continues to stand up to scrutiny, it remains; when it can't, it's discarded for new, better hypotheses.

In the famous example provided by the philosopher Karl Popper, the belief that "all swans are white" is immediately disproven by the observation (and technically, the validation of that observation) of a single black swan ("No number of sightings of white swans can prove that all swans are white. The sighting of just one black (swan) may disprove it."). This is called "falsification," and it's one of the important standards of critical thinking: beliefs that can be falsified should not be regarded as providing "best evidence" in a topic.

So what is *your* falsification evidence in this argument -- that is, data or observation that would

disprove your own belief? If you believe that posture is important, maybe falsification for you would be evidence that showed that there are no correlations between standing posture and pain or performance? If you believe that posture is overrated, perhaps falsification of this belief would be evidence that shows that when posture is changed, people experience pain or reduced strength in activity?

By deciding what to look for *before* you read an argument, you can be more consistent in guarding against personal bias and assessing information rationally and consistently. After all, if you decide that in order to stop performing posture assessments of your clients you would need to see evidence that posture doesn't influence pain, you'll be forced to deal with such evidence if it's presented rather than dismissing it to maintain your bias. All of these things are important to consider as we look through the papers, which is what you should do right now.

To keep things a little easier, we're only going to focus our attention on the first half of Justin's article and the focus of Ellen's rebuttal -- posture assessments. We're also going to limit the analysis to the research cited as it relates to each argument. Why? Because an argument is only as valid as the information that supports it.

By looking at the evidence itself, we can evaluate claims more effectively without being influenced by writing styles or anything else that would otherwise take our focus off of the things that truly count: who has the benefit of the evidence itself. Personal experience and education such as the qualifications listed for Ms. Buckley can be helpful at times, but there are very important limitations to personal experience.

What we take from any personal event can and will be influenced through our personal biases, inability to account for all factors that might influence outcomes, as well as an inability to accurately observe events due to the nature of our senses and everyday analytical abilities.

As an example, I have a similar background to Ms. Buckley as a physical therapist myself. If we

come to different conclusions, each offering different personal experiences and clinical beliefs, how could either of us have a superior argument? We *must* use research to help us determine the hidden variables within our observations or explanations -- called confounding variables -- that one or both of us are likely missing in any personal observations.

As you follow along with each paper analysis, keep a few thoughts in mind:

- Does this paper generally support the argument being made, or are the conclusions different from what is being claimed in the original article?
- Is the paper compromised by obvious issues, perhaps the size of the sample of subjects (smaller studies may not accurately represent the general population), or perhaps there's a difference in the subject or the article vs the subject of the research paper (studies need to be as specific as possible, and we cannot use a research paper looking at dynamic posture if our argument is concerning static posture unless we know that they are actually equivalent, for instance)?
- Is the paper representative of the larger body of evidence, or is it a single paper? We always want to understand, when possible, what multiple studies have concluded, not just one. Because of this, we can never assume that a single paper -- no matter how well performed it might be -- is accurate. There is always a chance that its findings cannot be duplicated.

Analyzing Ms. Buckley's Article

The first offer of evidence made in Ms. Buckley's article refers to sitting and the occurrence of back pain, where she states that "(p)oor sitting posture has been consistently shown to be a strong predictor of low back pain." She references the article "Conservative Treatment of Acute Low-Back Pain: A Prospective Randomized Trial: McKenzie Method of Treatment Versus Patient Education in "Mini Back School." Does she make a strong case?

Ideally, we would want to read the paper itself (and all the papers cited as references) to decide the quality of that paper, based on its methods, its statistical analysis, its design weaknesses, etc. However, I'll work under the assumption that unless the paper happens to be accessible freely (which isn't always the case, as most journals are protected behind a pay-wall) the average reader won't have access to the full article.

Therefore, I'll show you how to look for clues when you can't assess a paper thoroughly (always read a paper fully if you're able to -- an abstract tells you nothing about the quality of a paper and its findings).

The first thing to notice is that this argument doesn't refute anything directly in Mr. Kompf's article. He never speaks about sitting, sitting posture, or how that may or may not be related to experiencing low back pain. We should therefore be cautious here -- when a person introduces a variation of an argument, it's called a "strawman." It changes the actual content of the opponent's argument to more easily refute it.

In this case, Mr. Kompf's description of standing postural assessments becomes refuted with an argument of sitting posture, which are two different things: one doesn't necessarily have any relevance to the other, and vice-versa.

We should also notice that her study doesn't appear to test the relationship between sitting

posture and the prediction of low back pain at all! It is a study testing something called the McKenzie Method, which is an evaluation and treatment approach in rehab, developed by the late Robin McKenzie.

We should be very cautious here, too -- citing a study that doesn't investigate what's being claimed should immediately raise a "red flag." Either the article is cherry-picked for the illusion of evidence, or the article may make reference to what is being claimed in the introduction and its own works cited, indicating that the original source of that information has not been verified or validated by Ms. Buckley. Essentially, this is "research hearsay," and should never be accepted as a quality argument.

Finally, we should also note that the claim and the type of evidence itself don't match. Ms. Buckley states that her assertion has "consistently" been shown in the evidence. This would indicate that there are a number of quality studies showing this argument. We might expect to see things called "Systematic Reviews" or "Meta-Analysis" papers, which are collections of studies performed in a specific area. These are strong sources of evidence, because they allow us to look at an entire body of work, not just one or two papers. A single experiment is not evidence for anything "consistent."

However, we shouldn't assume that there are any such reviews available. Perhaps Ms. Buckley's paper is the best currently available? A quick search on the research search engine Google Scholar can give us a clue.

Using the search terms "Low Back Pain & Sitting Posture," I was able to quickly find a systematic review titled "Review Article: Is sitting-while-at-work associated with low back pain? A systematic, critical literature review" (2). The researcher's findings state that:

> "Eight studies were found to have a representative sample, a clear definition of LBP and a clear statistical analysis. Regardless of quality, **all but one of the studies failed to find a positive association between sitting-while-working and LBP.** High quality studies found a marginally negative association for sitting compared to diverse workplace exposures, e.g. standing, driving, lifting bending, and compared to diverse

occupations. One low quality study associated sitting in a poor posture with LBP (emphasis mine)."

It's important that when we read the abstract, we can't say confidently that this is a quality paper -- after all, a review paper may itself be flawed in some way as to make the results unusable. However, it's probably fair to say that we have gathered enough evidence to doubt the reliability of Ms. Buckley's first cited statement based on our examination.

Ms. Buckley continues, adding that "more recent studies have found that back pain and posture can be sub-grouped, so there is a sub-group who hold themselves actively into extension who have pain, and a sub-group who are in excessive flexion with pain." In support of this, she provides a second article, "The relationship between posture and back muscle endurance in industrial workers with flexion-related low back pain."

Immediately, we should recognize that this study is attempting to compare current patients with low back pain with apparently healthy individuals without pain. This causes a problem for her argument -- there may be very important differences between people experiencing pain and those that are not, and the differences can't be seen as having a cause and effect relationship.

For instance, we know that when a patient is immobilized with a cast after they have broken an arm, they will have an atrophy of the muscles in that arm. If we were to compare individuals that have been casted after breaking their arms with individuals that had not broken their arms, we might find significant differences in muscle volume, strength, and symmetry side to side. Clearly it wouldn't make sense to claim that these things had always been here and that the breaking of the arm was caused by decreased muscle and strength.

In the same way, finding differences in sitting posture and muscle function in people currently experiencing pain and noting that those without pain do not have these issues doesn't tell us that sitting posture and muscle timing caused pain and should therefore be screened and evaluated in healthy populations.

Surprisingly, by just reading the abstract of this paper, we also find that rather than support Ms. Buckley's argument, it turns out that it really supports Mr. Kompf's argument! Besides finding differences in sitting posture (again, a strawman argument), the paper also finds that "There was no significant differences found between the groups for the standing and lifting posture measures." That *supports* Mr. Kompf's original article!

In her third citation, Ms. Buckley references a paper from the European Spine Journal. Again, confining our analysis only to what's publically assessable, we can still find issues with the paper that she has chosen to support her argument. It's immediately clear that this article does not make reference to static posture, but rather awkward dynamic posture (among a list of other variables) following fatigue in individuals already experiencing chronic low back pain.

This is a very different instance than what Mr. Kompf refers to in his article, and ultimately describes a clinical population in a very specific circumstance. Mr. Kompf's article looks at assessing apparently healthy individuals while standing still, while this journal article is describing individuals currently in pain and fatigued reacting to sudden changes in their balance in response to a sudden loading variable. They're about as distinctly different as one could imagine.

Once again, we must conclude that Ms. Buckley's evidence falls short of supporting her argument, and certainly doesn't provide alternative evidence to weaken Mr. Kompf's article.

Ms. Buckley ends her argument by referencing current examination guidelines next, stating that "the vast majority of clinical protocols (based on clinical trials) for all shoulder issues recommend postural assessment and treatment of major postural deviations" and referencing a single paper with the assurance that there are many more like it (it should be noted that she accuses Mr. Kompf of possibly cherry-picking his references, and then immediately does the same thing.

I'm not certain that making the same "mistake" that you're accusing someone else of just

previously is the best way to make a strong point, but I digress). So what does that paper, "Thoracic outlet syndrome part 1: Clinical manifestations, differentiation and treatment pathways," actually show us?

Unfortunately, the abstract doesn't tell us much, and without looking through the paper, we will have to take Ms. Buckley's assessment at her word. However, there's some information provided that is very helpful:

> "Thoracic outlet syndrome (TOS) is a challenging condition to diagnose correctly and manage appropriately. This is the result of a number of factors including the multifaceted contribution to the syndrome, **the limitations of current clinical diagnostic tests**, the insufficient recognition of the sub-types of TOS and the dearth of research into the optimal treatment approach (emphasis mine)."

This paper would seem to agree again with Mr. Kompf's argument: current evaluation procedures -- which may include static posture examination -- are limited! We can't conclude that current clinical protocols are valid and useful -- they may not be at all. Using a clinical protocol as evidence is only valuable if the methods within that protocol are valid and reliable.

A paper remarking that there are significant challenges to proper diagnosis of the condition in question doesn't show us anything that we might conclude as reliable and useful. We must also realize that again, Ms. Buckley continues to confuse individuals presenting with pain or disease with apparently healthy individuals in a personal training program.

From here, Ms. Buckley goes on to briefly discuss issues that she feels are more important in terms of injury risk, including neuromuscular timing. It's safe to say that the rebuttal argument that we analyzed here falls short of providing us with a consistent and reliable argument -- in at least one of these papers, her evidence supported her opponent's position!

Analyzing Mr. Kompf's Article

At this point, we'll leave Ms. Buckley's article and turn to Mr. Kompf's work -- did Mr. Kompf do any better and give us an argument worth considering?

Much like Ms. Buckley's paper, the articles Mr. Kompf presented are not without flaws, and we should be aware of these limitations. Mr. Kompf references two articles, both from Dr. Eyal Lederman, "The fall of the postural-structural-biomechanical model in manual and physical therapies: Exemplified by lower back pain" and "The myth of core stability."

Both of these articles are available as free .pdf files, and you should take a moment to read them. What you will see is that they are not studies, but rather review articles that make specific arguments. In other words, they're opinion papers. While an expert's opinion might be considered as evidence, it should be approached very cautiously.

Remember when I mentioned bias? A paper like this, by definition, is biased. It's making an argument in support of a particular concept or idea. As we see with these two articles on the PTDC, we don't always know which opinion is "right." Do we know for a fact that Dr. Lederman has provided us with a complete and comprehensive evaluation of the literature in either paper?

We should consider what he has to say -- and to that point, you'll likely gain a great perspective on issues that affect you as a trainer or therapist when you do -- but alone we shouldn't use this as evidence unless there is nothing else available on a subject, or risk being swayed by the original author's bias instead of the complete body of evidence in total.

Mr. Kompf did provide us with other papers, and many are also publically available. Mr. Kompf provides a direct quote from the paper "Lumbar Lordosis and Pelvic Inclination in Adults With

Chronic Low Back Pain" where he repeats the findings of the investigators "…patients with CLBP had no more standing lumbar lordosis or pelvic inclination than their counterparts with healthy backs…" However, this is actually an incomplete quote. In fact, the full sentence continues "…but that their abdominal muscle force was less than that of the control subjects."

This finding is somewhat contradictory to Mr. Kompf's thesis, and disregarding this aspect of the paper is cherry picking. Is the difference in abdominal strength important here? As we explained before, it may not be. We can't take information from patients in pain and assume that they reflect causes, however, this also suggests why we should always check references and sources. What Mr. Kompf decides is important or not important is an opinion. We should also be able to decide if this was decided appropriately ourselves.

The article itself, however, *is* informative -- when there are no identifiable differences between these two groups concerning a hypothetical cause, we can suspect that the hypothetical cause may not be a true cause. If the investigators could not find a difference in posture between healthy individuals and patients with pain, how could hypothetical differences in posture have caused that pain? It wouldn't make sense. This does support Mr. Kompf's position.

Mr. Kompf also explains that, contrary to popular belief, posture doesn't have a relationship to muscle strength, which would refute the current concept of "long and weak" as it applies to length-tension relationships in muscles of the body. To support this, he provides the paper "Relationships between lumbar lordosis, pelvic tilt, and abdominal muscle performance."

There are a few things that we must consider when looking at this paper.

It's a rather small study, 31 subjects in total, all of whom are physical therapy students. Does this matter? It may indeed. When researchers perform research on subjects, they're trying to capture a group that in theory represents very closely the entire population under consideration.

For example, if I wanted to know the average height of Americans, I would want my group being studied -- my sample -- to be representative of all Americans. If I took my sample only of Californians, perhaps they would be representative, but maybe Californians are taller or shorter on average than all Americans? If so, my results would be skewed. If I worked for the NBA and recruited my sample from the team that I worked for, I would have a disproportionately tall sample that was in reality quite different from the average American. Any findings from a paper evaluating average height but only looking at NBA players would not, therefore, apply to the "average" American.

This is called a convenience sample -- rather than looking to obtain a truly random sample of subjects, the researchers recruit subjects that are readily available. In this case, it was a study conducted in a physical therapy program using the students already in that program, not members of the university at-large, not members of the community at-large where the university is located, and not random samples taken throughout the state or country.

Issues such as activity levels and exercise history, body weight, age, health history, etc., may all be different in this group vs. any population that any of us might find ourselves working with. This is an important issue -- we should always seek out information that reflects the individuals and the conditions most similar to the ones that we are interested in. Differences between a study's population and the one that you work with can be important and lead to findings that don't apply to you.

The subjects' pelvic and lumbar positions were measured simply using a clinical method, which is valuable here, as it's similar to how most trainers or clinicians might measure these positions, too. However, the researchers chose a particular method to measure abdominal strength -- a supine leg lower. Is this a valid test of abdominal strength? Do we know? The authors don't tell us, they refer to the classic textbook "Muscles: Testing and Function, with Posture and Pain," but this is a book, and therefore it's also an expert opinion.

Unless we have validation studies of this particular test, we can't say that we know that the test is really able to measure what is being claimed (this is one of the basic forms of validity, called "construct validity"). Is it measuring all the abdominals, or just some? Is it a better measure of the hip flexors than the abdominals? Does it measure the abdominal force when in this activity, but fails to be applicable to other positions or activities such as squats or deadlifts, where we could imagine pelvic inclination being possibly more valuable? These questions require their own literature review, and until we have those answers, we cannot assume that this study provides much value to the central argument.

In "Incidence of common postural abnormalities in the cervical shoulder and thoracic regions and their associations with pain in two age groups of healthy subjects," Mr. Kompf's next article, we have a different set of problems to discuss. This study is what we call a "retrospective" or "case control study," where the researchers gather data from their subjects about events that have already happened, attempting to draw associations with a particular item of interest -- in this case, currently observed posture and previous incidents of pain or injury.

This is a good method of analysis, but not without drawbacks -- memory is very subjective, and the ability of the researchers to accurately find correlations is heavily reliant on the accuracy of reporting by the subjects. If I were to ask you to tell me every time you've bumped your elbow in the past five months, would you be able to? It's unlikely that you could, certainly not with a high degree of accuracy.

There may also be influential, causative factors that have not been considered by the researchers as well, and any investigation that fails to account for a true cause will miss real associations that could help to inform us about the condition -- in this case, pain secondary to cervical and thoracic postures. Therefore, even though the researchers were unable to find an association between postural abnormalities and pain, we can't be entirely confident that an association doesn't exist.

The researchers *did* discover an association -- an increase of pain reporting and individuals with the most severe postural deviations measured. Does this refute Mr. Kompf's claims? Again, with this type of study, we can't assume a cause and effect -- it's possible that these postural abnormalities were caused by pain and were not themselves the cause (this is entirely plausible).

It's something to consider, however, it could be reasoned that relatively minor changes in posture are harmless by themselves (and this study did observe that the majority of subjects had identifiable postural variations, which would indicate that "good" posture is not the norm, but would really be *abnormal*), but that more extreme variations of posture could be problematic. We can't be certain of this from the study, but we are unable to rule that possibility out, either.

However, we should also note in the methods section that the authors also used a sample of convenience, and therefore the issues that were just discussed regarding the previous paper exist here, too. At best, we can decide that this may be the case for this particular sample of subjects, but we can't automatically apply this information to all potential populations without better, more thorough, and higher quality literature.

In Mr. Kompf's next literature choice, "Subacromial impingement syndrome: The effect of changing posture on shoulder range of movement," the researchers used a wide range of clinical shoulder tests to evaluate the presence of absence of subacromial impingement syndrome, and how changing posture might affect these patients.

If you've been paying attention, you're probably already thinking "well sure, but these are people *already in pain*, and you'd be absolutely correct. Again, we're faced with the problem of a study that is looking at individuals already experiencing pain, which is not the same as the average personal training client who is presumably *not* in pain. Because of this, the findings of this study will have limited relevance to this argument.

If you've *really* been paying attention, however, another question should have entered your mind: how "good" are these tests? Are they reliable? This is an excellent question indeed. A good search of the literature will bring up a helpful meta-analysis of this very question, "Which physical examination tests provide clinicians with the most value when examining the shoulder? Update of a systematic review with meta-analysis of individual tests[3]" where the authors found that

> "Based on data from the original 2008 review and this update, the use of any single (shoulder physical examination) ShPE test to make a pathognomonic diagnosis cannot be unequivocally recommended… Combinations of ShPE tests provide better accuracy, but marginally so."

Recall that a meta-analysis is a very powerful form of evidence that not only looks at the body of evidence on any particular subject, but also runs analysis of the pooled data itself making it, in effect, one large and powerful study. What we can gain from this meta-analysis is that the tests used in Mr. Kompf's study cannot reliably evidence the presence of a "true" pathology, the subacromial impingement.

While it is a strength that the authors used common clinical tests as part of the analysis of their subjects, it's entirely possible that some or all the study's subjects did not suffer from subacromial impingement, and that could influence the outcomes observed in the study.

In addition, this study does not make a strong case for Mr. Kompf, either. While there are a number of strengths of this analysis, including placebo controlled subjects, the findings somewhat contradict the assertion that posture isn't related to aspects that might be important to a personal trainer, as the authors discovered that the experimental group increased their shoulder flexion and abduction ranges of motion.

We must conclude that this study offers us little in addressing the argument, and provides a small amount of evidence for the argument *for* assessing posture, with significant limitations in its applicability to the personal trainer.

The next study presented, however, offers a much stronger source of evidence to consider. Although the full study isn't available on a basic search, we are able to take some key points away from "Is there a relationship between subacromial impingement syndrome and scapular orientation? A systematic review." The authors report:

> "…there is insufficient evidence to support a clinical belief that the scapula adopts a common and consistent posture in SIS. This may reflect the complex, multifactorial nature of the syndrome. Additionally, it may be due to the methodological variations and shortfalls in the available research. It also raises the possibility that deviation from a 'normal' scapular position may not be contributory to SIS but part of normal variations."

Does this finding put the proverbial nail in the postural coffin? No, not quite. The lack of quality of currently available research must be considered in this statement, and it's always possible that higher quality evidence could produce more consistent and reliable data, and of course we can't evaluate the quality of the review itself.

However, this is certainly strong evidence to support the position that posture may not have any association with preventing or causing injury or pain. If there isn't a consistent pattern to look for, how would we even begin to evaluate any presumed deviation from "normal," as "normal" might represent a range of positions.

Mr. Kompf's final supporting postural article, "Assessment of the degree of pelvic tilt within a normal asymptomatic population," is unavailable without a subscription, so we'll have to take what we can from the abstract and remember to be cautious of any information that we can't verify by a full analysis of the methods used. However, the study appears interesting, finding that at least in asymptomatic populations (i.e., people without pain), not only is anterior pelvic tilt apparently common, but also may be the "norm."

There is an important issue to consider here too, of course -- observations of apparently healthy individuals do not rule out the possibility of future occurrences of pain, such as low back pain,

and therefore we cannot say that this finding is good or bad by itself. When we consider the commonly reported estimate of ~80% lifetime occurrence of low back pain in society, these numbers provide potential support that anterior tilt may be related (although the 80% value is likely incorrect, by a quick look into the literature (4,5). *Always* check your information, never make assumptions!). Alone, this study at best weakly supports the argument.

What have we learned today?

- We've learned that even the seemingly simplest of questions can be complex to answer.
- We've learned that although both arguments appeared to be equally matched, each providing research to support their arguments, when you take the time to evaluate them with a skeptical eye and some basic understanding of how to look at research the illusion of a strong argument quickly disappears.
- We've also learned that analyzing research is no simple task, even in a simplified form like the one that we just used here. When I analyze an academic paper, I spend *hours* looking up terms, statistics, and previous research on the subject. If I'm reviewing the paper for a journal as a peer-reviewer, the process takes days and dozens of read-throughs!

We have seen that Ms. Buckley was unable to support her argument with supporting evidence, ultimately providing more reason to believe that although she argued strongly for her position, the best information that she was able to provide didn't agree with her views, and because of this, neither should we.

We also see that Mr. Kompf's collective evidence was somewhat stronger in supporting his argument, but it certainly wasn't a "strong" argument in most cases. Each article chosen came with its own set of issues, and we need to consider the limitations carefully.

What should we take away from these articles? There may be reason to question static postural assessments, but we can't say that we know this as a fact, at least by this argument alone. If this

is a topic that interests you or that might affect your work or training, you should do your own research review, looking at the available data and making up your own mind.

Of course, that's just my opinion -- you're free to form your own. Now, you have the basic tools to do so.

TERMINOLOGY CHEAT SHEET

Evidence: Facts or information indicating that a statement, belief or position is either true or valid. Evidence comes in many forms, such as personal anecdotes or systematic research studies; however, not all evidence is equal and a person's opinion is much less reliable than is a competently performed research study.

Cherry-picking: Selectively choosing examples or items from the total available, either to support your preferred position or to refute an opponent's position. If I support an argument only with evidence that helps my position while ignoring quality evidence that contradicts that argument, I have cherry-picked. Arguments should be determined on the total available evidence and the quality of that evidence, not because some information was purposely left out in order to win a debate.

Population: A well-defined collection of individuals or groups known to have similar characteristics. In research, a population is the total number of individuals or items that possess a trait that the researchers are interested in, in which the study sample – the participants – are meant to represent. When reading an argument or research paper, it is very important to have a firm understanding of which population – whether it's based on age, ethnicity, gender, activity level, the presence or risk of a disease or injury, or any other potential variable or combination of variables – that is being studied or otherwise commented on. If the paper's population is not the same as your population of interest, the findings may not specifically be valuable to you (unless the differences have been shown not to impact those outcomes).

Bias: A tendency to believe that some people, ideas, etc., are better than others that usually results in treating some people unfairly. Bias is the sum of our emotions, experiences, beliefs and intuitions; It influences our decision-making by causing us to prefer some explanations or ideas over others before we openly consider new information. The universal occurrence of bias is one of the most important reasons that personal experience can offer only limited and incomplete

evidence for a belief or argument and should always be viewed with skepticism without more powerful, less-biased sources of information, such as carefully constructed research studies.

Prove (proof): To demonstrate the truth or existence of something by evidence. In reality, "proving" any argument, scientifically or otherwise, is extraordinarily difficult and philosophically impossible: rather than attempting to "prove" an argument, researchers conduct experiments and make observations that will either show evidence for or against an idea or concept. At some point, there will be enough quality evidence for or against an argument to decide if it is reasonable to consider the matter *much more than likely* true or not true, but never technically "proven."

Hypothesis: A proposed explanation based on limited evidence, a scientifically plausible explanation for a phenomenon. The hypothesis is then tested repeatedly to find evidence that either supports or denies the idea. In common language, people mistakenly use the term "theory" when they really mean "hypothesis;" in fact, a theory is a well-substantiated and highly evidenced hypothesis or group of hypotheses, often validated over many years of hundreds of scientific trials and evidence supporting it.

Falsification: The act of showing that a hypothesis or theory is incorrect with conflicting, validated evidence. The statement "all swans are white" is immediately falsified by the observation (and technically, the validation of that observation) of a single black swan. Thinking critically and the scientific method both demand that one constantly searches for falsification evidence to their own beliefs or hypotheses. The absence of falsification evidence does not "prove" that an idea is true, but allows that idea to remain a plausible explanation for an observed phenomenon.

Confounding Variables: An aspect of a system that in turn affects other aspects of that system yet remains unaccounted for. For example, it is a true association that drowning deaths increase along with the number of ice cream sales. While we could try to reason that people eating ice

cream might be heavier and sink, or that eating ice cream causes cramps when swimming, causing people to drown, neither explanation takes into account that in warmer temperatures, more people eat ice cream as a cold treat, and they also swim more to cool off. If you were to accept either of the precious explanations, then increased temperature would be the confounding variable in those explanations, an unaccounted detail that reveals the true association. Personal anecdotes or observations without controls, such as those found in well-designed research studies, are often incapable of observing and accounting for all potential confounding variables, making them far more unlikely to accurately explain and evidence a cause and effect relationship between events.

Strawman: a logical fallacy where an argument is misrepresented in order to more easily defeat that argument. Most often, a strawman is constructed by changing or emitting any number of key points in the original argument in order to more easily refute it with evidence or counter-argument that would not have otherwise applied.

Systematic Review: A high-level overview of the primary research examining a particular topic. Systematic Reviews can give us insight into the total body of knowledge through specifically outlined selection criteria and appraisal of identified articles. For this reason, a well-performed Systematic Review should be considered as persuasive evidence in any given topic.

Meta-Analysis: A statistical analysis of the data collected through a Systematic Review. A Meta-Analysis is, in essence, one large research paper which is based on the data collected from the best available research on a specific topic collected and analyzed during the systematic review process. All Meta-Analyses should be based on a Systematic Review, but not all Systematic Reviews will be a Meta-Analysis, which requires additional statistical work beyond the Systematic Review process.

Sample: A selected group of individuals or items from a larger population that is meant to represent specific characteristics of that population for the purpose of investigation and research.

For example, if I was interested in researching the effects of a training program on professional baseball players, I could select two players from each team in MLB, or I could limit my population of interest to just first basemen and randomly select 15 first basemen from the 30 possible teams. Each subject would become a member of my study sample, with the expectation that with a random selection of players, the average performance of my testing will be applicable to all members of their population (recognize that the population of interest here is not "professional athletes" but "professional baseball players." While a professional baseball player is also a professional athlete, because the total population of professional athletes would include a wide variety of different body types, sport-specific strengths and skills, heights, weights, etc, a study claiming to evaluate characteristics of professional athletes but only using a sample of professional baseball players might not actually be applicable to the larger population of *all professional athletes*).

Convenience Sample: Obtaining a study's subjects through what's most readily available or easily acquired. Using the example in this article, even though the authors of the paper claimed to be reporting on the abdominal strength and posture of all humans (or, at least, all North Americans), the sample itself can't be used to inform us about any population other than physical therapy students, predominantly female, between the ages of 20-33 located in Virginia and their performance on a specific test that has yet to be validated for the purpose of general abdominal strength.

If this is the only investigation into this subject, we can cautiously take some information concerning the plausibility of the hypothesis (i.e., that pelvic position may not greatly influence abdominal strength), but we can't say anything more definitive than this, certainly not with any degree of certainty or confidence, due to the design of the experiment as well as the convenience sampling performed which limited the applicability of these findings.

Retrospective (Case-Control) study: A study design that looks back at specific events that occurred in the past in order to evaluate possible influencing factors on a particular item of

interest, such as a disease or measure of performance. A case-control study will compare this data with individuals (the controls) that do not present with the item or quality of interest but who otherwise appear equivalent (such as medical doctors who smoke vs. medical doctors that do not smoke in an investigation of lung cancer). This type of study is most effective when looking at rare events, such as a rare form of a disease, where there may be few possible subjects to investigate; however, they are subject to a high risk of bias (the factors that a researcher believes are important in selecting controls are subject to that investigators beliefs concerning what qualities are and are not important), as well as the issues of accurate subject recollections of key events and exposures, among others.

Six Steps to Evaluate a Claim

1. Identify the argument being made and its central claim

- What do you already know about this topic?
- What is your current belief concerning this topic (your bias)?
- Do you agree or disagree with the central claim *before evaluating the argument*? Why or why not?

2. Identify what information you would need to observe in order to change your belief (your falsification data)

- Write this down and refer to it throughout your evaluation – if you encounter this within the argument, even if the central claim was something that you had initially believed, you must consider reassessing your belief.

3. Analyze the argument carefully

- What are the facts being used to support the argument and central claim?
- What is the quality of these sources? Are they opinions? Poorly performed research studies? Well-performed research studies?
- What is the level of the evidence provided? Is it showing cause and effect or is it associative/correlational only? Is it a single study or does it reflect well-conducted Systematic Reviews?
- Is the data from these sources validated and known to be true, or is it speculative?

4. Critically assess the claim relative to the argument being made

- Does the argument support the claim?
- Does the argument depend on unrealistic, improbable assumptions or generalizations?
- Do the sources support the argument being made, or do they suggest something other than what is being argued?
- Is the overall argument clearly presented and logical?
- Is the overall argument concise and specific, or does it make claims beyond the ability of its evidence to provide?

5. Consult the body of knowledge on the topic

- Look up any terms that you were unfamiliar with for further clarity
- Look up any Systematic Reviews or Literature Reviews that might be available on the topic and compare the argument's claims with this information
- Look up any additional claims or articles referred to in the argument for alternative data or opinions

6. Re-assess your opinion/bias

- • Has the article changed your opinion?
- If not, why do you remain skeptical? Is it a justifiable position supported by logic and sound judgment, or is it based on personal beliefs or preferences that cannot be supported otherwise?
- Is the argument strong enough to suggest a change in your personal practice or lifestyle, or is the argument not strong enough to do so? Why or why not?

References

1. Merriam-Webster.com; http://www.merriam-webster.com/dictionary/bias
2. Hartvigsen J, Leboeuf-Yde C, Lings S, Corder EH. "Is sitting-while-at-work associated with low back pain? A systematic, critical literature review." *Scandinavian Journal of Public Health*. 2000 Sep;28(3):230-9
3. Hegedus EJ, Goode AP, Cook CE, Michener L, Myer CA, Myer DM, Wright AA. "Which physical examination tests provide clinicians with the most value when examining the shoulder? Update of a systematic review with meta-analysis of individual tests." *British Journal of Sports Medicine*. 2012 Nov;46(14):964-78
4. Walker BF. "The Prevalence of Low Back Pain: A Systematic Review of the Literature from 1966 to 1998." *Journal of Spinal Disorders.* 2000 Jun;13(3):205-17
5. Hoy D, Bain C, Williams G, March L, Brooks P, Blyth F, Woolf A, Vos T, Buchbinder R. "A systematic review of the global prevalence of low back pain." Arthritis and Rhumatism. 2012 Jun;64(6):2028-37

Additional References

Standkovic, R. & Johnell, O. (1990). Conservative Treatment of Acute Low-Back Pain: A Prospective Randomized Trial: McKenzie Method of Treatment Versus Patient Education in "Mini Back School". Spine, 15(2),

O'Sullivan, P. B., Mitchell, T., Bulich, P., Waller, R., & Holte, J. (2006). The relationship beween posture and back muscle endurance in industrial workers with flexion-related low back pain. Manual therapy, 11(4), 264-271.

Magnusson, M. L., Aleksiev, A., Wilder, D. G., Pope, M. H., Spratt, K., Lee, S. H., … & Weinstein, J. N. (1996). European spine society—The acromed prize for spinal research 1995 unexpected load and asymmetric posture as etiologic factors in low back pain. European Spine Journal, 5(1), 23-35.

Watson, L.A., Pizzari, T. & Balster, S. (2009). Thoracic outlet syndrome part 1: Clinical manifestations, differentiation and treatment pathways. Manual Therapy, 14(1), 586-595

Lederman E. The fall of the postural-structural-biomechanical model in manual and physical therapies: Exemplified by lower back pain. *Journal Of Bodywork & Movement Therapies* [serial

online]. April 2011;15(2):131-138.

Youdas W., Garrett T., Egan K., Therneau T. Lumbar lordosis and pelvic inclination in adults with chronic low back pain. Physical Therapy. 80: 261-275, 2000

Walker M., Rothstein J., Finucane S., Lamb R. Relationships between lumbar lordosis, pelvic tilt, and abdominal muscle performance. Journal of American Physical Therapy. 67: 512-516, 1987

Lederman E. The myth of core stability. *Journal Of Bodywork & Movement Therapies* [serial online]. January 2010;14(1):84-98

Griegel-Morris P., Larson K., Mueller-Klaus K., Oatis C. Incidence of common postural abnormalities in the cervical shoulder and thoracic regions and their associations with pain in two age groups of healthy subjects. Journal of the American Physical Therapy Association. 72: 425-431, 1992

Lewis J., Wright C., Green A. Subacromial impingement syndrome: The effect of changing posture on shoulder range of movement. Journal of Orthopaedic & Sports Physical Therapy. 35: 72-87, 2005

Ratcliffe E., Pickering S., McLean S., Lewis J. Is there a relationship between subacromial impingement syndrome and scapular orientation? A systematic review. British Journal of Sports Medicine. 2013

Herrington L. Assessment of the degree of pelvic tilt within a normal asymptomatic population. *Manual Therapy* [serial online]. 16(6):646-648, 2011

About the Author

Jonathan Fass is currently the Private Physical Therapist and Sports Manager of His Royal Highness Prince Alwaleed bin Talal, billionaire investor, philanthropist, and humanitarian. He is a graduate of the first Doctoral Class in the City University of New York's Physical Therapy program, and attended his Orthopedic Physical Therapy Residency at the University of Delaware, one of the top-ranked physical therapy programs in the nation. Jonathan is the former co-host of "The FitCast," and now has his own podcast, "The Strength of Evidence" which he promises will have all-new episodes soon. You can also find him at www.JonathanFass.com, which he also promises to update…soon. You can follow him on Twitter at https://twitter.com/JonFass and Facebook at https://www.facebook.com/jon.fass. He actually updates those. Sometimes he posts pictures of cats, too.