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Editorial

Confirmation bias in orthopaedic surgery: the challenge of the information overload era

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Modern orthopaedic practice takes place in a context of information abundance. Clinical trials, national registries, systematic reviews, and meta-analyses are published constantly, producing more evidence than any clinician can follow. Over the past decade, the number of publications in high-impact orthopaedic journals has grown steadily, with post-pandemic years showing a particularly steep increase [1]. One might expect that more evidence leads to better and more objective decisions. However, having access to information does not always guarantee that new studies are interpreted without bias [2].

Confirmation bias, the tendency to search for, interpret, and remember information in ways that support our prior beliefs, while giving less weight to evidence that contradicts them, is well documented

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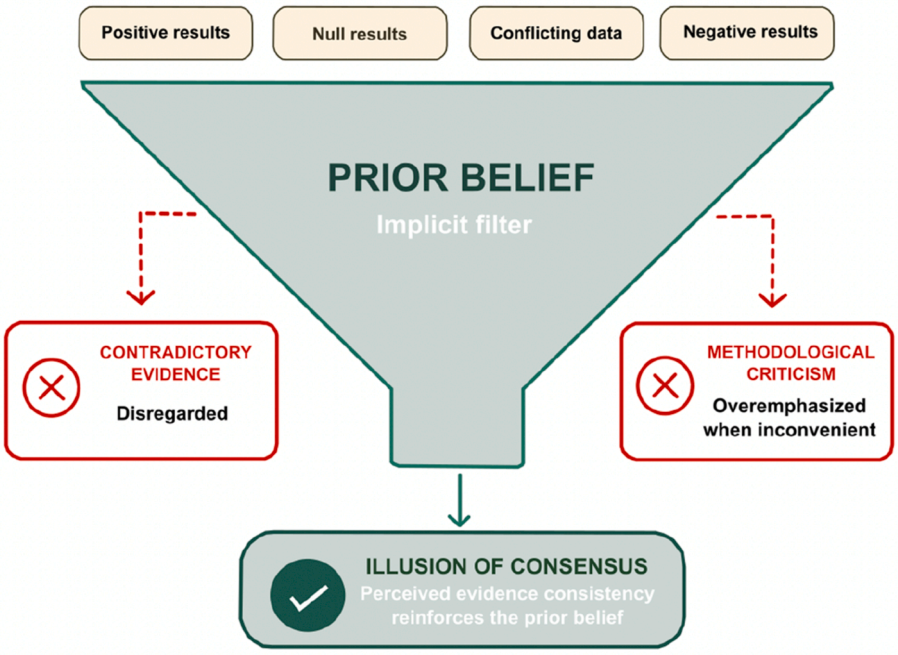

Fig. 1. Confirmation bias as an implicit filter in evidence appraisal. When evaluating the literature, prior beliefs unconsciously determine how evidence is processed. Contradictory evidence is disregarded, and methodological limitations are selectively emphasized when results are inconvenient. The result is an illusion of consensus that reinforces what the reader already believed.

in medicine and surgery. A systematic review of cognitive biases across all areas of surgical care found that the three most-common biases were *overconfidence, anchoring,* and *confirmation bias*, and that these were associated with inaccurate risk-benefit estimations in roughly one quarter of studies [3]. This has been shown specifically in orthopaedics; in a survey of 196 orthopaedic surgeons, confirmation bias, anchoring, and framing effects were all measurable across multiple clinical scenarios, with confirmation bias present in up to 51% of responses depending on the case [4]. This does not mean that surgeons are careless or dishonest, it simply reflects how human reasoning works. That is precisely why the impact of this bias can be significant and often difficult to notice.

If cognitive biases affect how we diagnose individual patients, it is reasonable to think they also affect how clinicians read and use the scientific evidence that guides their practice.

READING THE LITERATURE: A FILTER WE DON'T ALWAYS NOTICE

Confirmation bias can show up when we evaluate scientific studies. When a paper supports what we already know, we tend to see it as clinically relevant and methodologically solid. When results challenge our decisions, we become more critical of their limitations. Even when reading the same study, different surgeons may focus on different findings: some will highlight statistically significant differences, others will point to effect size or heterogeneity. The choice of what to emphasize is rarely fully neutral.

In widely debated technical discussions, the same body of evidence can be interpreted as proof of superiority, equivalence, or absence of clinically relevant differences, depending on which outcome is prioritized. The issue is not the specific technique but the conceptual framework used to analyze the information (Fig. 1).

STATISTICAL INTERPRETATION AND SCIENTIFIC NARRATIVE

Statistics offer objective tools but how we interpret them is not immune to cognitive influence. The p-values close to the conventional threshold are sometimes described as "trends" when they support the hypothesis, while a nonsignificant result may be attributed to insufficient sample size when the result goes against what we expected. Probably, we have seen the sentence…"almost statistically significant"…written in scientific text several times and…"the almost significant value"… is used to claim clinical relevance.

In this context, practices such as formulating hypotheses after the results are known (HARKing) and running multiple analyses until a significant p-value appears (p-hacking) have been well described. Simmons et al. showed how uncontrolled analytical flexibility can substantially increase the rate of false positive findings [5]. These practices are not limited to other fields; a specific analysis of leading orthopaedic journals found evidence of p-hacking, with an excess of p-values just below 0.05 that was unlikely to occur by chance [6]. Results manipulating behaviors demonstrate how the scientific narrative can be shaped to fit the results obtained, leading to conclusions that deserve more caution than they receive.

Keeping a clear distinction between *exploratory* and *confirmatory analyses* is not just a methodological detail; it is a basic condition for interpreting evidence correctly.

SCIENTIFIC OUTPUT AND ACADEMIC PRESSURE

Today's academic environment rewards productivity and visibility. The "publish or perish" culture creates structural incentives that work quietly but consistently. In this setting, the tendency to highlight positive or clinically appealing results can emerge without explicit intention. Selectively reporting favorable secondary outcomes, or interpreting

borderline results in an optimistic way, can reinforce an initial hypothesis without any deliberate effort to deceive. *Publication bias* in orthopaedic surgery systematic reviews has been formally documented; nearly one-third of systematic reviews that were assessed for *publication bias* showed evidence of it, and fewer than half of the published reviews even discussed the issue [7].

Declaring conflicts of interest is now a standard requirement. Existence of conflicts does not automatically invalidate a study but does require reading the conclusions with that context in mind. Methodological rigor depends not only on individual honesty but also on systems that support preregistered protocols, trial registration, and demanding peer review.

ARTIFICIAL INTELLIGENCE AND THE RISK OF AMPLIFIED BIAS

Generative artificial intelligence (AI) tools are increasingly used in manuscript writing, and while AI offers real benefits for those working in a second language, AI use is not without risks [8–10]. AI tools tend to follow the user's lead rather than challenge their assumptions, if a researcher asks an AI to frame a discussion section with a particular conclusion already in mind, the tool will do so without resistance. AI executes the prompt; it does not question the hypothesis. When used to search or summarize the literature, AI tools also tend to favor what is most cited and most represented in their training data, which skew toward positive results and further underrepresents negative studies. In a field already vulnerable to confirmation bias, using AI without critical awareness may quietly deepen the problem rather than correct it. Using AI tools responsibly means understanding not only our own biases but also those built into the technology itself.

JOURNAL QUALITY AND THE HIERARCHY OF EVIDENCE

Not all published evidence carries the same weight. Understanding study design, sample size, follow-up length, and how confounders were handled is essential before drawing practical conclusions. Knowing the editorial standards of the journals we read, their peer review process, methodological requirements, and indexing also helps us judge how much confidence the readers place in a given paper.

Formal tools exist to support this process. Checklists, risk of bias instruments, and reporting guidelines have been developed specifically for orthopaedics, sports medicine, and rehabilitation to help readers and researchers assess methodological quality in a structured way [11,12].

Choosing journals with rigorous review processes does not eliminate bias entirely but it does reduce the chance of obvious methodological problems going unnoticed. Confusing the confidence of a conclusion with the quality of the evidence behind it is a common mistake in an environment where there is already too much to read.

INTELLECTUAL HUMILITY AS A PRACTICAL TOOL

Since *confirmation bias* is a part of how human reasoning works, it cannot be fully eliminated. But it can be reduced through deliberate habits; for instance, reviewing the methodology of a paper before accepting its conclusions, understanding whether a study is exploratory or confirmatory, checking conflicts of interest carefully, paying attention to whether study protocols were preregistered, and making a real effort to read papers that challenge the reader's usual approach.

Surveys within the orthopaedic and sports medicine community suggest that evidence-based medicine is generally well regarded in principle but its consistent application in everyday clinical practice remains limited [12]. This gap between attitude and behavior is itself a form of bias, one that deserves the same honest attention as any other.

Intellectual humility does not mean being uncertain about everything or avoiding decisions. It means being aware that our beliefs can shape how we read data. It also means accepting that the evidence may sometimes require us to change practices we have defended for years. We encourage readers, reviewers, and editors to actively support a culture where negative and even contradictory results receive the same serious attention as positive results because science moves forward through disconfirmation as much as through confirmation.

CONCLUSION

Understanding *confirmation bias* is important. Orthopaedic surgery is defined by technical progress and continuous scientific output. Therefore, the challenge is not only to keep up with the literature but to maintain a critical and honest attitude toward the growing body of literature. The availability of more information renders good judgment more critical, not less important.

Recognizing *confirmation bias* does not weaken our practice. It makes it stronger instead. The surgeons who are willing to question their own assumptions are not less confident, they are more honest and this will be reflected in their patient work.

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Tomás Pineda contributed to conceptualization, writing – original draft.

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Jon Karlsson contributed to supervision, writing – review & editing, final approval.

Volker Musahl contributed to supervision, writing – review & editing, final approval.

Olufemi Ayeni contributed to supervision, writing – review & editing, final approval.

All authors have approved the final version of the manuscript and agree to be accountable for all aspects of the work.

Declaration of generative AI and ai-assisted technologies in the manuscript preparation process

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