

## Editorial

### Fairness to All: Gender and Sex in Scientific Reporting

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Women do not benefit from medical research as much as men do [2, 5]. This problem stems both from research design (which scientists largely control), and from scientific reporting in journals (which editors can influence).

Starting with the latter, we first must learn to talk about sex. Sex (female or male) refers to the genotype, while gender (woman or girl, man or boy) refers to the social constructs that overlie the genotype. Gender tends to be culturally laden, and as such, separating sex from gender in certain kinds of research is nearly impossible. Do women as a cultural norm have less pain after knee replacement, or

is it a condition innate to the biology of the female sex? If the former, might this be driven by women reporting pain differently on standardized scoring instruments (or to their surgeons, who are more likely to be men)? Or are there important physiological differences in pain signaling between males and females? Other explanations are possible — for example, it is likely that women's responses are interpreted differently by surgeons of either gender — and it is not always possible to know whether sex, gender, or both account for the observed effect. But when possible, we will seek clarity in authors' explanations: Are the differences gender-driven, sex-driven, or is it not possible to tell?

This is not just a semantic issue. It is a health issue, both for women and men. Women have been underrepresented in medical research, and therefore the evidence that drives their care is less robust [2, 5]. Pharmacokinetics and responses to important therapeutic interventions differ between men and women [3], and women are more likely to experience adverse drug reactions [6]. Surgeons may believe this is a “medical thing” and not a problem in

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orthopaedic surgery. That is wrong. Women consume approximately 85% of the Cox-II-specific NSAIDs that are prescribed and the side effect profiles of these drugs — including important, life-threatening side effects — differ between men and women [6]. Yet, the treatment of women with NSAIDs is based on Cox-II trials consisting disproportionately of men [1]. We learned only belatedly that women are at much greater risk of complications and failure after total hip resurfacing arthroplasty [4], and the result suggests that clearer scientific reporting would have prevented harm to many women. We probably do not know the full extent of the harm we may be causing because the reporting of results by gender is so inconsistently performed in medical and surgical trials in our specialty. This must change.

Accordingly, we recommend that investigators writing for *CORR*®:

- Design studies that are sufficiently powered to answer research questions both for males and females (or men and women) if the health condition being studied occurs in both sexes/genders.
- Provide sex- and/or gender-specific data where relevant in all clinical, basic science, and epidemiological studies.
- Analyze the influence (or association) of sex or gender on the results of the study, or indicate in the *Patients and Methods* section why such analyses were not performed, and consider this topic as a limitation to cover in the *Discussion* section. Readers need to know whether the results generalize to both sexes/genders.
- Indicate (if sex or gender analyses were performed post-hoc) that these analyses should be interpreted cautiously because they may be underpowered (leading to a false conclusion of no difference). If there are many such analyses, indicate that they may lead to

spurious significance, and an erroneous conclusion of a sex- or gender-related difference.

We present these as recommendations, rather than requirements for publication because the topic is relatively new to the collective consciousness of our specialty. Our editorial board will continue to evaluate whether and when guidelines like these should become requirements. For now, we will consider the scientific reporting of sex- and gender-related findings an important element of the papers we consider for publication.

Our research needs to reflect that we treat both men and women, and that both are equally entitled to the benefits of care based on good, applicable evidence.

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## References

1. Chilet-Rosell E, Ruiz-Cantero MT, Horga JF. Women's health and gender-based clinical trials on Etoricoxib: Methodological gender bias. *Journal of Public Health*. 2009;31:434–445.
2. Curno MJ, Heidari S. Absence of evidence is not evidence of absence: Encouraging gender analyses in scholarly publications. *Eur Sci Editing*. 2011;37:104–105.
3. Franconi F, Carru C, Malomi W, Vella S, Mercuro G. The effect of sex/gender on cardiovascular pharmacology. *Curr Pharm Des*. 2011;17:1095–1097.
4. Glyn-Jones S, Pandit H, Kwon YM, Doll H, Gill HS, Murray DW. Risk factors for inflammatory pseudotumor formation following hip resurfacing. *J Bone Joint Surg Br*. 2009;91:1566–1574.
5. National Research Council. *Sex-Specific Reporting of Scientific Research: A Workshop Summary*. Washington, D.C.: The National Academies Press;2012:1–72.
6. Raz L, Miller VM. Considerations of sex and gender differences in preclinical and clinical trials. *Handb Exp Pharmacol*. 2012;214: 127–147.