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## Sex-based medicine – an essential step toward personalized therapy

A strong correlation exists between sex and the incidence, prevalence, symptoms, ages at onset, and severity of disease as well as the reaction to drugs. Now a team of US authors has set out to explain why sex-based medicine is the next step toward the delivery of true personalized medicine. In a full review published in the July issue of *Women's Health*, the authors expand on their recent Opinion article that appeared in *Nature*<sup>1</sup>. The article is freely available and is entitled *Sex and Sensitivity: the Continued Need for Sex-based Biomedical Research and Implementation*<sup>2</sup>.

**Candace Tingen, Alison Kim, Pei-Hsuan Wu** and **Teresa Woodruff** of Chicago's Northwestern University Feinberg School of Medicine argue that sex-based medicine is implicitly good for both sexes and that sex-based development of new technologies will improve healthcare and cut costs for all. They believe that sex-based medicine must become a primary consideration for all clinicians in their interactions with and treatment of patients as our understanding of sex differences continues to expand past the reproductive system. Practicing physicians may lack appropriate and up-to-date knowledge of the scientific literature, compromising their ability to accurately diagnose their patients in a sex-based manner. They cite a recent survey that revealed that only one in five physicians were aware that more women than men die from cardiovascular disease each year.

Aside from the biological, sex-based disparities, they also highlight behavioral, gender-based disparities between male and female patients and the way physicians interact with them. For example, among patients with chest pain, female patients tended to describe their emotional state more than their physical suffering compared to male patients, who directly communicated their illness and their interest in treating it.

The authors contend that a sex-based approach is vital at four separate 'checkpoints' in the pipeline of biomedical discovery and dissemination:

- 1) **Biomedical research:** biological sex differences come from more than just sex chromosomes and hormones, they also extend to the gene expression patterns across the genome
- 2) **Medical education & clinical diagnosis:** Clinicians are not always properly educated regarding differences in the presentation of disease in women. They are also more likely to underestimate the risk of disease and attribute patient-reported symptoms to anxiety or emotion in women as compared to men

- 3) **Development of therapeutics and diagnostics:** The presentation of disease differs based on sex. Pharmacokinetics are also sex-specific owing to differences in body weight, fat distribution and metabolism, but sex-specific drug dosages are often absent from drug labels
- 4) **Patient access to healthcare:** Women are the primary users of medical care in the United States. Despite lower incomes, women pay more for medical care, are less likely than men to be covered by their employer's plan, are more likely than men to have only the unstable coverage of a spouse's employer, and pay more for private insurance

Teresa Woodruff, guest editor of the Editorial commented "*Studying similarities and differences in disease diagnosis and treatment in men and women will lead to the best science and medicine for both sexes.*"

In order to address these sex and gender disparities, the authors propose that scientific journals require sex differences to be analyzed and addressed or for the exclusion to be explained, that funding and regulatory agencies implement these same requirements for patent or grant proposals, and that researchers and clinicians to make the effort to educate themselves regarding sex differences in biomedicine.

## References

1. Alison M. Kim, Candace M. Tingen & Teresa K. Woodruff. Sex bias in trials and treatment must end, *Nature* 465, 688-689 (10 June 2010)
2. Candace M. Tingen, Alison M. Kim, Pei-Hsuan WU & Teresa K. Woodruff. Sex and sensitivity: the continued need for sex-based biomedical research and implementation, *Women's Health* (2010) **6**(4), 511-516

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