



Considering Sex and Gender Sensitive Methods in Biomedical and Health Research

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Differences in health and illness are influenced by individual genetic and physiological constitutions, interactions between individual and perceived environmental and experiential factors. The interaction between sex and gender can affect health and disease as well as molecular cell biological processes and clinical characteristics. Therefore, it is important to understand the terms sex and gender correctly and to use them properly. Gender identity and gender role affect individual activities, exposures, and access to care, all of which can affect health and cultures. The incidence and severity of diseases may be related to differences in exposures, routes of entry and the processing of a foreign agent, and cellular responses. Therefore, gender difference is an important basic human variable that should be considered when designing and analyzing studies at all levels of biomedical and health-related research [1,2].

Today, it has been confirmed that the maintenance of health and the process of disease development are different for each individual. Among other characteristics, sex and gender are particularly important factors [2]. It has been shown that females with ST-segment elevation myocardial infarction (STEMI) have a higher mortality than males following primary percutaneous coronary intervention (PPCI). Compared with elderly males in that study, elderly females had less typical chest pain (45.3% vs. 57.3%, $p < .01$) and greater lack of chest pain (22.2% vs. 12.3%, $p < .01$). For the elderly, males were more likely to present with chest pain whereas females were more likely to present with nausea [3]. Cardiovascular risk factors have more impact on gender characteristics than biological gender

itself [4].

Recent studies investigate whether differences in quality of care the severity of lipid-lowering medication therapy, and medication compliance can explain these inconsistencies. The primary result was low-density lipoprotein (LDL) cholesterol. Women had higher LDL cholesterol levels than men, but were not likely to achieve recommended processes of diabetes care, to attain targets for controlling blood sugar and blood pressure, or receiving intensive medication regimens[5]. Female patients were found to be more depressed than male patients. They also caused more complications. Depressive symptoms increased the incidence of complications in female and male patients by 40% and 33%, respectively, after controlling for sociodemographic and clinical variables. These results shows that females have more depression than males[6]. Previous studies suggest that gender differences exist in COPD (Chronic Obstructive Pulmonary Disease) diagnosis and symptoms; these differences can be more pronounced in younger adults. Compared to men with COPD, younger women with COPD had a greater likelihood of more severe dyspnea, airflow restrictions, increased risk of exacerbations, and categorization in GOLD groups B and D. A significant ($p = .02$) age-by-gender interaction was also observed. In particular, the association between gender and symptom reporting was weakened among older participants. Older women with COPD were also more likely to report severe dyspnea than older men with COPD (OR: 1.38, 95% CI: 1.11~1.71) [7].

Scientifically, women are excluded as clinical research participants because there is a general belief among clin-

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ical researchers that men and women do not differ significantly to evaluate response to treatment in most situations. In addition, the inclusion of women introduces additional variables (in the form of hormonal cycles) and decreases the homogeneity of the study population [8].

In 1997~2000, in the United States, ten drugs caused fatal health problems and eight out of ten drugs caused more serious side effects in women than in men. This was because clinical trials were primarily performed in men without considering gender as a biological variable [9,10]. Heparin sodium, a blood coagulation inhibitor, exhibits more severe bleeding tendencies, scarring, platelet abnormalities, and movement disorders in women while Lisinopril (ACE inhibitor) or atenolol (beta blocker) for hypertension treatment causes erectile dysfunction in men [11].

In 1993, the National Institutes of Health Revitalization Act, ORWH (The Office of Research on Women's Health) was authorized statutorily and the guidelines for inclusion of women and minorities became law. In 2014, the NIH published a policy to include gender in its research plan as an important biological variable in studies using laboratory animals or cells when conducting research design and analysis on vertebrates and humans to improve the quality of life sciences [1,12,13].

Researchers should develop new knowledge generation and knowledge technology diffusion strategies in human-oriented studies with full consideration of gender and genders' effects. In addition, it should be accomplished with prompt respond without being gender-biased or sensitive to the issue of gender, thus achieving a fair impact on the health of various populations. Gender identity and gender role can affect individual activities, exposures, and access to treatment, all of which can affect health. They vary widely across cultures.

Males and females have different patterns of illness and life spans, changing the impact of the relative roles of genes and environment. Understanding bases of gender differences is important for developing new approaches to prevention, diagnosis, and treatment. Nevertheless, barriers to the advancement of knowledge about gender differences in health and illness still exist. They must be eliminated [1]. The research of life sciences in Korea is regarded as having international competitiveness, but there is no policy support for research considering sex and gender. However, in order to conduct research with international competitiveness, it is urgent to introduce new perspectives considering sex and gender [2]. Furthermore, continued research is needed to examine how biological functions are formed by experimental effects so that our overall understanding of the relationship between gender

and health can be improved.

Conflict of Interest

The authors declared no conflict of interest.

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