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Measuring the health effects of gender

S P Phillips

ABSTRACT
The health effects of gender are mediated via group-level constraints of sex roles and norms, discrimination and marginalisation of individuals, and internalisation of the stresses of role discordance. Although gender is frequently a lens through which data are interpreted there are few composite measures that insert gender as an independent variable into research design. Instead, sex disaggregation of data is often conflated with gender, identifying statistically significant but sometimes clinically insignificant sex differences. To directly assess the impact of gender on wellbeing requires development of group and individual-level derived variables. At the ecological level such a summative variable could be composed of a selection of group-level measures of equality between sexes. This gender index could be used in ecological and individual-level studies of health outcomes. A quantitative indicator of gender role acceptance and of the personal effects of gender inequities could insert the often hidden variable of gender into individual-level clinical research.

The health determinants literature is replete with evidence that social circumstances such as income, occupation, culture and social connectedness have a powerful effect on the wellbeing of individuals and populations. Often missing from this list of non-biological determinants is gender—that is, the socially constructed roles associated with being male or female in a given grouping or society. In addition to being a lens through which findings are viewed or interpreted, gender roles, expectations and inequalities function in at least three different ways to affect health directly. The gender norms of a culture, state or social grouping may constrain or disadvantage one sex resulting in a group-level gender effect. For example, the shortened lifespan of men relative to women in most countries is attributable, in large part, to male risk taking behaviour. Direct discrimination such as the marginalisation of women relative to men in much of the world is a common source of individual health inequalities. Examples of the health effects of this form of gender inequity result from differential access to nutrition, resources, health care or protection from violence. Finally, both acceptance of and dissonance with expected gender roles may create internalised individual stresses that may precipitate or aggravate illnesses such as depression or heart disease.

This paper explores models for assessing the direct impact of gender on the health of individuals and populations.

SEX DIFFERENCES—ONLY PART OF THE STORY
If we assume that the categories male and female are genetically determined then there will be limited value in disaggregating research data by sex. Biological differences or inequities are not readily amenable to change nor are they minimised via political or social interventions. If, however, we add the social construct of gender to the meaning of maleness or femaleness then identifying inequities between sexes becomes worthwhile. These inequities are not fixed and may be ameliorated or rectified by changing the social (for example, policy or legal) circumstances from which they arise.

In reality, not only gender but also sex differences are often invisible in medical research. Although women and men share about 99% of their genetic material the remaining small genotypic differences account for large phenotypic variation between the sexes. A failure to disaggregate research data on the basis of sex, and the willingness to generalise from male research subjects to female populations can be interpreted in a variety of ways. Sex disaggregation of data would not be warranted if researchers believed that differences within each sex (for example, among men) were greater than differences between or across sexes. Instead, factors other than sex that could account for the observed differences would be more appropriate targets of study. On the other hand, not reporting research data by sex may give rise to erroneous conclusions and to bias. When data are collected for men and women but results are not sex disaggregated the generalisability of findings must be questioned. For example, a study with equal numbers of female and male participants might show a 75% cure rate overall. However, if 100% of the women who were treated were cured while only 25% of the men benefited, such a treatment would be advisable for women but perhaps not for men. Without separating results by sex the historical errors that arose as a result of assuming that study data gathered on men were generalisable to women will persist. In the decade since the National Institutes of Health in the United States mandated the inclusion of women in research studies there has been a shift towards parity in the sex of participants but not in reporting of data. Disaggregating findings on the basis of sex should be a fundamental component of data analysis.

While sex differences should be identified in all research that includes men and women, interpretation of such findings must be cautious and rigorous. There will be many studies in which similarities between sexes will outweigh differences. Inflating the importance of small sex disparities in absolute risks or in treatment effects may highlight differences that are of no clinical significance. The difficult question is when might statistically significant “between”-group differences, with the groups being men and women, be of enough clinical significance to validate using
scarce resources to search for them? Finding a balance between the added costs of including men and women in research and the reality that no between-group differences will ever be found if they are not sought is essential if valid and clinically significant sex differences are to be identified.

**GENDER IN CLINICAL RESEARCH**

Gender, as distinct from sex, is rarely an independent variable in clinical studies. To a certain extent this is because it defies inclusion as an independent variable in research design. Gender is not a single, quantifiable, and consistent trait uniquely attributable to an individual or a population. Perhaps this explains why much of the literature that promises gender analysis delivers sex disaggregation or, occasionally, women's health instead. Gender is often conflated with identifying these more easily defined and biologically determined sex differences, or with doing research on women. Aggregation of a group of social indicators of gender equality relevant to the particular outcome being studied is largely unexplored ground in the health sciences.

It could be argued that the randomised controlled trial (RCT), considered to be the most robust of clinical research designs, purges the confounding effect of contextual social factors. By distributing all unmeasured inputs equally between groups these factors, although not identified, are eliminated as sources of variability in the outcome being measured. The result of randomisation, however, is that social aspects of the environment are made invisible rather than being treated as independent variables of interest. Wealth is one such social parameter. Generally, the association between income and health outcome is not of interest in clinical trials and is effectively removed as a potential confounder through randomisation. Each arm of a properly designed RCT should have subjects representing an equivalent range of socioeconomic status. The effect of income cannot, therefore, be measured but is equally distributed across groups and does not bias measurement of the associations of interest.

Social factors do merit recognition as associations of interest, nevertheless. When the correlation between numerous variables including socioeconomic status and health outcome is explicitly examined in cohort, case-control or cross-sectional studies, income is often the strongest measurable determinant of health. If its effect is “removed” through randomisation the central role of income will disappear. Similarly, despite the difficulty of defining just what is meant by race, the American health literature shows a consistent inverse relation between this characteristic and wellbeing. Could this be the case with gender? Would quantitative variables that are markers for gender, expand and enrich our understanding of gender’s effect on population and individual-level outcomes beyond the current approach of inserting gender only as a lens through which findings are interpreted?

**GENDER AS AN INDEPENDENT VARIABLE**

Gender effects arise from characteristics of groups such as societies, cultures or states, and have the potential to shape health outcomes at both the group and the individual level. For example, the gender roles and norms of a group may be associated with individual disease rates, teen pregnancy, depression or survival after a heart attack. The transmission of AIDS in sub-Saharan Africa illustrates the role of gender as an independent risk factor for disease. Biology confers greater risk of seroconversion upon women exposed to HIV, but it is the behaviour of men, and women’s lack of control over sexual activity, both elements of gender, that put women at risk of exposure to the virus. Counts of the newly infected quantify sex differences but fail to examine why these differences exist. The cross-level effect arising when a group or ecological-level variable influences the individual-level outcomes of health, disease or risk has been identified for social determinants such as income inequality and social capital. Similarly, the contextual-level effect of gender should be sought in both clinical and population-level research.

Like social capital, the impact of gender could be captured using a summative variable, mathematically derived by grouping relevant measures of equality such as ratios of women to men completing higher education, or income of women as a percentage of that of men into a "gender index variable." Identification and quantification of which parameters are subsumed under the term gender will present some challenges. Gender is a composite of many factors including social status, income, empowerment, equality and access to resources. Implicit within the concept of a gender perspective is a complexity and diversity that must be addressed and retained as part of any summative index. In other words, it could be argued that to identify three or four measures of, for example, sexual equality, and collapse these into a gender score to be applied universally contradicts the relational and contextual nature of gender. Perhaps the components of that summative index are, themselves, contextual, and the indicators selected to define any gender index will vary with the specific research question and setting. The measurement of social capital follows this model; a variety of possible summary measures, each useful in a particular context, has been utilised. A few examples of indices that rank gender equity or development across countries can be found on the websites of the United Nations Development Programme and Social Watch. The components of these scales may inform future work on a gender index, but neither scale can be adapted universally and neither is applicable to geographic units smaller than states. Some of these group measures will have no individual-level equivalent while others may, but the gender index variable could have meaning as a correlate of outcomes at the individual and ecological level.

Including a group-level variable such as gender in research necessitates discussion of what the appropriate group or unit is. This grouping may be based on geography, such as a neighbourhood or state, on religion, income or some other commonality. Embedded in the concept that groupings are not static, solitary or universally defined, is recognition that the effect of gender will vary with other social factors—that is, that there will be an interaction between gender and variables such as income, religion or race.

In any study, characteristics of participants that alter the outcome of interest should be identified and explored (effect modifiers) while factors that are proxies for some other input (confounders) should be replaced by the variable of more direct importance. Effect modification or interaction occurs when the association between an independent variable and the outcome measured differs according to categories or magnitude of a third variable. One might hypothesise that the extent of emancipation of women may modify the nature of the direct association between, for example, income and education. Stratification of data by some measure of women’s rights would identify whether this aspect of gender interacts with the association between wealth and education. Such a finding would deepen understanding of the meaning of research results and should be sought. On the other hand, confounders are variables that...
### Theory and methods

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<th>What this paper adds</th>
<th>Policy implications</th>
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<td>Gender as a determinant of health is poorly defined, often conflated with sex differences, and generally addressed via data interpretation rather than by direct measurement. This paper proposes a framework for understanding the direct effects of gender on health and for inserting an index of gender equality into health research at either the population or individual level.</td>
<td>By definition those determinants of health that are social, rather than biological, are amenable to change through social and policy changes. When research more clearly explores those aspects of gender that compromise the health of men or women, policy responses will become apparent. Use of a gender index in research will deepen understanding of which social norms should be addressed by policy changes as a means of improving health.</td>
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appear to be in the causal pathway from input to outcome but are actually proxies for another independent variable of more importance. If a study revealed that coffee drinkers have three times the lung cancer rate of those with no caffeine intake one might infer that coffee is associated with the risk of developing lung cancer. When, however, the association between coffee drinking and smoking is explored it becomes apparent that smoking is much more prevalent among coffee drinkers and the observed association between caffeine and lung cancer is a confounder of the more direct link between smoking and the outcome of interest.

There will be times when gender is an effect modifier, others when it is a confounder of some more important association, and times when clarifying whether gender is a confounder or the variable of significance will be difficult. The authors of a commentary in the *Journal of the Canadian Medical Association* write that injury is responsible for an alarmingly high death rate among young Canadians and advise medical and policy interventions. The editorial is an example of a failure to consider gender as an effect modifier. Stratification of data by sex shows that the excess risk discussed arises from the behaviours of young men but not women. To understand and respond with appropriate policy this gender difference must be identified. A Swedish study showing that maternity leave is associated with decreased male mortality illustrates the dilemma of whether gender is the association of importance or a confounder. As the authors note, taking maternity leave indicates a “departure from traditional masculinity” and that may be associated with other variations from the norm which, although not measured, may be the associations most likely to confer better health upon stay-at-home fathers. In this case the beneficial effect of atypical gender roles may be significant but may actually be a confounder of some other more important association.

**GENDER ROLES AND INDIVIDUAL HEALTH**

Although gender is a social construct there are concepts that convey aspects of the effects of gender on the individual. CP Jones’s model of how the internalisation of race affects health can be extrapolated and applied to gender. How an individual lives and responds to expected gender roles, for example, may have an impact on the health of that individual and can be isolated and measured. The impact of concordance or dissonance with gender stereotypes can be quantified and, therefore, used as an independent variable in health outcomes research. Inventories or scales measuring acceptance of sex roles and gender stereotypes could be independent variables in regression analyses or categories by which data are stratified. Such an approach could determine whether internalising either traditional or non-traditional gender roles contributes to disease risk.

In gathering background data about study participants, researchers often consider factors such as age, co-morbidities, smoking history or drug use. Perhaps of equal importance would be documenting a history of physical or sexual abuse or measuring control at home and in the workplace. These are examples of individual-level indicators of gender that are likely to be correlated with health and illness. As with the inventories described in the preceding paragraph these measures could be incorporated into an index of gender.

### CONCLUSION

Gender is the elephant in the epidemiology room, a ubiquitous but hidden social determinant of health. The inclusion of the individual-level variable, sex, may be a prerequisite for, but in itself, is not sufficient evidence that the role of gender has been identified in research. Interpreting data through a gender lens enriches the meaning of the results but, again, does not insert gender into the research itself. Gender is somewhat like social capital. It is difficult to define or measure; however, there is growing acceptance that the set of conditions operating across a group and summarised by the term have a role in health and illness. Unlike social capital, at present, gender is unlikely to appear as an independent variable whose effect on outcomes is assessed. Internalisation of sex roles and gender stereotypes and the ramifications of these roles, both of which can be measured at an individual level, are rarely among the inputs studied when health is the output. I would propose that to truly assess the impact of gender on wellbeing requires inclusion of group and individual-level derived variables or indices. At the ecological level this gender index could be a summative variable composed of a number of group-level measures of equality between women and men. Such a variable could be used in multi-level analyses and individual-level studies to assess the role of gender in health outcomes. A quantitative indicator of gender role acceptance and personal sequelae of gender inequities could insert gender as a variable in appropriate individual-level clinical research. The ongoing discussion as to best measures of other social determinants of health such as social capital or even income (despite income being a number, there is no consensus as to whether individual or household income is the more appropriate indicator) suggests that there is no one universally applicable gender index and more debate and study are required to identify which parameters are central to the measure of gender in various settings.

### Competing interests

None.

### REFERENCES


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This year’s seminar will focus on three key topics: (1) How does patient privacy legislation affect an editor’s ability to publish? (2) What is publication? — the changing definitions of publication. (3) COPE’s new Best Practice Guidelines. There will also be a short demonstration of an anti-plagiarism system as it is working in a publishing house.

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