GUIDELINES FOR SEX/GENDER INTO SCIENTIFIC RESEARCH

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WHAT IS THE DIFFERENCE BETWEEN “SEX” AND “GENDER”?

The terms “sex” and “gender” are not always easy to understand and are often used interchangeably. Put simply, sex refers to the biological difference between men and women, whereas gender – a term which first appeared the 70s with the development of women’s studies – is rather the social construction of the roles and expectations that are attributed to one sex or the other. Consider French writer and feminist Simone de Beauvoir’s famous remark that one is not born, but rather becomes, a woman.¹

Men and women are taught almost from birth how to behave in society in accordance with the biological sex they have been assigned. This will influence for example the toys a child is given or plays with (cars are for boys and dolls for girls), the clothes we wear (dresses are for girls, not for boys), the sports we play (rugby is a boys’ sport) and later on in life, the courses we choose to study at university (science and maths are for boys, literature and psychology are for girls) or even our profession (men are professors, scientists, and managers, while women are nurses, teachers and secretaries). Such examples may appear to us as rather stereotypical today, but just consider the following facts:

- only 18% of the world’s top-ranking universities are led by women²;
- just under 11% of nurses registered in Britain are men³;
- make-up and fashion-related play is still explicitly marketed to girls, while train sets, construction toys and model kits will generally still have boys pictured on the packaging⁴;
- women make up only 14.4% of all people working in Stem (Science, technology, engineering and maths) in the UK, despite being about half of the workforce⁵.

There is still some way to go in the deconstruction of these gendered representations, however stereotypical they might appear to us.

Of course, nothing should prevent women – or men – from engaging in activities or professions traditionally assigned to the other sex, but even though there may have

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² https://www.ecu.ac.uk/blogs/far-women-come-higher-education/
been some progress made over the years, habits are hard to break, and more importantly, we need to be aware of gendered roles in order to evolve in a more equal society, free from discrimination.

**WHY INTEGRATING SEX AND GENDER INTO SCIENTIFIC RESEARCH MATTERS**

Even scientific research is not free from gender stereotypes and segregation. Reports show, for example, that women are still under-represented in some areas of scientific research, particularly in the STEM fields.

There are three ways in which gender can be integrated into scientific research:

- Gender equality in research teams;
- Gender-sensitive research – gender is considered at every stage of the research project;
- Gender-specific research – gender is the field of study itself.

**Gender-balanced research teams:**

Promoting gender balance in working groups and research teams contributes to closing the gaps in the participation of women and to improving their careers. Ensuring a gender balance in the research team will also improve the quality of the research simply by providing a more diverse outlook and by considering all the potential talent available in a particular research field. It has also been shown that men and women prefer to work in a mixed environment, and that this improves the quality of collaboration and therefore team performance.

To ensure a better gender balance in research teams, we need, for example:

- To pay attention to potential gender bias in deciding on who will take part;
- To create an environment that fosters equal working conditions (fair access to funding, consideration of working hours and family responsibilities);

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7 These guidelines are concerned with the first two.

8 Gender in EU-funded research, Yellow Window, [http://www.yellowwindow.com/genderinresearch](http://www.yellowwindow.com/genderinresearch)

To be aware that there may be resistances;
• To evolve professionally in a more gender-balanced network.

The fact that a lot of funding for research today is conditioned by integrating gender at all stages of a project (this is the case for the Horizon 2020 research programme, or the Marie Sklodowska-Curie Actions (MSCA) Fellowship for example) underlines the importance given to gender equality and gender mainstreaming in research.

Gender-sensitive research:
A gender-sensitive approach to research is important because we need to take into consideration the differences that exist between men and women, whether they be biological or gender based. Being aware of the gender dimension in research content improves the scientific quality and the relevance of the results. In health sciences for example, the male body is often used as the norm, which can lead to misdiagnosis of an illness or neglecting health problems in one sex because they are generally associated with the other. Take for example myocardial infarction (heart attack) which has long been associated with work-related stress in the older man. Because of this, the illness is under-diagnosed (or diagnosed too late) in women, and a woman who suffers from chest pain will more likely be prescribed anti-depressants, while a man will be sent to a cardiologist. Failing to consider the gender dimension of this illness means that the majority of deaths linked to heart disease concern women.

In the field of social sciences, the gender dimension is often crucial since we are focusing on societal questions. In political science for example, a research project on war and conflict studies cannot ignore the role women play, even if they are not directly involved in armed struggle. In research that requires quantitative or qualitative analysis, a researcher must bear in mind the way questions are formulated, since they may not be perceived in the same way by respondents of different genders.

Gender-sensitive research therefore demands that we consider gender at every stage of the process, where it is appropriate:
• In formulating the question
• In gathering the team, and organizing the work
• In deciding upon the research methods used
• In data collection and analysis
• In the presentation/reporting of the findings

Useful resources:
If you would like to see how a gender-sensitive approach can be applied to your research field, the Yellow Window project provides a series of case studies to illustrate how gender-sensitive research can be applied to the fields of health; food, agriculture and biotechnology; nanoscience and nanotechnologies; energy; the environment; transport; socio-economic science and the humanities; science in society and specific activities of international cooperation: http://www.yellowwindow.com/genderinresearch

Stanford University's Gendered Innovations website also provides case studies in diverse research fields related to engineering, science, the environment and health and medicine: http://genderedinnovations.stanford.edu/fix-the-knowledge.html


**HOW TO INCORPORATE SEX/GENDER IN RESEARCH DESIGN, DATA-COLLECTION AND RESEARCH FINDINGS/RESULTS/REPORTING**

Sex and gender can interfere with all stages of research processes, from strategic considerations for defining priorities, developing theoretical concepts and formulating questions, as well as designing methodologies, analysing data and disseminating results. Since gender is built up from perceived sex differences, it is crucial to distinguish between gender and sex when incorporating both variables into the research processes.

**Research design**

Not only new ideas or opportunities can be identified, but many problematic outcomes can be avoided by designing sex and gender analysis into research from the start of the research process. Researchers must be aware that their choices and priorities may have implications in terms of sex or gender and should know how to address them.

1. **Context factors**

   Institutional and political factors, as well as work conditions, personal attitudes or relational factors may interfere with the setting up of research priorities and may raise issues related to sex and gender. Those factors may influence researchers’ choices, which define the potential impact of the research on gender equality. For example, research interferes with gender equality whenever a developing technology benefits more men than women:
- engineers have designed seatbelts that do not provide safety for pregnant women and foetuses, who can be injured even in low-impact automobile collisions;
- software developers produce “pink” games for girls, thus reinforcing gendered stereotypes about women’s interests;
- despite heart disease being a major killer of women, it has long been considered and thus studied as a male disease, as already mentioned in the previous paragraph.

2. **Defining priorities**

In order to make evidence-based judgments about integrating sex or gender into research priorities, sponsors and researchers need to know if the study should differentiate between women and men, and, if so, which specific women or men. For instance:

- sponsors and researchers leading studies on assistive technologies that help the elderly remain independent not only must know that the majority of the elderly and of elder caregivers are women, but also need to access the available evidence regarding the influence of sex (sex differences in age signalling) and gender (gender differences in how men or women experience aging) on elderly care.

Establishing priorities according to gender assumptions rather than evidence may result in a loss of opportunity for new scientific findings. For example:

- focus on testis determination historically led to overlooking the role of ovarian development on sex determination.

3. **Theoretical framework**

Researchers should revisit theories and concepts of sex and gender, as well as rethink their own theories and concepts in articulation with sex and gender whether research directly involves humans as research objects or not. If research does not directly involve humans, the theoretical framework should consider and clarify the likelihood of differentiated gender relations to the research. Since theories and concepts are crucial for explaining and categorizing phenomena, they play a major role in defining:

- the interesting research topics and questions;
- the most suitable methods;
- the results that count as evidence and those that counter it;
- the appropriate interpretation of the evidence.
It is important that the theoretical framework allow to reveal decisive aspects of sex and gender for bringing new evidence. Therefore, theories and concepts must be underpinned by the best available information on sex and gender. For instance:

- in Europe and the U.S.A., men account for nearly a third of osteoporosis-related hip fractures, but they have been underdiagnosed because the disease has traditionally been defined as a postmenopausal women’s disease.

3. Research questions

Research priorities, theories and concepts directly interfere with the research design by delimiting questions (not) asked. Whenever sex and gender are central in formulating research questions:

- researchers should not ignore the current state of knowledge on the topic in their area of research, as well as what remain to know as a result of not considering sex and gender;
- researchers should know how far assumptions about sex and gender are underpinned by evidence or by gender stereotypes. Not only research based on stereotypes fails to achieve scientific objectivity and capture attitudes and behaviours, but products resulting from this research miss gender diversity;
- researchers should also be aware that sex and gender may limit the research questions. For instance, researchers asked how coronary angiography could be made safer for women after realising that angiography can cause bleeding complications, especially in women.

Data-collection

Whenever both biological basis of female/male distinctions and cultural attitudes are important variables to analyse, sex and gender respectively come into play. In order to unravel sex or gender differences in the data, not only research methods should be, whenever required, diverse from representative surveys by questionnaire to qualitative interviews or focus group, but samples and testing groups should be gender balanced.

1. Choosing the right methodology

Researchers should choose the most appropriate methodology, i.e., the right methodological strategy and tools to ensure that:

- sex and gender differences (if any) will be collected;
- sex and gender differences and the possible interactions between sex, gender and other factors as well will be analysed throughout the research steps and included in the final publication.

2. Incorporating sex in the analysis
Incorporating sex in the analysis involves much more than analysing and reporting results by sex. It also involves:

- to incorporate sex in tasks such as selecting of a set or subset of individuals may be crucial to gather the most accurate data. For instance, in a study under SAGE on students’ discourses about gender equality, it was crucial to form gender balanced focus groups in order to observe the discussion dynamics between men and women. Another example are telephone interviews, since the perceived sex (i.e., the gender) of the interviewer may interfere with the answer of research subjects.
- to report the sex of research subjects or considering the sex of the user/costumer to identify research gaps and prevent over-generalizing findings;
- to recognize differences amongst women and men (or females and males), such as transformations associated with aging and with reproductive biology (puberty, the menstrual cycle, pregnancy and menopause);
- to collect and report data on factors which intersect with sex - such as socioeconomic status, age or even lifestyle (physical activity, use of tobacco, alcohol or other drugs) -, since a focus exclusively on sex, even if biological sex gives rise to differences between men and women, may limit findings by overlooking the major role of other variables. For instance, despite designers of prostheses for total knee arthroplasty observed statistically significant differences between women and men’s knee anatomy, height reveal to be the principal factor for prosthesis selection.

3. Incorporating gender in the analysis

Incorporating gender in the analysis requires to be aware that, as a social construction, not only gender is a linguistic, cognitive and analytical category, which is pervasive in science, health/medicine and engineering, but men and women may have differing needs and expectations for outcomes and may interpret their needs influenced by stereotypes and normative expectations because societies are essentially structured around a gendered division of labour. It is thus crucial for the researchers to reflect on cultural attitudes and particularly on the "taken-for-granted" and invisible assumptions that affect research. For example,

- engineers who observed the workflow of employees with direct contact with customers were able to redesign software in ways that improved the performance of employees, who are more often women using software based on managers’ non-scientific assessments of their needs.

4. Analysing interaction and intersection

Sex and gender interact whether by forming differing bodies, cognitive and emotional abilities, disease patterns or shaping the ways researchers collect and analyse data or engineers plan cars, buildings and other infrastructures. For instance,
gender differences in how men or women report pain, and how men or women physicians treat pain in men or women, are a clear evidence of gender shaping sex, while sex differences in pain signalling play a role in the cultural interpretation of pain as being feminine or masculine. Whenever sex and gender influence data results, researchers should recognize:

- how gender shapes sex;
- how sex influences cultural patterns;
- how difficult it is to identify the specific influences of each factor independently.

Furthermore, sex often interacts with gender while being intersected by factors such as age, race, socioeconomic status, geographic location, language or religion. For instance, as far as brain development is concerned, those social and cultural factors interfere with the interaction between sex attributes, such as genes, chromosomes or hormones, and gender attributes, such as parental stimuli, formal education or the media.

**Reporting and disseminating research results**

There are a set of aspects which research must consider when reporting and disseminating research results. Researchers should consider:

- to include relevant gender differences that came up in the course of the project in presented statistics, tables, figures and descriptions;
- to report when sex differences are not detected in their analyses;
- to disseminate through institutions, departments and journals that focus on gender, along with mainstream research journals;
- to publish articles, chapters in book, etc. on gender-related findings;
- to check if language used is always inclusive.

**IN-DEPTH ANALYSIS: HOW TO BE GENDER-SENSITIVE IN SCIENCE**

These kinds of examples testify that we need to carefully consider gender/sex differences in scientific research. Furthermore, we are approaching the era of the Fourth Industrial Revolution. One of the characteristics of this era is that we are collecting vast amounts of data from various sources. Different science disciplines study this data and try to discover patterns that are going to drive scientific discovery. This discovery is often multidisciplinary, but it often requires support of physical and fundamental sciences. This means that design of different algorithms needs to address gender/sex issues so that the further scientific discovery will not have gender/sex bias.
To adopt gender sensitive in science, we need to consider gender/sex in all phases of the scientific discovery. To help researchers with this process, we here outline the questions that need to be posed and pondered upon in each phase:

**Research Ideas Phase**

- If the research involves humans as research objects, has the relevance of gender to the research topic been analysed?
- If the research does not directly involve humans, are the possibly differentiated relations of men and women to the research subject sufficiently clear?
- Have you reviewed literature and other sources relating to gender differences in the research field?
- What is the possible application of this research regarding to the different gender? Should different solutions be devised based on these applications?

**Proposal Phase**

- Does the methodology ensure that (possible) gender differences will be investigated: that sex/gender-differentiated data will be collected and analysed throughout the research cycle and be part of the final publication?
- Does the proposal explicitly and comprehensively explain how gender issues will be handled (e.g. in a specific work package)?
- Have possibly differentiated outcomes and impacts of the research on women and men been considered?

**Research Phase**

- Are questionnaires, surveys, focus groups etc. designed to unravel potentially relevant sex and/or gender differences in your data?
- Are the groups involved in the project (e.g. samples, testing groups) gender balanced? Are data analysed according to the sex/gender variable? Are other relevant variables analysed with respect to sex/gender?

**Dissemination Phase**

- Do analyses present statistics, tables, figures and descriptions that focus on the relevant gender differences that came up in the course of the project?
- Are institutions, departments and journals that focus on gender included among the target groups for dissemination, along with mainstream research journals?
- Have you considered a specific publication or event on gender-related findings?

**Exploitation/Evaluation Phase**
• Does the evaluation present statistics, tables, figures and descriptions that focus on the relevant gender differences that came up in the course of the project?
• Have you a gendered list of individuals and organisations useful for exploitation aims?
• Have you considered a specific publication or event gendered exploitation/evaluation?
• Is the language used always inclusive?
• Does the evaluation include comments on the GE progression in the organisation(s) during the project life?

If scientific discovery considers GE at all phases of the scientific research, it will address the intended societal challenges in a more comprehensive way. This will result in research applications that will more successfully address the needs of different genders.

**GENDER GAPS IN LITERATURE QUOTED: WHY IT IS IMPORTANT TO SAY IT**

The inclusion of gender/sex perspective in the literature analysis is twofold. It should be interpreted, on the one hand as the use of sources authored by female scholars and, on the other hand, as the integration of the gender/sex perspective in the researches cited.

Quotations of works by women could positively impact their career by ensuring circulation and visibility of their studies to new scholars and by increasing their citation impact (e.g. h-index), which should also be interpreted in a gender perspective. The measurement of scientific excellence and performance around the world is in fact intertwined with the socio-cultural context, usually gender insensitive, and so can relegate female researchers at the margins of the academia.

For example, one interesting meta research article\(^\text{10}\) reports that gender gap in publishing still persists, particularly in surgery, computer science, physics, and maths. It is particularly accentuated in authorship positions associated with seniority and in prestigious journals. Authors also underline that journals invite men scholars to submit papers at approximately double the rate of women.

The inclusion of gender/sex perspective in the literature analysis ensures the integration of the concepts of sex and gender in relation to data, methods, results and objectives, through comparison, rupture or continuity with respect to previous works. The growing appreciation of this perspective in different fields of sciences should be strengthened, deepened and fostered, also operating rigorous review of available sources. For example, some researchers\(^\text{11}\) worked on a literature review of the sources available for

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\(^\text{10}\) Holman L., Stuart-Fox D., Hauser C.E. (2018), *The gender gap in science: How long until women are equally represented?*, PLoS Biology, 16(4).

the study of the impact of sex and gender in medical research, providing a wide bibliography of tools to integrate those concepts in research design and methodology.

Literature analysis should then explain whether and to what extent sources quoted adopted a gender/sex perspective (including animals, tissues and cells), both from the point of view of research design and from the impact/effect/results or implications of the research itself. It should be underlined in which aspect/stages of the research gender and/or sex were integrated. If there is no source adopting a gender/sex perspective, the author should try to make the gap explicit and discuss it.

**HOW TO SUPPORT WOMEN TO ATTAIN KEY POSITIONS AND TO PARTICIPATE IN SCIENTIFIC AND SELECTION COMMITTEES**

In order to have larger involvement of women in scientific and selection committees we need to address this issue both at the top-down and bottom-up approach. This section outlines the issues that need to be considered at Managerial (top-down) and Principal Investigator (bottom-up) levels.

The aims of all those actions are to:

- Encourage equal participation of men and women in research teams at all levels
- Create working conditions and culture that allow men and women to have equally fulfilling careers

These are the common actions to fulfil these goals:

- ensure open and impartial selection procedures: use mixed selection panels, train panel members on gender bias, advertise open posts widely, explicitly encourage women to apply, accommodate atypical career patterns;
- use explicit, precise and transparent selection and evaluation criteria: set standards that are relevant to the pursuit of scientific knowledge, use appropriate indicators of performance that fit the life-cycle productivity of both men and women;
- working culture: equal working conditions (pay, opportunities for training, access to grants and funding, work-life balance), awareness of different possibilities in terms of geographical mobility, and accommodation of private commitments or different career structures.

List of coordinated actions from both sides which can support women to attain leading positions and to participate in scientific and selection committees.

**Top-down actions**
Top management is trained in unconscious bias and takes time and carefully considers gender in decision making processes
Top management promotes GE in the organization
Institution has GEP and continuously monitors gendered data (which includes participation in scientific and selection committees)
The management organizes leadership workshops
The management organizes dissemination skills workshops

Bottom-up actions

- Cultivate contacts with both men and women
- Create a mixed network of collaborators
- Plan gender-equal working conditions
- Involve men and women in writing the proposal
- Manage and monitor gender equality
- Create unbiased evaluation processes
- Create informal and formal support groups

HOW TO SUPPORT WOMEN TO ATTAIN KEY POSITIONS AND TO PARTICIPATE TO EDITORIAL BOARDS

Editorial boards, especially top boards, play a central role in defining excellence in research and science. They may determine, and at the same promote, the success in a particular field of study. Women are under-represented or sometimes even absent from top boards, especially in specific fields, such as STEAM and medical areas. For example, a 2016 study on “Gender Representation on Journal Editorial Boards in the Mathematical Sciences” reported that women account for merely 8.9% of mathematical sciences journal editorships, concluding that the degree of underrepresentation on mathematical sciences journal editorial boards is deeper than in the field itself.

Each journal’s editorial and advisory board can play a role in controlling and excluding researchers, but also a critical one in resolving gender bias and in promoting innovation, influencing who can publish what. The correlation between the gender of journal editorials leaders and that of editorial members is confirmed, for example, from a

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study\textsuperscript{14} that underlines how the female gender of the editor-in-chief and associate editor-in-chief positively affected women’s participation in journal boards.

Journal should be aware of the proportion of women and men that are part of the top editorial board (including Scientific Committee), trying to include more women and scholars using a gender/sex perspective in the field among the top positions of the journal and of the editorial board and constantly monitoring gender equality both in the composition of top boards and in the working conditions and avoiding selection bias favouring men. Women and scholars with a gender/sex perspective should be encouraged to have a leading role and to cooperate in deciding the composition of the top editorial board, the topic/call for articles that the journal will cover, in identifying peer reviewers and in the financial decisional process of the journal.

**HOW TO DRAFT A GENDER-SENSITIVE CALL FOR ARTICLES**

According to what underlined about the gender gaps in the scientific literature quoted, call for articles/papers can influence the visibility, circulation and validation of gender equality and gender perspective in sciences and higher research institutions. Call for articles/papers can foster a gender perspective and equality both through the language adopted and the contents of contributions welcomed, influencing the authors as well as the referees. Call for articles/papers should use a gender-neutral language or gender-inclusive language in the call, that avoids bias towards a particular sex or gender.

The call should requires authors to clarify, even in the title and the abstract, if/when only one gender/sex is included in the study, to state if a gender/sex perspective intervened in the literature review, to adequately explain if gender/sex is integrated in the research design and study process and in presenting and discussing the effects and results of the study.

If the author does not adopt a sex/gender perspective in any of the previous points, referees and editorial board should encourage him/her to integrate and apply it when possible or to justify the lack of it before accepting the paper for the publication.

**CHECK LIST OF GENDER-SENSITIVE ACTIONS BEFORE SUBMITTING A RESEARCH PROPOSAL OR AN ARTICLE**

**Team**

- Is the team experienced and aware of gender related issues? If not, might they benefit from some training?

- Is there a gender balance in the team and among the leaders?
- Can all members combine work and family life in a way they find satisfactory?
- Is the gender balance in your team also reflected in the number of working hours?
- Is there a balanced number of young scientists - both women and men?
- Are there equal opportunities for women and men to participate in project management positions?
- Is the project management team trained to monitor the project from a gender perspective?

**Design**

- Have you analysed the relevance of sex/gender to the research topic?
- Have you checked if men and women and/or male and female subjects are differently related to the research problem?
- Have you reviewed the literature and other sources relating to sex and gender differences in the research field?
- Does the proposal explicitly and comprehensively explain how gender issues will be handled? If gender issues will not be included, is there a statement explaining why not?
- Does the methodology ensure that (possible) sex/gender differences will be investigated? (e.g. sex/gender differentiated data will be collected, analysed and part of the final publication?)
- Have you considered the possibility that there will be different outcomes and impacts of the research on women and men?

**Research**

- Do you disaggregate and analyse data by gender/sex?
- Are the research tools (questionnaires, surveys, focus groups, etc.) designed to disclose potentially relevant sex and/or gender differences in your data?
- Are the groups involved in the project (e.g. samples, testing groups) sex/gender-balanced?
- If you use interviews, do you include questions aimed at gathering information on how a particular situation may affect women and men differently? Remember that the gender dimension often remains invisible.
- Do you consider the gender of the interviewee, focus group leader, etc.? Some people may feel more comfortable with a researcher of the same gender, depending on sensitivity of the subject to be discussed.

**Results**

- Will the project results benefit the lives of both women and men? Do you explain that in the final publication?
• Do analyses present statistics, tables, figures and descriptions that focus on sex/gender differences?
• Are you using gender-sensitive language? (e.g. avoid overusing masculine pronouns).
• If the final publication contains images, are these representatives of the reality of women and men? Did you avoid stereotypical images?
• Is there a specific need to address your outcomes to women or men?
• Have you included stakeholders that focus on gender among the target groups for dissemination, along with mainstream research conferences or journals?