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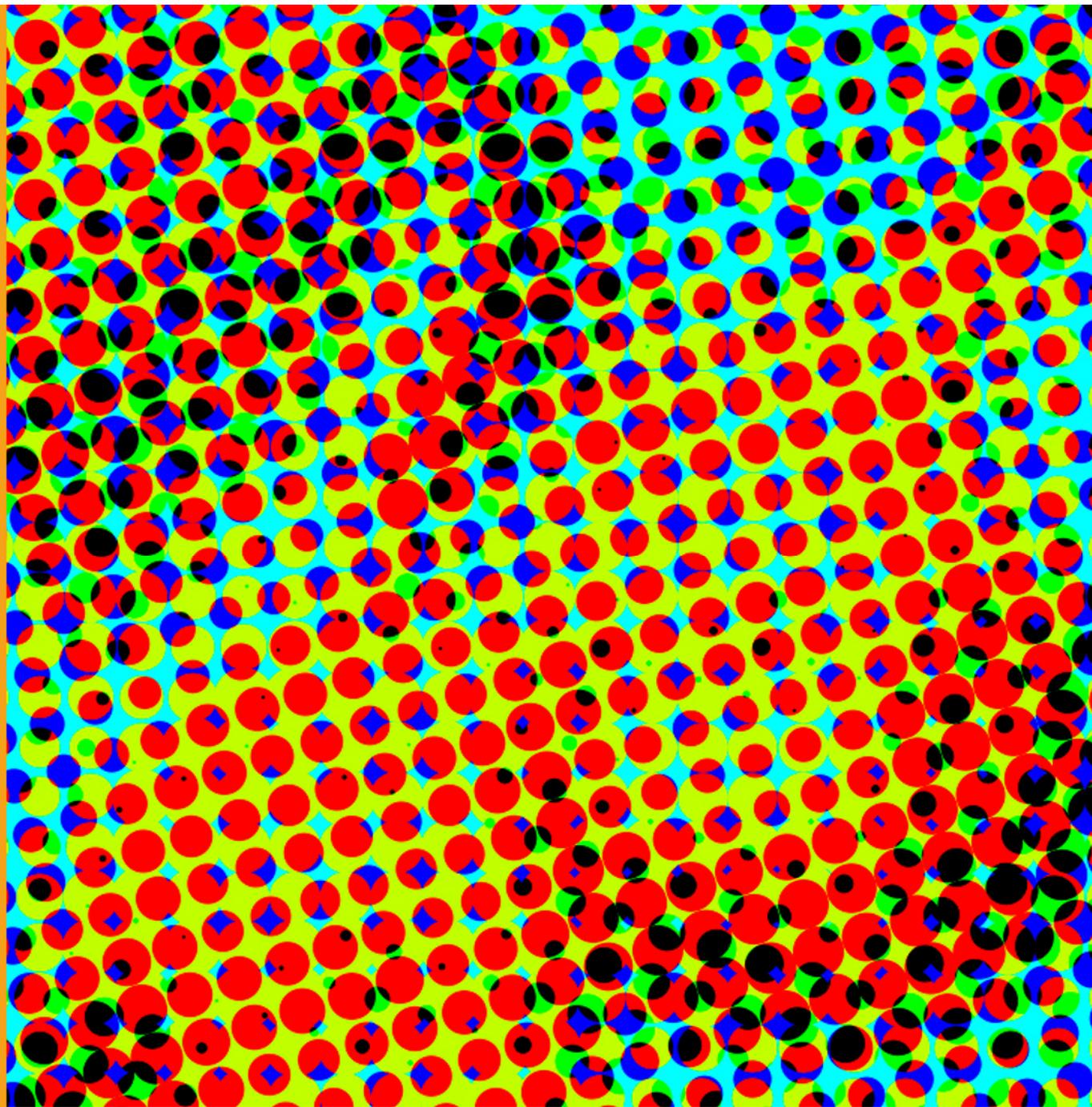
Research Synthesis 4

Gender in Research Content and Knowledge Production

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Description of the Problem

Three strategic approaches have been taken for gender equality in research over the past several decades:

1. "Fix the Numbers of Women" which focuses on increasing women's participation.
2. "Fix the Institutions" which promotes gender equality in careers through structural change in research organisations.
3. "Fix the Knowledge" which stimulates excellence in science and technology by integrating sex and gender analysis into research (Schiebinger, 2008).

This research synthesis addresses the third approach of 'fixing the knowledge'. It is focused on health research because it is an area where sex-gender differences as determinants of outcomes are most extensively evidenced. However, similar knowledge that shows important differences between the needs of women and men is emerging for other fields, for example climate change mitigation, energy and transport. These areas will be covered in future reports.

Despite evidence that sex and gender matter to health outcomes, data and analysis related to sex and gender are frequently absent in systematic reviews.

The quality of knowledge and of research outcomes for women and men often differs to the disadvantage of women. The understanding of sex and gender has been under critical scrutiny. This extends the longstanding development of gender studies, focused on social aspects of meanings ascribed to what is male and what is female, and biological research in natural and medical sciences.

The question of how sex-gender impacts on research and innovation process, and quality of outcomes for women and men, has increasingly driven the concern that improvements are needed in science practice (Schiebinger, 2008; GenSET, 2010).

Peer review used for the assessment of scientific excellence has not prevented gender bias in research. Life science and medical research has often gathered more data from males and men (Buitnedijk et al., 2011), than from females and women,

and many studies excluded females and women completely. A review of sex bias in research on mammals in 10 biological fields showed male bias in 8 disciplines. Single-sex studies of male animals outnumber those of females 5.5 to 1. Studies of both sexes frequently fail to analyse results by sex. In effect our understanding of female biology is compromised by these deficiencies (Beery & Zucker, 2011). Despite evidence that sex and gender matter to health outcomes, data and analysis related to sex and gender are frequently absent in systematic reviews, raising concerns about the quality and applicability of meta-analytical reviews (Runnels et al., 2014).

There has been an increasing interest in how introducing a sex and gender dimension into research content, not only bodes well for higher quality science, but also acts as a catalyst for innovation – i.e. by stimulating new areas of research and their application.

Recent and New Insights from Research

Gendering science, technology and innovation systems

Over the last decade, commentators have focused on the consequences of excluding women from research (as researchers and as subjects) and how this has affected scientific knowledge (Schiebinger, 2008). In 2010, the GenSET science leaders panel analysed gender and sex bias in basic research and found that medical treatments for women are less evidence-based than for men and asked that editors of peer-reviewed journals, medical and others, should require analysis of sex and gender effects when selecting papers for publication (Buitendijk et al., 2011).

The evidence of the impact of gender bias in research on quality led to the European Commission's new commitment to improve the situation within Horizon 2020. Staff from the Commission, potential applicants, the Helsinki Group, National Contact Points (NCPs), as well as expert evaluators and other actors involved in the implementation of Horizon 2020, were issued advice on how gender equality issues should be integrated at each stage of the research cycle: from programming through implementation, monitoring and programme evaluation (EC, 2014:1).

Three objectives underpin the Commission's activities on gender equality in Horizon 2020 (H2020): 1) fostering gender balance in Horizon 2020 research teams; 2) ensuring gender balance in decision-making; 3) integrating gender-sex analysis into research and innovation content (EC, 2014:2). Another novelty of H2020 is promotion of cross cutting impacts of gender by highlighting the relevance of gender as a determinant of quality of results in over 20% of the Call for proposals (programme for 2014-2015) – it was 2% in FP7.

A further novelty of Horizon 2020 is the inclusion of gender training among the eligible costs of an action. The aim is to help researchers to further develop and share gender expertise in relation to the funded project. This also applies to commission staff for systematic training for those involved in the drafting and the implementation of work programmes. Another novelty is the adoption of gender in H2020 as a cross cutting issue (EC, 2014:2).

An early evaluation of proposals submitted to Horizon 2020 in 2014 showed a much greater response to addressing gender considerations in the calls that flagged gender as a relevant topic. This evaluation also concluded that much “more needs to be done” in the next phases of H2020 programme (EC, 2015:1).

However, early draft working documents scoping the next phase of Horizon 2020 by various expert groups published in the autumn of 2014 raised concerns that gender may slip from the policy attention radar. Gender was missing in almost all thematic descriptions for 2016-17 at that point. For instance, in the nine pages of the priorities listed for Health, gender was mentioned only once and this was very briefly (Pollitzer, 2015). These omissions were corrected in the later stages, producing again around 20% of calls for proposals with gender flagged as a relevant consideration.

Sex and gender in research content and methods

There is a growing body of persuasive evidence showing sex-gender differences in health and the importance of identifying differential effects of interventions for men and women. Yet, to whom the research evidence does or does not apply, with regard to sex-gender, is often insufficiently answered. A major meta-analysis of brain structure research has concluded that “the majority of the regions displaying sex differences also show structural differences between typically developing individuals and individuals with neuropsychiatric conditions such as autism, depression, ADHD”

(Ruigrok et al., 2014). Although a number of gender-sensitive Public Health Policies have been developed and implemented in the last two decades, research on impact and efficiency of such approaches, and on risk factor control and management is very scarce, and there is a lack of critical discussion on methodology of gender sensitised interventions (Hawkes & Kent, 2013).

Autism spectrum conditions have been hypothesised to be an exaggeration of normal male low-empathising and high-systemising behaviours. Profiling blood serum

We should avoid any attempt to stigmatise gender-atypical individuals

from adult subjects with Asperger's syndrome (AS) led to identification of distinct sex-specific biomarker fingerprints for male and female subjects. Males with AS showed altered levels of 24 biomarkers. In contrast, AS females showed altered levels of 17 biomarkers including growth factors and hormones such as androgens, growth hormone and insulin-related molecules. The finding of elevated testosterone in AS females confirmed predictions from the 'extreme male brain' and androgen theories of autism spectrum conditions. Sex is therefore an essential criterion in understanding the etiology and development of autism spectrum conditions (Lai et al, 2015).

Recent consensus is that individuals with an atypical male or female phenotype are to be considered to have a "disorder of sexual development". The goal is to eliminate previous terminology that included the terms intersex, hermaphrodite or pseudo-hermaphrodite. However, the teaching of embryology, and particularly teaching about the development of the reproductive system, still has not made the change to the new terminology. If those who teach embryology to health-care professionals remain unaware of the controversies associated with the old terminology and continue to use it, they will perpetuate a nomenclature that can be destructive. Any terminology must be used carefully to avoid dehumanising the individual to a disease or a medical state. We should be able to state clearly the variations in morphology that exist, attend to the immediate health of the individual and avoid any attempt to stigmatise gender-atypical individuals (Marino, 2010).

A good example of how sex and gender impact on health outcomes is provided in the field of tissue transplantation. The sex and gender of donors and recipients is involved in the entire process, including organ donation and transplant surgery.

Females are more likely to donate their organs and are less willing than males to accept transplant surgery. In general, sex mismatch is not advantageous to transplant outcome, as evidenced by many aspects of biological investigations and sex-gender issues should be considered to improve graft survival in clinical practice. (Ge et al, 2013).

Biomedical research makes great use of systematic reviews, which rely on the completeness of the information provided in individual studies. If sex-gender considerations are missing, even if relevant, this will affect the quality of meta-analysis. Cochrane is a world-leading organisation overseeing the quality of systematic reviews. It has recently issued sex-gender analysis briefing notes to assist systematic reviewers in ensuring the applicability of research evidence, with the goal of improved health outcomes for diverse populations (Doull et al, 2014).

In medicine, where research evidence of unequal disease related dynamics for women and men are commonplace, the significance and benefits of gender-sensitive medicine are being gradually recognised. These efforts have been led in Europe by the Institute of Gender in Medicine, founded as an interdisciplinary Centre in the year 2003 and converted into an independent Institute at Charité, Universitaetsmedizin Berlin in 2007 under the leadership of Vera Reigitz-Zagrosek.

In 2013, the Gender in Medicine Institute started a new project, EUGenMed to develop an innovative roadmap for implementation of Sex and Gender (S&G) in biomedicine and health research. This will improve the treatment of major chronic diseases such as infarction, heart failure, diabetes, rheumatic disease, etc. in women and men, and promote new research in these areas.

Five out of 25 analysed countries in Europe have 10 or more full gender study programmes at different levels (BA and Masters) (Lipinsky et al., 2015). The institutionalisation of gender studies can be viewed as an indication of gender knowledge, gender expertise and competence (ibid). This can provide important tools and specific stimulus for integrating the gender dimension into research content in a wide variety of research fields – particularly for interdisciplinary research projects. Mainstreaming gender throughout various degree programmes and into researcher training is a prerequisite for the elimination of gender bias in science knowledge making (GenSET, 2010).

Since 2012, the EU-Stanford University funded project, Gendered Innovations, has been developing systematic sex-gender analysis methodologies involving case studies covering several different research areas, not just medicine, with explanations of terminology and study design checklists (Schiebinger et al., 2011-2015). This body of knowledge is a key learning resource for applicants to Horizon 2020, which identifies the role of gender in the programme as consisting of three things: improved participation of women in scientific roles; integration of sex-gender analysis into project design and research content; and mainstreaming considerations of sex-gender across all relevant topics (EC, 2014).

Implications for Policy

Many published studies did not analyse, or report, their data stratified by sex although there is a strong correlation between sex and the incidence, prevalence, age at onset, symptoms and severity of a disease, as well as the reaction to drugs. In the metabolomics studies, metabolite concentration profiles and genomic data have been shown to provide sources of predictive biomarkers to indicate the presence or severity of a disease depending on gender, which can transform health economics of diseases linked to metabolic processes such as diabetes and Alzheimer's (Mittelstrass et al, 2011).

The analyses provided by the pharmaceutical industry to regulatory authorities often do not present safety and efficacy data by sex. Novartis has started a gender-medicine project called MetaGeM, which includes nine observational studies sponsored by Novartis Farma, Italy; conducted in Italy between 2002 and 2013 in a range of different clinical areas. The MetaGeM project aims to analyse and describe by means of post hoc analyses and meta-analyses, clinical outcomes, therapeutic approaches, and safety data of these studies, by sex (Colombo et al, 2014).

There is consensus amongst various stakeholders (e.g. journal editors, research funders and policy-makers) that the consideration of sex and gender in research is not only essential for scientific rigour but also for informed decision-making, for reduction of harm and for addressing inequities in health outcomes. The National Institutes of Health unveiled policies to ensure that pre-clinical research funded by the US National Institutes of Health considers females and males (Clayton & Collins, 2014).

In recent years the Research Council of Norway has introduced gender perspectives in research as a mandatory criterion in the assessment of grant applications. For many years the Norwegian Research Council has worked to promote gender equality in research, and encouraged research that incorporates gender perspectives and produces fundamental knowledge about gender. The new policy requires that all programmes and initiatives must specifically assess what the gender dimension means for their particular knowledge field. The aim is to enhance the overall quality of research (Hallén, 2014).

The Irish Research Council's new strategy for 2013-2020 (IRC, 2013) requires all applicants to demonstrate that they have given full consideration to whether there is a potential sex and/or gender dimension in their proposed research. In 2013, the Council hosted workshops with international gender experts on how to identify whether a sex and/or gender dimension was relevant and, if so, how to fully integrate sex-gender analysis into the design, implementation, evaluation and dissemination of the research.

The consideration of sex and gender in research is not only essential for scientific rigour but also for informed decision-making

The first Gender Summit in 2011 included a session for science editors. The conclusions of this session was that we need guidance for medical journals on the reporting and analysis of results by gender, and we should encourage all those involved in the management of journals, in all disciplines, to ensure that women are properly represented on editorial boards and among the peer review community. A call for the European Medicines Agency was also issued to license drugs only when the data fully cover the effects in women (Heidari & Marsh, 2012).

Analysis of the impact of a requirement introduced in December 2010, that all applicants to the Canadian Institutes of Health Research indicate whether their research designs accounted for sex or gender, showed that biomedical researchers were least likely to report accounting for sex and gender. These disparities represent opportunities for policy intervention by health research funders (Johnson et al., 2014).

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Note: The present document gives a brief overview of recent research findings regarding *Gender in Research Content and Knowledge Production*. Further research syntheses on (1) Education and Training, (2) Academic and Science Careers, (3) Institutional Practices and Processes, (5) Agenda Setting, Policy and Implementation, and (6) Histories and Futures are available at www.genderportal.eu

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