Gender equality in science, medicine, and global health: where are we at and why does it matter?

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Abstract

The purpose of this review is to provide evidence for why gender equality in science, medicine and global health matters for health and health-related outcomes. We present a high-level synthesis of global gender data, summarise progress towards gender equality in science, medicine and global health, review the evidence for why gender equality in these fields matters in terms of health and social outcomes, and reflect on strategies to promote change. Notwithstanding the evolving landscape of global gender data, the overall pattern of gender equality for women science, medicine and global health is one of mixed gains and persistent challenges. Gender equality in science, medicine and global health has the potential to lead to significant health, social, and economic gains. The current gender reckoning in our field highlights both missed and future opportunities, the need to situate gender analyses in the context of political influences and structural inequalities, and to draw upon contemporary social movements to advance the field. With the evolving landscape, we are in the position to demand more from the evidence, to innovate beyond current discourses, and to realise true gender equality for everyone, everywhere.

Introduction

We are in the midst of a gender reckoning in the fields of science, medicine, and global health.[1] Four contemporary social movements have helped shape the global gender and health landscape: online movements against violence, including #MeToo and #NiUnaMenos; intersectional feminism; the evolving recognition of men and masculinities; and, the global trans rights movement. These movements are transforming the health sciences, forcing us to grapple with "…questions of agency, vulnerability, and the dynamic and changing realities of gendered power relations."[2] We are living through transformative and challenging times.

It is in this context that we review the evidence for why gender equality matters in science, medicine and global health. The purpose of this review is to provide a high-level synthesis of global gender data, summarise progress towards gender equality in science, medicine and global health, and review the evidence for why gender equality matters in terms of health and social outcomes. We will situate the current #LancetWomen theme issue in the context of global movements transforming our field, drawing inspiration from trans, feminist, and intersectional scholarship.

Gender, health and society

Restrictive gender norms affect everybody. As a *shared determinant*[3] of health for men, women, boys, girls and gender diverse people, gender inequalities drive large-scale excess in mortality and morbidity globally.[4,5] Gender inequality is transformed into health risk through discriminatory values, norms, beliefs and practices, differential exposures and vulnerabilities to disease, disability and injuries, biases in health systems, and biases in health research.[4] Gender discrimination at any of these levels detrimentally impacts health and social outcomes.[4,5] For example, interpersonal violence, including violence against women, is influenced by harmful gender norms and broader systems of oppression;[6,7] confronting these gendered structures is relevant to all people. More insidiously, gender inequalities contribute to increased levels of stress and anxiety: among women through their socially-prescribed role as caregivers,[8] among men through their socially-prescribed role as breadwinners,[9] and among trans people where non-conformity to gender norms are often socially penalised.[10,11] Table 1 provides a summary of some key literature which outlines the relationship between gender and health.

Gender equality is a human right.[12,13] It is essential "to achieve peaceful societies, with full human potential and sustainable development."[14] After more than a century of feminist advocacy,[14,15] 40 years of international discourses on gender in development,[2,17] and a mounting body of evidence,[1,18] gender equality is recognised as one of the most significant determinants of health and economic development.[4,19,20] Despite this recognition, gender equality remains a complex issue in health and development. For one, the term gender is a "widely used and often misunderstood term. It is sometimes conflated with sex or used to refer only to women,"[21] and also categorically excludes trans and non-gender-binary people.[18,19] Here, we use the Global Health 5050 definition of gender[19] and the United Nations (UN) definition of gender equality[22] (Panel 1). While gender equality has been positioned as key to achieving the Sustainable Development Goals,[23,24] there is "a distinct lack of clarity about how such a goal should be defined or about how it might be achieved."[25] Gender is an inherently political issue that "is missing from, misunderstood in, and only sometimes

mainstreamed into global health policies and programmes."[18] There has been sluggish progress towards international gender equality targets,[18,19] and conservative campaigns against 'gender ideology' threaten to undermine progress.[26,27]

The global state of gender equality data

Gender data matter for women in science, medicine, and global health: to both monitor progress and reflect critically on research processes and outputs. A range of gender data has emerged in the last two decades.[28-31] The Organisation for Economic Co-Operation and Development (OECD) reports aggregate gender data on employment, education, entrepreneurship, health development, and governance.[32] The World Bank's Gender Data Portal contains over 500 indicators on agency, socioeconomic context, economic opportunities, education, health, public life, and decision-making.[33] The UN Statistics Division's Minimum Set of Gender Indicators contain 52 quantitative and 11 qualitative indicators over the domains of economic structures and access to resources, education, health, public life and decision-making, and human rights.[34] In addition, there are numerous international gender indexes, reflecting composite data over various aspects of gender, health and development.[35-37]

Despite the proliferation of indicators, methodological and conceptual shortfalls significantly limit the use of gender data.[29,35,36,39,40] Methodological limitations include unequal country coverage, lack of international standards for comparability, insufficient complexity of indicators across gender domains, and insufficient granularity for disaggregation.[41-43] Conceptual shortfalls include assumptions of heteronormativity, exclusion of non-gender-binary persons and men, lack of meaningful information about within-household gender dynamics, and inadequate quantification of unpaid and domestic labour.[18,44-46] Initiatives such as Data2X and Equal Measures 2030 aim to fill these gaps and transform gender data collection systems through conceptualising and collecting new data, and reorganizing existing data so it is more actionable by policy makers.[42,43] The Gender Equitable Men Scale (GEMS) offers survey tools that explore attitudes to gender norms, violence, masculinities, and sexual health.[47] With massive national epidemiological and demographic transitions – combined with the growing recognition of sub-national and intra-urban heterogeneity and the need for intersectional approaches to the quantification of relative advantage or disadvantage[48] – gender metrics are moving towards individual-level approaches.[49,50]

Notwithstanding the changing landscape of global gender data, the overall pattern of gender equality for women science, medicine and global health is one of mixed gains and persistent challenges.

Gender equality in science, medicine and global health

Progress

In science, the "knowledge gender divide continues to exist in all countries, even those which have a highly-developed knowledge society."[51] UNESCO Women in Science data demonstrate that less than 30% of the world's researchers are women, comprising only 19% in South and West Asia, 23% in East

Asia and the Pacific, 30% in Sub-Saharan Africa, 32% in North America and Western Europe and 45% in Latin America[52] (Figure 1). The proportion of women researchers is increasing worldwide (Figure 2), although they publish fewer research papers on average than men and are less likely to collaborate internationally.[53] In Europe and North America, men are still more likely to graduate from the natural sciences, mathematics, and information and communication technologies, and to translate higher degrees into employment.[54] Women are often 'squeezed out' of science careers by structural barriers: SAGE (Science in Australia Gender Equity), the American Association of University Women (AAUW), and the European Commission (She Figures) report that gender inequality is a function of systemic factors unrelated to ability, including bias, organisational constraints, organisational culture, and differential effects of work and family demands.[55-57] Analysis of Programme for International Student Assessment (PISA) data found, paradoxically, that countries with high levels of gender equality have some of the largest STEM gaps in secondary and tertiary education.[58]

In health, issues of occupational segregation, wage and working conditions, and leadership disparities remain pronounced. The health workforce is feminising, and women's participation is consistently higher than in science or the general workforce (Figures 1 and 2), but this is occurring unequally: approximately 75% of the global health workforce is female, yet women disproportionately represent lower cadres of health workers.[59] In medicine, there are persistent imbalances in specialist training participation with women remaining the minority in surgical specialties[60] and gender pay gaps across all specialties, which are not wholly explained by seniority, career breaks, and part-time work.[61] Further, wage conditions may deteriorate as more women join the ranks of health professions.[62] The High-Level Commission on Health Employment and Economic Growth recognised that working conditions of health workers were affected by poor wages and benefits, the absence of social protection and unsafe working conditions.[63] Although women comprise the majority of the health workforce around the world, they hold a small fraction of leadership positions.[1,64] The WHO Global Health Workforce Network Gender Equity Hub recognises that, across the health and social care workforce, women are significantly under-represented in management, leadership and governance.[65]

Global Health is defined as "collaborative trans-national research and action for promoting health for all,"[66] and encompasses international governance, research, and health financing. Despite this inclusive definition, global health as a field remains gender unequal or gender-blind. For example, among 140 global health organizations, only 40% mention gender in their governance documents.[19] Only 20% of global health organisations had gender parity on their governing boards,[19] and only two UN Agencies related to health have women heads.[64] Despite recent commitment by The WHO's Director General to gender equality, only a quarter of Member State chief delegates to the World Health Assembly or Ministers of Health are women.[67] Gender has only recently been explicitly recognised by philanthropic bodies and research funders, with organisational commitments to gender equality from the Bill and Melinda Gates Foundation, Caterpillar Foundation, Ford Foundation, National Institutes of Health, Rockefeller Foundation, and Open Society Foundations.[19] In health financing, gender is insufficiently addressed, despite the purported emphasis placed on equity by proponents of universal health coverage.[68]

Limits

Gender biases in the health sector "…undermine inclusive economic growth, full employment, decent work and the achievement of gender equality. They also create inefficiencies in health systems by limiting the productivity, distribution, motivation and retention of female workers, who constitute the majority of the health workforce."[69] Gender discrimination is linked to low morale, low self-esteem, and lower productivity.[65,70] In many countries, women lack access to productive resources – including land, finance, technology and education – necessary to support engagement in science.[71] Research from East Africa suggests that women scientists face higher burdens of unpaid work and gender violence, with serious sequelae for mental and physical health.[70-74] Systematic gender inequality leads to health workforce maldistribution, and inefficiencies in or barriers to healthcare for those who need it most.[70,75] Unless gender – and its intersections with other social stratifiers – is explicitly recognised, progress towards UHC may fail to address or even exacerbate gender inequality.[68]

Although men face fewer barriers to career progression in science, medicine and global health, they also lack systematic support for transforming existing workplace gender structures. Resources such as Men Advocating Real Change (MARC, by Catalyst) exist to support gender equality initiatives, although there are few targeted policies supporting men as carers or other policies supporting men in transforming workplace gender cultures.[76] An EU report found that, despite positive effects of paternity leave on economic, social and demographic outcomes, uptake of leave remained low, due to poor compensation, lack of affordable childcare, inflexibility of leave arrangements, gender norms and cultural expectations.[77]

There is a paucity of information available about trans persons in the science, medicine and global health workforce. However, a recent study of employment outcomes, using the American National Transgender Discrimination Survey, found they experience greater discrimination in hiring, and differential treatment once employed.[78] Research on the health burden and needs of gender minorities is increasingly available, but trans issues remain marginalized: for example, much data remains blind to trans identities due to the absence of survey items with which to identify as non-gender-binary.[79]

Why gender matters: opportunities in science, medicine and global health

Gender equality in science, medicine and global health has the potential to lead to significant health, social, and economic gains. There is widespread consensus that gender equality in the community promotes economic growth, lowers fertility, reduces child mortality, and improves nutrition.[75,80,81] There is also evidence, primarily from business and management sectors, that gender-diverse workplaces have improved productivity, innovation, decision-making, and employee retention and satisfaction.[82] Gender-diverse institutions are more likely to outperform those that are not gender-diverse.[83,84] If productivity and innovation can be improved by increasing gender diversity, then there is an ethical imperative to do so. Any organisation that is not gender diverse is failing to access and leverage talent.

A benefit of diversity in corporate settings is that the workforce better understands the diverse consumer population can therefore create products and services tailored to clients, leading to increased returns.[85] The same may be true in science, medicine and global health: a more diverse research team may develop more nuanced and relevant research questions, resulting in research that is applicable (and beneficial) to a broader population. In science research, ethnic diversity of authors is associated with increased impact and citations.[86] A review article exploring the culture in medicine toward sexual and gender minorities notes that increasing visibility of LGBT and gender-diverse healthcare providers may promote a welcoming environment for staff and patients.[87] In these ways, gender transformation in health and science sectors has the potential to contribute significantly to gains in gender equality in the wider community.[69,70,88]

A gender diverse medical workforce may also translate into improved patient outcomes. There is evidence that different patients prefer to be treated by a certain gendered doctor,[89] which is important for equity of access to care. A study investigating mortality of women patients with acute myocardial infarction found higher mortality rates of women treated by male doctors.[90] Interestingly, the effect was attenuated if male doctors had higher exposure to female patients and physician colleagues.[90] There is also emerging evidence of beneficial differences in the way women doctors practice, leading to lower patient morbidity and mortality.[91,92] For example, in a matched cohort study performed in Canada, patients treated by female surgeons had a modest but statistically significant decrease in a composite outcome of 30-day mortality, complications, and readmission.[91] Similarly, Tsugawa and colleagues found that hospitalised patients treated by women internists had lower mortality and readmissions compared with those cared for by male doctors.[92] A Canadian study found that patients of women primary care physicians had more consistently received recommended health screening, and had fewer emergency department visits than those treated by male primary care physicians.[93] The authors of the papers conclude that gender is a marker of other behaviours that lead to better outcomes, pointing to evidence that women doctors tend to follow guidelines more closely, spend more time with patients, and may have more effective communication skills.[93] In one meta-analysis of the gender effect in medical communication,[94] women primary care physicians had a more patient-centred communication style however there was no gender difference in the quality of information conveyed to patients, and male obstetrics and gynaecology specialists scored higher for emotionally-focused talk. Other gender differences in the medical workforce have been described, from simulated surgical skills tasks to mentorship.[95] While gender differences are apparent, it is important not to assume these are inherent and unchangeable. Instead, we should investigate the drivers of these observed differences to elucidate the positive behaviours that lead to improved outcomes, to optimise training and development for the entire science and health workforce.

Promoting gender equality in science, medicine, and global health

Specific strategies exist to promote women and girls in health and science. The WHO has catalogued a range of tools to assist with gender analysis in health,[96] and outlines gender transformative strategies for programmes and policies.[97] The Commission on the Status of Women 55th Session adopted a report which recognised education and training in STEM, and the 2013 UN General Assembly adopted a resolution on science, technology and innovation for development, recognising

the need for full and equal access by women and girls. The African Union's Science, Technology and Innovation Strategy for Africa 2024 recognises inclusion of women and youth in the industry,[98,99] the East African Community adopted a framework to promote gender in science, technology and innovation, and the Southern Africa Development Community (SADC)'s Gender Policy supports equal access to science education.[98] Policies such as these are supported by international advocacy networks such as Gender in Science, Innovation, Technology and Engineering[100] and the Organisation for Women in Science for the Developing World.[101]

However, these policies have not been sufficient to bring about the widespread social changes needed to ensure gender equality in science, medicine and global health. Social movements, such as the global trans rights movement and online movements against violence, contain important lessons for current efforts for women within science, medicine and global health. Social movements work by politicising issues, calling for the rights of marginalised or less powerful groups in ways that transform power relations and create enabling environments for demands to be heard.[102] At the turn of the 20th century, women physicians were very much part of the women's health movement, which led to a groundswell of changes in the exclusionary practices of medical schools.[103] However, as women became more integrated into medicine, the focus on feminist principles faded despite the continuation of widespread inequalities in specialisation, pay and career advancement.[103] Social movements played a critical role in drawing attention to the voices of women and marginalized groups in global health, particularly in HIV and AIDS.[104] For instance, the Treatment Action Campaign mobilised thousands of unemployed black women, medical professionals, students and academics reaching across boundaries of race, education and class to successfully transform South Africa's HIV/AIDS policy.[102] In science, social collectives and networks play an important role in encouraging women to enter and remain in their careers[105] and may be more important than more individual approaches such as mentorship or 'girl-friendly' curriculums.[106] Taken as a whole, this literature highlights the critical importance of collective networks in bringing about fundamental changes in gender inequalities, and the urgent need for feminist action to transform the position of women in science, medicine and global health.

Conclusion

Our review has highlighted the evidence for why gender equality matters in terms of health and health-related outcomes, positioning the #LancetWomen movement within a discussion of progress towards gender equality worldwide. We found that better gender data are available, women are making progress but remain considerably disadvantaged, men's roles are expanding but are limited by restrictive gender norms, and information on the trans community is limited. Despite this progress, conceptual and methodological shortfalls in research - including outdated conceptualisations of gender and gender inequalities – persist, meaning we only understand part of a much more complex whole.

Gender equality mattes for health. It is one of the most significant drivers of health and health inequalities of our time. The current gender reckoning in science, medicine and global health highlights both missed and future opportunities, the need to situate gender analyses in the context of political influences and structural inequalities, and to draw upon contemporary social movements

to advance the field. Beyond quantitative gender equality, we must strive for a cultural transformation that allows for the inclusion of values of transparency, honesty, fairness, and justice. With the evolving landscape, we are in the position to demand more from the evidence, to innovate beyond current discourses, and to realise true gender equality for everyone, everywhere. Achieving gender equality is not simply instrumental for health and development; its impact has wide-ranging benefits and is a matter of fairness and social justice for everyone.

Author contributions

All authors contributed equally to the conceptualisation of the study. GS, KW, MJ, and JM performed the literature search. CC and AM contributed to insights on masculinities and transgender communities, while AE and AO contributed country-specific insights and supporting case-studies. GS drafted the article and collated the figures, with inputs from JM, KW, MJ, CC, AM, AE and AO.

Declaration of interests

We declare no competing interests. No funding sources to disclose.

Panels, Tables and Figures

Panel 1: Key terms and definitions

Gender refers to the "socially constructed norms that impose and determine roles, relationships and positional power for all people across their lifetime. Gender interacts with sex, the biological and physical characteristics that define women, men and those with intersex identities" (Global Health 5050, 2018)

Gender Data are data disaggregated by sex or reporting gendered phenomena**

Gender Equality means "equal rights, responsibilities and opportunities of women and men and girls and boys, when the interests, needs and priorities of both women and men are taken into consideration, recognizing the diversity of different groups of women and men." (UN Women, 2010)

Trans is "an umbrella term that is used to describe people whose gender is not the same as, or does not sit comfortably with, the sex they were assigned at birth" (Stonewall UK, 2017)

** We have used the Global Health 5050 definition because the definition put forward by the WHO does not explicitly recognise trans or non-gender-binary identities*
*** However, some agencies define gender data as data disaggregated by sex or as data that affects women exclusively*

Panel 2: Search strategy and selection criteria

We identified published and grey literature on gender equality and women in science medicine and global health using Medline, Embase, GoogleScholar, Greenfile, and Scopus search engines. Search terms included: gender, gender equ*, gender inequ*, gender disparit*, male, female, gender diversity; combined with patient outcomes, research outcomes, morbidity and mortality, differences in practice. Reference lists of relevant papers were then also searched to identify further relevant papers. The first 30 hits were looked at on Google and Google Scholar searches.

345 Table 1: The relationship between gender and health: summary of key literature
346 *Please see Supplementary File for full article references*

Author, Year	Summary
Artazcoz, L. et.al. 2007	A framework for occupational epidemiological research combining classic occupational epidemiology and the consideration of structural gender inequalities in health
Barker, Ricardo & Nascimento (2007)	Programmatic evidence on how to engage men and boys in changing gender-based inequity in health
Bates, Hankivsky & Springer (2009)	A comment on the Final Report of the WHO Commission on the Social Determinants of Health, promoting a discussion on gender and health beyond women's health alone.
Ballantyne, PJ. (1999)	A contribution to the analysis of gender differences in health and illness using a social determinants of health framework
Benagiano, G. et.al. (2011)	An article that attempts to expand concepts of gender and explore sexual identity, sexual behaviour, and sexual expression, with a focus on sexual minorities
Connell, R. (2012)	An in-depth exploration of the theoretical underpinnings of gender and health, outlining post-structuralist, relational theories of gender, and positioning gender analysis in both local and global arenas
Courtenay, WH. (2000)	An examination of constructions of masculinity and health within a relational context, outlining structures of gender and power
Denton & Walters (1999)	Research exploring the gender differences in structural and behavioral determinants of health
Doyal, L. (2001)	A call for a much clearer approach to sex, gender and health, which highlights the the impact of both sex and gender on health for both men and women
Galdas, Cheater & Marshall (2005)	A literature review on men and health help-seeking behaviours
Garcia-Moreno, C. et.al. (2006)	A multi-country study on the health impacts of intimate partner violence
Hankivsky, O. (2012)	The implications for research, policy, and practice of intersectionality on women's health, men's health, and gender and health
Hawkes & Buse (2013)	A survey of the evidence for the role of gender in health status, responses by global health actors, and strategies for mainstreaming gender evidence in policies/programmes
Hosseinpoor AR, et.al. (2013)	An investigation of the social determinants of self-reported health in women and men, and male-female differences in health
Institute of Medicine (US) (2011)	A comprehensive review of the health of lesbian, gay, bisexual, and transgender people, as well as identification of research gaps and opportunities related to LGBT health
Krieger, N. (2003)	The paper draws on ecosocial theory to present examples of how gender and sex are relevant as independent or synergistic determinants of health outcomes
Macintyre, Hunt & Sweeting (1996)	A paper exploring the direction and magnitude of sex differences in health according to symptoms or conditions, and according to the phase of the life cycle
Manandhar M, et.al. (2018)	A conceptual framework reflecting on the relationship between gender and health in the context of the sustainable development goals (SDGs)
Matthews, Manor & Power (1999)	A paper that explores the magnitude of gender difference in socioeconomic inequalities in health
McDonough &Walters (2001)	A review of gender differences in health, and a revised framework for conceptualizing pathways linking gender and health
Payne, S. (2015)	This article focuses on the health of women and girls, and the need to address gender equality and gender equity in promoting health.
Phillips, SP. (2005)	An exploration of how gender is defined and measured as a social determinant of health, as well as a model for incorporating gender into epidemiologic analyses is proposed.
Reisner SL, et.al. (2016)	A review of the global health burden and needs of transgender populations
Sen G, Ostlin P. (2007)	A comprehensive report that provides an overview of gender inequity in health, as well as a clear conceptual framework linking gendered social and structural determinants and health outcomes
Verbrugge, L. (1985)	An early article that outlines the evidence of the relationship between gender and health
Vissandjee, B, et.al. (2013)	A review of sex, gender, ethnicity and migration as social determinants of women's health
Vlassoff, C. (2007)	Employs a framework developed for gender and tropical diseases for the analysis of non-communicable diseases and conditions in developing and industrialized countries
World Health Organization (1998)	A technical paper outlining some of the implications of the shift from 'women in development' to 'gender and development' on the analysis of health and healthcare

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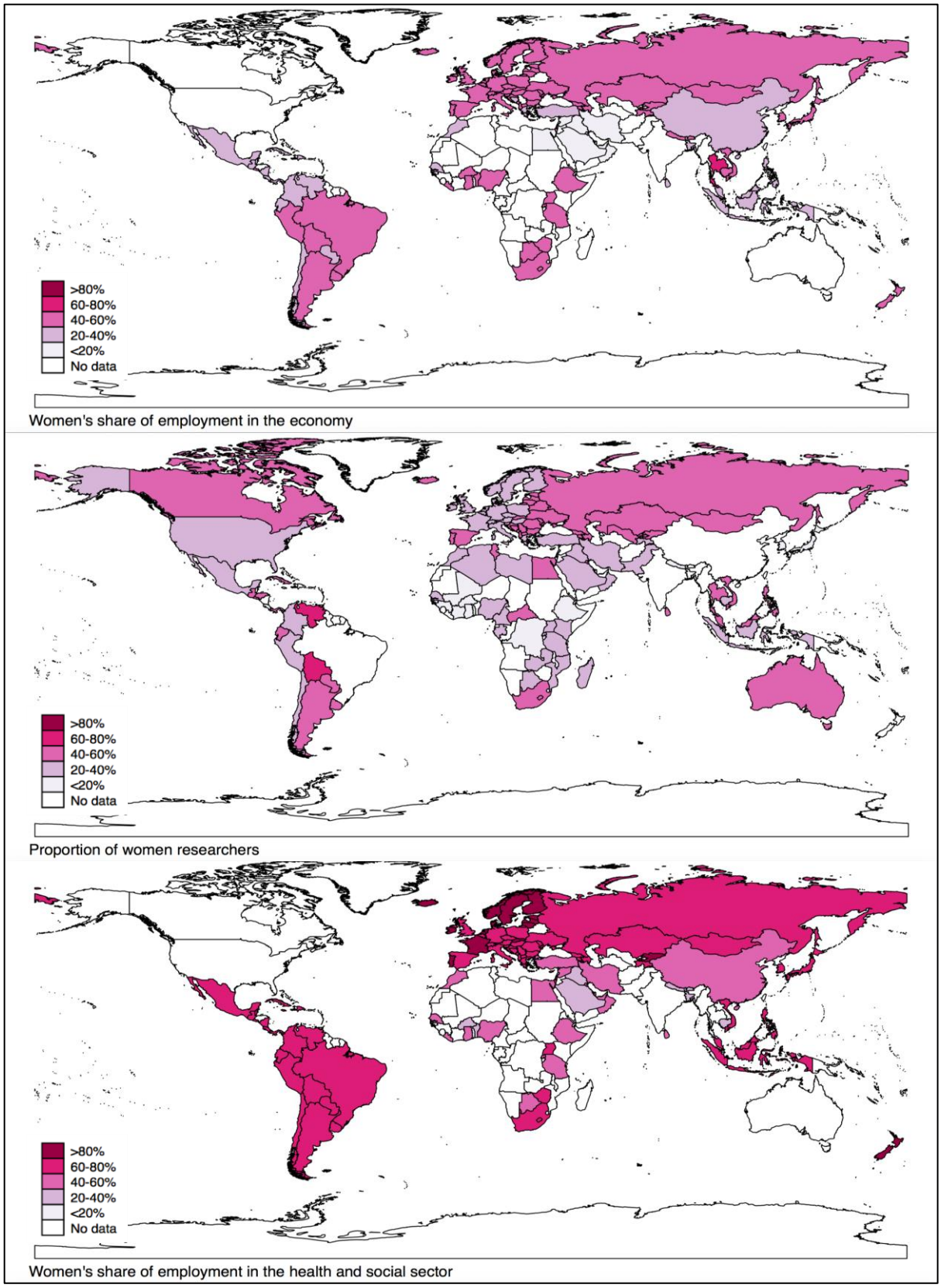

Figure 1: Women's share of employment in the economy (top), share of women in science (middle), and share of employment in the health and social sector (bottom)

Data on the share of women's employment in the economy and the health sector extracted from Health Employment and Economic Growth: An Evidence Base (Buchan J, Dhillon IS& Campbell J, eds. 2017) and checked against ILOSTAT database; data on the proportion of women researchers derived from UNESCO Women in Science, Technology and Innovation dataset (2016), SAGE (For Australian data, 2016), and Gender and the Global Research Landscape (Elsevir, 2016)

Figure 2: Trends in women's participation in the general workforce (orange, solid line), science workforce (yellow, dashed line), and in the health workforce (grey, dotted line) across selected countries derived from international *WageIndicator* survey data.

Data on participation in the general workforce was derived by calculating the gender ratio between women and men completing WageIndicator surveys by country and year. Participation in the science workforce was derived by extracting data from ISCO-08 categories beginning with 21 (Science and Engineering Professionals) and 31 (Science and Engineering Associate Professionals). Participation in the health workforce was derived by extracting data from ISCO-08 categories beginning with 13 (Health Managers), 22 (Health Professionals), 32 (Associate Health Professionals) and 53 (Carers in health Services).

WageIndicator is an online platform for information on the labour market as well as a survey tool to collect self-reported data on background, occupation, and wages. The questionnaire comparable across countries, and adapted to local languages and contexts. More detailed information on the survey tool as well as a discussion on the strengths and limitations of this approach can be found at: Tijdens K, de Vries D, Steinmetz S. Health workforce remuneration: comparing wage levels, ranking, and dispersion of 16 occupational groups in 20 countries. Human Resources for Health. 2013; 11(11). We were granted access to WageIndicator data for free for the purpose of academic research from the IZA, Germany, at http://idsc.iza.org/?page=27&stid=1025.16

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589 **Supplementary material**

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591 Table 1: *The relationship between gender and health: summary of key references*

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