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

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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 in 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 substantial health, social, and economic gains. Positioned within an evolving landscape of gender activism and evidence, our Review highlights missed and future opportunities, as well as the need to draw upon contemporary social movements to advance the field.

Introduction

The fields of science, medicine, and global health are in the midst of a gender reckoning.[1] Four contemporary social movements have helped to 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 transgender rights movement. These movements are transforming the health sciences; as Hilhorst and colleagues state, they are forcing society 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.

In this context, 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 #LancetWomen theme issue in the context of global movements transforming the field, drawing inspiration from transgender, feminist, and intersectional scholarship.

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, Google Scholar, Greenfile, and Scopus search engines. Our last search was done between Nov 1 and Nov 20, 2018. Search terms included: "gender", "gender equ*", "gender inequ*", "gender disparit*", "male", "female", and "gender diversity"; combined with "patient outcomes", "research outcomes", "morbidity" and "mortality", and "differences in practice". We did not apply any publication date or language restrictions. We also searched reference lists of relevant papers to identify further relevant papers. Only the first 30 hits, ordered by relevance, were looked at on Google Scholar searches.

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 excesses in mortality and morbidity globally.[4,5] Gender inequality is transformed into health risk through the following: discriminatory values, norms, beliefs, and practices; differential exposures and susceptibilities to disease, disability, and injuries; biases in health systems; and biases in health research.[4] Gender discrimination at any of these levels detrimentally affects 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 transgender people, in whom non-conformity to gender norms is often socially penalised.[10,11] The table provides a collection of existing resources on the relationship between gender and health.

Gender equality is a human right[39,40] and is essential to the achievement of peaceful societies with full human potential and sustainable development.[41] After more than a century of feminist advocacy,[41,42] 40 years of international discourses on gender in development,[2,43] and a mounting body of evidence,[1,24] gender equality is recognised as one of the most important determinants of health and economic development.[4,39,44] Despite this recognition, gender equality remains a complex issue in health and development. For example, as observed by Momsen,[45] the term gender is a "widely used and often misunderstood term. It is sometimes mistakenly conflated with sex or used to refer only to women", and also categorically excludes transgender and non-gender-binary people.[24,39] In this Review, we use the Global Health 50/50 definition of

	Summary
Artazcoz et al (2007)[12]	A framework for occupational epidemiological research combining classic occupational epidemiology and the consideration of structural gender inequalities in health
Barker et al (2007)[13]	Programmatic evidence on how to engage men and boys in changing gender-based inequity in health
Bates et al (2009)[14]	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 (1999)[15]	A contribution to the analysis of gender differences in health and illness using a social-determinants-of-health framework
Benagiano et al (2011)[16]	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 (2012)[17]	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 (2000)[18]	An examination of constructions of masculinity and health within a relational context, outlining structures of gender and power
Denton and Walters (1999)[19]	Research exploring the gender differences in structural and behavioural determinants of health
Doyal (2001)[20]	A call for a much clearer approach to sex, gender, and health that highlights the impact of both sex and gender on health for both men and women
Galdas et al (2005)[21]	A literature review on men and health help-seeking behaviours
Garcia-Moreno et al (2006)[22]	A multicountry study on the health effects of intimate partner violence
Hankivsky (2012)[23]	The implications for research, policy, and practice of intersectionality on women's health, men's health, and gender and health
Hawkes and Buse (2013)[24]	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 and programmes
Hosseinpoor et al (2013)[25]	An investigation of the social determinants of self-reported health in women and men, and male–female differences in health
US Institute of Medicine (2011)[26]	A comprehensive review of the health of LGBT people, and identification of research gaps and opportunities related to LGBT health
Krieger (2003)[27]	A paper drawing on ecosocial theory to present examples of how gender and sex are relevant as independent or synergistic determinants of health outcomes
Macintyre et al (1996)[28]	A paper exploring the direction and magnitude of sex differences in health according to symptoms or conditions, and according to the phase of the lifecycle
Manandhar et al (2018)[29]	A conceptual framework reflecting on the relationship between gender and health in the context of the Sustainable Development Goals
Matthews et al (1999)[30]	A paper that explores the magnitude of gender difference in socioeconomic inequalities in health
McDonough and Walters (2001)[31]	A review of gender differences in health, and a revised framework for conceptualising pathways linking gender and health
Payne (2015)[32]	An article focusing on the health of women and girls, and the need to address gender equality and gender equity in promoting health
Phillips (2005)[33]	An exploration of how gender is defined and measured as a social determinant of health; a model for incorporating gender into epidemiological analyses is proposed
Reisner et al (2016)[34]	A review of the global health burden and needs of transgender populations
Sen and Ostlin (2007)[4]	A comprehensive report that provides an overview of gender inequity in health, and a clear conceptual framework linking gendered social and structural determinants and health outcomes
Verbrugge (1985)[35]	An early article that outlines the evidence of the relationship between gender and health
Vissandjee et al (2013)[36]	A review of sex, gender, ethnicity, and migration as social determinants of women's health
Vlassoff (2007)[37]	A paper that uses a framework developed for gender and tropical diseases for the analysis of non-communicable diseases and conditions in developing and industrialised countries
WHO (1998)[38]	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 health care

This list was compiled on the basis of the relevance of the literature to the relationship between gender and health, to provide a starting point for reading; it is not intended to be an exhaustive list. LGBT=lesbian, gay, bisexual, and transgender.

Table: **Selected resources outlining the relationship between gender and health**

gender[46] and the UN Women definition of gender equality[47] (panel). Although gender equality has been positioned as key to achieving the Sustainable Development Goals,[50,51] there is a distinct lack of clarity about how such a goal should be defined or how it might be achieved.[52] Gender is an inherently political issue that, according to Hawkes and Buse, "is missing from, misunderstood in, and only sometimes mainstreamed into global health policies and programmes".[24] Progress towards international gender equality targets has been sluggish,[24,39] and conservative campaigns against so-called gender ideology threaten to undermine progress.[53,54]

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 past two decades.[44,55–57] The Organisation for Economic Co-operation and Development reports aggregate gender data on employment, education, entrepreneurship, health, development, and governance.[58] The World Bank's Gender Data Portal contains over 500 indicators on agency, socioeconomic context, economic opportunities, education, health, public life, and decision making.[59] The UN Statistics Division's Minimum Set of Gender Indicators comprise 52 quantitative and 11 qualitative indicators in the domains of economic structures and access to resources, education, health, public life and decision making, and human rights.[60] Additionally, there are numerous international gender indexes, reflecting composite data on various aspects of gender, health, and development.[61–63]

***Panel*: Key terms and definitions**

Gender

"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", as defined by Global Health 50/50.[46]*

Gender data

Gender data encompass sex-disaggregated data, and ensure the "concepts, definitions and methods used in data production are conceived to reflect gender roles, relations and inequalities in society", as described by the European Institute for Gender Equality.[48]†

Gender equality

"Refers to the equal rights, responsibilities and opportunities of women and men and girls and boys…[implying] that the interests, needs and priorities of both women and men are taken into consideration, recognizing the diversity of different groups of women and men", as defined by UN Women.[47]

Transgender

"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", as defined by Stonewall UK.[49]

*We have used the Global Health 50/50 definition because the definition of gender put forward by WHO does not explicitly recognise transgender or non-gender-binary identities. †However, some agencies define gender data as data disaggregated by sex alone, or as data that affect women exclusively.

Despite the proliferation of indicators, methodological and conceptual shortfalls substantially limit the use of gender data.[56,61,62,64,65] Methodological limitations include unequal country coverage, lack of international standards for comparability, insufficient complexity of indicators across gender domains, and insufficient granularity for disaggregation.[66,67] Conceptual shortfalls include assumptions of heteronormativity, exclusion of non-gender-binary people and men, lack of meaningful information about within-household gender dynamics, and inadequate quantification of unpaid and domestic labour.[24,68–70] Initiatives such as Data2× and Equal Measures 2030 aim to fill these gaps and transform gender data collection systems through conceptualising and collecting new data, and reorganising existing data so it is more actionable by policy makers.[67] The Gender Equitable Men Scale offers survey tools that explore attitudes to gender norms, violence, masculinities, and sexual health.[71] With massive national epidemiological and demographic transitions, combined with the growing recognition of subnational and intra-urban heterogeneity and the need for intersectional approaches to the quantification of relative advantage or disadvantage,[72] gender metrics are moving towards individual-level approaches.[73,74]

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.

For more on **Data2×** see https://www.data2x.org/

For more on **Equal Measures 2030** see http://www.equalmeasures2030.org

Gender equality in science, medicine, and global health

Progress

In science, the division in knowledge between genders continues to exist in all countries, even those that have a highly developed knowledge society.[75] The UN Educational, Scientific and Cultural Organization's Women in Science data show 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[76] (figure 1). The proportion of female researchers is increasing worldwide (figure 2), although they publish fewer research papers on average than male researchers and are less likely to collaborate internationally.[80] 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, than are women.[83] Women are often squeezed out of science careers by structural barriers; Science in Australia Gender Equity,[79] the American Association of University Women,[84] and the European Commission[85] 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. An analysis of data from the Programme for International Student Assessment found, paradoxically, that countries with high levels of gender equality have some of the largest gender gaps in secondary and tertiary education of science, technology, engineering, and mathematics (STEM).[86]

In health, issues of occupational segregation, wage and working conditions, and leadership disparities are pronounced. The health workforce is feminising, and women's participation is consistently higher than in science or the general workforce (figures 1, 2), but the feminisation of the workforce is occurring unequally: approximately 75% of the global health workforce is female, yet women disproportionately represent lower cadres of health workers.[87] In medicine, imbalances in specialist training participation persist, with women remaining the minority in surgical specialties,[88] and gender pay gaps are reported across all specialties that are not wholly explained by seniority, career breaks, and part-time work.[89] Further, wage conditions might deteriorate as more women join the ranks of health professions.[90] 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.[91] Although women comprise the majority of the health workforce around

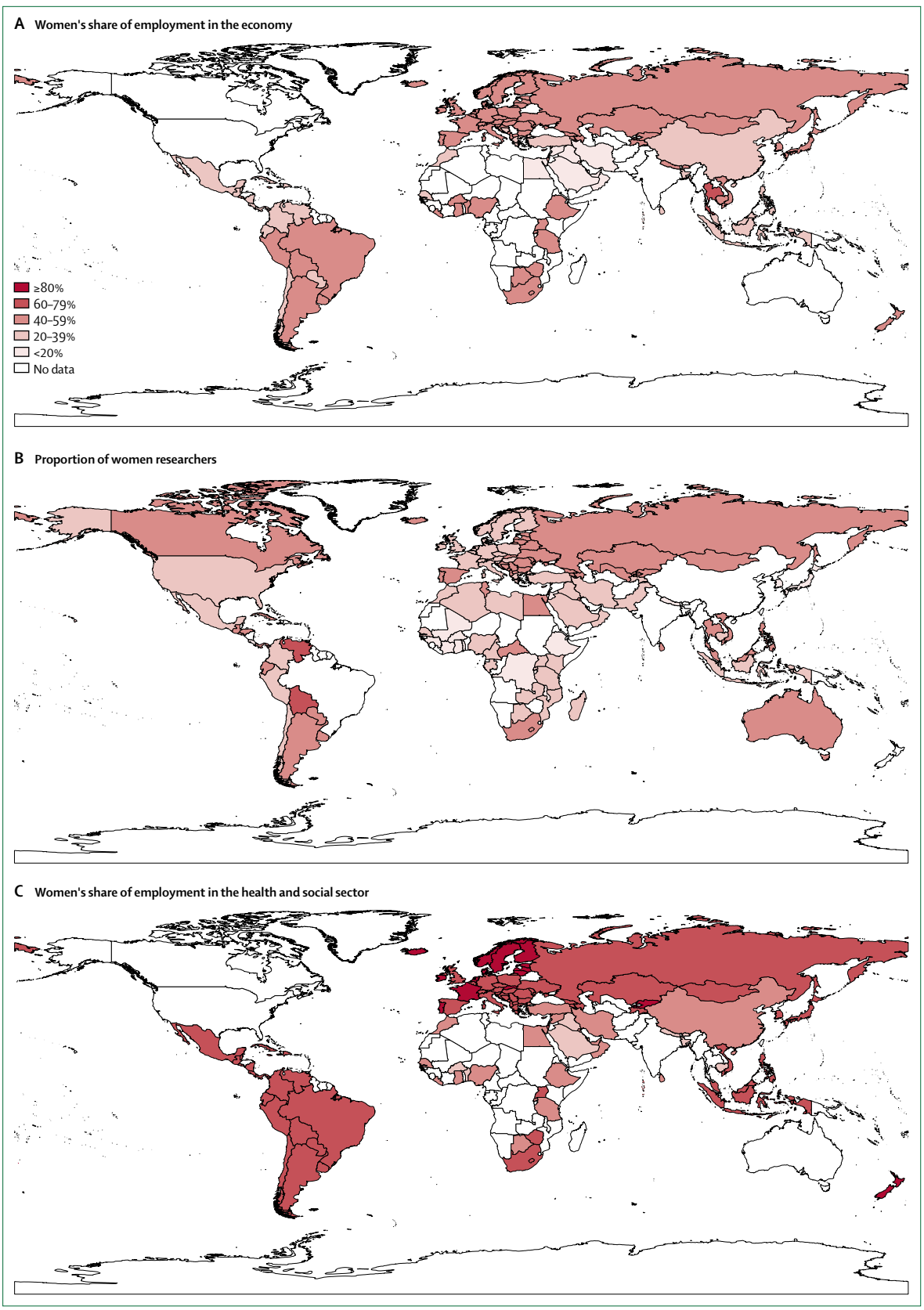

Figure 1: **Women's share of employment in the economy, science, and the health and social sector**
Graphs show the proportion of women in each country (for which data are available) employed in any sector out of the total working-age population (A), employed within the science sector, specifically as researchers (B), and employed in the health and social sector (C). We extracted data on women's overall employment and employment within the health and social sector from a 2017 WHO report by Magar and colleagues[77] and checked it against the ILOSTAT database.[78] We derived the data on the proportion of women researchers from the UN Educational, Scientific and Cultural Organization's Women in Science, Technology and Innovation dataset,[76] Science in Australia Gender Equity (for Australian data),[79] and an Elsevier report.[80]

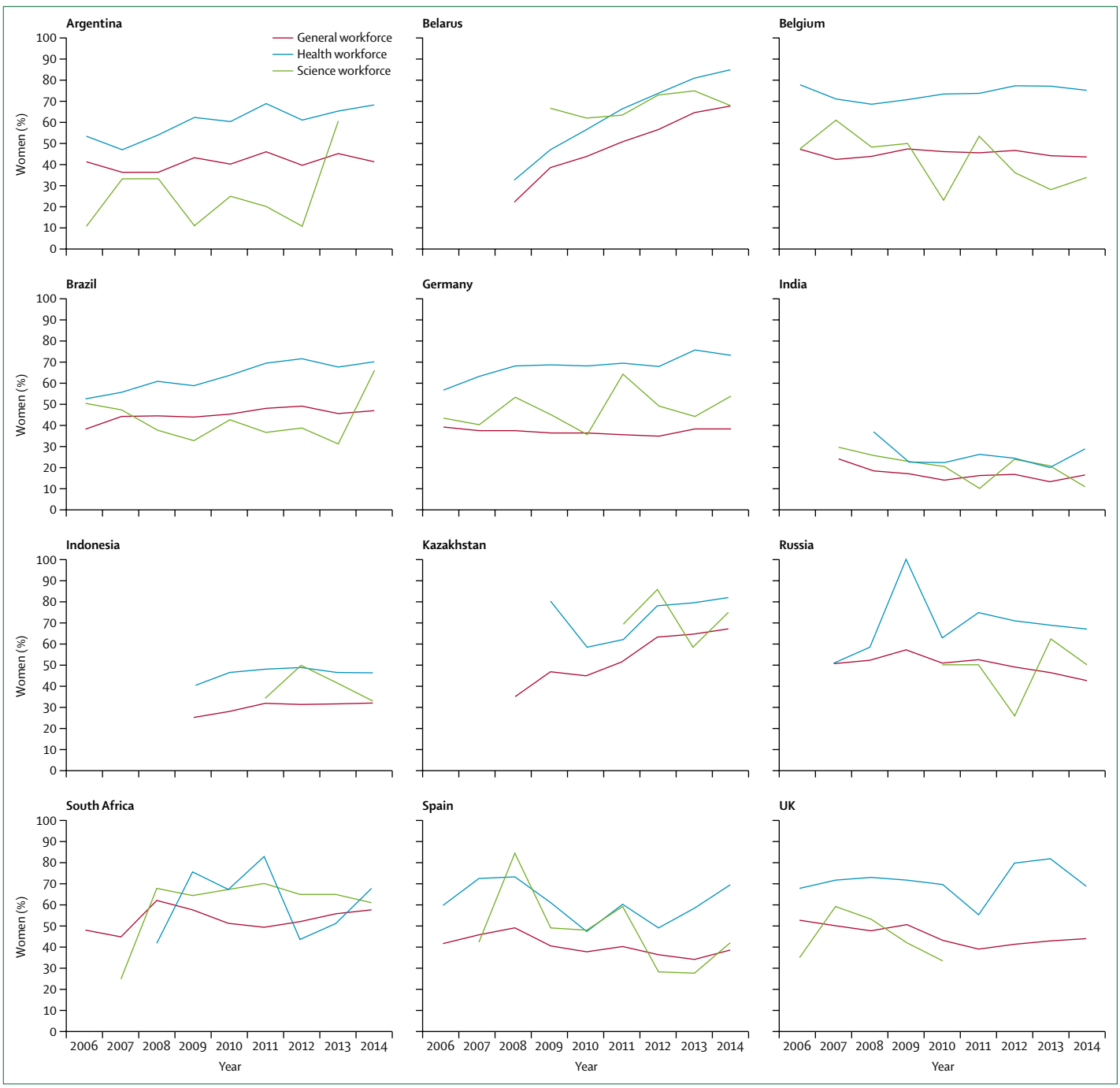

Figure 2: **Trends in women's participation in the general workforce, science workforce, and health workforce across selected countries**
Data are derived from international WageIndicator survey data.[81] Data on participation in the general workforce was derived by calculating the gender ratio between women and men completing WageIndicator surveys by country and year. Participation in the science workforce was derived by extracting data from International Standard Classification of Occupations (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 and a survey tool to collect self-reported data on background, occupation, and wages.[82] The questionnaire is comparable across countries, and adapted to local languages and contexts. We were granted access to WageIndicator data for free for the purpose of academic research from the Research Data Center of the German Institute of Labour Economics (IZA), Bonn, Germany.

the world, they hold a small fraction of leadership positions.[1,92] The WHO Global Health Workforce Network Gender Equity Hub recognises that, across the health and social care workforce, women are substantially under-represented in management, leadership, and governance.[93]

Global health is defined by Beaglehole and Bonita[94] as "collaborative trans-national research and action for promoting health for all", and encompasses international governance, research, and health financing. Despite this inclusive definition, global health as a field is gender unequal or gender blind. For example, among 140 global health organisations, only 40% mention gender in their governance documents.[39] Only 20% of global health organisations had gender parity on their governing boards,[39] and only two UN agencies related to health have female heads.[92] Despite 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.[95] Only 8% of global health philanthropic bodies and research funders provide a definition of gender consistent with international norms.[39] In health financing, gender is insufficiently addressed, despite the purported emphasis placed on equity by proponents of universal health coverage.[96]

Limits

According to the High-Level Commission on Health Employment and Economic Growth, 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."[91] Gender discrimination is linked to low morale, low self-esteem, and lower productivity.[93,97] In many countries, women do not have access to productive resources—including land, finance, technology, and education—necessary to support engagement in science.[75] Research from east Africa suggests that female scientists face higher burdens of unpaid work and gender violence than do male scientists, with serious sequelae for mental and physical health.[75,97,98,99] Systematic gender inequality leads to health workforce maldistribution, and inefficiencies in or barriers to health care for people who need it most.[97,100] Unless gender—and its intersections with other social stratifiers—is explicitly recognised, progress towards universal health coverage might not address, or might even exacerbate, gender inequality.[96]

Although men face fewer barriers to career progression in science, medicine, and global health than do women, they also lack systematic support for transforming existing workplace gender structures. Resources such as Men Advocating Real Change, initiated by the non-profit organisation 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.[84] An EU report found that, despite positive effects of paternity leave on economic, social, and demographic outcomes, uptake of leave remained low because of poor compensation, a shortage of affordable childcare, inflexibility of leave arrangements, restrictive gender norms, and cultural expectations.[101]

There is a paucity of information available about transgender people in the science, medicine, and global health workforce. However, a study of employment outcomes, using data from the US National Transgender Discrimination Survey, found that transgender people experience greater discrimination in hiring than cisgender people, and differential treatment once employed.[102] Research on the health burden and needs of gender minorities is increasingly available, but transgender issues remain marginalised—eg, much data remain blind to transgender identities because of the absence of survey items with which to identify as non-gender binary.[34]

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

Gender equality in science, medicine, and global health has the potential to lead to substantial 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.[100,103,104] 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.[105] Gender-diverse institutions are more likely to outperform those that are not gender diverse.[106,107] 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 and can therefore create products and services tailored to clients, leading to increased returns.[108] The same might be true in science, medicine, and global health: a more diverse research team might 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.[109] A review article exploring the culture in medicine toward sexual and gender minorities notes that increasing visibility of lesbian, gay, bisexual, transgender, and gender-diverse health-care providers might promote a welcoming environment for staff and patients.[110] In these ways, gender transformation in health and science sectors has the potential to contribute substantially to gains in gender equality in the wider community.[91,97,111]

For more on **Men Advocating Real Change** see http://onthemarc.org/home

A gender diverse medical workforce might also translate into improved patient outcomes. There is evidence that different patients prefer to be treated by a specific gendered doctor,[112] which is important for equity of access to care. A study investigating mortality of female patients with acute myocardial infarction found higher mortality in women treated by male doctors than in those treated by

For more on **GenderINSITE** see https://genderinsite.net

For more on the **Organisation for Women in Science for the Developing World** see https://owsd.net

female doctors.[113] The effect was attenuated if male doctors had higher exposure to female patients and physician colleagues.[113] There is also emerging evidence of beneficial differences in the way female doctors practice, leading to lower patient morbidity and mortality.[114,115] For example, in a matched cohort study in Canada, patients treated by female surgeons had a modest but statistically significant decrease in a composite outcome of 30-day mortality, complications, and re-admission than did those treated by male surgeons.[114] Similarly, Tsugawa and colleagues[115] found that patients admitted to hospital and treated by women internists had lower mortality and readmission than did those cared for by male doctors.[115] A Canadian study found that patients of female primary care physicians had more consistently received recommended health screening and had fewer emergency department visits than those treated by male primary care physicians.[116] The authors of these papers conclude that gender is a marker of other behaviours that lead to better outcomes, pointing to evidence that female doctors tend to follow guidelines more closely, spend more time with patients, and might have more effective communication skills than male doctors.[116] In one meta-analysis of the gender effect in medical communication,[117] female 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 than did female specialists. Other gender differences in the medical workforce have been described, from simulated surgical skills tasks to mentorship.[118] Although gender differences are apparent, it is important not to assume these are inherent and unchangeable. Instead, the drivers of these observed differences should be investigated to elucidate the positive behaviours that lead to 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. WHO has catalogued a range of tools to assist with gender analysis in health,[119] and outlines gender transformative strategies for programmes and policies.[120] The 55th Session of the Commission on the Status of Women adopted a report that 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,[121,122] the East African Community has adopted a framework to promote gender in science, technology, and innovation, and the Southern Africa Development Community's gender policy supports equal access to science education.[121] Policies such as these are supported by international advocacy networks such as Gender in Science, Innovation, Technology and Engineering and the Organisation for Women in Science for the Developing World.

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 transgender rights movement and online movements against violence, contain important lessons for efforts to improve representation and inclusion of 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.[123] At the turn of the 20th century, female 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.[124] 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.[124] Social movements played a crucial role in drawing attention to the voices of women and marginalised groups in global health, particularly in the HIV/AIDS response.[125] 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.[123] In science, social collectives and networks play an important role in encouraging women to enter and remain in their careers[126] and might be more important than more individual approaches, such as mentorship or so-called girl-friendly curriculums.[127] Taken as a whole, the literature highlights the crucial 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 the amount and quality of gender data are improving over time, women are making progress but remain considerably disadvantaged, men's roles are expanding but are limited by restrictive gender norms, and information on the transgender community is scarce. Despite this progress, conceptual and methodological shortfalls in research—including outdated conceptualisations of gender and gender inequalities—persist, meaning that we only understand part of a much more complex whole.

Gender equality matters for health. It is one of the most important 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 the need 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.

Contributors

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

Declaration of interests

We declare no competing interests.

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