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Research Paper

# Gender parity at scale: Examining correlations of country-level female participation in education and work with measures of men's and women's survival

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ABSTRACT

*Background:* Past research has demonstrated the relationship between women's educational levels and other measures of social development with maternal and child health outcomes. This study examines the relationship between gender parity in education and work, achieved through greater female participation in both spheres, with survival in both women and men.
*Methods:* Utilizing cross-sectional indicators from United Nations agencies, we constructed global indices of gender parity in education and work for international comparison. Multivariable regression was performed to assess relationships between gender parity index scores and national mortality rates or life expectancy indicators.
*Findings:* Gender parity in both arenas was significantly associated with improved health outcomes after controlling for country health expenditures and other characteristics. A 10% higher country educational parity index score was associated with 59·5 fewer maternal deaths per 100 000 live births, a 2·1-year increase in female life expectancy, and almost a 1-year increase in male life expectancy at birth. Similarly, a 10% higher work parity index score was significantly associated with 14·6 fewer maternal deaths per 100 000 live births and a 0·9-year increase in female life expectancy at birth, with no deleterious relationship to male life expectancy.
*Interpretation:* This study extends past research by examining actionable areas of gender equality and their impact on both male and female survival. While longitudinal research is needed to examine both causality and mechanisms, our findings suggest longevity gains for both women and men, and for all children through reduced maternal mortality, where greater parity in school and work is exhibited.
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## 1. Introduction

While extensive and far-reaching, the impacts of gender on health can be summarised as operating through two major pathways: directly to and from the health care system, and indirectly mediated by other social, economic, and political determinants of health [1]. Examples of direct impacts include influencing health-seeking behaviours and health care received [2]. Indirect impacts may include differential work experiences, with implications for personal income, occupational exposures, and other factors affecting health and health care [3–5].

Three of the central social determinants of health—education, work, and income—are shaped by marked gender disparities [6]. Globally, an excess of 5 million girls of primary school age remain out of school compared with their male peers, and only three in four girls complete their lower secondary education [7,8]. Women are also far less represented in the formal labour market, trailing men's participation rate by more than 25% [9]. Amongst those able to secure formal employment, women are consistently compensated less for their work than men, and frequently relegated to jobs with low potential for promotional growth [10–14].

These figures are concerning considering a large body of literature linking poor education and work outcomes to poor health [6,15–17]. Important research exploring the relationship between various measures of women's empowerment and health has shown that higher female educational attainment and improved gender equality are associated with reduced maternal and infant mortality, as well as increased health service utilisation [18–24]. However, these findings have been restricted almost exclusively to low and middle income countries (LMIC), and focus heavily on reproductive and child health,

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**Research in Context**

*Evidence before this study*

Using the final report of the Women and Gender Equity Knowledge Network to the WHO Commission on Social Determinants of Health as a launching point (published Sept. 2007), we conducted targeted searches of the World Bank, ILO, UN agencies, and WHO websites to collect reports on gender equality and its relationship with health, education, and labour. Additionally, we searched PubMed for quantitative analytic articles published between October 2007 and October 2018 with Boolean search terms ('gender equity' OR 'gender inequity' OR 'gender equality' OR 'gender inequality' OR 'gender parity') AND ('index' OR 'indices') AND ('health' OR 'mortality' OR 'survival' OR 'life expectancy').

Gender inequality has been consistently linked with poor education and work outcomes, especially for women, and with sex-based health disparities. Empirical studies of gender equality have primarily reported negative associations between gender equality and maternal mortality in low- and middle-income countries, with a few studies extending this relationship to child and infant mortality. However, links between gender equality and the long-term health and survival of both sexes remains uncertain.

*Added value of this study*

To our knowledge, this is the first study to investigate the quantitative relationship between country-level gender parity in education or work and broad measures of longevity for people of both sexes. We constructed novel, segregated gender parity indices for school and work that measured the inclusion and advancement of women in each social sphere. Compiling an international sample of 97 countries from every region and income level, we found that gender parity in education was significantly associated with female and male life expectancy at birth ($p<0{\cdot}0001$ and $p = 0{\cdot}04$, respectively) and with maternal mortality ratios ($p<0{\cdot}0001$), following control for several national covariates. Furthermore, gender parity in work was significantly associated with maternal mortality ($p = 0{\cdot}002$) and female life expectancy ($p<0{\cdot}0001$). While occupational gender parity was positively correlated with men's life expectancy in crude analysis ($p = 0{\cdot}04$), this relationship did not hold in the adjusted model.

*Implications of all the available evidence*

This study shows that greater gender parity, translatable to discrete increases in school and work participation, is associated with significant improvements to women's mortality and longevity, with positive or neutral links to men's life expectancy. Thus, improving gender equality by increasing female participation in schools and labour markets might offer a promising route for broad public health promotion in countries of all economic and political climates, while supporting human rights and development-based imperatives for gender gap elimination.

without examination of impacts to long-term survival or wellbeing of both women and men. Examinations of the relationship between health and improved female participation in the workforce are also lacking.

In this study, we carry out original analyses of the association of girl's educational participation and women's labour force participation, resulting in higher gender parity in school and work, with life expectancy of both women and men. We also extend past examinations of maternal mortality beyond LMIC to examine the global relationship between varying levels of educational and occupational gender parity and maternal mortality across a sample of countries from all geographic regions and income levels. Implications for future research and for population health policy are discussed.

## 2. Methods

### 2.1. Measures of gender parity

Our goal for each parity index was to describe concisely both the overall proportion of girls or women participating in each social sphere out of a total age-eligible population of female participants at the national level (absolute participation), and how that proportion of participants compares with the same measure for boys or men (relative participation). Absolute measures of participation were included to identify distinctions between countries with poor participation rates for both men and women and countries with high participation rates for both, which would otherwise be masked. Participation at higher levels of education and occupation, as well as overall participation, is incorporated into each index.

### 2.2. Gender parity in education

Our measure of gender parity in education captures three aspects of women's and girls' educational attainment: (1) overall enrolment rates for girls, (2) how enrolment for girls compares to boys, and (3) whether women and girls are advancing in their education by examining enrolment in primary, secondary, and tertiary education. For each level of education (primary, secondary, and tertiary), we multiply the gross female enrolment rate by the ratio of female-to-male (F:M) enrolment. All female-to-male ratios were capped at a maximum value of 1, the benchmark of equality, to avoid penalisation of countries where female participation rates surpass those of men (the same approach taken by the World Economic Forum's Gender Gap Index) [25]. We then sum these ratios and divide by 3 to create an educational parity index score that can be interpreted as the average product of a country's F:M enrolment ratios and gross enrolment rates for girls across all three levels of schooling, as follows:

$$\frac{\sum_{n=1}^{3}\left(Gross\ girls'\ school\ enrolment_n\ *\ F:M\ enrolment\ ratio_n\right)}{3},$$

where n represents the education level (1=primary school, 2=secondary school, 3=tertiary school). Finally, the index was normalised on a scale of 0 to 100 (100 representing the country with the greatest gender parity) to produce common measures for international comparison.

Educational enrolment data were obtained from the World Bank's DataBank [26]. National data were sufficient to construct an educational gender parity index score for 97 countries, including countries in all six World Health Organization (WHO) regions and all four World Bank income levels (Fig. 1).

### 2.3. Gender parity in work

Our measure of gender parity in work captures two aspects of gender equality at work: (1) overall participation of women in the labour market and (2) how participation in more skilled occupations by women compares to men, a measure of both occupational gender segregation and workplace advancement. We derive this index by determining the average female-to-male ratio across professional workers, technical workers, and managerial workers. We then multiply the average F:M ratio of these occupational categories by the national female labour force participation rate, as follows:

$$\left[\frac{\sum_{k=1}^{3}\left(F:M\ ratio\ of\ workers\ in\ occupation_k\right)}{3}\right] * \left(Female\ labour\ force\ participation\ rate\right),$$

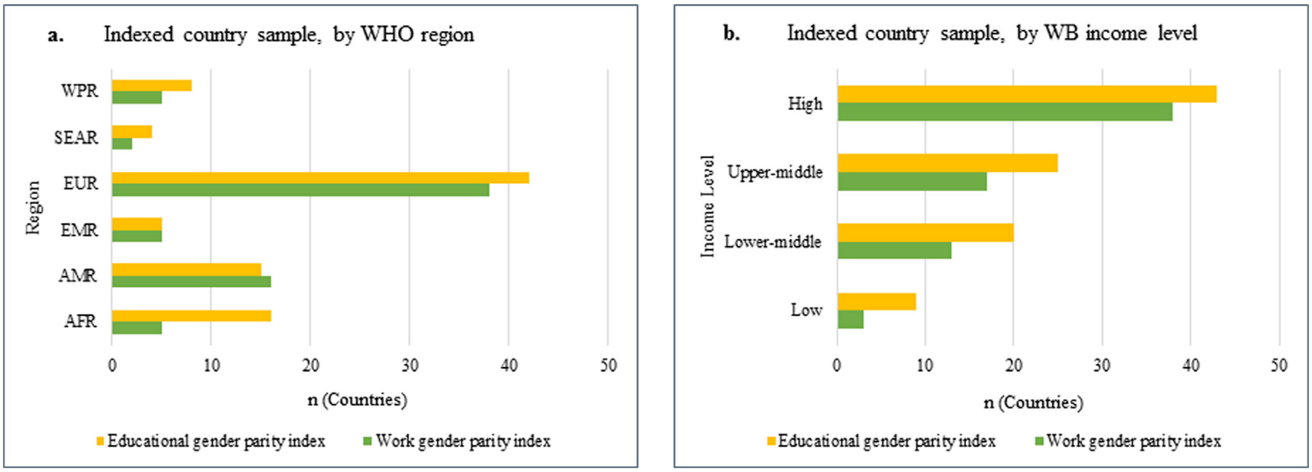


**Fig. 1.** Country representation in gender parity indices, by region and income level designation.

WHO, World Health Organization; WB, World Bank; n, sample size; WPR, Western Pacific Region; SEAR, South-East Asian Region; EUR, European Region; EMR, Eastern Mediterranean Region; AMR, Americas Region; AFR, African Region.

Panel (a) shows the total distribution of countries across WHO regions, as well as the number of countries in each region for which data from the year 2015 were sufficient to create educational and work gender parity indices for use in the statistical analysis. Panel (b) shows the total and parity index-specific distribution of countries by WB income-level designation.

where k represents the job class designation, as classified by ILOSTAT (1=managers, 2=professionals, 3=technicians and associate professionals). Thus, the work parity index score assigned to each country can be interpreted as the product of mean F:M ratios of professional, technical, and managerial workers and total female labour force participation. Each ratio was constructed by stratifying ILOSTAT's measures of occupational distribution per country by gender, and taking the fraction of eligible proportions of female over male participants in each occupational category. Similar to the construction of the education index, all female-to-male ratios were capped at a maximum value of 1, and the index was normalised on a scale of 0 to 100 to facilitate cross-country comparisons.

We obtained measures of job class distribution by sex from the International Labour Organization's ILOSTAT database [27], and female labour force participation information from the World Bank's DataBank [26]. National data were sufficient to construct work gender parity index scores for 71 countries, including countries in all regions and income levels (Fig. 1).

### 2.4. Measures of population health

Three population health outcomes were examined in this analysis, with the intention of examining broad measures of population health as reflected by mortality and survival. Female and male life expectancy at birth, defined as the number of years a newborn infant would live given prevailing patterns of mortality at the time of birth remain constant throughout its life, were collected for the year 2015 from the World Bank's DataBank (interpolated annually from rolling five-year estimates by the United Nations Population Division). Life expectancy was examined as a broad measure of population health across the lifecourse.

The specific impact of gender parity on maternal mortality, an important global indicator of women's health with express significance in Millennium and Sustainable Development Goals benchmarking, was also examined [28,29]. Global estimates of maternal mortality—produced every five years by WHO (most recent estimates from 2015) via reproductive-age mortality studies and modelling household survey results—were accessed from the Global Health Observatory [30]. National estimates of maternal mortality were assessed as rates, specifically as the number of maternal deaths per 100 000 live births for the year 2015.

### 2.5. Data sources

The World Bank's DataBank [26], World Health Organization's Global Health Observatory [31], and International Labour Organization's ILOSTAT [27] databases were used to access indicators for inclusion in our school and work indices, to serve as covariates and outcome measures of interest in regression analysis. These indicators draw from several different sources including household surveys, national and regional surveys (such as the EU Labour Force Survey), census data, and other estimates generated by individual governments. All national data utilised in this report represent information for the year 2015, for which the greatest number of country-specific data points were available across indicators.

### 2.6. Statistical analysis

First, we tabulated the distribution of countries represented by each gender parity index according to geographic region and income level. Gender parity indices were then plotted against health outcomes of interest, with Pearson correlation coefficients generated to quantitatively describe crude associations. Next, using the health and development indicators described above, we ran multivariable ordinary least squares regression models to examine the ecologic relationship between broad health outcomes and national gender parity in education and work. All regression models included control for country per capita gross domestic product (GDP; logarithmically transformed to meet regression assumptions of normality), national unemployment rate, urban population as a percent of the total national population, and domestic government health expenditures as a percent of national GDP. Control for these factors allowed for the assessment of the relationships between our indices and outcomes of interest independent of national wealth, economic climate, development and urbanisation, or government prioritisation of health-care spending. Homoscedasticity and the appropriateness of other linear regression assumptions were assessed for all models to ensure validity. SAS software version 9.4 (Cary, NC, USA) was used to perform all data compilation and analyses. Plots and tables were generated in SAS or Microsoft Excel 2016 (Redmond, WA, USA).

### 2.7. Role of the funding source

The funding source had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The

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corresponding author had full access to all the data and had final responsibility to submit the paper for publication.

## 3. Results

### 3.1. Educational parity

Educational parity index scores ranged from a minimum value of 18·84, in Eritrea, to a maximum of 100·00, in Australia. The median score was 69.80 [interquartile range (IQR) 57·95–76·10]. Gender equality in education was significantly positively associated with female ($r = 0{\cdot}80$, $p<0{\cdot}0001$) and male ($r = 0{\cdot}75$, $p<0{\cdot}0001$) life expectancy estimates (Fig. 2), as well as negatively correlated with a country's maternal mortality rate (Pearson $r = -0{\cdot}80$, $p<0{\cdot}0001$).

In multivariable regression analysis, higher national educational gender parity was found to be significantly associated with better country-level health outcomes for both women and men following control for covariates. Specifically, a 10% increase in our educational parity index, or a 4·9% increase in gross annual school enrolment for girls across all three levels of education, was associated with both a 2·1-year greater female life expectancy and a nearly 1-year greater male life expectancy at birth (0·9 years), after controlling for all country-level covariates (Tables 2, 3). Log GDP per capita was also a significant predictor of life expectancy in both models, and domestic government health expenditures were positively associated with male life expectancy.

Higher educational gender parity was also associated with a reduction of more than 59 maternal deaths per 100 000 live births, all else constant. Overall country wealth (measured as GDP per capita) also contributed significantly to decreased national mortality rates (Table 1).

**Table 1**
Relationship between gender parity and maternal mortality rate (per 100 000 live births) at the country level, 2015.

| | Parameter estimate ($\beta$) | 95% CI | *p*-value |
|---|---|---|---|
| Educational parity index[†] | −5·95 | (−8·23, −3·67) | <0·0001 |
| Log GDP per capita | −77·56 | (−114·17, −40·95) | <0·0001 |
| Unemployment | 0·32 | (−3·36, 4·00) | 0·86 |
| Urban population | 1·64 | (−0·15, 3·43) | 0·07 |
| DGHE | 7·81 | (−5·37, 20·99) | 0·24 |
| **Observations** | | *n* = 83 | |
| Work parity index[†] | −1·46 | (−2·37, −0·55) | 0·002 |
| Log GDP per capita | −86·34 | (−108·56, −64·13) | <0·0001 |
| Unemployment | −1·17 | (−3·53, 1·18) | 0·32 |
| Urban population | 0·74 | (−0·35, 1·81) | 0·18 |
| DGHE | 2·81 | (−4·98, 10·60) | 0·47 |
| **Observations** | | *n* = 69 | |

[†] Represents a 1-point (1%) change in exposure to the index (index created on a 0 to 100 scale). Hence, a 1% increase in the educational parity index, for instance, is associated with a reduction of 5·95 maternal deaths per 100 000 live births; likewise, a 10% increase in the index is associated with 59·5 fewer maternal deaths per 100 000 live births.
Coefficients determined by ordinary least squares regression. 95% confidence intervals (CI) reported in parentheses. All estimates controlled for country per capita gross domestic product (GDP), urban population as a percent of the total national population, unemployment rate, and domestic government health expenditures (DGHE) as a percent of GDP.

### 3.2. Work parity

Work parity index scores ranged from a minimum of 21·17, in Pakistan, to a maximum of 100·00, in Moldova, with a median

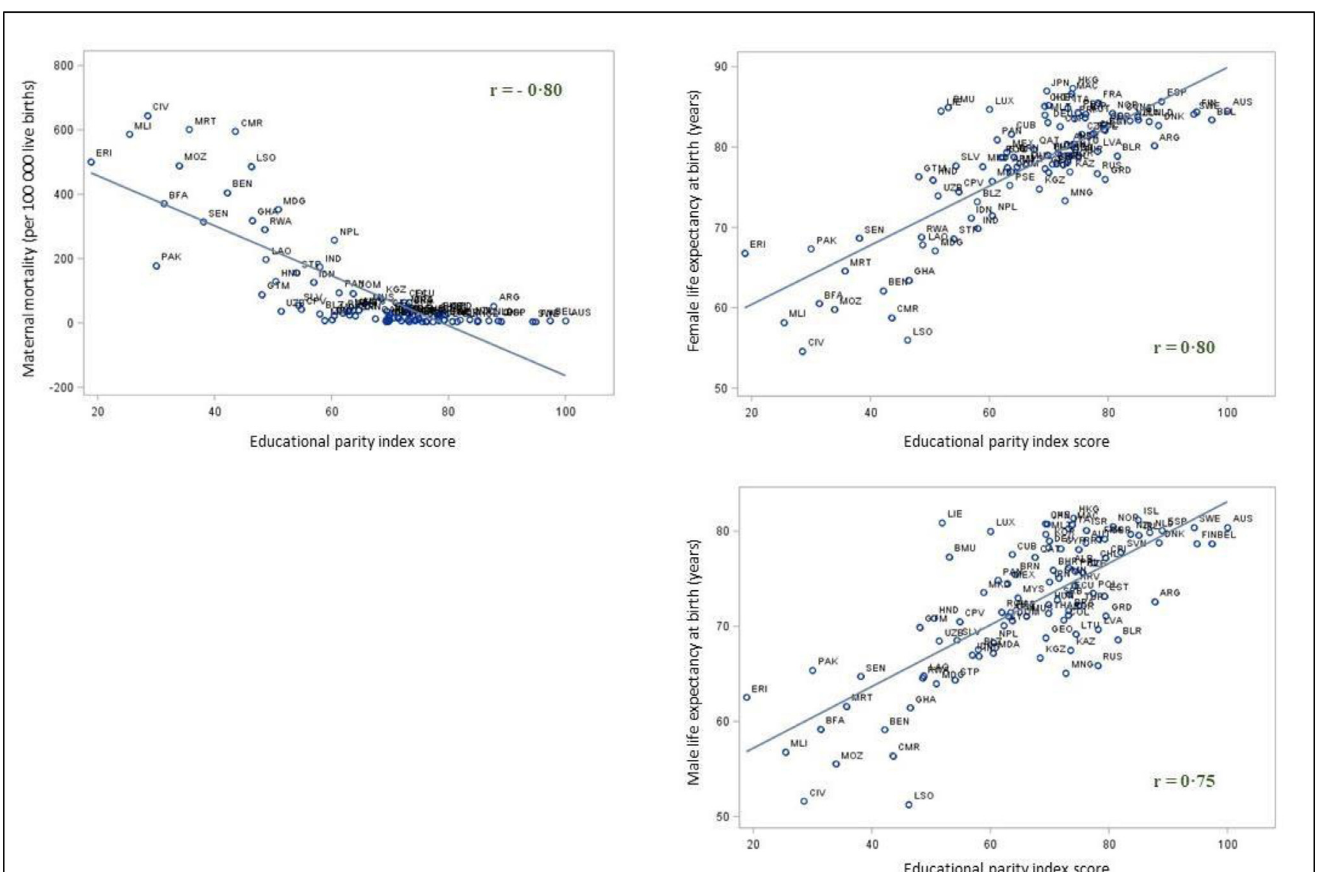


**Fig. 2.** Association between educational gender parity index score and population health outcomes of interest, by country (2015).
International Organization for Standardization (ISO) 3-letter country codes used to denote each country on scatterplot graphs. Pearson correlation coefficients reported for each relationship (r). All parity index scores range from 0 to 100.

country score of 80·82 (IQR 71·25–85·79). Occupational gender parity was significantly associated with increased female ($r$ = 0·43, $p$ = 0·0002) and male life expectancy ($r$ = 0·24, $p$ = 0·04). Improved work parity stemming from greater female representation in the national workforce, including in managerial, technical and professional jobs, was also significantly correlated with reduced maternal mortality (Pearson $r$= −0·32, $p$ = 0·006); outliers Mozambique and Madagascar displayed especially high mortality rates compared with the rest of the countries analysed (Fig. 3).

In multivariable regression, a 10% increase in the work parity index—equivalent to a 10% increase in female labour force participation—was indicative of 14·6 fewer maternal deaths per 100 000 live births, and almost a full year's extension of female life expectancy at birth (0·9 years), with no effect on male life expectancy (tables 1–3). As in the educational parity models, country per capita GDP was associated with all outcomes of interest. Domestic government health expenditures were also positively associated with both female and male life expectancy following adjustment for gender parity in the workforce and all other covariates.

**Table 2**
Relationship between gender parity and female life expectancy (in years at birth) at the country level, 2015.

| | Parameter estimate ($\beta$) | 95% CI | $p$-value |
|---|---|---|---|
| Educational parity index† | 0·21 | (0·13, 0·29) | <0·0001 |
| Log GDP per capita | 3·46 | (2·18, 4·75) | <0·0001 |
| Unemployment | −0·03 | (−0·16, 0·10) | 0·61 |
| Urban population | −0·03 | (−0·09, 0·03) | 0·32 |
| DGHE | 0·34 | (−0·12, 0·81) | 0·14 |
| **Observations** | | $n$ = 83 | |
| Work parity index† | 0·09 | (0·05, 0·13) | <0·0001 |
| Log GDP per capita | 3·96 | (3·08, 4·84) | <0·0001 |
| Unemployment | 0·12 | (0·03, 0·21) | 0·01 |
| Urban population | 0·01 | (−0·04, 0·04) | 0·80 |
| DGHE | 0·36 | (0·06, 0·67) | 0·02 |
| **Observations** | | $n$ = 69 | |

† Represents a 1-point (1%) change in exposure to the index (index created on a 0 to 100 scale).
Coefficients determined by ordinary least squares regression. 95% confidence intervals (CI) reported in parentheses. All estimates controlled for country per capita gross domestic product (GDP), urban population as a percent of the total national population, unemployment rate, and domestic government health expenditures (DGHE) as a percent of GDP.

## 4. Discussion

In this paper we demonstrate that changes in girls' and women's participation and parity in the educational and occupational spheres are associated with greater longevity. Specifically, increased gender parity in education was associated with significantly lower maternal mortality and longer life expectancy for men and women, while increased gender parity in work was associated with lower maternal mortality and lengthier female life expectancy. Notably, greater female participation in school and work was found to have either positive or null associations with men's longevity. This finding suggests that improvements for women in these domains do not come at the expense of men's wellbeing, and may actually play a role in improving men's health. Eliminating gender gaps in education and work can thus serve as upstream, complementary interventions to more downstream health care system improvements ensuring

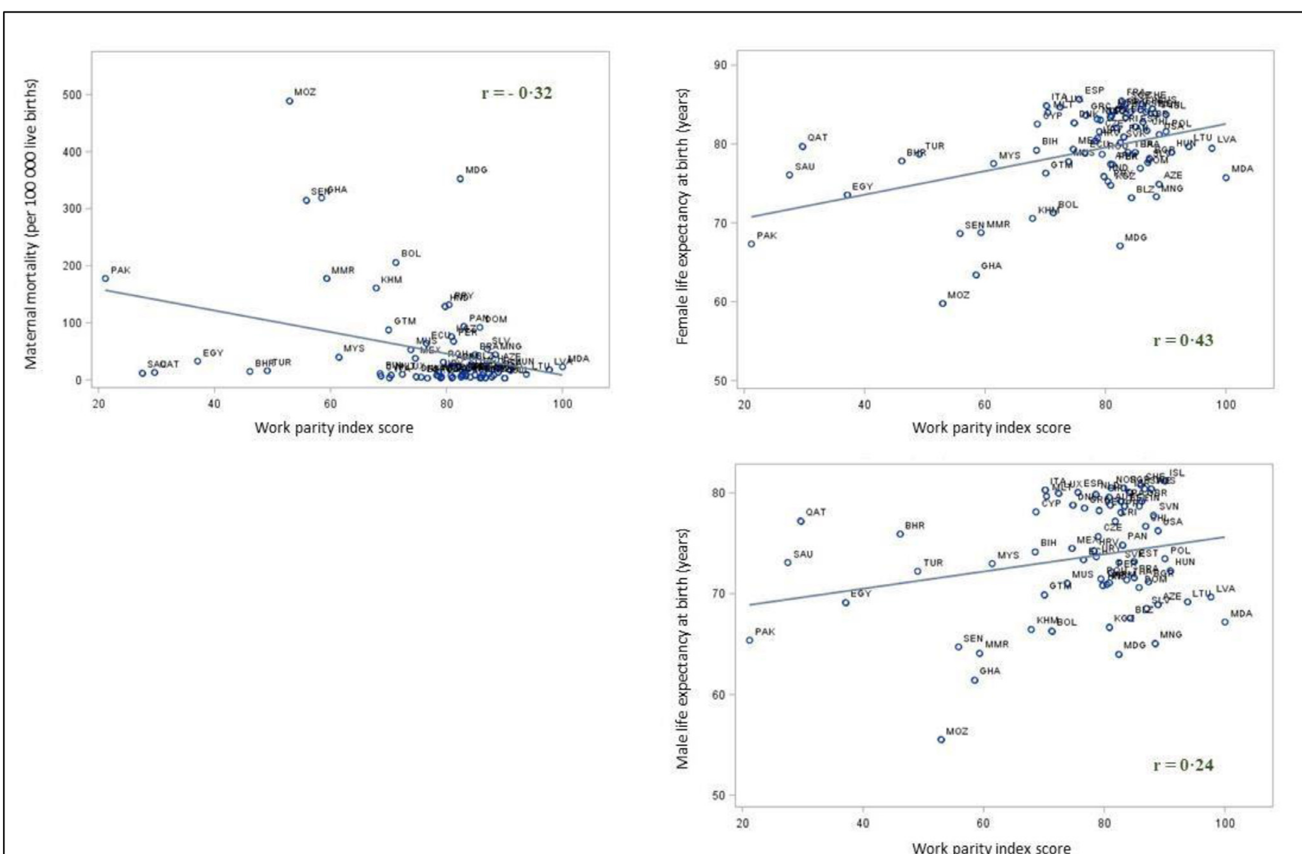


**Fig. 3.** Association between work gender parity index score and population health outcomes of interest, by country (2015).
International Organization for Standardization (ISO) 3-letter country codes used to denote each country on scatterplot graphs. Pearson correlation coefficients reported for each relationship (r). All parity index scores range from 0 to 100.

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**Table 3**
Relationship between gender parity and male life expectancy (in years at birth) at the country level, 2015.

| | Parameter estimate ($\beta$) | 95% CI | *p*-value |
|---|---|---|---|
| Educational parity index† | 0·09 | (0·01, 0·17) | 0·04 |
| Log GDP per capita | 3·64 | (2·31, 4·97) | <0·0001 |
| Unemployment | −0·03 | (−0·17, 0·10) | 0·64 |
| Urban population | −0·01 | (−0·07, 0·05) | 0·82 |
| DGHE | 0·66 | (0·18, 1·14) | 0·008 |
| **Observations** | | *n* = 83 | |
| Work parity index† | 0·01 | (−0·04, 0·04) | 0·83 |
| Log GDP per capita | 3·52 | (2·55, 4·49) | <0·0001 |
| Unemployment | 0·06 | (−0·04, 0·17) | 0·23 |
| Urban population | 0·02 | (−0·02, 0·07) | 0·33 |
| DGHE | 0·71 | (0·37, 1·05) | 0·0001 |
| **Observations** | | *n* = 69 | |

† Represents a 1-point (1%) change in exposure to the index (index created on a 0 to 100 scale).
Coefficients determined by ordinary least squares regression. 95% confidence intervals (CI) reported in parentheses. All estimates controlled for country per capita gross domestic product (GDP), urban population as a percent of the total national population, unemployment rate, and domestic government health expenditures (DGHE) as a percent of GDP.

clinical medicine provides equal access and quality care for people of all genders in order to advance the health and survival of all.

As expected, higher educational gender parity scores were also associated with significantly lower maternal mortality rates in both crude and adjusted analyses. Increased female education has consistently been associated with improved sexual and reproductive health knowledge, increased use of contraceptives, lower fertility rates, and more frequent utilisation of healthcare services—all behaviours that result in fewer total pregnancies, fewer adolescent and teenage pregnancies, and safer deliveries, corresponding with our finding [15]. This result also corroborates the inverse correlation between levels of female empowerment and maternal mortality ratios noted by other studies, including two analyses of composite (2012 Gender Equity Index and Social Institutions and Gender Index) and education-specific (2010 Gender Gap Index educational attainment sub-index) measures of gender equality [18,20].

Increased work parity was also associated with significantly lower maternal mortality rates in both crude and adjusted analyses. Improved female participation in the formal labour market may yield greater overall health insurance coverage for women and their families, particularly in countries with employer-sponsored insurance, which promotes the use of preventive care and maternal health services [10,32,33]. Female employment in higher-level technical, professional, and managerial roles may also generate greater household income, removing financial barriers to antenatal care and health facility deliveries, including the use of skilled birth attendants [34]. Finally, increased representation of women in the workforce has been associated with increased reproductive autonomy [10,35]. This can reduce maternal mortality through decreased fertility rates and safer pregnancies, for instance through birth spacing [36].

These factors and other downstream effects of higher gender parity, including greater decision-making power, bodily autonomy, and resource control by women within their households and larger communities, are likely to also contribute to the positive association noted between both parity indices and female life expectancy [15]. Of note, the magnitude of the female life expectancy−educational advancement relationship was greater than that for professional work attainment, perhaps due to the upstream effects of education which lead it to affect education itself and also work and income outcomes, or as a result of lower work index score variance across countries.

Higher levels of male educational attainment have been associated with lower levels of male all-cause mortality; [37] we extend this finding by showing that higher female educational attainment may also offer a path towards male longevity. One explanation for this result is the society-wide effect of increased human capital and of the role greater gender parity plays in investment and economic outcomes. Improved female participation in public life has been demonstrated to induce strong economic growth and sustained development [38,39]. Moreover, compared with men, women are more likely to invest back in their own families and communities, and put a larger share of their income into health care, communal infrastructure, and other means of raising living standards [40]. Socialised gender norms may also play a role. As documented by the World Health Organization, gender stereotypes reinforce masculine behaviours that increase risks to injury and death, including through substance abuse, sexual behaviours linked to sexually transmitted infections, accidents, and violence [41,42]. Increasing boys' exposure to and socialisation with girls as equal peers in early life, including in the classroom, may help reshape or deconstruct gender norms that encourage behaviours with hazardous consequences to men's health. Finally, maternal education supports improved outcomes for both female and male children, and may thus serve as a means of increasing offspring survival and longevity [22,24].

In the adjusted analysis, men's life expectancy was neither negatively nor positively associated with occupational gender parity. One possible explanation is that the extended female life expectancy observed in countries with more equal labour participation might be partially attributable to reductions in maternal mortality, a pathway for improving survival not available to men. Alternatively, this lack of association may reflect a greater impact of educational parity as an upstream exposure to workplace participation, or could reflect data constraints. Missing job classification information for numerous countries in the ILOSTAT database may have influenced our findings and weakened our measures of association. Only two countries from the South East Asian region (18%), five countries from the African region (11%), and four countries from the Western Pacific region (15%) had complete data available for work index construction, thereby limiting our estimation precision and ability to infer with confidence the full effect of occupational gender parity on global health patterns.

There are several limitations to this research. First, it is cross-sectional in design, precluding causal inferences from these data. An extension of our findings that includes longitudinal analyses will be required to characterise the temporality of these relationships. While the United Nations agencies responsible for the secondary data utilized herein work to ensure comparability, country-level data may in some cases lack complete intra-indicator consistency, as several indicators included primary data aggregated from multiple national and regional sources. Such aggregation limits our ability to examine distinct experiences at the subnational level. Furthermore, data sources do not allow for stratification of participation and health outcome information on the basis of gender identity or intersectional group identities. Surveys which aim to collect national information on health and development should evolve to better represent transgender and gender non-conforming populations and incorporate intersectional frameworks of social identity. Finally, our analysis is focused on absolute and relative female participation and advancement, but other measures such as equality in the law provide alternative approaches to defining and examining gender parity [4,43].

Independent measures of gender parity in education and work offer important insights into their distinct relationships with mortality and life expectancy. Unlike composite measures of gender equality and women's empowerment, the indices constructed here provide estimates of female participation in school and work which are actionable and easily interpretable. This study demonstrates that gender parity across these key social determinants of health is associated with better health outcomes even after controlling for country-level markers of wealth, investment, and urbanisation. Given

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limitations in global, longitudinal data for measures of participation and parity in school and workplace advancement, this cross-sectional snapshot provides an initial understanding of the links between national measures of gender equality in education and work with population health.

While further research is warranted, this study marks an important step in quantitatively debunking the notion that women's improved social standing and access to secure livelihoods can only come at men's expense; indeed, our research suggests that male life expectancy may potentially be extended through educational equality or in environments where educational equality thrives. Improvements in gender parity in access to and quality of clinical care received, as well as the biomedical research that supports this care, have a profound role to play in reducing morbidity and mortality alongside social determinants of health. Advances in access to and gender parity in education and work are likely to accelerate extensions in life expectancy for all people.

## Authors' contributions

This study was co-conceived by Adva Gadoth and Jody Heymann. Adva Gadoth designed the study and carried out data compilation and analysis; she wrote and revised the article. Jody Heymann contributed to the methodological design of the index construction and revised the article.

## Declaration of Competing Interest

Drs. Gadoth and Heymann have nothing to disclose.

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## Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.eclinm.2020.100299.

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