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Functional limitation among middle age and older adults: Exploring cross-national gender disparities

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Abstract

Objective: Functional limitations are prevalent among aging demographics, especially women. Structural and health factors, which vary worldwide, influence rates of functional limitations. Yet, gender disparities in functional limitation remain unclear in a global context.

Methods: We use 2018 data from the Health and Retirement Study (HRS) international family of studies with respondents ages 50–64 and (n=87,479) and 65–89 (n=92,145) to investigate gender disparities in large muscle functional limitation (LMFL) across 10 countries/regions using mixed effects logistic regression, with special attention to structural indicators of inequality and health.

Results: Among both women and men, LMFL was generally higher in China, India, Mexico, United States, and Baltic States than in England, Scandinavia, Southern Europe, Eastern Europe, and Western Europe. The gender disparity in LMFL gradually declined at older ages in India, China, Mexico, and United States, while this disparity gradually increased at older ages throughout Europe. Among middle age respondents, the greater risk of LMFL for women in countries/regions with a high GII was no longer observed *after* accounting for comorbidities. Among older respondents, a lower risk of LMFL for women in countries/regions with a high GII was not observed *until* accounting for comorbidities.

Discussion: Our findings suggest that rates of LMFL are higher in middle-income countries than high-income countries, especially among women, and in countries with a higher GII. In addition, consideration of comorbidities was integral to these relationships. Thus, national/regional contexts inform differential rates of functional limitation, particularly as it relates to gender.

Keywords

comorbidities; disablement process; gender inequality; global aging; life course

1. Introduction

Many people who live to older ages develop functional limitations which are restrictions that prevent a person from performing daily fundamental bodily movement (Verbrugge & Jette, 1994). ‘The disablement process’ posits that functional limitations are the result of

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impairment (i.e., abnormality of the body) and is the antecedent to disability which is difficulty participating in personal and social activities. In addition to functional limitations being most prevalent among older adults (Choi et al., 2020; Duntava et al., 2021), women are especially at risk (Auais et al., 2019; Barbosa et al., 2005; Zeki Al Hazzouri et al., 2011; Zunzunegui et al., 2015). Socioeconomic and health conditions, which vary worldwide, influence the development of functional limitations (Von Bonsdorff & Rantanen, 2011). Yet, this gender disparity in older adult functional limitation remains unclear in a global context. We explore this gap in the literature by investigating differential reports of large muscle functional limitation (LMFL) by country/region and gender, with special attention to socioeconomic factors and structural indicators of inequality.

Research from across the world has consistently shown that older women report greater rates of functional limitation than older men (Auais et al., 2019; Barbosa et al., 2005; Crimmins et al., 2011; Jindai et al., 2016; Ofstedal et al., 2007; Onadja et al., 2013; Yount & Agree, 2005; Zeki Al Hazzouri et al., 2011; Zimmer et al., 2014; Zunzunegui et al., 2015). Gender health disparities are influenced by an amalgamation of biological and social factors that often disadvantage women (Heise et al., 2019; Waldron, 2000). Specifically, older females have a biological endowment that puts that at high risk of developing arthritis which is associated with functional limitation (Callahan et al., 1996; Case & Paxson, 2005; Dunlop et al., 2005; Guccione, 1994). Moreover, women are immersed into a gendered social system, covering various domains (i.e., family; community; economy), that often situates them into social disadvantage (Heise et al., 2019). In addition, these factors intersect with other characteristics (e.g., age; class) that shape one’s social position and, ultimately, their health.

Researchers have attributed the older adult gender disparity in functional limitation to women having more comorbidities than men (Jindai et al., 2016; Yount & Agree, 2005; Zeki Al Hazzouri et al., 2011). Also, women regularly experience harsher social and economic conditions than men throughout the life course (Stuck et al., 1999; Yount & Agree, 2005). Such conditions can contribute to poorer functioning outcomes (Murray et al., 2011). For example, research shows that high gender inequality is associated with the onset of activities of daily living (ADL) disability among women—but not men (Lee et al., 2021). Though ADL disability is contextualized by one’s environment, while functional limitations are theoretically understood as restrictions in bodily movement (Verbrugge & Jette, 1994). This close distinction can be misinterpreted when composite measures are used in functional limitation research (Krause et al., 1998; Micheli et al., 2018).

Many studies that investigate functional limitation disparities by gender focus on a single country and use a distinct measurement of this phenomenon (Barbosa et al., 2005; Jindai et al., 2016; Onadja et al., 2013; Zeki Al Hazzouri et al., 2011; Zimmer et al., 2014). A small area of this literature uses a harmonized measure of functional limitation to compare differences between countries. These studies have found that cross-national differences in older adult functional limitation can be explained by availability of kin, education, family cohabitation, and religious group participation (Hong et al., 2020; Ofstedal et al., 2007; Yount & Agree, 2005). Another study found that obesity and smoking history explain differential rates of functional limitation between women and men (Crimmins et al., 2011).

However, this research has largely been focused in Western contexts which only represent a small proportion of the global aging population.

The experience of aging varies across the world due to the diverse cultural, economic, and social conditions across the life course. These differences are consequential to gender disparities in health. Though there are no known studies that investigate cross-national gender disparities in older adult functional limitation from both middle-income countries (MICs) and high-income countries (HICs). Cross-national examination of older adult gender disparities in functional limitation can help elucidate differences and similarities that precede the environmental influence of disability. Additionally, understanding the mechanisms behind functional limitation gender disparities on a global scale can help inform programming and policy aimed at preventing disability, a growing concern in aging societies.

We use recent nationally representative data from three MICs (i.e., China; India; Mexico) and seven HICs/regions (i.e., England; United States; Scandinavia; Baltic States; Southern Europe; Eastern Europe; Western Europe) to investigate cross-country and gender disparities in large muscle functional limitation (LMFL) among middle age (50–64) and older adults (65–89). We look at both middle age and older adults to observe if there are different patterns of LMFL by age group. We use demographic data to detail differences by country/region, gender, and age group as well as include structural, social, and health indicators. This study seeks to understand gender disparities in older adult functional limitation in a cross-national context by answering three essential questions: (1) Do age group patterns of LMFL vary by country/region and gender? (2) Do gender disparities in LMFL differ by country/region? (3) Do structural, social, and health inequalities contribute to gender disparities in LMFL?

2. Materials and Methods

2.1. Data.

We used data (2018) from six nationally representative datasets on older adults that fielded questions related to functional limitation: United States (Health and Retirement Study - HRS), India (Longitudinal Aging Study in India – LASI), China (China Health and Retirement Longitudinal Study – CHARLS), Mexico (Mexican Health & Aging Study – MHAS), England (English Longitudinal Study of Ageing – ELSA), and five regions of Europe (Survey of Health, Ageing and Retirement in Europe – SHARE). Further information on each these surveys can be found here: HRS (Sonnega et al., 2014), LASI (Arokiasamy et al., 2012), CHARLS (Zhao et al., 2014), MHAS (Wong et al., 2017), ELSA (Steptoe et al., 2013), and SHARE (Börsch-Supan et al., 2013). We restricted our sample to those ages 50–89 (n=182,031). We excluded respondents who were missing reports of education (n=997), marital status (n=113), and the person-level survey weight (n=1,297), leading to an analytical sample of n=179,624. In addition, we used country level data from the United Nations (i.e., gender inequality index) and World Bank (i.e., gross national income per capita) to investigate structural inequalities.

2.2. Dependent Variable.

Performance-based measures of functional limitation do not necessarily inform self-reported measures of functional limitation (Twardzik et al., 2023). As such, we use a dichotomous large muscle functional limitation (LMFL) variable, informed by a similar indicator (An & Lu, 2016; An & Shi, 2015), that measures self-reported difficulty with any of the following four functional limitations: walking one block/100 m/100 yds, getting up from a chair, stooping/kneeling/crouching, and lifting or carrying 10 lbs/kilos. Those who did not report any of the four functional limitations were recoded as “No” and those who reported one or more of these four functional limitations were recoded as “Yes”.

2.3. Independent Variable.

Gender is categorized into men (reference) and women.

2.4. Country/Region.

reflects the nationally representative datasets included in this study. We also grouped countries from SHARE per the United Nations geoscheme which indicates that sub-regions are “…drawn as to obtain greater homogeneity in sizes of population, demographic circumstances, and accuracy of demographic statistics” (UN DESA, 2022); though Northern Europe was divided into the Baltic States and Scandinavia, mainly due to historical, cultural, and economic vestiges from the Soviet Union that currently affect the Baltic States (Mole, 2012). These total five regions were categorized as follows: Baltic States (Estonia; Latvia; Lithuania), Scandinavia (Denmark; Finland; Sweden), Southern Europe (Croatia; Cyprus; Greece; Italy; Malta; Portugal; Slovenia; Spain), Eastern Europe (Bulgaria; Czech Republic; Hungary; Poland; Romania; Slovakia), and Western Europe (Austria; Belgium; France; Germany; Luxembourg; Switzerland). Thus, the countries/regions analyzed in this study were: United States (reference), India, China, Mexico, England, Baltic States, Scandinavia, Southern Europe, Eastern Europe, and Western Europe.

2.5. Covariates.

Age Group is a dichotomous measure categorized into the following groups: middle age (50–64) and older adults (65–89). *Gross National Income per Capita based on Purchasing Power Parity (GNI PPP)* is a conversion of gross national income to international dollars using purchasing power parity rates (World Bank, 2023b). As demonstrated in prior research (Lee et al., 2021), we used the log of GNI PPP in our regression analysis. The log GNI PPP for the five regions of Europe were the average of the countries in each respective region; details on the GNI PPP of each country and region are included in Supplemental Table 1. *Gender Inequality Index (GII)* measures three integral components of gender and development: health, empowerment, and labor market. The higher the score, the more gender inequality (United Nations, 2020). The GII for the five regions of Europe were the average of the countries in each respective region; details on the GII of each country and region are included in Supplemental Table 2. *Education* is a categorical variable that measures three educational attainment groups: less than upper secondary is named “low education” (reference); upper secondary/vocational training is termed “moderate education”; tertiary education is called “high education”. *Marital/Partner*

Status is a categorical variable that indicates the respondent is Married/Partnered (reference), Separated/Divorced, Widowed, or Never Married. Lives Alone is a dichotomous variable that measures those who do not live alone “No” (reference) and those who live alone, “Yes”. *Household Size* is a count variable that ranges from 1–35. *Comorbidities* is a count variable that collects self-reports of the following 6 diagnoses: hypertension, diabetes, cancer, lung condition, heart condition, stroke. The range in our sample was 0–6.

2.6. Statistical Analysis.

First, we examined reports of LMFL by country/region and gender to understand central themes. We then assessed age group differences in reporting LMFL by country/region and gender. Following, we analyzed how gender disparities in LMFL differ by country/region. Finally, we used age group-stratified (i.e., middle age; older adults) mixed effects logistic regression models with odds ratios to examine if structural, social, and health inequalities contribute to gender disparities in LMFL. Both age group-stratified models were progressively adjusted so that gender, age, and GNI PPP were included in Model 1, GII was added in Model 2, an interaction term between gender and GII was incorporated into Model 3 to test if gender inequality contributes to the gender disparity, social determinants of health (SDOH)—namely education, marital status, and household size—were added to Model 4, and comorbidities represented health in Model 5.

3. Results

3.1. Sample Characteristics.

The sample characteristics by country/region and gender are presented in Table 1 (n=179,624). Women reported more LMFL than men within every country/region. The largest gender disparities in LMFL were in Mexico (19.1%) and China (18.1%). Conversely, the smallest gender disparities in LMFL were in England (10.5%) and the United States (10.8%). Women reported greater rates of low education than men in most countries/regions, except the Baltic States (Men=22.6%; Women=21.2%) and Scandinavia (Men=26.0%; Women=25.5%). India had the highest gender differential of reporting low education (21.9%). Reports of high education were highest in Scandinavia, followed by Western Europe, the Baltic States, and United States.

3.2. Age Group Patterns.

To analyze age differences in reporting LMFL, we analyzed prevalence rates by country/region and age group separately for women (Figure 1) and men (Figure 2). We found that women generally reported higher prevalence of LMFL across all age groups. Among women, the prevlance of LMFL was notably higher in India, China, Mexico, and the United States. Rates of LMFL were comparatively low in Scandinavia. Though these country/region differences begin to dissipate at ages 80–84. While country/region differences were not as pronounced among men, rates of LMFL were still particularly high among respondents from India, China, and the United States. Much like women, rates of LMFL were comparatively low in Scandinavia. In addition, these country/region differences mostly dissipate at ages 80–84, with exception of India.

3.3. Gender Disparities.

To assess lifespan differences by gender and country/region, we analyzed the gender difference in reports of LMFL by country/region and age group (Figure 3). We found that, in China, India, Mexico, and United States, the gender disparity in LMFL was highest among younger respondents, though this disparity gradually decreased at older ages. To the contrary, throughout most of Europe (sans the Baltic States) the gender disparity in LMFL was lowest among younger respondents, yet primarily increased at older ages. We also cross-arrayed these gender disparities in LMFL (ages 50–89) by country/region and to compare it with GII (Figure 4). We found a positive relationship between the gender disparity in LMFL and GII, thus indicating that greater gender disparities in LMFL were observed in countries/regions with greater gender inequality.

3.4. Multivariable Analysis.

Table 2 (n=87,479) presents adjusted odds ratios of reporting LMFL among middle age respondents. In the model adjusted for GNI per capita (Model 1), women reported almost two-fold higher odds of LMFL than men (OR=1.94; 95% CI= 1.89, 2.00; p=0.000). Older age had significantly greater odds of reporting LMFL (OR=1.06; 95% CI= 1.06, 1.06; p=0.000). Higher log GNI per capita was associated with significantly lower odds of LMFL (OR=0.70; 95% CI= 0.51, 0.97; p=0.030). When adding GII to our regression (Model 2), we found that a higher GII was associated with markedly greater LMFL (OR=23.51; 95% CI= 2.06, 268.34; p=0.011). Also, the log GNI per capita no longer had a significant relationship with the odds of reporting LMFL. There was a statistically significant interaction between women and GII (Model 3) (OR=1.84; 95% CI= 1.57, 2.17; p=0.000) indicating that for middle aged adults the gender disparity in LMFL is greater in countries with higher gender inequality. Adding social determinants of health to our model (Model 4) did not result in any significant changes to the relationship between gender and the odds of reporting LMFL. However, compared to respondents with low education, significantly lower odds of LMFL were reported among those with moderate (OR=0.78; 95% CI= 0.75, 0.81; p=0.000) and high (OR=0.50; 95% CI= 0.47, 0.52; p=0.000) education. Also, compared to respondents who were married/partnered, significantly greater odds of LMFL were reported among those who were separated/divorced (OR=1.20; 95% CI= 1.13, 1.27; p=0.000), widowed (OR=1.16; 95% CI= 1.10, 1.22; p=0.000), and never married (OR=1.21; 95% CI= 1.12, 1.30; p=0.000). Finally, when including health conditions (Model 5), more comorbidities was associated with higher odds of LMFL (OR=1.73; 95% CI= 1.70, 1.76; p=0.000), net of demographic and social factors. In addition, after adjusting for health conditions, the interaction term between women and GII was no longer statistically significant, suggesting that women's greater burden of chronic diseases in countries with higher gender inequality effectively account for their higher odds of LMFL in middle age compared to men.

Table 3 (n=92,145) presents adjusted odds ratios of reporting LMFL among older adult respondents. After adjusting for GNI per capita (Model 1), women reported significantly greater odds of LMFL than men (OR=1.95; 95% CI= 1.90, 2.00; p=0.000). The odds of reporting LMFL also increased with each year of age (OR=1.07; 95% CI= 1.07, 1.07; p=0.000). Older adults in countries with higher log GNI per capita had significantly lower odds of LMFL (OR=0.61; 95% CI= 0.47, 0.80; p=0.000). When adding GII to our regression (Model 2), we found no relationship between GII and the odds of LMFL. In addition, log GNI per capita no longer had a significant relationship with the odds of reporting LMFL. There was no statistically significant interaction term between women and GII (Model 3). Adding social determinants of health to our model (Model 4) did not result in any significant changes to the relationship between gender and the odds of reporting LMFL. However, compared to respondents with low education, significantly lower odds of LMFL were reported among those with moderate (OR=0.76; 95% CI= 0.73, 0.79; p=0.000) and high (OR=0.56; 95% CI= 0.54, 0.59; p=0.000) education. Also, compared to respondents who were married/partnered, significantly greater odds of LMFL were reported among those who were separated/divorced (OR=1.22; 95% CI= 1.15, 1.30; p=0.000), widowed (OR=1.16; 95% CI= 1.12, 1.20; p=0.000), and never married (OR=1.13; 95% CI= 1.04, 1.23; p=0.004).

Finally, after including health (Model 5), having more comorbidities was associated with higher odds of LMFL in older adults (OR=1.59; 95% CI= 1.57, 1.61; p=0.000). After adjusting for health conditions, the interaction term between women and GII was statistically significant (OR=0.65; 95% CI= 0.54, 0.77; p=0.000). For ease of interpreting this interaction term, estimates of predicted probabilities are provided in Figure 5 (where low GII=0.043 and high GII=0.501 which are the highest and lowest values in the sample, respectively). We also tested for gender disparities by GII using chi-square tests: (1) men*low GII versus women*low GII (x^2=1,021.6; p=0.000) and (1) men*high GII versus women*high GII (x^2=1,331.4; p=0.000). As illustrated in Figure 5, the probability of LMFL is higher (for both men and women) in countries with higher gender inequality; however, the gender disparity in LMFL is attenuated (after adjusting for comorbidities) in countries with a high GII compared to countries with a low GII. Thus, while women's greater burden of comorbidities in high GII countries appears to account for much of the gender disparity in LMFL, in low GII countries it is women's lower comorbidity burden compared to men that once accounted for results in greater gender inequality in LMFL than in high GII countries. In addition, this model adjustment also resulted in significantly higher odds of LMFL among never married respondents compared to married respondents (OR=1.16; 95% CI= 1.07, 1.26; p=0.000).

4. Conclusions

The purpose of this study was to investigate cross-country disparities in functional limitation among middle age and older adults, with special attention to structural indicators of inequality and health. We add to previous disability and aging research by analyzing global reports of functional limitation, an integral component of the disablement process (Verbrugge & Jette, 1994). In addition, this is the first known study to cross-nationally examine reports of LMFL among middle age and older adults from both MICs and HICs with a range of economic, environmental, and social contexts. Our study highlights reports of LMFL by country/region and gender as well as illustrates how comorbidities contribute to the LMFL gender gap in countries/regions with high gender inequality. As a result, our analyses provide new insight to the growing global aging literature by investigating global patterns of middle age and older adult LMFL and its relationship to gender inequalities.

We found that respondents in India, China, Mexico, and United States reported the highest rates of LMFL, especially among women. When looking at country/region differences by age group, LMFL was notably greater among women. However, these global gender disparities began to look similar at older ages. In terms of gender inequality, women's disproportionately high rates of LMFL were largest in India, China, and Mexico among the middle age groups. Conversely, this gender disparity was greater throughout most of Europe among older adults. We also found a positive relationship between the gender disparity in LMFL and GII, thus suggesting that gender disparities in LMFL coincide with gender inequality at the national level. Finally, our adjusted mixed effects logit regression models showed that comorbidities contribute to the LMFL gender gap in countries/regions with high gender inequality.

While prior research has found that women report higher rates of functional limitation than men (Auais et al., 2019; Barbosa et al., 2005; Jindai et al., 2016; Ofstedal et al., 2007; Onadja et al., 2013; Yount & Agree, 2005; Zeki Al Hazzouri et al., 2011; Zimmer et al., 2014; Zunzunegui et al., 2015), our analyses suggest these rates vary considerably across the world. Specifically, we found that rates were generally higher in MICs (i.e., India; China; Mexico) as well as the United States. This finding aligns with prior literature that highlights the relationship between poverty and disability, particularly in low- and middle-income countries (LMICs) (Banks et al., 2017). In addition to country income level, we speculate that income inequality, which is notably high in some of these countries (World Bank, 2023a), influence greater rates of functional limitation, much like disability (Lee et al., 2021). Though the United States had a particularly high rate of LMFL as a HIC which is possibly due to their high level of income inequality that is especially harsh on health and functioning (Choi et al., 2020, 2022). The Baltic States Eastern Europe, and England had the highest rates of LMFL in Europe, just behind the best performing MIC which was China. These findings could, arguably, be contributive to these countries' rates of income inequality (World Bank, 2023a). Moreover, LMFL gender inequalities in the Baltic States and Eastern Europe are possibly informed by economic and cultural vestiges of the former-Soviet Union and allied states, respectively (Chawla et al., 2007). Incorporating representative data from additional MICs, such as those in South America (Lima-Costa et al., 2018) and Africa (Darkwah et al., 2022), would provide additional insight to this older adult functional limitation gender disparity, though the availability of such data is currently limited.

Interestingly, we found that the gender disparity (i.e., women's disadvantage) in LMFL gradually declined in India, China, and Mexico at older ages but gradually increased at older ages throughout Europe. This finding should compel future researchers to investigate whether the gender gap at older ages decreases in MICs or increases in HICs. Yet, it is possible that both men in MICs are living long enough to acquire LMFL, while women in HICs progressively outlive men even longer (Clark & Peck, 2012). Nevertheless, these differences between men and women are, indeed, informed by the level of gender inequality, as our findings and other aging research suggest (Lee et al., 2021; Zimmer et al., 2022). Future research on this topic would benefit from analyzing specific indicators of gender inequality such as education access and labor force participation (United Nations, 2020).

We found that comorbidities contribute to the LMFL gender gap in countries/regions with high gender inequality. This finding suggests that women's risk of having a LMFL in a country/region with a higher GII is largely because the health of older women is poorer than that of older men. Our findings resonate with previous research that has attributed comorbidities to older women's higher rates of functional limitation (Jindai et al., 2016; Yount & Agree, 2005; Zeki Al Hazzouri et al., 2011). In addition, our study compliments prior research that has studied how gender inequality at the structural level contributes older women's disability disadvantage (Lee et al., 2021). Therefore, better health care access could curb the accumulation of comorbidities (Prince et al., 2015) and thus attenuate middle age and older women's high risk of LMFL. Future research on this topic has would benefit from investigating a breadth of individual morbidities to see how they relate to gender disparities in LMFL. Though having better health would not remedy the social conditions that place women at a functional limitation disadvantage. Thus, improving societal indicators related to the GII (i.e., reproductive health; empowerment; labor market) would, hypothetically, contribute to lower rates of functional limitation among older women (Borrell et al., 2014), particularly those in MICs.

This study is novel due to its global examination of middle age and older adult functional limitation gender disparities. Our emphasis on functional limitation in various national contexts provides key insight regarding the 'extra-individual factors' that influence the disablement process (Verbrugge & Jette, 1994). However, this study is not without its limitations. First, the LMFL measures are not precisely comparable across country/region. Specifically, walking one block versus 100 meters versus 100 yards are rough estimations for one another; also, walkability of one's community must be considered (Van Holle et al., 2016). A similar critique can be applied to lifting or carrying 10 pounds versus 5 kilograms which are also estimations of one another. Also, getting up from a chair can be influenced by environmental factors such as the chair itself, particularly its size, quality, and components (e.g., armrests; lifts; padding). Second, the challenge of conducting cross-national research restricted our study to a limited set of covariates. We did not include an occupation history variable due to the lack of harmonizability and missingness across these six datasets; though previous research using the HRS international family of studies has shown that analyzing if a respondent has ever worked does not provide much context to gender disparities in disability (Lee et al., 2021). On the other hand, it is documented that physical work effort (Pebley et al., 2021) and demand (Beltrán-Sánchez et al., 2017) contribute to greater risk of functional limitation later in life. Moreover, research has shown that occupation type and risk of functional limitation has differential outcomes between older women and men (Keddie et al., 2005; Welmer et al., 2013). Other important indicators related to functional limitation later in life, such as wealth (Kumar et al., 2016), neighborhood characteristics (Nguyen et al., 2016), health care access (Silva et al., 2017), and health behaviors (Liao et al., 2011), were not included in our study due to exceptional or absolute missingness in certain datasets. Third, our regional groupings of Europe, which were designed to improve sample size, prevent us from parsing out differences by individual European countries. As such, important cultural, economic, and social differences between countries in each of the five European regions could not be considered.

Our findings suggest that rates of LMFL are largely distinctive between MICs and many HICs, especially among women. This gender disparity in LMFL is largest in MICs among the youngest respondents but largest in HICs among the oldest respondents. We observed that LMFL gender disparities are correlated with gender inequality at the national level. Also, comorbidities contributed to women's LMFL disadvantage in countries/regions with high levels of gender inequality. Our study contributes to the gerontological literature by considering how national contexts inform gendered disparities in functional limitation, a phenomenon that is theoretically understood as restrictions in bodily movement that are distinguishable from disability (Verbrugge & Jette, 1994). This research is essential to understanding the universal versus country-specific processes that contribute to the functional limitation gender disparity. Future research in this area would benefit from incorporating a more diverse selection of: (1) countries that are experiencing rapid aging, (2) measures related to functional limitation, and (3) indicators of gender inequality.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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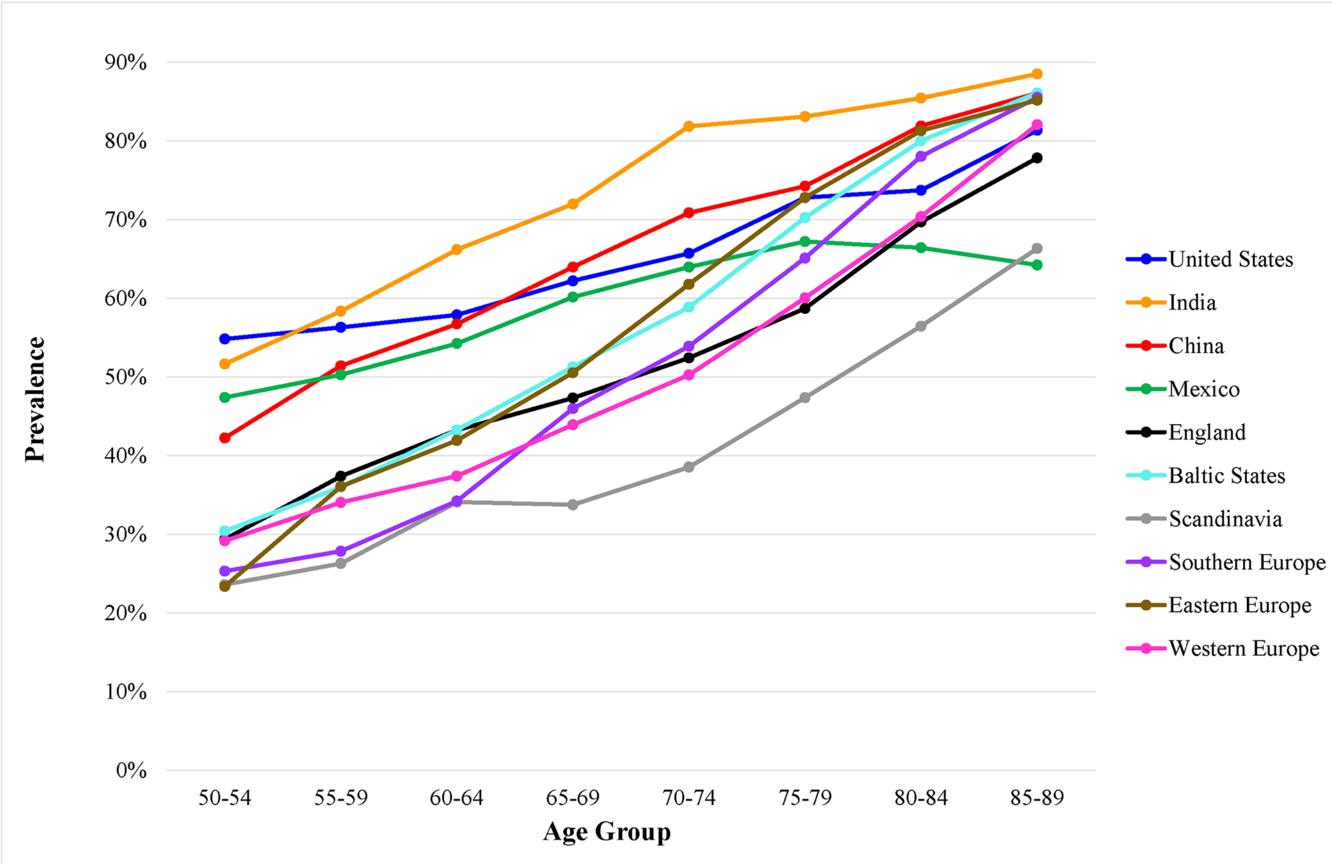


Fig. 1.
Women's large muscle functional limitation prevalence by country/region and age group

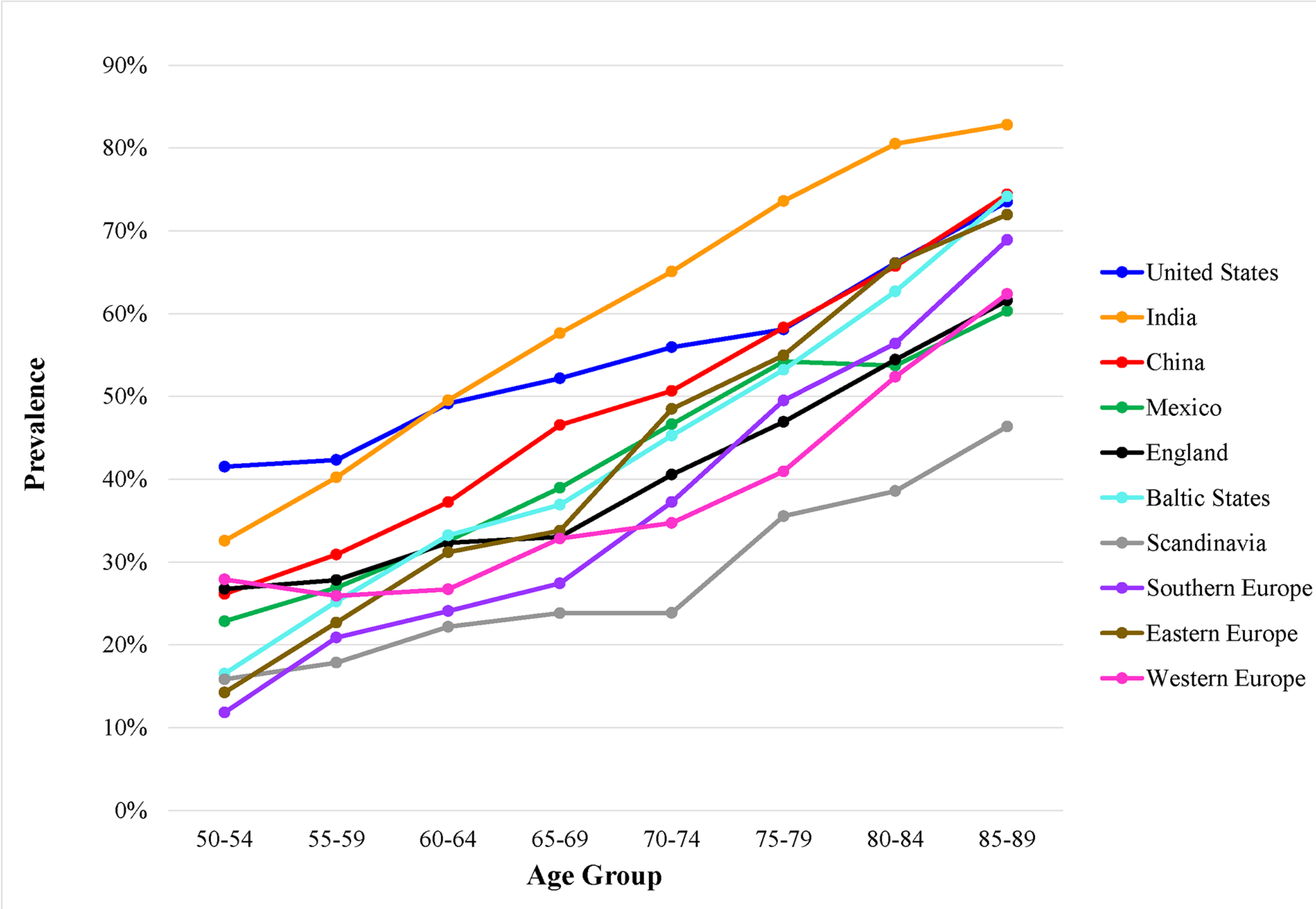


Fig. 2.
Men’s large muscle functional limitation prevalence by country/region and age group

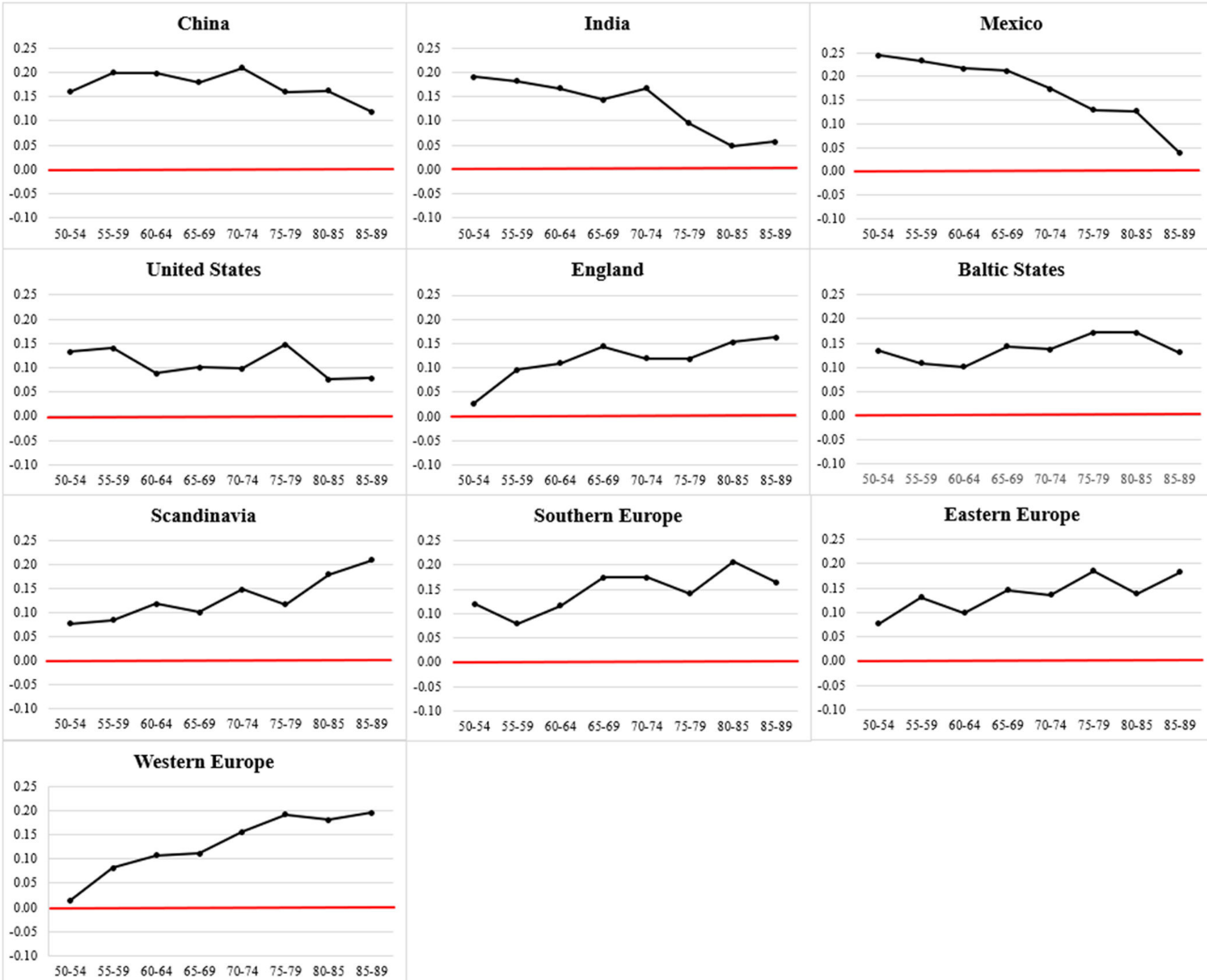


Fig. 3.

Gender difference in reports of large muscle functional limitation by country/region and age group

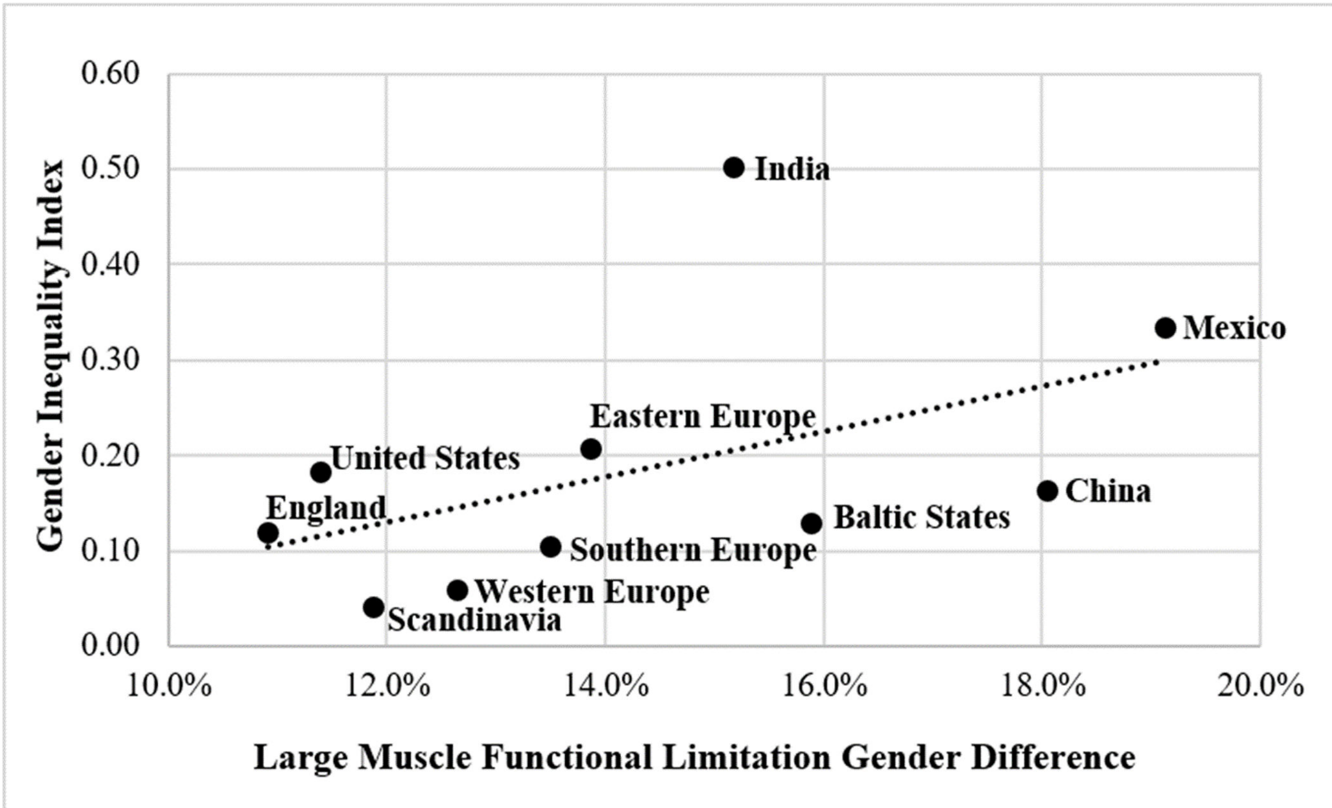
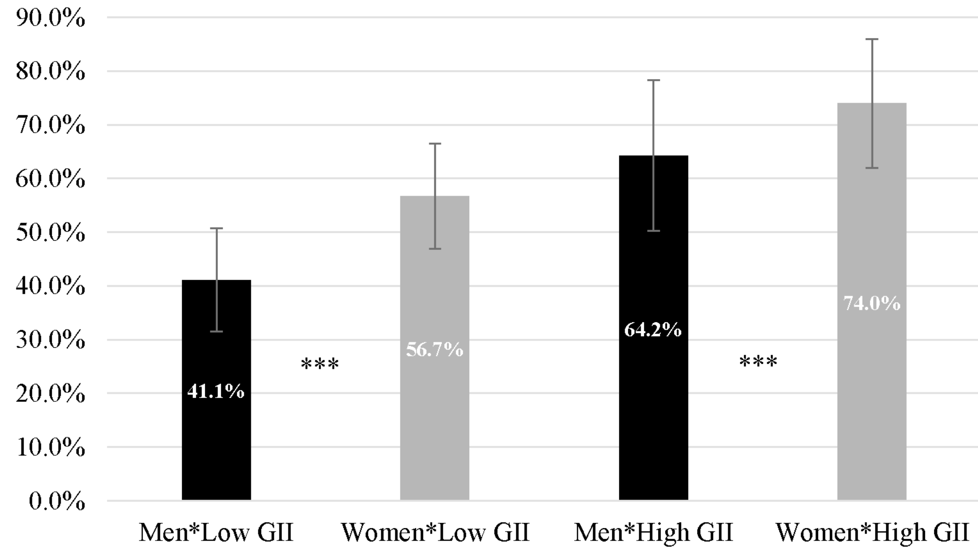


Fig. 4.

Gender differences in reports of large muscle functional limitation and gender inequality index by country/region



Note: *** p<0.001 gender difference by GII; Low GII=0.043; High GII=0.501

Fig. 5.
Health adjusted predicted probabilities of large muscle functional limitation by interaction of gender and gender inequality index (GII) among older adults (65–89)

Table 1

Sample characteristics by country/region and gender (*N*=179,624).

	China		India		Mexico		United States		England	
	Women	**Men**	**Women**	**Men**	**Women**	**Men**	**Women**	**Men**	**Women**	**Men**
LMFL	58.7%	40.6%	66.2%	51.0%	56.7%	37.6%	63.0%	52.2%	48.3%	37.8%
Middle Age	57.2%	56.7%	61.6%	58.0%	52.1%	49.6%	47.0%	47.8%	38.6%	35.1%
Older Adults	42.8%	43.3%	38.4%	42.0%	47.9%	50.4%	53.0%	52.2%	61.4%	64.9%
Low Education	92.1%	83.7%	84.2%	62.3%	86.4%	78.2%	16.6%	16.5%	25.6%	19.4%
Moderate Education	6.9%	13.8%	13.4%	30.3%	2.2%	3.9%	60.0%	55.9%	55.1%	54.2%
High Education	1.0%	2.5%	2.4%	7.4%	11.4%	17.9%	23.4%	27.6%	19.2%	26.4%
Married/Partnered	79.3%	89.7%	59.1%	87.3%	58.3%	81.6%	52.3%	74.3%	65.3%	79.7%
Separated/Divorced	0.9%	1.5%	1.7%	0.9%	9.8%	5.5%	19.0%	12.6%	12.8%	7.7%
Widowed	19.7%	7.7%	38.2%	10.4%	25.4%	8.8%	21.6%	6.9%	16.5%	6.3%
Never Married	0.1%	1.1%	0.9%	1.3%	6.4%	4.1%	7.1%	6.1%	5.3%	6.4%
Household Size[†]	2.7	2.8	4.9	5.1	2.4	2.4	2.3	2.4	2.0	2.2
Comorbidities[†]	1.1	1.0	0.6	0.5	1.3	1.0	1.5	1.6	1.0	1.1
n=	**16,035**		**51,817**		**15,372**		**16,174**		**7,613**	
	Baltic States		**Scandinavia**		**Southern Europe**		**Eastern Europe**		**Western Europe**	
	Women	**Men**	**Women**	**Men**	**Women**	**Men**	**Women**	**Men**	**Women**	**Men**
LMFL	55.0%	39.1%	37.8%	25.9%	48.6%	35.1%	51.3%	37.4%	47.4%	34.8%
Middle Age	38.9%	44.6%	39.4%	36.6%	39.6%	33.7%	44.6%	44.9%	40.9%	37.5%
Older Adults	61.1%	55.4%	60.6%	63.4%	60.4%	66.3%	55.4%	55.1%	59.1%	62.5%
Low Education	21.2%	22.6%	25.5%	26.0%	63.1%	56.0%	36.6%	25.4%	31.8%	21.4%
Moderate Education	49.2%	53.1%	31.6%	38.7%	25.7%	29.3%	51.9%	60.6%	43.2%	46.0%
High Education	29.5%	24.3%	42.9%	35.3%	11.2%	14.7%	11.5%	14.0%	25.0%	32.6%
Married/Partnered	50.8%	78.6%	69.9%	80.2%	69.9%	86.3%	62.9%	82.7%	65.1%	80.4%
Separated/Divorced	13.4%	9.4%	11.4%	8.2%	4.5%	3.6%	8.2%	5.7%	11.4%	7.9%
Widowed	30.6%	7.5%	13.7%	5.8%	21.7%	5.4%	26.7%	7.2%	18.8%	6.1%
Never Married	5.2%	4.5%	4.9%	5.8%	4.0%	4.7%	2.2%	4.3%	4.7%	5.6%

Household Size†	1.8	2.1	1.8	2.0	2.2	2.4	2.2	2.4	1.9	2.1
Comorbidities†	1.3	1.2	1.0	1.1	1.1	1.3	1.1	1.1	1.1	1.3
n=	**8,578**		**8,169**		**21,500**		**16,111**		**18,255**	

Note: Figures shown are weighted percentages

† = Age mean; LMFL=Large Muscle Functional Limitation; *p*=gender difference

* $p<0.05$

** $p<0.01$

*** $p<0.001$

Table 2

Adjusted mixed effects logistic regression odds ratios of reporting large muscle functional limitation among middle age adults

	Model 1: GNI				Model 2: GII				Model 3: Interaction				Model 4: SDOH				Model 5: Health			
	OR		95% CI		OR		95% CI		OR		95% CI		OR		95% CI		OR		95% CI	
Women	1.94	***	1.89	2.00	1.94	***	1.89	2.00	1.62	***	1.53	1.71	1.66	***	1.57	1.76	1.82	***	1.72	1.93
Age	1.06	***	1.06	1.06	1.06	***	1.06	1.06	1.06	***	1.06	1.06	1.06	***	1.05	1.06	1.04	***	1.04	1.04
2018 Log PPP, GNI per capita	0.70	*	0.51	0.97	1.17		0.73	1.88	1.17		0.74	1.87	1.35		0.87	2.10	1.21		0.82	1.80
GII (2018)					23.51	*	2.06	268.34	16.31	*	1.46	182.46	19.40	*	1.97	190.63	17.54	**	2.31	133.03
Women X GII									1.84	***	1.57	2.17	1.43	***	1.22	1.69	1.10		0.93	1.30
(Low Education)																				
Moderate Education													0.78	***	0.75	0.81	0.76	***	0.73	0.79
High Education													0.50	***	0.47	0.52	0.51	***	0.49	0.54
(Married/Partnered)																				
Separated/Divorced													1.20	***	1.13	1.27	1.17	***	1.10	1.24
Widowed													1.16	***	1.10	1.22	1.14	***	1.08	1.20
Never Married													1.21	***	1.12	1.30	1.23	***	1.14	1.33
Household Size													1.00		0.99	1.01	1.00		0.99	1.01
Comorbidities																	1.73	***	1.70	1.76

N=87,479

Notes: OR = Odds Ratio; CI = Confidence Interval

* p<0.05

** p<0.01

*** p<0.001

PPP = Purchasing Power Parity; GNI = Gross National Income; GII = Gender Inequality Index; SDOH = Social Determinants of Health

Table 3

Adjusted mixed effects logistic regression odds ratios of reporting large muscle functional limitation among older adults

	Model 1: GNI				Model 2: GII				Model 3: Interaction				Model 4: SDOH				Model 5: Health			
	OR		**95% CI**		**OR**		**95% CI**		**OR**		**95% CI**		**OR**		**95% CI**		**OR**		**95% CI**	
Women	1.95	***	1.90	2.00	1.95	***	1.90	2.00	1.94	***	1.85	2.03	1.84	***	1.75	1.93	2.07	***	1.97	2.17
Age	1.07	***	1.07	1.07	1.07	***	1.07	1.07	1.07	***	1.07	1.07	1.06	***	1.06	1.07	1.05	***	1.05	1.06
2018 Log PPP, GNI per capita	0.61	***	0.47	0.80	0.84		0.55	1.31	0.84		0.55	1.31	1.00		0.63	1.57	0.85		0.54	1.34
GII (2018)					7.22		0.76	68.89	7.10		0.74	67.93	9.38		0.89	99.48	10.17		0.98	105.23
Women X GII									1.03		0.87	1.23	0.88		0.73	1.04	0.65	***	0.54	0.77
(Low Education)																				
Moderate Education													0.76	***	0.73	0.79	0.76	***	0.73	0.78
High Education													0.56	***	0.54	0.59	0.58	***	0.56	0.61
(Married/Partnered)																				
Separated/Divorced													1.22	***	1.15	1.30	1.20	***	1.13	1.28
Widowed													1.16	***	1.12	1.20	1.15	***	1.11	1.19
Never Married													1.13	**	1.04	1.23	1.16	***	1.07	1.26
Household Size													1.00		0.99	1.01	1.00		0.99	1.01
Comorbidities																	1.59	***	1.57	1.61
N=92,145																				

Notes: OR = Odds Ratio; CI = Confidence Interval

* p<0.05

** p<0.01

*** p<0.001

PPP = Purchasing Power Parity; GNI = Gross National Income; GII = Gender Inequality Index; SDOH = Social Determinants of Health