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Can Sex Differences in Old Age Disabilities be Attributed to Socioeconomic Conditions? Evidence from a Mapping Review of the Literature

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Abstract
Old age disabilities are more common among women than men, and adverse socioeconomic conditions are associated with a higher prevalence of disabilities among older adults. The goal of this study was to complete a mapping review of the available evidence assessing the extent to which the observed sex differences in older adults' disabilities can be attributed to sex differences in socioeconomic status. We searched three databases for articles published between 2009 and 2019, and after screening and looking at eligibility criteria, 6 articles were included in the review. For those studies that did not directly analyse the contribution of socioeconomic conditions, we used the 'difference method' to estimate the proportion of the sex gap in disabilities among older adults that could be attributed to socioeconomic conditions. Our review demonstrated that women generally have a higher prevalence of disabilities than men. In several studies, these differences could be partly attributed to sex differences in the distribution of socioeconomic conditions. We also find great elasticity in the magnitude of both the sex gap in disabilities and in the proportion that could be attributed to differences in socioeconomic conditions.

Keywords Old-age disabilities · Sex/gender · Socioeconomic conditions · Mapping review

Introduction

The world is undergoing significant changes in population structure with a resulting unprecedented ageing of populations (United Nations, 2019). Ageing inevitably brings a deterioration in individual health and an increased risk of disability and

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mortality (World Health Organisation, 2017). Greater life expectancy has led to a larger pool of individuals surviving to old age but also increased frailty and susceptibility to disabilities (Guzman-Castillo et al., 2017). Physical or mental limitations related to mobility issues, sensory and cognitive limitations, and illnesses, impair a person's ability to perform everyday activities independently. Women have an advantage over men in life expectancy, but they are disadvantaged in many areas of health such as functioning, well-being and quality of life (Carmel, 2019). There is also a relationship between lower socioeconomic status and greater disability (Braveman & Gottlieb, 2014). In this mapping review, we examine to what extent the relationship between sex and disability can be attributed to gendered socioeconomic conditions. Estimating this is an important step to increase understanding of the observed sex gap in disabilities among older adults. Such insights may, in the future, have important policy implications when it comes to equalising health and preparing health and welfare services for an ageing society.

We have conducted a mapping review of the literature to assess the evidence about whether and to what extent observed sex differences in disabilities among older adults can be attributed to gendered differences in socioeconomic conditions.

Gender

There is a marked health disparity observed between the sexes in terms of disabilities in old age (Chatterji et al., 2015; Crimmins et al., 2016; Jacob et al., 2018). Women are more likely to report functional limitations and have more severe disabilities compared to similarly aged men (Hosseinpoor et al., 2012; Murtagh & Hubert, 2004). Sex differences in disability may in part be due to differences in the nature of disabling conditions men and women experience and whether these disabilities are strongly related to subsequent mortality. Men tend to have more life-threatening health conditions leading to early mortality, while women enjoy greater longevity but experience more health conditions that are disabling (Murtagh & Hubert, 2004; Nusselder et al., 2019). Among the oldest adults the sex difference in relation to health and disabilities increases, with women living longer and tending to have higher levels of morbidity and disability (Uccheddu et al., 2019). This is central to the different health and care needs of women and men.

Sex-based health inequalities that older adults face are not as well researched in relation to social determinants as compared to younger groups, and there is a lack of understanding of the interaction of socioeconomic conditions and sex in old age (Wheaton & Crimmins, 2016).

Gender norms may lead to differences in men's and women's exposure and vulnerability to specific risks and health behaviours, employment patterns and differences in social norms and economic burdens (Read & Gorman, 2011; Uccheddu et al., 2019). There is some evidence for these mechanisms as studies have found that gender inequalities in disability can be partly attributed to the unequal distribution of socioeconomic conditions between women and men (Cambois et al., 2016; Hosseinpoor, 2012). Put another way, socioeconomic resources are unequally distributed between women and men and as socioeconomic status is connected to the risk of disability this could explain observed sex differences in disabilities.

Among current cohorts of older adults, women have, on average, lower education, lower income, lower social class, and lower wealth than men. While this relationship is shifting in younger cohorts, particularly when it comes to education, women still face several barriers. High female employment rates among older workers often coexist with significant glass ceilings for top occupations and wages. Due to reproductive roles, gender discrimination, and segregation in the labour market, women are likely to see their earnings potential reduced throughout the life course, leading to reduced financial resources in retirement. Intersecting inequalities of gender and socioeconomic status leave older women particularly vulnerable, especially when frailty compounds problems. Women above age 65 have a higher likelihood of poverty, financial distress, and social exclusion than men, particularly as women tend to live longer and are therefore more likely to live alone with less income (Ilinca et al., 2016; Bettio et al., 2013).

Socioeconomic Conditions

Commonly used indicators of socioeconomic conditions are education, occupation, and income, all of which have been found to have shared and separate associations with a wide variety of health outcomes. The mechanisms that generate these associations rely on a multitude of interrelated and complex processes that occur as intertwined processes across the life course (Kröger et al., 2015; Lundberg, 2020). For example, it is commonly found that education and income are related to mortality in old age (Kinge et al., 2015; Rehnberg et al., 2019). Similarly, studies show that the prevalence of disability in older populations with greater income is lower than in those with fewer financial resources (Melzer et al., 2000; Darin-Mattsson et al., 2017). Those with fewer resources are at greater risk of developing serious health conditions such as coronary heart disease. These increased risks extend to disabilities and functional limitations (Enroth & Fors, 2021; Steptoe & Zaninotto, 2020; Guerra et al., 2008; Zhong et al., 2017).

Measuring the socioeconomic conditions of older adults is complicated by the fact that factors which are important in younger years may lose some of their importance with ageing. For example, income distribution becomes more compressed during retirement and the role of occupation as a determinant of socioeconomic conditions changes after retirement, whereas differences in wealth may become increasingly important (Cubbin et al., 2011). In contrast, the level of education is an important determinant of health, as it tends to remain stable over the life course. Those with higher education are, nevertheless, likely to have had a higher income and occupational status before they retired than those with a lower education level (Amemiya et al., 2019). However, there is a gender gap in education among older cohorts, as women in older generations had less access to higher education and were often confined to more traditional female work (Ilinca et al., 2016; Back & Lee, 2011). There is evidence of an association between years of education and mobility/physical function, as well as significant increments in disability prevalence among less educated older adults (Enroth et al., 2019; Fors & Thorslund, 2015; Coppin et al., 2006; Zajacova, 2006).

The relationship is bidirectional: disabilities affect socioeconomic conditions as well. Functional disabilities can prevent individuals from saving or investing in their education and career as a result of having to spend time and money on medical expenses, assistance or personal care (Hoffman et al., 2018; Galama & van Kippersluis, 2019). Moreover, there are confounding background factors that affect both the likelihood of socioeconomic success and the risk of disabilities such as morbidity, personality, genetics, and innate physical and cognitive abilities (Mackenbach, 2019; Goldman, 2001). Sex differences in health most likely depend on a combination of biological and social factors, so it is unlikely that social factors can explain all observed differences.

In sum, it is plausible that the observed gender gap in disabilities among older adults is partly attributed to sex differences in socioeconomic status (Read & Gorman, 2010; Uccheddu et al., 2019; Bloomberg et al., 2021; Kieny et al., 2021). Developing targeted prevention policies mitigating gender inequality in functional disability requires an understanding of the magnitude of the inequality and which factors contribute to it. If sex differences in disability in older adults are mainly explained by socioeconomic conditions, then health policy and programmes aimed at reducing inequalities in socioeconomic resources may mitigate the inequality (Le et al., 2020). In this study, we conduct a mapping review to assess the extent to which the hypothesis that a proportion of sex differences in disabilities in older adults can be attributed to socioeconomic conditions is supported by the current literature. As few studies have tested this hypothesis explicitly, we also, to the extent possible, re-analyse the results from studies that were designed for other purposes. To our knowledge, no such reviews of the literature have previously been done.

Methods

Search Strategy and Inclusion Criteria

We retrieved studies that either explicitly analysed how much of the sex gap in disabilities among older adults could be attributed to socioeconomic factors, or that contained enough information for us to estimate that contribution. The search terms used are described in detail in the supplementary material. In summary, to search socioeconomic conditions, we used a broad range of terms indicating socioeconomic, financial, occupational, or educational status. Similarly, for the outcome, we used sets of terms indicating disabilities, limitations with activities of daily living (ADL), functional limitations, or mobility limitations. Searches were conducted in three databases: Medline, Web of Science Core Collection, and Cinahl on August 28, 2019.

Papers published in the 10 years between 2009 and 2019, peer-reviewed, written in English, including older adults (aged 50+) and both men and women, having disabilities as an outcome, and based on observational, quantitative studies from mid-to high-income countries were included. We excluded studies based on selected samples (e.g. special patient groups) and those that examined cognitive disabilities, or indices combining disabilities with other health problems, as outcomes.

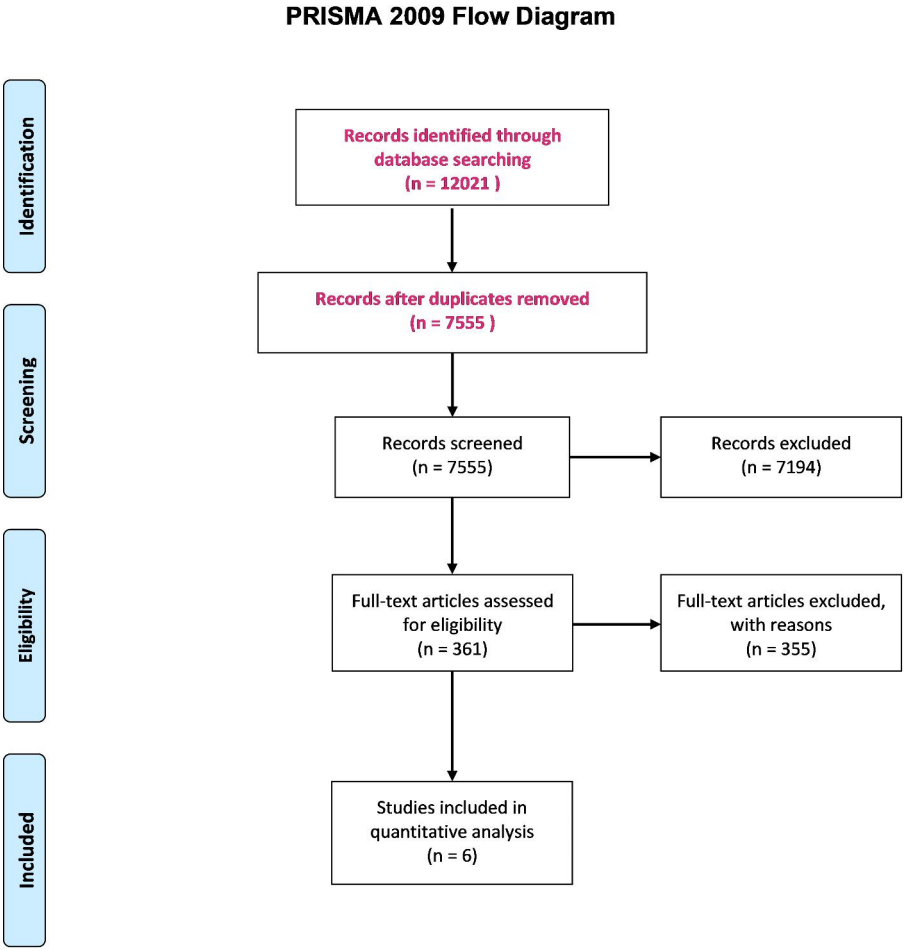

Fig. 1 Flowchart detailing the selection of studies into the analysis

For us to be able to extract the necessary information, the studies needed to either be explicitly designed to decompose the sex gap in disabilities by socioeconomic conditions or be based on a regression design that allowed us to decompose the sex gap. That is, the studies needed to include two models; one where they estimated the sex gap in disabilities without adjusting for socioeconomic conditions, and one where they adjusted for socioeconomic conditions. Several studies were excluded because they bundled adjustment for socioeconomic conditions with adjustment for health in the second model, which rendered it impossible to examine the specific contribution of socioeconomic conditions.

The initial search retrieved 12,021 matches, from which 7,555 matches remained after excluding duplicates. Two reviewers (SF and JR) excluded 7,194 papers after reading the title and abstract. The reviewers then read the full text of 361 papers out of which 355 were excluded, leaving us with an analytic sample of 6 papers.

The review process was administered using Rayyan online software (Ouzzani et al., 2016).

Table 1 shows that the included studies range from international to local and represent a wide range of countries from various regions. The data included in these studies range from the 1990s up to 2012. Study designs are a mixture of longitudinal and cross-sectional. The age spans used differ, with the youngest starting at age 45 and multiple studies having no upper age limit, with the most common upper age limit being 79. The number of respondents also varies substantially, ranging from local studies with around 450 respondents to an international study with 63.000 respondents. Physical functioning, or disability outcomes, were mostly captured through ADL measurements, with the addition of physical and performance tasks. Socioeconomic factors included in the studies were primarily education with some focus on economic situation in the form of occupation and income, with one study also including childhood socioeconomic status.

Data Extraction

Two different strategies were used to extract the relevant quantitative data from the papers. Two of the studies explicitly analysed the contribution of socioeconomic conditions to the sex gap in disabilities among older adults. In these studies, the contribution was divided into two categories: (a) the contribution of the sex difference in the distribution of socioeconomic conditions; and (b) the differential effect of socioeconomic conditions on disabilities depending on sex. To make the results comparable to those from the regression-based analyses, we only considered the first category.

For the studies that did not directly analyse the contribution of socioeconomic conditions, we used the 'absolute difference method' to estimate the proportion of the sex gap in disabilities among older adults that could be attributed to socioeconomic conditions. That is, we used the following formula to extract the data from stepwise regression models in the papers:

$$100 * (\beta_{\text{unadjusted model}} - \beta_{\text{adjusted model}}) / \beta_{\text{unadjusted model}}.$$

This method has previously been used to assess the contribution of mediating factors in several original empirical studies (refs), and in at least one literature review (Petrovic et al., 2018). This is admittedly a crude method. Yet, to our knowledge, it is the only method that allows us to estimate the contribution of mediating factors, using aggregated data (Petrovic et al., 2018). The method is especially problematic for analyses of estimates from logistic regression models. As odds ratios, and log odds ratios, are non-collapsible by nature, they are not directly comparable across models (Mood, 2010; Greenland, 2021). Typically, this feature leads to increasing odds ratios when additional independent variables are introduced into the model, even when the independent variables are unrelated to each other (Mood, 2010). Thus, assessing mediation by comparing odds ratios or log odds ratios from nested models tend to lead to underestimations of true mediating effects. We discuss the implications of this bias for our study further in the discussion section.

In the first step, we extracted the estimates from all the eligible analyses in all the papers, this resulted in a total of 53 estimates. Several papers included comparative analyses based on several different samples and several different outcomes. In

the second step, we compared the estimates across regions, outcomes, associations, socioeconomic indicators, and types of analysis to determine if there were any systematic differences in the results based on any of these factors.

Importantly, all the estimates in the study are based on observational data. It is not possible to assess to what extent the observed associations reflect causal effects. Thus, we use the term 'contribution' in a strict statistical sense. An assessment of the causal contribution of socioeconomic conditions to the sex gap in disabilities among older adults would warrant studies with explicit identification strategies for causal effects.

Results

In Tables 2-4 the studies are presented by their method of statistical analysis. Table 2 presents the results from the studies that used generalised linear model (GLM) regressions (binary and multinomial logistic models).

There are sex differences present in all outcomes and regions. Among older adults from all regions, except Korea, women were more likely than men to report disabilities. Taiwan and Indonesia had the largest unadjusted scores, while the highest adjusted scores are found in Indonesia and the USA. The total contribution that socioeconomic conditions had on sex differences in disabilities varied between −5.8 and 63.4 per cent. The Korean study was excluded since the sex gap in disabilities among older adults was either non-existent or reversed (depending on the outcome) compared to other studies and it would therefore skew the results as an outlier.

Table 3 documents results from Trujillo et al., (2010) based on OLS regressions of data from four countries and using ADL and IADL as outcomes (reference category=men). They found that women reported more problems with ADL and IADL than men in all four countries. For IADL the range of crude coefficients is -0.54 to -0.65 compared to the crude coefficients for ADL where the range is -1.45 to -0.97. Adjusting for socioeconomic factors, this difference between men and women is attenuated but remains. IADL has a range of -0.42 to -0.21 and ADL has a range of -1 to -0.97. It is only in the study from Argentina where there is no reduction of the estimates when adjusting for socioeconomic conditions. A higher proportion of the association was attributable to socioeconomic conditions for IADL than for ADL in all samples.

The two studies which explicitly assessed the extent to which the sex gap in disabilities among older adults could be attributed to differences in socioeconomic conditions, using decomposition analysis, are presented in Table 4. The difference in the prevalence of disabilities among older adults between the sexes was statistically significant in both studies, Cambois et al., (2016) found a 6.3% point difference between men and women in physical functioning and Hosseinpoor et al., (2012) found a 16.4 per cent difference. The proportion of this sex difference which is attributable to the differential distribution of socioeconomic conditions is 47.6 per cent in the first study and 36.6 per cent in the second. Thus, both studies found that part of the inequality between men and women in disabilities among older adults can be attributed to differences in the distribution of socioeconomic factors.

Table 1 General characteristics of the studies included in the mapping review

Study	Country/region	Survey period	Study/cohort name	Type of study	Method	Age (included in study)	Number of observations	SEP indicator(s)	Outcome(s)
Included studies that decompose gender differences									
Cambois et al., 2016	France	2006	Health and Occupational Trajectories (SIP, French population survey)	Cross-sectional	Logit and Blinder-Oaxaca decomposition	45–74	7,537	Occupation	Physical functional limitations were measured by self-reported difficulties or inability to perform at least one of the listed activities involving physical body functions
Hosseinpoor et al., 2012	57 countries	2002–2004	World Health Survey (WHS)	Cross-sectional	Logit and Blinder-Oaxaca decomposition	50 and older	63,638	Education, income	Disability: eight health and functioning domains: vision, mobility, self-care, cognition, interpersonal activities, pain and discomfort, sleep and energy, and affect
Included studies that contain regression estimates									
Martin et al., 2017	USA	1998–2010	Health and Retirement Study (HRS)	Longitudinal	Logit	65–84	9,471	Education, childhood SES	Activities of Daily Living (ADL)

Table 1 (continued)

Study	Country/region	Survey period	Study/cohort name	Type of study	Method	Age (included in study)	Number of observations	SEP indicator(s)	Outcome(s)
Trujillo et al.	Brazil, Argentina, Chile, Mexico	1999–2000	SABE database	Cross-sectional	OLS	60+	2,143	Literacy, Education, Years of education, Occupation, Retired, Age of retirement, Home ownership, wealth, income	Self-reported health status, ADL, Instrumental Activities of Daily Living (IADL)

Table 1 (continued)

Study	Country/region	Survey period	Study/cohort name	Type of study	Method	Age (included in study)	Number of observations	SEP indicator(s)	Outcome(s)
Wheaton & Crimmins 2016	7 countries	2001–2011	The 2006 wave of the Health and Retirement Study (HRS) in the USA, the 2006 wave of the Social Environment and Biomarkers of Ageing Study (SEBAS) in Taiwan, the 2006 wave of the Korean Longitudinal Study of Aging (KLoSA), the 2001 wave of the Mexican Health and Aging Study (MHAS), the 2011/2012 China Health and Retirement Longitudinal Study (CHARLS), the 2007/2008 wave of the Indonesian Family Life Study (IFLS-4) and the UNM-UCSB Tsimane Health & Life History Project (THLHP)	Cross-sectional	Logit	55 and over	14,125 (HRS), 1,051 (SEBAS), 6,532 (KLoSA), 8,846 (MHAS), 7,438 (CHARLS), 4,196 (IFLS-4), 449 (THLHP)	Education	ADL, physical performance, functional tasks
Zunzunegui et al., 2015	Canada, Albania, Brazil and Colombia	2012	International Mobility in Aging Study (IMIAS)	Cross-sectional	GLM	65–74	1,995	Education, sufficiency of income	Physical performance, mobility, ADL

In Table 5 we present the results for the total sample of studies as well as stratified by region, outcome, association, socioeconomic indicators, and study type, to examine if there are any systematic differences in the results based on these factors. Overall, results show that in most studies women reported more disabilities than men, and this sex difference could partly, but not wholly, be attributed to sex differences in socioeconomic conditions. However, there was great variation in both the magnitude of the sex gap and in the proportion that could be attributed to the gender distribution of socioeconomic factors. The median contribution of socioeconomic conditions to the sex gap in disabilities among older adults was 18 per cent. Yet, across the studies, the contribution ranged between −6 per cent and 91 per cent.

Besides these patterns, it is difficult to distinguish any systematic patterns in the estimates as there is a substantial overlap of the ranges across regions, outcomes, associations, socioeconomic conditions, and study types. There seems to be less variation in the contribution among studies that had a larger initial association, than in those with smaller associations. Moreover, the two studies that explicitly addressed the contribution of socioeconomic conditions to the sex gap in disabilities among older adults using decomposition analyses showed similar results. Both showed that between 36.6 and 47.6 per cent of the sex gap in disabilities among older adults could be attributed to the gender distribution of socioeconomic conditions.

Discussion

We have compiled the available evidence on whether sex differences in old adults' disabilities can be attributed to gender differences in socioeconomic conditions. In most of the included studies, women have a higher prevalence of disabilities than men. Some, but not all, of these differences are linked to gender variability in socioeconomic conditions in most studies. When adjusting for socioeconomic factors, some of the sex differences diminished and thus, sex differences can be partly attributed to gendered differences in socioeconomic conditions. The results suggest plasticity in the magnitude of both the sex gap in disabilities, as well as in the proportion attributable to differences in socioeconomic conditions. We thereby find that, as has previously been acknowledged (Hosseinpoor et al., 2012), gender-based inequalities in socioeconomic conditions are associated with disability in older adults. What the findings from this review highlight is the variability in the proportion of sex differences in disability in old age which can be attributed to socioeconomic differences.

As with all empirical studies, our results should be interpreted with caution due to limitations inherent in such research. First, all included studies are observational; thus, we cannot determine if the correlations we find are causal. Thus, rather than unbiased causal estimates, this study describes the proportion of the sex gap in disabilities among older adults aligned with gender differences in the distribution of socioeconomic conditions - in a purely statistical sense. Future studies should address the causal nature of this attribution. Secondly, to compile all the limited available evidence, we had to include studies that varied widely in samples, periods covered, indicators included, etc. Thus, it is difficult to compare estimates across included studies. Thirdly, to extract the data from studies that were designed for other purposes, we had

Table 2 Associations between sex, disabilities and functional impairments and proportions of the associations attributable to socioeconomic conditions. Studies based on GLM regressions.*

		Crude		Adjusted		Contribution
Outcome	Region/Country	OR	95% CI	OR	95% CI	(%)
SPPB < 8	Natal, Brazil[a]	**1.67**	**(1.14–2.45)**	**1.70**	**(1.15–2.50)**	-3.5
	Manizales, Colombia[a]	**1.97**	**(1.06–3.65)**	1.87	(0.99–3.53)	7.7
	Tirana, Albania[a]	**2.38**	**(1.53–3.69)**	**2.03**	**(1.31–3.16)**	18.3
	Saint-Hyacinthe, Canada[a]	1.78	(0.81–3.87)	1.50	(0.67–3.35)	29.7
	Kingston, Canada[a]	1.16	(0.58–2.33)	1.16	(0.56–2.36	0.0
Impaired mobility	Natal, Brazil[a]	**2.25**	**(1.75–2.89)**	**2.16**	**(1.68–2.77)**	5.0
	Manizales, Colombia[a]	**1.51**	**(1.23–1.87)**	**1.45**	**(1.18–1.79)**	9.8
	Tirana, Albania[a]	**1.70**	**(1.39–2.08)**	**1.65**	**(1.34–2.02)**	5.6
	Saint-Hyacinthe, Canada[a]	**2.43**	**(1.59–3.70)**	**2.12**	**(1.38–3.25)**	15.4
	Kingston, Canada[a]	1.17	(0.78–1.75)	1.15	(0.76–1.72)	11.0
ADL-limitations	Natal, Brazil[a]	**1.62**	**(1.19–2.21)**	**1.62**	**(1.19–2.21)**	0,0
	Manizales, Colombia[a]	1.38	(0.99–1.93)	1.39	(0.99–1.95)	-2.2
	Tirana, Albania[a]	**1.57**	**(1.19–2.07)**	**1.40**	**(1.05–1.86)**	25.4
	Saint-Hyacinthe, Canada[a]	**1.70**	**(1.06–2.74)**	1.44	(0.89–2.34)	31.3
	Kingston, Canada[a]	**1.15**	**(0.79–1.66)**	1.12	(0.77–1.63)	18.9
	USA[b]	**1.60**	**(p < 0.001)**	**1.34**	**(p < 0.01)**	38.6
Squatting[c]	USA	**1.61**	**(1.48–1.75)**	**1.55**	**(1.41–1.70)**	8.0
	Taiwan	**2.04**	**(1.42–2.93)**	**1.89**	**(1.23–2.90)**	10.7
	Mexico	**1.84**	**(1.55–2.20)**	**1.83**	**(1.51–2.22)**	0.9
	China	**1.22**	**(1.10–1.36)**	**1.14**	**(1.01–1.29)**	34.1
	Indonesia	**1.37**	**(1.05–1.79)**	1.16	(0.84–1.61)	52.9
Stairs[c]	USA	**1.96**	**(1.80–2.13)**	**1.87**	**(1.71–2.04)**	7.0
	Taiwan	**2.63**	**(1.93–3.57)**	**2.04**	**(1.51–2.76)**	26.3
	Mexico	**1.97**	**(1.66–2.34)**	**1.92**	**(1.61–2.30)**	3.8
	China	**1.33**	**(1.17–1.50)**	**1.20**	**(1.05–1.37)**	36.1

Table 2 (continued)

		Crude		Adjusted		Contribution
Outcome	Region/Country	OR	95% CI	OR	95% CI	(%)
Carrying[c]	USA	**2.66**	**(2.37–2.97)**	**2.40**	**(2.13–2.71)**	10.5
	Taiwan	**5.13**	**(3.09–8.54)**	**4.76**	**(2.78–8.15)**	4.6
	Mexico	**2.62**	**(2.03–3.38)**	**2.43**	**(1.82–3.26)**	7.8
	China	**2.28**	**(1.97–2.63)**	**2.15**	**(1.82–2.54)**	7.1
	Indonesia	**2.66**	**(2.23–3.16)**	**2.23**	**(1.83–2.72)**	18.0
Dressing[c]	USA	**1.58**	**(1.36–1.84)**	**1.41**	**(1.21–1.65)**	24.9
	Taiwan	**2.16**	**(1.12–4.19)**	1.55	(0.74–3.25)	43.1
	Korea	0.74	(0.52–1.06)	**0.60**	**(0.40–0.92)**	-69.7
	Mexico	**1.43**	**(1.07–1.90)**	**1.46**	**(1.09–1.95)**	-5.8
	China	1.04	(0.85–1.26)	0.86	(0.70–1.07)	- [†]
	Indonesia	**2.00**	**(1.58–2.53)**	**1.85**	**(1.41–2.42)**	11.2
Bathing[c]	USA	**1.33**	**(1.10–1.62)**	1.11	(0.89–1.38)	63.4
	Taiwan	**2.15**	**(1.67–2.78)**	**1.90**	**(1.15–3.12)**	16.1
	Korea	0.96	(0.68–1.37)	0.80	(0.53–1.20)	- [†]
	Mexico	1.29	(0.88–1.90)	**1.20**	**(0.78–1.86)**	28.4
	China	1.09	(0.92–1.30)	0.92	(0.75–1.12)	- [†]
	Indonesia	**1.96**	**(1.42–2.70)**	**1.59**	**(1.05–2.41)**	31.1
Toiletting[c]	USA	**2.09**	**(1.64–2.66)**	**1.83**	**(1.41–2.36)**	18.0
	Taiwan	**2.29**	**(1.30–4.02)**	1.94	(0.95–3.98)	20.0
	Korea	**0.53**	**(0.31–0.92)**	**0.50**	**(0.26–0.97)**	-9.2
	Mexico	1.50	(0.98–2.30)	1.33	(0.84–2.13)	29.7

Table 2 (continued)

		Crude		Adjusted		Contribution
Outcome	Region/Country	OR	95% CI	OR	95% CI	(%)
	China	**1.22**	**(1.06–1.40)**	1.11	(0.94–1.30)	47.5
	Indonesia	1.26	(0.74–2.16)	1.02	(0.54–1.95)	91.4

* Statistically significant associations are marked in bold.

a Zunzunegui et al., 2015

b Martin et al., 2017

c Wheaton & Crimmins 2016

† No contribution is calculated as the unadjusted sex difference is < 10%

Table 3 Associations between sex, disabilities and functional impairments and proportions of the associations attributable to socioeconomic conditions. Studies based on OLS regressions with men as the reference category. *a

		Crude	Adjusted	Contribution
Outcome	Region/Country	β	β	(%)
IADL	Brazil	**-0.54**	**-0.27**	51
	Argentina	**-0.55**	**-0.42**	24
	Chile	**-0.65**	**-0.24**	63
	Mexico	**-0.59**	**-0.21**	66
ADL	Brazil	**-1.21**	**-1.00**	17
	Argentina	**-0.97**	**-0.97**	0
	Chile	**-1.45**	**-0.92**	36
	Mexico	**-1.14**	**-0.67**	41

* Statistically significant associations are marked in bold.

[a] Trujillo et al., 2010

Table 4 Associations between sex, disabilities and functional impairments and proportions of the associations attributable to socioeconomic conditions. Decomposition-based studies*

			Difference in	Due to	Contribution
Outcome	Region/Country	OR	prevalence	distribution	(%)
Physical functional limitations	France [a]	**1.16**	**6.3**	3.0	47.6
Disability	International [b] (57 countries)	2.14 [†]	**16.4**	6	36.6

* Statistically significant associations are marked in bold.

[a] Cambois et al., 2016

[b] Hosseinpoor et al., 2012

[†] No odds ratio was given for the sex difference in the paper. This is estimated from the raw prevalence given in Table 1.

to rely on the 'difference method' – a rudimentary approach to mediation analysis. A

Table 5 Percentage of sex gap attributable to socioeconomic conditions. In total and stratified by region, outcome, effect size, socioeconomic indicators, and study type

		Median	Min	Max	Nr. Associations
Total		18%	-6%	91%	53
By region[a]	Upper middle-income economies [b]	18%	-6%	91%	30
	High income economies	19%	0%	63%	22
	International	36.5%	36.5%	36.5%	1
By Outcome	SPPB < 8	8%	-3%	30%	5
	Impaired mobility	10%	5%	15%	5
	ADL-limitations	22%	-2%	41%	10
	IADL-limitations	57%	24%	66%	4
	Disability	45%	45%	45%	1
	Physical limitations	48%	48%	48%	1
	Squatting	11%	1%	53%	5
	Stairs	17%	4%	36%	4
	Carrying	8%	5%	18%	5
	Dressing	18%	-6%	43%	4
	Bathing	30%	16%	63%	4
	Toiletting	30%	18%	91%	5
By effect size c	OR 1.10–1.49	34	-6%	91%	13
	OR 1.50–1.99	9	-3%	39%	16
	OR ≥ 2.00	16%	5%	45%	16
By social	Education & childhood SES	39%	39%	39%	1
variables	Education & marital status	18%	-6%	91%	27
	Education & income	10%	-3%	45%	15
	Occupation	48%	48%	48%	1
	Vector of SES[c]	39%	0%	66%	8
Type of study	Regression based (GLM)	16%	-6%	91%	43
	Regression based (OLS)	39%	0%	66%	8
	Decomposition based	42.1%	36.6%	47.6%	2

[a] Upper middle income: Brazil, Colombia, Albania, Argentina, Mexico, China, Indonesia

High income: France, Canada, USA, Chile, Taiwan

[b] No contribution is calculated for Korea, as the sex gap was reversed in the Korean study.

[c] Do not include Trujillo et al., 2010, as no comparable effect sizes can be calculated for that study.

[d] Level of schooling, illiteracy, age when started to work, current work status, age at retirement, type of occupation, total income from different sources (pension, family transfers, banking income, welfare subsidy), home ownership, list of household assets (e.g., refrigerator, washer, water heater, microwave, television, telephone, VCR, radio player, heating, air conditioning, fan)

Availability of health insurance, includes the following categories: social security, private and public insurance

consequence of this is that our estimates do not account for interactions between sex

and socioeconomic conditions but only for gender differences in the distribution of socioeconomic conditions. This is a limitation as gendered socioeconomic conditions may contribute to the sex gap in health through two types of mechanisms. The first mechanism is through the unequal distribution of socioeconomic resources between men and women. This is the type of gendered pattern we can estimate in this review. The second type of potential mechanism could work through the different impacts of socioeconomic conditions between men and women. For example, low income may be more strongly associated with health in one of the genders. Unfortunately, due to the limited data available to us, we have not been able to systematically assess such interactions in this study, so this remains an important topic for further research.

Finally, the method used to assess mediation – the absolute difference method – is especially problematic to use for estimates from logistic regression models. For technical reasons (see the methods section), this method tends to bias the results towards underestimations of true mediating effects when applied to odds ratios or log odds ratios (Mood, 2010). Thus, the estimates extracted from logistic regression models should be interpreted with extra caution. Yet, as one of the key findings of the study is the great range of estimates with vast overlaps across the different types of models, we don't believe that the main value of the review lies in precise interpretations of the estimates but rather in highlighting the substantial variation.

On the other hand, the main strength of this study is its novelty. We found two studies which explicitly examined the question, but none have compiled the literature and extracted data from studies that have originally been created for other purposes. One of the studies is a single country study and we have a greater geographical scope included in our study. Thus, to our knowledge, no previous attempt has been made to review and compile the available evidence on the role of socioeconomic conditions in shaping the sex gap in disabilities among older adults.

While estimates from the different studies are heterogeneous, partly reflecting substantial differences in study designs, the studies indicate two robust empirical findings. First, in most studies, women report more disabilities in old age than men. Secondly, the sex gap in old-age disabilities can be partly, but not wholly, attributed to inequalities in socioeconomic conditions between older women and men.

Our results suggest that a sizeable share of gender health differences may be alleviated by improving the socio-economic situation of women, i.e. by addressing gender inequalities in socioeconomic conditions. However, our findings also show that such an approach is likely not sufficient as a sizeable gender gap would remain. Part of these gender differences beyond socioeconomic inequalities may relate to biological factors – which would require specific health systems' response to deal with particular conditions or clinical risk factors – but others may relate to other social determinants of health that could be addressed through policy (e.g. access to health care) (Mauvais-Jarvis, 2020).

To turn these findings into tractable social policies, we suggest further investigation, exploring the extent to which observed associations reflect causal processes and/or whether processes differ across different social contexts and birth cohorts. In addition, further research is needed to assess to what extent the impact of socioeconomic conditions varies depending on gender. We propose that future studies should use our findings that women tend to report more disabilities in old age than men and

that this sex gap can partly, and to a varying degree, be attributed to inequalities in socioeconomic conditions between older women and men, as starting points for rigorous analyses.

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