## Can sex differences in old-age disabilities be attributed to socioeconomic conditions? Evidence from a scoping review of the literature.

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Abstract:

It has been established that old-age disabilities are more common among women than men, and that adverse socioeconomic conditions are associated with higher prevalence of old-age disabilities. What is not known is how much sex differences in socioeconomic status contribute to sex differences in old-age disabilities. The goal of this study was to carry out a scoping review of the available evidence assessing to what extent the observed sex-gap in old-age disabilities could be attributable 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 analyse the contribution of socioeconomic conditions directly, we used the ‘difference method’ to estimate the proportion of the sex-gap in old-age disabilities that could be attributed to socioeconomic conditions. Our scoping review finds that women have higher prevalence of disabilities than men in most studies, and in most studies some, but not all, of these differences could be attributed to sex differences in the distribution of socioeconomic conditions. We also find great plasticity in the magnitude of both the sex-gap in disabilities, and in the proportion that could be attributed to differences in socioeconomic conditions. To turn these findings into tractable social policies, we need to know to what extent the observed associations reflect causal processes. We also need to know to what extent these processes differ across different social contexts and birth cohorts.

Key words: Old-age disabilities, sex/gender, socioeconomic conditions, scoping review

Introduction

The world is undergoing critical changes in population structure which result in an unprecedented advance of population ageing (United Nations 2019). Ageing is significantly associated with the deterioration of individuals’ health, as well as posing a higher risk of disability and mortality (World Health Organisation, 2017). The increase in life expectancy has led to a larger pool of individuals surviving to old age and hence increased frailty and susceptibility to disabilities (Guzman-Castillo et al., 2017). Through physical or mental limitations related to mobility issues, sensory and cognitive limitations, and illnesses, functional disabilities impair a person’s ability to perform everyday activities independently. Old-age disabilities are more common among women than men (Carmel, 2019) and there is an established relationship between disabilities and socioeconomic status, where those with the most socioeconomically disadvantaged positions are most likely to be affected (Braveman & Gottlieb, 2014). In this scoping review, we examine to what extent the relationship between sex and disability can be attributed to sex differences in the distribution of socioeconomic conditions. Estimating the potential impact of gendered socioeconomic conditions on disability outcomes is an important step in order increase understanding of the mechanisms behind the observed sex-gap in old-age disabilities. Such insights may, further down the line, yield important policy implications when it comes to equalising health and to prepare health and welfare institutions for an ageing society.

In this paper, we conduct a scoping review of the literature to assess what the evidence tells us about whether, and if so to what extent, sex differences in old-age disabilities can be attributed to gendered distributions of socioeconomic conditions.

## *Gender*

There is a robust health disparity observed between the sexes in terms of old-age disabilities (Chatterji et al. 2015; Crimmins, Zhang and Saito 2016; Jacob, et al. 2018) where women are more likely to report functional limitations and have more severe disabilities compared to similarly aged men (Hosseinpoor et al. 2012; Murtagh and Hubert 2004). Sex differences in disability may in part be due to differences in the types of disabling conditions, as men tend to have more fatal health conditions leading to early mortality while women on the other hand have later mortality as their health conditions tend to be more disabling than immediately fatal (Murtagh and Hubert 2004; Nusselder et al. 2019). However, a study in the United States found that there was only a modest impact of mortality differences in men and women on disability prevalence (Leveille et al. 2000). When reaching higher ages, the difference between the sexes in relation to health and disabilities increase, women live longer, and have higher levels of morbidity and disability (Uccheddu et al. 2019). This difference is central to the different needs for healthcare and care services.

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

Gender norms may lead to sex differences in exposures and vulnerability to specific risks and health behaviours, employment patterns and differences in social and economic burdens (Read and Gorman 2011; Uccheddu et al. 2019). Some studies have estimated that a proportion of gender inequalities in disability can be attributed to the unequal distribution of socioeconomic conditions between women and men (Cambois, Garrouste and Pailhé 2016; Hosseinpoor 2012). Socioeconomic resources are unequally divided between women and men and as socioeconomic status is connected to the risk of disability it could be an explanation for the observed sex differences in disabilities.

Among the current cohorts of older adults, women have, on average, had lower education, lower income, lower social class, and lower wealth than the men. Today this relationship is changing in younger cohorts, at least when it come to education but the sex differences in the other aspects are shrinking and changing too. High female employment rates among older workers often coexist with significant glass ceilings both in terms of 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 cycle. This can lead to reduced availability of financial resources when being retired. Intersecting inequalities of gender relations and socioeconomic status make older women particularly vulnerable in old age, especially when becoming frail. Women above age 65 have a higher risk for poverty, financial distress, and social exclusion than men do, one of the main reasons for this is that women live longer and are therefore more likely to live alone with less income (Ilinca et al. 2016; Bettio et al. 2013).

## *Socioeconomic conditions*

Socioeconomic status (SES) is a major determinant of health and disability in later life, and the association between SES and mortality in old age has long been established (Kinge et al. 2015; Rehnberg, Fors and Fritzell 2019). Studies show that the prevalence of disability in more privileged sections of the older population is lower than in less privileged groups (Melzer, et al. 2000; Darin-Mattsson, Fors and Kåreholt 2017), and people with a lower SES have an increased risk of developing serious health conditions such as coronary heart disease. In older ages these increased risks also include disabilities and functional limitations (Enroth and Fors 2021; Steptoe and Zaninotto 2020; Guerra, Alvarado and Zunzunegui 2008; Zhong, Wang and Nicholas 2017). A complicating factor when measuring SES for older adults is that the things which are significant in younger years may lose some of their significance in old age. The income distribution becomes more compressed during retirement and the role of occupation changes after retirement, whereas differences in wealth may become increasingly important (Cubbin et al. 2011). Level of education is an important indicator of SES, which tends to remain stable over the later part of the life course. Higher education is associated with higher health literacy and is a predictor of occupation and income. Thus, those with a higher education are 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 big gender gap in education for older adults as women in older generations had less access to higher education and were often confined to more traditionally female roles (Ilinca et al. 2016; Back and Lee 2011). Studies have found that there is an association between years of education and mobility functioning, 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 not one sided, disabilities affect socioeconomic conditions as well, functional disabilities may create obstacles for individuals to invest in education, career and wealth through spending time and money on medical expenses or needing assistance which can present a challenge to further education or a career (Hoffman, Kröger and Pakpahan 2018; Galama and van Kippersluis 2019). Moreover, there are confounding background factors which 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).

In sum, it is plausible that the observed sex-gap in old-age disabilities is partly attributable to sex differences in socioeconomic status (Read and Gorman 2010; Uccheddu et al. 2019). In this study, we conduct a scoping review of the available evidence to assess to what extent this hypothesis is supported by the current literature. As few studies have tested this hypothesis explicitly, we will also, to the extent it is possible, re-analyse the results from studies that were designed for other purposes. To our knowledge, no such reviews of the literature have been done previously.

# Methods

## *Search strategy and inclusion criteria*

In this scoping review we aimed to retrieve studies that either explicitly analysed how much of the sex-gap in old-age disabilities could be attributed to socioeconomic factors, or that contained enough information for us to estimate the contribution. The search terms used are described in detail in the supplementary material. In terms of socioeconomic conditions, we searched broadly, using a range of search 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.

To be included, the papers had to be published between 2009 and 2019, be peer-reviewed, written in English, include older-adults (aged 50+), include both men and women, have disabilities as an outcome, and be based on observational, quantitative studies from mid- to high-income countries. We excluded studies based on specific samples (e.g. special patient groups). We also excluded studies that had cognitive disabilities, or indices combining disabilities with other health problems, as outcomes.

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 make a decomposition. 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 models, which made a specific attribution to socioeconomic conditions impossible.

<Insert Figure 1 about here >

The initial search retrieved 12 021 matches, after we removed the duplicates 7 555 matches remained. 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 349 were excluded, leaving us with an analytic sample of 6 papers.

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

<Insert table 1 around here>

Table 1 shows that the studies included range from international to local and include examples of countries from different regions. The data included in these studies comes from the 1990s up to 2012. The analytical strategies encompass a mixture of longitudinal and cross-sectional study designs. The age spans used differ with the youngest starting at 45 and multiple studies having no upper age limit, the most common upper age limit being 79. The number of respondents also covers a lot of heterogeneity, ranging from local studies with around 450 respondents to an international study with 63.000 respondents. Physical functioning, or disability outcomes, was mostly captured through ADL measurements, with the addition of physical and performance tasks or domains. The socioeconomic factors included in the studies consist mainly of 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 old-age disabilities. 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 contribution of the gendered distribution of socioeconomic conditions in this study.

For the studies that did not analyse the contribution of socioeconomic conditions directly, we used the ‘difference method’ to estimate the proportion of the sex-gap in old-age disabilities 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\*(βunadjusted model – βadjusted model)/ βunadjusted model. This method has previously been used to assess the contribution of mediating factors in at least one literature review (Petrovic et al. 2018).

In the first step, we extracted the estimates from all the eligible analyses in all the papers. Several papers included comparative analyses based on several different samples and several different outcomes. So, in the end we ended up with a total of 53 estimates. In the second step, we tried to compare the estimates across regions, outcomes, effect sizes, socioeconomic indicators, and types of analysis to see 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 old-age disabilities would warrant studies with explicit identification strategies for causal effects.

# Results

*Table 2*

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In tables 2-4 the studies are presented by type of statistical analysis. Table 2 presents the results from the studies that used GLM regressions (binary and multinomial logistic models).

There are sex differences present in all outcomes and regions. Women are more likely than men to have old-age disabilities in the estimates from all regions, except Korea. Taiwan and Indonesia have the largest unadjusted scores and the highest adjusted scores are found in Indonesia and the USA. Most outcomes show that a proportion of sex differences can be attributed to gendered differences in the distribution of socioeconomic conditions, with some showing a stronger contribution than others. When looking at the contribution there is a large range, between -5.8 – 63.4 percent. Korea has been excluded from this range since the sex-gap in old-age disabilities were non-existent or reversed (depending on the outcome) in the Korean study, compared to in the other studies.

*Table 3*

<Insert table 3 around here>

Table 3 shows results from Trujillo et al (2010) based on OLS regressions on data from four countries with ADL and IADL as outcomes, and male as the reference category. All studies found that women have worse ADL and IADL functions than men. 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. There is a clear difference between men and women here, when adjusting for socioeconomic factors IADL has a range of -0.42 to -0.21 and ADL has a range of -1 to -0.97. Only in the study from Argentina there is no attenuation of the estimates when adjusting for socioeconomic conditions. This shows that some of the sex differences diminished when adjusting for socioeconomic factors and, thus sex differences can be partly attributed to gendered differences in socioeconomic conditions. A higher proportion of the association was attributable to socioeconomic conditions for IADL than for ADL in all samples.

*Table 4*

<Insert table 4 around here>

The two studies which explicitly assessed the extent to which the sex-gap in old-age disabilities could be attributed to differences in socioeconomic conditions, using decomposition analysis, are presented in table four. The difference in the prevalence of old-age disabilities between the sexes was statistically significant in both studies, Cambois, Garrouste and Pailhé (2016) found a 6.3 percentage point difference between men and women in physical functioning and Hosseinpoor et al (2012) found 16.4 percentage points difference. The proportion of this sex difference which is attributable to the differential distribution of socioeconomic conditions is 47.6 percent in the first study and 36.6 percent in the second. Thus, both studies found that part of the inequality between men and women in old-age disabilities can be attributed to differences in the distribution of socioeconomic factors.

*Table 5*

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In table five we present the results for the total sample of studies as well as stratified by region, outcome, effect size, socioeconomic indicators, and study type to see if there are any systematic differences in the results based on any of these factors. Overall, the 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 gendered distributions of socioeconomic resources. The median contribution of socioeconomic conditions to the sex-gap in old-age disabilities was 18 percent. Yet, across the studies the contribution ranged between -6 percent and 91 percent.

Besides these patterns, it is difficult to distinguish any systematic patterns in the estimates as there is substantial overlap of the ranges across regions, outcomes, effect sizes, socioeconomic conditions, and study types. If anything, there seems to be less variation in the contribution in the studies that had a larger initial effect size, than in the studies with smaller effect sizes. Moreover, the two studies that explicitly addressed the contribution of socioeconomic conditions to the sex-gap in old-age disabilities using decomposition analyses showed similar results. Both showed that between 36.6 and 47.6 percent of the sex-gap in old-age disabilities could be attributed to the gendered distribution of socioeconomic conditions.

# Discussion

In this study, we sought to compile the available evidence on how much of the sex differences in old-age disabilities could be attributed to gendered differences in socioeconomic conditions. In most of the included studies, women have higher prevalence of disabilities than men, and in most studies some, but not all, of these differences could be attributed to sex differences in socioeconomic conditions. The results also suggest great plasticity in the magnitude of both the sex-gap in disabilities, and in the proportion that could be attributed to differences in socioeconomic conditions.

As with all empirical studies, the results should be interpreted with caution due to a set of limitations of the study. 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 shows how much of the sex-gap in old age disabilities which could be attributed to gendered differences in the distribution of socioeconomic conditions - in a purely statistical sense. Future studies should address the causal nature of this attribution. Secondly, in order to compile all the available evidence, we had to search widely and include studies characterized by wide differences in terms of e.g., samples, periods covered, indicators included, etc. Thus, it is difficult to compare the estimates across the included studies. Finally, to extract the data, we needed from studies that were designed for other purposes, we had to rely on the ‘difference method’ – which is a rudimentary method for mediation analysis. A consequence of this, is that our estimates do not account for interactions between sex and socioeconomic conditions – only for gendered differences in the distribution of socioeconomic conditions.

On the other hand, the main strength of this study is that it, from what we are aware, is the first of its kind. We found two studies which explicitly examined the question, but none have compiled the literature and extracted data from studies which have originally been created for other purposes. Thus, to our knowledge, no previous attempt has been made to compile the available evidence on the role of socioeconomic conditions in shaping the sex-gap in old-age disabilities.

While the estimates from the different studies are very heterogeneous, partly reflecting substantial differences in study designs, most of the studies indicate two robust empirical regularities. First, in most studies women report more old-age disabilities 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.

We propose that future studies should use these empirical regularities as starting points for rigorous analyses. To turn these findings into tractable social policies, we need to know to what extent the observed associations reflect causal processes. We also need to know to what extent these processes differ across different social contexts and birth cohorts.

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**Declaration of contribution of authors:**

**Statement of conflict of interest:** None

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