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

Erika Augustsson a

Johan Rehnberg a c

[---]

Stefan Fors a b \*

*a Aging Research Center, Karolinska Institutet & Stockholm University, Stockholm, Sweden.*

*b Center for Epidemiology and Community Medicine, Region Stockholm, Stockholm, Sweden.*

*c Department of Public Health Sciences, Stockholm University, Stockholm, Sweden.*

*d European Center for Social Welfare Policy and Research, Vienna, Austria.*

*f School of Rehabilitation Therapy, Queen’s University, Kingston, Canada.*

*g Department of Family Medicine, Queen’s University, Kingston, Canada.*

\* Corresponding author:

Erika Augustsson

Aging Research Center

Tomtebodavägen 18A

SE-171 65 Solna

SWEDEN

Introduction

The world is undergoing critical changes in population structure which result in an unprecedented advance of population aging (United Nations 2019). Aging is significantly associated with the deterioration of individuals’ health, as well as posing a higher risk of disability and mortality (World Health Organisation, 2017). Through physical or mental limitations related to mobility handicaps, illness, sensory and cognitive limitations, functional disabilities impair a person’s activities. Life expectancy increasing has led to enlarging the pool of individuals surviving to old age and hence increased frailty and susceptibility to disabilities such as dementia (Guzman-Castillo et al., 2017). This increase in life expectancy and its consequences affect men and women differently, as women represent a growing proportion of the older adult population (United Nations 2019) they are also more impacted by these old age disabilities.

There is a health disparity between the sexes in old age disabilities (Crimmins, Zhang and Saito 2016; Jacob, et al. 2017) where women are more likely to report functional limitations and have a greater degree of disabilities compared to similarly aged men (Hosseinpoor et al. 2012; Murtagh and Hubert 2004). It has been shown that women are more likely to suffer from disabilities which are chronic and nonfatal, such as arthritis, which negatively impact wellbeing (Case and Paxson 2005; Read and Gorman 2010) whereas men are more likely to engage in behaviours which affect their health and risk of premature mortality (Rieker, Bird and Lang 2010). Gender differences in disability may in part be because of 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 are more disabling than immediately fatal (Murtagh and Hubert 2004; Nusselder et al. 2018), 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 these health differences play a role in the overall wellbeing of the individual and the difference between the sexes in relation to health and disabilities increase, women live longer, need more healthcare, and have higher levels of morbidity and disability (Uccheddu et al. 2019).

There are many mechanisms which create health inequalities, this paper pays particular attention to how socioeconomic conditions influence health, keeping in mind that the opposite relation also holds true. Socioeconomic conditions throughout the life course are associated with many factors which can affect the risk for functional limitations in later life (Guerra, Alvarado and Zunzunegui 2008; Zhong, Wang and Nicholas 2017). Among other things education can influence health through awareness of health and risk behaviours and its effect on social mobility, occupational status can influence health through working conditions and stress levels, and income can influence health through access to care, consumption patterns and the psychological burden of being poor (Hoffman, Kröger and Pakpahan 2018). Higher socioeconomic status (SES) allows for more flexible resources, such as money and knowledge, which can give individuals with higher SES access to health-related knowledge, possibilities to cope with stressful events and avoiding illnesses through preventative measures as well as lifestyles more conducive to better long term health (Phelan, Link and Tehranifar 2010; Gathmann, Jürges and Reinhold 2015*)*. On the other hand, individuals with low SES can have limited access to medical services, inadequate nutrition and unhealthy behaviours which increase the prevalence of functional disabilities and accelerated ageing (Steptoe and Zaninotto 2020). The relationship is not one sided, health can affect socioeconomic conditions as well, health conditions and 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 201+). There are factors which affect both socioeconomic conditions and health, these may be genetics, individual characteristics such as personality (Goldman, 2001).

Socioeconomic conditions may contribute to the sex gap in old-age disabilities. 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). In high-income countries socioeconomic disadvantage is associated with greater disability among older women (WHO, 2011; Lima et al 2020). 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 et al. 2016; Hosseinpoor 2012).

The gender-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, disabilities and gender in old age (Wheaton and Crimmins 2016). These differences come from a combination of social and biological factors which may in part be attributable to differences in gendered socioeconomic status (Read and Gorman 2010; Uccheddu et al. 2019). In order to capture to what extent sex differences in old-age disabilities are attributable to gendered socioeconomic conditions there needs to be an overview of the evidence. To see what support there is for socioeconomic status affecting the relationship between gender and health this paper creates a systematic review of available literature to this theory. The main aim of this scoping review is to assess what the literature can tell us about the extent to which the gendered distribution of socioeconomic resources can explain sex differences in disabilities and mobility impairments in later life.

# 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. 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. We excluded studies based on specific samples (e.g. special patient groups).

In order 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.

Searches were conducted in three databases: Medline, Web of Science Core Collection, and Cinahl.



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

The 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.

**Data extraction**

Two different strategies were used to extract the relevant quantitative data from the papers. The papers that explicitly decomposed the sex-gap in old-age disabilities by socioeconomic conditions (n=2) gave: a) the contribution of the gendered difference in the distribution of socioeconomic conditions; and b) the contribution of differential associations between sex and disabilities, separately. In order to make the results comparable to those from the regression-based analyses, we only considered the contribution of the gendered distribution of socioeconomic conditions.

For regression-based studies 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.

In the first step, we extracted the estimates from all the eligible analyses in all the papers. Several papers included analyses based on different samples and different outcomes. So, we ended up with a total of 53 estimates.

In the second step, we tried to compare the estimates by region, outcome, effect size, socioeconomic indicators, and type of analysis to see if there were any systematic differences in the results based on any of these factors

# Results

Table 1 shows that the studies included range from international to local and cover a wide variety of societies. The data included in these studies comes from the 1990s up to 2012 with 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 wide range with local studies with around 450 respondents up to 63.000 respondents in an international study. 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 surrounding income or having some form of wealth, with one study taking childhood socioeconomic status into consideration.

**Table 2**

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). Most outcomes show a positive contribution of socioeconomic factors, with some showing a stronger contribution than others.

There are gender differences present in all outcomes and regions, apart from China and Korea, however China does show gender differences in carrying, walking up stairs and squatting, and Korea in toileting. When looking at the main effects both crude and adjusted show that carrying has the highest values with Taiwan, Mexico, USA and Indonesia scoring the highest. In the highest ten readings for both crude and adjusted levels, Taiwan appears at least twice (three times in the adjusted model). Impaired mobility has the second highest main effects, followed by climbing stairs, toileting, SPBB, bathing, squatting, dressing and finally ADL. As the range is quite large the outcomes with the lowest readings are toileting, dressing and bathing which all have some of the lowest of the statistically significant results.

When looking at the contribution there is a large range, but when disregarding the Korean outlier (toileting) the range is between -5.8 – 63.4%. USA and Indonesia have the highest contribution percentage in ADL limitations (38.6%), bathing (31.1%), carrying (18%) and dressing (24.9%). China has the highest contribution when it comes to squatting (34.1%) and walking the stairs (36.1%). Canada, Albania and Taiwan have the highest in the remaining categories between 15.4%-20%.

**Table 3**

Table 3 shows data from Trujillo et al (2010) using four countries with ADL and IADL as outcomes. All four countries showed statistically significant results in associations between sex, disabilities and functional impairments. Most countries also showed quite a high contribution in IADL and gender differences in ADL also showed some proportions being attributable to socioeconomic conditions. The effect size for IADL ranges between -0.21- -0.42 with the largest effect in Argentina and for ADL Brazil had the highest and the range was -0.67 - -1. Contribution was lowest for Argentina in both outcomes and Mexico was highest, closely followed by Chile. The range for contribution was 24-66% for IADL and 0-41% for ADL.

**Table 4**

The two studies which have explicitly addressed our research question, using decomposition analysis, are presented in table four. Cambois et al (2016) found that the proportion of the associations attributable to socioeconomic conditions was at 48%. Hosseinpoor et al (2012) found that around 36.5% of the inequality between men and women in their study can be attributed to differences in the distribution of sociodemographic factors.

**Table 5**

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. The total sample has a 18% median with a -6 – 91% range of contribution. This range covers a lot and doesn’t show anything on its own. The median at 18% indicates that some proportion of the difference in outcome by gender may be attributable to socioeconomic conditions. No systematic differences were found between the subgroups as the ranges between the groups consistently intersect.

Table 5 shows that there is large variation in all factors and studies, but the one thing that sticks out is the decomposition-based studies and that these have high and very similar results. Most studies also show that women have higher rates of disabilities than men, and that socioeconomic factors do explain some percentage of this difference.

# Discussion

References

Cambois E., Garrouste C. & Pailhé A. (2016). Gender career divide and women's disadvantage in depressive symptoms and physical limitations in France. *SSM Population Health*, 3, pp. 81-88. <https://doi.org/10.1016/j.ssmph.2016.12.008>

Case, A. & Paxson, C.H. (2005). Sex Differences in Morbidity and Mortality. *Demography*, 42(2), pp.189–214. <https://doi.org/10.3386/w10653>

Crimmins, E. M., Zhang, Y., & Saito, Y. (2016). Trends Over 4 Decades in Disability-Free Life Expectancy in the United States. *American journal of public health*, 106(7), 1287–1293. <https://doi.org/10.2105/AJPH.2016.303120>

Galama, T. & van Kippersluis, H. (2019). **A theory of socioeconomic disparities in health over the life cycle, *The Economic Journal*, 129(617), pp. 338-274.**

<https://doi.org/10.1111/ecoj.12577>

Gathmann, C.,  Jürges, H., &  Reinhold, S. (2015). **Compulsory schooling reforms: Education and mortality in twentieth century Europe,** *Social Science & Medicine*, 127, pp. 74-82. [https://doi.org/10.1016/j.socscimed.2014.01.037](https://doi.org/10.1016/j.socscimed.2014.01.037" \o "Persistent link using digital object identifier" \t "_blank)

Goldman, N. (2001). **Social inequalities in health: Disentangling the underlying mechanisms,** *Annals of the New York Academy of Sciences*, 954, pp. 118-139. [https://doi.org/10.1111/j. 1749-6632.2001. tb02750.x](https://doi.org/10.1111/j.%201749-6632.2001.%20tb02750.x" \t "_blank)

Guerra, R.O., Alvarado, B.E. & Zunzunegui, M.V. (2008). Life course, gender and ethnic inequalities in functional disability in a Brazilian urban elderly population. *Aging Clinical Experimental Research*, 20, pp. 53–61. <https://doi.org/10.1007/BF03324748>

Guzman-Castillo, M., Ahmadi-Abhari, S., Bandosz, P., Capewell, S., Steptoe, A., Singh-Manoux, A., Kivimaki, M., Shipley, M., Brunner, E. & O'Flaherty, M. (2017). Forecasted trends in disability and life expectancy in England and Wales up to 2025: a modelling study. *The Lancet Public Health*, 2(7), pp. e307-e313. <https://doi.org/10.1016/S2468-2667(17)30091-9>

[Hoffmann R., Kröger H. & Pakpahan E. (2018). Pathways between socioeconomic status and health: Does health selection or social causation dominate in Europe? *Advances in Life Course Research*, 36, pp. 23-36.](https://doi.org/10.1016/j.alcr.2018.02.002) <https://doi.org/10.1016/j.alcr.2018.02.002>

Hosseinpoor, A., Stewart Williams, J., Jann, B., Kowal, P., Officer, A., Posarac, A. & Chatterji, S. (2012). Social determinants of sex differences in disability among older adults: a multi-country decomposition analysis using the World Health Survey. *International Journal for Equity in Health* 11, 52. <https://doi.org/10.1186/1475-9276-11-52>

Jacob, M., Marron, M., Boudreau, R., Odden, M., Arnold, A. & Newman, A., (2018) Age, Race, and Gender Factors in Incident Disability, The Journals of Gerontology: Series A, 73(2), pp. 194–197. <https://doi.org/10.1093/gerona/glx194>

Leveille, S. G., Penninx, B. W., Melzer, D., Izmirlian, G., & Guralnik, J. M. (2000). Sex differences in the prevalence of mobility disability in old age: the dynamics of incidence, recovery, and mortality, *The journals of gerontology: Series B*, 55(1), pp. S41–S50. <https://doi.org/10.1093/geronb/55.1.s41>

‌Lima, AL.B. de, Espelt, A., Bosque-Prous, M. & Lima, K.C. (2020). Gender differences in disability among older adults in the context of social gender and income inequalities: 2013 Brazilian Health Survey. *Revista Brasileira de Epidemiologia*, 23(2). <https://doi.org/10.1590/1980-549720200002>

Murtagh, K. N., & Hubert, H. B. (2004). Gender differences in physical disability among an elderly cohort. *American Journal of Public Health*, *94*(8), pp. 1406–1411. <https://doi.org/10.2105/ajph.94.8.1406>

Nusselder, W., Wapperom, D., Looman, C., Yokota, R., van Oyen, H., Jagger, C., Robine, J. & Cambois, E. (2019) Contribution of chronic conditions to disability in men and women in France, European Journal of Public Health, 29(1), pp. 99-104. <https://doi.org/10.1093/eurpub/cky138>

Phelan J. C., Link B. G. & Tehranifar P. (2010). Social conditions as fundamental causes of health inequalities: theory, evidence, and policy implications, *Journal of Health and Social Behavior*, 51, pp. S28–S40. [https://doi.org/10.1177/0022146510383498](https://doi.org/10.1177/0022146510383498" \t "_blank)

Read, J.G. & Gorman, B.K. (2010). Gender and Health Inequality. *Annual Review of Sociology*, 36(1), pp.371–386. <https://doi.org/10.1146/annurev.soc.012809.102535>

Read J. G. & Gorman B. K. (2011). Gender and health revisited, Pescosolido B. A., Martin J. K., McLeod J. D., Rogers A. (Eds.), *Handbook of the Sociology of Health, Illness, and Healing - A Blueprint for the 21st Century*. New York: Springer, pp. 411–429.

Rieker P. P., Bird C. E. & Lang M. E. (2010). Understanding gender and health - old patterns, new trends, and future directions. In Bird C. E., Conrad P., Fremont A. M., Timmermans S. (Eds.), *Handbook of Medical Sociology*. Nashville: Vanderbilt University Press, pp. 52–74.

Steptoe, A. & Zaninotto, P. (2020). Lower socioeconomic status and the acceleration of aging: An outcome-wide analysis, *Proceedings of the National Academy of Sciences*, 117(26), pp.14911–14917. <https://doi.org/10.1073/pnas.1915741117>

Uccheddu, D., Gauthier, A.H., Steverink, N. & Emery, T. (2019). Gender and Socioeconomic Inequalities in Health at Older Ages Across Different European Welfare Clusters: Evidence from SHARE Data, 2004–2015. *European Sociological Review*, 35(3), pp.346–362. <https://doi.org/10.1093/esr/jcz007>

United Nations (2019). *World Population Ageing 2019*. [online] United Nations. Available at: <https://www.un.org/en/development/desa/population/publications/pdf/ageing/WorldPopulationAgeing2019-Report.pdf>

Wheaton, F.V. & Crimmins, E.M. (2015). Female disability disadvantage: a global perspective on sex differences in physical function and disability. *Ageing and Society*, 36(06), pp. 1136–1156. [https://doi.org/10.1017/S0144686X15000227](https://doi.org/10.1017/s0144686x15000227" \t "_blank)

[‌](https://doi.org/10.1017/s0144686x15000227" \t "_blank)World Health Organisation (2017). Global strategy and action plan on ageing and health. Geneva: World Health Organization. Available online at: <https://www.who.int/ageing/WHO-GSAP-2017.pdf>

World Health Organisation (2011). *World Report on Disability*. [online] *World Health Organisation*. World Health Organisation. Available at: <https://www.who.int/disabilities/world_report/2011/report.pdf?ua=1>

Zhong, Y., Wang, J. & Nicholas, S. Gender (2017). Childhood and adult socioeconomic inequalities in functional disability among Chinese older adults. *International Journal for Equity in Health* 16, 165. <https://doi.org/10.1186/s12939-017-0662-3>