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Contribution of chronic conditions to disability in men and women in France

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Background: Women report more disability than men perhaps due to gender differences in the prevalence of diseases and/or in their disabling impact. We compare the contribution of chronic diseases to disability in men and women in France, using a disability survey conducted in both private households and institutions, and we also examine the effect of excluding the institutionalized population. **Methods:** Data comprised 17 549 individuals age 50+, who participated in the 2008–09 French Disability Health Survey including people living in institutions. Disability was defined by limitations in activities people usually do due to health problems (global activity limitation indicator). Additive regression models were fitted separately by gender to estimate the contribution of conditions to disability taking into account multi-morbidity. **Results:** Musculoskeletal diseases caused most disability for both men (10.1%, CI: 8.1–12.0) and women (16.0%, CI 13.6–18.2). The second contributor for men was heart diseases (5.7%, CI: 4.5–6.9%), and for women anxiety-depression (4.0, CI 3.1–5.0%) closely followed by heart diseases (3.8%, CI 2.9–4.7%). Women's higher contribution of musculoskeletal diseases reflected their higher prevalence and disabling impact; women's higher contribution of anxiety-depression and lower contributions of heart diseases reflected gender differences in prevalence. Excluding the institutionalized population did not change the overall conclusions. **Conclusions:** The largest contributors to the higher disability of women than men are moderately disabling conditions with a high prevalence. Whereas traditional disabling conditions such as musculoskeletal diseases are more prevalent and disabling in women, fatal diseases such as cardiovascular disease are also important contributors in women and men.

Introduction

Today women's life expectancy is higher everywhere, but this does not necessarily mean women have better health. Despite lower mortality at all ages, women report more frequent disability and other health problems than men of the same age.[1–4] A common explanation for the disability-survival paradox is that men have more fatal diseases and women have more disabling diseases. The higher survival chances in women stem from biological factors, including hormonal, autoimmune and genetic effects, behavioral factors, including risk taking behavior such as cigarette smoking and alcohol consumption, readiness to consult health care professionals and social factors including occupational experience.[5,6]

It is increasingly acknowledged that women do not suffer from greater levels of all types of ill-health.[1] Women report more non-life threatening disabling conditions such as arthritis and depression, whereas men report more fatal diseases, including cardiovascular diseases.[1–3] However, there has been a sharp reduction in cardiovascular disease mortality, partly reflecting increased survival through better health care,[7] as well as an increase of smoking-related diseases in women,[8] and evidence that cardiovascular diseases are not only fatal but also disabling.[9–11] Thus, the explanation that men mainly suffer fatal diseases and women mainly disabling diseases may no longer hold.

Insight into the contribution of diseases to disability and the role of prevalence vs. the disabling impact is relevant for better understanding of gender disparities, optimizing strategies for reducing disability in the population, and planning the provision of health and social care. A high contribution due to high prevalence may point to specific modifiable risk factors, leading to a focus on primary prevention of the disease e.g. on the reduction of unhealthy life styles or on screening programs. However, if the main contribution is the high disabling impact, that is a high rate of disability among individuals with the disease, then providing assistive devices or improving disease management to reduce disability may yield greater disability reduction.

Previous studies that have examined the contribution of conditions to disability are limited. Most could not include mental diseases, such as depression,[9,10,12] despite evidence from the Burden of Disease Study that the non-fatal health burden of these diseases is high.[13] In addition, although the global activity limitation indicator (GALI) is the disability measure underlying the healthy life years (HLY) and used across Europe to monitor health[14] and to formulate health targets,[15,16] only one study has used this measure, and it focused on multi-morbidity rather than gender differences.[17] Finally most prior studies, with the exception of a few restricted to older people, exclude the institutionalized population,[9,10,12,18] and the extent to which the contribution of diseases to disability is biased by excluding the institutionalized population is unclear.

This study focuses on the contribution of conditions to disability as measured by the GALI. We estimate the contribution of specific chronic conditions to GALI disability in men and women, taking into account both the prevalence and disabling impact of the

conditions. Our second aim is to assess the effect of including or excluding the institutionalized population.

Methods

Study population

We used the French Disability Health Survey ('Enquête Handicap et Santé') 2008–09, consisting of two parts: (i) a survey of people living in private households (HSM) and (ii) a survey of people living in people living in nursing homes, homes for the elderly and mental institutions (HSI).

For the HSM 39 065 people were approached in 2008, disabled people being oversampled based on a short screening questionnaire sent to a large sample of the population which was then used to stratify the survey sample according to disabilities. The response rate to the survey was 76.6% (n = 29 931). For the HSI, 9104 persons living in 1519 institutions responded, a response rate of 97% (institutions) and 91% (people). For both surveys we excluded people who lived in French overseas territories (HSM: 3494, HSI: 624), people who did not respond to the individual questionnaire (HSM: 45) or who had incomplete information on age and sex (HSM: 2, HSI: 8). We constrained our analyses to people aged 50 and over (HSM: 13 683, HSI: 4954) and those with complete information on chronic conditions and disability, although proxy response was allowed, resulting in a total study population of 17 549 (HSM: 12 835, HSI: 4714). The study population included 7110 men and 10 439 women. Additional information on the study population can be found in Supplementary table S1. Background information on the 'Enquête Handicap et Santé', 2008–09 can be found online.[19,20]

Disability

Disability was based on the GALI question: 'For at least the last 6 months, have you been limited because of a health problem in activities people usually do?' which aims to capture long-term limitation caused by ill-health through three severity levels: none, limited but not severely and severely limited. People were considered to have disability if they reported any limitation, this being the cut-off used in the HLY indicator. The reliability and validity of the GALI have already been reported.[21–25]

Chronic conditions

Health conditions were self-reported and selected by participants from the illness card, which included both somatic and mental diseases, as well as information on permanent injury. We included the following groups: heart diseases, cerebrovascular accident, peripheral vascular disease, cancer, chronic non-pecific lung diseases, musculoskeletal diseases, Alzheimer and Parkinson diseases, other neurological diseases (multiple sclerosis, and other unspecific neurological problems), depression and anxiety, other mental diseases (autism, schizophrenia, other unspecified psychiatric impairments), diabetes mellitus and accidents. Supplementary table S2 presents the groups and diseases/conditions within each group.

Attributing chronic conditions to disability

The attribution method[26,27] is an additive regression model, used to attribute disability to health conditions. The method makes two assumptions. Firstly that multi-morbidity yields additive contributions of the conditions. Secondly that disability in people without a reported condition is entirely attributed to background, meaning a risk explained by other factors than the conditions under consideration. Disability in persons with at least one condition is attributed partly to background and partly to the condition(s). The regression model yields background and condition-specific cumulative rates of disability (labeled as 'disabling impact'). The disabling impact of a condition combined with its prevalence yields its contribution to the total disability prevalence.[27] Details on the methods and further assumptions are given in Supplementary data on the additive hazard model.

All models were fitted seperately for men and women. We first estimated models with the background rate by 5-year age group to compare the disabling impact between men and women. Next, we allowed the disabling impact to vary by age (15 year age groups) using a common age pattern across conditions. In sensitivity analsyes we allowed the age patterns of the disabling impact to vary across conditions.

The contributions of background and all conditions were expressed as a percentage of the total number of persons which sum to the total disability prevalence. In addition, we calculated relative contributions, indicating the percentage of the total number of persons with disability who are disabled due to the specific condition.

Effect of including the institutionalized population

Most surveys are based on household populations only. To assess potential bias from excluding the institutionalized population (2% of men and 3.5% of women), we repeated analyses for the non-institutionalized population only and compared the results. As the institutionalized population is largely concentrated in the older age groups (80–84, 85+) we also compared the results specifically for the 80+ age group.

Additive hazard analyses used the attribution tool in the statistical software R (version 3.0.1) which is available on request. Weights were applied to account for sample design and non-response. Given the range of the sampling weights caused by pooling the household and institutional dataset we report confidence intervals based on bootstrapping (1000 simulations). To test whether prevalence, disabling impact and contributions differed between men and women we used z tests for the gender difference with standard errors based on bootstrapping.

Results

Prevalence of disability and health conditions

The overall prevalence of GALI disability was significantly higher in women aged 50+ (49.8, 95% Confidence Interval (CI): 47.9–51.6) than men (44.1%, 95% CI: 42.0–46.1). With regard to health conditions, musculoskeletal diseases had the highest prevalence for both men (50.5%, CI 48.4–52.7) and women (64.3%, CI 62.7–66.0), with the second highest being heart diseases for men (20.6% CI: 19.0–22.1) and anxiety-depression for women (15.8%, CI 14.7–16.9) (table 1). The prevalence of musculoskeletal diseases, anxiety-depression and Alzheimer–Parkinson, were significantly higher for women than men, whilst women had significantly lower prevalence of heart diseases, cardiovascular accident, peripheral vascular disease, chronic non-specific lung diseases, diabetes mellitus and accidents.

Disabling impact of health conditions

For both men and women, the conditions with the largest disabling impacts were Alzheimer–Parkinson, peripheral vascular disease and other neurological disease (multiple sclerosis, other unspecific neurological problems) (table 2). The disabling impacts of diabetes and of musculoskeletal diseases were higher in women but no significant gender differences were found for other conditions.

Contribution of conditions to GALI disability

For both men and women the greatest contribution to GALI disability came from musculoskeletal diseases (men: 10.1%,

Table 1 Prevalence of chronic conditions (%), Disability Health Survey (HSM and HSI), France, 2008–09, men and women age 50+

	Prevalence (%, 95%CI)		
	Men	**Women**	**Difference**
Heart diseases	20.6 (CI: 19.0–22.1)	13.6 (CI: 12.6–14.7)	−6.9 (CI: −7.6 to −6.3)
Cerebrovascular accident	4.2 (CI: 3.6–4.8)	3.2 (CI: 2.8–3.7)	−1.0 (CI: −1.6 to −0.4)
Peripheral vascular disease	3.6 (CI: 3.0–4.3)	1.5 (CI: 1.2–1.8)	−2.1 (CI: −4.2 to −0.0)
Musculoskeletal diseases	50.5 (CI: 48.4–52.7)	64.3 (CI: 62.7–66.0)	13.8 (CI: 12.7–14.9)
Cancer	8.6 (CI: 7.6–9.7)	9.2 (CI: 848–10.2)	0.6 (CI: 0.2–1.1)
Alzheimer–Parkinson	2.6 (CI: 2.1–3.1)	3.6 (CI: 3.2–4.0)	1.0 (CI: 0.5–1.5)
Other neurological diseases	2.5 (CI: 2.1–3.0)	2.5 (CI: 2.1–2.9)	−0.1 (CI: −1.3–1.2)
Chronic non-specific lung diseases (CNSLD)	13.9 (CI: 12.8–15.2)	12.1 (CI: 11.5–12.6)	−1.8 (CI: −2.9 to −0.8)
Anxiety and depression	8.9 (CI: 7.9–9.9)	15.8 (CI: 14.7–16.9)	6.9 (CI: 6.4 – 7.3)
Other mental	1.4 (CI: 1.0–1.8)	1.2 (CI: 1.0–1.5)	−0.2 (CI: −1.4–1.1)
Diabetes mellitus	13.8 (CI: 12.50–15.2)	9.9 (CI: 9.0–10.9)	−3.9 (CI: −5.1 to −2.7)
Accidents	10.5 (CI: 9.3–11.7)	5.8 (CI: 5.1–6.5)	−4.7 (CI: −6.7 to −2.7)

Table 2 Condition-specific disability rates (disabling impact), Health and Disability Survey (HSM and HSI), France, 2008–09, men and women age 50+

		Disabling impact[a] (rate, 95% CI)	
	Men	**Women**	**Difference**
Heart diseases	0.46 (CI: 0.34–0.59)	0.53 (CI: 0.36–0.70)	0.07 (CI: −0.07–0.21)
Cerebrovascular accident	0.69 (CI: 0.33–1.05)	0.57 (CI: 0.19–0.96)	−0.11 (CI: −0.55–0.32)
Peripheral vascular disease	0.76 (CI: 0.31–1.21)	0.94 (CI: 0.20–1.68)	0.18 (CI: −0.55–0.91)
Musculoskeletal diseases	0.27 (CI: 0.21–0.34)	0.36 (CI: 0.30–0.41)	0.08 (CI: 0.02–0.15)
Cancer	0.32 (CI: 0.16–0.48)	0.36 (CI: 0.22–0.50)	0.04 (CI: −0.13–0.21)
Alzheimer–Parkinson	1.20 (CI: 0.40–2.00)	1.40 (CI: 0.96–1.83)	0.20 (CI: −0.70–1.09)
Other neurological diseases	0.75 (CI: 0.32–1.18)	0.69 (CI: 0.28–1.09)	−0.07 (CI: −0.58–0.45)
Chronic non-specific lung diseases	0.30 (CI: 0.18–0.43)	0.24 (CI: 0.12–0.36)	−0.06 (CI: −0.20–0.07)
Anxiety and depression	0.40 (CI: 0.21–0.59)	0.45 (CI: 0.32–0.58)	0.05 (CI: −0.15–0.25)
Other mental	0.74 (CI: 0.17–1.31)	0.50 (CI: 0.08–0.91)	−0.25 (CI: −0.90–0.41)
Diabetes mellitus	0.13 (CI: 0.04–0.21)	0.32 (CI: 0.19–0.45)	0.19 (CI: 0.10–0.29)
Accidents	0.29 (CI: 0.15–0.43)	0.27 (CI: 0.09–0.44)	−0.02 (CI: −0.18–0.13)

a: Based on the model with no variation in disabling impact by age.

Table 3 Absolute and relative contribution of conditions on disability, Health and Disability Survey (HSM and HSI), France, 2008–09, men and women age 50+

	Men		**Women**		**Difference (W−M)**
	Absolute contribution	**Relative contribution (%)**	**Absolute contribution**	**Relative contribution (%)**	**Absolute contribution**
Heart diseases	0.057 (CI: 0.045–0.069)	12.9	0.038 (CI: 0.029–0.047)	7.7	−0.019 (CI: –0.031 to −0.007)
Cerebrovascular accident	0.013 (CI: 0.008–0.018)	3.0	0.008 (CI: 0.005–0.012)	1.7	−0.005 (CI: −0.010–0.000)
Peripheral vascular disease	0.013 (CI: 0.008–0.018)	2.9	0.006 (CI: 0.003–0.008)	1.1	−0.007 (CI: −0.012 to −0.002)
Musculoskeletal diseases	0.101 (CI: 0.081–0.120)	22.8	0.160 (CI: 0.136–0.182)	32.1	0.059 (CI: 0.039–0.079)
Cancer	0.017 (CI: 0.010–0.024)	3.9	0.021 (CI: 0.015–0.028)	4.2	0.004 (CI: −0.003–0.011)
Alzheimer–Parkinson	0.012 (CI: 0.009–0.016)	2.8	0.017 (CI: 0.014–0.021)	3.5	0.005 (CI: 0.001–0.009)
Other neurological diseases	0.009 (CI: 0.005–0.012)	2.0	0.008 (CI: 0.005–0.011)	1.6	−0.001 (CI: −0.004–0.003)
Chronic non-specific lung diseases	0.027 (CI: 0.018–0.037)	6.1	0.018 (CI: 0.010–0.025)	3.5	−0.010 (CI: −0.019–0.000)
Anxiety and depression	0.021 (CI: 0.013–0.029)	4.7	0.040 (CI: 0.031–0.050)	8.0	0.019 (CI: 0.011–0.027)
Other mental	0.005 (CI: 0.003–0.009)	1.2	0.003 (CI: 0.002–0.004)	0.6	−0.003 (CI: −0.006–0.001)
Diabetes mellitus	0.013 (CI: 0.005–0.021)	2.9	0.019 (CI: 0.013–0.026)	3.9	0.007 (CI: −0.001–0.015)
Accidents	0.020 (CI: 0.012–0.028)	4.5	0.009 (CI: 0.004–0.014)	1.8	−0.011 (CI: −0.019 to −0.003)
Background	0.133 (CI: 0.128–0.138)	30.1	0.150 (CI: 0.145–0.155)	30.1	0.017 (CI: 0.012–0.022)
Total	0.441 (CI: 0.420–0.461)	100.0	0.498 (CI: 0.479–0.516)	100.0	0.057 (CI: 0.035–0.078)

W−M=women−men.

CI: 8.1–12.0; women: 16.0%, CI 13.6–18.2), corresponding to 23 and 32%, respectively, of the total disability prevalence (table 3 and figure 1). For men the second largest contributor was heart diseases (5.7%, CI: 4.5–6.9%), and for women anxiety-depression (4.0%, CI 3.1–5.0%) closely followed by heart diseases (3.8%, CI 2.9–4.7%). For men the third contributor was chronic non-specific lung diseases (2.7%, CI 1.8–3.7%). Disability from conditions other than those included in our analyses ('background'), including unspecified age-related decline in functioning, accounted for 30% of the total male and female disability prevalence.

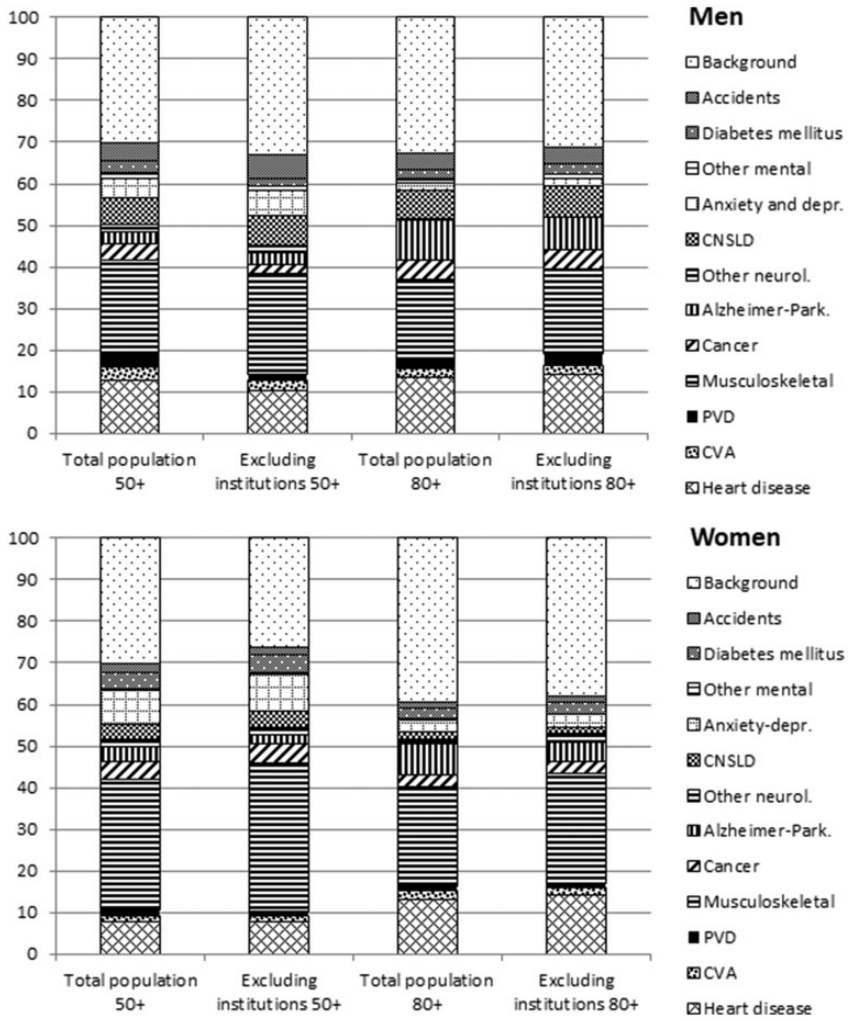

Figure 1 Relative contribution of conditions to GALI disability, based on HSM and HSI, France, by age and inclusion vs. exclusion institutionalized population and gender

The contribution of musculoskeletal diseases and anxiety-depression was significantly higher in women than men, whilst the contribution of heart diseases, cerebrovascular accidents, peripheral vascular disease and accidents was significantly higher in men. The higher contribution of musculoskeletal diseases in women reflected both the higher disease prevalence and the slightly higher disabling impact, while the higher contribution of anxiety-depression to disability was mainly due to higher prevalence. The higher contributions of heart diseases, peripheral vascular disease and accidents in men were due to the higher prevalence of these conditions in men.

Effect of including/excluding institutionalized population

Comparing results with or without inclusion of people in institutions had only a small effect on the relative contribution of each disease to disability and did not change the overall pattern (figure 1). Including only private households, as in most prior studies, tended to decrease the contribution of Alzheimer–Parkinson and to increase the contribution of musculoskeletal diseases, particularly in women. It also tended to decrease the contribution of cardiovascular diseases cardiovascular accident peripheral vascular disease in men in both the 50+ and 80+ populations, but not in women.

The sensitivity analyses allowing age patterns of disabling impact to vary across conditions indicated that our assumption of the same age pattern for all conditions did not affect conclusions (Supplementary table S3).

Discussion

Our analyses showed that the largest contributors to the gender difference in disability are moderately disabling conditions with a high prevalence and not conditions with the largest disabling impacts. Accounting for both prevalence and disabling impact, the largest contributors were musculoskeletal diseases and heart diseases in men and women, chronic non-specific pulmonary disease (men), and anxiety and depression (women). Musculoskeletal diseases and anxiety-depression contributed more in women, while heart diseases, peripheral vascular disease and accidents contributed more in men, because the latter are more prevalent in men. The disabling impact of conditions were either higher in women (musculoskeletal and diabetes) or did not differ statistically between the genders. Omitting the institutionalized population, as in prior studies, did not affect our conclusions substantially, although the percentage of GALI disability due to Alzheimer–Parkinson was lower, especially for the 80+ age group where these conditions are both important contributors to GALI disability and a reason for admission to institutional care.

Evaluations of data and methods

A major strength of our study is that it is based on a large comprehensive survey, the Disability Health Survey, which covers both the household and institutionalized population of France, and includes detailed information on a wide range of fatal and non-fatal chronic conditions, including mental diseases.

Our study was based on self-reported health conditions and GALI disability from a health survey. Possible selection bias caused by non-response (<25% in household population and <12.5% in institutionalized population) was reduced by using individual sampling weights reflecting the probability of being sampled (depending on presumed disability severity and area of residence) and of response. However, this will not account for selection bias if response is related to the presence of particular conditions. Gender differences in reporting cannot be ruled out, as the GALI indicator is subject to variations in the tendency to report health problems,[28] although higher prevalence of disability in women is evident in performance-based measures.[29] There is no consistent evidence that men and women assess their health in different ways, nor that men tend to report health conditions only when they are at more severe or more advanced stages.[1] Self-report of most chronic conditions is reasonably accurate, with the highest accuracy for diabetes, asthma, moderate agreement for coronary heart diseases and at best moderate agreement for arthritis.[30] People may have attributed pain or stiffness in the joints to arthritis or rheumatism while older persons may have underreported this disease.[31] As the contribution of a condition is determined both by prevalence and disabling impact, we expect that if over(under)reporting of the condition was present this is likely to have been (largely) nullified by a lower(higher) disabling impact on average.

While the attribution took into account competing causes of disability and the presence of disability in people free of the selected conditions, we cannot ascertain that all conditions were present before the onset of disability. While diseases are considered to precede disability in the disablement process,[32] in particular for depression the opposite pathway cannot be eliminated. We allowed the disabling impacts of conditions to vary by age, but similarly for all conditions. Consistent with prior studies, disabling impacts increased with age.[9,12,26] The sensitivity analyses presented in Supplementary table S4, show that the results differed little if we allowed age patterns to vary across conditions.

The results of our study based on the GALI disability may not be generalizable to other disability indicators. The GALI is a measure of participation restriction, which is the societal perspective of disability,[33] and is not measuring functional limitation. Prior studies have shown that gender differences differ across disability indicators.[2,34] This was an important reason to examine gender disparities using the GALI, as this measure is now used for HLY across Europe and included in several European and national surveys. The relevance of the GALI to public health relies on the fact that it reflects the health-related difficulties for social participation, which drives quality of life and care needs.

Comparisons with previous studies

Our findings on the role of musculoskeletal diseases as a major contributor to disability confirm others using the same attribution method but for other countries and disability measures.[9,11,35,36] The higher prevalence of musculoskeletal diseases in women compared to men confirms previous studies using disability indicators other than the GALI,[9,10,34,37,38] as does the higher disabling impact of musculoskeletal diseases for women than men[9,10,31,37] and the higher disabling impact of diabetes in women,[9,10,34] although the latter is not an unequivocal finding. However, in the very old, diabetes has been associated with a higher disabling impact among men when disability was measured by instrumental and basic activities of daily living.[38] In contrast to Klijs,[9] and Kingston[38] but similar to Scott,[39] we did not find a higher disabling impact of heart diseases in women compared to men. While most other studies did not include the institutionalized population, our study suggests that this does not affect findings substantially for the 50+ population.

This study extends the literature on gender differences in disability by adding findings on the increasingly popular GALI. We confirm the general picture that men have a greater prevalence of fatal diseases. Women, on the other hand, experience more non-fatal but disabling diseases, such as musculoskeletal disease and anxiety-depression that contribute to greater activity restriction. Additionally we demonstrate that the gender split in non-fatal and fatal disease ignores that common fatal diseases in men (cardiovascular diseases, respiratory diseases) also cause significant disability as measured by limitations in usual activities.

Interpretation

Activity restrictions are common (about 45–50% of population aged 50+) and conditions that are common and at least moderately disabling contribute most to GALI limitations and to gender differences. This is true for non-fatal diseases, such as musculoskeletal diseases, but also for 'traditional' fatal chronic diseases, such as cardiovascular diseases and injuries. Survival from cardiovascular diseases has improved dramatically but this has resulted in disability among survivors, thereby reducing the gender gap in GALI disability as these diseases are more prevalent in men. Severely disabling conditions, such as Parkinson–Alzheimer are more strongly associated with activity restriction, but, because of the relatively low prevalence in the total 50+ population, contribute less to activity restrictions and to gender differences. At older ages, the contribution of these conditions becomes more important and including the institutionalized population better reflects their contribution to disability.

Implications and conclusion

The well-known disabling conditions such as musculoskeletal diseases contribute most to disability, particularly in women, whereas cardiovascular diseases and respiratory diseases contribute more to disability in men and partly nullify the female excess disability. Further improvements in survival from cardiovascular diseases in combination with greater equality in health and working behaviors between men and women, may increase the contribution of these traditionally fatal conditions, not only in men, but also in women.

A future expansion of disability could be avoided by targeting healthier behaviors, avoiding occupation and life style hazards, earlier and better treatment to delay the onset and progression of chronic conditions, complemented with better and more available assistive technology to counteract limitations in activities people usually do.

Supplementary data

Supplementary data are available at *EURPUB* online.

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Conflicts of interest: None declared.

Key points

- The largest contributors to GALI disability in the French population aged 50+ are musculoskeletal diseases, heart diseases, chronic non-specific pulmonary disease (mainly in men) and anxiety and depression (mainly in women).
- The contribution of musculoskeletal diseases and anxiety-depression is higher in women, whereas the contribution of heart diseases, peripheral vascular diseases and accidents is higher in men.
- Gender differences in the contributions of chronic conditions to disability mirrored differences in the prevalence of conditions. Musculoskeletal diseases in addition had a higher disabling impact for women.
- Including or excluding the institutionalized population did not affect the overall conclusions.

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