Doctor of Sociology

Smoking not only Kills: Impact of Smoking on Morbidity, Disability, and Duration of Life

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Abstract

The increase in life expectancy observed worldwide does not necessarily mean an increase in the number of years lived in good health due to the growing prevalence of chronic conditions and disability at older ages. Chronic conditions are the main cause of disability in the older population. Among the risk factors for chronic diseases, smoking is considered the main cause of premature death, increasing mortality from cardiovascular disease, cancer, chronic respiratory diseases, and diabetes. Smoking has also been associated with disability owing to its role on the disablement process (i.e. as a risk factor for several chronic conditions) and its exacerbating effect on existing chronic diseases. This thesis aimed to better understand the disease burden on disability and mortality and to gain more insights on the role of smoking on this association.

This thesis focused on the attribution method to investigate the causes of disability. Briefly, the method partitions the disability prevalence estimated with cross-sectional data into the additive contribution of diseases, accounting for multimorbidity and allowing disability to occur without any disease (“background”). To identify the leading causes of disability, two factors are essential: the prevalence and disabling impacts of the diseases. While the disease prevalence is based on the observed cross-sectional data, the disabling impacts are estimated with the additive hazard model. In this thesis, the attribution method, originally developed for binary disability outcomes, was extensively used and further explored to allow multicategory disability responses. To disseminate the use of both versions of the method, we developed an open-source software to fit the additive hazard models and to estimate the contribution of diseases to the disability prevalence in R, which is publicly available with the package “addhaz”. Despite the advantages of accounting for competing risks between disability causes and estimating the contribution of diseases that sum to the disability prevalence, which allows the use of the results for the decomposition of differences in health expectancies by causes of disability, the method relies on a strong causal assumption between disease and disability, which can only implied, but not established with cross-sectional data. To better understand the disease burden on the interaction between disability and mortality, decomposition methods were used to investigate the contribution of chronic conditions to gender and smoking differences in health expectancies.

The results of the attribution method in Belgium indicated that approximately one third of the older population reported disability, with musculoskeletal conditions, cardiovascular diseases, and chronic
respiratory diseases being the major causes of disability in the Belgian older population. An interesting finding was the small, but existing prevalence of disability in young individuals (4-5%), with depression being among the main contributors to disability in this group. Another important finding was the identification of the co-occurrence of (i) diabetes and cardiovascular diseases and (ii) chronic respiratory diseases and depression as the most disabling conditions, i.e. the co-occurrence of these diseases resulted in a high disability rate in the older population in Belgium. Despite their high disabling impact, these disease combinations did not show important contributions to disability due to their low frequency in the population. When looking at the disability burden in Brazil, it was somewhat surprising that the disability prevalence was very similar to the prevalence in Belgium: approximately 30% in the older population. Although musculoskeletal conditions were among the main contributors to the disability prevalence, stroke was the leading disability cause among Brazilian men and diabetes was the main cause in Brazilian women.

The investigation of the contribution of diseases to moderate and severe disability in the older population using a multinomial disability outcome in Belgium and Brazil also showed unexpected findings: in Belgium, severe disability (men: 8%; women: 17%) was more common than moderate (men: 6%; women:12%), while the opposite was observed in Brazil (men moderate: 8%; women moderate: 12%; men severe: 9%; women severe: 6%). Also, the prevalence of moderate and severe disability (except among women) was rather similar in Belgium and Brazil. Besides the cultural differences in reporting disability, this can be related to a mortality selection during childhood in the older population in Brazil and longer exposure to unhealthy behaviours in the older individuals in Belgium, since the ageing process started earlier in Belgium than in Brazil. Musculoskeletal conditions were the main contributors to the moderate and severe disability prevalence in Belgium, but only to moderate disability in Brazil. Depression (men) and heart diseases (women) were the main causes of severe disability in Brazil.

We also applied the attribution method to assess the impact of smoking on disability. This analysis was restricted to middle-aged adults from Belgium, due to the high impact of smoking on premature mortality. Our results showed a small, but increasing trend in the disability prevalence across smoking categories in men (never: 5%, former: 6%, daily light: 8%, daily heavy: 11%) and women (never: 8%, former: 8%, daily light: 10%, daily heavy: 12%). Besides the high contribution of musculoskeletal conditions across all smoking categories, an increasing trend in the relative contribution of chronic respiratory diseases in men (heavy: 7%, daily light: 6%, former: 3%, never: 0.2%) and of cardiovascular diseases in women (heavy: 7%, daily light: 5%, former: 5%, never: 3%) was also observed, suggesting that besides the high effect of smoking on mortality, it also has a negative impact on disability.

The results of the decomposition by kind of effect and cause of gender differences in health expectancies confirmed the male-female health-survival paradox in Belgium: women live longer than men and spend more years with and without disability. A small decrease in the gender gap in life expectancy (LE) (2001: 5.9; 2004: 5.6; 2008: 5.3) was observed, followed by a reduction in the gender differences in disability-free LE (DFLE) (2001: 1.9; 2004: 1.3, 2008: 0.5) and an increase in the gender gap in LE with disability (LED) (2001: 4.0; 2004: 4.4; 2008: 4.8). The female DFLE advantage was mainly attributed to their lower mortality from external causes, lung/larynx/trachea cancer, and ischaemic heart diseases while the female LED disadvantage was attributed to their lower mortality due to lung/larynx/trachea cancer, ischaemic heart diseases, and external causes in 2001 and 2004, and higher disability due to musculoskeletal conditions in 2008.

Finally, the analysis of the impact of smoking on the contribution of diseases to differences in DFLE and LED showed that never smokers enjoyed longer and healthier lives than daily smokers: never
smokers are expected to live on average 8.8 years (men) and 5.9 years (women) longer than daily smokers, of which 8.5 years (men) and 4.3 years (women) are expected to be lived free of disability. The DFLE advantage in never smokers was attributed to their lower mortality (men: 6.2 years; women: 3.0 years) and lower disability (men: 2.3 years; women: 1.3 years) compared to daily smokers. Nonetheless, never smokers are also expected to live slightly longer with disability than daily smokers (men: 0.3 years; women: 1.6 years). The LED disadvantage in never smokers was mainly attributed to their lower mortality (men: 2.6 years; women: 2.9 years) compared to daily smokers. Lower mortality from lung/larynx/trachea cancer, ischaemic heart diseases, and chronic respiratory diseases in never compared to daily smokers were the main contributors to their higher DFLE and LED. Compared to the mortality effect, the disability effect on the smoking differences in DFLE and LED was smaller. Musculoskeletal conditions, ischaemic heart diseases, and chronic respiratory diseases in men and background, chronic respiratory diseases, and musculoskeletal conditions in women were the main contributors to the disability effect on smoking disparities in DFLE and LED.

Taken together, our results highlight the importance of disentangling the role of the disease burden on disability and mortality. Strategies to reduce the burden of diseases on disability at older ages should consider the role of the prevalence and disabling impact of diseases. For example, for diseases that showed a high contribution to disability owing to their high occurrence in the populations, focus should be on prevention of disease onset, while for diseases with high disabling impact, disease management, rehabilitation, and enabling environments should be prioritized. For instance, the high burden of musculoskeletal conditions (Brazil and Belgium), chronic respiratory diseases (Belgian men), and diabetes (Brazilian women) on disability were mainly attributed to their high prevalence in the older population and could be reduced by promoting healthy lifestyles. Multimorbidity among the older also deserves attention, due to its high impact on disability. To reduce the female disability disadvantage, interventions should focus on non-fatal conditions, particularly on musculoskeletal conditions, by promoting physical activity and reducing obesity. The reduction of the male mortality disadvantage could be achieved by reducing smoking, promoting physical activity, healthy diets, safe driving, and changing the environment. Tobacco control measures will not only reduce mortality more than any other single public health intervention, but it can also improve and preserve the quality of life of individuals later in life. Interventions focusing on smoking may reduce disability and mortality from cardiovascular and chronic respiratory diseases, given the double burden of these conditions observed among smokers.