

The State of Health in Belgium, 1990–2019: A Benchmarking Analysis Based on the Global Burden of Disease 2019 Study

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Abstract

Background

In spite of high health expenditures and several reforms, Belgian healthcare system shows unsatisfactory health outcomes. Evidence-based decision-making is essential in a context of decreasing resources and growing health needs. This study aims to assess the health trends in Belgium between 1990 and 2019, to compare the Belgian health status to that of the EU-15 countries, and to identify the main drivers in trends over time and country differences within the EU-15.

Methods

We extracted estimates from the GBD 2019 study via the GBD results tool and visualization tools. We compared the Belgian health status with 14 European Union comparator countries between 1990 and 2019.

Results

Life expectancy (LE) in Belgium improved significantly between 1990 and 2019 for both men and women. Belgium Age-standardised (AS) mortality dropped significantly for men (-40%) and women (-33%) between 1990 and 2019. Belgium performed significantly better in 2019 than in 1990 in terms of AS Year of Life Lost (YLL) rates. The main contributors to the significant premature mortality decrease were ischemic heart disease, lung cancer and road injuries in men; ischemic heart disease, stroke and breast cancer in women. AS Years lived with disability (YLD) did not significantly differ between 1990 and 2019. Overall, Belgium AS Disability-Adjusted Life Year (DALY) rates dropped by 23%. This decrease is mainly due to decreasing trend in YLL rates while YLDs rates remained stable. Compared to EU-15, Belgium ranking worsened in terms of AS DALY rates for both men and women in 2019. The main contributors for AS DALY rates were ischemic heart disease, lung cancer and self-harm in men; headache disorders, low back pain and gynaecological disorders in women.

Conclusion

Non-communicable diseases are the main contributors for health burden in Belgium since 1990. Despite the considerable improvement, Belgium's ranking for DALYs decreased between 1990 and 2019 compared to the EU-15. Primary and secondary prevention could be crucial elements to improve patient health outcomes and reduce their burden on the healthcare system.

Background

Belgium grants importance to the quality of its healthcare system and expenditures have been generous over the years. Health expenditure accounted for 10% of the Belgian Gross Domestic Product in 2016 (42 billion Euros, in absolute terms) [1]. Despite high health expenditures and multiple reforms, the healthcare system shows large socio-economic disparities preventing the disadvantaged from immediate access to

healthcare, alarming mental health results, and high avoidable hospitalizations rates. The system itself still favours delivering acute care as opposed to preventive measures [1].

As in many high-income countries, ageing of the population is putting additional pressure on the healthcare system. Currently, 16% of the population is above 65 years, while this percentage is projected to increase to 18% by 2040 [2]. Older life stages are often accompanied by increasing morbidity and frailty which require appropriate care and health infrastructures [3]. However, since Belgium finances its health system through social security contributions of working citizens [4], an increasing share of the inactive population will compromise future healthcare budgets.

In a context of decreasing resources compared to the growing health needs of the population, appropriate decisions must be evidence-based in order to allocate the available resources. This involves independent and objective assessment of the population's health state to be able to set priorities, with consistent and comparable data on mortality and morbidity [5].

The Global Burden of Disease (GBD) study offers a comprehensive framework for decision-makers (at the local, regional, national, and global level) by making available estimated trends in, and drivers of, population health. This allows decision-making process to be based on internally consistent evidence, obtained via a systematic quantification of the comparative magnitude of health loss from diseases, injuries, and risks by age, sex, and population over time. To date, the GBD study covers 204 countries and territories and includes a vast number of parameters, i.e. 369 diseases and injuries, 3,473 sequelae of these diseases and injuries, and 87 risks or combinations of risks using 281,586 data sources. [6][7][8]

Using the results of Global Burden of Disease 2019, this study aims to assess the health trends in Belgium between 1990 and 2019, to compare the Belgian health status to that of the EU-15 countries, and to identify the main drivers in trends over time and country differences within the EU-15.

Methods

We extracted estimates from the GBD 2019 study via the GBD results tools [9] and visualization tools [10]. We focused on life expectancy (LE), mortality rates (MR), years of life lost (YLLs), years lived with disability (YLDs) and disability-adjusted life years (DALYs) in Belgium between 1990 and 2019 for level 3 causes and risk factors [6].

The GBD generates data on the basis of a comparative descriptive approach of health status in the world according to age, sex and geographical locations on different health metrics. The latest published version is the GBD 2019 that looks at 369 diseases and injuries and 84 risks factors in 204 countries. GBD 2019 follows the Guidelines for Accurate and Transparent Health Estimates Reporting as well as the GATHER guidelines [11].

YLL measures premature death caused by a specific disease or injury. It is the product of the deaths' number multiplied by life expectancy when death occurred [6]. YLDs were calculated by multiplying the

prevalence of diseases or injuries by their related disability weight [6]. Disability weights represent the severity of health loss associated with an exposure to a disease or injury. They are numbers between 0 and 1, 0 being associated with no disability and 1 corresponds to death[6]. DALYs are the sum of YLLs and YLDs, accounting for the years of healthy life lost due to premature death and disability. DALYs were analysed according to geographic locations, gender, age groups and socio-demographic index (SDI) [6] [12]. We extracted age-standardized rates (per 100,000), based on GBD's global population standard, for comparing estimates between genders, time periods and countries. To assess the significance of differences in rates, we assessed whether or not the 95% uncertainty intervals (UIs) overlapped: non-overlapping UIs were considered indicative of significant differences, whereas overlapping UIs were considered inconclusive. Age-standardization is a statistical method whereby rates are adjusted according to the population weight of each age group. GBD provides a set of standard population weight to be used for age-standardization [6][7]. This statistical technique is particularly relevant in countries with aging population such as Belgium.

Benchmarking

We compared the Belgian health status with 14 European Union comparator countries: Austria, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, United Kingdom and Sweden. The selected countries have similar economic, demographic and social conditions as Belgium, and are jointly referred to as the EU-15 countries. We compared Belgium to the average of the EU-15 countries in terms of LE, mortality, YLL, YLD, and DALY rates. Furthermore, we decomposed the differences in mortality, YLL, YLD, and DALY rates between Belgium and each of the other EU-15 countries, allowing to identify the main causes of mortality and disability for which Belgium performs inferior or superior, across the set of comparator countries.

Decomposition of time trends and country differences

In addition to reporting the GBD estimates for Belgium, we decomposed the time trends and country differences into the unique contributions of the different underlying causes of death and disability. For any given country, year and sex, the overall (age-standardized) mortality, YLD, YLL, or DALY rate is the sum of the cause-specific rates. Mathematically, it then follows that a difference in overall rates (e.g., between two time periods or between two countries), corresponds to the sum of differences in cause-specific rates. This decomposition allows us to pinpoint the main drivers of time trends or differences among country.

Results

Life expectancy

In 2019, LE in Belgium was 79 years [95% UI 78.7-79.2] for men and 84 years [95% UI 83.6-84] for women. Between 1990 and 2019, LE at birth increased significantly for both men (+6.2 years) and women (+4.3 years). In 2019, life expectancy in Belgium was slightly below the EU-15 average for both men (-0.7) and

women (-0.5) (EU-15 LE in men: 79.7 years [95% UI 79.4-80]; EU-15 LE in women 84.3 years [95% UI 84-84.5] - these differences were significant. Across the EU-15 countries, LE in Belgian men and women ranked 12th and 10th, respectively (Figure 1). This is worse compared to the LE among men and women in 1990, where Belgium ranked 8th for LE in men and women.

Mortality rates

In men, age-standardized MR for the top five causes of death observed in 2019 were ischemic heart disease (74 deaths [95% UI: 68-79] per 100,000), tracheal, bronchus, and lung cancer (henceforth referred to as “lung cancer”) (55 deaths [95% UI: 51-58] per 100,000), chronic obstructive pulmonary disease (COPD) (37 deaths [95% UI: 32-42] per 100,000), stroke (35 deaths [95% UI: 31-39] per 100,000), and lower respiratory infections (27 deaths [95% UI: 24-30] per 100,000). The top five causes of mortality identified in women were ischemic heart disease (40 deaths [95% UI: 34-44] per 100,000), stroke (30 deaths [95% UI: 26-34] per 100,000), breast cancer (23 deaths [95% UI: 21-25] per 100,000), Alzheimer’s disease and other dementias (henceforth referred to as “dementia”) (22 deaths [95% UI: 6-56] per 100,000), and lung cancer (19 deaths [95% UI: 18-21] per 100,000).

Evolution 1990-2019

Age-standardised mortality rates for men significantly dropped from 924 [95% UI: 916-931] per 100,000 in 1990 to 559 [95%UI: 546-572] per 100,000 in 2019 (-365 deaths per 100,000; -40%). The main contributors to this significant decrease were ischemic heart disease (-121 deaths per 100,000), lung cancer (-49 deaths per 100,000), stroke (-49 deaths per 100,000), COPD (-27 deaths per 100,000), and road injuries (-19 deaths per 100,000) (Figure 2).

Age-standardized mortality rates for women also decreased significantly, from 541 [95% UI: 536-546] per 100,000 in 1990 to 362 [95%UI: 354-371] per 100,000 in 2019 (-179 deaths per 100,000; -33%). The main contributors to this significant decrease were ischemic heart disease (-68 deaths per 100,000), stroke (-40 deaths per 100,000), breast cancer (-13 deaths per 100,000), colorectal cancer (-9 deaths per 100,000), and diabetes mellitus (-7 deaths per 100,000). Deaths caused by lung cancer however significantly increased from 13 deaths [95% UI: 12-14] per 100,000 to 20 deaths [95% UI: 18-21] per 100,000 (+7 deaths per 100,000) (Figure 3).

Benchmarking

In 2019, the age-standardized mortality rate was higher than the EU-15 average for both Belgian men (BE: 559 deaths [95% UI: 546-572] – EU-15: 526 deaths [95% UI: 513-541]), and women (BE: 362 deaths [95% UI: 354-371] – EU-15: 348 deaths [95% UI: 340-357]). Across the EU-15 countries, Belgium ranked 12th and 10th in terms of age-standardized mortality rates for men and women, respectively. This is a worsening compared to 1990, when Belgium ranked 9th and 6th, respectively.

In Belgium, men performed significantly worse compared to the EU-15 average in terms of lung cancer (+13 deaths per 100,000), lower respiratory infections (+9 deaths per 100,000), COPD (+8 deaths per

100,000), self-harm (+8 deaths per 100,000), and falls (+3 deaths per 100,000). Men however performed significantly better in terms of ischemic heart disease (-12 deaths per 100,000) and hypertensive heart disease (-4 deaths per 100,000). Belgian women performed significantly worse in terms of lower respiratory infections (+5 deaths per 100,000), self-harm (+4 deaths per 100,000) and breast cancer (+3 deaths per 100,000) but significantly better in terms of ischemic heart disease (-8 deaths per 100,000) and hypertensive heart disease (-4 deaths per 100,000).

Compared to each individual EU-15 country, Belgian men performed worse than men in 8 other countries in terms of lung cancer, and better than in 7 countries in terms of ischemic heart disease. Belgian women performed worst in terms of lower respiratory infections (6 countries), and best in terms of ischemic heart disease (5 countries).

Years of life lost

In men, in 2019, age-standardized YLL rates were primarily due to ischemic heart disease (1221 YLLs [95% UI: 1151-1285] per 100,000), lung cancer (1141 YLLs [95% UI: 1071-1208] per 100,000), self-harm (951 YLLs [95% UI: 895-1014] per 100,000), COPD (543 YLLs [95% UI: 479-623] per 100,000), and stroke (519 YLLs [95% UI: 471-564] per 100,000). The major causes of age-standardized YLLs in women were breast cancer (557 YLLs [95% UI: 520-599] per 100,000), ischemic heart disease (529 YLLs [95% UI: 472-573] per 100,000), lung cancer (471 YLLs [95% UI: 435-510] per 100,000), stroke (416 YLLs [95% UI: 367-457] per 100,000) and self-harm (336 YLLs [95% UI: 313-360] per 100,000).

Evolution 1990-2019

Age-standardized YLL rates for men significantly decreased from 20,493 [95% UI: 20,296-20,692] per 100,000 in 1990, to 11,526 [95%UI: 11,161-11,930] per 100,000 in 2019 (-8967 YLLs per 100,000; -44%) (Figure 4). The main contributors to the significant YLL decrease in men were ischemic heart disease (-2283 YLLs per 100,000), lung cancer (-1112 YLLs per 100,000), road injuries (-1054 YLLs per 100,000), stroke (-793 YLLs per 100,000), and COPD (-442 YLLs per 100,000). YLLs however increased between 1990 and 2019 for drug use disorders (+84 YLLs per 100,000), alcohol use disorders (+46 YLLs per 100,000), and liver cancer (+36 YLLs per 100,000) (Figure 5). Drug use disorders are related to the use of opioids, amphetamines, cocaine, cannabis and others [13].

Age-standardized YLL rates for women also decreased significantly, from 11,396 [95% UI: 11,271-11,524] per 100,000 in 1990, to 6,962 [95%UI: 6740-7208] per 100,000 in 2019 (-4434 deaths per 100,000; -40%) (Figure 4). The main causes of the significant decrease in YLLs in women were ischemic heart disease (-1036 YLLs per 100,000), stroke (-627 YLLs per 100,000), breast cancer (-397 YLLs per 100,000), road injuries (-371 YLLs per 100,000) and neonatal disorders (-303 YLLs per 100,000). YLLs caused by lung cancer, however, significantly increased from 317 YLLs [95% UI: 301-333] per 100,000 to 471 YLLs [95% UI: 435-510] per 100,000 (+154 per 100,000; +54%) (Figure 6).

Benchmarking

In 2019, the age-standardized YLL rate in Belgium was higher than the EU-15 average for both men (BE: 11,526 YLLs [95%UI: 11,161-11,930] – EU-15: 10,737 YLLs [95% UI: 10368-11153]), and women (BE: 6,962 YLLs [95%UI: 6,740-7,208] – EU-15: 6,497 YLLs [95% UI: 6274-6750]). Across the EU-15 countries, Belgium ranked 12th and 10th in terms of age-standardized YLL rates for men and women, respectively. This is a worsening compared to 1990, where Belgium ranked 8th for both men and women.

Belgian men performed significantly worse compared to the EU-15 average in terms of self-harm (+358 YLLs per 100,000), lung cancer (+259 YLLs per 100,000), COPD (+148 YLLs per 100,000), road injuries (+113 YLLs per 100,000), and lower respiratory infections (+107 YLLs per 100,000). Men however performed significantly better in terms of ischemic heart disease (-196 YLLs per 100,000) and drug use disorders (-56 YLLs per 100,000). Belgian women performed significantly worse in terms of self-harm (+150 YLLs per 100,000), and breast cancer (+76 YLLs per 100,000) but significantly better in terms of ischemic heart disease (-63 YLLs per 100,000) and hypertensive heart disease (-40 YLLs per 100,000).

Compared to the individual EU-15 countries, in terms of self-harm, Belgian men and women performed worse than 9 and 8 countries respectively, and better than 6 countries in terms of ischemic heart disease for both men and women.

Years lived with disability (YLD)

In 2019, the main causes of age-standardized YLD rates in men were low back pain (898 YLDs [95% UI: 624-1,215] per 100,000), falls (596 YLDs [95% UI: 408-855] per 100,000), headache disorders (576 YLDs [95% UI: 87-1,309] per 100,000), depressive disorders (478 YLDs [95% UI: 329-660] per 100,000), and diabetes mellitus (424 YLDs [95% UI: 277-606] per 100,000). The main causes of age-standardized YLD rates in women were headache disorders (1,206 YLDs [95% UI: 184-2,802] per 100,000), low back pain (1,184 YLDs [95% UI: 833-1,595] per 100,000), gynaecological disorders (1,129 YLDs [95% UI: 764-1,568] per 100,000), depressive disorders (762 YLDs [95% UI: 517-1,069] per 100,000), and falls (616 YLDs [95% UI: 427-862] per 100,000).

Evolution 1990-2019

Age-standardized YLD rates for men increased, albeit not significantly, from 9,726 [95% UI: 7192-12,669] per 100,000 in 1990, to 9901 [95%UI: 7,332- 12,889] per 100,000 in 2019 (+175 YLDs per 100,000; +1.8%) (Figure 4). The main contributors to the increase in YLDs between 1990 and 2019 in men were diabetes mellitus (+169 YLDs per 100,000), falls (+114 YLDs per 100,000), drug use disorders (+55 YLDs per 100,000), depressive disorders (+43 YLDs per 100,000), and other musculoskeletal disorders (+40 YLDs per 100,000). In the same period, YLDs caused by asthma and road injuries have decreased (-106 YLDs per 100,000 and -71 YLDs per 100,000, respectively) (Figure 7).

As for men, there was a non-significant increase in age-standardized YLD rates for women, from 11,808 [95% UI: 8623-15,448] per 100,000 in 1990, to 12,178 [95%UI: 8886-15,797] per 100,000 in 2017 (+371 YLDs per 100,000; +3.1%) (Figure 4). The main contributors to the increase in YLDs in women were falls (+158 YLDs per 100,000), diabetes mellitus (+133 YLDs per 100,000), headache disorders (+116 YLDs per

100,000), depressive disorders (+58 YLDs per 100,000), and COPD (+52 YLDs per 100,000). In the same period, YLDs caused by asthma (-97 YLDs per 100,000) and road injuries (-40 YLDs per 100,000) decreased (Figure 8).

Benchmarking

In 2019, the age-standardized YLD rate in Belgium was higher, albeit not significantly, than the EU-15 average for both men (BE: 9,900 YLDs [95%UI: 7,332- 12,889] – EU-15: 9,571 YLDs [95% UI: 7082-12403]), and women (BE: 12,178 YLDs [95%UI: 8,886-15,797] – EU-15: 12,023 YLDs [95% UI: 8,821-15,684]). Across the EU-15 countries, Belgium ranked 14th and 12th in terms of age-standardized YLD rates for men and women, respectively. This is a worsening compared to 1990, where Belgium ranked 9th and 5th for men and women, respectively.

Belgian men performed worse compared to the EU-15 average in terms of endocrine, metabolic, blood, and immune disorders (+119 YLDs per 100,000), falls (+110 YLDs per 100,000), headache disorders (+83 YLDs per 100,000), osteoarthritis (+52 YLDs per 100,000) and, COPD (+49 YLDs per 100,000). Men performed better, albeit not significantly, in terms of asthma (-51 YLDs per 100,000) and neck pain (-50 YLDs per 100,000). Belgian women performed worse in terms of headache disorders (+225 YLDs per 100,000), falls (+174 YLDs per 100,000), gynaecological diseases (+138 YLDs per 100,000), oral disorders (+50 YLDs per 100,000), and COPD (+37 YLDs per 100,000). Women performed better, albeit not significantly, in terms of anxiety disorders (-122 YLDs per 100,000) and depressive disorders (-105 YLDs per 100,000).

Compared to the individual EU-15 countries, Belgian men performed worst in terms of falls (6 countries), and best in terms of low back pain (3 countries). Belgian women performed worst in terms of headache disorders (8 countries), and best in terms of anxiety disorders (7 countries).

Disability-adjusted life years (DALY)

In 2019, the main causes of age-standardized DALY rates in men were ischemic heart disease (1,291 DALYs [95% UI: 1,221-1,362] per 100,000), lung cancer (1,156 DALYs [95% UI: 1084-1,223] per 100,000), self-harm (968 DALYs [95% UI: 913-1,034] per 100,000), low back pain (898 DALYs [95% UI: 624-1,215] per 100,000), and falls (840 DALYs [95% UI: 648-1094] per 100,000) (Table 1). The main causes of age-standardized DALY rates in women were headache disorders (1,206 DALYs [95% UI: 184-2,801] per 100,000), low back pain (1,184 DALYs [95% UI: 833-1595] per 100,000), gynaecological disorders (1129 DALYs [95% UI: 765-1,569] per 100,000), depressive disorders (762 DALYs [95% UI: 517-1,069] per 100,000), and falls (751 DALYs [95% UI: 558-998] per 100,000) (Table 2).

Table 1 Age-standardized Disability-Adjusted Life Years per 100,000 by cause, men, 1990 and 2019, Belgium

Causes	Belgium, 1990				Belgium, 2019				Absolute DALYs changes
	DALY rank	DALY ^a rate	LB 95% UI	UB 95% UI	DALY rank	DALY ^a rate	LB 95% UI	UB 95% UI	
Ischemic heart disease	1	3599	3470	3715	1	1291	1222	1362	-2307
Tracheal, bronchus, and lung cancer	2	2277	2197	2356	2	1156	1084	1223	-1121
Self-harm	6	1133	1094	1171	3	968	913	1034	-165
Low back pain	7	935	653	1280	4	898	624	1215	-37
Falls	9	733	579	942	5	840	648	1094	107
Chronic obstructive pulmonary disease	5	1240	1148	1321	6	798	714	890	-442
Stroke	4	1439	1362	1512	7	608	553	660	-832
Road injuries	3	1731	1661	1805	8	606	558	653	-1125
Headache disorders	13	551	86	1239	9	576	87	1309	25
Diabetes mellitus	17	441	352	550	10	556	409	743	115

^aage-standardized DALY per 100,000

Table 2 Age-standardized Disability-Adjusted Life Years per 100,000 by cause, women, 1990 and 2019, Belgium

Causes	Belgium, 1990				Belgium, 2019				Absolute DALYs changes
	DALY rank	DALY ^a rate	LB 95% UI	UB 95% UI	DALY rank	DALY ^a rate	LB 95% UI	UB 95% UI	
Headache disorders	5	1090	186	2511	1	1206	184	2802	116
Low back pain	2	1209	849	1633	2	1184	833	1595	-25
Gynecological diseases	4	1129	764	1569	3	1129	765	1569	0
Depressive disorders	7	704	494	953	4	762	517	1069	58
Falls	10	601	457	790	5	751	558	998	150
Breast cancer	6	1029	985	1073	6	630	580	693	-400
Anxiety disorders	11	570	382	810	7	572	374	815	2
Ischemic heart disease	1	1619	1510	1691	8	571	511	618	-1049
Stroke	3	1196	1109	1263	9	534	481	589	-662
Chronic obstructive pulmonary disease	17	412	360	466	10	487	406	552	75

^aage-standardized DALY per 100,000

Evolution 1990-2019

Age-standardized DALY rates for men significantly decreased from 30,219 DALYs [95% UI: 27,638-33,092] per 100,000 in 1990, to 21,427 DALYs [95% UI: 18,812-24,409] per 100,000 in 2019 (-8792 DALYs per

100,000). The main contributors to the significant DALY decrease in men were ischemic heart disease (-2,307 DALYs per 100,000), road injuries (-1,125 DALYs per 100,000), lung cancer (-1,121 DALYs per 100,000), stroke (-832 DALYs per 100,000) and COPD (-442 DALYs per 100,000). On the other hand, DALYs associated with drug use disorders (+139 DALYs per 100,000), diabetes mellitus (+115 DALYs per 100,000), falls (+107 DALYs per 100,000), alcohol use disorders (+48 DALYs per 100,000), and endocrine, metabolic, blood, and immune disorders (+48 DALYs per 100,000) increased between 1990 and 2019 however this increase was not significant (Figure 9).

Age-standardized DALY rates for women also decreased, albeit not significantly, from 23203 [95% UI: 20,051-26,847] per 100,000 in 1990, to 19,140 [95%UI: 15,835-22,728] per 100,000 in 2019 (-4063 DALYs per 100,000; -18%). The main causes of the decrease in DALYs in women were ischemic heart disease (-1,049 DALYs per 100,000), stroke (-662 DALYs per 100,000), road injuries (-410 DALYs per 100,000), breast cancer (-400 DALYs per 100,000), and neonatal disorders (-288 DALYs per 100,000). DALYs associated with lung cancer (+157 DALYs per 100,000), falls (+150 DALYs per 100,000), headache disorders (+116 DALYs per 100,000), COPD (+75 DALYs per 100,000), and drug use disorders (+65 DALYs per 100,000), increased between 1990 and 2019 (Figure 10)

Benchmarking

In 2019, the age-standardized DALY rate in Belgium was higher, albeit not significantly, than the EU-15 average for both men (BE: 21,427 DALYs [95% UI: 18,812-24,409] – EU-15: 20,307 DALYs per 100,000 [95% UI: 17,778-23,174]), and women (BE:19,140 DALYs [95%UI: 15,835-22,728] – EU-15: 18,521 DALYs per 100,000[95% UI: 15,328-22,184]). Across the EU-15 countries, Belgium ranked 12th in terms of age-standardized DALY rates for both men and women, respectively. This is a worsening compared to 1990, where Belgium ranked 7th and 8th for men and women, respectively.

In 2019, Belgian men performed significantly worse compared to the EU-15 average in terms of self-harm (+365), lung cancer (+262), COPD (+198). Men however performed significantly better in terms of ischemic heart disease (-190 DALYs per 100,000). Belgian women performed worse in terms of falls (+229 DALYs per 100,000), headache disorders (+225 DALYs per 100,000), self-harm (+159 DALYs per 100,000), gynaecological diseases (+138 DALYs per 100,000), and breast cancer (+83 DALYs per 100,000). Women performed better in terms of anxiety and depressive disorders (-122 and -105 DALYs per 100,000, respectively).

Compared to the individual EU-15 countries, Belgian men performed worse than 9 countries in terms of self-harm, and better than 6 countries in terms of ischemic heart disease. Belgian women performed worse than 6 countries in terms of falls, and better than 6 countries in terms of anxiety disorders.

Discussion

The health status of Belgian population generally improved between 1990 and 2019. Despite this positive outcome, results show that Belgium did not perform better than other EU-15 countries and overall

improvement slowed down over the years. This study shows the major changes in the health status in Belgium between 1990 and 2019.

First, LE in Belgium improved between 1990 and 2019 for men and women. The gap between LE for men and LE for women decreased between 1990 and 2019. LE in Belgium was in line with the EU-15 average. This result was supported by the Belgian Health Status 2019, a report based on national administrative data, registries and surveys. The Belgian Health Status data highlights that the gap between male and female life expectancy has been decreasing over time, reaching the 4.4 years gap observed in 2019. It also reports regional differences within Belgium: the highest life expectancy was observed in Flanders, followed by Brussels in the second place and Wallonia last [14].

Second, age-standardised MR in Belgium significantly decreased between 1990 and 2019 for men and women. Despite this improvement, Belgian MR is still above EU-15 average for both men and women. Mortality caused by ischemic heart disease decreased between 1990 and 2019; nevertheless, it still accounts for the main cause of death in men and women. Compared to EU-15 average, Belgium performed significantly better in ischemic heart disease and hypertensive heart disease in both men and women. Nichols and colleagues reported that despite the decrease in coronary heart disease mortality in European countries over the past years, it is still one of the leading causes of death responsible for one in five of all deaths in Europe [15]. In Belgium, therapeutic achievements lead to improved outcomes in cardiovascular diseases yet targets are still suboptimal which can be explained by a healthcare system heavily reliant on acute care and medical interventions [16]. In its 2019 report on the performance of the Belgian health system, the Belgian Health Care Knowledge Centre (“KCE”) has observed that Belgium performed worse than the EU-15 in terms of preventable mortality. The report states that preventable mortality in Belgium is 281.4 deaths per 100,000 in men and 152.4 deaths per 100,000 in women, whereas in the EU-15 it is 263.3 per 100,000 in men and 133.4 per 100,000 in women [1]. According to Hermans and colleagues, for cardiovascular risk factors to be adequately controlled, efforts should focus on lifestyle modifications, patients’ compliance to secondary prevention and clinical adherence to European guidelines [16].

Third, in terms of premature mortality, YLLs in Belgium significantly decreased between 1990 and 2019 for men and women. In 2019, the main causes for premature mortality in men were ischemic heart disease, lung cancer and self-harm. The main causes for premature mortality in women were breast cancer, ischemic heart disease and lung cancer. The KCE highlighted that lung cancer is associated with poor prognosis because patients are diagnosed at a relatively late stage [17]. The cancer registry in Belgium reports that lung cancer accounts for the main cause of mortality in cancer among men. They also report that, compared to other cancers, breast cancer is the main cause of mortality in women followed by lung cancer [18]. Looking at head and neck cancer, breast cancer and colorectal cancer, Rosskamp and colleagues showed an association between cancer survival and socioeconomic status [19]. Screening programs and follow up have been associated with decrease in breast cancer specific mortality [20]. Belgium introduced a national screening program for breast cancer in 2001. Mammographic screening is free of charge every two years and covers women between 50 and 69 years

old [21]. According to the KCE, overall coverage, which includes organized and opportunistic screening, is still suboptimal and covered only 62% of the target population with differences between the 3 regions. Moreover, socio-economic inequalities remain a barrier for participation in screening programs [1].

Premature mortality between 1990 and 2019 worsened for drug use disorders in men and lung cancer in women. Compared to the EU-15, Belgium performed significantly worse for self-harm in both men and women. The report on the performance of the Belgian healthcare system shows discouraging mental health indicators such as waiting times for a first contact with ambulatory mental health service, inappropriate prescription of antidepressants and poor adherence to major depression guidelines: Belgian rates are higher than EU-15 countries (Belgium: 79 Defined Daily Doses [DDD] per 1,000 population/day vs. EU-15: 70 DDD per 1,000 population/day). [1].

Fourth, over the last two decades, age-standardized YLDs and Belgium's ranking among the EU-15 countries have not significantly changed between 1990 and 2019. The main drivers for YLDs were low back pain and headache disorders in both men and women in Belgium in 2019. Age-standardised YLDs did not significantly change between 1990 and 2016 in men and women. According to the national Health interview survey conducted in 2018 in Belgium, low back pain is between the top five chronic conditions most reported among adults with a prevalence of 23.2% and 26.4% in men and women respectively [22].

Fifth, in terms of DALYs, ischemic heart disease, lung cancer, and self-harm contributed the most to the burden of disease in men, while headache disorders, low back pain and gynecological disorders are the top causes for DALYs in women. Streeel and colleagues reported a one-year-point prevalence of migraine of 25.8% with higher prevalence in women [23]. We observed an improvement in DALYS associated with ischemic heart disease and road injuries between 1990 and 2019 in both men and women and a worsening outcome in drug use disorders for both men and women between 1990 and 2019. Our results are supported by the 2020 report of the Federal Public Service of Transports and Mobility. The report outlined that Belgium recorded a 28% decrease in road fatalities per million inhabitants, a result close to the European average [24].

Between 1990 and 2019, overall age-standardized DALY rates in Belgium have decreased by 23%. This drop in DALYs is mainly due to the decreasing trend in YLL rates, whereas YLD rates have remained stable. A further consequence of these diverging trends is that now disability is the main contributing factor to the burden of disease, with overall YLD rates accounting for 55% of overall DALY rates.

This article is subject to the limitations of GBD studies such as limitations associated with the availability of primary data. GBD studies rely on modelling results estimates when primary data is not available [6]. As a matter of fact, the last population census in Belgium was held in 2011 which means that many of the GBD 2019 estimates for Belgium rely on projections from other years or neighbouring countries [25]. Relying on estimations to evaluate country progress might result in false assumptions in health trends and assessment based on projections or estimations. Predicted results cannot sense change in policy or circumstances which makes us question transparency and the ethical side of guiding health agendas

based on estimations rather than real values [26]. Furthermore, uncertainty intervals are generated with thousands of iterations and adjustments. Although comparing these intervals is not a very robust method to conclude on differences, it is still the only way enabling a comparison between estimates. Thus, overlapping intervals do not necessarily mean insignificant results [27].

This study gives us information about health status in Belgium on a countrywide level and compares it to other EU-15 which can help understand health priorities to be addressed on a national level. Nevertheless, many health outcomes revealed to be different between regions and socio-economic classes which may be hindered by country averages. [28] Thus, it would be interesting to assess health performance on a subnational level given the federal organisation, and autonomous competences of the regions in terms of health programs and the socio-economic differences.

Conclusion

Non-communicable diseases are the main source of health burden in Belgium and they are the main contributors since 1990. Increasing LE explains the rise in YLD and their contribution to the burden of disease. Despite the substantial improvement, Belgium's ranking for DALYs decreased between 1990 and 2019 compared to the EU-15. Primary and secondary prevention could be key elements to improve patient health outcomes and reduce their burden on the healthcare system. GBD 2019 estimates are subject to many limitations such as accuracy and external validity. Therefore, national burden of disease remains essential for more accurate health estimates and guiding policy.

Abbreviations

AS: age-standardised; BE: Belgium; COPD: chronic obstructive pulmonary disease; DALY: disability-adjusted life year; DW: disability weight; EU: European Union; GBD: global burden of disease; IHD: ischemic heart disease; KCE: Belgian Health Care Knowledge Centre; LE: life expectancy; MR: mortality rate; SDI: socio-demographic index; UI: uncertainty interval; YLD: year lived with disability; YLL: year of life lost

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

All data were retrieved from the GBD study, via the GBD results tool (<http://ghdx.healthdata.org/gbd-results-tool>). Detailed R code and outputs are available via <https://github.com/brechtdv/GBD-BE>.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Study design: JG; Interpretation of data for the work: JG, BD; Drafting the manuscript: JG; Data analysis: BD; Critically revising the manuscript: VG, RBP, NS, ST, BD; Final approval of the version to be published: JG, VG, RBP, NS, ST, BD; Agreement to be accountable for all aspects of the work: JG, VG, RBP, NS, ST, BD.

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Figures

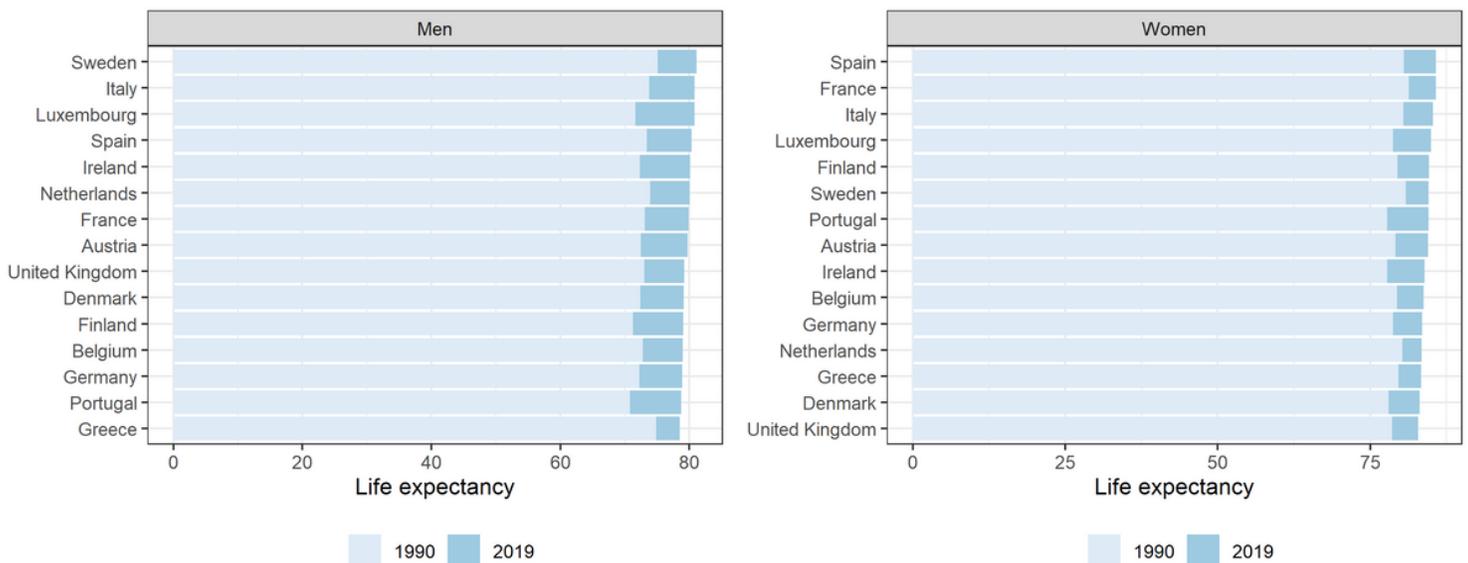


Figure 1

Life expectancy (LE) at birth in the EU-15, in 1990 and 2019, for men and women

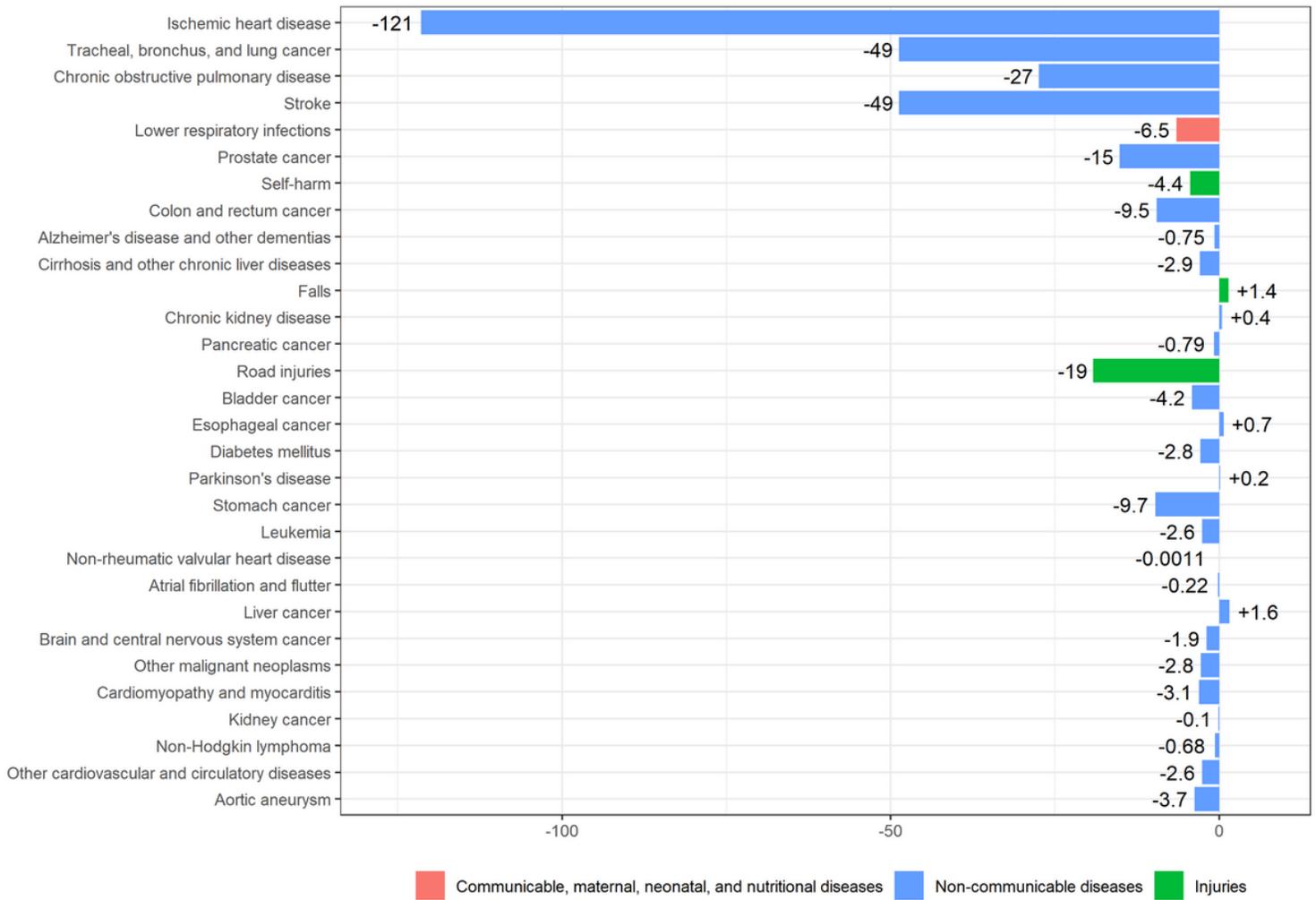


Figure 2

Absolute change in age-standardised deaths per 100,000 in men, 1990-2019, Belgium

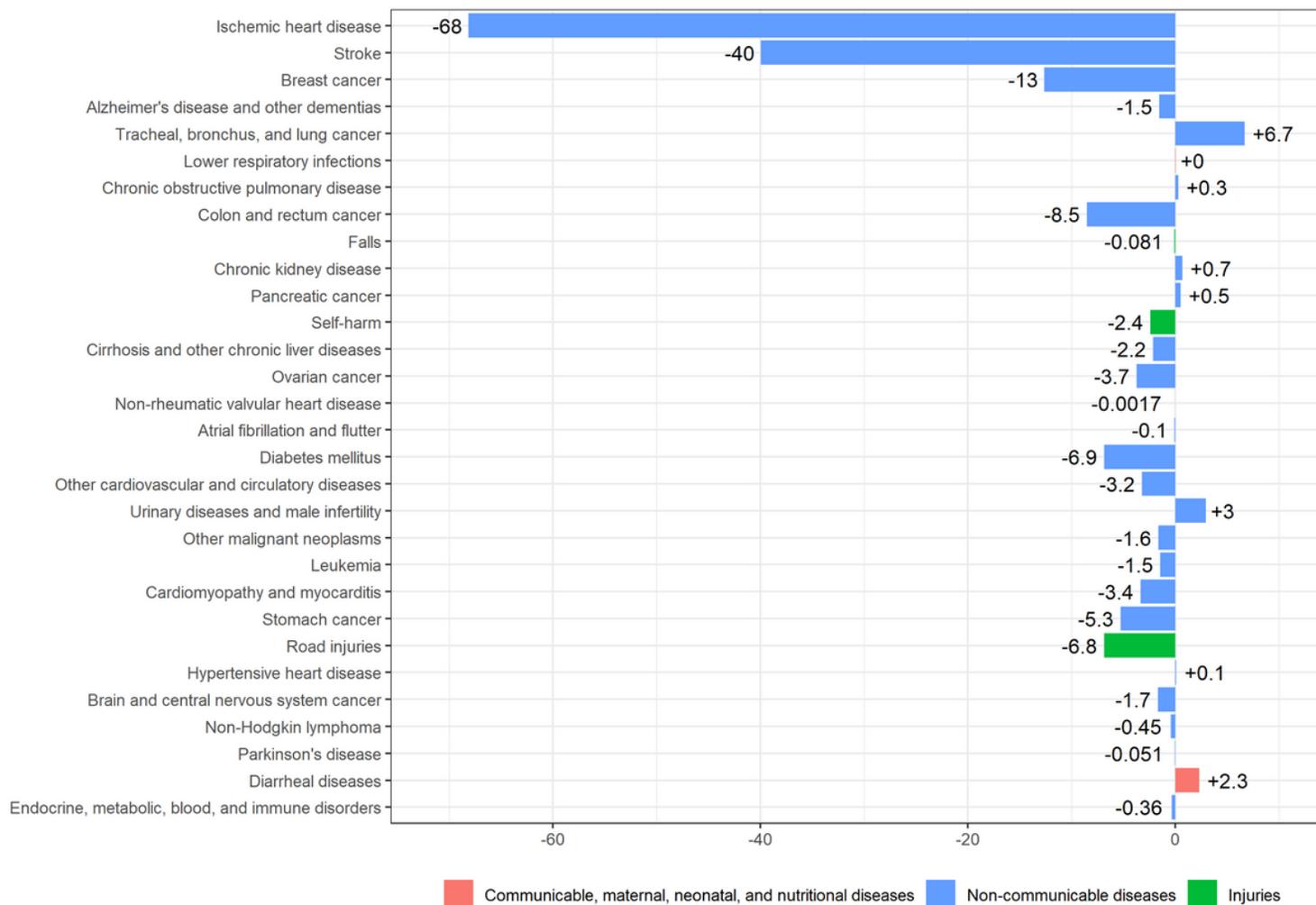


Figure 3

Absolute change in age-standardised deaths per 100,000 in women, 1990-2019, Belgium

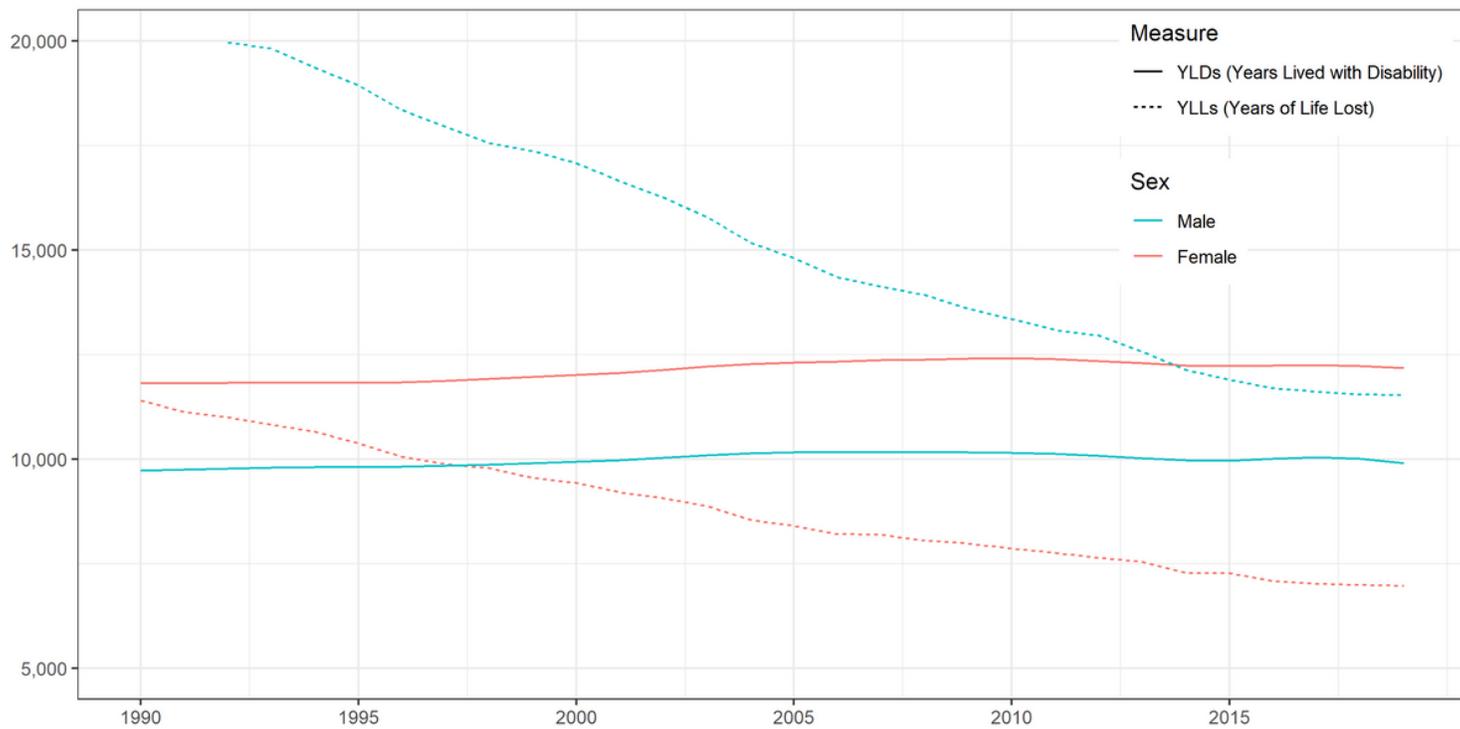


Figure 4

Evolution of age-standardised Years Lived with Disability (YLDs) and Years of Life Lost (YLLs) rates per 100,000 in men and women, Belgium, 1990-2019

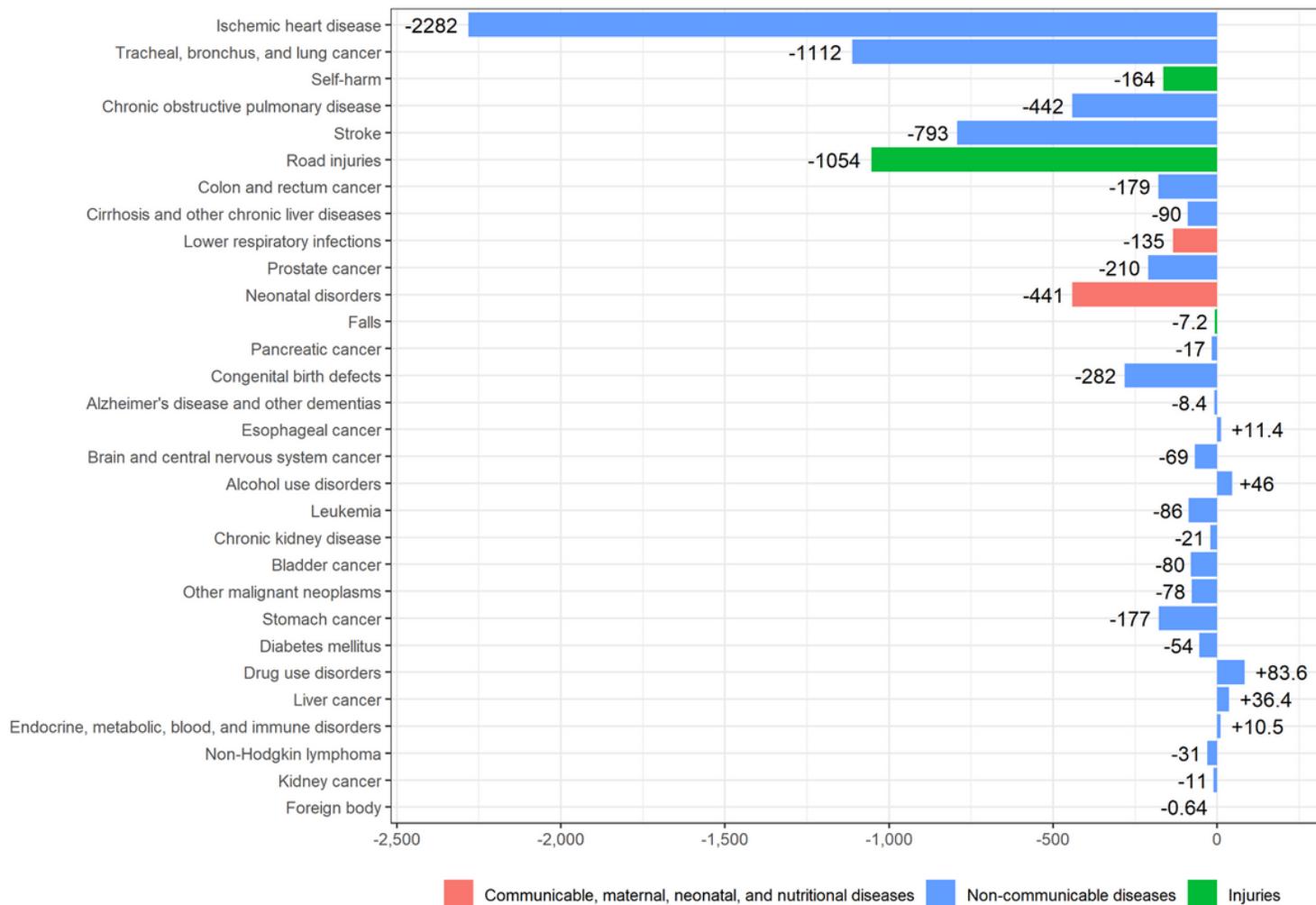


Figure 5

Absolute change in age-standardised Years of Life Lost (YLLs) rates per 100,000 in men, 1990-2019, Belgium

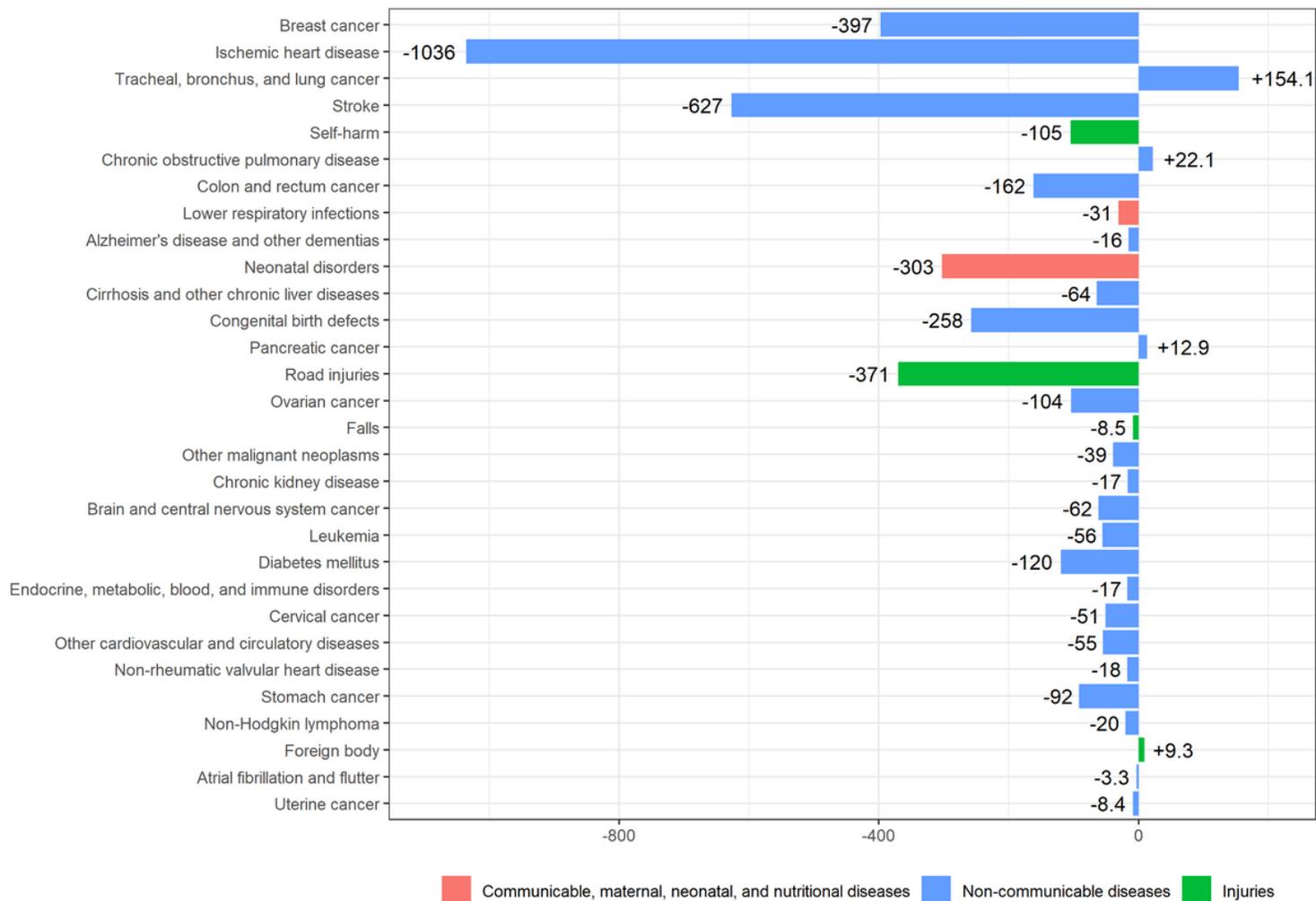


Figure 6

Absolute change in age-standardised Years of Life Lost (YLLs) rates per 100,000 in women, 1990-2019, Belgium

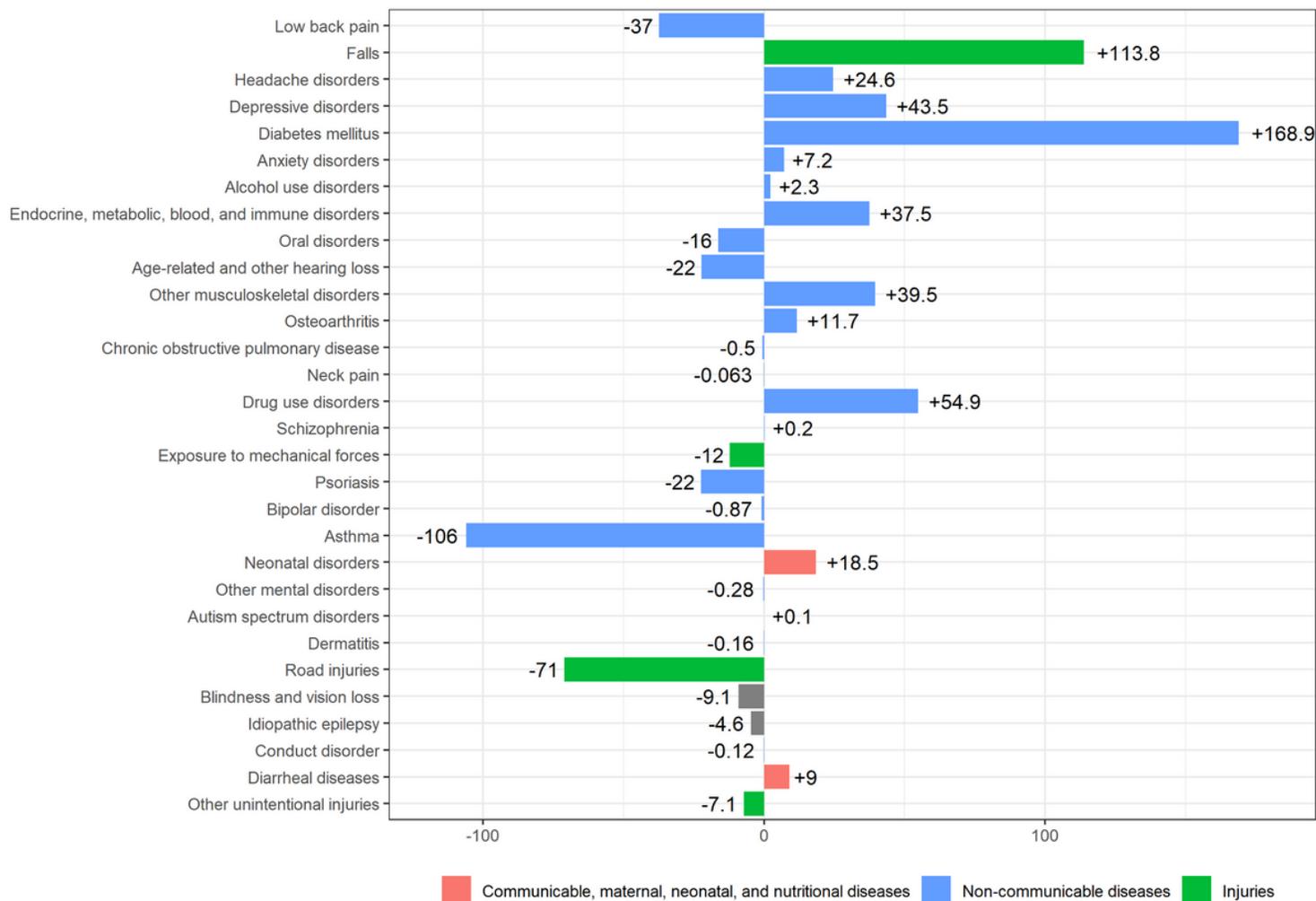


Figure 7

Absolute change in age-standardised Years Lived with Disability (YLDs) rates per 100,000 in men, 1990-2019, Belgium

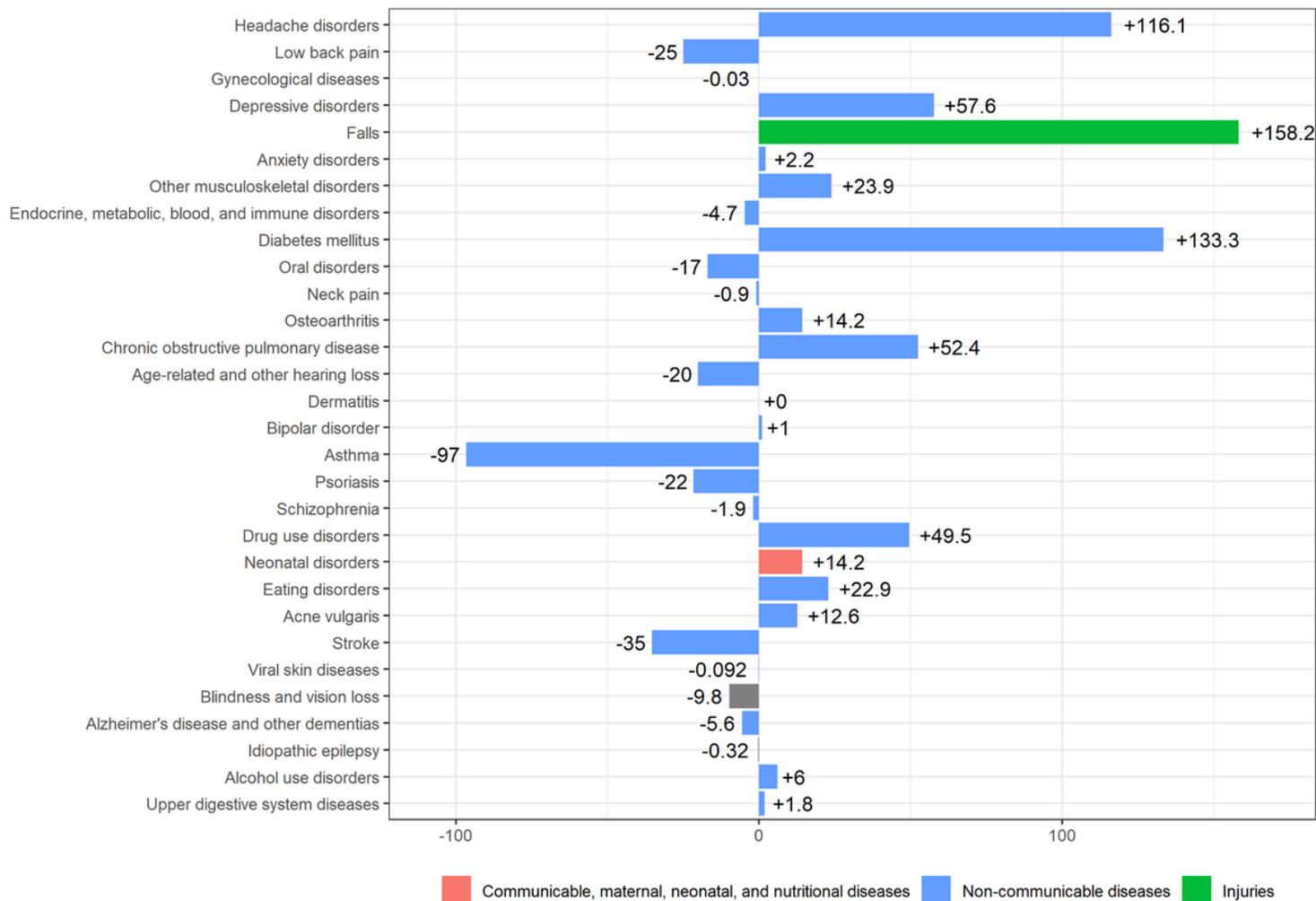


Figure 8

Absolute change in age-standardised Years Lived with Disability (YLDs) rates per 100,000 in women, 1990-2019, Belgium

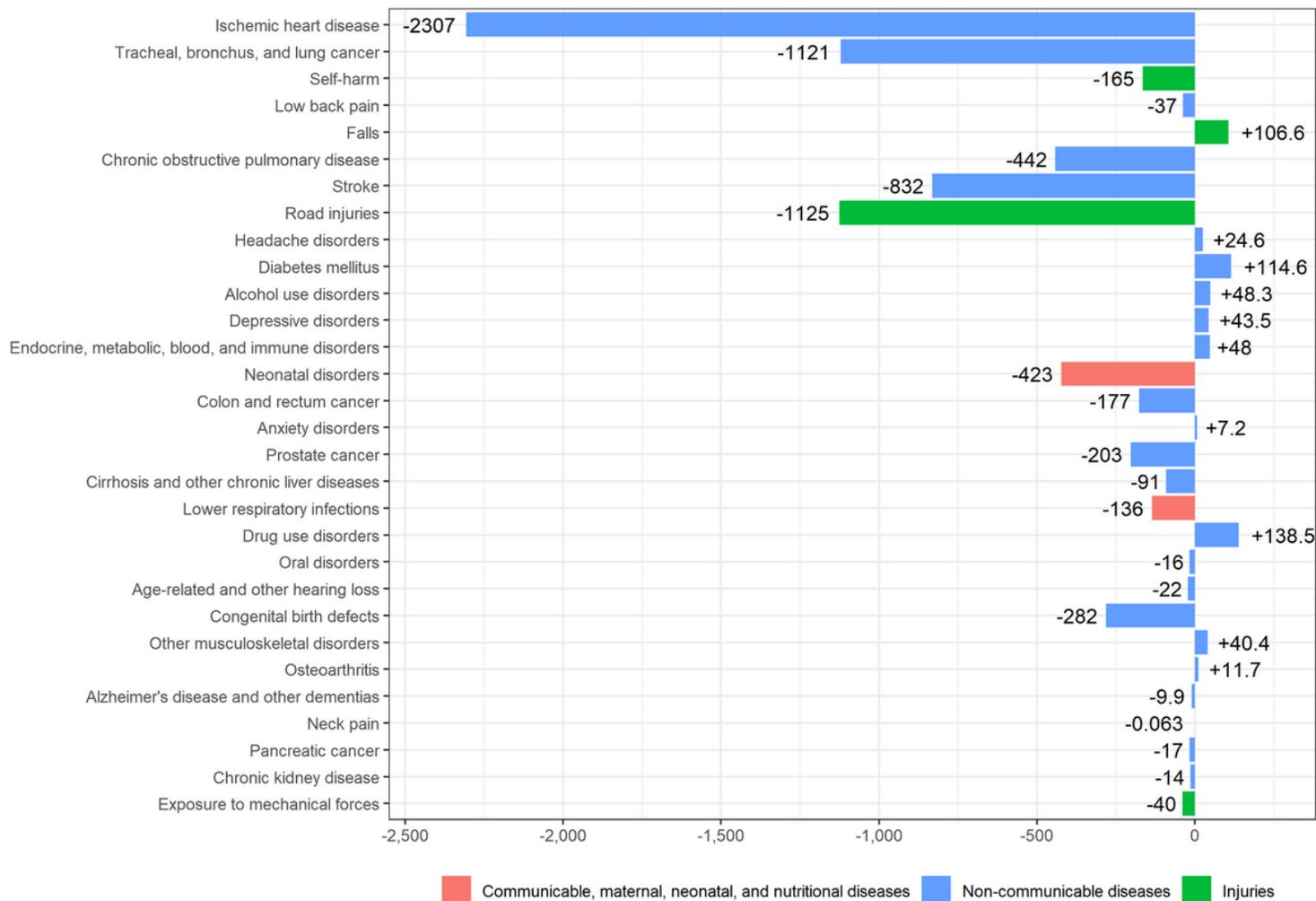


Figure 9

Absolute change in age-standardised Disability-Adjusted Life Year (DALY) rates per 100,000 in men, 1990-2019, Belgium

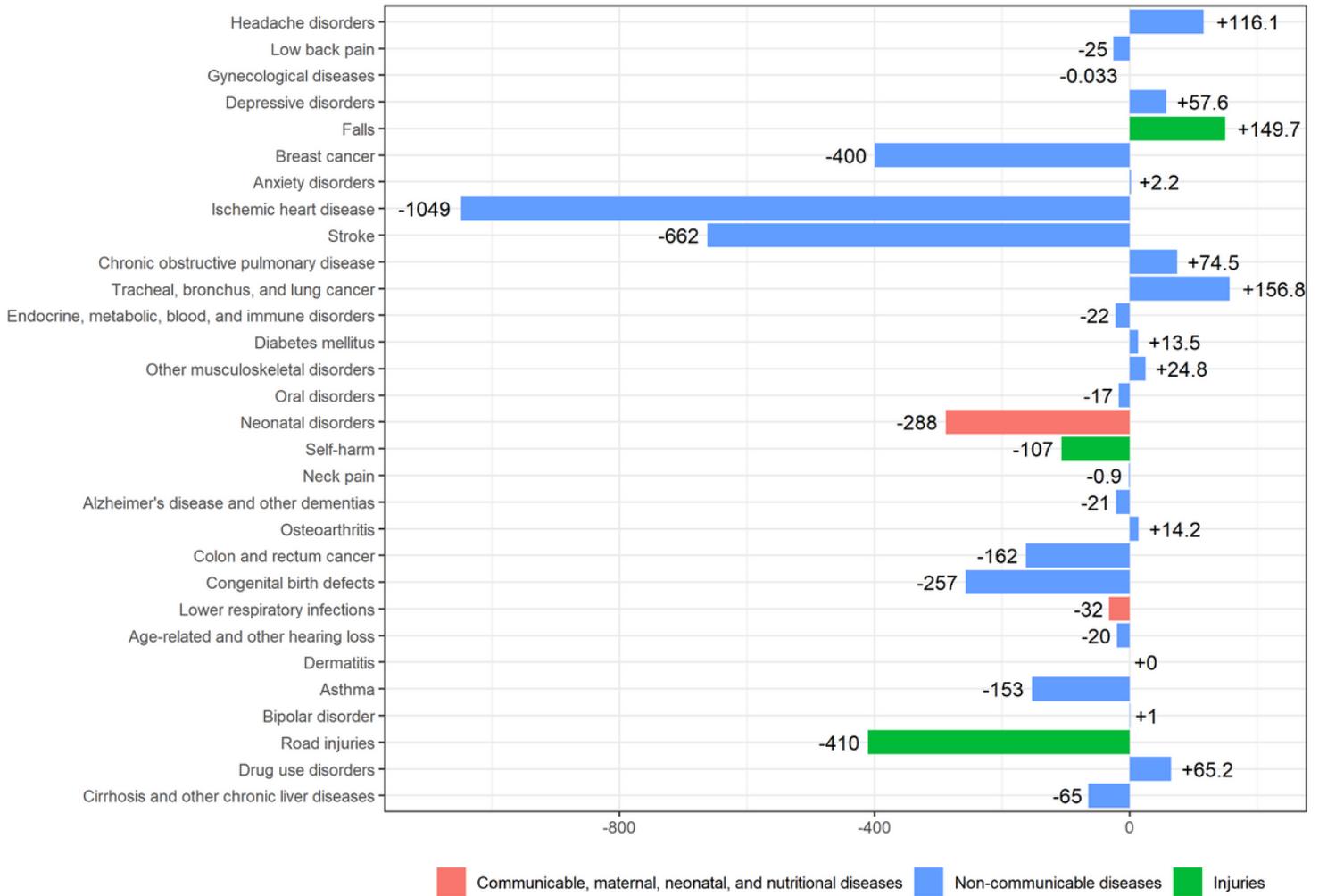


Figure 10

Absolute change in age-standardised Disability-Adjusted Life Year (DALY) rates per 100,000 in women, 1990-2019, Belgium