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BJS 0387 Short report

Trends in the mortality, incidence and disability-adjusted life-years of intestinal obstruction and paralytic ileus: an observational study of the Global Burden of Disease database

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Introduction

Intestinal obstruction and paralytic ileus represent some of the most common surgical emergencies globally accounting for 20% of acute abdominal surgical presentations in the USA(1) and being associated with mortality of up to 10%.(2) The sizeable financial costs to healthcare systems(3) combined with some of the eminently treatable causes (abdominal hernias, malignancy, metabolic disturbance etc) mean these pathologies are of particular interest to policymakers. Several retrospective analyses investigating epidemiological trends have been published, but existing literature focuses on the burden of disease in individual nations(4,5) or middle- and lower-income countries.(6–8) Therefore, the aim of this analysis was to characterise trends in mortality, incidence and DALYs of intestinal obstruction and paralytic ileus.

Methods

Data Source

The Global Burden of Disease (GBD) database is a WHO-commissioned study that pools epidemiological data for 369 pathologies across 204 nations based on the 10th iteration of the International Classification of Disease (ICD-10) coding system.(9) Code K56 corresponds to intestinal obstruction and paralytic ileus. This publicly accessible dataset compiles mortality and disability data from systematic reviews, registries, inpatient and outpatient hospital encounter data and claims data. Bayesian statistical methods are used to generate population estimates and confidence intervals for disease death rates, incidences and DALYs.

Data Handling

Sex-specific age-standardised mortality rates (ASMRs), age-standardised incidence rates (ASIRs) and DALYs per 100,000 population for intestinal obstruction and paralytic ileus were extracted for each EU15+ country from 1990 to 2019 inclusive. European Union (EU) 15+ countries include Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, UK and USA. Absolute and relative changes in ASMR, ASIR and DALYs were calculated using the difference between data values at the start and end of the observation period (ie. between 1990 and 2019). A standardised measure of individual case mortality, the mortality-to-incidence index (MII), was also calculated by dividing the ASMR by the ASIR and multiplying by 1000.

Statistical Analysis

A Joinpoint regression analysis of the data was performed using Joinpoint software (Joinpoint Command Line Version 4.9.1.0).(10) Full methods and Joinpoint analysis are presented in the Supplementary Material.

Results

Significant changes in ASMRs, ASIRs, MIIs and DALYs were observed in all countries (Table S1). ASMRs were variable with decreasing trends observed in approximately half of the EU15+ countries, while ASIRs demonstrated mostly increasing trends. Contrastingly, an overall decrease in MIIs and DALYs was observed in most EU15+ countries. Results are presented as descriptive statistics.

Mortality

Overall, ten countries demonstrated a decrease in ASMR among females and nine countries among males, with an increase in ASMR noted in certain countries among both sexes during the 2000s: Austria, Belgium, Canada, Denmark, Finland, Germany, Luxembourg, Netherlands, Spain, UK, USA (Figure 1). The median percentage change between 1990 and 2019 across EU15+ countries was -8.11% (IQR -18.52% - +8.23%) for females, but +5.50% (IQR -7.20% - +18.11%) for males.

Incidence

Most EU15+ countries demonstrated increasing ASIRs among both females and males between 1990 and 2019 (Figure 2). Over the observation period, the median percentage change across EU15+ countries was +18.71% (IQR +3.57% - +24.42%) for females and +15.30% (IQR +2.17% - +19.87) for males.

Mortality to Incidence Index

The majority of EU15+ countries demonstrated decreasing MIIs over the observation period (Figure S3). Only four countries were noted to have an overall increase in MII among females (Greece, Sweden, UK, USA) and six among males (Belgium, Germany, Greece, Sweden, UK, USA). Over the observation period the median percentage change among females was -18.12% (-31.88% - -4.84%) compared to -5.04% (IQR -21.12% - +7.60%) among males.

DALYs

The majority of EU15+ countries demonstrated an overall decrease in DALYs for both sexes, 15/19 for females and 12/19 for males (Figure S4). The median percentage change throughout the observation period was -11.86% (IQR -22.86% - -2.70%) in females and -5.80% (IQR -17.32% - +8.16%) in males.

Discussion

The explanations underlying the observed trends are likely complex and multifactorial. For one, developments in management strategies may have impacted epidemiological trends. The decreasing ASMRs and DALYs observed during the 2010s may result from laparoscopic and non-operative strategies becoming increasingly commonplace with an associated reduction in length of hospital stay and complication rates. Expert consensus suggests that a trial of non-operative management may be pursued for up to 72 hours in uncomplicated small bowel obstruction (SBO), and the adoption of this approach into the Bologna Guidelines from 2010 onwards coincides with a decrease in ASMRs in several EU15+ countries (Austria, Belgium, Denmark, Finland, Spain).(11) Non-operative management may also partially explain the increasing ASIRs observed (15/19 countries for both females and males). Danish data from 1984-2013 demonstrated lower mortality but a higher incidence rate in females managed non-operatively, accounted for by higher rates of disease recurrence compared to operative management.(4) Additionally, water-soluble contrast administration has been associated with a rate of SBO recurrence of up to 20% within 5 years(12) but a shorter time to resolution and shorter length of stay,(13) which may have contributed to the increasing ASIRs and decreasing DALYs from 2010 onwards. An alternative explanation is the increased use of self-expanding metallic stents (SEMS) in the treatment of large bowel obstruction (LBO) secondary to malignancy throughout the 1990s and 2000s, which has been associated with better prognosis and a reduced risk of early complications compared to surgical intervention.(14)

Of note, diagnostic considerations may shape the trends observed, such as the availability of colorectal cancer screening across the EU15+ nations. Data from a Canadian

cohort study suggest that screening reduces the rate of emergency hospital admissions, perhaps as a result of earlier disease detection.(15) This would be in accordance with the relatively low individual case mortality (MIIs) observed in Canada despite relatively high ASIRs. Alternatively, computed tomography (CT) imaging has seen more widespread use since the 1990s, providing greater diagnostic accuracy than conventional abdominal X-rays. The USA has seen comparatively low individual case mortality, which may be accounted for by widespread use of CT imaging to improve disease detection and operative planning.

Furthermore, changing epidemiological trends in disease risk factors may have impacted ASIRs. The incidence of emergent ventral and inguinal hernia repairs increased between 2001 and 2010 in the USA,(16) potentially implying a greater frequency of strangulation and incarceration leading to SBO. The incidence of hospitalisation from paralytic ileus also increased in the USA between 2001 and 2011,(17) a trend that is mirrored in the GBD dataset. This may be partially accounted for by the rise in prescription opioid use, which quadruped between 1999 and 2010 in the USA.(18)

Sex disparities are difficult to account for without data breakdown by aetiology, but it is possible that higher ASIRs among females result from higher rates of abdominal surgery leading to adhesive obstruction (Caesarean section, cholecystectomy etc).(19) The higher ASMRs and MIIs observed among males may arise from the greater mortality associated with malignancy among male patients such as prostate cancer,(20) more likely necessitating palliative therapy for malignant obstruction. The strengths of this study include the comprehensive and standardised dataset, while limitations include an inability to establish causal inference and a reliance on the quality of input data which does not differentiate by aetiology.

Acknowledgements / Author Contributions

DWP and JS conceptualised the study and were responsible for its design. Statistical analysis was performed by KB. Interpretation of results and drafting of the manuscript was performed by all authors. All authors read and approved the final manuscript.

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Figure Legends

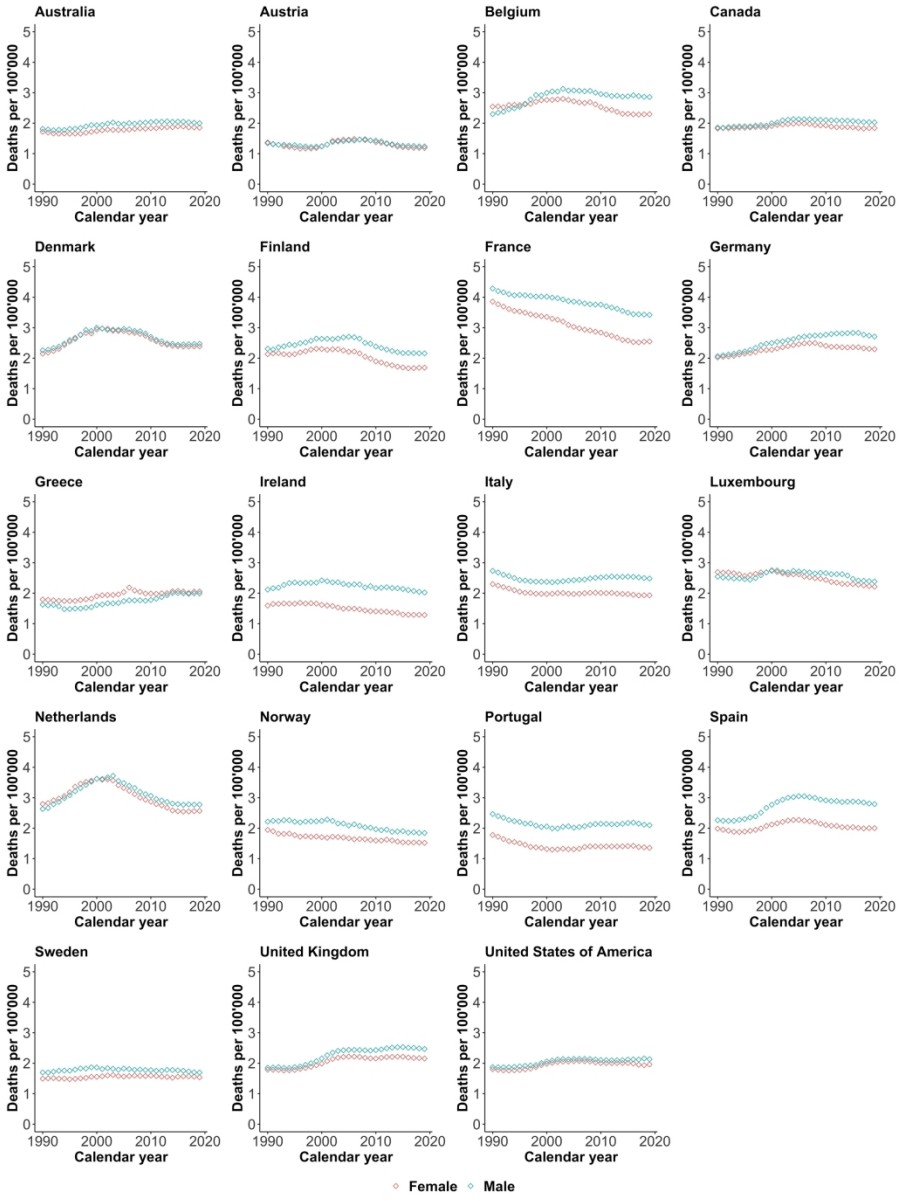
Figure 1: Mortality trends for males and females in EU15+ countries. Symbols represent raw data, age-standardised mortality rates (ASMR) per 100,000. Blue lines represent males and red lines females.

Figure 2: Incidence trends for males and females in EU15+ countries. Symbols represent raw data, age-standardised incidence rates (ASIR) per 100,000. Blue lines represent males and red lines females.

Figure S3: Mortality to incidence index trends for males and females in EU15+ countries. Symbols represent raw data, age-standardised incidence rates (ASIR) per 100,000. Blue lines represent males and red lines females.

Figure S4: Disability adjusted life years (DALYs) trends for males and females in EU15+ countries. Symbols represent raw data, age-standardised incidence rates (ASIR) per 100,000. Blue lines represent males and red lines females.

Table S1: Values for age-standardised mortality rate (ASMR) per 100,000, age-standardised incidence rate (ASIR) per 100,000, mortality-to-incidence index (MII) and disability adjusted life years (DALYs) per 100,000 for intestinal obstruction and paralytic ileus in EU15+ countries in the years 1990 and 2019



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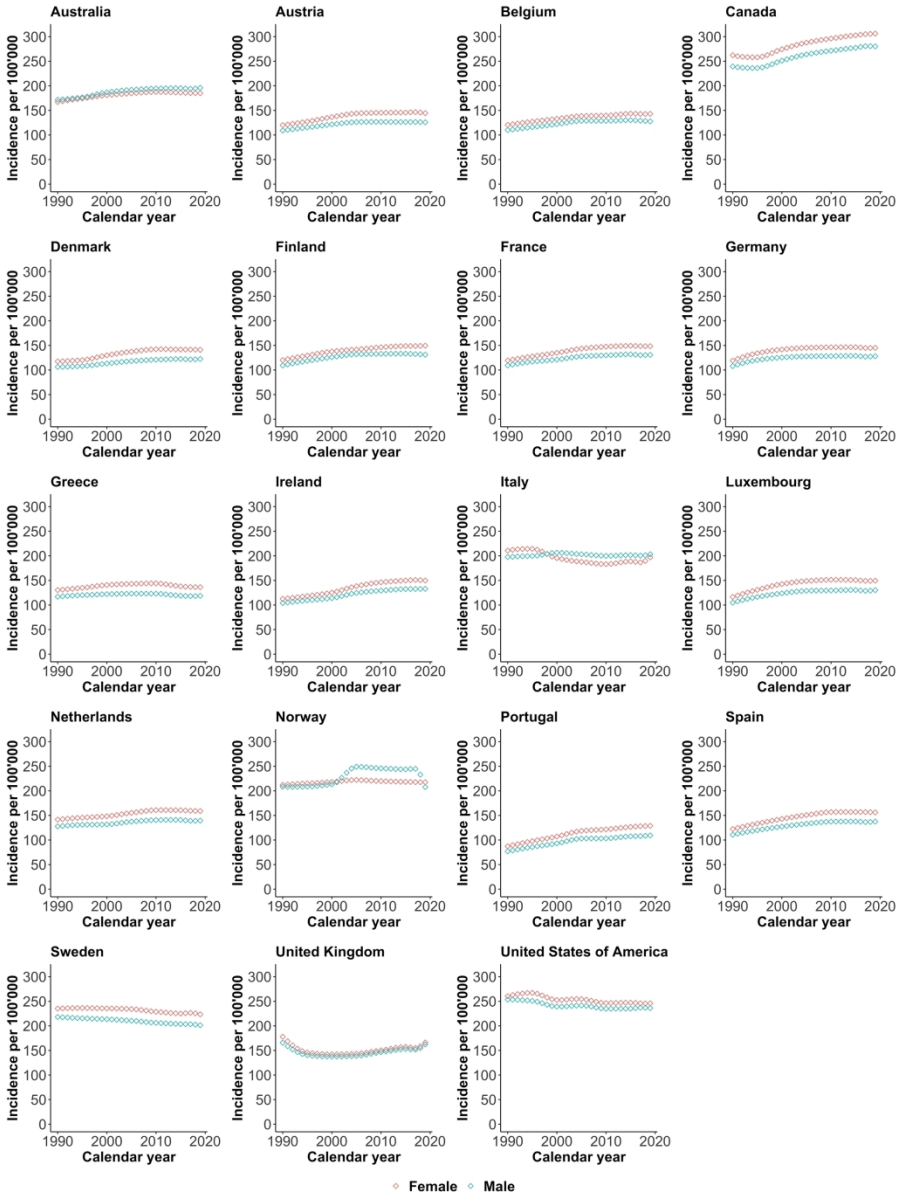

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Supplementary Materials - Index

Supplementary Methods

Methods

Data Source

The GBD study was the primary data source for this analysis. The GBD database is a WHO-commissioned study that pools epidemiological data for 369 diseases and injuries across 204 nations.(16) A publicly accessible source of information, the dataset compiles mortality and disability data (deaths, death rates, years of life lost due to premature mortality, incidence, prevalence) from multiple sources (systematic reviews, disease registries, inpatient and outpatient hospital encounter data and claims data for various risk factors, diseases and procedures). Bayesian statistical methods are used to generate population estimates and confidence intervals for disease death rates, incidences and disability-adjusted life years (DALYs) which are readily accessible via the online GBD Results Tool - http://ghdx.healthdata.org/gbd-results-tool.(17) The 10th iteration of the International Classification of Disease (ICD-10) coding system is used by the GBD study to attribute each death to a single underlying cause with code K56 corresponding to intestinal obstruction and paralytic ileus.

A 5-star scale relating to availability and completeness of mortality data is used to assess reliability. Ten countries in this analysis received a 5-star grade representing greater than or equal to 85% data completeness (Australia, Austria, Canada, Finland, Ireland, Italy, Norway, Sweden, UK, USA) with the remaining nine nations receiving a 4-star grade denoting 65-84% data completeness (Belgium, Denmark, France, Germany, Greece, Luxembourg, Netherlands, Portugal, Spain). Full details of the GBD data sources and statistical methods have been published previously.(18)

Vital registration (VR) and verbal autopsy (VA) data from the cause of death (COD) database were used to compute mortality estimates. VA data in children under the age of 1 were excluded on account of it being impossible to diagnose intestinal obstruction or paralytic ileus in this age group using VA methods. Outliers were identified by systematic examination and data that violated established temporal trends were also excluded. The VR and VA data was modelled against location-level co-variates (socio-demographic index, education years per capita, log lag-distributed income, healthcare access and quality index and scaled exposure variables for low fruit and vegetable consumption) using the GBD Cause of Death Ensemble model (CODEm). Separate modelling was undertaken for female and male mortality data. Unadjusted results were computed through hybridisation of separate global and data-rich models, with adjusted results finalised using CodCorrect.

Hospital discharge and claims data for both inpatient and outpatient encounters were used to generate incidence estimates. Patient encounters with an appropriate ICD-10 code were extracted and adjusted using correction factors from claims data to produce an estimate of the number of individuals from each encounter. Re-admissions within 28 days of the initial code were categorised as the same episode of illness. A DisMod-MR 2.1 model was used to produce final estimates by age, sex, year and location, drawing on previous excess mortality rate data adjusted for the predictive co-variate of healthcare access and quality index.

DALYs for intestinal obstruction and paralytic ileus were calculated as the sum of the years of life lost (YLL) and years lived with disability (YLD). YLL were calculated by multiplying

the life expectancy at the age of death by the estimated number of deaths from intestinal obstruction and paralytic ileus. YLD were calculated by multiplying the estimated prevalence of intestinal obstruction/paralytic ileus (from the DisMod MR 2.1 model) by the disability-weighting for intestinal obstruction/paralytic ileus (from the GBD 2013 European disability weights measurement study(16)) and correcting for comorbidity.

Data Handling

Sex-specific age-standardised mortality rates (ASMRs), age-standardised incidence rates (ASIRs) and DALYs per 100,000 population for intestinal obstruction and paralytic ileus were extract for each EU15+ country in the years from 1990 to 2019 inclusive. The age-standardisation process involves calculating estimates for a standard population based on a non-weighted average of a percentage of the population of all countries in five yearly age brackets in the years 2010-2035 (from the 2012 revision of the United Nations Population Division's World Population Prospects).(19)

Absolute and relative changes in ASMR, ASIR and DALYs for females and males over the observation period were calculated using the difference between data values at the start and end of the observation period (ie. between 1990 and 2019). A standardised measure of individual case mortality, the mortality-to-incidence index (MII), was also calculated by dividing the ASMR by the ASIR and multiplying by 1000 to better characterise the burden of disease in each country.

Statistical Analysis

A Joinpoint regression analysis of the data was performed using Joinpoint software (Joinpoint Command Line Version 4.9.1.0) developed by the United States National

Cancer Institute Surveillance Research Programme.(20) This method of statistical analysis involves fitting the simplest statistical model to a dataset by connecting line segments, also known as Joinpoints, on a logarithmic scale. For each data sequence (for example, ASMR in females in Australia) a Monte Carlo permutation method was used to assess whether the inclusion of additional Joinpoints was statistically significant, with the simplest statistical model being an uninterrupted line (ie. 0 Joinpoints). Operating with a null hypothesis that there is no annual percentage change between GBD data estimates, the analysis calculates the estimated annual percentage change (EAPC) for each Joinpoint with 95% confidence intervals to establish any deviation from the null hypothesis, and it is the calculation of the EAPC that enables assessment of the changing temporal trends at a constant percentage per year. The final model consists of a number of Joinpoints that each represent a statistically significant increasing or decreasing trend during the observation period (p-value <0.05).

Joinpoint Regression Analysis:

Tables of sex-specific Joinpoint regression analyses for age-standardised mortality rate (ASMR) per 100,000, age-standardised incidence rate (ASIR) per 100,000, mortality-to-incidence index (MII) and disability adjusted life years (DALYs) per 100,000 for bowel obstruction and paralytic ileus in EU15+ countries in the years 1990-2019.

Abbreviations

EAPC: Estimated Annual Percentage Change

P: *p*-value

JP: Joinpoint

ASMRs

JP Table 1: ASMR Joinpoint Trend 1 Among Females in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	1990	1996	-0.6	-0.9	-0.3	0.001
Austria	1990	1998	-2.1	-2.6	-1.6	<0.001
Belgium	1990	2002	0.9	0.7	1	<0.001
Canada	1990	1999	0.4	0.2	0.5	<0.001
Denmark	1990	2000	3.5	3.2	3.8	<0.001
Finland	1990	2004	0.6	0.4	0.8	<0.001
France	1990	1993	-2.3	-3.3	-1.2	<0.001
Germany	1990	2007	1.3	1.3	1.4	<0.001
Greece	1990	1996	-0.5	-1.1	0.1	0.093
Ireland	1990	1998	0.4	0.1	0.8	0.014
Italy	1990	1996	-2.2	-2.5	-2	<0.001
Luxembourg	1990	1995	-1	-1.4	-0.5	<0.001
Netherlands	1990	1998	3.2	2.9	3.6	<0.001
Norway	1990	1992	-3.7	-6.9	-0.4	0.03
Portugal	1990	1999	-3.1	-3.4	-2.9	<0.001
Spain	1990	1994	-1.8	-2.4	-1.2	<0.001
Sweden	1990	1996	-0.2	-0.7	0.3	0.406
UK	1990	1994	-0.4	-1.2	0.4	0.287
USA	1990	1995	-0.4	-0.9	0.1	0.118

JP Table 2: ASMR Joinpoint Trend 2 Among Females in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	1996	2001	1.4	0.9	2	<0.001
Austria	1998	2002	5.4	3.1	7.8	<0.001
Belgium	2002	2008	-0.8	-1.3	-0.2	0.008
Canada	1999	2005	1.1	0.8	1.4	<0.001
Denmark	2000	2008	-0.8	-1.3	-0.3	0.004
Finland	2004	2014	-3	-3.4	-2.7	<0.001
France	1993	2000	-1.1	-1.4	-0.7	<0.001
Germany	2007	2011	-1.4	-2.1	-0.7	0.001
Greece	1996	2006	1.9	1.6	2.3	<0.001
Ireland	1998	2004	-1.8	-2.5	-1.1	<0.001
Italy	1996	1999	-0.5	-2.1	1	0.468
Luxembourg	1995	2000	1.2	0.6	1.9	0.001
Netherlands	1998	2002	0.6	-1	2.3	0.447
Norway	1992	2019	-0.7	-0.7	-0.6	<0.001
Portugal	1999	2005	-0.2	-0.9	0.5	0.568
Spain	1994	2004	2.2	2.1	2.4	<0.001
Sweden	1996	2002	1.2	0.6	1.9	0.001
UK	1994	1998	1.6	0.3	2.9	0.02
USA	1995	2001	2.3	1.8	2.8	<0.001

JP Table 3: ASMR Joinpoint Trend 3 Among Females in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	2001	2016	0.5	0.4	0.6	<0.001
Austria	2002	2006	1.6	-0.7	3.9	0.169
Belgium	2008	2014	-2.4	-2.9	-1.8	<0.001
Canada	2005	2012	-1	-1.2	-0.7	<0.001
Denmark	2008	2013	-3	-4.1	-1.8	<0.001
Finland	2014	2019	-0.3	-1.3	0.7	0.551
France	2000	2016	-1.7	-1.8	-1.6	<0.001
Germany	2011	2019	-0.4	-0.6	-0.2	<0.001
Greece	2006	2010	-1.4	-3.1	0.4	0.111
Ireland	2004	2019	-1.2	-1.3	-1	<0.001
Italy	1999	2011	0.1	0	0.2	0.013
Luxembourg	2000	2013	-1.2	-1.4	-1.1	<0.001
Netherlands	2002	2014	-2.8	-3	-2.6	<0.001
Norway						
Portugal	2005	2008	2.6	-0.5	5.9	0.1
Spain	2004	2013	-1.3	-1.5	-1.1	<0.001
Sweden	2002	2019	-0.2	-0.3	-0.1	0.001
UK	1998	2003	3.3	2.4	4.1	<0.001
USA	2001	2005	0.7	-0.4	1.8	0.227

JP Table 4: ASMR Joinpoint Trend 4 Among Females in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	2016	2019	-0.8	-1.6	0.2	0.097
Austria	2006	2019	-2	-2.2	-1.7	<0.001
Belgium	2014	2019	-0.2	-0.7	0.4	0.514
Canada	2012	2019	-0.4	-0.5	-0.2	0.001
Denmark	2013	2019	-0.2	-0.9	0.4	0.444
Finland						
France	2016	2019	0.2	-0.9	1.2	0.749
Germany						
Greece	2010	2019	0.4	0.1	0.8	0.009
Ireland						
Italy	2011	2019	-0.6	-0.7	-0.4	<0.001
Luxembourg	2013	2019	-0.8	-1.2	-0.5	<0.001
Netherlands	2014	2019	-0.1	-0.8	0.6	0.799
Norway						
Portugal	2008	2019	-0.2	-0.4	0	0.066
Spain	2013	2019	-0.4	-0.7	-0.1	0.025
Sweden						
UK	2003	2019	-0.1	-0.2	0	0.146
USA	2005	2019	-0.4	-0.5	-0.3	<0.001

JP Table 5: ASMR Joinpoint Trend 1 Among Males in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	1990	1993	-0.8	-2	0.5	0.197
Austria	1990	1999	-1	-1.4	-0.7	<0.001
Belgium	1990	1995	2	1.3	2.6	<0.001
Canada	1990	1999	0.5	0.4	0.6	<0.001
Denmark	1990	2000	3.1	2.8	3.4	<0.001
Finland	1990	1999	1.5	1.3	1.7	<0.001
France	1990	1993	-1.5	-2.3	-0.6	0.002
Germany	1990	2000	2	1.8	2.2	<0.001
Greece	1990	1995	-2.2	-3.4	-1	0.001
Ireland	1990	1994	2.5	1.4	3.6	<0.001
Italy	1990	1995	-2.4	-2.6	-2.1	<0.001
Luxembourg	1990	1996	-0.7	-1.2	-0.1	0.014
Netherlands	1990	2000	3.4	3.3	3.5	<0.001
Norway	1990	2001	0.1	-0.1	0.3	0.516
Portugal	1990	1993	-2.7	-4.3	-1.2	0.002
Spain	1990	1995	0.2	-0.4	0.8	0.526
Sweden	1990	1999	1	0.8	1.3	<0.001
UK	1990	1996	0.2	-0.2	0.6	0.329
USA	1990	1997	0.4	0.2	0.6	0.002

JP Table 6: ASMR Joinpoint Trend 2 Among Males in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	1993	2002	1.3	1	1.6	<0.001
Austria	1999	2003	3.8	1.7	6	0.001
Belgium	1995	1998	4.7	1.7	7.7	0.003
Canada	1999	2002	2.7	1.7	3.7	<0.001
Denmark	2000	2008	-0.5	-1	0	0.049
Finland	1999	2006	0.4	0	0.8	0.044
France	1993	2000	-0.3	-0.6	0	0.052
Germany	2000	2006	1.4	0.9	2	<0.001
Greece	1995	2015	1.5	1.3	1.6	<0.001
Ireland	1994	2001	0.4	-0.2	0.9	0.197
Italy	1995	2001	-0.5	-0.8	-0.3	<0.001
Luxembourg	1996	2000	3	1.4	4.5	0.001
Netherlands	2000	2003	0.2	-1.4	1.9	0.762
Norway	2001	2013	-1.4	-1.6	-1.2	<0.001
Portugal	1993	2001	-1.6	-2	-1.1	<0.001
Spain	1995	2003	3.8	3.4	4.2	<0.001
Sweden	1999	2011	-0.4	-0.6	-0.3	<0.001
UK	1996	2003	3.6	3.2	4.1	<0.001
USA	1997	2002	2.3	1.7	2.9	<0.001

JP Table 7: ASMR Joinpoint Trend 3 Among Males in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	2002	2015	0.3	0.1	0.4	0.001
Austria	2003	2008	0.7	-0.6	2	0.287
Belgium	1998	2003	1.3	0.4	2.2	0.007
Canada	2002	2005	0.8	-0.2	1.8	0.106
Denmark	2008	2013	-3.1	-4.2	-2	<0.001
Finland	2006	2013	-2.8	-3.2	-2.4	<0.001
France	2000	2010	-0.7	-0.9	-0.6	<0.001
Germany	2006	2015	0.5	0.3	0.8	<0.001
Greece	2015	2019	0.2	-1.5	2	0.788
Ireland	2001	2019	-0.8	-1	-0.7	<0.001
Italy	2001	2012	0.7	0.7	0.8	<0.001
Luxembourg	2000	2012	-0.3	-0.6	-0.1	0.002
Netherlands	2003	2013	-2.6	-2.7	-2.4	<0.001
Norway	2013	2019	-0.5	-1	0	0.05
Portugal	2001	2016	0.6	0.4	0.7	<0.001
Spain	2003	2019	-0.6	-0.7	-0.4	<0.001
Sweden	2011	2014	0.4	-1.8	2.7	0.702
UK	2003	2016	0.4	0.2	0.5	<0.001
USA	2002	2013	-0.2	-0.3	0	0.012

JP Table 8: ASMR Joinpoint Trend 4 Among Males in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	2015	2019	-0.7	-1.5	0.1	0.084
Austria	2008	2019	-1.7	-2	-1.5	<0.001
Belgium	2003	2019	-0.6	-0.7	-0.5	<0.001
Canada	2005	2019	-0.4	-0.4	-0.3	<0.001
Denmark	2013	2019	0	-0.6	0.6	0.949
Finland	2013	2019	-0.5	-0.9	-0.1	0.025
France	2010	2019	-1.1	-1.2	-0.9	<0.001
Germany	2015	2019	-1.2	-2	-0.4	0.004
Greece						
Ireland						
Italy	2012	2019	-0.3	-0.5	-0.2	<0.001
Luxembourg	2012	2019	-1.6	-2	-1.2	<0.001
Netherlands	2013	2019	-0.4	-0.6	-0.1	0.016
Norway						
Portugal	2016	2019	-1.5	-3	0.1	0.063
Spain						
Sweden	2014	2019	-1	-1.5	-0.5	<0.001
UK	2016	2019	-0.6	-1.9	0.6	0.292
USA	2013	2019	0.3	0	0.6	0.026

ASIRs

JP Table 9: ASIR Joinpoint Trend 1 Among Females in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	1990	1999	0.8	0.8	0.8	<0.001
Austria	1990	1994	1.1	1	1.3	<0.001
Belgium	1990	2004	1	0.9	1	<0.001
Canada	1990	1995	-0.4	-0.5	-0.2	<0.001
Denmark	1990	1995	0.4	0.4	0.5	<0.001
Finland	1990	1997	1.5	1.4	1.5	<0.001
France	1990	1993	1.4	1.2	1.7	<0.001
Germany	1990	1994	2.7	2.4	2.9	<0.001
Greece	1990	2001	0.8	0.7	0.8	<0.001
Ireland	1990	1999	1	1	1.1	<0.001
Italy	1990	1995	0.4	-0.1	0.9	0.121
Luxembourg	1990	1998	2.2	2.1	2.3	<0.001
Netherlands	1990	2000	0.4	0.4	0.5	<0.001
Norway	1990	2000	0.3	0.3	0.3	<0.001
Portugal	1990	1994	2.4	2.2	2.7	<0.001
Spain	1990	1995	1.7	1.7	1.8	<0.001
Sweden	1990	2004	0	-0.1	0	0.023
UK	1990	1994	-4.7	-5.5	-3.8	<0.001
USA	1990	1995	0.6	0.2	1	0.008

JP Table 10: ASIR Joinpoint Trend 2 Among Females in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	1999	2003	0.5	0.4	0.6	<0.001
Austria	1994	2004	1.4	1.3	1.4	<0.001
Belgium	2004	2010	0.2	0.1	0.3	0.006
Canada	1995	2003	1.3	1.2	1.3	<0.001
Denmark	1995	2002	1.6	1.5	1.6	<0.001
Finland	1997	2000	1.1	0.8	1.5	<0.001
France	1993	2006	1.2	1.1	1.2	<0.001
Germany	1994	2000	1.2	1	1.4	<0.001
Greece	2001	2010	0.2	0.2	0.3	<0.001
Ireland	1999	2007	1.9	1.8	2	<0.001
Italy	1995	2001	-1.9	-2.4	-1.4	<0.001
Luxembourg	1998	2003	1.1	0.9	1.4	<0.001
Netherlands	2000	2009	0.9	0.8	0.9	<0.001
Norway	2000	2004	0.5	0.4	0.6	<0.001
Portugal	1994	2000	1.8	1.7	2	<0.001
Spain	1995	2001	1.4	1.3	1.4	<0.001
Sweden	2004	2014	-0.4	-0.5	-0.4	<0.001
UK	1994	2002	-0.5	-0.9	-0.1	0.012
USA	1995	1999	-1.3	-2.2	-0.4	0.005

JP Table 11: ASIR Joinpoint Trend 3 Among Females in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	2003	2010	0.3	0.3	0.4	<0.001
Austria	2004	2017	0.1	0.1	0.2	<0.001
Belgium	2010	2015	0.5	0.4	0.7	<0.001
Canada	2003	2010	0.6	0.5	0.7	<0.001
Denmark	2002	2009	0.9	0.8	1	<0.001
Finland	2000	2012	0.6	0.6	0.6	<0.001
France	2006	2014	0.4	0.3	0.4	<0.001
Germany	2000	2009	0.3	0.3	0.4	<0.001
Greece	2010	2016	-0.9	-1	-0.8	<0.001
Ireland	2007	2016	0.6	0.5	0.7	<0.001
Italy	2001	2010	-0.6	-0.8	-0.3	<0.001
Luxembourg	2003	2010	0.4	0.3	0.6	<0.001
Netherlands	2009	2014	0	-0.1	0.2	0.671
Norway	2004	2014	-0.2	-0.2	-0.2	<0.001
Portugal	2000	2004	2.4	2	2.8	<0.001
Spain	2001	2009	1	1	1	<0.001
Sweden	2014	2017	0.2	-0.3	0.7	0.442
UK	2002	2019	0.8	0.7	0.9	<0.001
USA	1999	2019	-0.2	-0.2	-0.2	<0.001

JP Table 12: ASIR Joinpoint Trend 4 Among Females in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	2010	2019	-0.2	-0.2	-0.2	<0.001
Austria	2017	2019	-0.7	-1	-0.3	0.002
Belgium	2015	2019	-0.1	-0.3	0	0.114
Canada	2010	2019	0.4	0.3	0.4	<0.001
Denmark	2009	2019	-0.1	-0.1	0	<0.001
Finland	2012	2019	0.2	0.1	0.2	<0.001
France	2014	2019	-0.1	-0.2	0	0.01
Germany	2009	2019	-0.1	-0.2	-0.1	<0.001
Greece	2016	2019	-0.2	-0.4	0	0.113
Ireland	2016	2019	-0.2	-0.6	0.1	0.126
Italy	2010	2019	0.6	0.4	0.8	<0.001
Luxembourg	2010	2019	-0.2	-0.3	-0.1	<0.001
Netherlands	2014	2019	-0.3	-0.3	-0.2	<0.001
Norway	2014	2019	-0.1	-0.1	0	0.001
Portugal	2004	2019	0.7	0.6	0.7	<0.001
Spain	2009	2019	0	0	0	0.211
Sweden	2017	2019	-0.6	-1.1	-0.1	0.025
UK						
USA						

JP Table 13: ASIR Joinpoint Trend 1 Among Males in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	1990	1995	0.6	0.4	0.7	<0.001
Austria	1990	1999	1.1	1.1	1.1	<0.001
Belgium	1990	2005	1.1	1.1	1.1	<0.001
Canada	1990	1995	-0.3	-0.4	-0.2	<0.001
Denmark	1990	1995	0.3	0.2	0.5	<0.001
Finland	1990	1995	1.7	1.6	1.7	<0.001
France	1990	1993	1.5	1	2	<0.001
Germany	1990	1994	2.4	2.1	2.7	<0.001
Greece	1990	2000	0.4	0.4	0.5	<0.001
Ireland	1990	2000	0.9	0.8	0.9	<0.001
Italy	1990	1996	0.2	0.1	0.3	<0.001
Luxembourg	1990	1995	2.2	2	2.4	<0.001
Netherlands	1990	1994	0.6	0.3	0.8	<0.001
Norway	1990	2000	0.2	0.1	0.2	<0.001
Portugal	1990	2005	1.9	1.9	2	<0.001
Spain	1990	1995	1.7	1.5	1.8	<0.001
Sweden	1990	2003	-0.2	-0.2	-0.2	<0.001
UK	1990	1994	-4	-4.8	-3.1	<0.001
USA	1990	2001	-0.6	-0.7	-0.5	<0.001

JP Table 14: ASIR Joinpoint Trend 2 Among Males in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	1995	2001	1.1	1	1.3	<0.001
Austria	1999	2004	0.9	0.8	1	<0.001
Belgium	2005	2010	-0.1	-0.2	0.1	0.394
Canada	1995	2004	1.2	1.2	1.3	<0.001
Denmark	1995	2005	0.9	0.9	1	<0.001
Finland	1995	2004	1.2	1.2	1.2	<0.001
France	1993	2006	0.9	0.8	0.9	<0.001
Germany	1994	1999	1	0.7	1.3	<0.001
Greece	2000	2010	0.1	0	0.1	0.001
Ireland	2000	2005	1.9	1.7	2	<0.001
Italy	1996	2000	0.8	0.5	1.1	<0.001
Luxembourg	1995	2004	1.1	1	1.2	<0.001
Netherlands	1994	2000	0.1	-0.1	0.3	0.203
Norway	2000	2004	4	3.6	4.4	<0.001
Portugal	2005	2009	-0.1	-0.8	0.7	0.849
Spain	1995	2003	1.1	1	1.2	<0.001
Sweden	2003	2011	-0.4	-0.4	-0.4	<0.001
UK	1994	2003	-0.3	-0.6	0	0.039
USA	2001	2005	0.3	-0.5	1.1	0.473

JP Table 15: ASIR Joinpoint Trend 3 Among Males in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	2001	2009	0.4	0.3	0.5	<0.001
Austria	2004	2008	0.2	0	0.3	0.021
Belgium	2010	2015	0.3	0.1	0.4	0.002
Canada	2004	2017	0.5	0.5	0.5	<0.001
Denmark	2005	2013	0.4	0.3	0.5	<0.001
Finland	2004	2015	0.1	0.1	0.1	<0.001
France	2006	2014	0.3	0.2	0.4	<0.001
Germany	1999	2006	0.4	0.2	0.5	<0.001
Greece	2010	2016	-0.7	-0.8	-0.6	<0.001
Ireland	2005	2013	0.7	0.6	0.7	<0.001
Italy	2000	2010	-0.3	-0.4	-0.3	<0.001
Luxembourg	2004	2014	0.1	0	0.2	0.008
Netherlands	2000	2009	0.8	0.7	0.9	<0.001
Norway	2004	2017	-0.1	-0.1	0	0.005
Portugal	2009	2019	0.6	0.5	0.7	<0.001
Spain	2003	2010	0.7	0.6	0.8	<0.001
Sweden	2011	2017	-0.2	-0.2	-0.1	<0.001
UK	2003	2019	0.9	0.8	1	<0.001
USA	2005	2010	-0.6	-1.1	-0.1	0.018

JP Table 16: ASIR Joinpoint Trend 4 Among Males in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	2009	2019	0	0	0.1	0.394
Austria	2008	2019	-0.1	-0.1	0	<0.001
Belgium	2015	2019	-0.5	-0.6	-0.3	<0.001
Canada	2017	2019	-0.1	-0.6	0.5	0.751
Denmark	2013	2019	0	-0.1	0.1	0.406
Finland	2015	2019	-0.4	-0.5	-0.3	<0.001
France	2014	2019	-0.2	-0.4	0	0.079
Germany	2006	2019	0	-0.1	0	0.17
Greece	2016	2019	0.1	-0.1	0.3	0.248
Ireland	2013	2019	0.1	0.1	0.2	0.003
Italy	2010	2019	0.1	0.1	0.2	<0.001
Luxembourg	2014	2019	-0.1	-0.3	0	0.123
Netherlands	2009	2019	-0.1	-0.2	-0.1	0.001
Norway	2017	2019	-7.3	-8	-6.5	<0.001
Portugal						
Spain	2010	2019	-0.1	-0.1	0	0.017
Sweden	2017	2019	-0.4	-0.6	-0.2	<0.001
UK						
USA	2010	2019	0.1	0	0.2	0.167

DALYs

JP Table 17: DALYs Joinpoint Trend 1 Among Females in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	1990	1996	-1.2	-1.4	-0.9	<0.001
Austria	1990	1997	-4.1	-4.7	-3.6	<0.001
Belgium	1990	2002	0.4	0.3	0.6	<0.001
Canada	1990	1997	-0.3	-0.5	-0.1	0.002
Denmark	1990	2000	2.6	2.4	2.8	<0.001
Finland	1990	2004	0.4	0.2	0.7	0.001
France	1990	1996	-2.1	-2.4	-1.8	<0.001
Germany	1990	1993	0.4	-0.2	1.1	0.193
Greece	1990	1995	-0.7	-1.5	0	0.064
Ireland	1990	1998	0.4	0.2	0.6	0.002
Italy	1990	1998	-2.1	-2.3	-2	<0.001
Luxembourg	1990	1995	-1.6	-2	-1.3	<0.001
Netherlands	1990	2001	2.1	1.9	2.3	<0.001
Norway	1990	1993	-2.8	-4.3	-1.3	0.001
Portugal	1990	2001	-3.2	-3.4	-3	<0.001
Spain	1990	1995	-1.7	-2	-1.3	<0.001
Sweden	1990	1996	-1.1	-1.5	-0.7	<0.001
UK	1990	1995	-0.5	-0.8	-0.1	0.009
USA	1990	1996	-0.3	-0.7	0.1	0.113

JP Table 18: DALYs Joinpoint Trend 2 Among Females in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	1996	2001	1.4	0.9	1.8	<0.001
Austria	1997	2003	2.3	1.3	3.3	<0.001
Belgium	2002	2008	-0.6	-1.2	0	0.064
Canada	1997	2005	0.8	0.6	1	<0.001
Denmark	2000	2008	-1.6	-2	-1.2	<0.001
Finland	2004	2015	-2.8	-3.2	-2.4	<0.001
France	1996	2001	-0.5	-1	0	0.07
Germany	1993	1998	1.4	1	1.8	<0.001
Greece	1995	2006	1	0.7	1.2	<0.001
Ireland	1998	2004	-1.8	-2.2	-1.3	<0.001
Italy	1998	2006	-0.4	-0.6	-0.2	<0.001
Luxembourg	1995	2000	0.8	0.3	1.3	0.003
Netherlands	2001	2014	-2.9	-3	-2.7	<0.001
Norway	1993	2019	-0.9	-0.9	-0.8	<0.001
Portugal	2001	2016	-0.3	-0.4	-0.1	0.001
Spain	1995	2004	1.8	1.7	2	<0.001
Sweden	1996	2002	0.7	0.1	1.3	0.021
UK	1995	2004	2.2	2.1	2.4	<0.001
USA	1996	2002	2.9	2.4	3.5	<0.001

JP Table 19: DALYs Joinpoint Trend 3 Among Females in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	2001	2016	0.1	0.1	0.2	0.001
Austria	2003	2008	-0.6	-2	0.7	0.339
Belgium	2008	2014	-1.9	-2.5	-1.3	<0.001
Canada	2005	2012	-0.9	-1.1	-0.7	<0.001
Denmark	2008	2014	-2.9	-3.6	-2.2	<0.001
Finland	2015	2019	0	-1.5	1.6	0.989
France	2001	2016	-1.5	-1.6	-1.4	<0.001
Germany	1998	2006	0.7	0.5	0.8	<0.001
Greece	2006	2010	-0.4	-2.1	1.4	0.661
Ireland	2004	2016	-1.3	-1.4	-1.2	<0.001
Italy	2006	2009	0.2	-1	1.4	0.774
Luxembourg	2000	2013	-1.3	-1.3	-1.2	<0.001
Netherlands	2014	2019	-0.1	-0.8	0.6	0.683
Norway						
Portugal	2016	2019	-1.6	-3.1	-0.2	0.031
Spain	2004	2013	-1.6	-1.7	-1.4	<0.001
Sweden	2002	2019	-0.5	-0.5	-0.4	<0.001
UK	2004	2012	-0.7	-0.9	-0.5	<0.001
USA	2002	2006	1.1	-0.1	2.4	0.071

JP Table 20: DALYs Joinpoint Trend 4 Among Females in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	2016	2019	-0.8	-1.5	-0.1	0.026
Austria	2008	2019	-2.1	-2.3	-1.8	<0.001
Belgium	2014	2019	-0.3	-0.9	0.3	0.259
Canada	2012	2019	-0.3	-0.5	-0.1	0.003
Denmark	2014	2019	0	-0.6	0.7	0.888
Finland						
France	2016	2019	-0.1	-0.9	0.8	0.889
Germany	2006	2019	-0.8	-0.9	-0.7	<0.001
Greece	2010	2019	0.6	0.2	0.9	0.002
Ireland	2016	2019	-0.5	-1.5	0.5	0.324
Italy	2009	2019	-0.6	-0.7	-0.5	<0.001
Luxembourg	2013	2019	-0.8	-1.1	-0.6	<0.001
Netherlands						
Norway						
Portugal						
Spain	2013	2019	-0.5	-0.7	-0.2	0.002
Sweden						
UK	2012	2019	-0.3	-0.5	-0.1	0.011
USA	2006	2019	-0.8	-1	-0.7	<0.001

JP Table 21: DALYs Joinpoint Trend 1 Among Males in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	1990	1994	-0.9	-1.4	-0.4	0.001
Austria	1990	1998	-2.9	-3.3	-2.5	<0.001
Belgium	1990	1995	1.4	1	1.9	<0.001
Canada	1990	1999	-0.3	-0.4	-0.2	<0.001
Denmark	1990	2000	2.4	2.1	2.7	<0.001
Finland	1990	2005	0.9	0.8	1	<0.001
France	1990	1996	-1.5	-1.7	-1.2	<0.001
Germany	1990	1995	1	0.7	1.4	<0.001
Greece	1990	1995	-1.7	-2.5	-1	<0.001
Ireland	1990	1994	2.2	1.4	2.9	<0.001
Italy	1990	1996	-2.4	-2.6	-2.2	<0.001
Luxembourg	1990	1996	-1.4	-1.7	-1	<0.001
Netherlands	1990	2000	2.7	2.6	2.9	<0.001
Norway	1990	1996	-0.5	-0.9	-0.1	0.015
Portugal	1990	1993	-3.4	-4.7	-2.1	<0.001
Spain	1990	1995	-0.9	-1.5	-0.2	0.012
Sweden	1990	1999	0.3	0.1	0.4	0.006
UK	1990	1994	-0.3	-0.8	0.1	0.138
USA	1990	1996	0	-0.4	0.4	0.94

JP Table 22: DALYs Joinpoint Trend 2 Among Males in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	1994	2003	1.2	1.1	1.4	<0.001
Austria	1998	2008	1.1	0.7	1.5	<0.001
Belgium	1995	1998	4	2	6	<0.001
Canada	1999	2002	2.1	1	3.3	0.001
Denmark	2000	2008	-0.9	-1.4	-0.4	0.001
Finland	2005	2014	-2.5	-2.7	-2.2	<0.001
France	1996	2001	0.3	-0.1	0.7	0.15
Germany	1995	1999	2.9	2	3.8	<0.001
Greece	1995	2003	1	0.5	1.4	<0.001
Ireland	1994	2000	0.3	-0.1	0.8	0.164
Italy	1996	2001	-1	-1.3	-0.7	<0.001
Luxembourg	1996	2000	2.1	1.1	3.1	<0.001
Netherlands	2000	2003	0.2	-1.8	2.3	0.814
Norway	1996	2001	0.2	-0.5	1	0.496
Portugal	1993	2001	-2.3	-2.6	-1.9	<0.001
Spain	1995	2003	3.1	2.7	3.5	<0.001
Sweden	1999	2011	-0.7	-0.8	-0.5	<0.001
UK	1994	1998	1.8	1.1	2.6	<0.001
USA	1996	2004	2.7	2.3	3	<0.001

JP Table 23: DALYs Joinpoint Trend 3 Among Males in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	2003	2015	-0.1	-0.2	0	0.066
Austria	2008	2015	-2.7	-3.4	-2.1	<0.001
Belgium	1998	2003	1	0.4	1.7	0.002
Canada	2002	2005	0.9	-0.3	2.1	0.135
Denmark	2008	2013	-3.5	-4.7	-2.4	<0.001
Finland	2014	2019	-0.4	-1	0.2	0.16
France	2001	2019	-1	-1	-0.9	<0.001
Germany	1999	2009	0.7	0.5	0.8	<0.001
Greece	2003	2015	1.8	1.6	2	<0.001
Ireland	2000	2019	-1.1	-1.1	-1	<0.001
Italy	2001	2014	0.2	0.2	0.3	<0.001
Luxembourg	2000	2019	-1	-1.1	-0.9	<0.001
Netherlands	2003	2013	-2.9	-3.1	-2.8	<0.001
Norway	2001	2011	-1.6	-1.8	-1.4	<0.001
Portugal	2001	2016	-0.3	-0.4	-0.2	<0.001
Spain	2003	2019	-0.9	-1	-0.7	<0.001
Sweden	2011	2014	0.3	-1.6	2.3	0.739
UK	1998	2003	3.2	2.7	3.7	<0.001
USA	2004	2019	-0.7	-0.8	-0.6	<0.001

JP Table 24: DALYs Joinpoint Trend 4 Among Males in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	2015	2019	-0.8	-1.2	-0.3	0.004
Austria	2015	2019	-0.8	-2	0.5	0.219
Belgium	2003	2019	-0.6	-0.7	-0.5	<0.001
Canada	2005	2019	-0.5	-0.5	-0.4	<0.001
Denmark	2013	2019	-0.1	-0.8	0.5	0.695
Finland						
France						
Germany	2009	2019	-0.5	-0.6	-0.3	<0.001
Greece	2015	2019	-0.1	-1.1	0.9	0.853
Ireland						
Italy	2014	2019	-0.6	-0.9	-0.4	<0.001
Luxembourg						
Netherlands	2013	2019	-0.4	-0.7	-0.1	0.026
Norway	2011	2019	-0.8	-1.1	-0.6	<0.001
Portugal	2016	2019	-1.2	-2.5	0.2	0.083
Spain						
Sweden	2014	2019	-1.1	-1.5	-0.7	<0.001
UK	2003	2019	-0.2	-0.2	-0.1	<0.001
USA						

MIIs

JP Table 25: MII Joinpoint Trend 1 Among Females in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	1990	1995	-1.6	-2.2	-1	<0.001
Austria	1990	1997	-3.6	-4.2	-3	<0.001
Belgium	1990	2002	-0.1	-0.3	0.1	0.347
Canada	1990	1994	0.7	-0.1	1.4	0.075
Denmark	1990	1997	3.2	2.6	3.7	<0.001
Finland	1990	1994	-1.6	-2.7	-0.4	0.012
France	1990	2002	-2.5	-2.6	-2.3	<0.001
Germany	1990	1995	-1.3	-1.8	-0.9	<0.001
Greece	1990	1997	-1	-1.5	-0.5	0.001
Ireland	1990	1999	-0.7	-1	-0.4	<0.001
Italy	1990	1996	-2.4	-2.7	-2	<0.001
Luxembourg	1990	1995	-3.3	-3.6	-2.9	<0.001
Netherlands	1990	2000	2.6	2.3	2.9	<0.001
Norway	1990	1996	-2.1	-2.6	-1.5	<0.001
Portugal	1990	1998	-5.3	-5.6	-5	<0.001
Spain	1990	1995	-2.8	-3.2	-2.4	<0.001
Sweden	1990	1996	-0.3	-0.7	0.2	0.236
UK	1990	1992	5.2	2.4	8.1	0.001
USA	1990	1995	-1	-1.4	-0.5	<0.001

JP Table 26: MII Joinpoint Trend 2 Among Females in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	1995	2019	0.3	0.3	0.4	<0.001
Austria	1997	2006	2	1.5	2.6	<0.001
Belgium	2002	2009	-1.3	-1.8	-0.8	<0.001
Canada	1994	2006	-0.4	-0.5	-0.2	<0.001
Denmark	1997	2002	0.1	-1.1	1.3	0.907
Finland	1994	2004	-0.2	-0.6	0.1	0.146
France	2002	2005	-3.4	-5.9	-0.9	0.012
Germany	1995	2008	0.6	0.5	0.8	<0.001
Greece	1997	2006	1.6	1.1	2	<0.001
Ireland	1999	2004	-4.2	-5.2	-3.2	<0.001
Italy	1996	2001	1.8	1.2	2.5	<0.001
Luxembourg	1995	2000	-0.7	-1.3	-0.2	0.011
Netherlands	2000	2014	-3.2	-3.4	-3	<0.001
Norway	1996	2019	-0.6	-0.7	-0.6	<0.001
Portugal	1998	2005	-2.5	-3	-2	<0.001
Spain	1995	2004	1.1	0.9	1.3	<0.001
Sweden	1996	2002	1.3	0.7	1.9	<0.001
UK	1992	2003	3	2.8	3.2	<0.001
USA	1995	2000	3.8	3.2	4.4	<0.001

JP Table 27: MII Joinpoint Trend 3 Among Females in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia						
Austria	2006	2016	-2.5	-2.9	-2	<0.001
Belgium	2009	2014	-3	-3.9	-2	<0.001
Canada	2006	2012	-1.5	-2	-1	<0.001
Denmark	2002	2014	-2.4	-2.6	-2.1	<0.001
Finland	2004	2014	-3.5	-3.9	-3.2	<0.001
France	2005	2016	-2	-2.2	-1.8	<0.001
Germany	2008	2011	-1.9	-3.8	0.1	0.056
Greece	2006	2010	-1.4	-3.3	0.6	0.155
Ireland	2004	2016	-2	-2.3	-1.8	<0.001
Italy	2001	2010	0.8	0.5	1	<0.001
Luxembourg	2000	2012	-1.7	-1.8	-1.6	<0.001
Netherlands	2014	2019	0.3	-0.6	1.3	0.482
Norway						
Portugal	2005	2008	2.4	-0.7	5.6	0.12
Spain	2004	2011	-2.2	-2.5	-1.9	<0.001
Sweden	2002	2019	0.1	0	0.2	0.014
UK	2003	2017	-0.8	-0.9	-0.6	<0.001
USA	2000	2007	0.7	0.3	1	<0.001

JP Table 28: MII Joinpoint Trend 4 Among Females in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia						
Austria	2016	2019	0.1	-2.2	2.4	0.932
Belgium	2014	2019	-0.2	-0.8	0.5	0.629
Canada	2012	2019	-0.7	-1	-0.4	<0.001
Denmark	2014	2019	0	-0.8	0.9	0.954
Finland	2014	2019	-0.3	-1.2	0.5	0.405
France	2016	2019	0.4	-0.9	1.8	0.489
Germany	2011	2019	-0.2	-0.4	0	0.044
Greece	2010	2019	1.1	0.8	1.5	<0.001
Ireland	2016	2019	0	-1.6	1.7	0.996
Italy	2010	2019	-1.1	-1.3	-0.9	<0.001
Luxembourg	2012	2019	-0.5	-0.8	-0.3	<0.001
Netherlands						
Norway						
Portugal	2008	2019	-0.9	-1.1	-0.7	<0.001
Spain	2011	2019	-0.5	-0.7	-0.3	<0.001
Sweden						
UK	2017	2019	-2.9	-5.5	-0.2	0.034
USA	2007	2019	-0.3	-0.4	-0.2	<0.001

JP Table 29: MII Joinpoint Trend 1 Among Males in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	1990	1992	-1.6	-4.2	1.1	0.237
Austria	1990	1998	-2.2	-2.7	-1.8	<0.001
Belgium	1990	1994	0.9	0	1.9	0.057
Canada	1990	1995	0.9	0.6	1.1	<0.001
Denmark	1990	1999	2.6	2.4	2.9	<0.001
Finland	1990	2005	-0.1	-0.2	0	0.129
France	1990	1993	-2.8	-4	-1.6	<0.001
Germany	1990	1993	-1.5	-2.5	-0.5	0.005
Greece	1990	1995	-2.7	-3.7	-1.6	<0.001
Ireland	1990	1994	1.4	0.3	2.4	0.013
Italy	1990	1996	-2.4	-2.6	-2.2	<0.001
Luxembourg	1990	1996	-2.6	-3.1	-2.1	<0.001
Netherlands	1990	2000	3.1	3	3.3	<0.001
Norway	1990	2001	-0.3	-0.5	0	0.025
Portugal	1990	1999	-3.8	-4.1	-3.5	<0.001
Spain	1990	1995	-1.4	-2.1	-0.8	<0.001
Sweden	1990	1999	1.2	1	1.4	<0.001
UK	1990	2004	3.3	3.2	3.5	<0.001
USA	1990	1993	0	-0.8	0.8	0.945

JP Table 30: MII Joinpoint Trend 2 Among Males in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	1992	2016	0.1	0.1	0.2	<0.001
Austria	1998	2008	1.4	1	1.8	<0.001
Belgium	1994	2000	2.4	1.7	3.1	<0.001
Canada	1995	1999	-0.8	-1.4	-0.3	0.005
Denmark	1999	2008	-1	-1.4	-0.7	<0.001
Finland	2005	2014	-2.5	-2.8	-2.2	<0.001
France	1993	2016	-1.3	-1.4	-1.3	<0.001
Germany	1993	2006	1.1	1	1.3	<0.001
Greece	1995	2011	1.2	1	1.4	<0.001
Ireland	1994	2001	-0.4	-1	0.1	0.114
Italy	1996	2001	-0.9	-1.3	-0.5	<0.001
Luxembourg	1996	1999	2.2	-0.9	5.5	0.153
Netherlands	2000	2003	-0.6	-2.8	1.7	0.599
Norway	2001	2004	-6.3	-9.4	-3.2	<0.001
Portugal	1999	2005	-2.1	-2.9	-1.2	<0.001
Spain	1995	2003	2.7	2.3	3.1	<0.001
Sweden	1999	2011	-0.1	-0.3	0.1	0.203
UK	2004	2009	-1.4	-2.2	-0.5	0.004
USA	1993	1997	1.4	0.6	2.1	0.002

JP Table 31: MII Joinpoint Trend 3 Among Males in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia	2016	2019	-1	-2.3	0.4	0.142
Austria	2008	2015	-2.4	-3.1	-1.7	<0.001
Belgium	2000	2014	-0.8	-1	-0.7	<0.001
Canada	1999	2003	1.2	0.7	1.8	<0.001
Denmark	2008	2013	-3.5	-4.4	-2.5	<0.001
Finland	2014	2019	0.1	-0.6	0.8	0.833
France	2016	2019	-0.2	-1.4	1	0.744
Germany	2006	2016	0.4	0.3	0.6	<0.001
Greece	2011	2014	4	-0.7	9	0.092
Ireland	2001	2005	-3.2	-4.8	-1.6	0.001
Italy	2001	2011	1.1	1	1.2	<0.001
Luxembourg	1999	2012	-0.7	-0.8	-0.5	<0.001
Netherlands	2003	2012	-3.2	-3.4	-2.9	<0.001
Norway	2004	2017	-1	-1.2	-0.9	<0.001
Portugal	2005	2009	1.6	-0.3	3.5	0.102
Spain	2003	2011	-1.3	-1.6	-0.9	<0.001
Sweden	2011	2014	0.7	-1.6	3	0.543
UK	2009	2017	-0.1	-0.5	0.3	0.606
USA	1997	2001	3.2	2.4	4	<0.001

JP Table 32: MII Joinpoint Trend 4 Among Males in EU15+ Countries

Location	Start	Finish	EAPC	EAPC lower limit	EAPC upper limit	P
Australia						
Austria	2015	2019	-0.3	-1.6	1.1	0.698
Belgium	2014	2019	0.2	-0.5	0.8	0.635
Canada	2003	2019	-0.8	-0.9	-0.8	<0.001
Denmark	2013	2019	0	-0.5	0.5	0.967
Finland						
France						
Germany	2016	2019	-1.5	-2.5	-0.5	0.007
Greece	2014	2019	0.1	-0.9	1.1	0.851
Ireland	2005	2019	-1.3	-1.4	-1.1	<0.001
Italy	2011	2019	-0.4	-0.5	-0.2	<0.001
Luxembourg	2012	2019	-1.5	-1.9	-1.1	<0.001
Netherlands	2012	2019	-0.4	-0.7	-0.1	0.021
Norway	2017	2019	8	4.6	11.6	<0.001
Portugal	2009	2019	-0.7	-0.9	-0.4	<0.001
Spain	2011	2019	-0.3	-0.7	0	0.033
Sweden	2014	2019	-0.8	-1.3	-0.3	0.005
UK	2017	2019	-3.9	-6.6	-1.2	0.008
USA	2001	2019	0.1	0.1	0.2	<0.001

Supplementary Figures and Tables

Figure S3: Mortality to incidence index trends for males and females in EU15+ countries. Symbols represent raw data, mortality to incidence indices (MIIs). Blue lines represent males and red lines females.

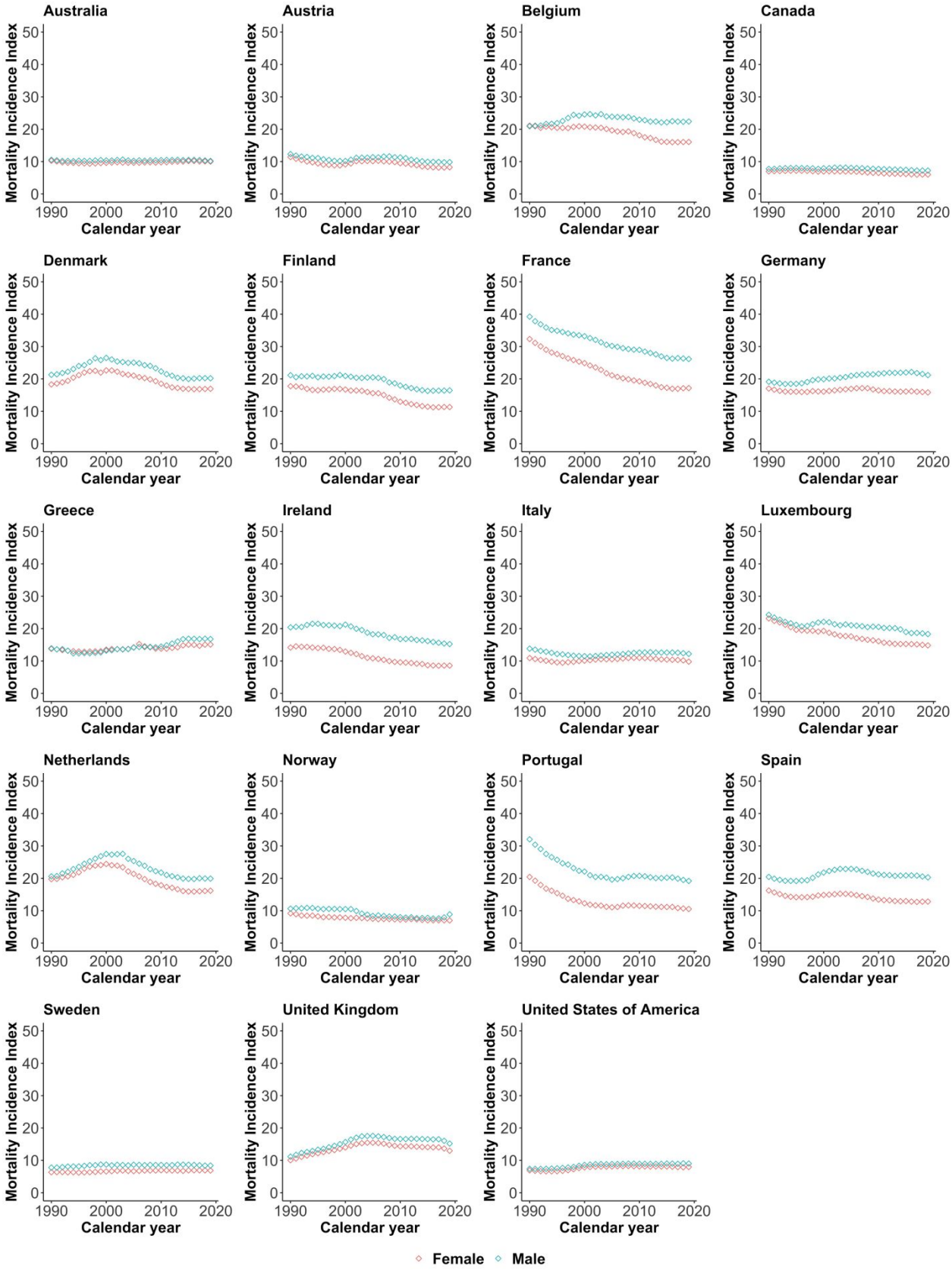
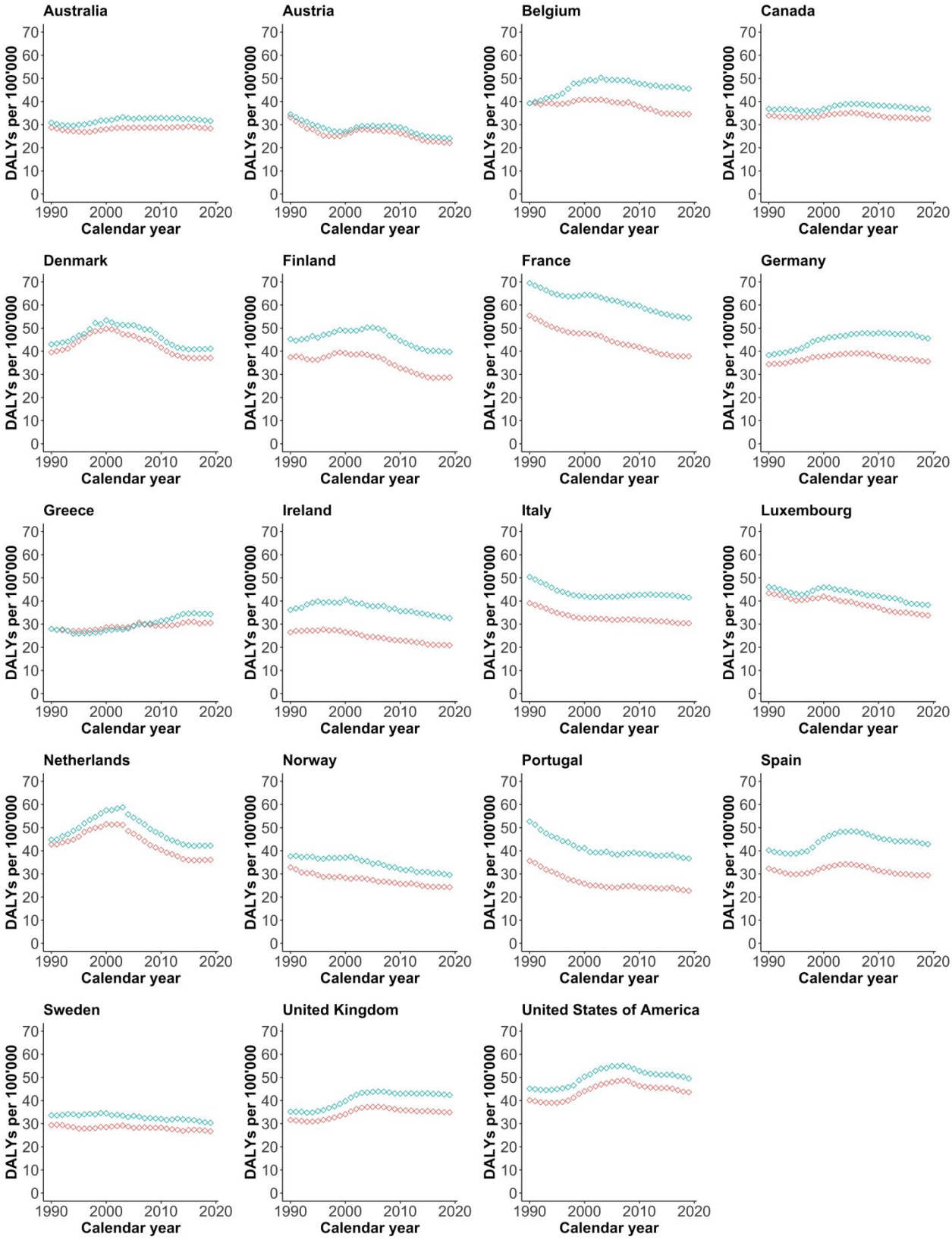

Australia
Austria
Belgium
Canada
Denmark
Finland
France
Germany
Greece
Ireland
Italy
Luxembourg
Netherlands
Norway
Portugal
Spain
Sweden
United Kingdom
United States of America
Mortality Incidence Index
Calendar year
0
10
20
30
40
50
1990
2000
2010
2020
Female
Male

Figure S4: Disability adjusted life years (DALYs) trends for males and females in EU15+ countries. Symbols represent raw data, DALYs per 100,000. Blue lines represent males and red lines females.


Australia
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France
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Greece
Ireland
Italy
Luxembourg
Netherlands
Norway
Portugal
Spain
Sweden
United Kingdom
United States of America
DALYs per 100'000
Calendar year
Female
Male

Table S1: Values for age-standardised mortality rate (ASMR) per 100,000, age-standardised incidence rate (ASIR) per 100,000, mortality-to-incidence index (MII) and disability adjusted life years (DALYs) per 100,000 for intestinal obstruction and paralytic ileus in EU15+ countries in the years 1990 and 2019.

	Mortality (ASMR per 100,000)			Incidence (ASIR per 100,000)			Mortality Incidence Indices			DALYs per 100,000		
Country	**1990**	**2019**	**Change (%)**	**1990**	**2019**	**Change (%)**	**1990**	**2019**	**Change (%)**	**1990**	**2019**	**Change (%)**
Female												
Australia	1.72	1.85	7.82	167	185	10.73	10.28	10.01	-2.63	28.76	28.31	-1.54
Austria	1.37	1.19	-13.16	120	144	20.24	11.41	8.24	-27.78	33.18	22.08	-33.44
Belgium	2.54	2.30	-9.61	120	143	18.71	21.10	16.07	-23.85	39.17	34.52	-11.86
Canada	1.83	1.84	0.70	262	306	16.81	6.97	6.01	-13.79	33.88	32.57	-3.86
Denmark	2.15	2.39	11.20	117	141	20.04	18.30	16.95	-7.36	39.55	37.10	-6.20
Finland	2.13	1.69	-20.74	120	149	24.48	17.76	11.31	-36.33	37.43	28.65	-23.46
France	3.86	2.55	-33.92	119	148	24.36	32.31	17.17	-46.86	55.42	37.79	-31.81
Germany	2.03	2.29	13.26	119	145	21.86	17.03	15.83	-7.05	34.38	35.58	3.49
Greece	1.79	2.06	14.69	130	136	4.53	13.74	15.08	9.72	27.97	30.53	9.17
Ireland	1.59	1.29	-19.30	112	150	33.20	14.17	8.58	-39.42	26.46	20.87	-21.10
Italy	2.30	1.93	-16.04	211	197	-6.48	10.91	9.80	-10.22	39.07	30.37	-22.25
Luxembourg	2.69	2.22	-17.74	116	149	28.51	23.15	14.82	-35.99	43.38	33.76	-22.16

Netherlands	2.80	2.57	-8.11	142	159	12.22	19.74	16.17	-18.12	42.71	36.10	-15.48
Norway	1.95	1.52	-21.87	212	218	2.63	9.17	6.98	-23.88	32.81	24.22	-26.19
Portugal	1.78	1.36	-23.72	87	129	47.83	20.41	10.53	-48.40	35.64	22.70	-36.30
Spain	1.98	2.00	0.88	122	156	27.75	16.23	12.82	-21.03	32.29	29.40	-8.97
Sweden	1.49	1.54	2.92	235	223	-4.98	6.35	6.88	8.32	29.36	26.72	-9.01
UK	1.79	2.15	20.46	178	166	-6.59	10.06	12.97	28.96	31.60	34.89	10.41
USA	1.80	1.96	8.64	260	246	-5.55	6.93	7.97	15.03	40.17	43.60	8.53
Male												
Australia	1.81	2.00	10.43	172	196	14.13	10.54	10.20	-3.25	30.79	31.56	2.53
Austria	1.34	1.24	-7.90	109	126	15.30	12.31	9.84	-20.12	34.41	24.02	-30.18
Belgium	2.30	2.86	24.35	110	128	16.14	20.90	22.38	7.07	39.27	45.54	15.97
Canada	1.86	2.03	9.28	239	280	17.06	7.75	7.24	-6.64	36.82	36.63	-0.52
Denmark	2.26	2.47	9.46	106	122	15.28	21.28	20.20	-5.04	42.98	41.11	-4.35
Finland	2.31	2.16	-6.49	109	131	20.06	21.14	16.46	-22.11	45.22	39.72	-12.17
France	4.29	3.42	-20.20	109	131	19.69	39.22	26.15	-33.33	69.47	54.40	-21.69
Germany	2.06	2.71	31.29	108	128	18.59	19.13	21.17	10.71	38.34	45.54	18.77
Greece	1.63	1.99	22.46	117	119	1.52	13.92	16.79	20.62	27.96	34.33	22.80
Ireland	2.12	2.02	-4.47	104	133	27.89	20.39	15.23	-25.31	36.18	32.58	-9.95

Italy	2.73	2.48	-9.20	198	203	2.81	13.82	12.21	-11.69	50.40	41.47	-17.72
Luxembourg	2.54	2.38	-6.24	105	130	24.19	24.26	18.31	-24.50	46.06	38.27	-16.93
Netherlands	2.63	2.78	5.50	128	139	9.16	20.59	19.90	-3.35	44.81	42.21	-5.80
Norway	2.21	1.84	-16.76	208	208	-0.28	10.63	8.87	-16.52	37.61	29.56	-21.40
Portugal	2.47	2.10	-14.92	77	109	42.09	32.03	19.18	-40.12	52.65	36.67	-30.35
Spain	2.26	2.79	23.32	111	138	24.18	20.43	20.29	-0.69	40.20	42.88	6.65
Sweden	1.70	1.69	-0.18	218	201	-7.69	7.79	8.42	8.14	33.61	30.37	-9.64
UK	1.85	2.47	33.35	166	162	-2.10	11.16	15.20	36.21	35.15	42.40	20.61
USA	1.87	2.13	13.77	254	236	-6.88	7.39	9.03	22.17	45.14	49.51	9.67