

---

# Burden of diseases and injuries attributable to risk factors in the European Union in 2019

João Vasco Santos, Alicia Padron Monedero, Anette Kocbach Bolling, Boris Bikbov, Brigid Unim, Diana Alecsandra Grad, Dietrich Plass, Florian Fischer, Francesco S. Violante, Gerhard Sulo, Che Henry Ngwa, Isabel Noguer-Zambrano, José Peñalvo, Juanita A. Haagsma, Katarzyna Kissimova-Skarbek, Lorenzo Monasta, Nermin Ghith, Rannveig Sigurvinsdóttir, Rodrigo Sarmiento-Suarez, Romana Haneef, Stefania Mondello, Susanne Breitner, Zubair Kabir, Brecht Devleeschauwer

Faculty of Medicine. University of Porto

CINTESIS—Centre for Health Technology and Services Research

Public Health Unit. ACES Grande Porto VIII (ARS Norte)

[jvasco.santos@gmail.com](mailto:jvasco.santos@gmail.com)



# Background (I)

Non-communicable diseases are the leading cause of burden in the EU


- Could be tackled through behavioural interventions
- Organisation of health systems

Previous studies based on Global Burden of Disease (GBD) 2017 estimates

- Decreasing risk factors-attributable burden
- Heterogeneity between EU countries

European Journal of Public Health, 1–10  
© The Author(s) 2021. Published by Oxford University Press on behalf of the European Public Health Association. All rights reserved.  
doi:10.1093/eurpub/ckab145

## **Risk factors and their contribution to population health in the European Union (EU-28) countries in 2007 and 2017**

João Vasco Santos <sup>1,2,3</sup>, Vanessa Gorasso<sup>4</sup>, Júlio Souza<sup>1,2</sup>, Grant M.A. Wyper<sup>5</sup>, Ian Grant<sup>5</sup>, Vera Pinheiro<sup>2,6</sup>, João Viana<sup>1,2</sup>, Walter Ricciardi<sup>7</sup>, Juanita A. Haagsma<sup>8</sup>, Brecht Devleeschauwer<sup>4,9</sup>, Dietrich Plass<sup>10</sup>, Alberto Freitas<sup>1,2</sup>

- 1 MEDCIDS – Department of Community Medicine, Information and Health Decision Sciences, Faculty of Medicine, University of Porto, Porto, Portugal
- 2 CINTESIS – Centre for Health Technology and Services Research, Porto, Portugal
- 3 Public Health Unit, ACES Grande Porto VIII, ARS Norte, Espinho/Gaia, Portugal
- 4 Department of Epidemiology and Public Health, Sciensano, Brussels, Belgium
- 5 Public Health Scotland, UK
- 6 Public Health Unit, ULS Baixo Alentejo, ARS Alentejo, Beja, Portugal
- 7 Section of Hygiene, Institute of Public Health, Università Cattolica del Sacro Cuore, Fondazione Policlinico ‘A. Gemelli’ IRCCS, Rome, Italy
- 8 Department of Public Health, Erasmus MC University Medical Center, Rotterdam, The Netherlands
- 9 Department of Veterinary Public Health and Food Safety, Ghent University, Merelbeke, Belgium
- 10 German Environment Agency, Section Exposure Assessment and Environmental Health Indicators, Berlin, Germany

**Correspondence:** João Vasco Santos, Rua Dr. Plácido da Costa, 4200-450 Porto, Portugal, Tel: +351 225 513 622, Fax: +351 225 513 623, e-mail: jvasco.santos@gmail.com



## Background (II)

### GBD 2019 improvements

- Revised corrections for non-reference method exposure measurements
- High and low non-optimal temperatures as new risk factors
- Dose-response meta-regressions

### **Aim**

To analyse the GBD 2019 estimates to describe the attributable burden resulting from the exposure to risk factors in the EU over the 2010-2019 period

---

## Methods (I)

Retrospective, observational and ecological study  
EU-28 countries, 2010-2019 estimates



GBD 2019 study

- 369 diseases and injuries (286 causes of death)
- 87 risk factors
- Cause-specific incidence, prevalence, mortality, YLDs, YLLs, DALYs, LE and HALE



## Methods (II)

1. Risk-outcome pairs
2. Relative risks as a function of exposure
3. Levels of exposure in each age-sex-location-year
4. Theoretical minimum risk exposure level
5. Computing mortality and DALYs (through PAF)
6. Adjusting PAF considering mediation of risk factors



## Methods (III)

Estimates included 95% uncertainty intervals

Mortality and DALY estimates attributable to risk factors

Summary exposure value (SEV): excess risk – prevalence and extent of risk factors (0-100)

Relative change between 2010 and 2019 were also used for assessing time trends

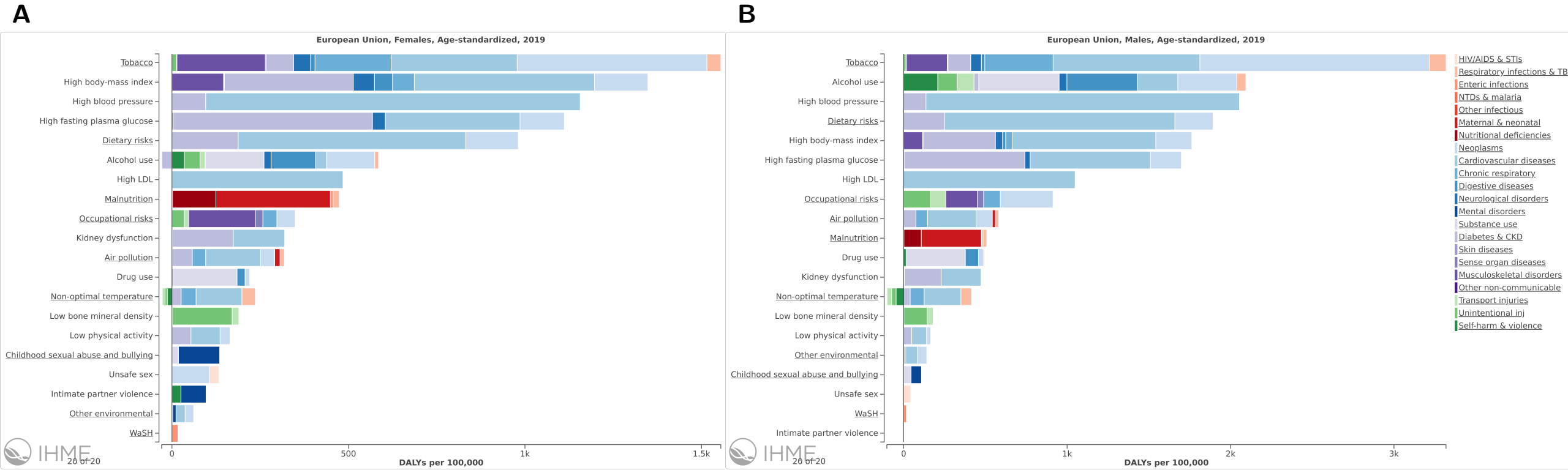


## Results (I)

### EU-28 2019

- 60% of age-standardised death rate attributable to risk factors
- 40% of age-standardised DALY rate attributable to risk factors
  
- 10.7% decrease of all-cause risk-factor attributable death rate
- 9.1% decrease of all-cause risk-factor attributable DALY rate

# Results (II)



**Figure 1.** Age-standardised DALY rates ranked by Level 2 risk factor for females (A) and for males (B) for the European Union in 2019.

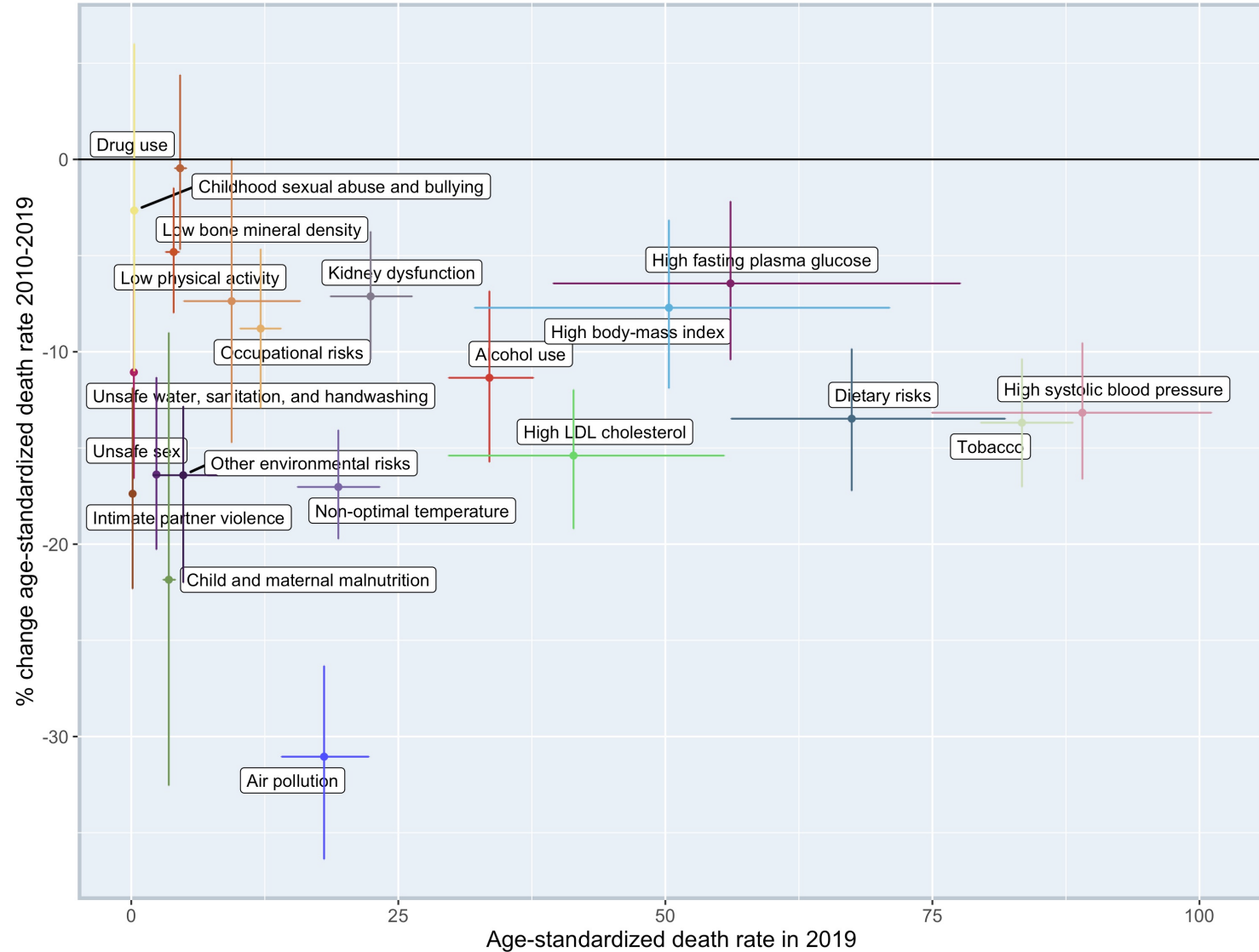


## Results (III)

|                | All risk factors | Tobacco | High systolic blood pressure | High body-mass index | Dietary risks | High fasting plasma glucose | Alcohol use | High LDL cholesterol | Occupational risks | Child and maternal malnutrition | Air pollution | Kidney dysfunction | Drug use | Non-optimal temperature | Low bone mineral density | Low physical activity | Childhood sexual abuse and bullying | Other environmental risks | Unsafe sex | Intimate partner violence | Unsafe water, sanitation, and handwashing |
|----------------|------------------|---------|------------------------------|----------------------|---------------|-----------------------------|-------------|----------------------|--------------------|---------------------------------|---------------|--------------------|----------|-------------------------|--------------------------|-----------------------|-------------------------------------|---------------------------|------------|---------------------------|---|
| EU-28          | 8026             | 2369    | 1586                         | 1554                 | 1410          | 1388                        | 1300        | 755                  | 616                | 492                             | 443           | 389                | 360      | 253                     | 187                      | 166                   | 122                                 | 97                        | 90         | 49                        | 19  |
| Italy          | 6268             | 1754    | 1082                         | 1134                 | 1027          | 1292                        | 770         | 495                  | 574                | 416                             | 381           | 297                | 294      | 183                     | 154                      | 173                   | 98                                  | 86                        | 78         | 66                        | 6   |
| Sweden         | 6334             | 1613    | 1300                         | 1133                 | 1096          | 1067                        | 901         | 631                  | 502                | 329                             | 79            | 307                | 450      | 134                     | 195                      | 118                   | 121                                 | 52                        | 53         | 63                        | 8   |
| Spain          | 6357             | 2053    | 1044                         | 1211                 | 884           | 1214                        | 825         | 437                  | 452                | 398                             | 245           | 283                | 337      | 192                     | 147                      | 159                   | 85                                  | 119                       | 93         | 36                        | 7   |
| France         | 6374             | 1792    | 903                          | 920                  | 838           | 600                         | 1291        | 403                  | 756                | 417                             | 230           | 230                | 315      | 114                     | 214                      | 138                   | 130                                 | 84                        | 80         | 51                        | 8   |
| Netherlands    | 6688             | 2304    | 1058                         | 1025                 | 955           | 927                         | 854         | 479                  | 642                | 456                             | 323           | 307                | 250      | 230                     | 198                      | 71                    | 125                                 | 45                        | 55         | 52                        | 6   |
| Luxembourg     | 6759             | 1942    | 1185                         | 1144                 | 1067          | 1327                        | 1176        | 497                  | 510                | 337                             | 243           | 338                | 406      | 166                     | 193                      | 142                   | 129                                 | 85                        | 50         | 42                        | 7   |
| Malta          | 7042             | 1860    | 1511                         | 1250                 | 1388          | 1589                        | 653         | 841                  | 597                | 671                             | 403           | 440                | 323      | 172                     | 167                      | 337                   | 82                                  | 193                       | 47         | 37                        | 7   |
| Ireland        | 7107             | 2094    | 1260                         | 1221                 | 1097          | 1069                        | 1052        | 611                  | 596                | 368                             | 166           | 356                | 504      | 264                     | 145                      | 223                   | 148                                 | 91                        | 61         | 40                        | 8   |
| Austria        | 7174             | 2064    | 1461                         | 1224                 | 1114          | 1165                        | 1237        | 717                  | 556                | 402                             | 318           | 437                | 389      | 156                     | 193                      | 156                   | 141                                 | 86                        | 67         | 34                        | 8   |
| Portugal       | 7193             | 1776    | 1212                         | 1270                 | 1089          | 1494                        | 1267        | 535                  | 585                | 406                             | 207           | 380                | 251      | 269                     | 123                      | 222                   | 155                                 | 128                       | 216        | 48                        | 19  |
| Belgium        | 7322             | 2337    | 1189                         | 1088                 | 1036          | 1054                        | 1319        | 502                  | 599                | 422                             | 360           | 327                | 367      | 224                     | 249                      | 165                   | 142                                 | 132                       | 72         | 57                        | 11  |
| Finland        | 7331             | 1613    | 1649                         | 1322                 | 1372          | 1440                        | 1384        | 799                  | 508                | 278                             | 79            | 292                | 572      | 115                     | 247                      | 175                   | 120                                 | 48                        | 34         | 72                        | 5   |
| Cyprus         | 7490             | 2316    | 1762                         | 1263                 | 1411          | 1829                        | 768         | 920                  | 525                | 440                             | 535           | 550                | 198      | 219                     | 215                      | 199                   | 101                                 | 85                        | 55         | 34                        | 9   |
| Slovenia       | 7631             | 2216    | 1582                         | 1646                 | 1384          | 1139                        | 1193        | 620                  | 689                | 373                             | 492           | 304                | 302      | 166                     | 303                      | 98                    | 85                                  | 90                        | 56         | 44                        | 33  |
| Denmark        | 7657             | 2611    | 1183                         | 1055                 | 994           | 982                         | 1315        | 502                  | 701                | 471                             | 270           | 330                | 422      | 272                     | 164                      | 138                   | 105                                 | 68                        | 73         | 57                        | 9   |
| Germany        | 7943             | 2239    | 1563                         | 1479                 | 1303          | 1559                        | 1470        | 726                  | 591                | 459                             | 351           | 430                | 342      | 230                     | 173                      | 144                   | 152                                 | 69                        | 69         | 50                        | 7   |
| Greece         | 7998             | 3109    | 1744                         | 1514                 | 1473          | 1325                        | 737         | 982                  | 490                | 493                             | 546           | 528                | 289      | 307                     | 139                      | 125                   | 133                                 | 148                       | 57         | 60                        | 8   |
| United Kingdom | 8179             | 2474    | 1177                         | 1601                 | 1277          | 1473                        | 1120        | 663                  | 628                | 584                             | 287           | 280                | 595      | 317                     | 156                      | 202                   | 150                                 | 64                        | 78         | 59                        | 7   |
| Czechia        | 10034            | 2902    | 2043                         | 2469                 | 2344          | 2558                        | 1551        | 1256                 | 801                | 437                             | 738           | 514                | 272      | 308                     | 254                      | 214                   | 85                                  | 127                       | 83         | 57                        | 43  |
| Croatia        | 10083            | 3249    | 2661                         | 2351                 | 2264          | 2106                        | 1406        | 1239                 | 642                | 484                             | 843           | 629                | 233      | 368                     | 307                      | 160                   | 75                                  | 108                       | 73         | 45                        | 50  |
| Poland         | 10692            | 3315    | 2346                         | 2396                 | 2206          | 2004                        | 1971        | 1157                 | 696                | 572                             | 1058          | 512                | 246      | 307                     | 238                      | 198                   | 98                                  | 136                       | 114        | 16                        | 45  |
| Slovakia       | 10912            | 2808    | 3168                         | 2578                 | 2940          | 1749                        | 1780        | 1743                 | 501                | 642                             | 895           | 715                | 266      | 392                     | 257                      | 203                   | 72                                  | 136                       | 100        | 41                        | 49  |
| Estonia        | 11017            | 2547    | 3108                         | 2541                 | 1809          | 1170                        | 2258        | 1305                 | 462                | 362                             | 178           | 626                | 1195     | 210                     | 177                      | 135                   | 135                                 | 84                        | 188        | 47                        | 83  |
| Lithuania      | 11873            | 2793    | 3671                         | 2476                 | 2754          | 1157                        | 2572        | 2020                 | 500                | 437                             | 502           | 672                | 700      | 255                     | 235                      | 301                   | 170                                 | 71                        | 134        | 58                        | 101                                       |
| Hungary        | 12281            | 4165    | 3036                         | 2937                 | 3102          | 2426                        | 1972        | 1634                 | 617                | 573                             | 1081          | 679                | 190      | 481                     | 251                      | 159                   | 69                                  | 174                       | 112        | 31                        | 76  |
| Latvia         | 12672            | 3063    | 3909                         | 2804                 | 2900          | 1536                        | 2693        | 2062                 | 515                | 483                             | 674           | 758                | 678      | 292                     | 206                      | 302                   | 139                                 | 106                       | 237        | 80                        | 98  |
| Romania        | 13250            | 3629    | 4341                         | 3033                 | 3264          | 1612                        | 2184        | 1887                 | 726                | 988                             | 1098          | 766                | 292      | 640                     | 207                      | 231                   | 84                                  | 207                       | 224        | 43                        | 119                                       |
| Bulgaria       | 16211            | 4958    | 5953                         | 4243                 | 4778          | 2928                        | 2189        | 2606                 | 564                | 869                             | 1778          | 1208               | 321      | 929                     | 196                      | 241                   | 80                                  | 251                       | 173        | 33                        | 76  |

Figure 2. Age-standardised DALY rates (per 100 000 inhabitants) by the level 2 risk factors for EU-28 and each country in 2019.

## Results (IV)



**Figure 3.** Age-standardised death rate in 2019 and change (in %) between 2010 and 2019 for the level two risk factors in EU-28.

# Results (V)

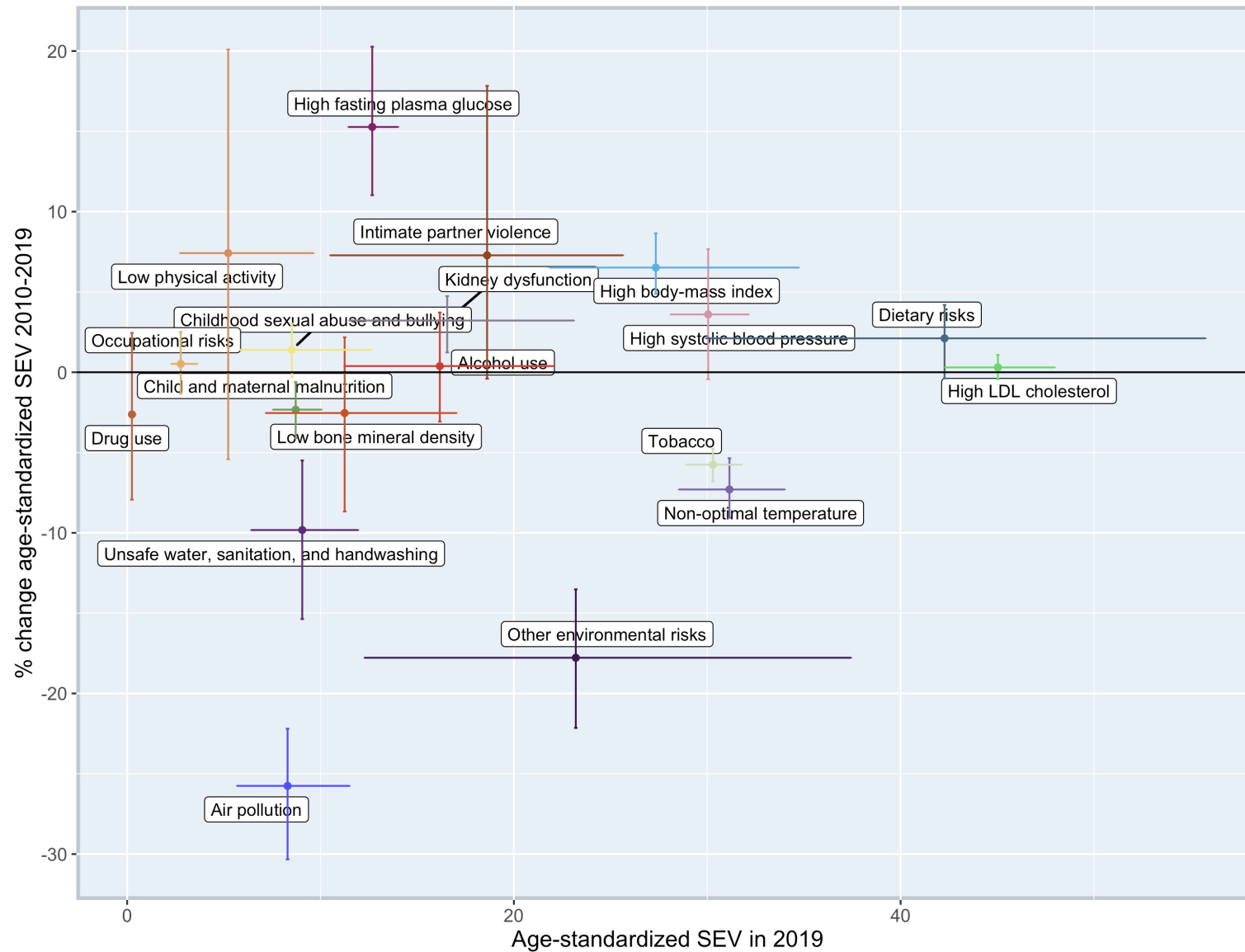
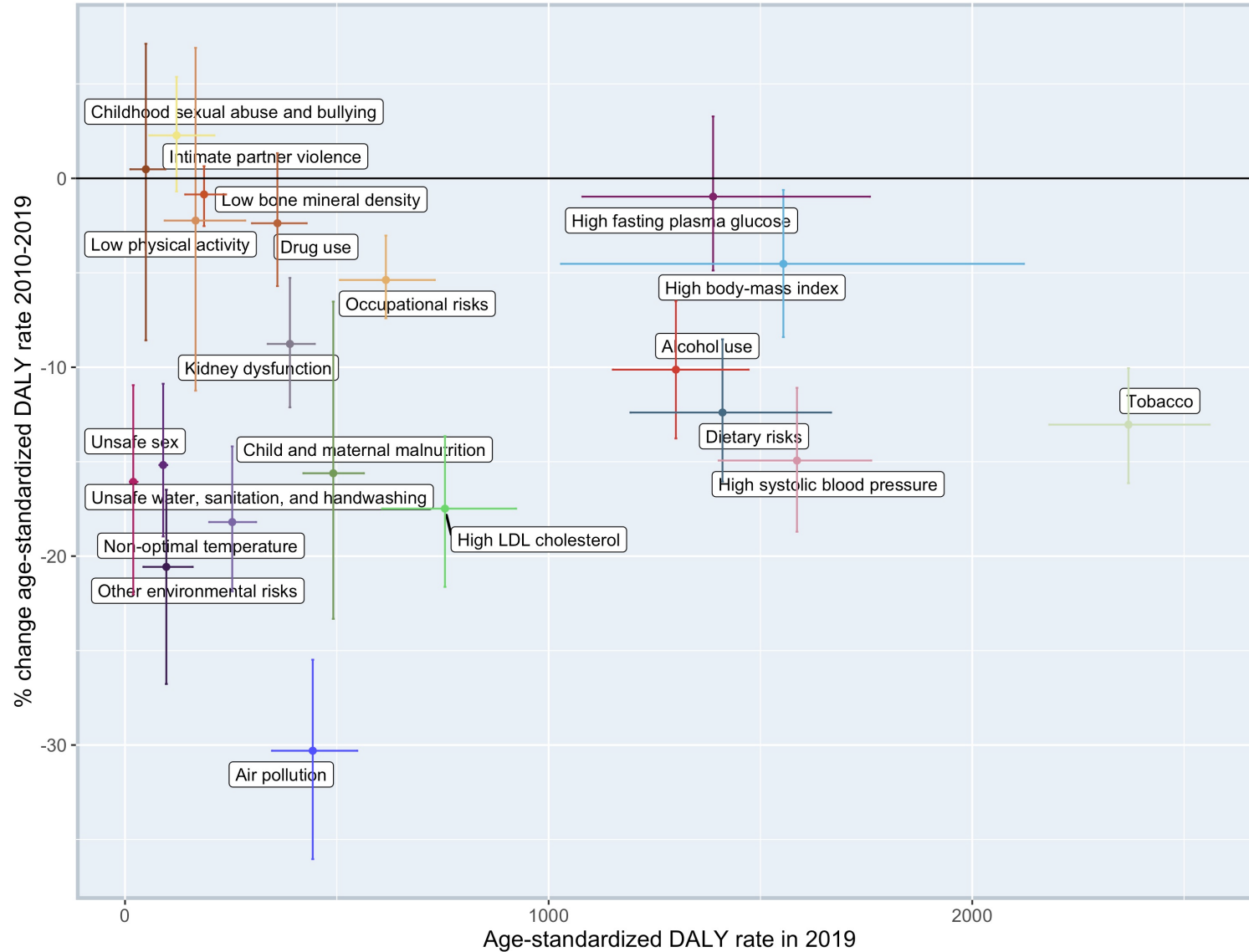


Figure 5. Age-standardised SEV in 2019 and change (in %) between 2010 and 2019 for the level two risk factors in EU-28.

# Results (VI)



**Figure 6.** Age-standardised DALY rate in 2019 and change (in %) between 2010 and 2019 for the level two risk factors in EU-28.



## Conclusions (I)

- Decreasing of burden of disease attributable to risk factors
- East-West burden of diseases gap still persists
- Important increase of exposure to metabolic risks (e.g. high fasting plasma glucose)
- Significant decreases of air pollution-related burden of disease
- Implementation of evidence-based policies and interventions is needed

### **Limitations**

- Several risks not included in the analyses (e.g. social determinants of health)
- Same disability weights and same severity distributions
- Morbidity data availability and quality

---

# Burden of diseases and injuries attributable to risk factors in the European Union in 2019

João Vasco Santos, Alicia Padron Monedero, Anette Kocbach Bolling, Boris Bikbov, Brigid Unim, Diana Alecsandra Grad, Dietrich Plass, Florian Fischer, Francesco S. Violante, Gerhard Sulo, Che Henry Ngwa, Isabel Noguer-Zambrano, José Peñalvo, Juanita A. Haagsma, Katarzyna Kissimova-Skarbek, Lorenzo Monasta, Nermin Ghith, Rannveig Sigurvinsdóttir, Rodrigo Sarmiento-Suarez, Romana Haneef, Stefania Mondello, Susanne Breitner, Zubair Kabir, Brecht Devleeschauwer

Faculty of Medicine. University of Porto

CINTESIS—Centre for Health Technology and Services Research

Public Health Unit. ACES Grande Porto VIII (ARS Norte)

[jvasco.santos@gmail.com](mailto:jvasco.santos@gmail.com)

