Socioeconomic disparities in changes to preterm birth and stillbirth rates during the first year of the COVID-19 pandemic: a study of 21 European countries

Jennifer Zeitlin

Obstetrical, Perinatal and Pediatric Epidemiology Research Team
Center for Epidemiology and Statistics Sorbonne Paris Cité

On behalf of the **Euro-Peristat Network**

Inserm

EURO PERISTAT

Université Paris Cité

The EURO-PERISTAT Network

- Aim : to monitor and evaluate perinatal health in Europe based on valid and reliable indicators from routine statistics (vital statistics, birth registers, hospital data)

  - 10 core and 20 recommended indicators
  - Data collected using a common protocol
  - 4 European reports, scientific publications
  - 31 participating countries

www.europeristat.com

Population Health Information Research Infrastructure

PHIRI
Population Health Information Research Infrastructure

- 41 partners in 30 countries to share data and expertise on the COVID-19 pandemic
- Generate knowledge about the effects of COVID on **population health**
- 4 research use cases by applying **a federated data** model to population health data
- 1 on **perinatal health and perinatal health inequalities.**

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 101018317

COVID-19 and perinatal health

- Pregnant women and newborns are vulnerable populations
  - ➢ *Direct effects*
    - Specificities of their immune systems
    - maternal-fetal transmission (fetal development/newborn health)
  - ➢ *Indirect effects*
    - Non-deferrable healthcare needs (antenatal visits, childbirth, newborn care)
    - Adverse outcomes associated with stress and socioeconomic circumstances
  - Women of low socioeconomic status more vulnerable to effects of stress, financial difficulty and poor access to care

Studies on indirect effects: reassuring, but puzzling

- Unexpected decreases in preterm birth rates in 2020
- Moderate reductions in high income countries of 4 to 9% or odds ratios:

Positive effects – rest? Less pollution?

Negative effects – interrupted health care, fewer indicated preterm births (may lead to higher stillbirth)

- No change in stillbirth, but data are sparse

Chmielewska et al. *Lancet Glob Health*. Jun 2021, Yang et al. *Acta Obstet Gynecol Scand*. Oct 2021, Yao XD et al. Zhu LJ, Yin J, Wen J. *Public Health*. Dec 2022, Calvert C et al.. *Nat Hum Behav*. Apr 2023

Objective

- To assess whether changes in the preterm birth rate and the stillbirth rate were the same in all socioeconomic (SES) groups

- We hypothesised that if the reduction were due to
  - **positive effects of the lockdown =** accentuated in higher SES groups with better living conditions and less financial stress
  - **restricted health care or other harmful effects =** affect lower SES groups more and be associated with higher stillbirth rate

Data collection

- Created a common data model for federated collection and analysis of Euro-Peristat core indicators
- **29 countries** provided data on births from 2015 to 2020
- **>29 million births**, > 2M preterm births, 100K stillbirths, 37K neonatal deaths

Publication

Zeitlin J, Philibert M, Estupiñán-Romero F, et al. *Open Research Europe 2023*

Methods

- **Outcomes**: singleton preterm birth rate and the stillbirth rate
- **Period**: 2015-2020 (March to December)
- **SES variable:** maternal educational level (preferred) or area-level deprivation/maternal occupation
- **Analysis**:
  - **Country-specific relative risks (RR)** of preterm birth and stillbirth in 2020 compared to expected rates based on linear trends from 2015-2019
  - Overall and by SES group
  - Pooled using **random effects meta-analysis**.

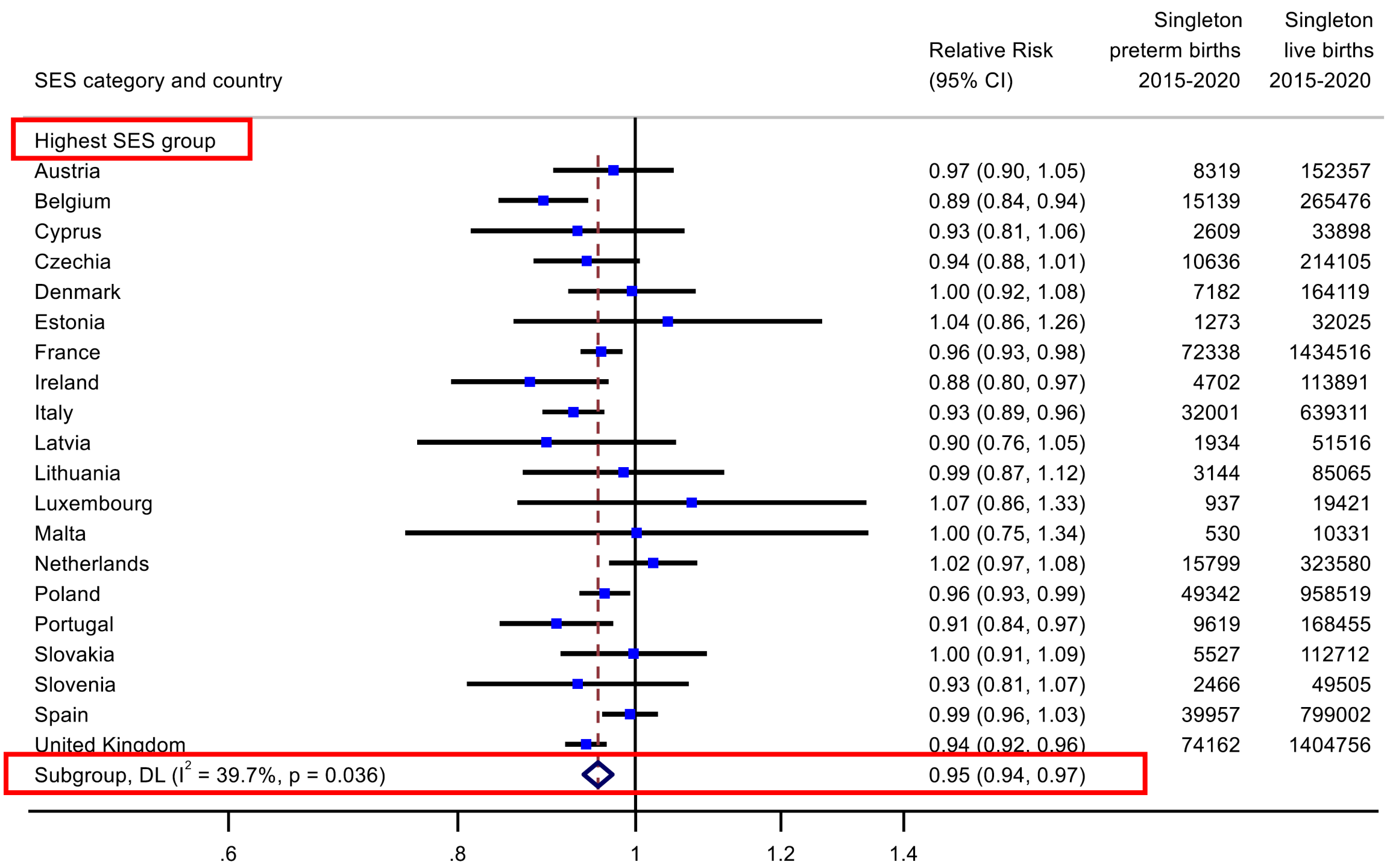
Measuring socio-economic status

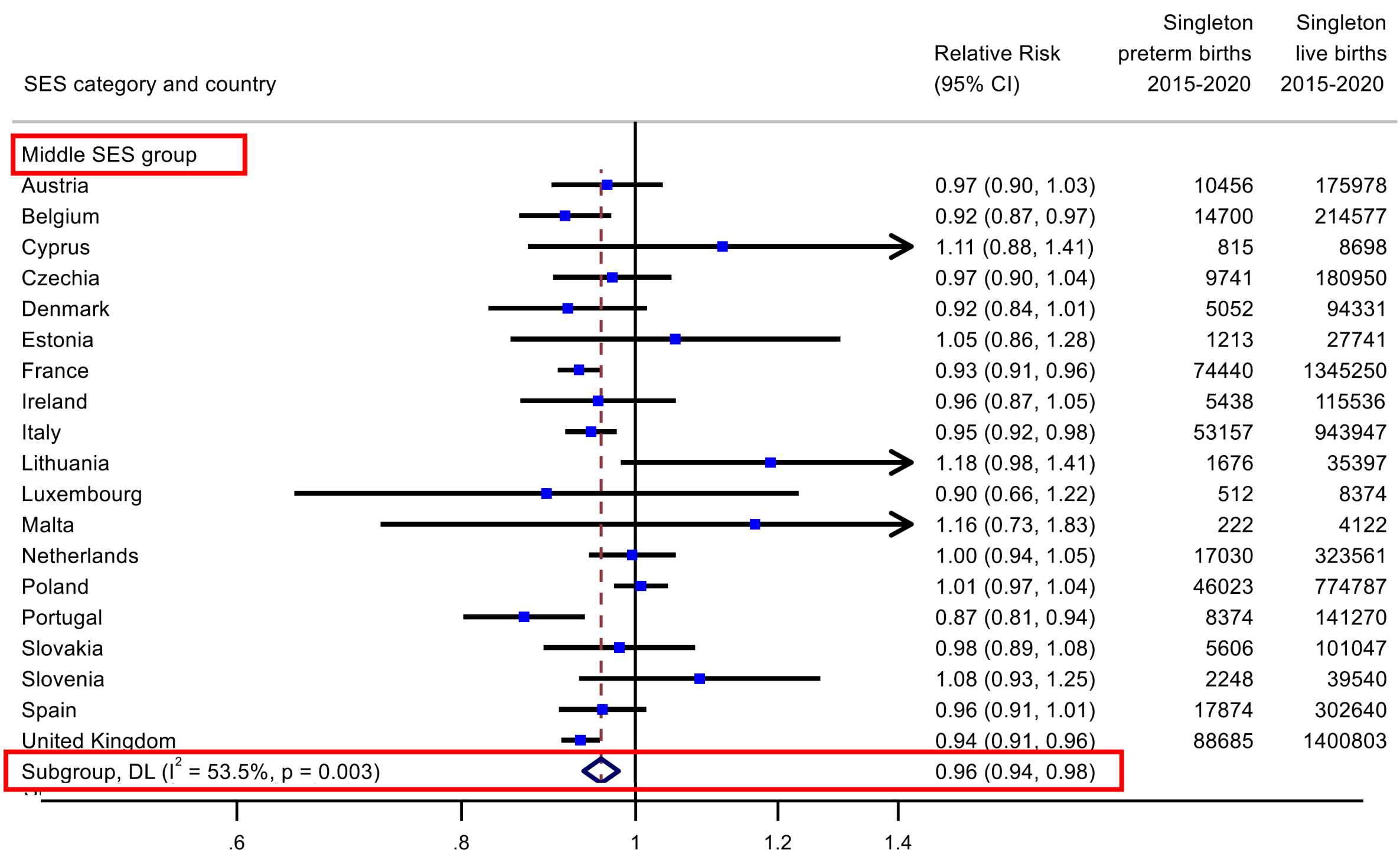
harmonized into high, medium low

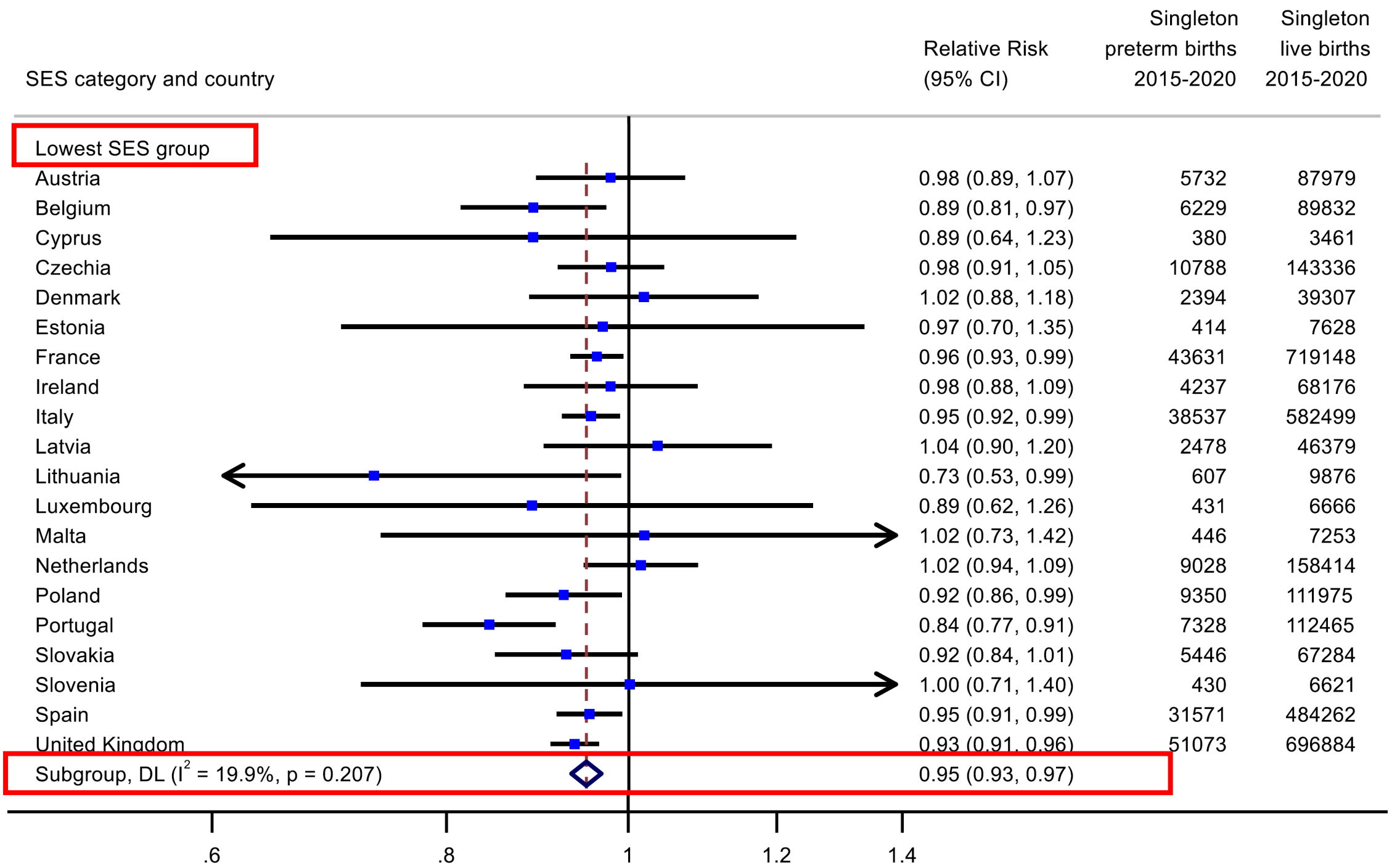
- Individual level data – 17 countries
  - Mother's education level (16 countries)
    - International Standard Classification of Education (ISCED)
    - Primary/lower secondary; Upper secondary; Post secondary
  - Mother's occupation (1 country)
    - Skilled/ unskilled workers; technicians/clerical/service occupations; Managers/professionals.
- Area level data – 6 countries
  - Socioeconomic deprivation index of mother's residence
    - 20% (lowest SES); 40% (Medium SES); 40% (Highest SES)

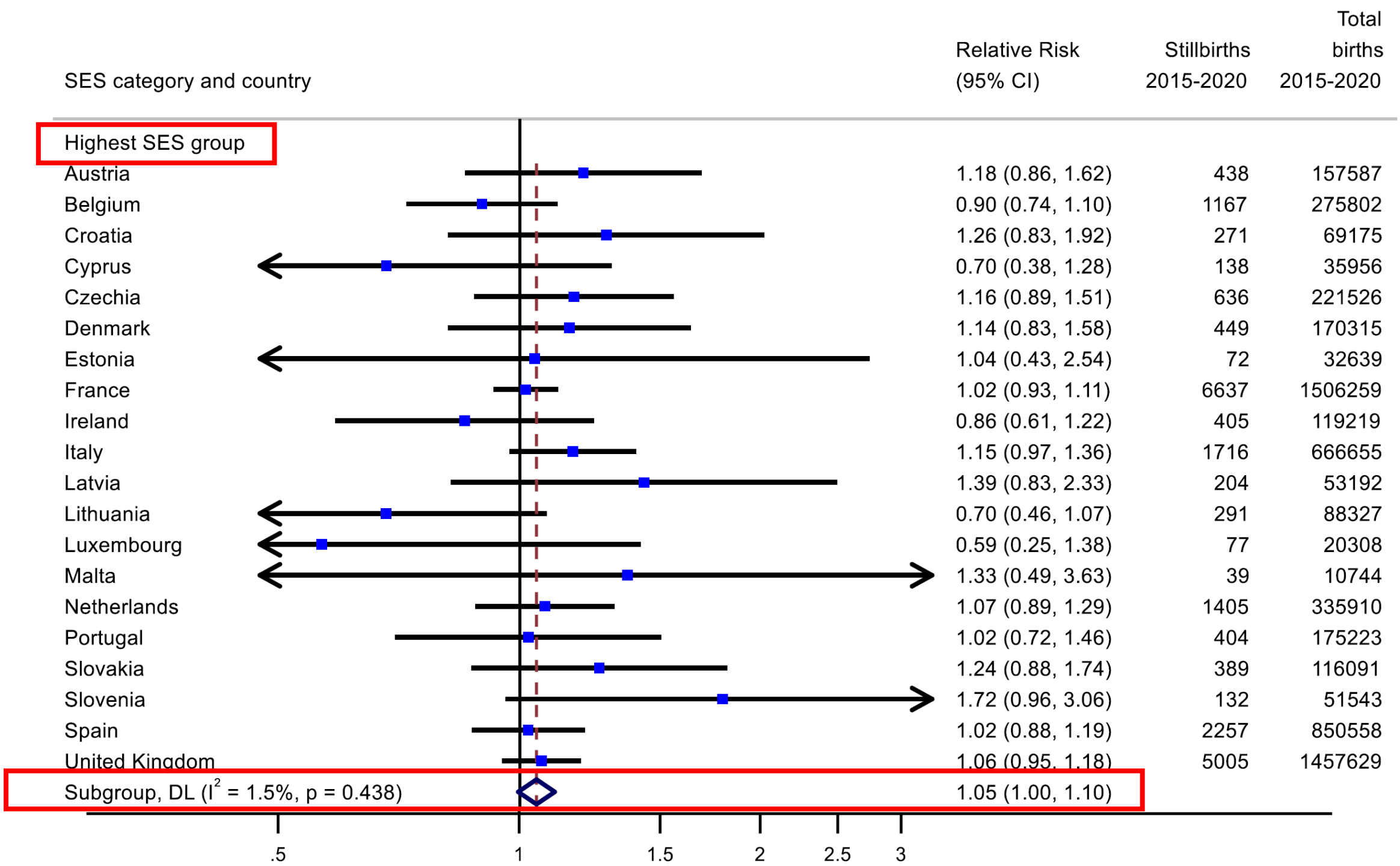
EUROPERISTAT

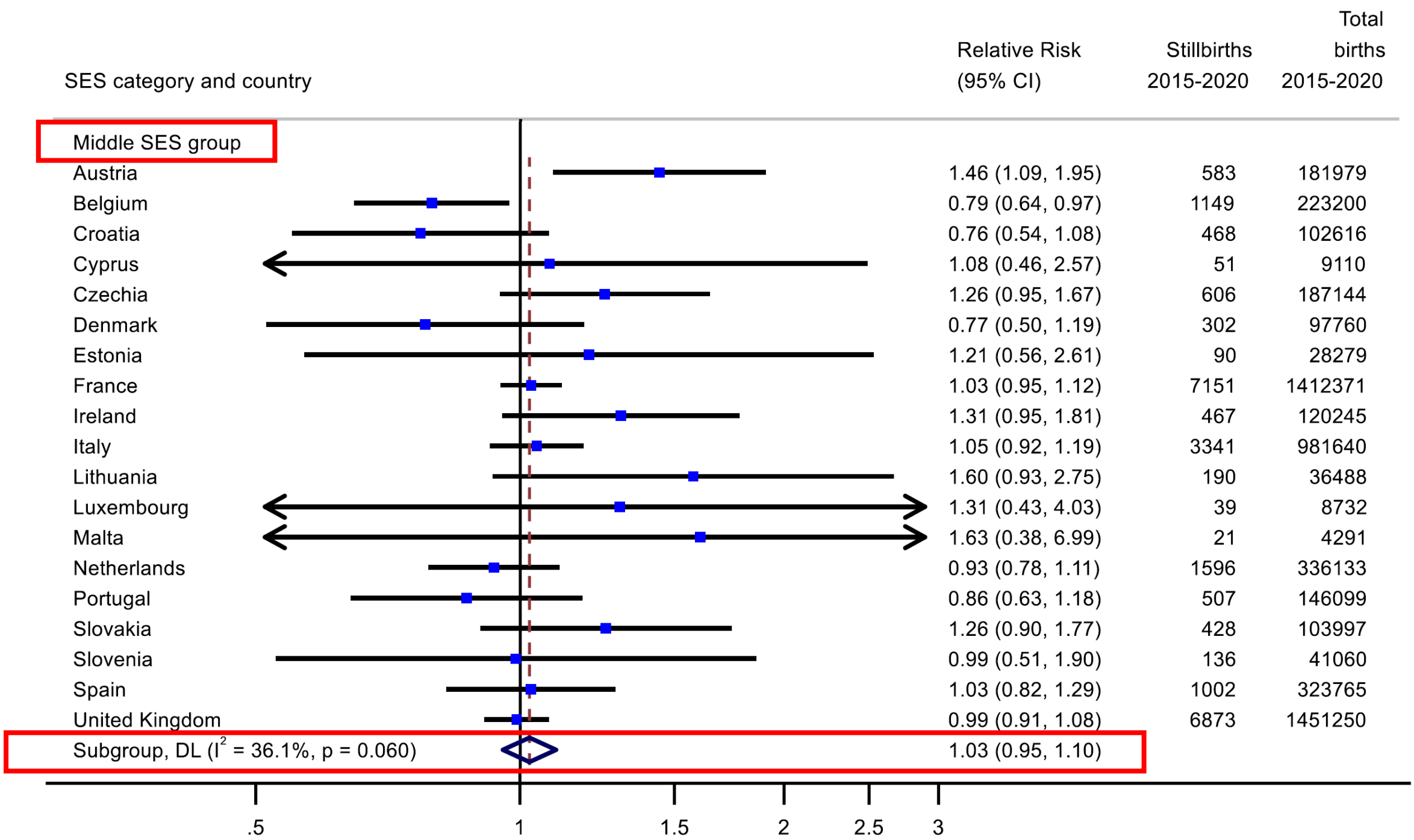
PHIRI Population Health Information Research Infrastructure

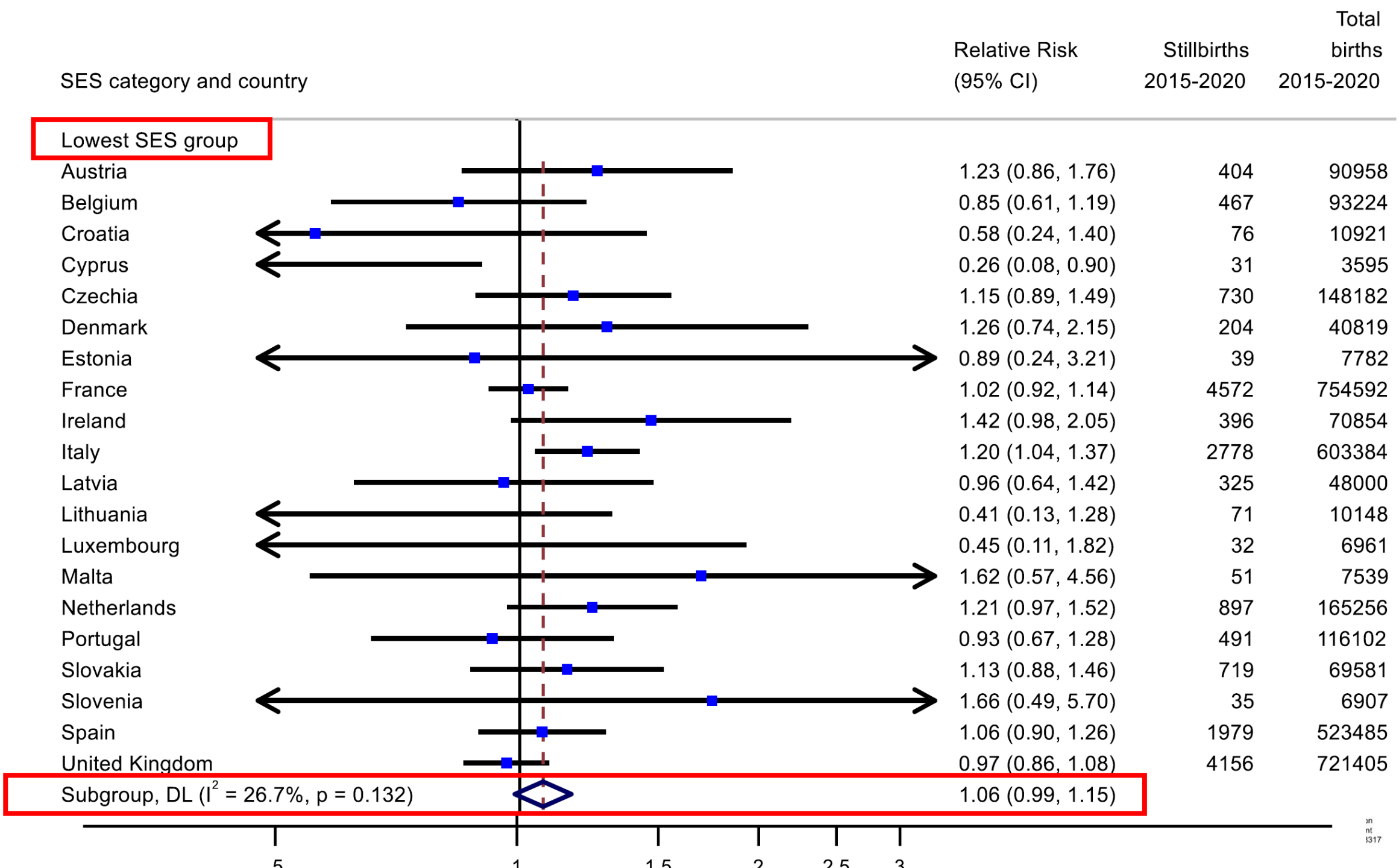

SES category and country
Relative Risk (95% CI)
Singleton preterm births 2015-2020
Singleton live births 2015-2020
Highest SES group
Austria 0.97 (0.90, 1.05) 8319 152357
Belgium 0.89 (0.84, 0.94) 15139 265476
Cyprus 0.93 (0.81, 1.06) 2609 33898
Czechia 0.94 (0.88, 1.01) 10636 214105
Denmark 1.00 (0.92, 1.08) 7182 164119
Estonia 1.04 (0.86, 1.26) 1273 32025
France 0.96 (0.93, 0.98) 72338 1434516
Ireland 0.88 (0.80, 0.97) 4702 113891
Italy 0.93 (0.89, 0.96) 32001 639311
Latvia 0.90 (0.76, 1.05) 1934 51516
Lithuania 0.99 (0.87, 1.12) 3144 85065
Luxembourg 1.07 (0.86, 1.33) 937 19421
Malta 1.00 (0.75, 1.34) 530 10331
Netherlands 1.02 (0.97, 1.08) 15799 323580
Poland 0.96 (0.93, 0.99) 49342 958519
Portugal 0.91 (0.84, 0.97) 9619 168455
Slovakia 1.00 (0.91, 1.09) 5527 112712
Slovenia 0.93 (0.81, 1.07) 2466 49505
Spain 0.99 (0.96, 1.03) 39957 799002
United Kingdom 0.94 (0.92, 0.96) 74162 1404756
Subgroup, DL (I^2 = 39.7%, p = 0.036) 0.95 (0.94, 0.97)
.6
.8
1
1.2
1.4


SES category and country
Relative Risk (95% CI)
Singleton preterm births 2015-2020
Singleton live births 2015-2020
Middle SES group
Austria 0.97 (0.90, 1.03) 10456 175978
Belgium 0.92 (0.87, 0.97) 14700 214577
Cyprus 1.11 (0.88, 1.41) 815 8698
Czechia 0.97 (0.90, 1.04) 9741 180950
Denmark 0.92 (0.84, 1.01) 5052 94331
Estonia 1.05 (0.86, 1.28) 1213 27741
France 0.93 (0.91, 0.96) 74440 1345250
Ireland 0.96 (0.87, 1.05) 5438 115536
Italy 0.95 (0.92, 0.98) 53157 943947
Lithuania 1.18 (0.98, 1.41) 1676 35397
Luxembourg 0.90 (0.66, 1.22) 512 8374
Malta 1.16 (0.73, 1.83) 222 4122
Netherlands 1.00 (0.94, 1.05) 17030 323561
Poland 1.01 (0.97, 1.04) 46023 774787
Portugal 0.87 (0.81, 0.94) 8374 141270
Slovakia 0.98 (0.89, 1.08) 5606 101047
Slovenia 1.08 (0.93, 1.25) 2248 39540
Spain 0.96 (0.91, 1.01) 17874 302640
United Kingdom 0.94 (0.91, 0.96) 88685 1400803
Subgroup, DL (I^2 = 53.5%, p = 0.003) 0.96 (0.94, 0.98)
.6
.8
1
1.2
1.4

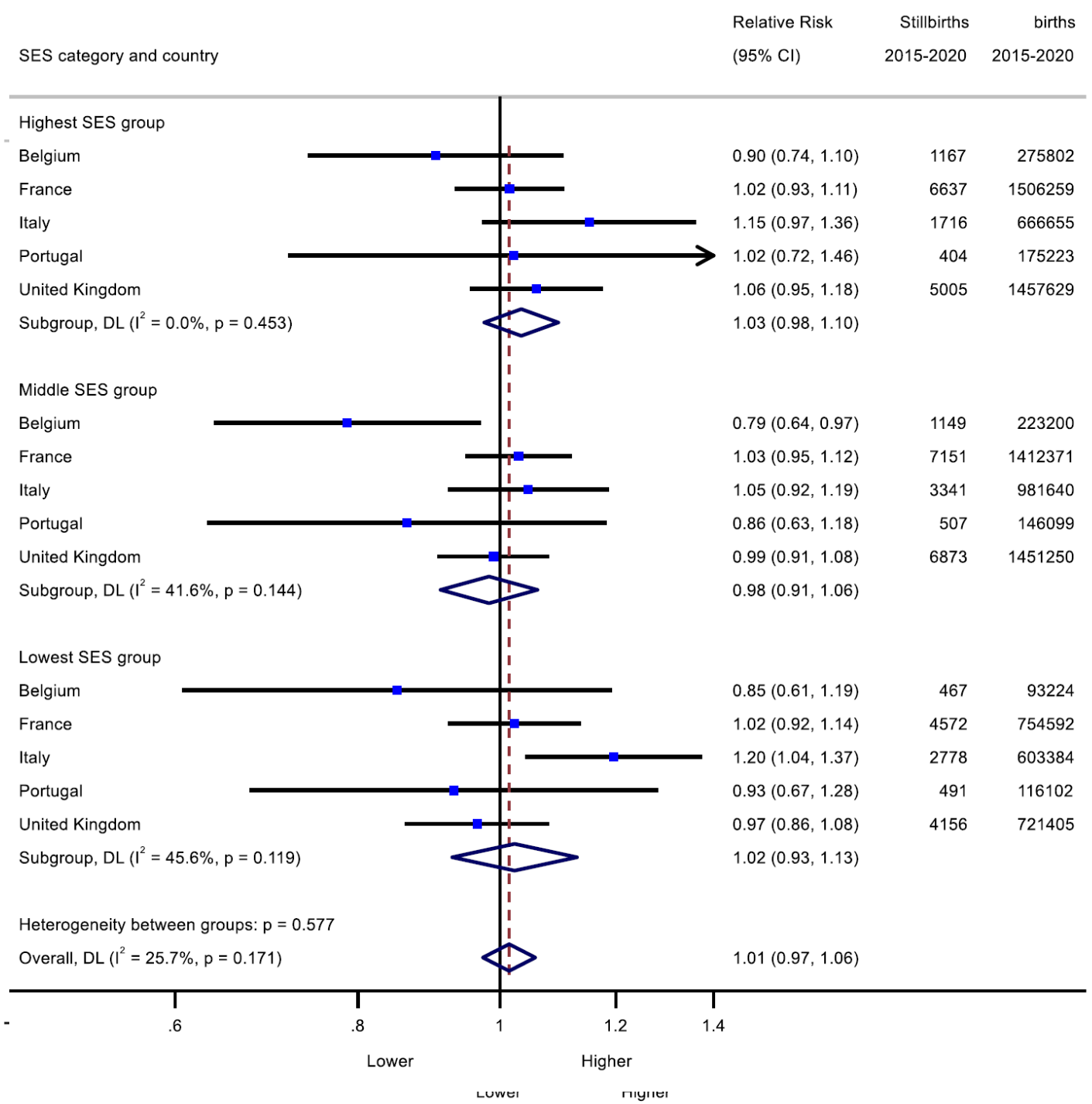

SES category and country
Relative Risk (95% CI)
Singleton preterm births 2015-2020
Singleton live births 2015-2020
Lowest SES group
Austria 0.98 (0.89, 1.07) 5732 87979
Belgium 0.89 (0.81, 0.97) 6229 89832
Cyprus 0.89 (0.64, 1.23) 380 3461
Czechia 0.98 (0.91, 1.05) 10788 143336
Denmark 1.02 (0.88, 1.18) 2394 39307
Estonia 0.97 (0.70, 1.35) 414 7628
France 0.96 (0.93, 0.99) 43631 719148
Ireland 0.98 (0.88, 1.09) 4237 68176
Italy 0.95 (0.92, 0.99) 38537 582499
Latvia 1.04 (0.90, 1.20) 2478 46379
Lithuania 0.73 (0.53, 0.99) 607 9876
Luxembourg 0.89 (0.62, 1.26) 431 6666
Malta 1.02 (0.73, 1.42) 446 7253
Netherlands 1.02 (0.94, 1.09) 9028 158414
Poland 0.92 (0.86, 0.99) 9350 111975
Portugal 0.84 (0.77, 0.91) 7328 112465
Slovakia 0.92 (0.84, 1.01) 5446 67284
Slovenia 1.00 (0.71, 1.40) 430 6621
Spain 0.95 (0.91, 0.99) 31571 484262
United Kingdom 0.93 (0.91, 0.96) 51073 696884
Subgroup, DL (I^2 = 19.9%, p = 0.207) 0.95 (0.93, 0.97)
.6
.8
1
1.2
1.4


SES category and country
Relative Risk (95% CI)
Stillbirths 2015-2020
Total births 2015-2020
Highest SES group
Austria 1.18 (0.86, 1.62) 438 157587
Belgium 0.90 (0.74, 1.10) 1167 275802
Croatia 1.26 (0.83, 1.92) 271 69175
Cyprus 0.70 (0.38, 1.28) 138 35956
Czechia 1.16 (0.89, 1.51) 636 221526
Denmark 1.14 (0.83, 1.58) 449 170315
Estonia 1.04 (0.43, 2.54) 72 32639
France 1.02 (0.93, 1.11) 6637 1506259
Ireland 0.86 (0.61, 1.22) 405 119219
Italy 1.15 (0.97, 1.36) 1716 666655
Latvia 1.39 (0.83, 2.33) 204 53192
Lithuania 0.70 (0.46, 1.07) 291 88327
Luxembourg 0.59 (0.25, 1.38) 77 20308
Malta 1.33 (0.49, 3.63) 39 10744
Netherlands 1.07 (0.89, 1.29) 1405 335910
Portugal 1.02 (0.72, 1.46) 404 175223
Slovakia 1.24 (0.88, 1.74) 389 116091
Slovenia 1.72 (0.96, 3.06) 132 51543
Spain 1.02 (0.88, 1.19) 2257 850558
United Kingdom 1.06 (0.95, 1.18) 5005 1457629
Subgroup, DL (I^2 = 1.5%, p = 0.438) 1.05 (1.00, 1.10)
.5
1
1.5
2
2.5
3


SES category and country
Relative Risk (95% CI)
Stillbirths 2015-2020
Total births 2015-2020
Middle SES group
Austria 1.46 (1.09, 1.95) 583 181979
Belgium 0.79 (0.64, 0.97) 1149 223200
Croatia 0.76 (0.54, 1.08) 468 102616
Cyprus 1.08 (0.46, 2.57) 51 9110
Czechia 1.26 (0.95, 1.67) 606 187144
Denmark 0.77 (0.50, 1.19) 302 97760
Estonia 1.21 (0.56, 2.61) 90 28279
France 1.03 (0.95, 1.12) 7151 1412371
Ireland 1.31 (0.95, 1.81) 467 120245
Italy 1.05 (0.92, 1.19) 3341 981640
Lithuania 1.60 (0.93, 2.75) 190 36488
Luxembourg 1.31 (0.43, 4.03) 39 8732
Malta 1.63 (0.38, 6.99) 21 4291
Netherlands 0.93 (0.78, 1.11) 1596 336133
Portugal 0.86 (0.63, 1.18) 507 146099
Slovakia 1.26 (0.90, 1.77) 428 103997
Slovenia 0.99 (0.51, 1.90) 136 41060
Spain 1.03 (0.82, 1.29) 1002 323765
United Kingdom 0.99 (0.91, 1.08) 6873 1451250
Subgroup, DL (I^2 = 36.1%, p = 0.060) 1.03 (0.95, 1.10)
.5
1
1.5
2
2.5
3


SES category and country
Relative Risk (95% CI)
Stillbirths 2015-2020
Total births 2015-2020
Lowest SES group
Austria 1.23 (0.86, 1.76) 404 90958
Belgium 0.85 (0.61, 1.19) 467 93224
Croatia 0.58 (0.24, 1.40) 76 10921
Cyprus 0.26 (0.08, 0.90) 31 3595
Czechia 1.15 (0.89, 1.49) 730 148182
Denmark 1.26 (0.74, 2.15) 204 40819
Estonia 0.89 (0.24, 3.21) 39 7782
France 1.02 (0.92, 1.14) 4572 754592
Ireland 1.42 (0.98, 2.05) 396 70854
Italy 1.20 (1.04, 1.37) 2778 603384
Latvia 0.96 (0.64, 1.42) 325 48000
Lithuania 0.41 (0.13, 1.28) 71 10148
Luxembourg 0.45 (0.11, 1.82) 32 6961
Malta 1.62 (0.57, 4.56) 51 7539
Netherlands 1.21 (0.97, 1.52) 897 165256
Portugal 0.93 (0.67, 1.28) 491 116102
Slovakia 1.13 (0.88, 1.46) 719 69581
Slovenia 1.66 (0.49, 5.70) 35 6907
Spain 1.06 (0.90, 1.26) 1979 523485
United Kingdom 0.97 (0.86, 1.08) 4156 721405
Subgroup, DL (I^2 = 26.7%, p = 0.132) 1.06 (0.99, 1.15)
.5
1
1.5
2
2.5
3

Five large countries with pronounced preterm birth decreases during the lockdown



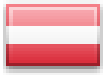
Summary and discussion

- Preterm birth rates were 4% lower than expected, on average, in all SES groups
- Stillbirth rates were 5% higher than expected, with no clear SES gradient.
- High heterogeneity overall and within SES groups
- Similar results for preterm birth in subgroup analysis in the five largest population countries, but stillbirth rates did not increase.

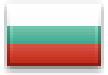
Summary and discussion

- Small effects, but mechanism affecting all SES groups similarly
- Stillbirths were not higher in countries where preterm birth declines were greatest
- This effect remains unexplained, but our results raise questions about impact of acute stressors on preterm birth
- Next steps to explore substantial heterogeneity – what explains the differences across Europe? Could this elucidate the cause?

EURO-PERISTAT COUNTRY TEAMS

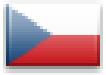
Austria 

Belgium

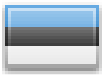
Bulgaria 

Croatia

Cyprus

Czech Rep. 

Denmark

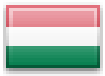
Estonia 

Finland

France

Germany

Greece

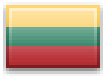
Hungary 

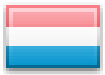
Iceland

Ireland

Italy

Latvia

Lithuania 

Luxembourg 

Malta

Netherlands

Norway

Poland

Portugal

Romania

Slovakia

Slovenia

Spain

Sweden

Switzerland

UK

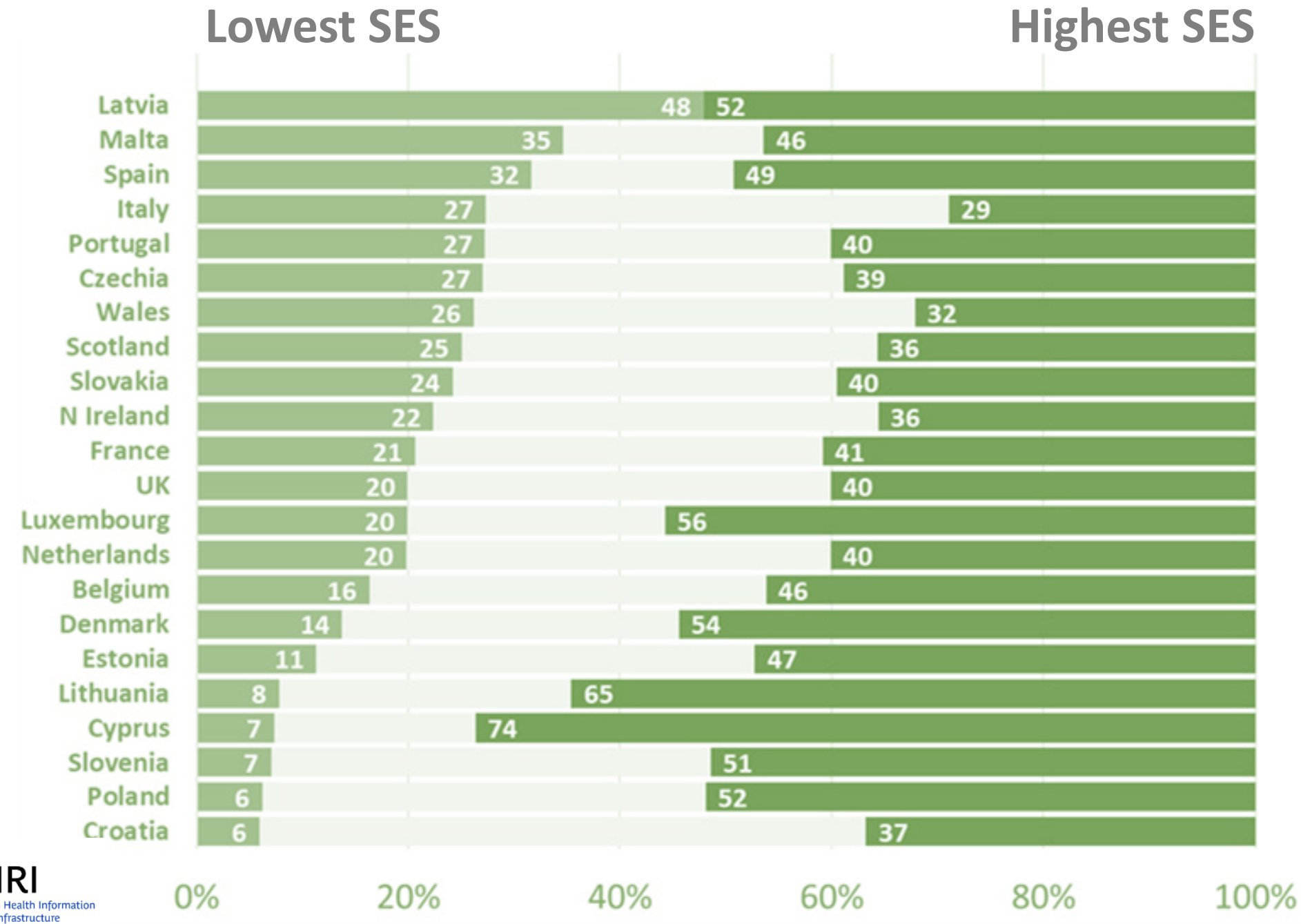
https://www.europeristat.com/index.php/our-network/country-teams.html

Euro-Peristat Research Group

Jeannette Klimont, Alex Farr (**Austria)** Sophie Alexander, Marie Delnord, Judith Racapé, Gisèle Vandervelpen, Wei-Hong Zhang (**Belgium**) Rumyana Kolarova, Evelin Jordanova (**Bulgaria**) Jelena Dimnjakovic, Željka Draušnik, Urelija Rodin (**Croatia**) Theopisti Kyprianou, Vasos Scoutellas (**Cyprus**) Jitka Jirova, Petr Velebil (**Czech Republic**) Anne Vinkel Hansen, Laust Hvas Mortensen (**Denmark**) Liili Abuladze, Luule Sakkeus (**Estonia**) Mika Gissler, Anna Heino (**Finland)** Melissa Amyx, Béatrice Blondel, Anne Chantry, Catherine Deneux Tharaux, Mélanie Durox, Jeanne Fresson, Alice Hocquette, Marianne Philibert, Annick Vilain, Jennifer Zeitlin (**France)** Dimitra Bon, Guenther Heller, Björn Misselwitz (**Germany**) Aris Antsaklis (**Greece**) István Sziller (**Hungary**) Védís Helga Eiríksdóttir, Jóhanna Gunnarsdóttir, Helga Sól Ólafsdóttir (**Iceland**) Karen Kearns, Izabela Sikora (**Ireland**) Rosaria Boldrini, Marina Cuttini, Serena Donati, Marzia Loghi, Marilena Pappagallo (**Italy**) Janis Misins, Irisa Zile-Velika (**Latvia**) Rita Gaidelyte, Jelena Isakova (**Lithuania**) Audrey Billy, Aline Lecomte, Jessica Pastore, Guy Weber (**Luxembourg**), Miriam Gatt (**Malta**), Peter Achterberg, Lisa Broeders, Ashna Hindori-Mohangoo, Jan Nijhuis (**Netherlands)** Rupali Akerkar, Hilde Engjom, Kari Klungsoyr (**Norway**) Ewa Mierzejewska, Katarzyna Szamotulska (**Poland**) Henrique Barros, Carina Rodrigues (**Portugal**) Mihaela-Alexandra Budianu, Alexandra Cucu, Mihai Horga, Lucian Puscasiu, Petru Sandu, Vlad Tica (**Romania**) Ján Cáp (**Slovakia**) **Miha Lucovnik, Ivan Verdenik (Slovenia)** Adela Recio Alcaide, Mireia Jané, Maria José Vidal, Óscar Zurriaga (**Spain**) Karin Källén, Anastasia Nyman (**Sweden**) Tonia Rihs (**Switzerland**) Diane Anderson, Samantha Clarke, Hannah McConnell, Alison Macfarlane, Sinead Magill, Kirsten Monteath, Siobhán Morgan, Joanne Murphy, Mark Piper, Sonya Scott, Lucy Smith, Craig Thomas, Martin Williams (**United Kingdom)**

Distribution of socioeconomic status by countries

% of births by SES



EUROPERISTAT

PHIRI Population Health Information Research Infrastructure