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Comparison of Belgian COVID-19 mortality between epidemiological surveillance and death certificates for the year 2020

C. Vernemmen[1] • J. Jurcevic[1] • R. Ekelson[1] • S. Nganda[1] • N. Bustos Sierra[1]

[1] Scientific Directorate of Epidemiology and public health, Epidemiology of infectious diseases, Sciensano, Brussels, Belgium

Key points

- **In 2020, the ad hoc epidemiological surveillance identified overall 90% (n=19,801) of COVID-19-associated deaths from death certificates (n=22,015), with high coverage via hospital (98%) and long-term care facility (90%) surveillances, but with low coverage for deaths occurring at home (5%), despite a surveillance being in place.**

- **One-to-one matching revealed that 2,592 deaths (13%) collected via the surveillance did not have COVID-19 as underlying cause of death according to the death certificates and that there was a significant underestimation of COVID-19 deaths in the surveillance during July and August (interwave period).**

Sciensano, in collaboration with health authorities, set up an ad hoc COVID-19 mortality surveillance to monitor the severity of the epidemic [1], as the processing of death certificates has a 3-year delay.
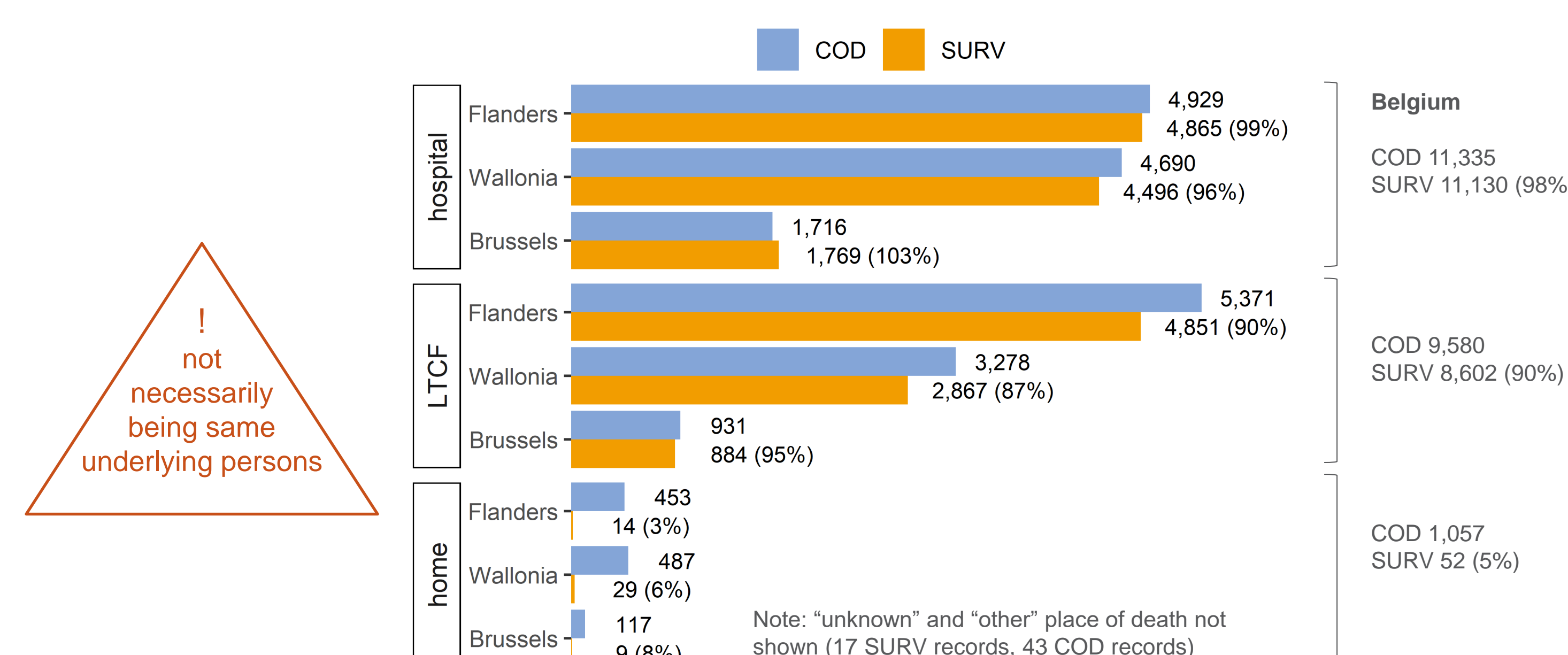
In the cause of death database from the death certificates (COD), a death is *due to* COVID-19 if the underlying cause of death (UCOD) is U07.1 (virus identified ~ laboratory-confirmed case) or U07.2 (virus not identified ~ possible case). Deaths *with* COVID-19 are not included in this analysis. The epidemiological surveillance database (SURV) should only contain deaths *due to* COVID-19, by design.

1. Global comparison

Both SURV and COD analysed as standalone databases.
Number of COVID-19 deaths per region of death and place of death.

- In 2020, **22,015 in COD** versus **19,801 in SURV** (90% captured).
- Hospital surveillance (Surge Capacity Survey) had the highest coverage (98%), followed by the long-term care facility (LTCF) surveillance in Brussels (95%), Flanders (90%) and Wallonia (87%).
- **SURV missed 1,005 at-home deaths**, despite a surveillance being put in place via general practitioners.
- COD showed 847 deaths *with* COVID-19.

COD / **SURV**

	COD	SURV
hospital Flanders	4,929	4,865 (99%)
hospital Wallonia	4,690	4,496 (96%)
hospital Brussels	1,716	1,769 (103%)
LTCF Flanders	5,371	4,851 (90%)
LTCF Wallonia	3,278	2,867 (87%)
LTCF Brussels	931	884 (95%)
home Flanders	453	14 (3%)
home Wallonia	487	29 (6%)
home Brussels	117	9 (8%)

Belgium
hospital: COD 11,335 / SURV 11,130 (98%)
LTCF: COD 9,580 / SURV 8,602 (90%)
home: COD 1,057 / SURV 52 (5%)

! not necessarily being same underlying persons

Note: "unknown" and "other" place of death not shown (17 SURV records, 43 COD records)

2. Person-based mismatch analysis

First step: probabilistic linkage between SURV and Statbel's all-cause mortality database (not containing info on UCOD), which adds the pseudonymized unique identifier (ID) in SURV.

Second step: direct linkage between SURV and COD through the ID, allowing a person-based mismatch analysis.

- One-to-one matching SURV–COD exposed greater underlying differences.
  Of the SURV records:
  - 617 (3%) remained unmatched with COD
  - 2,127 (11%) without COVID-19 indicated in COD
  - 465 (2%) with COVID-19 indicated in COD, but not as UCOD

- Together with the SURV missing small part of the COVID-19 deaths, the **sensitivity of capturing COVID-19 deaths by the SURV** remained high for all regions of death: **Flanders 80%**, **Wallonia 69%**, **Brussels 77%**.

Flanders COD: 10,777 — SURV: 9,746 — 145 (1.5%), 865 (8.9%), 125 (1.3%), 8,141 (75.5%), 6,890 (70.7%), 2,636 (24.5%), 1,721 (17.7%)

Wallonia COD: 8,468 — SURV: 7,392 — 397 (5.4%), 858 (11.6%), 292 (4%), 6,850 (80.9%), 4,990 (67.5%), 1,618 (19.1%), 855 (11.6%)

Brussels COD: 2,770 — SURV: 2,663 — 75 (2.8%), 404 (15.2%), 48 (1.8%), 1,986 (71.7%), 1,654 (62.1%), 784 (28.3%), 482 (18.1%)

Top other UCOD:
- 6.0% other ill-defined and unspecified causes (including 2% lost certificates)
- 5.5% pneumonia
- 4.9% unspecified dementia
- 4.3% heart failure
- 3.4% other COPD
- 2.8% Alzheimer
- 2.7% malignant neoplasm of bronchus and lung
- 2.7% stroke (not hemorrhage or infarction)

COD (death certificates)
- no COD match found
- U07.1 and U07.2 nowhere indicated
- U07.1 / U07.2 indicated, neither UCOD
- U07.1 as UCOD
- U07.2 as UCOD

3. Logistic regression analysis

Multivariate logistic regression model to explore influencing factors (region and place of death, wave) on the probability (p) that for a COD record with COVID-19 as UCOD, a matching SURV record exists.

- Final model:

$$\log(p/(1-p)) \sim \text{region of death} + \text{place of death} + \text{wave}$$
$$+ \text{region of death} * \text{wave} + \text{place of death} * \text{wave}$$
$$\chi^2(14, N=21{,}972) = 3{,}080.73 \quad p < 0.001$$

- Estimated average probabilities: **hospital 85%, LTCF 72%, at home 12%**.
- During **interwave**: **significant drop** for in-hospital deaths, but largest drop for deaths in LTCF.
- In wave 2: probability Flanders increases ↔ Wallonia/Brussels decreases.

● Flanders ● Wallonia ● Brussels

Probability corresp. SURV record exists

hospital / LTCF / home — wave 1, interwave, wave 2

Wave 1: 1 March – 21 June 2020
Interwave: 22 June – 30 August 2020
Wave 2: 31 August 2020 – 14 February 2021 (here 31 December 2020 as cut-off point)

REFERENCES AND ACKNOWLEDGEMENTS

[1] F. Renard et al., "Establishing an ad hoc COVID-19 mortality surveillance during the first epidemic wave in Belgium, 1 March to 21 June 2020," Eurosurveillance, vol. 26, no. 48, Dec. 2021, doi: 1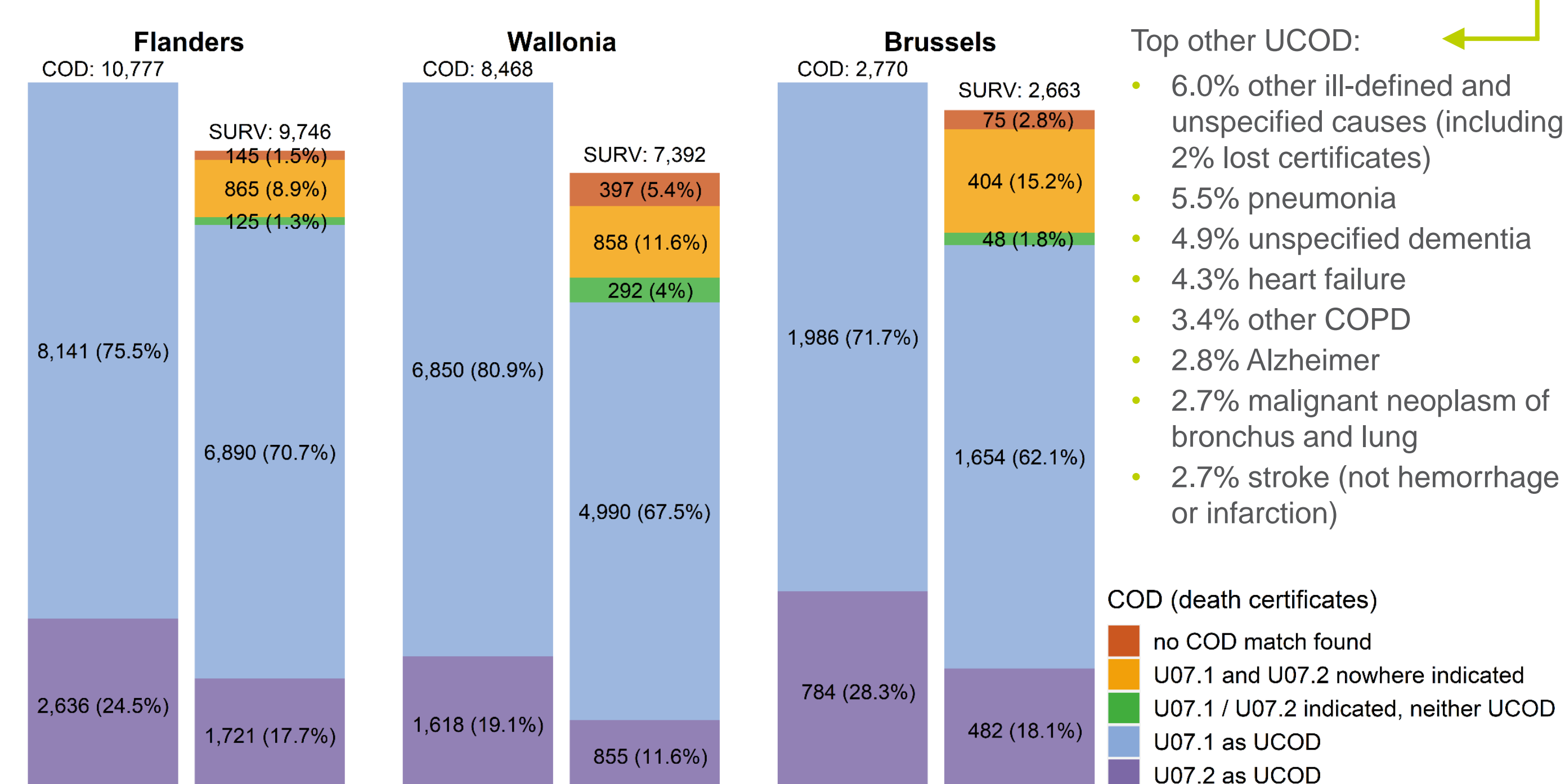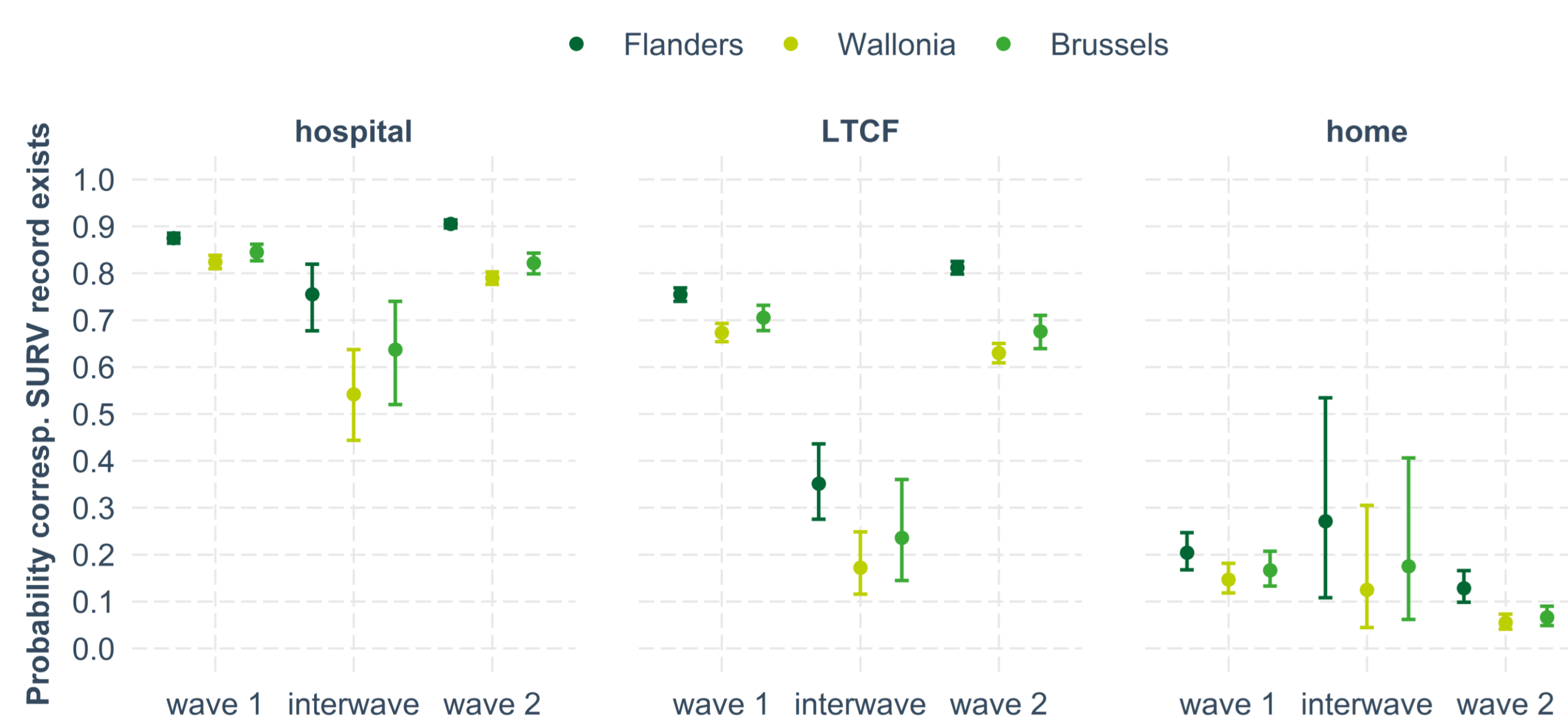0.2807/1560-7917.ES.2021.26.48.2001402.