Triangle Simplex Plot for Representing Multiple Cause of Death Dynamics

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3rd SCOR Seminar

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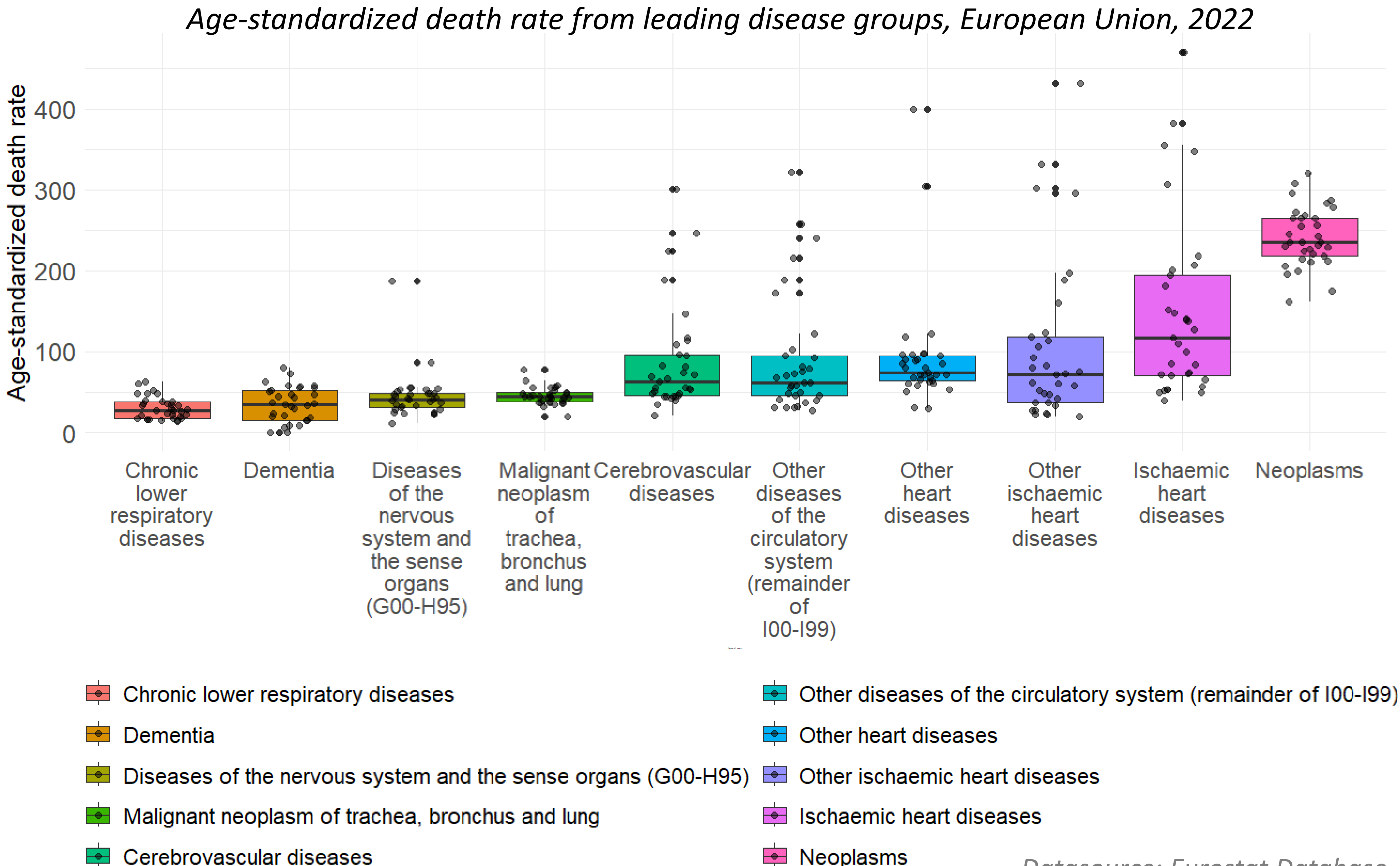
University of Southern Denmark

FOUNDATION FOR SCIENCE

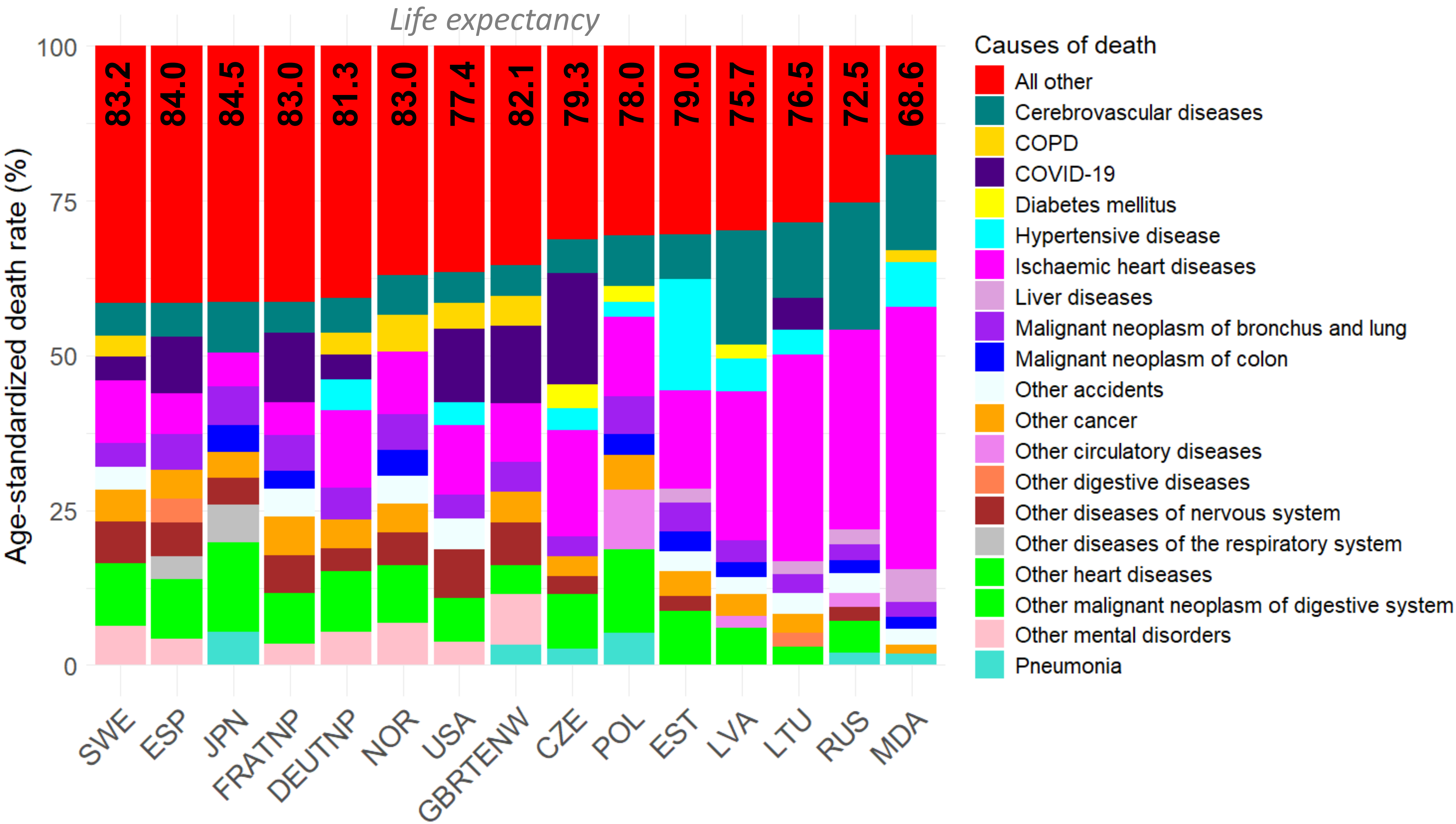
Background



Datasource: Eurostat Database

Background

Relativized age-standardized death rate from leading disease groups, selected countries, latest year



Datasource: Human Cause-of-death Database, Eurostat Databse, Human Life Table Database

Background

- To mitigate the impact of cause of death (COD) certification: validating death certificates with the opinions of medical experts, contrasting clinical COD with autopsy-based COD, **multiple COD analysis**

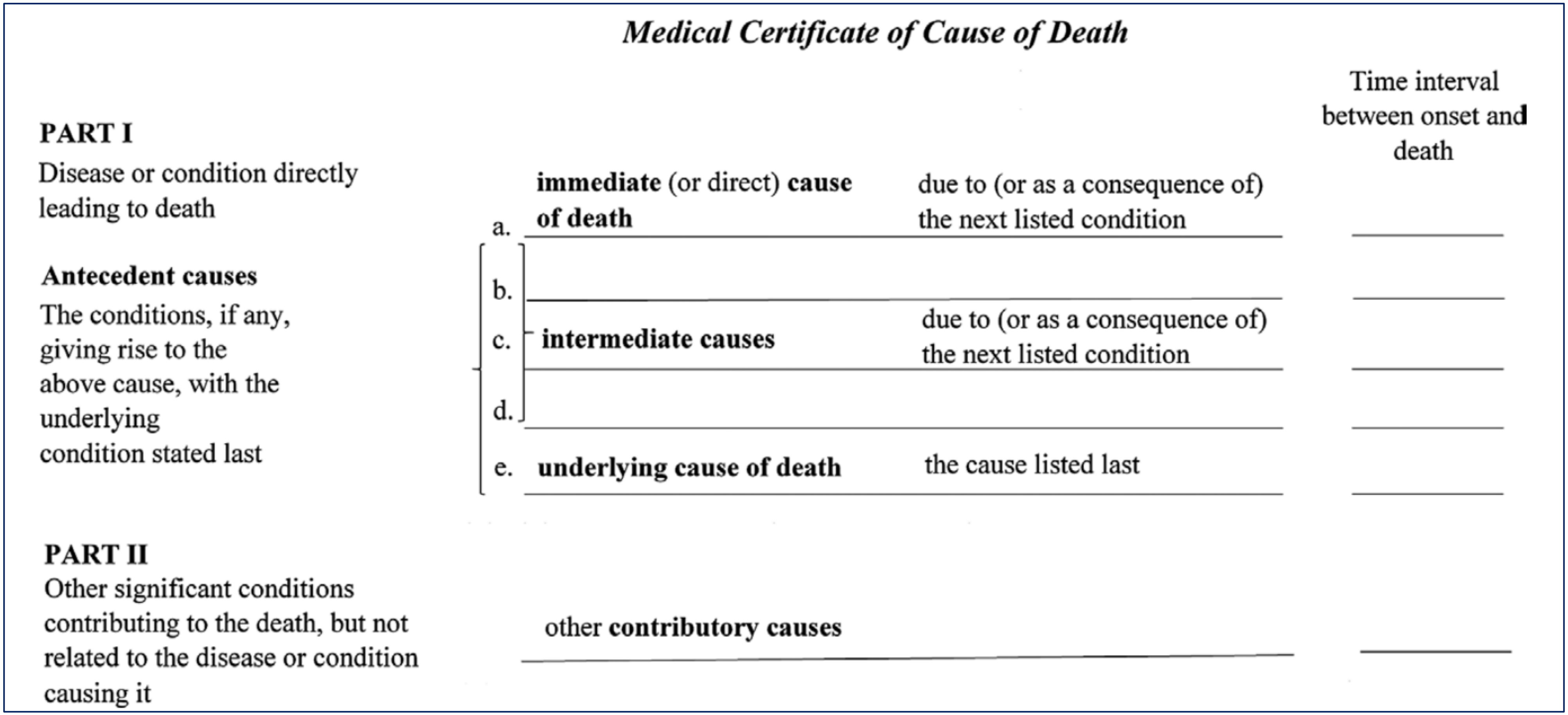
Medical Certificate of Cause of Death

				Time interval between onset and death
PART I Disease or condition directly leading to death	a.	**immediate** (or direct) **cause of death**	due to (or as a consequence of) the next listed condition	
Antecedent causes The conditions, if any, giving rise to the above cause, with the underlying condition stated last	b.			
	c.	**intermediate causes**	due to (or as a consequence of) the next listed condition	
	d.			
	e.	**underlying cause of death**	the cause listed last	
PART II Other significant conditions contributing to the death, but not related to the disease or condition causing it		other **contributory causes**		

Source: Bishop et al. (2023)

Background

- Aim: international comparison of mortality trends by underlying COD and multiple CODs within the context of dynamics of the roles diseases play in the lethal process



Medical Certificate of Cause of Death

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PART II Other significant conditions contributing to the death, but not related to the disease or condition causing it		other **contributory causes**		

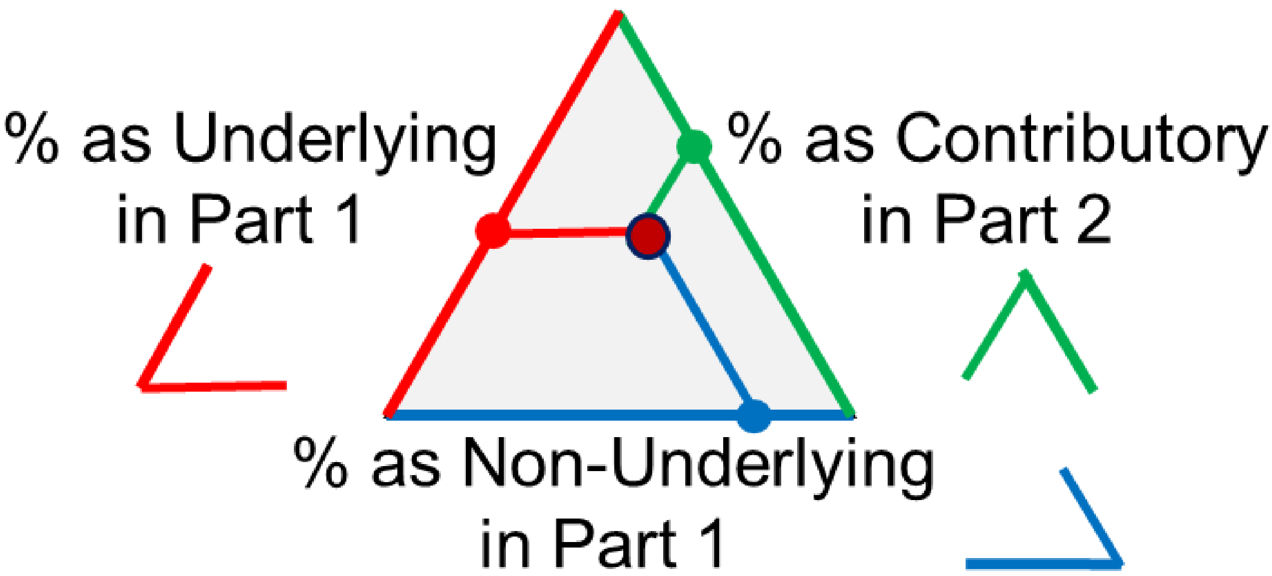
Source: Bishop et al. (2023)

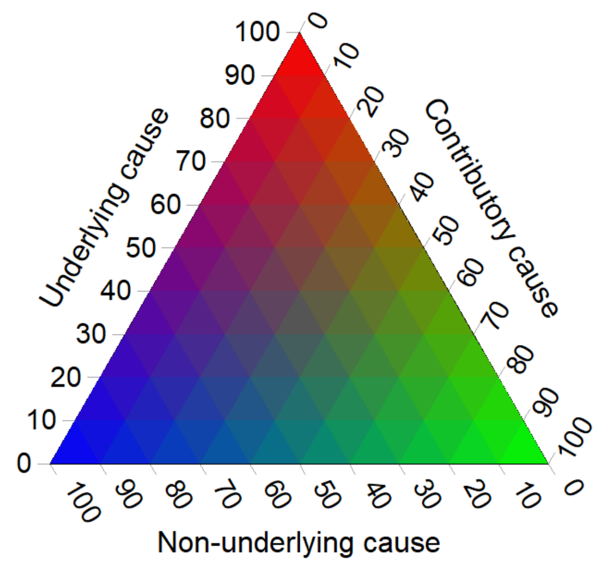
Data

- **Countries**: so far Czechia, Denmark, and the USA
- **Period**: 2000–2021 (or the most recent available data)
- **COD list**: Bishop et al. (2022) list for multiple cause of death analysis (~100 disease groups, preserves sufficient medical detail)
- Results for leading diagnoses in the major cause of death categories: Cardiovascular diseases, Respiratory diseases, Infectious diseases, Mental and nervous diseases, Metabolic diseases

Methods

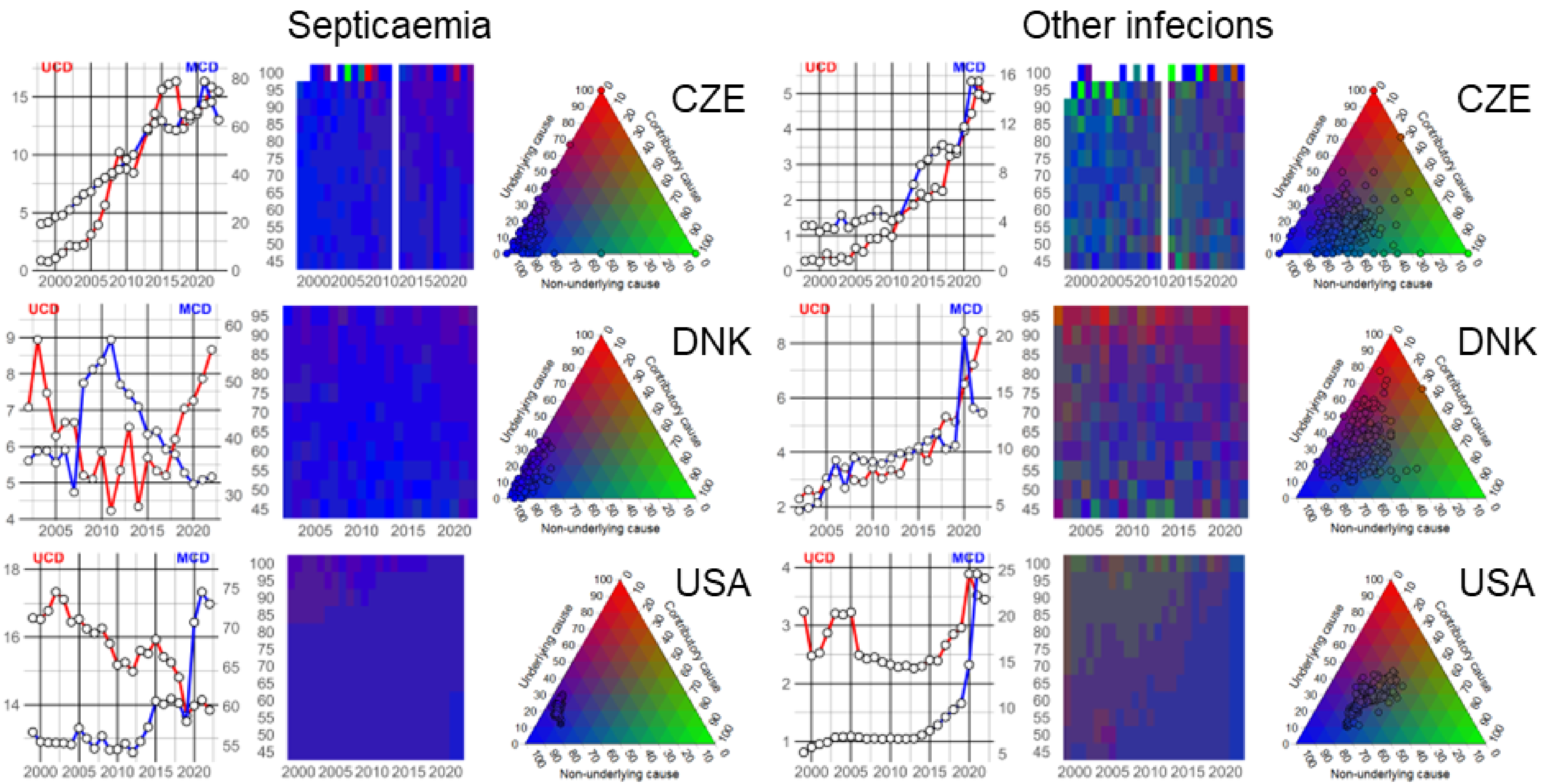
- Age-standardized death rates by cause
- Proportions of recording the disease as (i) underlying, (ii) part of chain of morbid events leading to death and (iii) contributory cause of death
  → compositional data visualized on simplex plots:



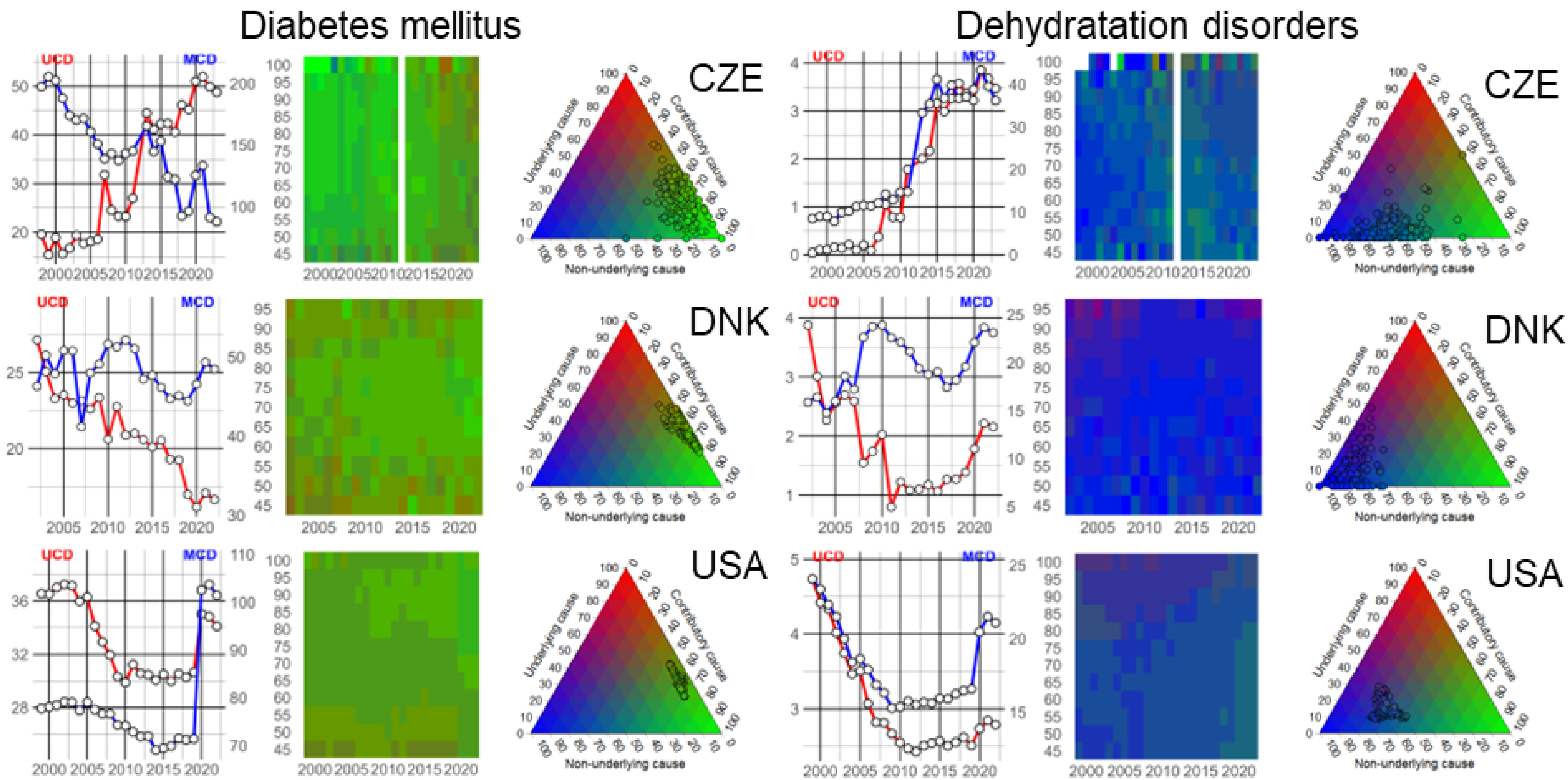


The color scheme is used as a legend for the Lexis surface plot to show trends over time and by age.

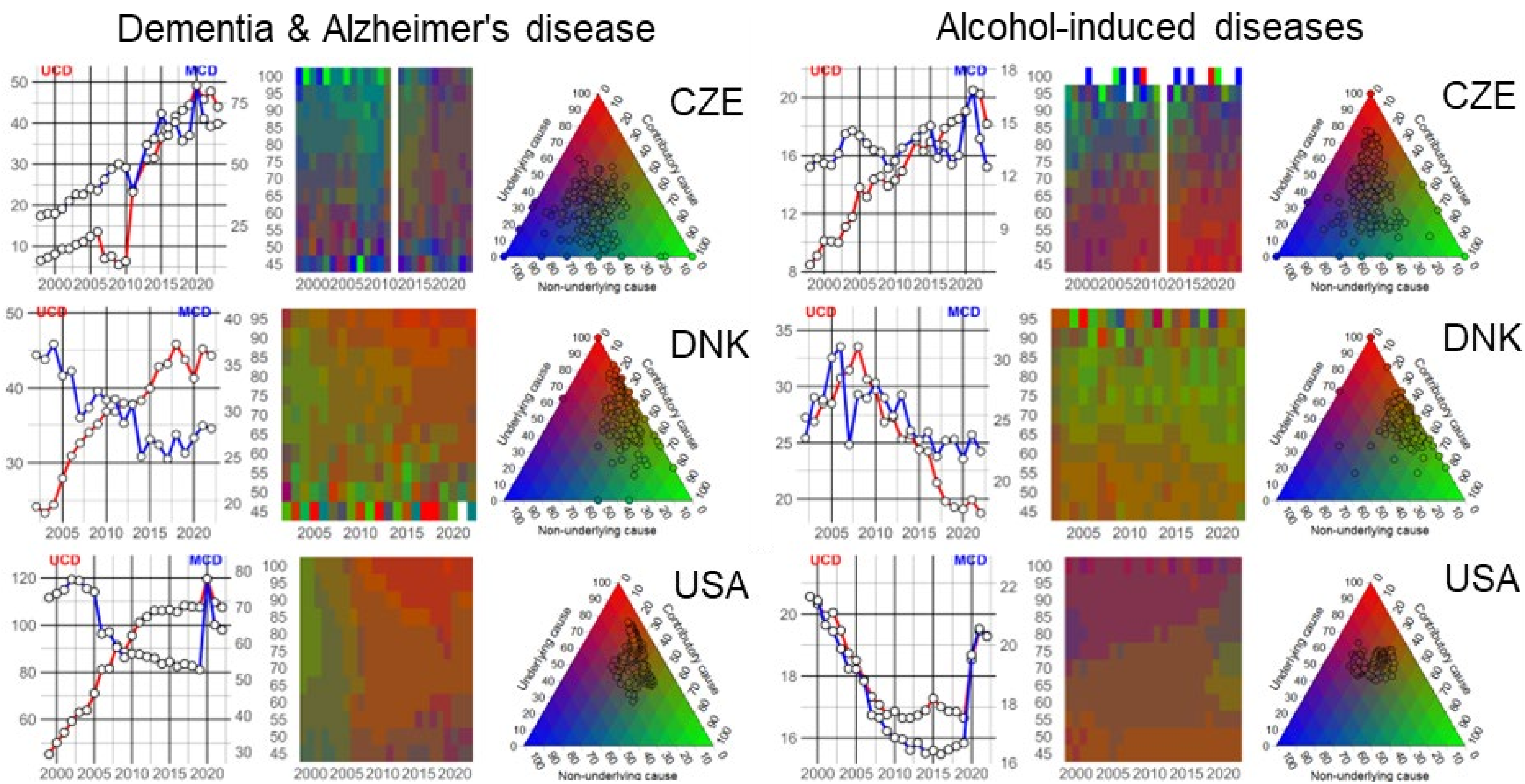
Results: infectious diseases



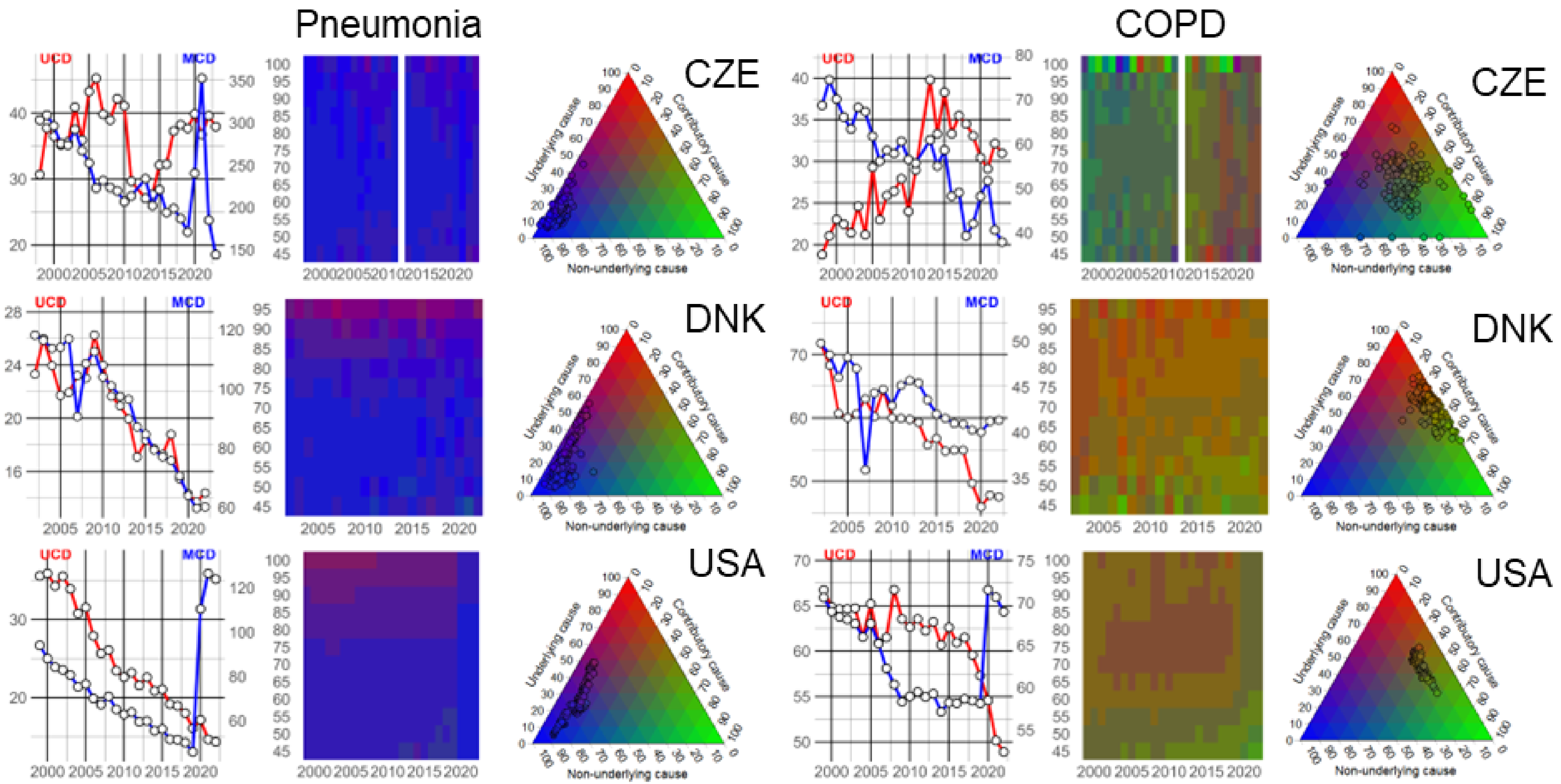
Results: metabolic diseases



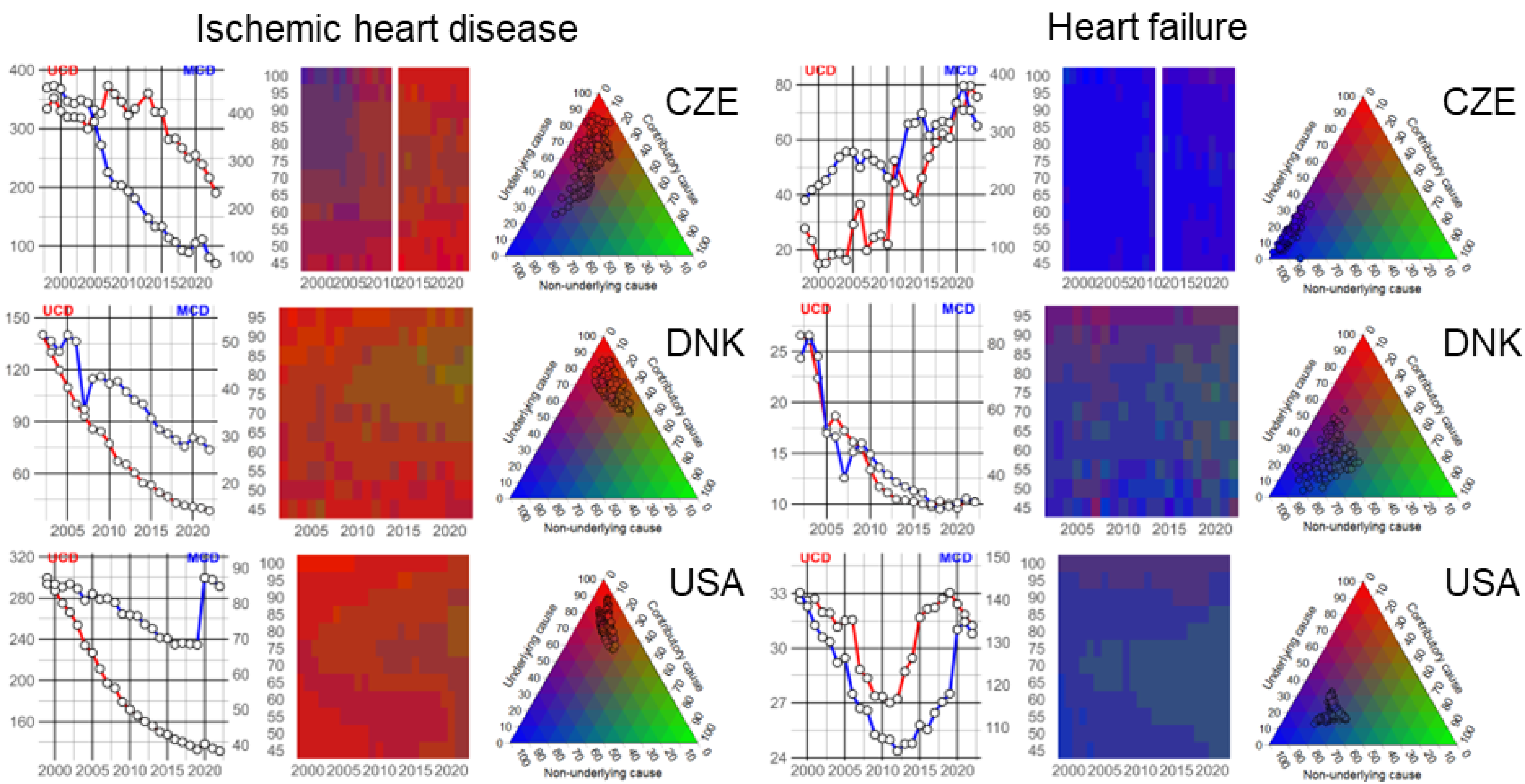
Results: mental and nervous diseases



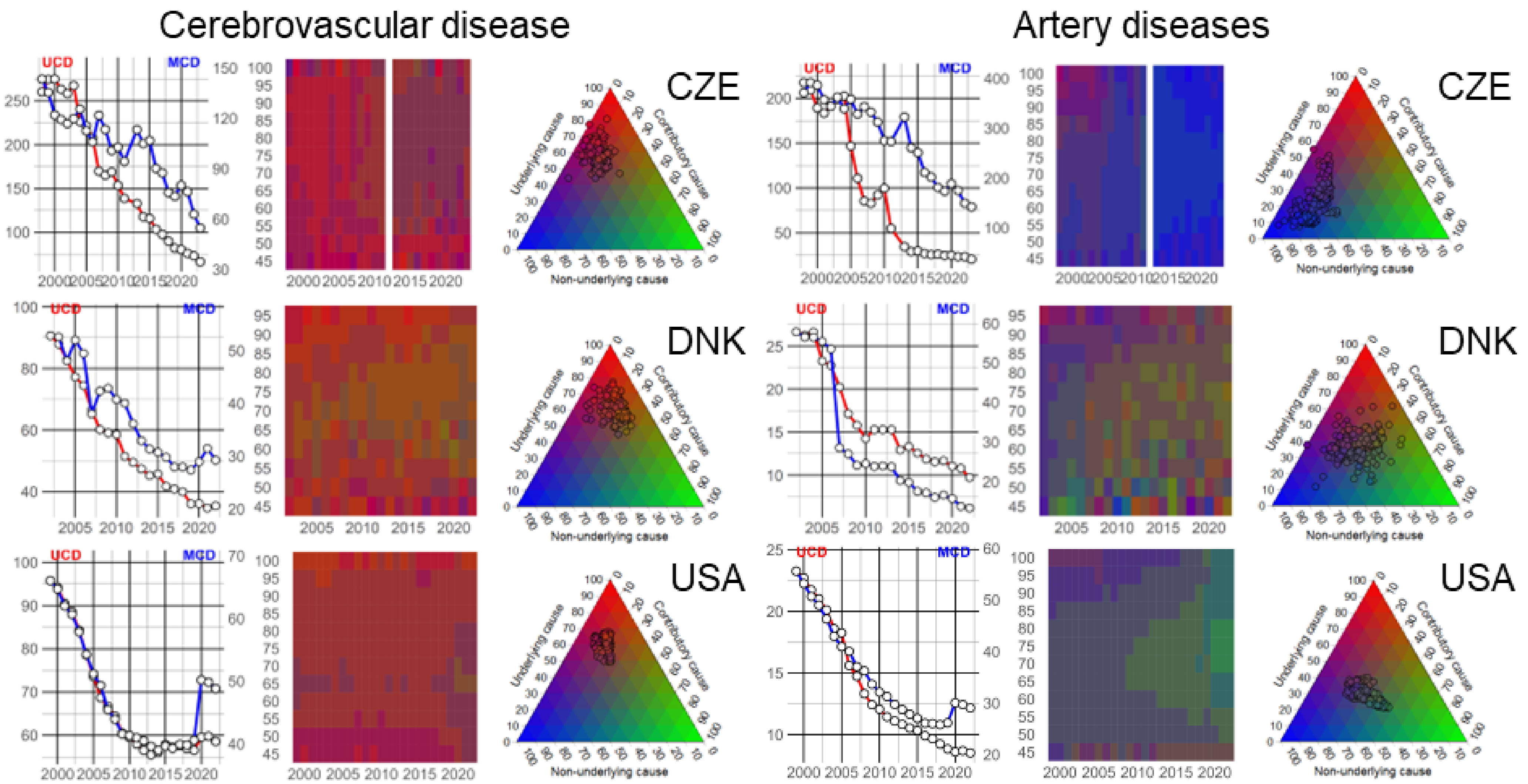
Results: respiratory diseases



Results: cardiovascular diseases I



Results: cardiovascular diseases II



Conclusion

- The recognition of the role played by leading causes of death is consistent across three independent datasets. Yet, Czechia, with its more recently established modern cause-of-death data collection system, demonstrates several unique features.
- Since the 2000s, ischemic heart diseases, artery diseases, leading infectious diseases, and dementia have notably altered their roles in the lethal process, indicating newly emerging trends in the health profiles of the studied populations.
- Diabetes, alcohol-induced diseases, pneumonia, and COPD change their role by age, potentially indicating changes in the severity of these diseases across different age groups.

Thank you.

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Sources

Bishop, K., Balogun, S., Eynstone-Hinkins, J., Moran, L., Martin, M., Banks, E., ... & Joshy, G. (2023). Analysis of multiple causes of death: a review of methods and practices. *Epidemiology*, *34*(3), 333-344.

Bishop, K., Moreno-Betancur, M., Balogun, S., Eynstone-Hinkins, J., Moran, L., Rao, C., ... & Joshy, G. (2023). Quantifying cause-related mortality in Australia, incorporating multiple causes: observed patterns, trends and practical considerations. *International Journal of Epidemiology*, *52*(1), 284-294.

Data sources:
Danish National Registry of Causes of Death, Statistics Denmark
Czech statistical Office and Czech Institute of Health Information and Statistics
Center for Disease Control and Prevention, USA
Eurostat Database
HumanCause of Death Database
Human Mortality Database