Multiple causes of death

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Plan of the webinar

1 Introduction

2 Accuracy (Cosmo)

3 Diversification

4 Competing causes

5 Association (Elizaveta)

6 Effect on mortality risks (Elizaveta)

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1. Introduction

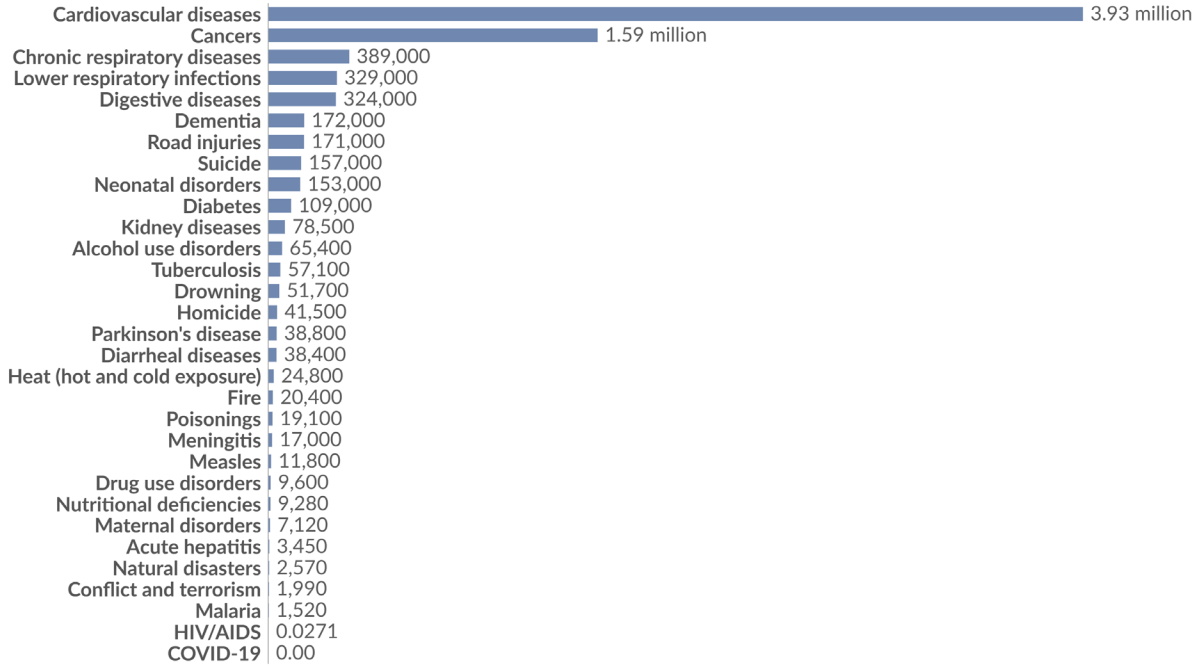
Why and from what do we die?

- Relates to how long we can live
- Help finding ways to save lives
- Inform on the burden of specific diseases in a population

Historical perspective

Causes of death, European Region (WHO), 1980

The estimated annual number of deaths from each cause. Estimates come with wide uncertainties, especially for countries with poor vital registration[1].



Data source: IHME, Global Burden of Disease (2024)

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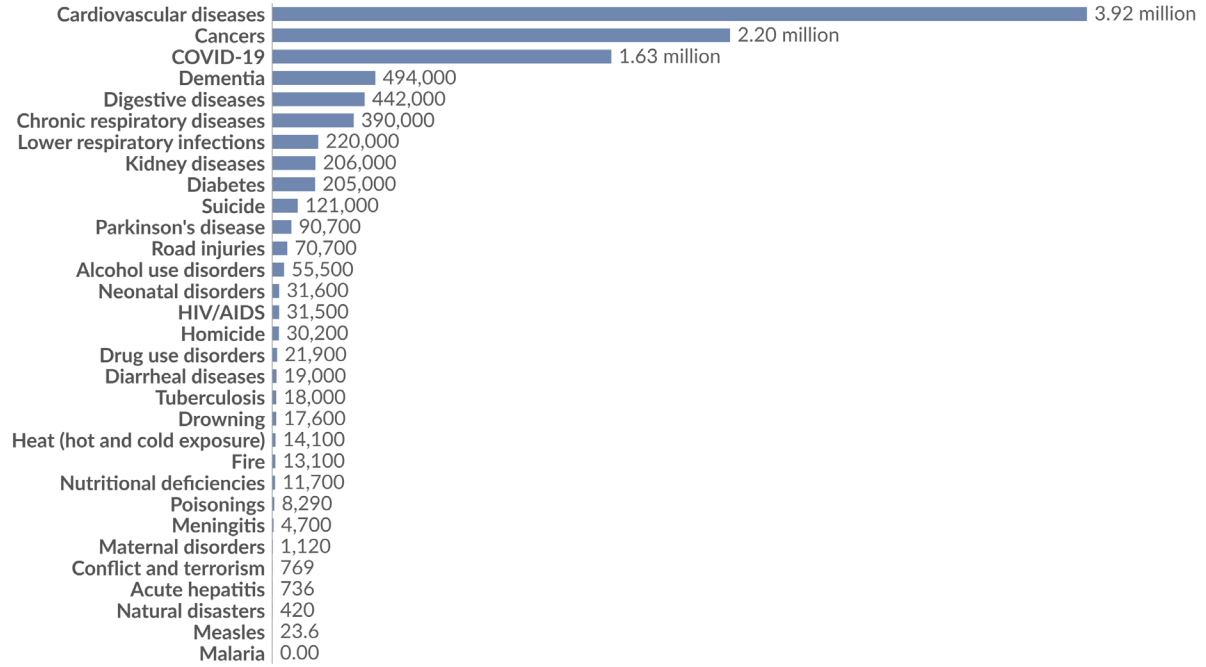
1. Civil Registration and Vital Statistics system A Civil Registration and Vital Statistics system (CRVS) is an administrative system in a country that manages information on births, marriages, deaths and divorces. It generates and stores 'vital records' and legal documents such as birth certificates and death certificates.

You can read more about how deaths are registered around the world in our article: How are causes of death registered around the world?

Causes of death, European Region (WHO), 2021

The estimated annual number of deaths from each cause. Estimates come with wide uncertainties, especially for countries with poor vital registration[1].



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We die once, but from how many causes?

Causes of death statistics often only show the underlying cause of death. But…

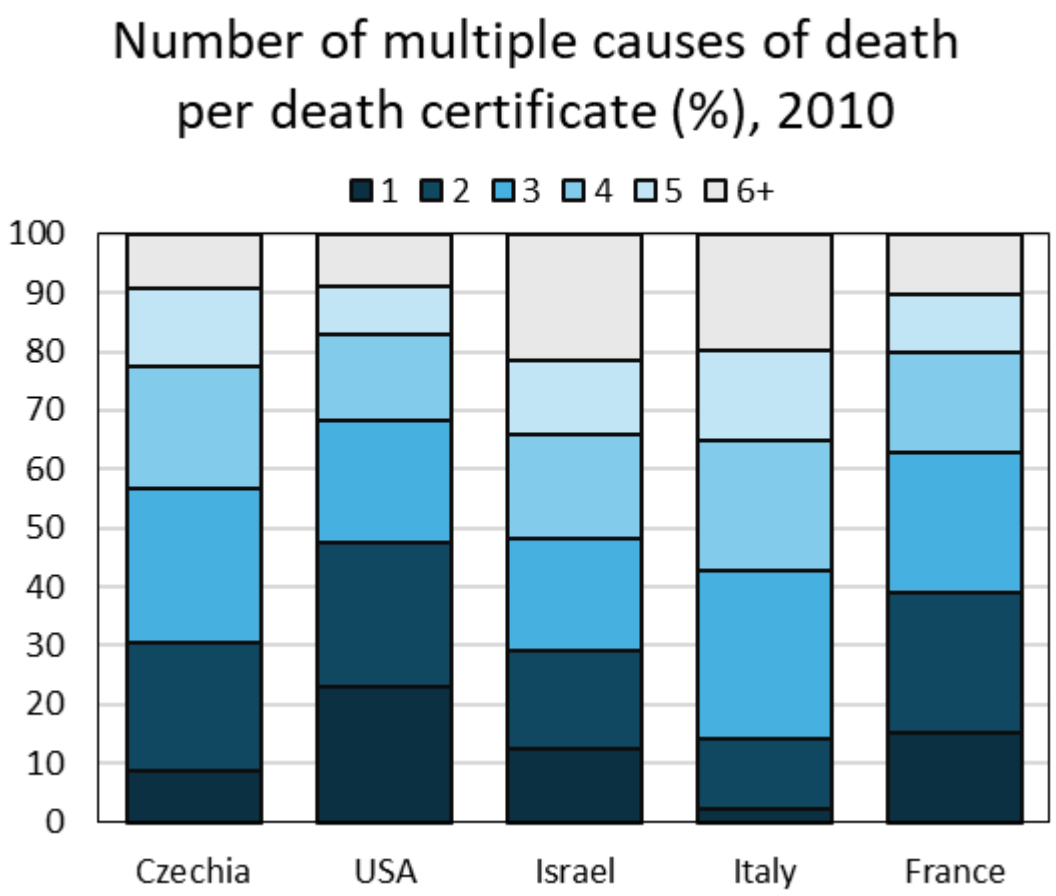
- Multiple causes can contribute to one death
- Only looking at one cause can downplay the roles of other diseases in the mortality process
- Can hide the mortality burden of specific diseases in a population.

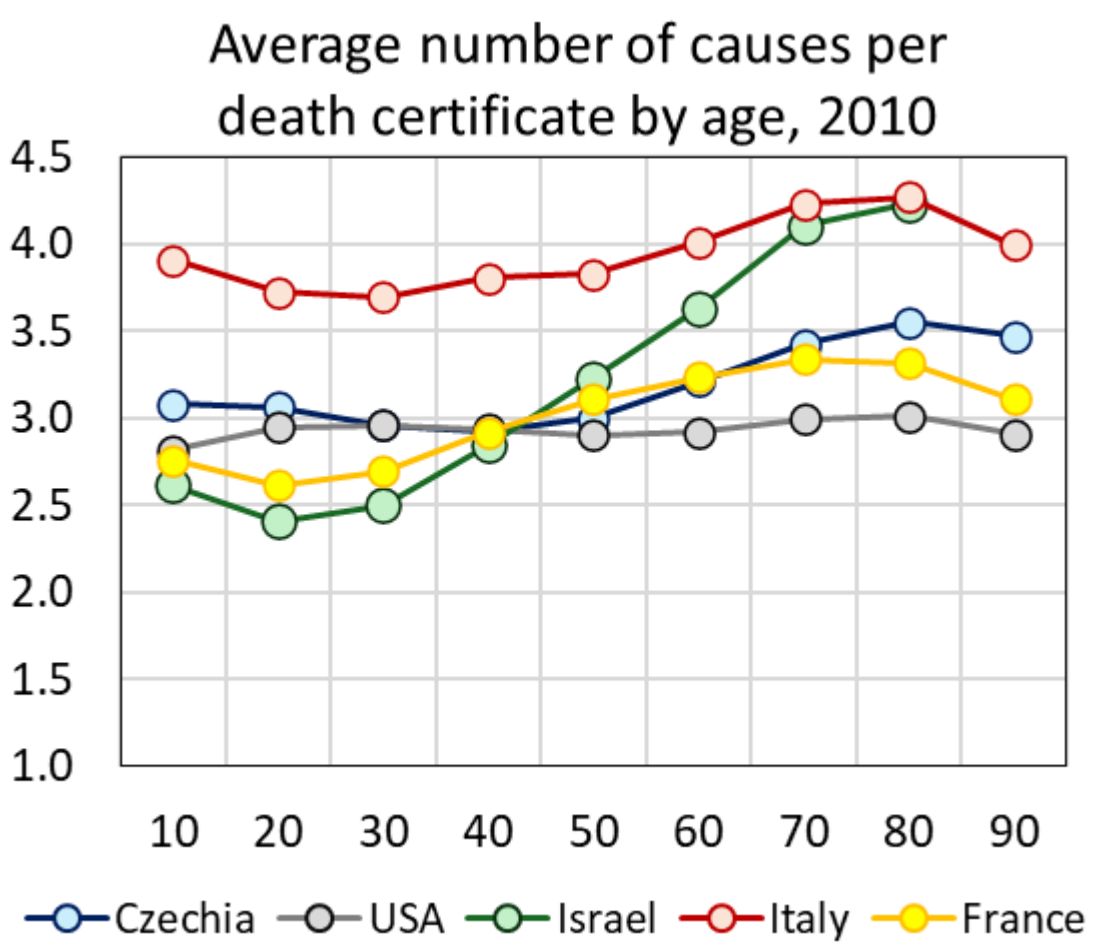
Medical Certificate of Cause of Death

			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**		

FIGURE 1. Layout of a standard international form of Medical Certificate of Cause of Death.

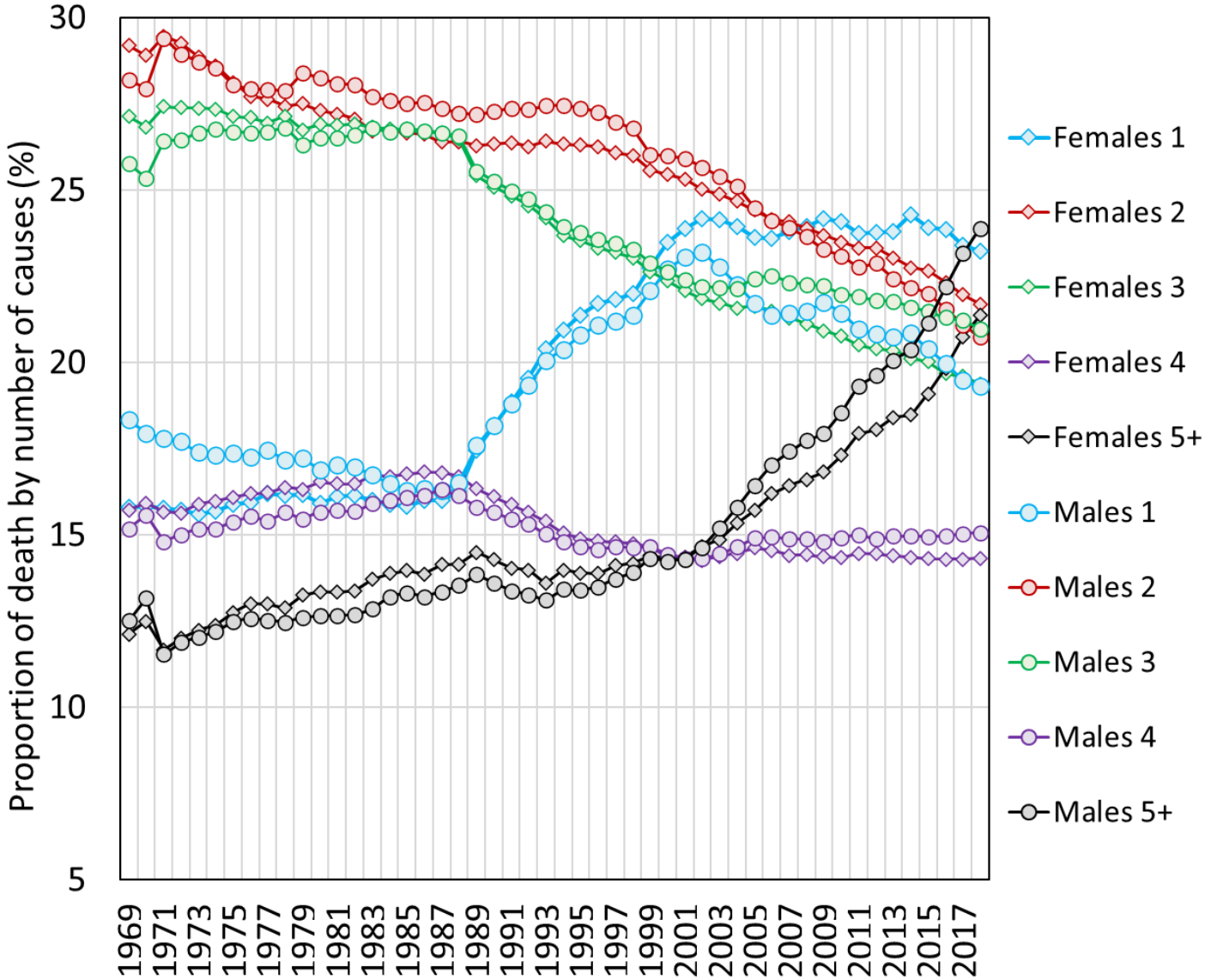
How many causes?





Source: https://mcod.web.ined.fr/wiki/Accueil

How many causes? Example for the U.S.



Source:
https://www.nber.org/research/data/mortality-data-vital-statistics-nchs-multiple-cause-death-data

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Mortality underestimation with underlying approach

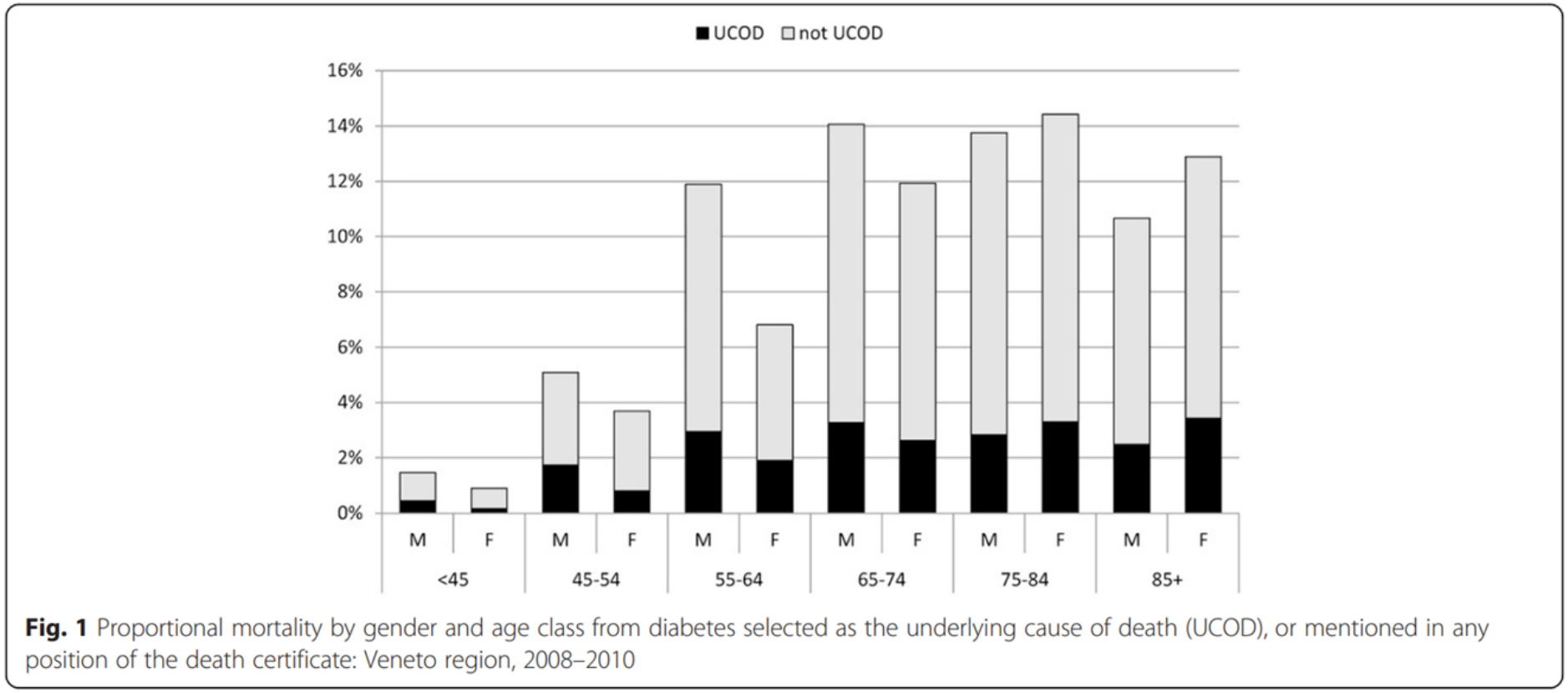

Fig. 1 Proportional mortality by gender and age class from diabetes selected as the underlying cause of death (UCOD), or mentioned in any position of the death certificate: Veneto region, 2008–2010

Source: Fedeli, U., Zoppini, G., Goldoni, C. A., Avossa, F., Mastrangelo, G., & Saugo, M. (2015). Multiple causes of death analysis of chronic diseases: the example of diabetes. Population health metrics, 13, 1-10.

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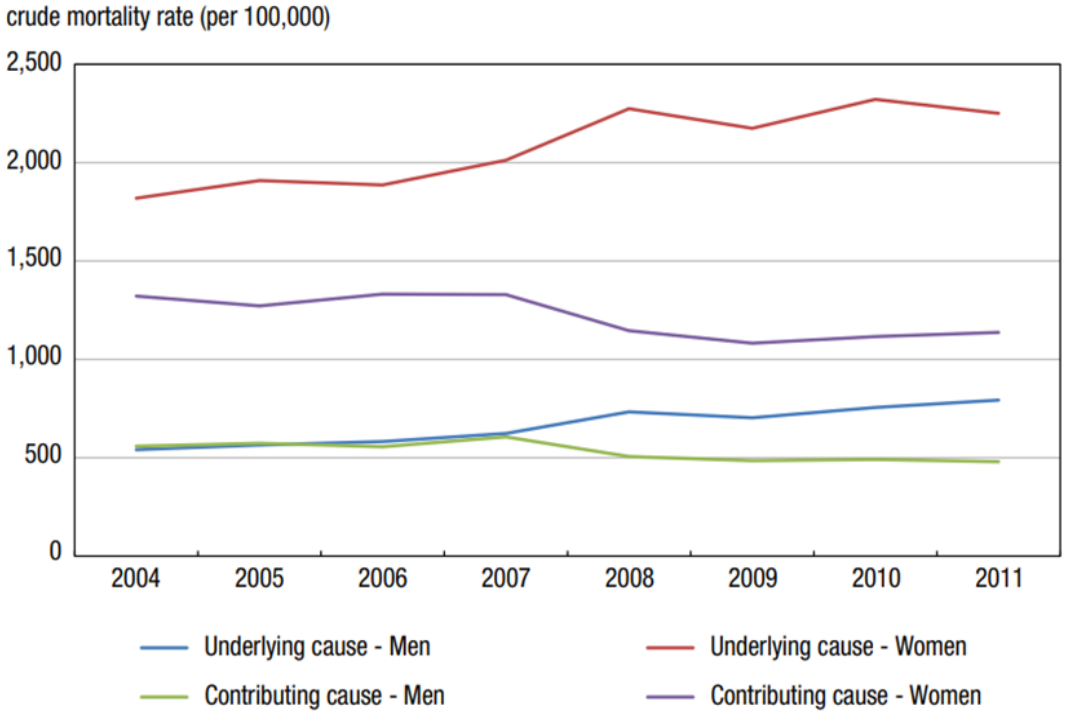
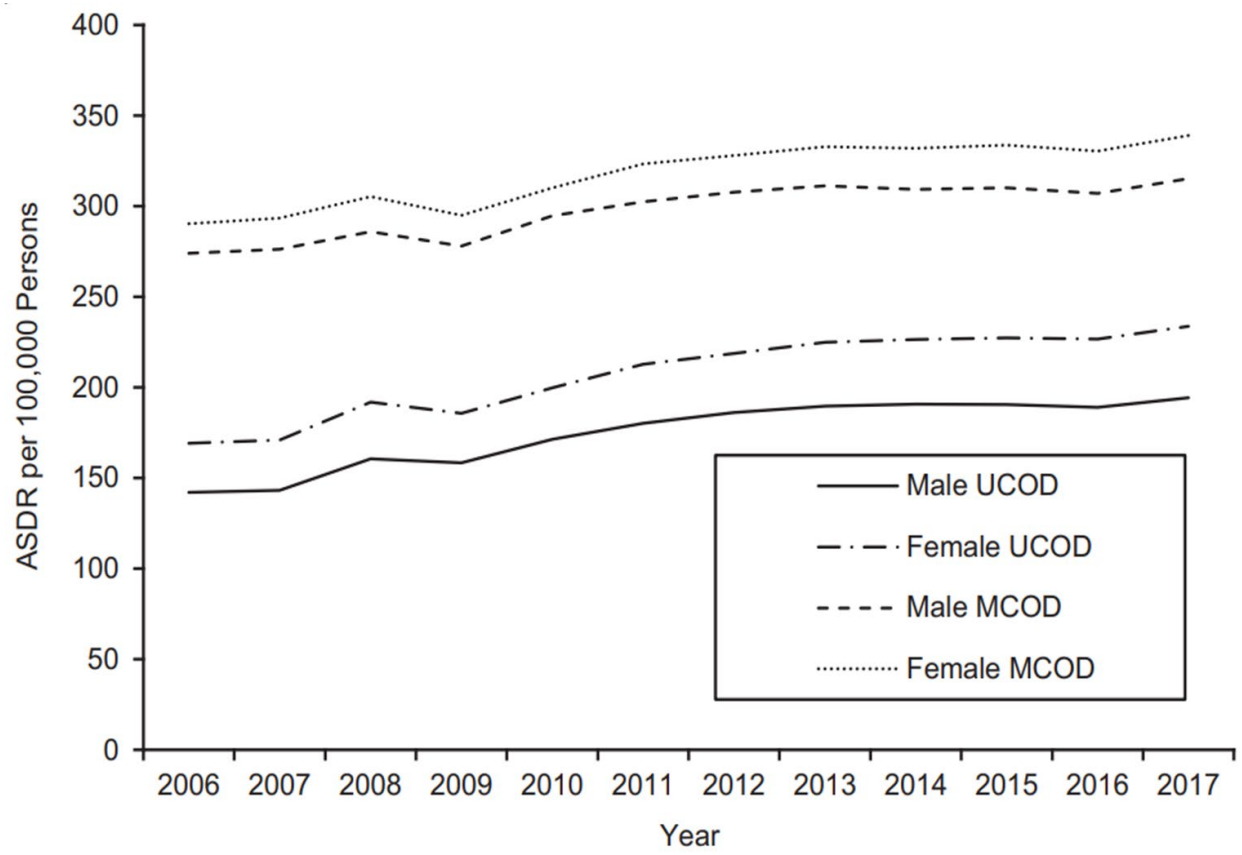
Mortality underestimation with underlying approach
Alzheimer and dementia

Figure 2
Crude mortality rate from Alzheimer's disease as underlying and contributing causes, by sex, population age 85 or older, 2004 to 2011, Canada



Source: Multiple-Cause-of-Death file, 2004 to 2011.



Source: Park, J. (2016). *Mortality from Alzheimer's disease in Canada: A multiple-cause-of-death analysis, 2004 to 2011*. Statistics Canada.

Adair, T., Temple, J., Anstey, K. J., & Lopez, A. D. (2022). Is the rise in reported dementia mortality real? Analysis of multiple-cause-of-death data for Australia and the United States. *American Journal of Epidemiology*, *191*(7), 1270-1279.

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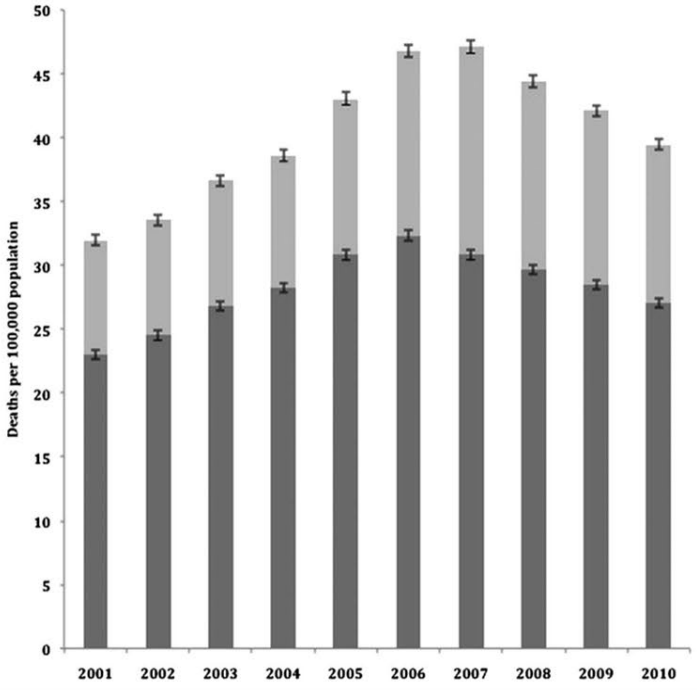
Mortality underestimation with underlying approach
Sepsis

Figure 1 Direct age-standardised rates of death definitely, dark grey, and maybe, light grey, associated with sepsis, England 2001–2010, with 95% CI for the rate.



Source: McPherson, D., Griffiths, C., Williams, M., Baker, A., Klodawski, E., Jacobson, B., & Donaldson, L. (2013). Sepsis-associated mortality in England: an analysis of multiple cause of death data from 2001 to 2010. BMJ open, 3(8), e002586. ;

Fedeli, U., Piccinni, P., Schievano, E., Saugo, M., & Pellizzer, G. (2016). Growing burden of sepsis-related mortality in northeastern Italy: a multiple causes of death analysis. *BMC infectious diseases*, *16*, 1-6.

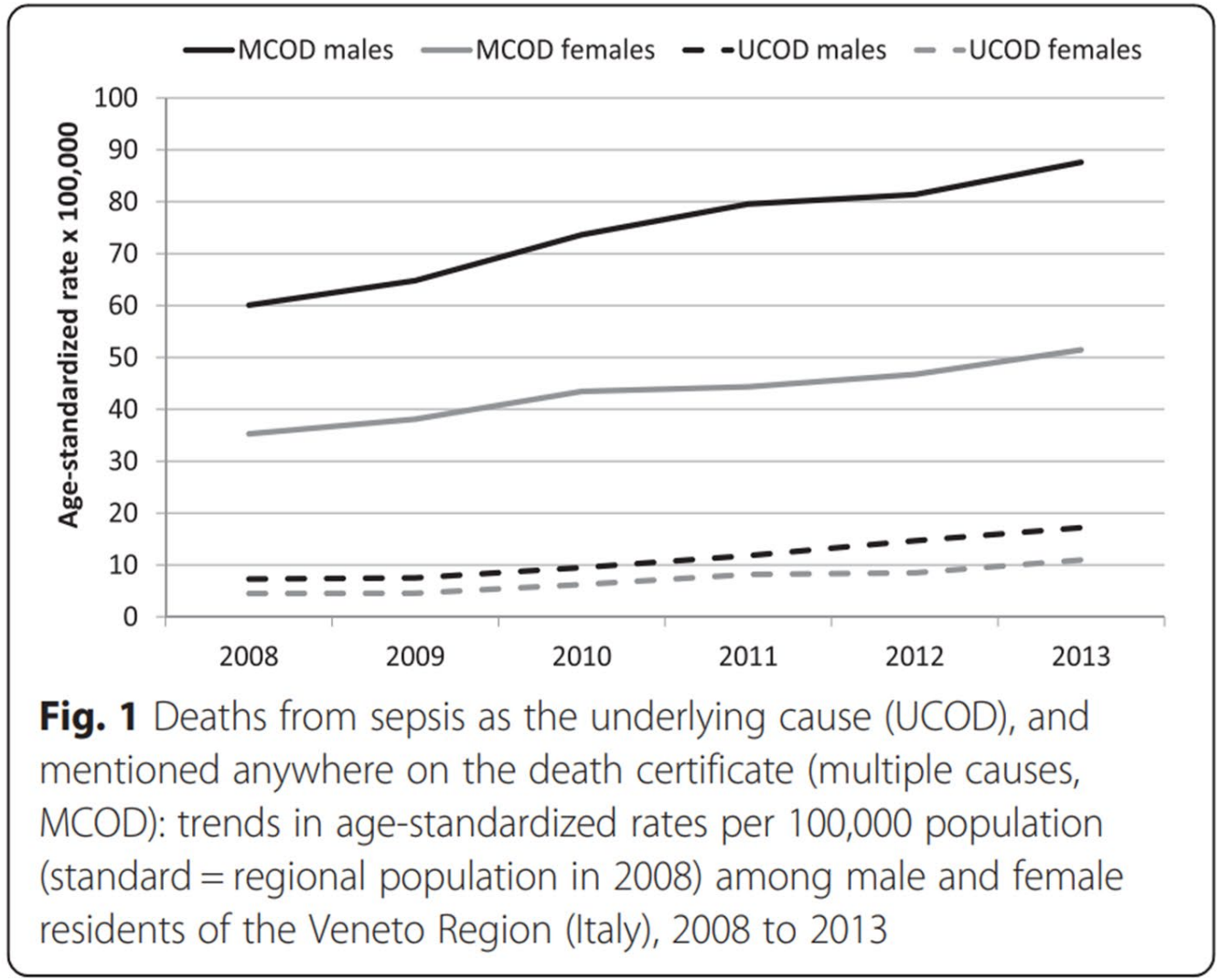
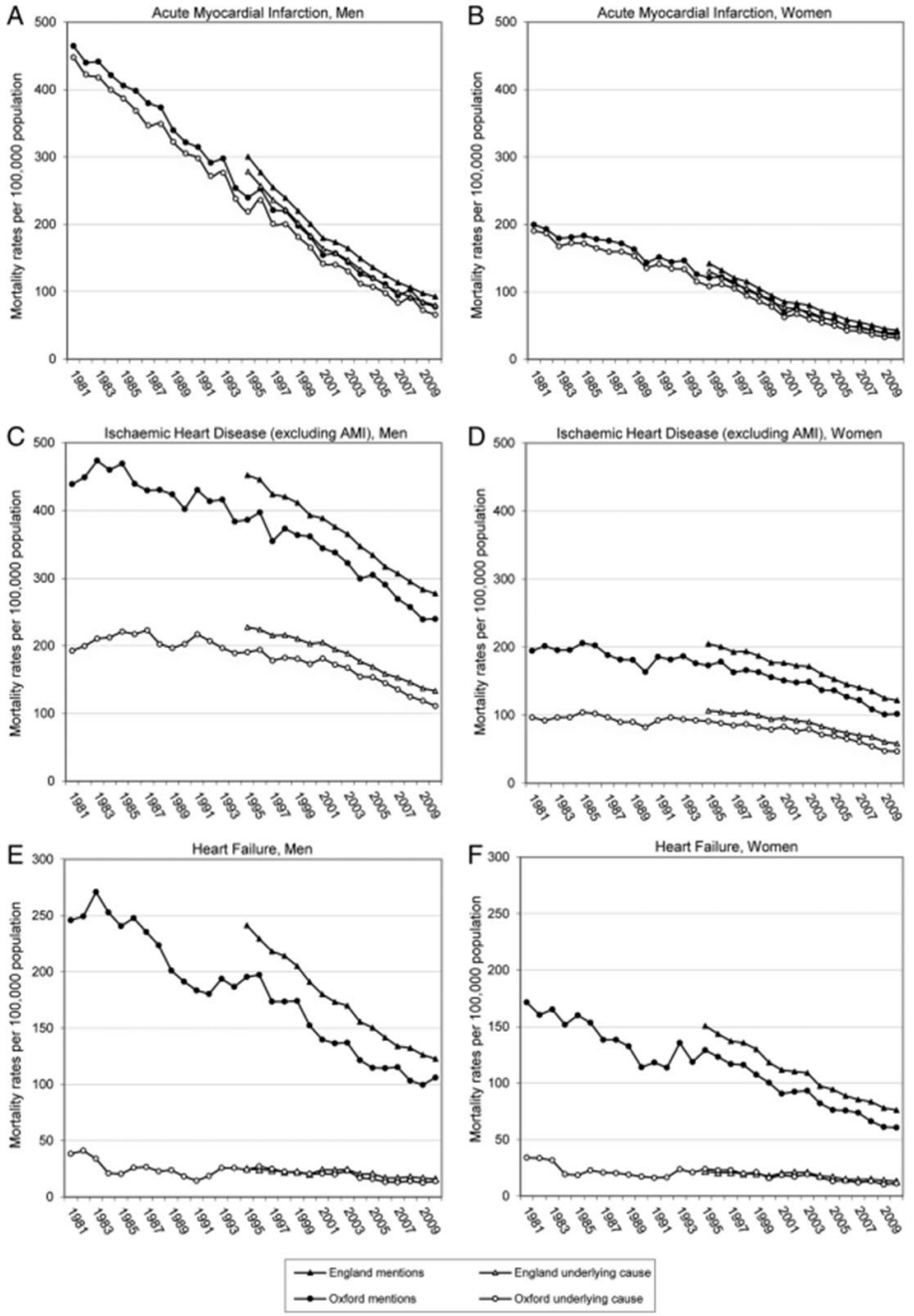


Fig. 1 Deaths from sepsis as the underlying cause (UCOD), and mentioned anywhere on the death certificate (multiple causes, MCOD): trends in age-standardized rates per 100,000 population (standard = regional population in 2008) among male and female residents of the Veneto Region (Italy), 2008 to 2013

Mortality underestimation with underlying approach

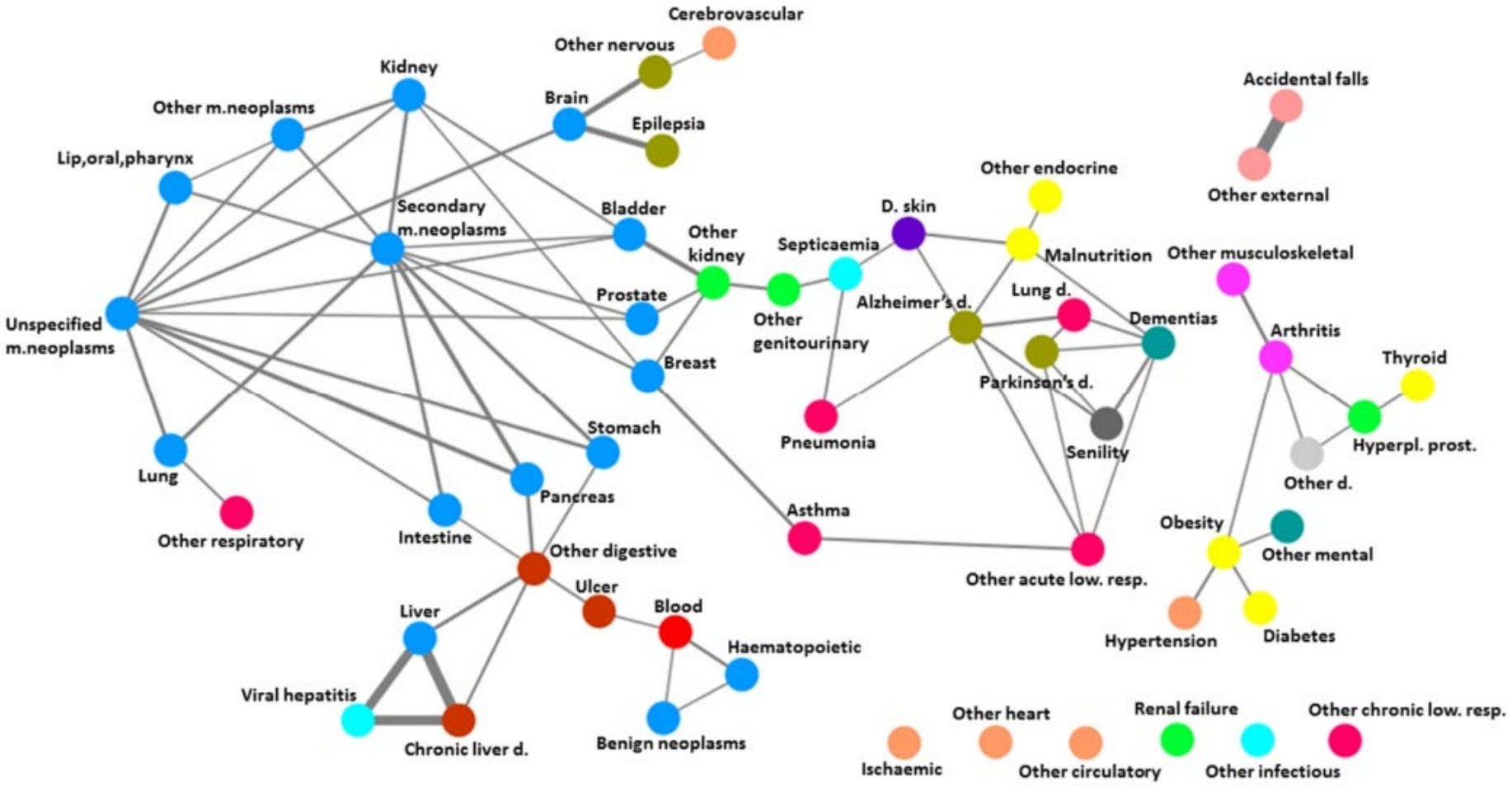
Cardiovascular diseases

Figure 1 Age-standardised mortality rates for acute myocardial infarction (AMI), other ischaemic heart disease and heart failure from 1995 to 2010 for the population aged 35 years and over.



Source: Rahimi, K., Duncan, M., Pitcher, A., Emdin, C. A., & Goldacre, M. J. (2015). Mortality from heart failure, acute myocardial infarction and other ischaemic heart disease in England and Oxford: a trend study of multiple-cause-coded death certification. J Epidemiol Community Health, 69(10), 1000-1005.

Association between causes



Source: Egidi V., Salvatore M. A., Rivellini G., & D'Angelo S. (2018). A network approach to studying cause-of-death interrelations. *Demographic Research*, 38, 373-400

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Take home message

The underlying causes of death only represent the tip of the iceberg!

Multiple causes of death analysis can better capture the role of specific diseases in the process leading to death!

2. Accuracy of multiple causes of death

Research questions

- Are the MCoD data representative of end of life health conditions?
  - NO!
- Do they better represent the chain of events leading to death?
  - MAYBE!

Data: Danish registers

- Cause of death register
  - Including all information on leading cause of death, contributing causes, and co-causes
- Register of chronic diseases
  - Including individuals diagnosed with: COPD, dementia, and diabetes

Data: Study population

- Danish population diagnosed with a chronic condition from 2010 who are at least 50 years old:
  - Sex
  - Birth date
  - Date (and age) at diagnosis
  - Date (and age) at death
  - Cause of death (1.a-1.d, 2.1-2.4)

Methods: Descriptive analysis

- Exploratory analysis to investigate:
  - Number of times (%) each chronic disease appears on the death certificate (in any position), both for the whole study population and only for those with 1 year elapsed between diagnosis and death
  - Location of the chronic disease on the death certificate (%), for those who have the chronic disease on the death certificate
  - Number of deaths (%) by causes of death, for those who have the chronic disease on the death certificate

Methods: Descriptive analysis

- Multiple decrement life tables computed by:
  - Sex
  - Period: 2010-11 to 2018-19
  - Chronic disease: COPD, dementia, and diabetes
  - Cause of death: Human Cause of Death Database (HCD), 17 categories

Descriptive results dementia - I

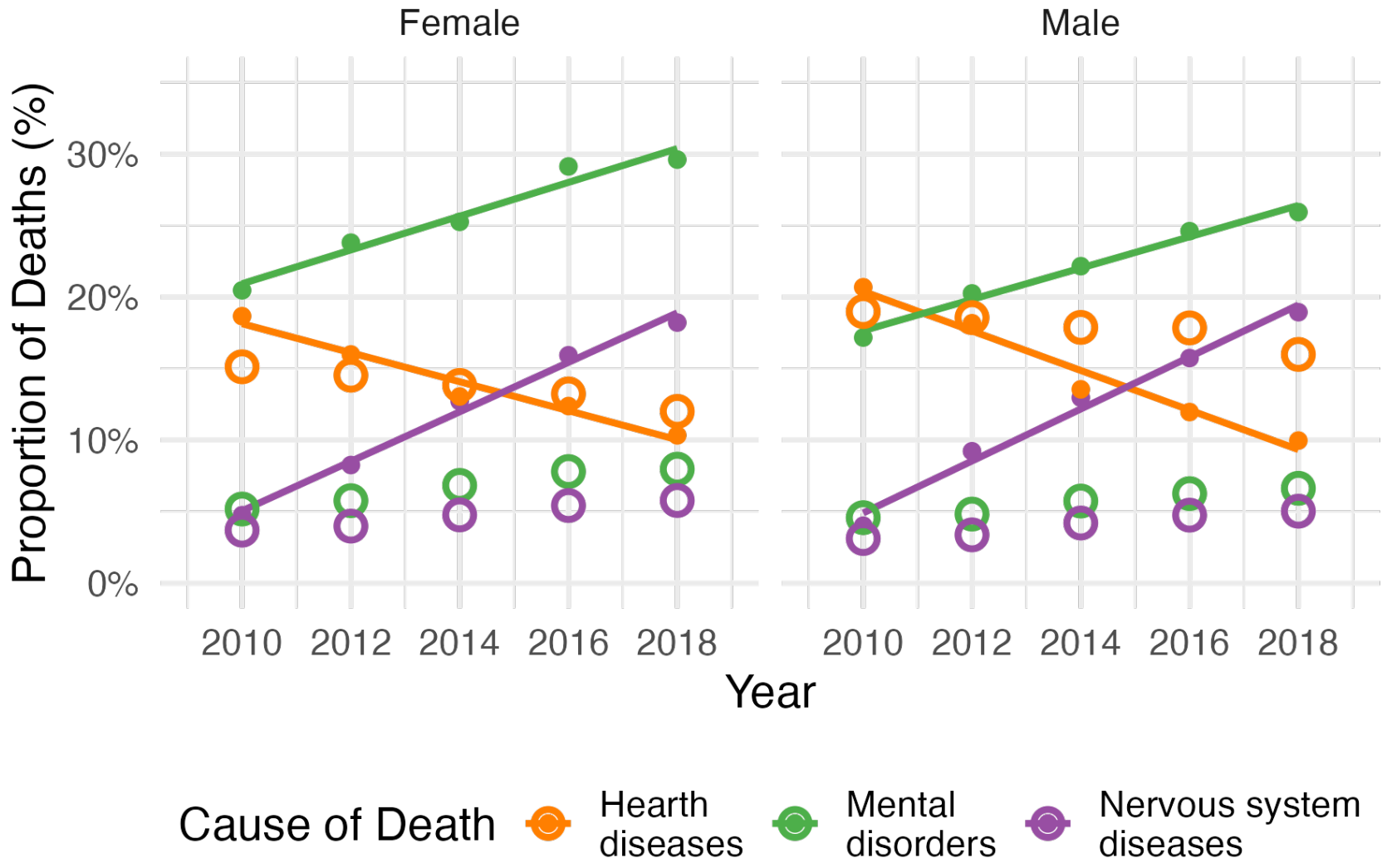
Total study population		
Has dementia	**n**	**%**
FALSE	20054	44,8
TRUE	**24665**	**55,2**

Subsample of those died within a year from diagnosis		
Has dementia	**n**	**%**
FALSE	7590	59,3
TRUE	**5207**	**40,7**

Placement on death certificate	**n**	**%**
1.a	5323	21,6
1.b	2694	10,9
1.c	779	3,2
1.d	3776	15,3
2.1	8752	35,5
2.2	2300	9,3
2.3	745	3,0
2.4	271	1,1

Placement on death certificate	**n**	**%**
1.a	759	14,6
1.b	482	9,3
1.c	166	3,2
1.d	615	11,8
2.1	2152	41,3
2.2	696	13,4
2.3	238	4,6
2.4	92	1,8

Proportion of deaths among those with dementia by three leading causes of death, sex, year



Descriptive results dementia - II

Among those with dementia somewhere in the death certificate			
CoD group	**CoD name**	**n**	**%**
1	Infectious diseases	263	28,6
2	Neoplasm	1598	34,8
3	Diseases of blood	51	31,7
4	Endocrine diseases	446	34,9
5	**Mental disorders**	**10480**	**98,3**
6	**Nervous system diseases**	**5944**	**84,0**
7	**Hearth diseases**	**2111**	**39,6**
8	Cerebrovascular diseases	1387	39,4
9	Other circulatory diseases	175	35,9
10	Acute respiratory diseases	95	5,2
11	Other respiratory diseases	883	34,0
12	Digestive system diseases	435	34,0
13	Skin and musculoskeletal diseases	85	32,7
14	Genitourinary and precnancy diseases	146	18,9
15	Perinatal and congenital	48	50,0
16	External causes	514	48,2
17	Ill-defined causes	4	0,1

Descriptive results diabetes - I

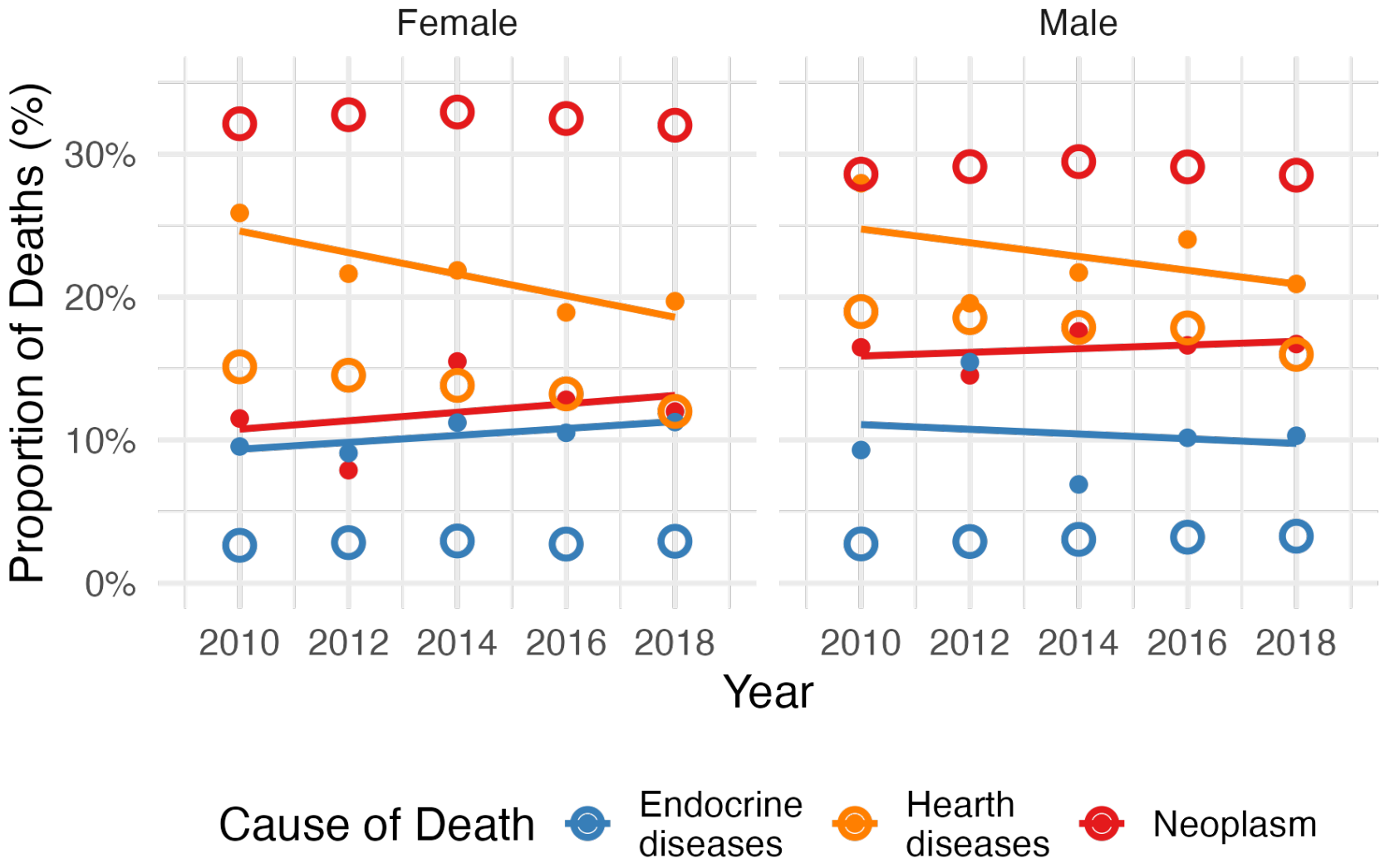
Total study population		
Has diabetes	**n**	**%**
FALSE	17381	85,9
TRUE	**2855**	**14,1**

Placement on death certificate	**n**	**%**
1.a	6	0,2
1.b	62	2,2
1.c	72	2,5
1.d	111	3,9
2.1	1287	45,1
2.2	866	30,4
2.3	359	12,6
2.4	90	3,2

Subsample of those died within a year from diagnosis		
Has diabetes	**n**	**%**
FALSE	3340	86,8
TRUE	**507**	**13,2**

Placement on death certificate	**n**	**%**
1.a	15	3,0
1.b	13	2,6
1.c	16	3,2
1.d	243	47,9
2.1	146	28,8
2.2	60	11,8
2.3	14	2,8
2.4	.	.

Proportion of deaths among those with diabetes by three leading causes of death, sex, year



Descriptive results diabetes - II

Among those with diabetes somewhere in the death certificate			
CoD group	**CoD name**	**n**	**%**
1	Infectious diseases	51	11,1
2	**Neoplasm**	**679**	**9,5**
3	Diseases of blood	16	18,2
4	**Endocrine diseases**	**498**	**36,7**
5	Mental disorders	102	12,8
6	Nervous system diseases	81	13,3
7	**Hearth diseases**	**544**	**17,0**
8	Cerebrovascular diseases	179	15,6
9	Other circulatory diseases	49	15,2
10	Acute respiratory diseases	70	11,7
11	Other respiratory diseases	321	16,6
12	Digestive system diseases	154	16,3
13	Skin and musculoskeletal diseases	15	12,3
14	Genitourinary and precnancy diseases	46	15,3
15	Perinatal and congenital	4	20,0
16	External causes	46	12,9
17	Ill-defined causes	.	.

Preliminary take home message

- MCoD data cannot be used as proxy of individual's health conditions at the end of life
  - At most half of the times (dementia) the chronic disease appears somewhere in the death certificate
- MCoD seem to be suitable for better understanding the chain of events leading to death
  - Looking at specific causes of death, associated with the chronic disease, it seems that the appearance rate is much higher
  - This is however not the case for diabetes

Next steps

- Investigate empirically whether age at diagnosis, age at death, time between diagnosis and death, cause of death (…) influence whether the chronic disease appears on the death certificate and where
- Look deeper into the MDLT results: compute confidence intervals to highlight differences between causes and over time
- Analyze cancer data and hospitalizations caused by health shocks (e.g., strokes)

3. Cause diversification

Diversification in causes of death

- Shift from a few major causes of death towards more diverse (“smaller”) causes of death
- Causes of death profile is becoming increasingly complex
- Lead to lower predictability of causes of death
- Lead to more fragmented effort to reduce mortality

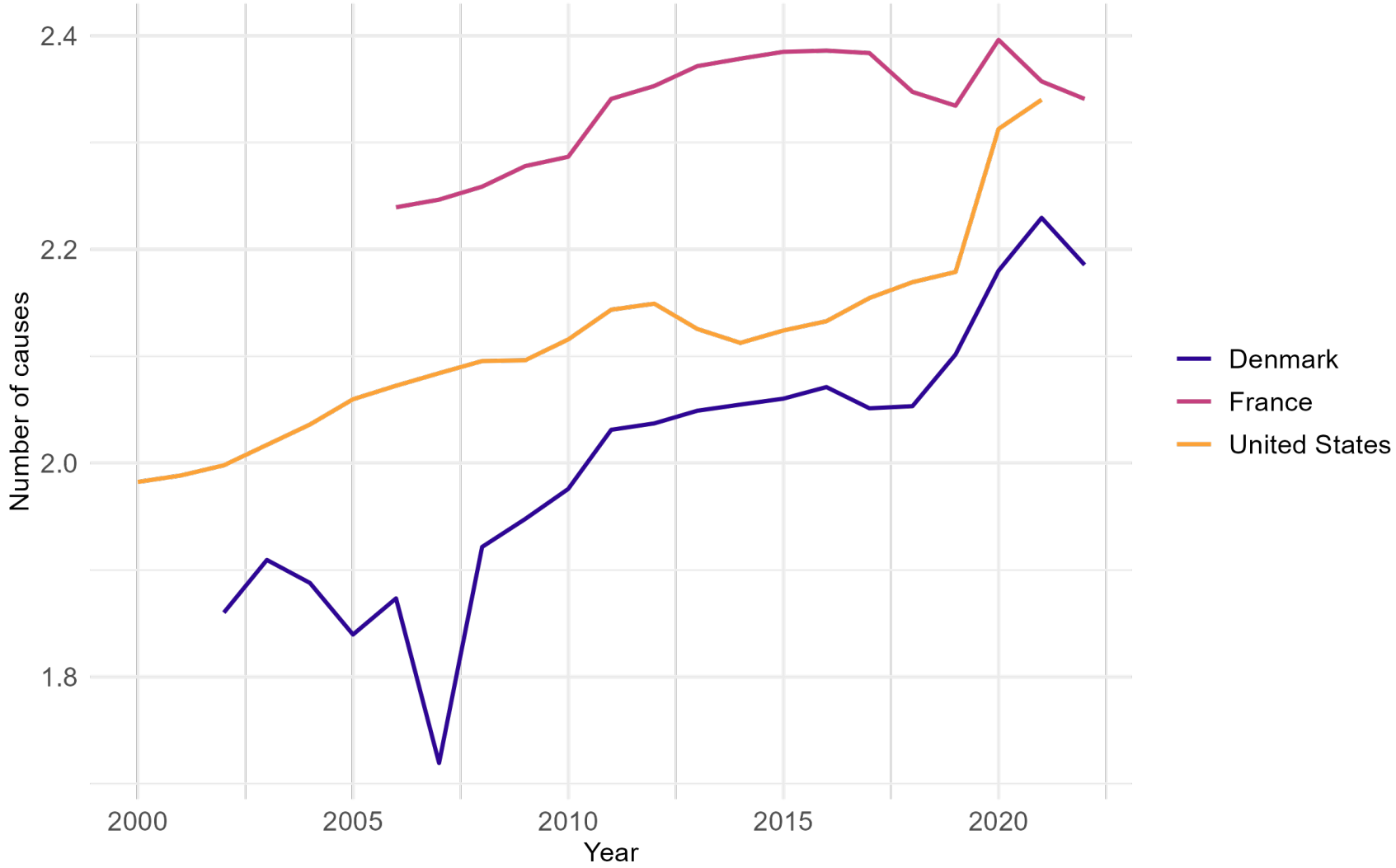
- But, cause diversity are often analysed based on the underlying cause only

How to estimate MCoD diversity

- Number of causes
- Relative abundance of causes
  - Diversity measures (e.g., Simpson index and Shannon entropy)
  - Are causes equally contributing to diversity or should the UCD be more important?

We came up with a framework to estimate MCoD diversity accounting for all aspects of diversity. All indicators proposed can be decomposed into constituent parts, so we can better understand differences.

Number of causes



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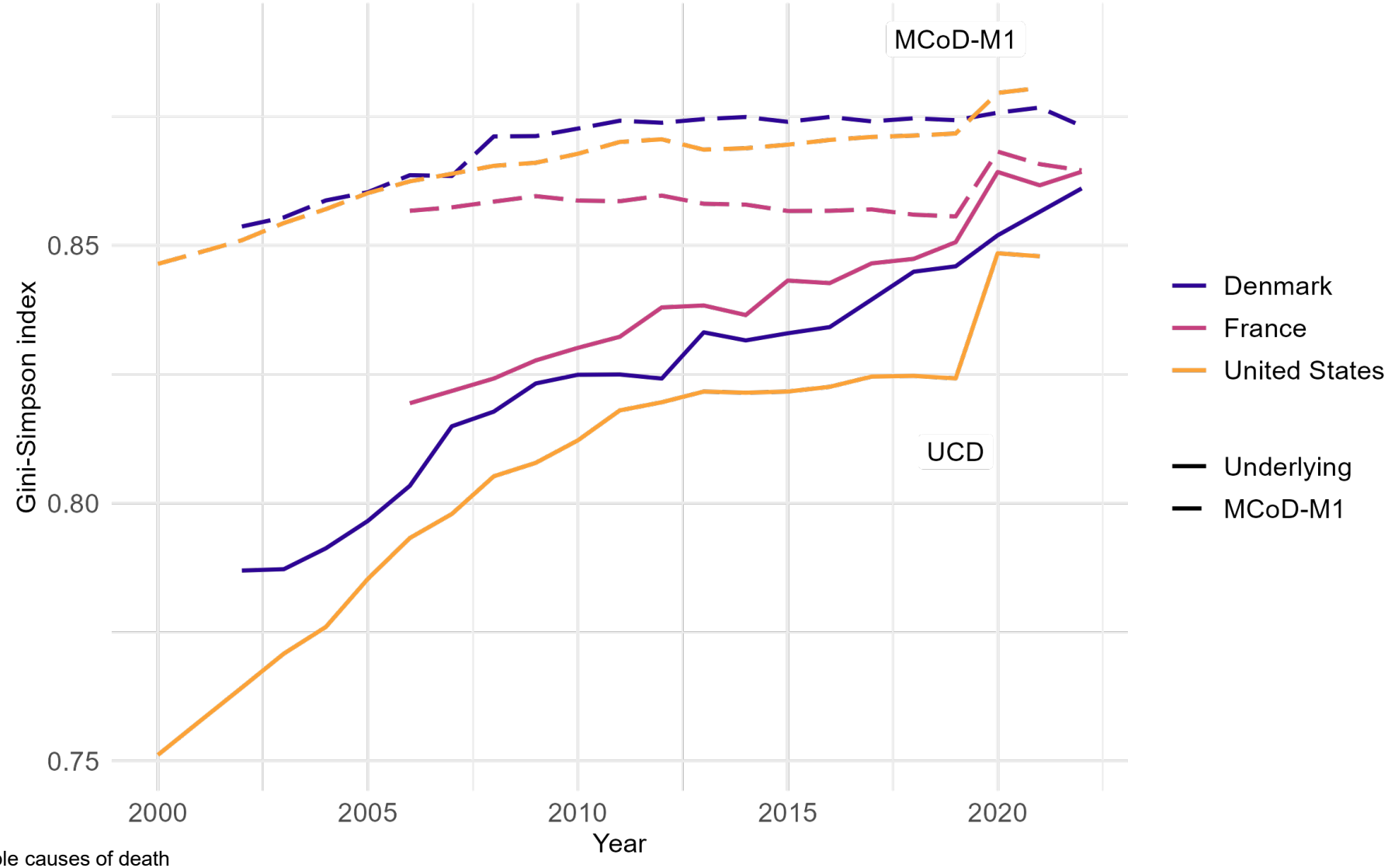
Number of causes – Decomposition, 2006 -2019

	Contributions from…			
	changes in age distribution	changes in UCD distribution	Increase in number of causes across ages and UCD	**Total**
Denmark	0.002	-0.024	0.240	**0.217**
France	-0.001	-0.031	0.127	**0.095**
United States	-0.004	0.023	0.088	**0.107**

Relative abundance – All causes contributes to diversity



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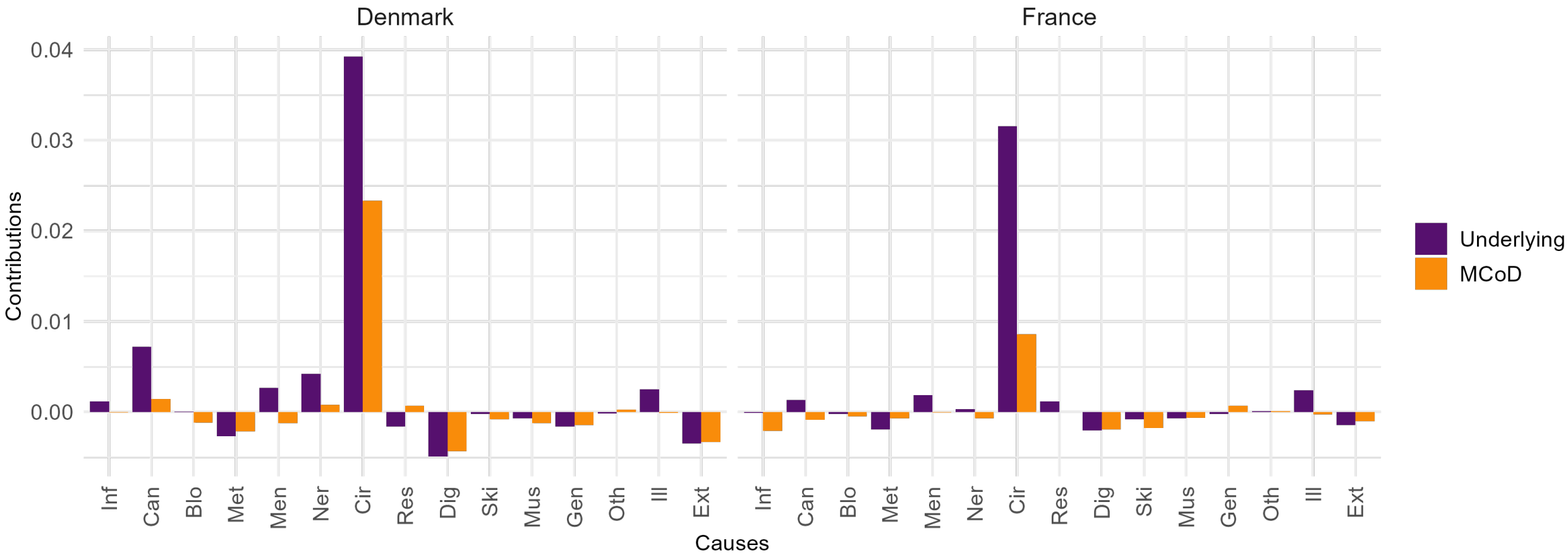
Relative abundance – All causes contributes to diversity - Decomposition



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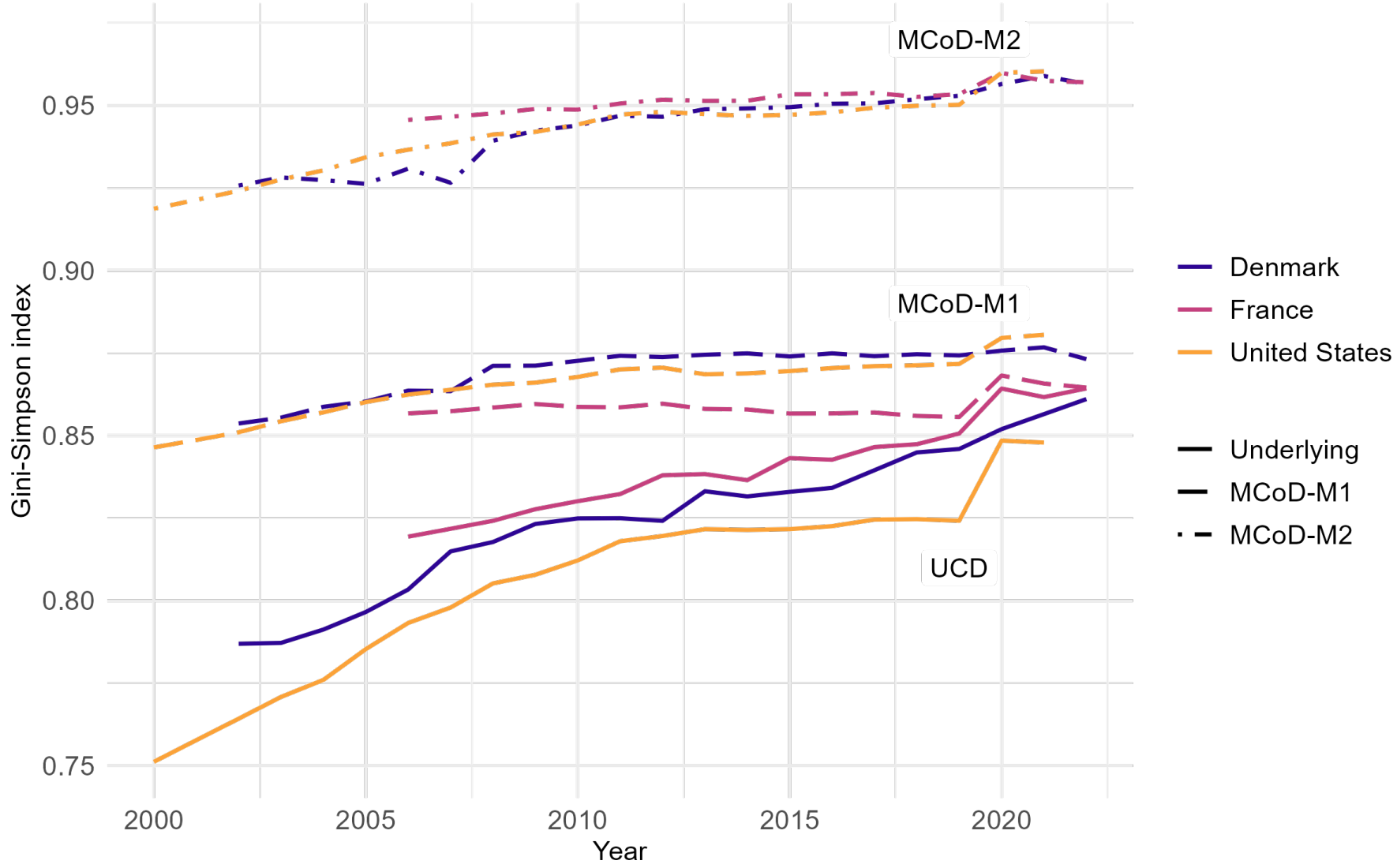
Relative abundance – UCD-centric



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Relative abundance – UCD-centric – Decomposition 2006-2019

	Contributions from…		
	changes in UCD distribution	Changes in MCoD diversity for each UCD	**Total**
Denmark	0.010	0.011	**0.021**
France	0.004	0.004	**0.008**
United States	0.010	0.004	**0.014**

Take home message

- Causes of death profile is becoming increasingly complex across countries due to both
  - Increase in the number of causes
  - Increase in the complexity of the relative abundance of causes

- Harder to keep improving life expectancy?
- Harder to predict cause-specific mortality?

4. Competing causes

Competing risk

Throughout life, individuals are exposed to multiple risks, where the occurrence of one can prevent the others.

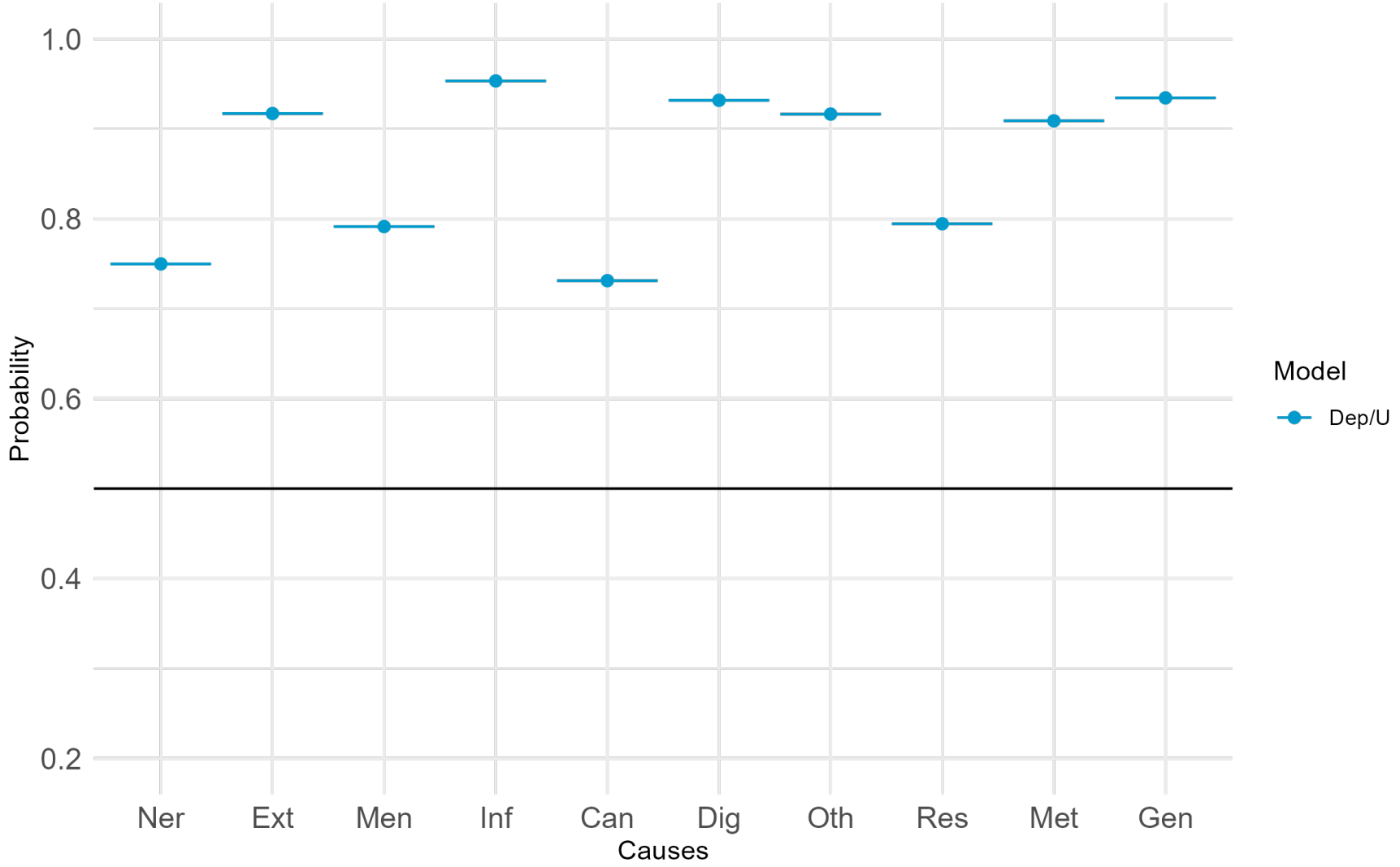
This is known as competing risks.

Competing causes of death

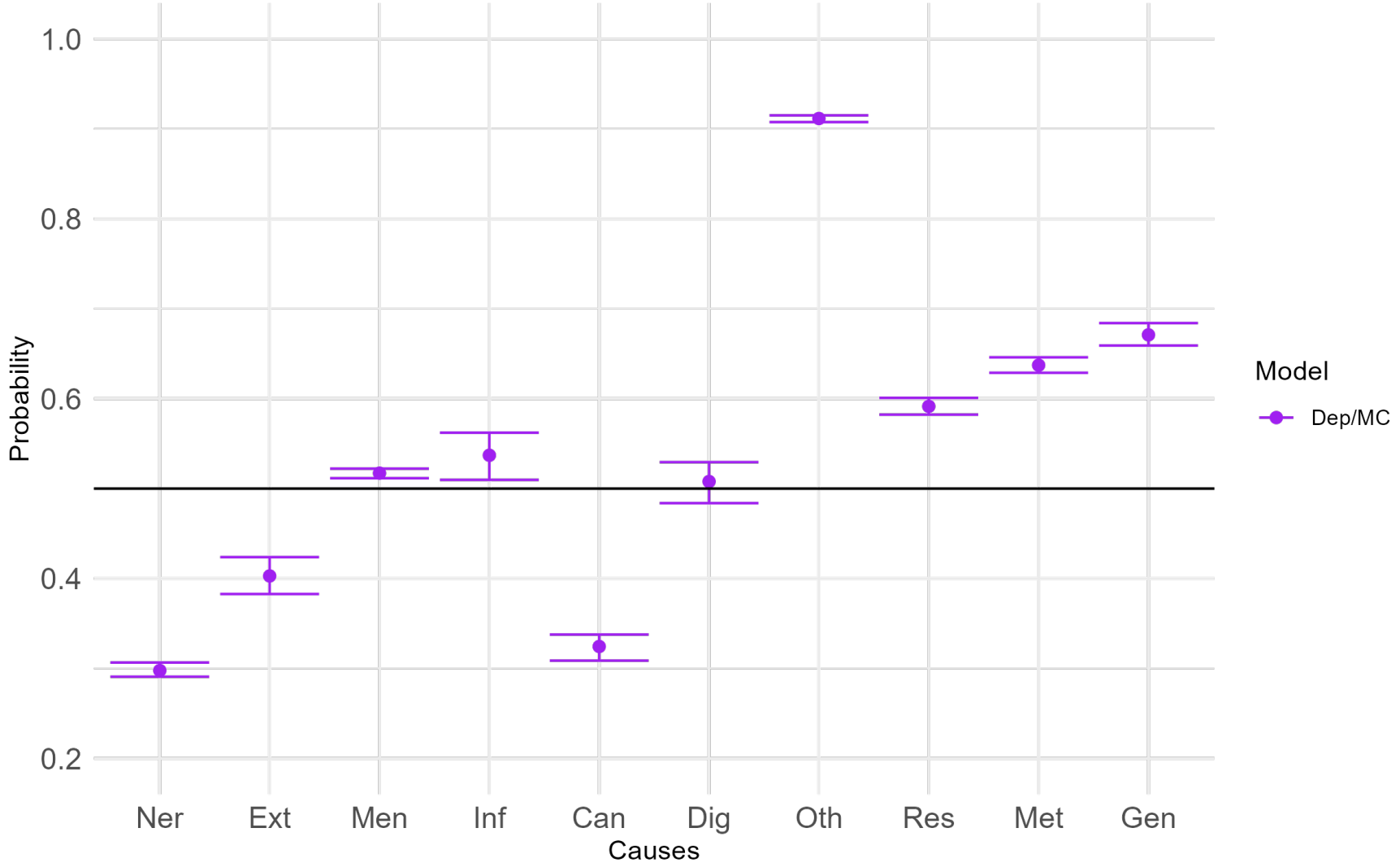
What is the probability to die from one cause (UCD) before another?

We do pairwise comparison across 10 causes!

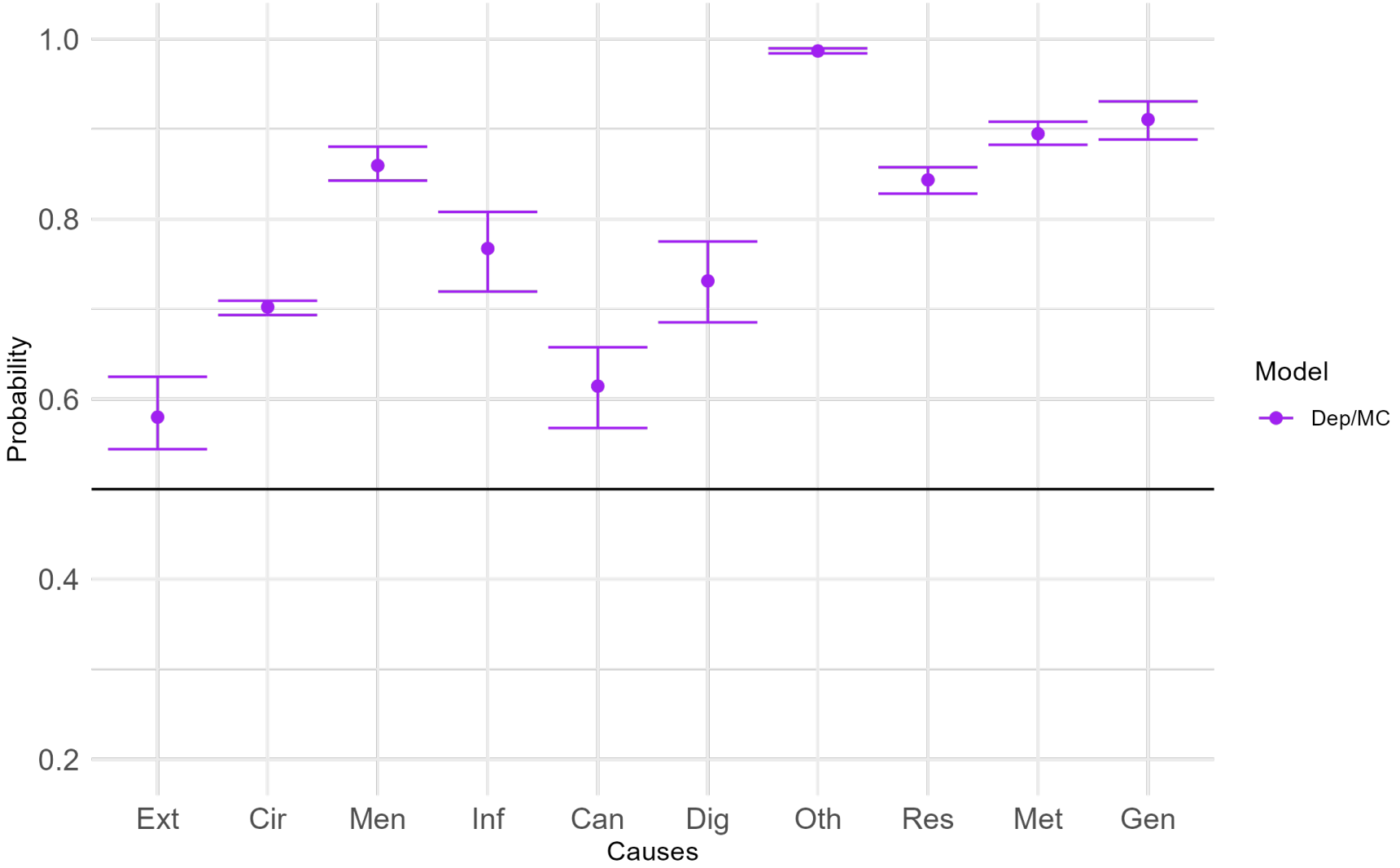
UCD analysis only – Diseases of the circulatory system first



MCoD analysis – Diseases of the circulatory system first



MCoD analysis – Diseases of the nervous system first

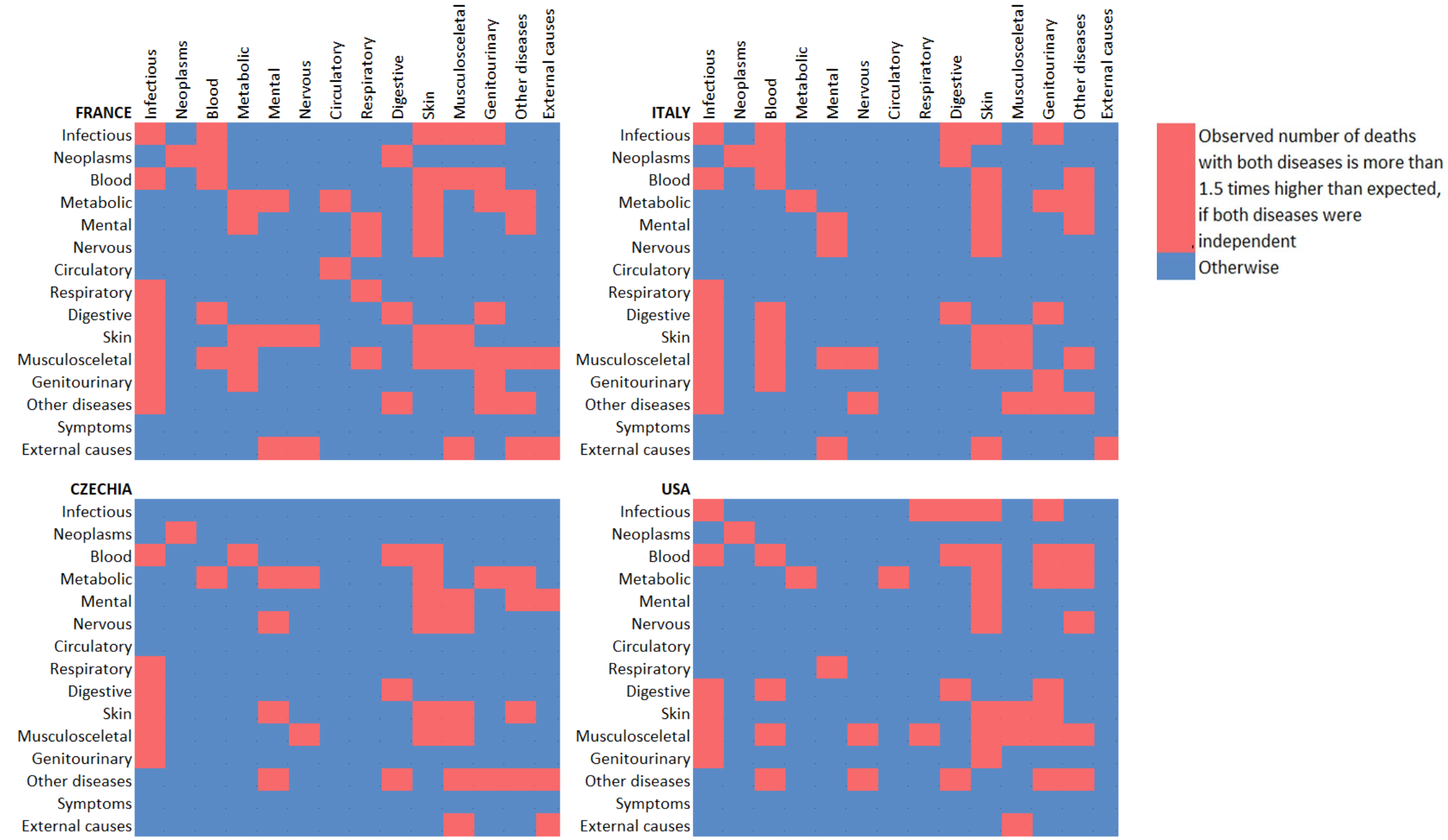


More to come…

- Cross-countries comparison
- Comparing results with diseases history

5. Cause association

Cause of death association indicator, 2010



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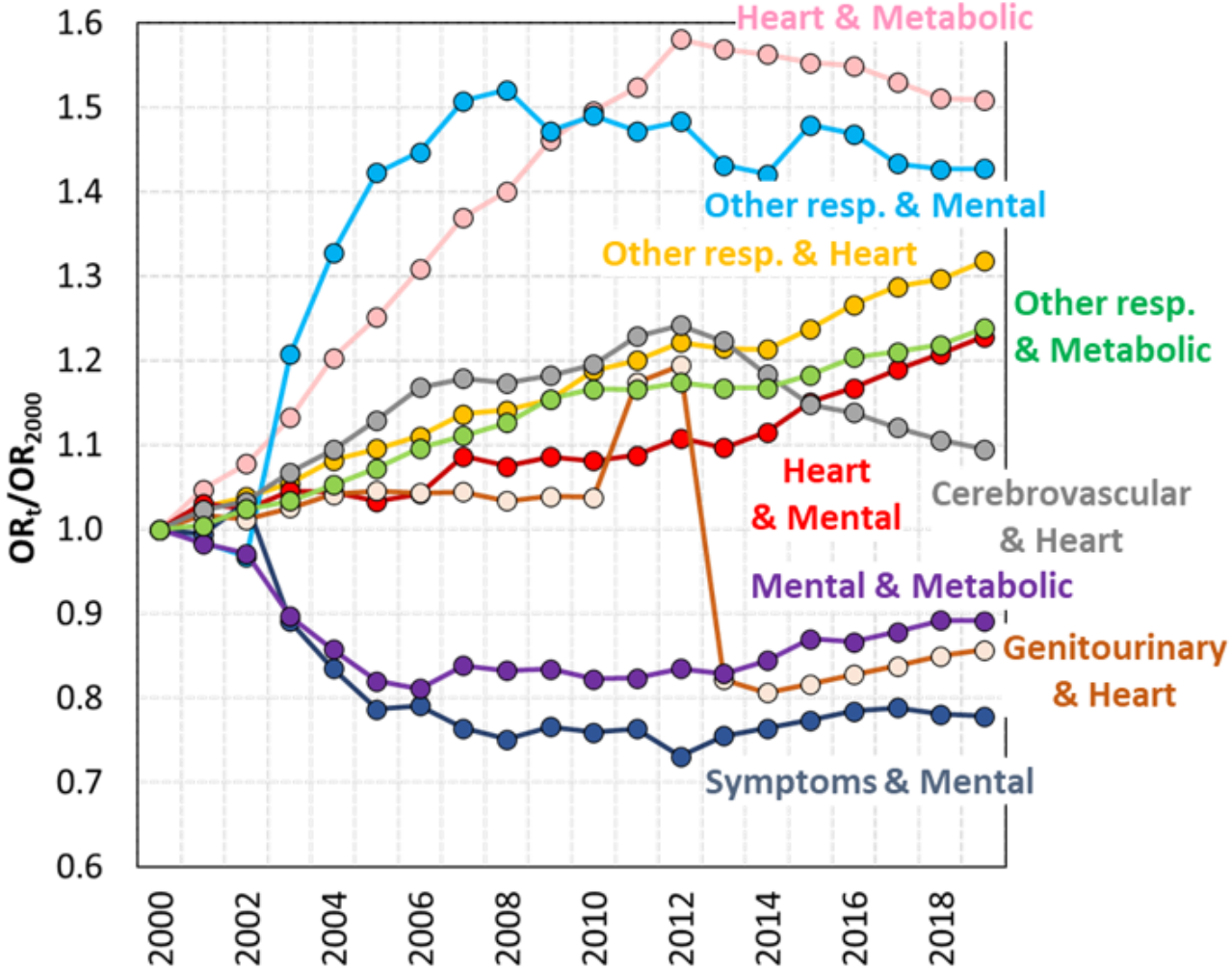
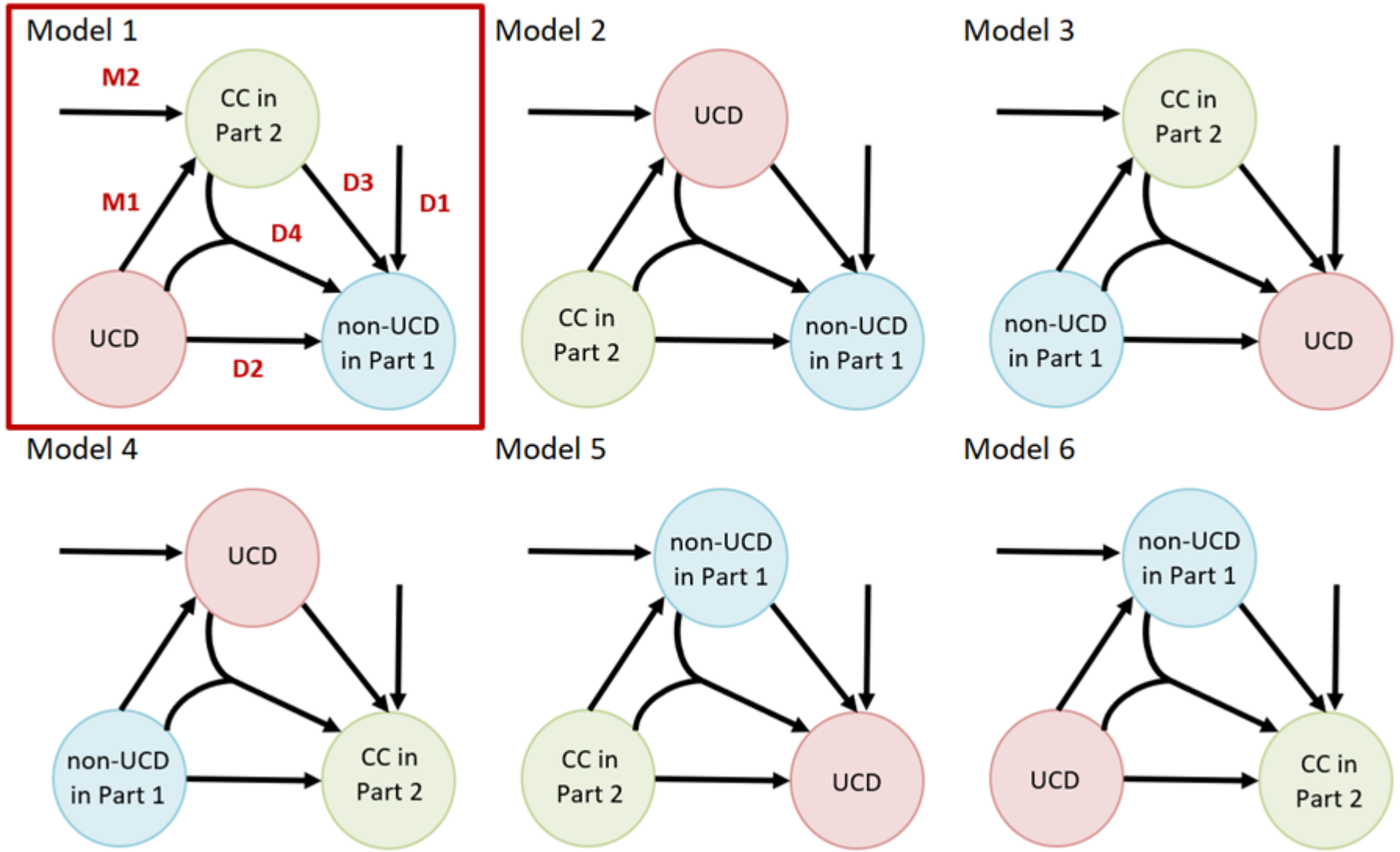
Cause of death association indicator, 2010

	Infectious	Neoplasms	Diseases of blood	Metabolic	Mental	Nervous	Heart	Cerebrovascular	Other circulatory	Acute resp.	Other resp.	Digestive	Diseases of skin	Genitourinary	Perinatal	Symptoms
Symptoms	1.1	0.4	1.6	1.0	1.2	1.0	0.6	0.8	1.1	1.0	1.0	1.2	1.6	1.1	0.7	
Perinatal	0.7	0.1	1.1	0.4	0.2	0.6	0.3	0.4	1.1	0.8	0.5	0.7	0.7	0.7		0.7
Genitourinary	4.8	0.6	3.2	1.4	0.8	0.9	1.3	0.7	1.8	2.1	1.5	2.3	2.1		0.7	1.1
Diseases of skin	3.8	0.6	2.9	2.7	1.3	1.7	1.5	1.0	2.7	1.3	1.4	1.5		2.1	0.7	1.6
Digestive	4.1	0.8	4.0	1.4	0.8	0.5	0.7	0.5	1.9	0.9	1.1		1.5	2.3	0.7	1.2
Other resp.	1.9	0.7	1.6	1.2	2.0	0.9	1.2	0.8	1.0	2.5		1.1	1.4	1.5	0.5	1.0
Acute resp.	6.4	0.7	1.8	1.0	0.8	0.9	0.8	0.7	0.7		2.5	0.9	1.3	2.1	0.8	1.0
Other circulatory	1.4	0.6	2.5	1.8	1.3	0.8	2.2	1.5		0.7	1.0	1.9	2.7	1.8	1.1	1.1
Cerebrovascular	0.6	0.3	1.1	1.3	1.0	1.1	1.3		1.5	0.7	0.8	0.5	1.0	0.7	0.4	0.8
Heart	0.7	0.3	1.4	3.8	1.1	0.7		1.3	2.2	0.8	1.2	0.7	1.5	1.3	0.3	0.6
Nervous	0.7	0.2	0.9	1.2	0.7		0.7	1.1	0.8	0.9	0.9	0.5	1.7	0.9	0.6	1.0
Mental	0.7	0.8	1.0	1.4		0.7	1.1	1.0	1.3	0.8	2.0	0.8	1.3	0.8	0.2	1.2
Metabolic	1.3	0.6	2.4		1.4	1.2	3.8	1.3	1.8	1.0	1.2	1.4	2.7	1.4	0.4	1.0
Diseases of blood	2.8	1.8		2.4	1.0	0.9	1.4	1.1	2.5	1.8	1.6	4.0	2.9	3.2	1.1	1.6
Neoplasms	0.7		1.8	0.6	0.8	0.2	0.3	0.3	0.6	0.7	0.7	0.8	0.6	0.6	0.1	0.4
Infectious		0.7	2.8	1.3	0.7	0.7	0.7	0.6	1.4	6.4	1.9	4.1	3.8	4.8	0.7	1.1



Aim: go beyond interactions → model mechanism of interplay
Focus on contributory causes of death recorded in Part 2 of the death certificate
RQ: Are contributory causes of death recorded in Part 2 of the death certificate mediators of chains of morbid events leading to death?

Causal pie models



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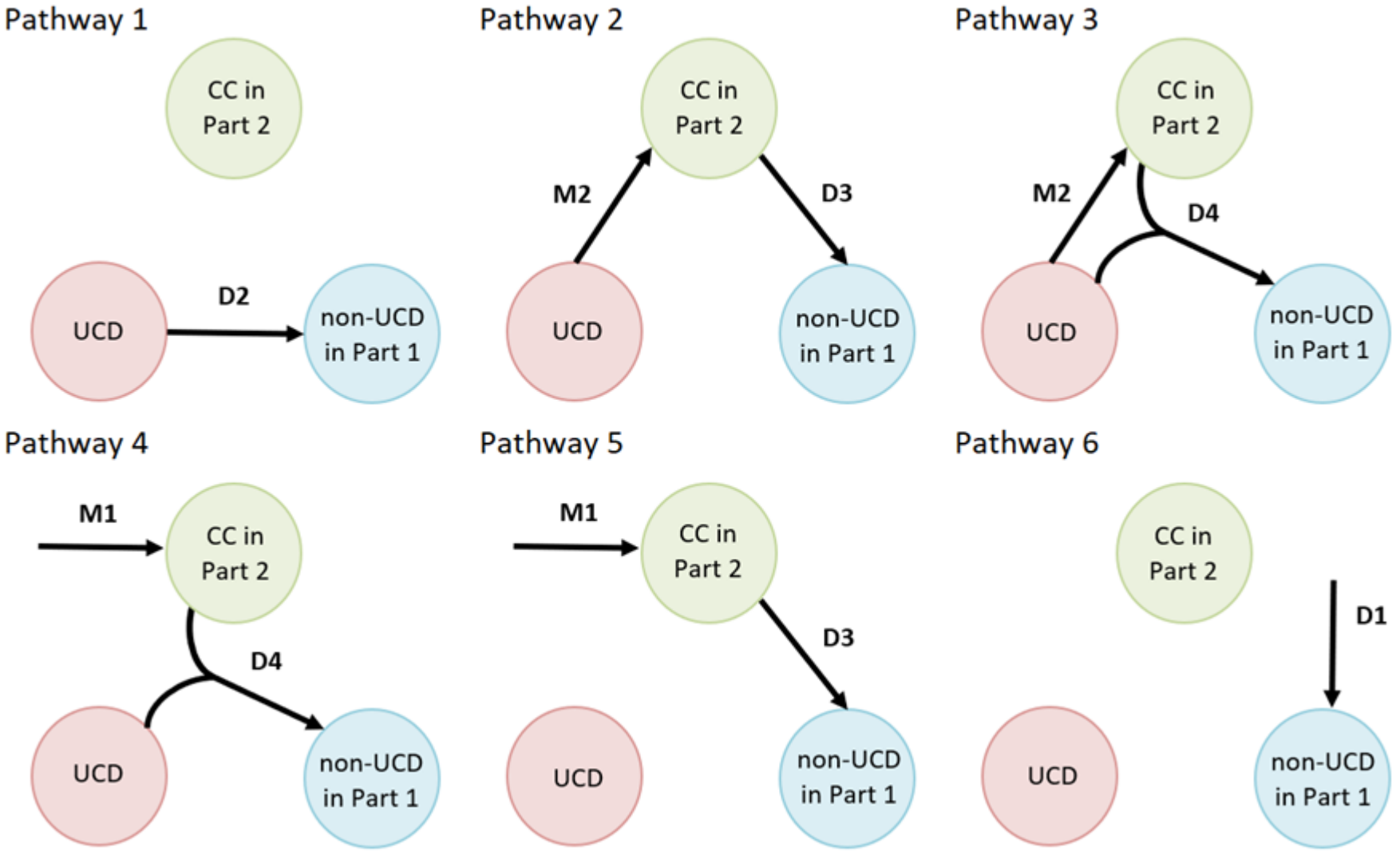
Pathways



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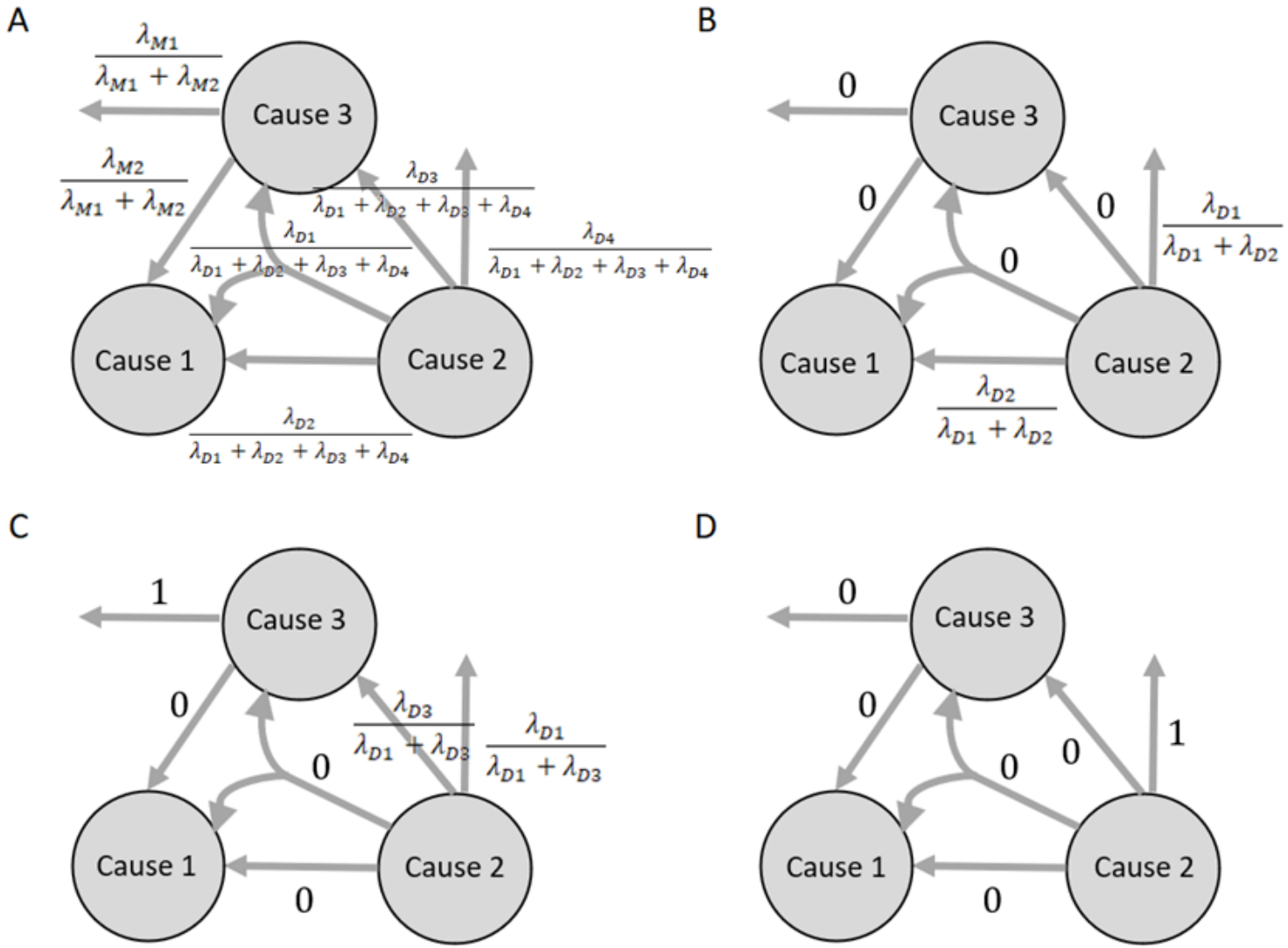
Attribution process



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Result: Best models for leading triads of diseases

UCD	CC	non-UCD	Model	Pathway	AF	Diff. 1	Diff. 2
Females, age 60-79							
COPD	Hypertension	Respiratory failure	6	6	0.67	-0.50	-0.38
COPD	Congestive heart failure	Respiratory failure	3	4	0.57	-0.35	-0.33
Acute myocardial infarction	Hypertension	Ischemic heart disease	2	5	0.64	-0.33	-0.33
Ischemic heart disease	Hypertension	Cardiac arrest	3	4	0.51	-0.18	-0.15
Ischemic heart disease	Diabetes mellitus	Hypertensive heart disease	5	2	0.56	-0.33	-0.18
Ischemic heart disease	COPD	Congestive heart failure	3	4	0.53	-0.40	-0.19
Ischemic heart disease	Hypertension	Congestive heart failure	3	4	0.59	-0.42	-0.33
Ischemic heart disease	Chronic kidney disease	Congestive heart failure	1	4	0.57	-0.43	-0.31
Ischemic heart disease	Diabetes mellitus	Congestive heart failure	3	4	0.41	-0.15	-0.09
Acute myocardial infarction	Diabetes mellitus	Ischemic heart disease	3	4	0.71	-0.57	-0.41
Males, age 60-79							
Acute myocardial infarction	Hypertension	Ischemic heart disease	2	5	0.60	-0.34	-0.29
Ischemic heart disease	Diabetes mellitus	Hypertensive heart disease	5	2	0.52	-0.05	-0.20
Ischemic heart disease	Hypertension	Cardiac arrest	1	6	0.63	-0.28	-0.03
Ischemic heart disease	Chronic kidney disease	Congestive heart failure	1	4	0.59	-0.46	-0.32
Ischemic heart disease	Hypertension	Congestive heart failure	2	5	0.59	-0.33	-0.02
Ischemic heart disease	COPD	Congestive heart failure	1	4	0.56	-0.42	-0.19
Acute myocardial infarction	Diabetes mellitus	Ischemic heart disease	4	5	0.96	-0.92	-0.60
Ischemic heart disease	Diabetes mellitus	Congestive heart failure	5	5	0.70	-0.43	-0.37
Ischemic heart disease	Diabetes mellitus	Cardiac arrest	5	5	0.70	-0.41	-0.40
Ischemic heart disease	Atrial fibrillation and flutter	Congestive heart failure	1	4	0.69	-0.54	-0.42

Result: Best models for leading triads of diseases

UCD	CC	non-UCD	Model	Pathway	AF	Diff. 1	Diff. 2
Females, age 80 and older							
Ischemic heart disease	Hypertension	Congestive heart failure	3	4	0.61	-0.43	-0.34
Ischemic heart disease	Atrial fibrillation and flutter	Congestive heart failure	1	4	0.60	-0.45	-0.32
Ischemic heart disease	Chronic kidney disease	Congestive heart failure	1	4	0.57	-0.40	-0.32
Ischemic heart disease	Hypertension	Cardiac arrest	2	5	0.64	-0.33	-0.04
Acute myocardial infarction	Hypertension	Ischemic heart disease	2	5	0.70	-0.41	-0.35
Ischemic heart disease	COPD	Congestive heart failure	1	4	0.51	-0.38	-0.22
Atrial fibrillation and flutter	Hypertension	Congestive heart failure	3	4	0.75	-0.60	-0.39
Ischemic heart disease	Dementia	Cardiac arrest	6	6	0.59	-0.21	-0.22
Ischemic heart disease	Dementia	Congestive heart failure	2	5	0.74	-0.54	-0.42
COPD	Congestive heart failure	Respiratory failure	3	4	0.55	-0.37	-0.30
Males, age 80 and older							
Ischemic heart disease	Atrial fibrillation and flutter	Congestive heart failure	1	4	0.54	-0.40	-0.19
Ischemic heart disease	Chronic kidney disease	Congestive heart failure	1	4	0.49	-0.34	-0.22
Ischemic heart disease	Hypertension	Congestive heart failure	2	5	0.63	-0.39	-0.06
Ischemic heart disease	COPD	Congestive heart failure	1	4	0.47	-0.29	-0.10
Ischemic heart disease	Hypertension	Cardiac arrest	2	5	0.57	-0.26	-0.09
Acute myocardial infarction	Hypertension	Ischemic heart disease	2	5	0.65	-0.32	-0.31
Ischemic heart disease	Diabetes mellitus	Congestive heart failure	2	5	0.66	-0.51	-0.35
Ischemic heart disease	Atrial fibrillation and flutter	Cardiac arrest	2	5	0.62	-0.28	-0.19
Ischemic heart disease	Dementia	Congestive heart failure	2	5	0.84	-0.69	-0.53
COPD	Congestive heart failure	Respiratory failure	3	4	0.57	-0.39	-0.31

Take home message

Results suggested that CC in Part 2 are integral components of the trains of morbid events leading to death.
Three broader categories of roles that CCs in Part 2 can play in the lethal process can be distinguished:
1. Some act as mediators in the chain of morbid events leading to death (atrial fibrillation and flutter, heart failure, COPD, chronic kidney disease).

2. Others do not exhibit any interaction with the conditions listed in Part 1 (dementia).

3. Additionally, as demonstrated by several models involving contributory diabetes, they can even play a role in the development of UCDs.

Furthermore, for certain diseases—particularly hypertension and diabetes—the interplay between diseases might be age-dependent, with older age groups showing lower levels of synergy within triads.

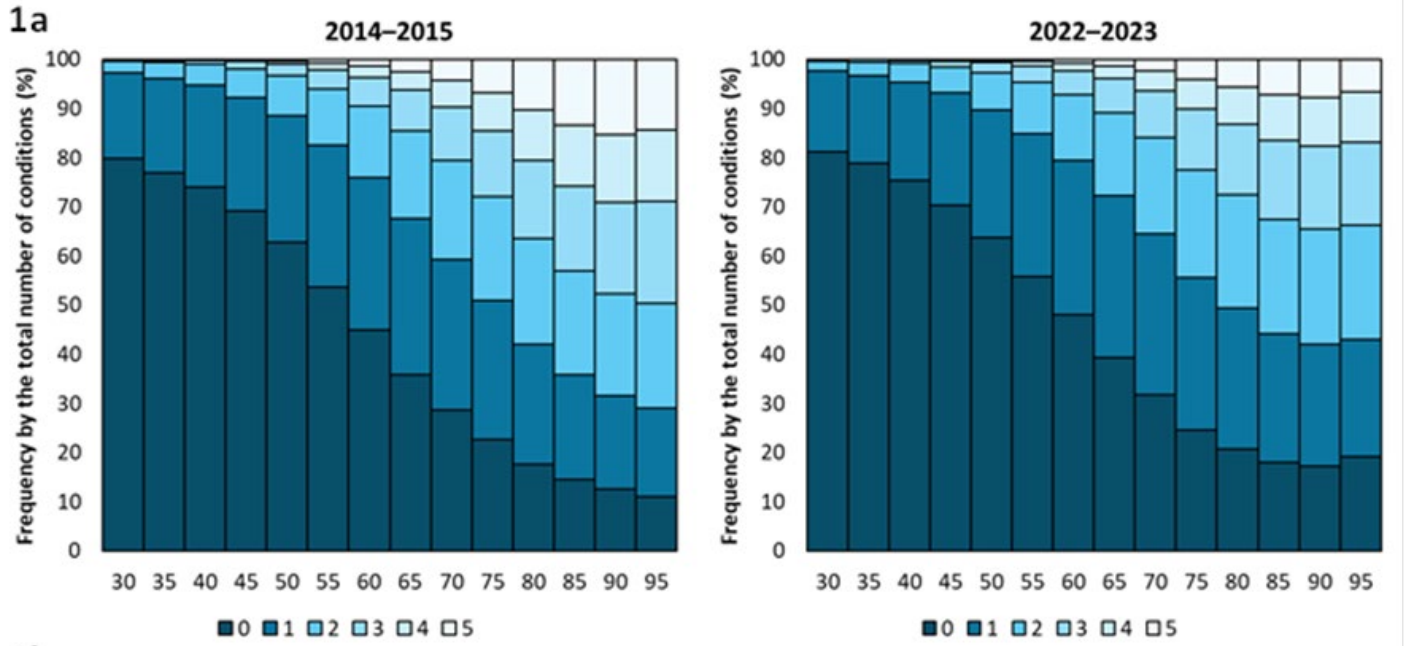
6. Effect on mortality risks

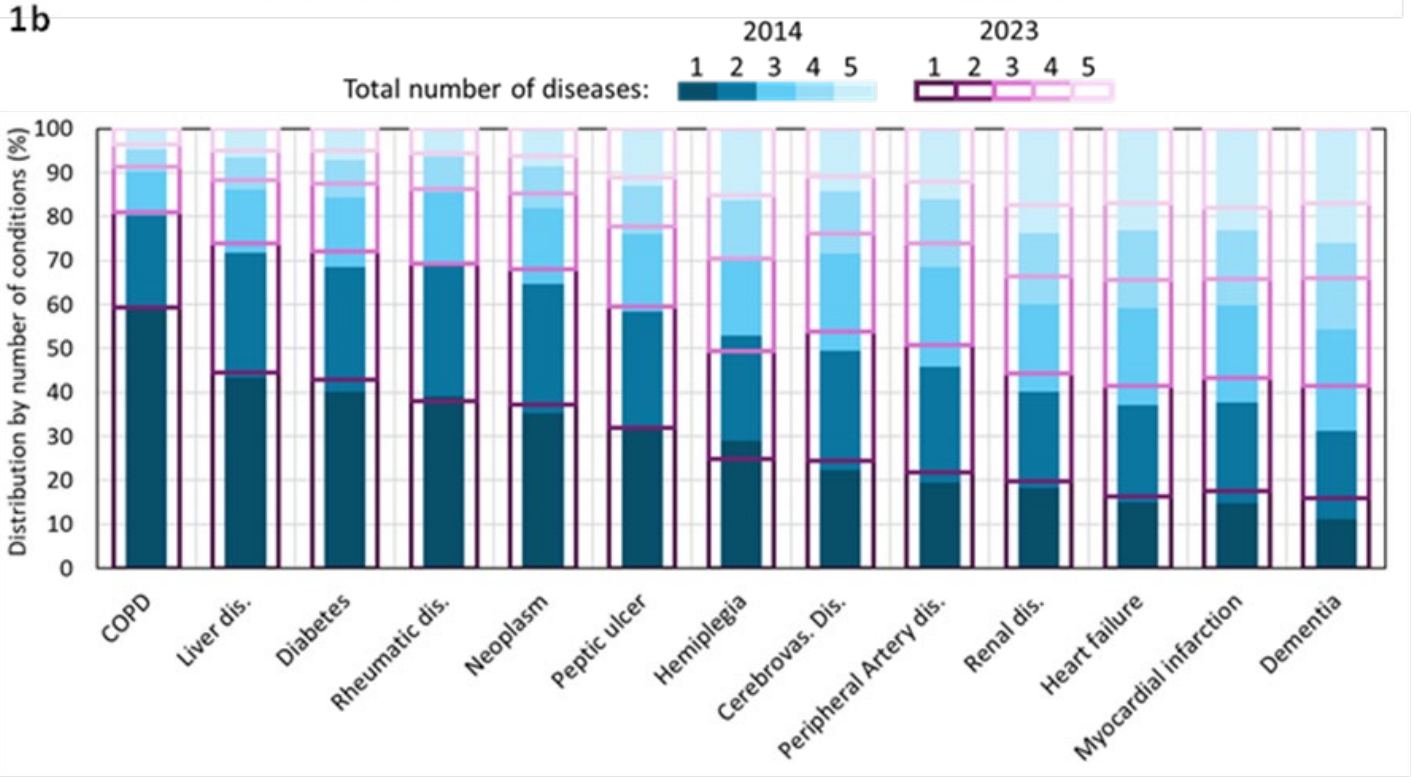
Mortality by multimorbidity

How does risk of death by age
vary by multimorbidity patterns?
How this developed in the latest decade?

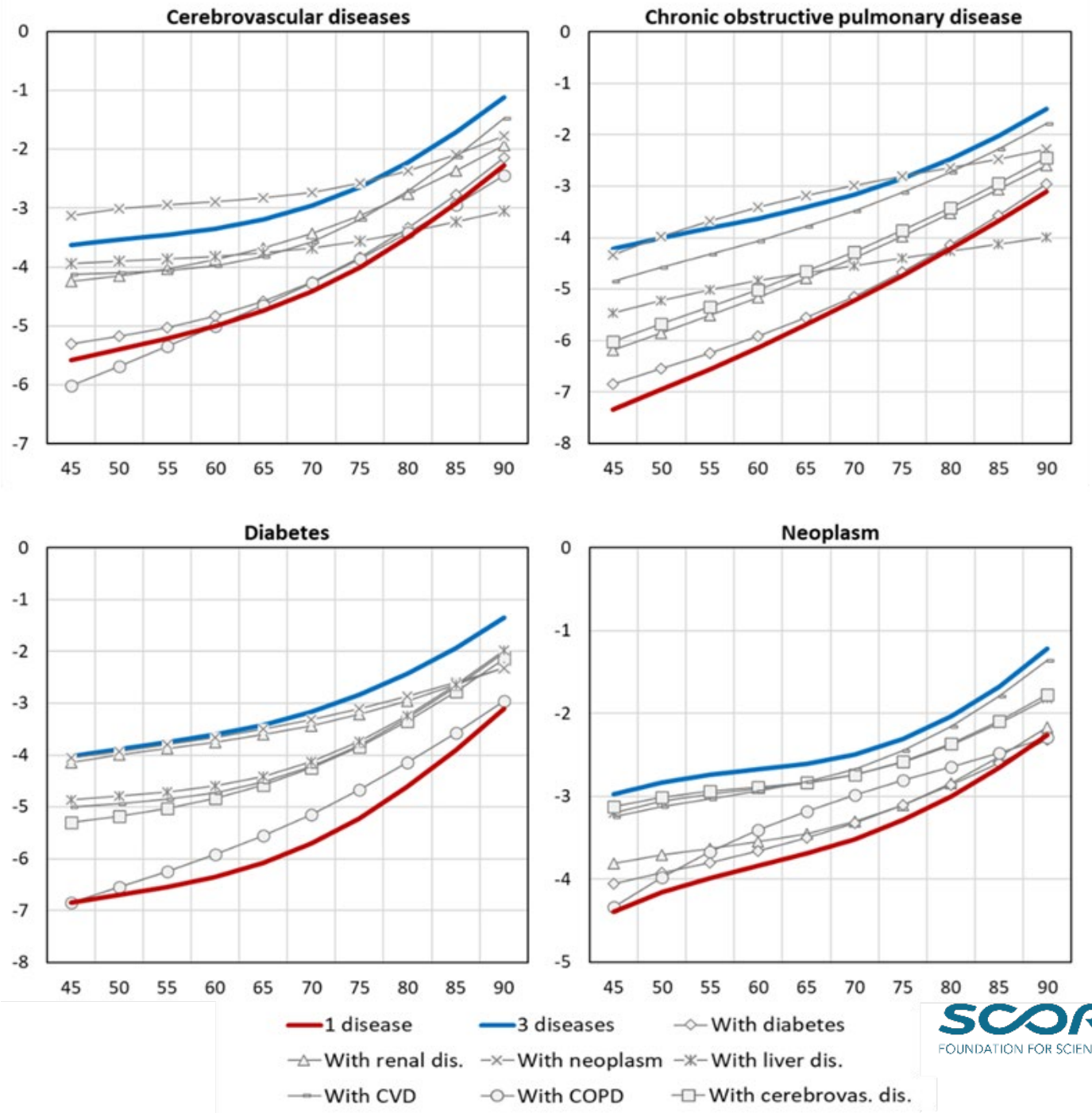
Data: Czech health registry data, 2014-2024

Context: Czechia has, in EU, one of the highest prevalences of self-reported multimorbidity. Czechia is one of the first countries in Eastern Europe having registry data. Czechia experienced one of the highest mortality increases during the COVID-19 pandemic.

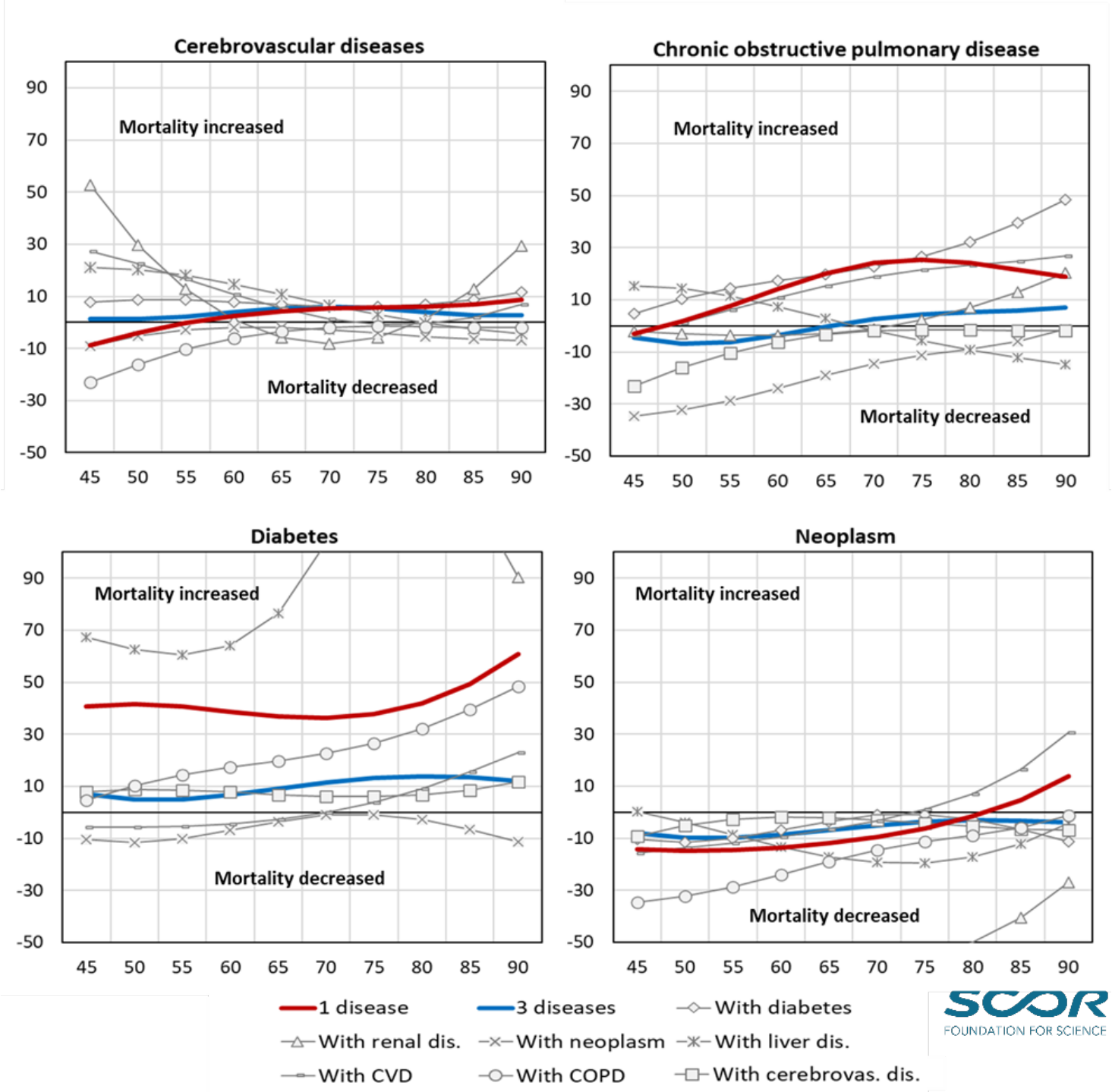




Age-specific mortality rates by age, leading combinations of chronic diseases, Czechia, 2022-2023



Changes between 2014 and 2023 in age-specific mortality rates by age, leading combinations of chronic diseases, Czechia



Results of decomposition analysis

	Cerebrovas. dis.	COPD	Diabetes	Neoplasm
CDR 2014-2015 (‰)	95.041	36.703	41.108	85.862
CDR 2022-2023 (‰)	89.238	33.465	40.143	78.935
Difference	-5.803	-3.237	-0.965	-6.927
Rate effect	2.772	0.681	3.502	-2.820
Multimorbidity effect	-8.775	-5.548	-7.021	-8.614
Age effect	0.199	1.630	2.553	4.507
Total	-5.803	-3.237	-0.965	-6.927

Table quantifies the importance of the factors of change in mortality in subgroups living with leading chronic conditions, between 2014 and 2023.

Mortality mostly decreased. This was due to reduction in multimorbid populations after COVID-19 pandemic. The pure rate effect shows upward trend in mortality.

Take home message

Upward trend in disease prevalence during 2014-2023, but lower burden of extremely complex multimorbidity patterns (4+ diseases).

Divergent trends in mortality were observed across morbidity groups, as well as within multimorbidity groups. Generally, adding additional diagnoses was associated with increased mortality.

Between 2014 and 2023, the mortality rate declined in subpopulations with leading morbidities, most notably in those with neoplasms. However, these declines were primarily attributed to changes in multimorbidity composition, which refer to a significant decline in the proportion of individuals with complex multimorbidity. In contrast, the rate effect was positive, implying rising intensity of mortality in chronically ill people in Czechia.

Conclusion

- Pathway to death is (increasingly) complex
- But multiple causes data still undercount the number of conditions present at the end of life
- The causes can compete to be the UCD, but they also interact
- Having multiple conditions increase mortality risks
- Multiple causes of death are more informative of pathway to death, BUT…
- Looking at multi-morbidities would capture even better the burden of diseases

Thank You

Marie-Pier Bergeron Boucher, Associate professor
Cosmo Strozza, Assistant professor
Elizaveta Ukolova, PhD student
21/05/2025

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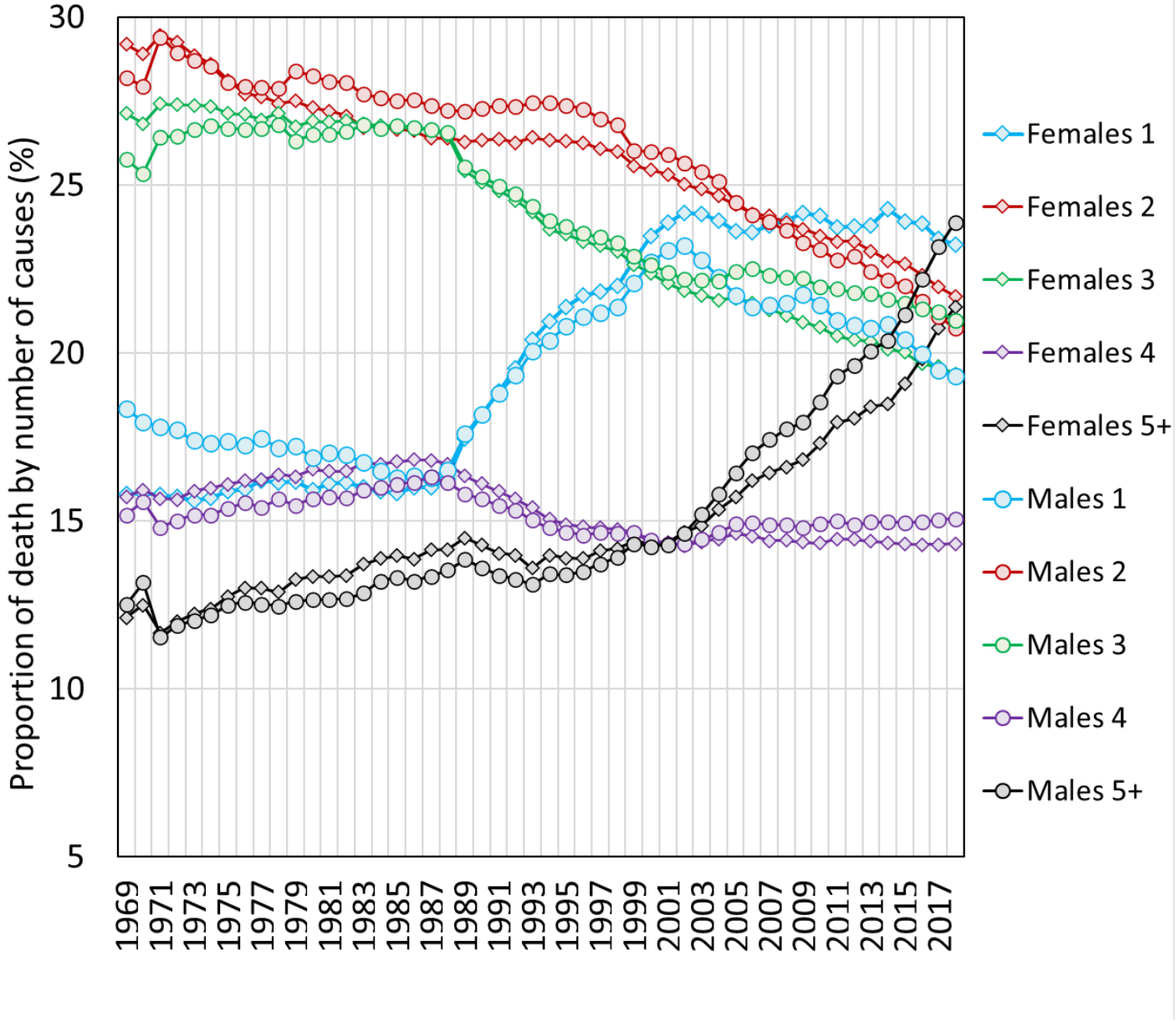
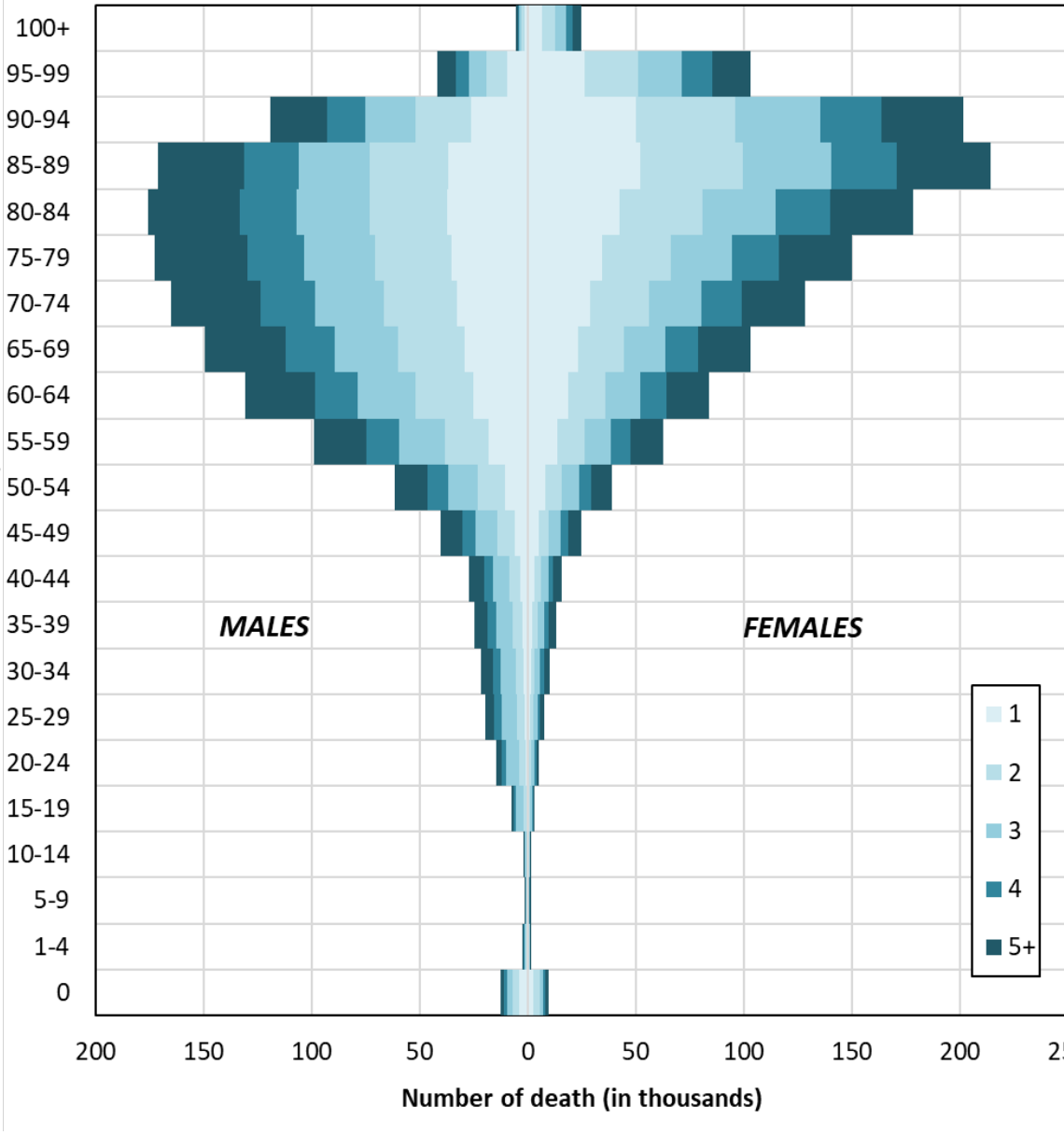
How many causes? (US example)





Diabetes

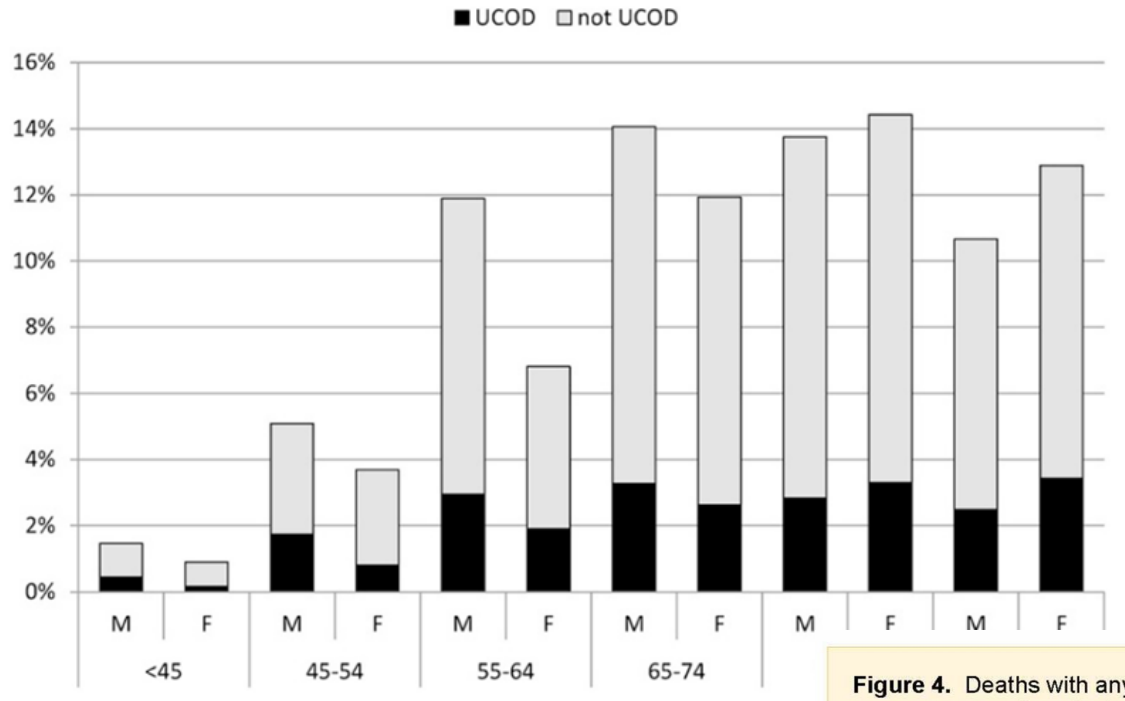
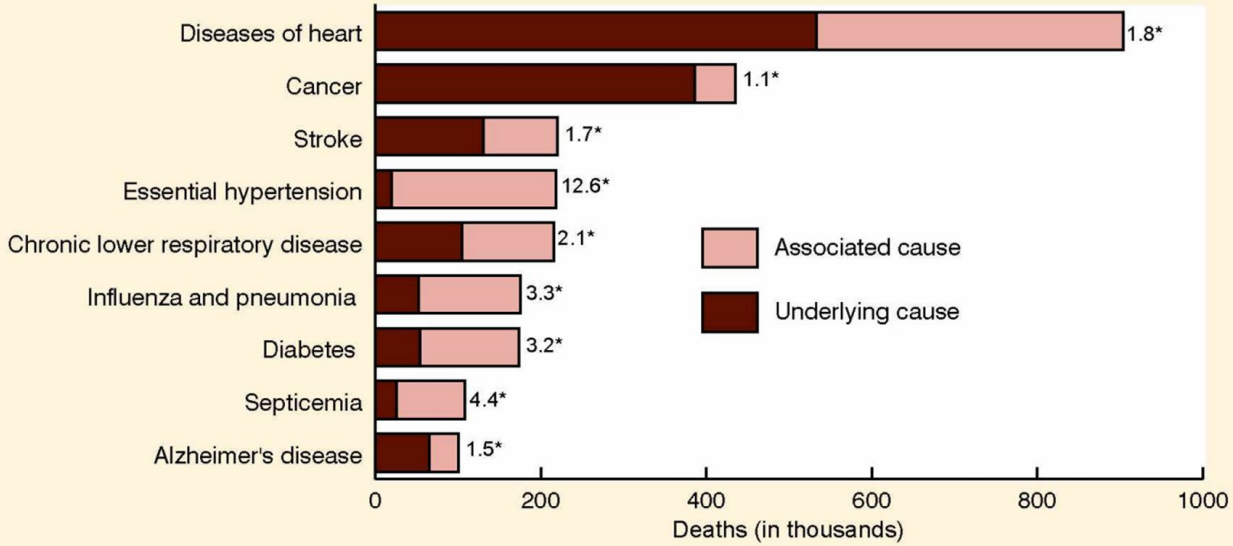


Fig. 1 Proportional mortality by gender and age class from diabetes selected as the underlyir position of the death certificate: Veneto region, 2008–2010

Figure 4. Deaths with any mention of major diseases on death certificate and as underlying and associated causes among decedents aged 65 years and over, United States, 2004



*Ratio of the number of deaths with any mention of a particular condition on the death certificate to the number of deaths for which that same condition was identified as the underlying cause.
SOURCE: National Vital Statistics System

Standardized ratio of multiple to underlying cause for major disease groups, 2010