

Appendix A

Measurement of mortality

Crucial 2020 mortality concepts in our approach are (i) the trend-predicted mortality, (ii) total observed mortality, (iii) COVID-19 cause-of-death mortality, (iv) excess mortality, and (v) non-COVID mortality. Figure 1 shows a graphical exposition of how these concepts are related. In 2020, the observed total mortality probability can differ from the trend-predicted probability because of a new cause (COVID-19) or because the mortality probabilities for non-COVID causes have changed. To determine what the mortality in 2020 would have been in the absence of COVID-19, we compute trend-predicted mortality ($M_{a,s,i}^{pred}$) in 2020 by estimating linear trends for each age-sex-income group for the years 2015-2019, and then predict the mortality probability in 2020.

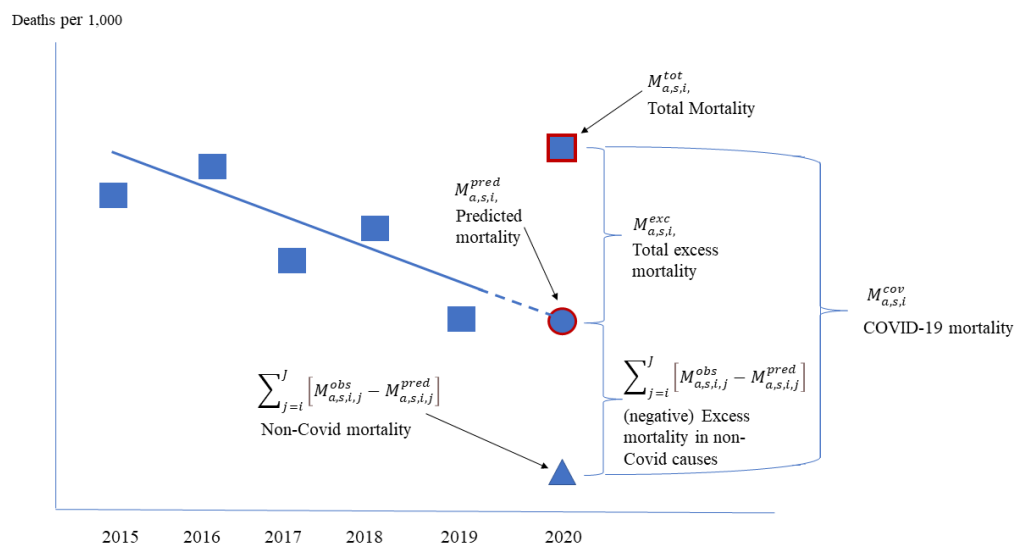


Figure A1: Illustration of Mortality Concepts

Figure 1 graphically illustrates the mortality concepts used in this paper using hypothetical data. The blue squares represent total observed mortality (in deaths per 1000) in 2015-2019, which are used to fit the time trend (solid line) to be extrapolated (dotted line) to obtain trend-predicted mortality in 2020 (circle). Excess mortality, defined as the difference between trend-predicted (circle) and observed mortality (blue-red square). The latter can be decomposed into (cause of death defined) COVID-19 and non-COVID mortality (triangle). We call the difference between COVID-19 and excess mortality substitute mortality, which is by definition equal to trend-predicted minus non-COVID mortality.

By subtracting trend-predicted from observed total mortality, we obtain an estimate of total excess mortality for each age(a), sex (s), and income (i) group: $M_{a,s,i}^{exc} = M_{a,s,i}^{obs} - M_{a,s,i}^{pred}$. It reflects how observed total mortality in 2020 differs from what would be expected from a simple linear age-, sex- and income-group-specific trend extrapolation. Total excess mortality is the sum of Covid-19 mortality ($M_{a,s,i}^{cov}$) and excess mortality in all J other causes ($\sum_{j=i}^J [M_{a,s,i,j}^{obs} - M_{a,s,i,j}^{pred}]$). This gives the following decomposition of total mortality that we will use throughout the remainder of the paper:

$$M_{a,s,i}^{obs} = M_{a,s,i}^{pred} + M_{a,s,i}^{cov} + \sum_{j=i}^J [M_{a,s,i,j}^{obs} - M_{a,s,i,j}^{pred}]. \quad [1]$$

Decomposition of inequality by cause of death

To assess how the emergence of COVID-19 mortality has affected inequality in total mortality, and how this effect depends on differential substitution of non-COVID mortality across groups, we start from the identity in Equation [1] and decompose the inequality in observed total mortality (in 2020) as a weighted sum of the inequality measured in trend-predicted total mortality plus COVID-19 mortality plus excess mortality for all other causes. We use the convenient property of the concentration index that it can be decomposed into sources or factors. For any variable that can be written as a sum of components, the concentration index of the sum equals the weighted sum of the concentration indices of these factors or components, with the weights equal to the relative shares of each component:

$$C(M_{a,s}^{tot}) = w_{a,s}^{pred} C(M_{a,s}^{pred}) + w_{a,s}^{Cov} C(M_{a,s}^{Cov}) + \sum_{j=1}^J [w_{a,s,j}^{obs} C(M_{a,s,j}^{obs}) - w_{a,s,j}^{pred} C(M_{a,s,j}^{pred})], \quad [2]$$

where $C(M_{a,s}^{tot})$ denotes the concentration index of the observed total mortality probability for age a and sex s . The other concentration indices are defined analogously for the trend-predicted total mortality probability $C(M_{a,s}^{pred})$, the COVID-19-attributed mortality probability $C(M_{a,s}^{Cov})$, the non-COVID cause-specific observed and trend-predicted mortality probabilities, $C(M_{a,s,j}^{obs})$ and $C(M_{a,s,j}^{pred})$, with j denoting the cause. The weights of each component are based on the shares of deaths relative to the total number of observed deaths in an age-sex group in 2020:

$$w_{a,s}^{pred} = \frac{\sum_{i=1}^{20} M_{a,s,i}^{pred}}{\sum_{i=1}^{20} M_{a,s,i}^{tot}}, w_{a,s}^{Cov} = \frac{\sum_{i=1}^{20} M_{a,s,i}^{Cov}}{\sum_{i=1}^{20} M_{a,s,i}^{tot}}, w_{a,s,j}^{obs} = \frac{\sum_{i=1}^{20} M_{a,s,i,j}^{obs}}{\sum_{i=1}^{20} M_{a,s,i}^{tot}}, \text{ and } w_{a,s,j}^{pred} = \frac{\sum_{i=1}^{20} M_{a,s,i,j}^{pred}}{\sum_{i=1}^{20} M_{a,s,i}^{tot}}.$$

The last term of Eq [2] allows us to compare the relative inequality in predicted mortality to actual mortality for each cause, and assess to which extent (negative) excess mortality for each cause has contributed to an in- or decrease of inequality in total mortality. To ease the interpretation, and by labeling the Concentration Index Contribution of cause j as $CIC(M_{a,s}^j) = w_{a,s}^{obs} C(M_{a,s}^{obs}) - w_{a,s}^{pred} C(M_{a,s}^{pred})$, we can rewrite Equation [2] as:

$$\underbrace{C(M_{a,s}^{tot}) - w_{a,s}^{pred} C(M_{a,s}^{pred})}_{\text{inequality in excess mortality in 2020}} = \underbrace{w_{a,s}^{Cov} C(M_{a,s}^{Cov})}_{\text{inequality contribution of Covid}} + \underbrace{\sum_{j=1}^J [CIC(M_{a,s})^j]}_{\text{inequality contribution of other causes}} \quad [3]$$

The left-hand side term measures the inequality in excess mortality in 2020, namely how much more unequal mortality has become compared to what was expected based on the trend. The right-hand side shows the contribution to the inequality in excess mortality as the weighted sum of inequality in COVID-19 mortality plus the inequality contributions of each of the J causes of death. The last term is now written as the (simple, unweighted) sum of the ‘inequality contributions’ of each cause of death. Note that these contributions can be positive or negative. Equation [3] is the identity used to disentangle the separate contributions of death causes to total observed inequality.

Appendix B

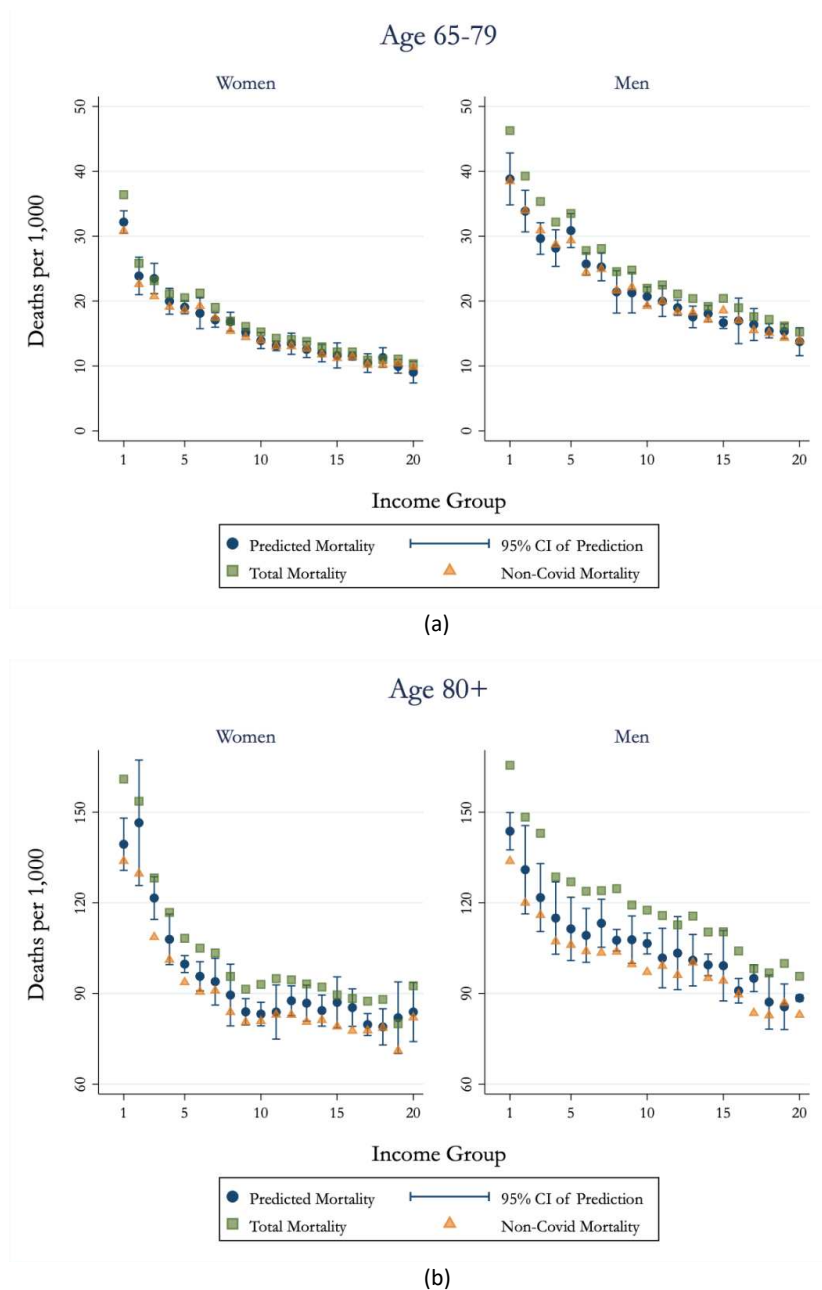


Figure B1: Total mortality, predicted mortality (with 95% confidence intervals) and non-COVID-19 mortality by 20 income ventiles, by four age-sex groups

Note: This Figure depicts the mortality income gradient in 2020 for total, predicted, and non-Covid mortality over 20 income groups in the Netherlands, with the y-axis symbolizing deaths per 1000 and the x-axis symbolizing the income group. Total mortality, represented by a square, is the mortality observed in 2020. Predicted mortality is calculated by age-sex-income group using 5-year trend probabilities and is shown as a circle. Non-Covid mortality

is all mortality attributable to causes of death that are not COVID-19, represented by a triangle. Total mortality is above predicted mortality for 2020, while non-Covid mortality is below what would have been expected for 2020.

Income Group	All	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Total Mortality	0-017	0-036	0-026	0-023	0-021	0-021	0-021	0-019	0-017	0-016	0-015	0-014	0-014	0-014	0-013	0-012	0-012	0-011	0-011	0-011	0-010	
Predicted Mortality	0-016	0-032	0-024	0-024	0-020	0-019	0-018	0-017	0-017	0-015	0-014	0-013	0-013	0-013	0-012	0-012	0-012	0-010	0-011	0-010	0-009	
	(0-014; 0-018)	(0-031; 0-033)	(0-023; 0-025)	(0-023; 0-025)	(0-019; 0-021)	(0-018; 0-02)	(0-017; 0-019)	(0-016; 0-018)	(0-016; 0-018)	(0-014; 0-016)	(0-013; 0-015)	(0-012; 0-014)	(0-012; 0-014)	(0-012; 0-014)	(0-011; 0-013)	(0-011; 0-013)	(0-011; 0-013)	(0-009; 0-011)	(0-01; 0-012)	(0-009; 0-011)	(0-008; 0-01)	
Covid Mortality	0-002	0-006	0-003	0-002	0-002	0-002	0-002	0-002	0-002	0-002	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-001	
Circulatory Mortality	0-003	0-006	0-005	0-004	0-004	0-004	0-004	0-003	0-003	0-003	0-003	0-002	0-002	0-002	0-002	0-002	0-002	0-002	0-002	0-002	0-002	
Predicted Mortality	0-003	0-006	0-005	0-005	0-004	0-003	0-003	0-003	0-003	0-003	0-002	0-002	0-002	0-002	0-002	0-002	0-002	0-002	0-002	0-002	0-001	
	(0-002; 0-004)	(0-003; 0-009)	(0-002; 0-007)	(0-002; 0-008)	(0-002; 0-007)	(0-001; 0-006)	(0; 0-006)	(0; 0-006)	(0; 0-006)	(0; 0-006)	(0; 0-005)	(-0-001; 0-005)	(-0-001; 0-005)	(-0-001; 0-005)	(-0-001; 0-005)	(-0-001; 0-005)	(-0-001; 0-005)	(-0-001; 0-005)	(-0-001; 0-005)	(-0-001; 0-004)	(-0-002; 0-004)	
Respiratory system Mortality	0-001	0-003	0-002	0-002	0-002	0-002	0-002	0-002	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-000	0-000	0-000	0-000	
Predicted Mortality	0-002	0-004	0-003	0-003	0-002	0-002	0-002	0-002	0-002	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-000	0-000	
	(-0-001; 0-004)	(0; 0-008)	(-0-001; 0-007)	(-0-001; 0-007)	(-0-002; 0-006)	(-0-002; 0-006)	(-0-002; 0-006)	(-0-002; 0-006)	(-0-002; 0-006)	(-0-003; 0-005)	(-0-003; 0-005)	(-0-003; 0-005)	(-0-003; 0-005)	(-0-003; 0-005)	(-0-003; 0-005)	(-0-003; 0-005)	(-0-003; 0-005)	(-0-003; 0-005)	(-0-003; 0-005)	(-0-004; 0-004)	(-0-004; 0-005)	
Mental Mortality	0-001	0-003	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-000	0-000	0-001	0-000	0-000	0-001	0-000	0-000	0-001	0-001	0-001	0-001	
Predicted Mortality	0-001	0-003	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-000	0-001	0-000	0-001	0-000	0-001	0-001	0-001	
	(0; 0-001)	(0-001; 0-005)	(-0-001; 0-003)	(-0-001; 0-003)	(-0-001; 0-003)	(-0-001; 0-003)	(-0-001; 0-003)	(-0-001; 0-002)	(-0-001; 0-002)	(-0-001; 0-002)	(-0-001; 0-003)	(-0-001; 0-002)	(-0-001; 0-003)	(-0-001; 0-002)	(-0-001; 0-002)	(-0-001; 0-002)	(-0-001; 0-002)	(-0-001; 0-002)	(-0-001; 0-002)	(-0-001; 0-002)	(-0-001; 0-002)	
Cancer Mortality	0-007	0-009	0-009	0-009	0-009	0-008	0-009	0-008	0-007	0-007	0-007	0-006	0-007	0-006	0-006	0-006	0-006	0-006	0-005	0-005	0-005	
Predicted Mortality	0-007	0-008	0-009	0-009	0-008	0-009	0-008	0-008	0-008	0-007	0-007	0-007	0-007	0-006	0-006	0-006	0-006	0-006	0-005	0-006	0-005	
	(0-005; 0-009)	(0-006; 0-011)	(0-007; 0-011)	(0-007; 0-011)	(0-006; 0-011)	(0-006; 0-011)	(0-006; 0-011)	(0-005; 0-01)	(0-006; 0-01)	(0-004; 0-009)	(0-005; 0-009)	(0-004; 0-009)	(0-004; 0-009)	(0-004; 0-009)	(0-004; 0-009)	(0-003; 0-008)	(0-003; 0-008)	(0-003; 0-008)	(0-003; 0-008)	(0-003; 0-008)	(0-003; 0-007)	
Other Mortality	0-004	0-010	0-005	0-005	0-004	0-004	0-004	0-004	0-003	0-003	0-003	0-003	0-003	0-003	0-003	0-002	0-002	0-002	0-002	0-002	0-002	
Predicted Mortality	0-004	0-011	0-006	0-005	0-004	0-004	0-004	0-004	0-004	0-003	0-003	0-002	0-002	0-003	0-003	0-003	0-003	0-002	0-002	0-002	0-002	
	(0-002; 0-005)	(0-009; 0-012)	(0-004; 0-008)	(0-004; 0-007)	(0-003; 0-006)	(0-002; 0-006)	(0-002; 0-005)	(0-002; 0-006)	(0-002; 0-006)	(0-002; 0-005)	(0-001; 0-005)	(0-001; 0-004)	(0-001; 0-004)	(0-001; 0-005)	(0-001; 0-004)	(0-001; 0-004)	(0-001; 0-004)	(0-001; 0-004)	(0; 0-004)	(0-001; 0-004)	(0; 0-004)	
Population	130593	9	65317	65286	65340	65315	65235	65367	65258	65266	65360	65259	65280	65310	65302	65286	65290	65299	65287	65294	65295	65293

Table B1: Summary Statistics for Women aged 65-79 by income group.

Note. This table shows the summary statistics of the mortality probabilities by cause of death for females aged 65-79 by 20 income groups. The causes of death are divided into 6 categories: COVID-19, circulatory, respiratory, mental, cancer, other mortality. The predicted values for 2020 are based on 5-year trend probabilities. The 95% Confidence Interval of the prediction is given in parentheses. Population is counted on January 1st of 2020.

Income Group	All	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Total Mortality	0-023	0-046	0-039	0-035	0-032	0-034	0-028	0-028	0-025	0-025	0-022	0-023	0-021	0-020	0-019	0-020	0-019	0-018	0-017	0-016	0-015
Predicted Mortality	0-022 (0-02; 0-024)	0-039 (0-038; 0-04)	0-034 (0-033; 0-035)	0-030 (0-029; 0-031)	0-028 (0-027; 0-029)	0-031 (0-03; 0-032)	0-026 (0-025; 0-027)	0-025 (0-024; 0-026)	0-021 (0-02; 0-022)	0-021 (0-02; 0-022)	0-021 (0-02; 0-022)	0-021 (0-019; 0-021)	0-020 (0-018; 0-02)	0-019 (0-017; 0-019)	0-018 (0-017; 0-018)	0-017 (0-016; 0-018)	0-017 (0-016; 0-018)	0-016 (0-015; 0-017)	0-015 (0-014; 0-016)	0-015 (0-014; 0-016)	0-014 (0-013; 0-015)
Covid Mortality	0-003	0-008	0-005	0-004	0-003	0-004	0-003	0-003	0-003	0-003	0-003	0-003	0-003	0-002	0-002	0-002	0-002	0-002	0-002	0-002	0-002
Circulatory Mortality	0-005	0-009	0-008	0-008	0-007	0-007	0-006	0-006	0-004	0-005	0-005	0-004	0-004	0-004	0-003	0-004	0-004	0-004	0-003	0-003	0-003
Predicted Mortality	0-005 (0-004; 0-006)	0-009 (0-006; 0-012)	0-008 (0-005; 0-011)	0-007 (0-004; 0-01)	0-007 (0-004; 0-01)	0-007 (0-005; 0-01)	0-006 (0-003; 0-009)	0-005 (0-003; 0-008)	0-005 (0-002; 0-008)	0-004 (0-002; 0-007)	0-004 (0-002; 0-007)	0-004 (0-001; 0-007)	0-004 (0-001; 0-007)	0-004 (0-001; 0-007)	0-004 (0-001; 0-007)	0-004 (0-001; 0-006)	0-003 (0-001; 0-006)	0-003 (0-001; 0-006)	0-003 (0-001; 0-006)	0-003 (0-001; 0-006)	0-003 (0-001; 0-006)
Respiratory system Mortality	0-002	0-004	0-003	0-003	0-002	0-003	0-002	0-002	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-001
Predicted Mortality	0-002 (-0-001; 0-004)	0-004 (0; 0-008)	0-003 (-0-001; 0-007)	0-003 (-0-001; 0-007)	0-003 (-0-001; 0-007)	0-003 (-0-001; 0-007)	0-002 (-0-001; 0-006)	0-002 (-0-001; 0-006)	0-002 (-0-001; 0-006)	0-002 (-0-001; 0-006)	0-002 (-0-001; 0-006)	0-001 (-0-001; 0-006)	0-001 (-0-001; 0-005)	0-001 (-0-001; 0-005)	0-001 (-0-001; 0-005)	0-001 (-0-001; 0-005)	0-001 (-0-001; 0-005)	0-001 (-0-001; 0-005)	0-001 (-0-001; 0-005)	0-001 (-0-001; 0-005)	0-001 (-0-001; 0-005)
Mental Mortality	0-001	0-002	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-001	0-000	0-001	0-000	0-001	0-000	0-001	0-000	0-000	0-000	0-000	0-000
Predicted Mortality	0-001 (0; 0-002)	0-003 (0-001; 0-005)	0-001 (0; 0-003)	0-001 (-0-001; 0-003)	0-001 (-0-001; 0-003)	0-001 (-0-001; 0-003)	0-001 (-0-001; 0-003)	0-001 (-0-001; 0-003)	0-001 (-0-001; 0-003)	0-001 (-0-001; 0-003)	0-001 (-0-001; 0-002)	0-001 (-0-001; 0-003)	0-001 (-0-001; 0-002)	0-001 (-0-001; 0-003)	0-001 (-0-001; 0-003)	0-001 (-0-001; 0-003)	0-000 (-0-001; 0-002)	0-000 (-0-001; 0-002)	0-000 (-0-001; 0-002)	0-000 (-0-001; 0-002)	0-000 (-0-001; 0-002)
Cancer Mortality	0-010	0-011	0-013	0-012	0-012	0-012	0-011	0-011	0-011	0-010	0-009	0-009	0-009	0-009	0-009	0-008	0-008	0-007	0-007	0-007	0-006
Predicted Mortality	0-010 (0-008; 0-012)	0-011 (0-008; 0-013)	0-013 (0-011; 0-015)	0-012 (0-009; 0-014)	0-012 (0-009; 0-014)	0-012 (0-011; 0-015)	0-011 (0-009; 0-014)	0-011 (0-009; 0-014)	0-011 (0-009; 0-014)	0-010 (0-007; 0-012)	0-010 (0-007; 0-012)	0-009 (0-007; 0-011)	0-009 (0-007; 0-011)	0-009 (0-006; 0-011)	0-009 (0-006; 0-011)	0-008 (0-005; 0-01)	0-008 (0-006; 0-01)	0-007 (0-006; 0-011)	0-007 (0-005; 0-01)	0-007 (0-005; 0-01)	0-006 (0-004; 0-009)
Other Mortality	0-005	0-012	0-008	0-007	0-006	0-007	0-005	0-005	0-004	0-005	0-004	0-004	0-004	0-004	0-004	0-005	0-004	0-003	0-004	0-003	0-003
Predicted Mortality	0-005 (0-003; 0-007)	0-012 (0-01; 0-014)	0-008 (0-006; 0-01)	0-007 (0-005; 0-009)	0-006 (0-005; 0-008)	0-007 (0-004; 0-008)	0-005 (0-004; 0-007)	0-005 (0-004; 0-007)	0-004 (0-003; 0-006)	0-005 (0-003; 0-006)	0-004 (0-003; 0-006)	0-004 (0-002; 0-006)	0-004 (0-003; 0-006)	0-004 (0-002; 0-005)	0-004 (0-003; 0-006)	0-004 (0-002; 0-006)	0-004 (0-002; 0-006)	0-004 (0-002; 0-005)	0-003 (0-002; 0-005)	0-004 (0-002; 0-005)	0-003 (0-002; 0-005)
Population	123537 9	61777	61765	61778	61799	61747	61754	61771	61794	61737	61809	61743	61757	61783	61770	61790	61746	61760	61764	61768	61767

Table B2: Summary Statistics for Men aged 65-79, by income group.

Note. This table shows the summary statistics of the mortality probabilities by cause of death for males aged 65-79 by 20 income groups. The causes of death are divided into 6 categories: COVID-19, circulatory, respiratory, mental, cancer, other mortality. The predicted values for 2020 are based on 5-year trend probabilities. The 95% Confidence Interval of the prediction is given in parentheses. Population is counted on January 1st of 2020.

Income Group	All	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Total Mortality	0-098	0-161	0-154	0-128	0-117	0-108	0-105	0-103	0-096	0-091	0-093	0-095	0-095	0-093	0-092	0-090	0-088	0-088	0-088	0-080	0-093	
Predicted Mortality	0-095 (0-093; 0-097)	0-139 (0-138; 0-14)	0-147 (0-146; 0-148)	0-122 (0-121; 0-123)	0-108 (0-107; 0-109)	0-100 (0-099; 0-101)	0-096 (0-095; 0-097)	0-094 (0-093; 0-095)	0-090 (0-089; 0-091)	0-084 (0-083; 0-085)	0-083 (0-082; 0-084)	0-084 (0-083; 0-085)	0-088 (0-087; 0-089)	0-087 (0-086; 0-088)	0-084 (0-083; 0-085)	0-087 (0-086; 0-088)	0-085 (0-084; 0-086)	0-080 (0-079; 0-081)	0-079 (0-078; 0-08)	0-082 (0-081; 0-083)	0-084 (0-083; 0-085)	
Covid Mortality	0-014	0-027	0-024	0-020	0-016	0-015	0-014	0-013	0-012	0-011	0-012	0-012	0-012	0-013	0-011	0-011	0-011	0-010	0-009	0-009	0-011	
Circulatory Mortality	0-029	0-037	0-035	0-031	0-030	0-028	0-027	0-028	0-027	0-025	0-025	0-026	0-026	0-025	0-024	0-025	0-024	0-023	0-024	0-021	0-023	
Predicted Mortality	0-027 (0-027; 0-028)	0-037 (0-034; 0-04)	0-037 (0-034; 0-04)	0-033 (0-03; 0-035)	0-030 (0-027; 0-033)	0-031 (0-029; 0-034)	0-028 (0-025; 0-031)	0-027 (0-024; 0-03)	0-027 (0-024; 0-029)	0-025 (0-022; 0-028)	0-025 (0-022; 0-028)	0-027 (0-024; 0-03)	0-025 (0-023; 0-028)	0-025 (0-023; 0-028)	0-025 (0-022; 0-028)	0-025 (0-022; 0-028)	0-025 (0-022; 0-028)	0-023 (0-021; 0-026)	0-026 (0-023; 0-028)	0-022 (0-019; 0-025)	0-024 (0-021; 0-026)	
Respiratory system Mortality	0-009	0-009	0-010	0-008	0-007	0-007	0-007	0-006	0-006	0-005	0-006	0-005	0-006	0-006	0-005	0-005	0-004	0-005	0-004	0-004	0-005	
Predicted Mortality	0-009 (0-006; 0-011)	0-013 (0-009; 0-017)	0-015 (0-011; 0-019)	0-011 (0-007; 0-015)	0-012 (0-008; 0-016)	0-009 (0-005; 0-013)	0-009 (0-005; 0-013)	0-009 (0-005; 0-014)	0-008 (0-004; 0-013)	0-008 (0-004; 0-012)	0-008 (0-004; 0-012)	0-007 (0-003; 0-011)	0-008 (0-004; 0-012)	0-008 (0-004; 0-012)	0-006 (0-002; 0-01)	0-008 (0-004; 0-012)	0-007 (0-003; 0-011)	0-007 (0-003; 0-011)	0-006 (0-002; 0-01)	0-006 (0-002; 0-01)	0-006 (0-002; 0-01)	
Mental Mortality	0-014	0-025	0-023	0-017	0-014	0-012	0-011	0-011	0-008	0-009	0-009	0-010	0-009	0-009	0-012	0-010	0-010	0-011	0-010	0-009	0-012	
Predicted Mortality	0-014 (0-013; 0-015)	0-029 (0-027; 0-03)	0-030 (0-028; 0-031)	0-021 (0-02; 0-023)	0-015 (0-013; 0-017)	0-014 (0-012; 0-016)	0-014 (0-012; 0-016)	0-012 (0-01; 0-014)	0-011 (0-009; 0-013)	0-009 (0-007; 0-011)	0-009 (0-007; 0-011)	0-010 (0-008; 0-012)	0-010 (0-009; 0-013)	0-012 (0-01; 0-013)	0-011 (0-009; 0-013)	0-012 (0-01; 0-015)	0-013 (0-01; 0-014)	0-012 (0-01; 0-014)	0-012 (0-01; 0-014)	0-009 (0-008; 0-011)	0-013 (0-011; 0-015)	0-014 (0-013; 0-016)
Cancer Mortality	0-015	0-015	0-015	0-015	0-016	0-016	0-016	0-016	0-017	0-017	0-016	0-015	0-015	0-015	0-015	0-014	0-014	0-014	0-015	0-014	0-013	
Predicted Mortality	0-015 (0-013; 0-017)	0-014 (0-011; 0-016)	0-016 (0-013; 0-018)	0-017 (0-015; 0-019)	0-017 (0-015; 0-019)	0-016 (0-014; 0-018)	0-015 (0-013; 0-018)	0-017 (0-015; 0-019)	0-017 (0-014; 0-019)	0-016 (0-013; 0-018)	0-016 (0-013; 0-018)	0-015 (0-013; 0-017)	0-016 (0-013; 0-018)	0-015 (0-013; 0-018)	0-015 (0-012; 0-017)	0-014 (0-012; 0-016)	0-013 (0-011; 0-015)	0-013 (0-011; 0-015)	0-014 (0-011; 0-016)	0-014 (0-012; 0-017)	0-012 (0-01; 0-015)	
Other Mortality	0-030	0-048	0-046	0-038	0-034	0-031	0-030	0-030	0-026	0-025	0-026	0-026	0-028	0-027	0-026	0-026	0-026	0-026	0-025	0-023	0-029	
Predicted Mortality	0-030 (0-029; 0-032)	0-047 (0-046; 0-049)	0-049 (0-047; 0-051)	0-040 (0-038; 0-042)	0-035 (0-033; 0-036)	0-029 (0-028; 0-031)	0-030 (0-028; 0-031)	0-028 (0-027; 0-03)	0-027 (0-026; 0-029)	0-027 (0-025; 0-028)	0-025 (0-024; 0-027)	0-025 (0-023; 0-027)	0-027 (0-025; 0-029)	0-027 (0-025; 0-029)	0-027 (0-025; 0-029)	0-026 (0-025; 0-029)	0-028 (0-026; 0-03)	0-028 (0-027; 0-027)	0-025 (0-023; 0-026)	0-025 (0-023; 0-026)	0-027 (0-025; 0-029)	0-028 (0-026; 0-03)
Population	504593	25233	25233	25236	25219	25232	25263	25218	25231	25228	25214	25236	25213	25248	25227	25224	25223	25227	25230	25230	25228	

Table B3: Summary Statistics for Women aged 80+, by income group.

Note. This table shows the summary statistics of the mortality probabilities by cause of death for females aged 80+ by 20 income groups. The causes of death are divided into 6 categories: COVID-19, circulatory, respiratory, mental, cancer, other mortality. The predicted values for 2020 are based on 5-year trend probabilities. The 95% Confidence Interval of the prediction is given in parentheses. Population is counted on January 1st of 2020.

Income Group	All	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Total Mortality	0-110	0-166	0-148	0-143	0-129	0-127	0-124	0-124	0-125	0-119	0-118	0-116	0-113	0-116	0-110	0-110	0-104	0-098	0-097	0-100	0-096	
Predicted Mortality	0-106 (0-104; 0-108)	0-144 (0-143; 0-145)	0-131 (0-13; 0-132)	0-122 (0-121; 0-123)	0-115 (0-114; 0-116)	0-111 (0-11; 0-112)	0-109 (0-108; 0-11)	0-113 (0-112; 0-114)	0-108 (0-107; 0-109)	0-108 (0-107; 0-109)	0-107 (0-106; 0-108)	0-102 (0-101; 0-103)	0-103 (0-102; 0-104)	0-101 (0-1; 0-102)	0-100 (0-099; 0-1)	0-099 (0-098; 0-1)	0-091 (0-09; 0-092)	0-095 (0-094; 0-096)	0-087 (0-086; 0-088)	0-086 (0-085; 0-087)	0-089 (0-088; 0-09)	
Covid Mortality	0-019	0-032	0-028	0-027	0-021	0-021	0-020	0-021	0-021	0-020	0-021	0-017	0-017	0-015	0-015	0-016	0-014	0-015	0-014	0-013	0-013	
Circulatory Mortality	0-032	0-039	0-035	0-031	0-031	0-031	0-031	0-030	0-031	0-032	0-028	0-029	0-029	0-030	0-030	0-027	0-027	0-024	0-023	0-023	0-024	
Predicted Mortality	0-029 (0-029; 0-03)	0-036 (0-033; 0-039)	0-035 (0-032; 0-038)	0-033 (0-03; 0-036)	0-032 (0-029; 0-035)	0-031 (0-028; 0-033)	0-033 (0-03; 0-035)	0-031 (0-028; 0-034)	0-032 (0-029; 0-035)	0-031 (0-028; 0-033)	0-033 (0-03; 0-036)	0-028 (0-025; 0-031)	0-027 (0-024; 0-03)	0-030 (0-027; 0-032)	0-028 (0-025; 0-03)	0-028 (0-025; 0-031)	0-024 (0-021; 0-027)	0-024 (0-021; 0-027)	0-024 (0-021; 0-027)	0-026 (0-023; 0-029)	0-024 (0-022; 0-027)	
Respiratory system Mortality	0-012	0-014	0-013	0-012	0-012	0-010	0-009	0-009	0-010	0-009	0-008	0-010	0-008	0-008	0-007	0-008	0-008	0-008	0-006	0-007	0-006	
Predicted Mortality	0-011 (0-009; 0-013)	0-017 (0-013; 0-021)	0-016 (0-012; 0-02)	0-016 (0-011; 0-02)	0-015 (0-01; 0-019)	0-013 (0-009; 0-017)	0-010 (0-006; 0-014)	0-014 (0-01; 0-018)	0-012 (0-008; 0-016)	0-011 (0-007; 0-015)	0-012 (0-008; 0-016)	0-010 (0-008; 0-016)	0-010 (0-006; 0-014)	0-008 (0-004; 0-013)	0-010 (0-006; 0-014)	0-008 (0-004; 0-012)	0-008 (0-004; 0-011)	0-008 (0-004; 0-011)	0-009 (0-005; 0-011)	0-006 (0-002; 0-01)	0-007 (0-003; 0-011)	0-007 (0-003; 0-011)
Mental Mortality	0-011	0-018	0-012	0-011	0-011	0-009	0-009	0-009	0-008	0-008	0-009	0-009	0-008	0-009	0-008	0-008	0-009	0-007	0-007	0-008	0-007	
Predicted Mortality	0-011 (0-01; 0-011)	0-021 (0-019; 0-023)	0-016 (0-014; 0-018)	0-014 (0-012; 0-016)	0-012 (0-01; 0-014)	0-010 (0-008; 0-012)	0-011 (0-009; 0-012)	0-012 (0-01; 0-013)	0-010 (0-008; 0-012)	0-009 (0-007; 0-011)	0-008 (0-006; 0-01)	0-009 (0-007; 0-011)	0-009 (0-009; 0-013)	0-011 (0-009; 0-013)	0-011 (0-007; 0-013)	0-009 (0-007; 0-011)	0-010 (0-008; 0-012)	0-009 (0-007; 0-011)	0-009 (0-007; 0-011)	0-008 (0-006; 0-01)	0-008 (0-006; 0-01)	0-010 (0-008; 0-012)
Cancer Mortality	0-027	0-023	0-025	0-031	0-027	0-029	0-027	0-027	0-029	0-024	0-027	0-027	0-024	0-027	0-024	0-026	0-023	0-021	0-024	0-022	0-023	
Predicted Mortality	0-026 (0-024; 0-028)	0-024 (0-022; 0-027)	0-027 (0-025; 0-029)	0-028 (0-025; 0-03)	0-028 (0-026; 0-03)	0-027 (0-025; 0-03)	0-029 (0-026; 0-031)	0-029 (0-027; 0-032)	0-027 (0-025; 0-029)	0-028 (0-026; 0-031)	0-026 (0-024; 0-029)	0-026 (0-023; 0-028)	0-029 (0-026; 0-031)	0-025 (0-023; 0-028)	0-025 (0-022; 0-027)	0-027 (0-025; 0-029)	0-024 (0-021; 0-027)	0-025 (0-023; 0-027)	0-022 (0-019; 0-024)	0-023 (0-021; 0-026)	0-023 (0-021; 0-025)	
Other Mortality	0-028	0-040	0-035	0-032	0-027	0-027	0-028	0-029	0-026	0-026	0-026	0-025	0-028	0-027	0-026	0-026	0-024	0-024	0-023	0-026	0-023	
Predicted Mortality	0-029 (0-027; 0-03)	0-045 (0-043; 0-046)	0-037 (0-036; 0-039)	0-032 (0-03; 0-034)	0-029 (0-027; 0-031)	0-031 (0-029; 0-033)	0-027 (0-026; 0-029)	0-028 (0-026; 0-03)	0-027 (0-025; 0-029)	0-029 (0-028; 0-031)	0-027 (0-025; 0-029)	0-026 (0-025; 0-028)	0-027 (0-025; 0-028)	0-027 (0-025; 0-029)	0-028 (0-027; 0-03)	0-026 (0-024; 0-028)	0-027 (0-025; 0-029)	0-028 (0-026; 0-029)	0-028 (0-027; 0-03)	0-021 (0-019; 0-023)	0-025 (0-023; 0-027)	
Population	324219	16212	16218	16208	16219	16211	16207	16218	16208	16208	16207	16210	16215	16214	16200	16216	16205	16212	16213	16208	16210	

Table B4: Summary Statistics for Men aged 80+, by income group.

Note. This table shows the summary statistics of the mortality probabilities by cause of death for females aged 80+ by 20 income groups. The causes of death are divided into 6 categories: COVID-19, circulatory, respiratory, mental, cancer, other mortality. The predicted values for 2020 are based on 5-year trend probabilities. The 95% Confidence Interval of the prediction is given in parentheses. Population is counted on January 1st of 2020.

Appendix C

	Women		Men	
	65-79	80+	65-79	80+
CI Total Mortality	-0.192	-0.0966	-0.176	-0.0792
CI Predicted Mortality	-0.189	-0.0911	-0.165	-0.0723
CI Observed Excess Mortality	-0.238	-0.164	-0.256	-0.135
Std. Error	0.106	0.0639	0.0506	0.031
Weight Excess Mortality	0.0698	0.076	0.115	0.11
Contribution to CI Total Mortality	-0.0166	-0.0124	-0.0293	-0.0149
COVID-19				
Weight Observed	0.095	0.131	0.121	0.159
CI Observed mortality	-0.326	-0.164	-0.236	-0.143
Cause-specific Contribution to CI to Excess Mortality	-0.031	-0.0215	-0.0284	-0.0227
Percentage contribution	187%	173%	97%	152%
Circulatory diseases				
Weight Predicted	0.17	0.266	0.196	0.247
CI Predicted Mortality	-0.232	-0.0749	-0.209	-0.0672
Weight Observed	0.173	0.259	0.205	0.245
CI Observed Mortality	-0.224	-0.0754	-0.187	-0.0673
Cause-specific Contribution to CI	0.000553	0.000404	0.00273	0.0000997
Percentage contribution	-3%	-3%	-9%	-1%
Respiratory diseases				
Weight Predicted	0.0889	0.0829	0.0714	0.0924
CI Prediction Mortality	-0.334	-0.146	-0.312	-0.154
Weight Observed	0.071	0.058	0.0624	0.0764
CI Observed Mortality	-0.323	-0.141	-0.323	-0.128
Cause-specific Contribution to CI	0.00681	0.00396	0.00212	0.00441
Percentage contribution	-41%	-32%	-7%	-30%
Mental Disorder Mortality				
Weight Predicted	0.0458	0.136	0.0352	0.0906
CI Predicted Mortality	-0.278	-0.142	-0.259	-0.117
Weight Observed	0.0403	0.118	0.0297	0.0771
CI Observed Mortality	-0.263	-0.134	-0.294	-0.106
Cause-specific Contribution to CI	0.00211	0.00355	0.000377	0.00237
Percentage contribution	-13%	-29%	-1%	-16%
Cancer Mortality				
Weight Predicted	0.412	0.146	0.382	0.219
CI Prediction Mortality	-0.107	-0.034	-0.0987	-0.0297
Weight Observed	0.413	0.146	0.38	0.213
CI Observed Mortality	-0.103	-0.0253	-0.109	-0.0351
Cause-specific Contribution to CI	0.00149	0.00128	-0.00364	-0.000973

	Percentage contribution	-9%	-10%	12%	7%
Other Mortality					
Weight Predicted		0.214	0.293	0.201	0.241
CI Prediction Mortality		-0.233	-0.0951	-0.18	-0.0681
Weight Observed		0.207	0.289	0.203	0.229
CI Observed Mortality		-0.224	-0.0968	-0.191	-0.0635
Cause-specific Contribution to CI		0.00346	-0.000133	-0.00251	0.0019
Percentage contribution		-21%	1%	9%	-13%

Table C1: Decomposition of excess mortality by cause of death

Note. This table is the full Table 1. It shows the decomposition of total mortality inequality in 2020 into causes of death categories. Mortality inequality is measured using the Concentration Index. Deaths are divided into six causes: COVID-19, circulatory deaths, deaths from mental disorders, cancer deaths, respiratory disease deaths and other causes. The Concentration Index is calculated for each cause of death and its predicted probability. The contribution to total excess mortality is shown as the cause-specific contribution.