Erasmus School of
Health Policy
& Management

Income Inequality in Years of Life Lost to Covid-19

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Background


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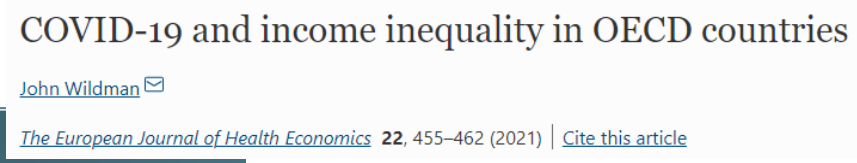
COVID-19 and social inequalities: a complex and dynamic interaction
Catherine Quantin • Pascale Tubert-Bitter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JOURNAL ARTICLE
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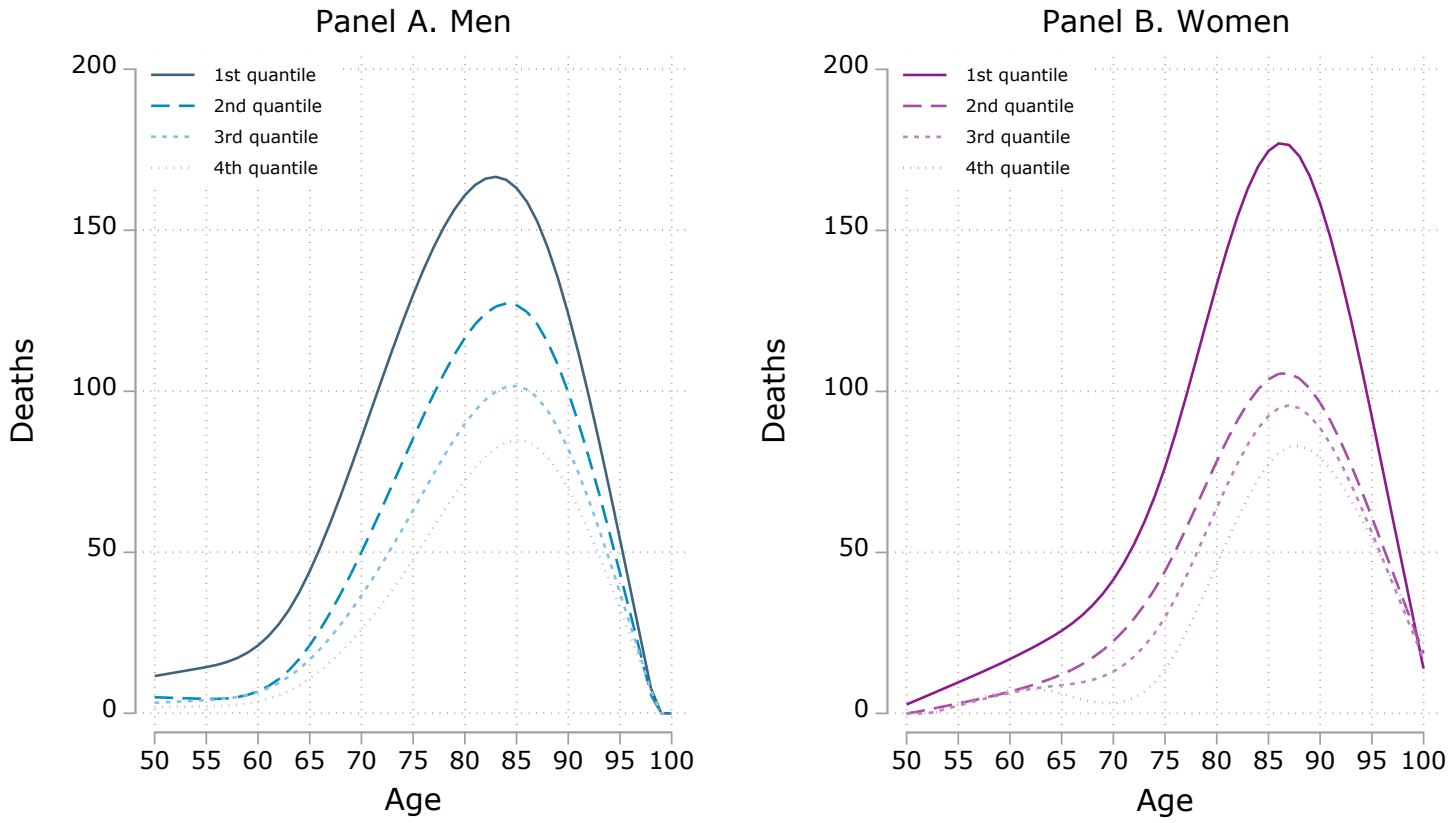
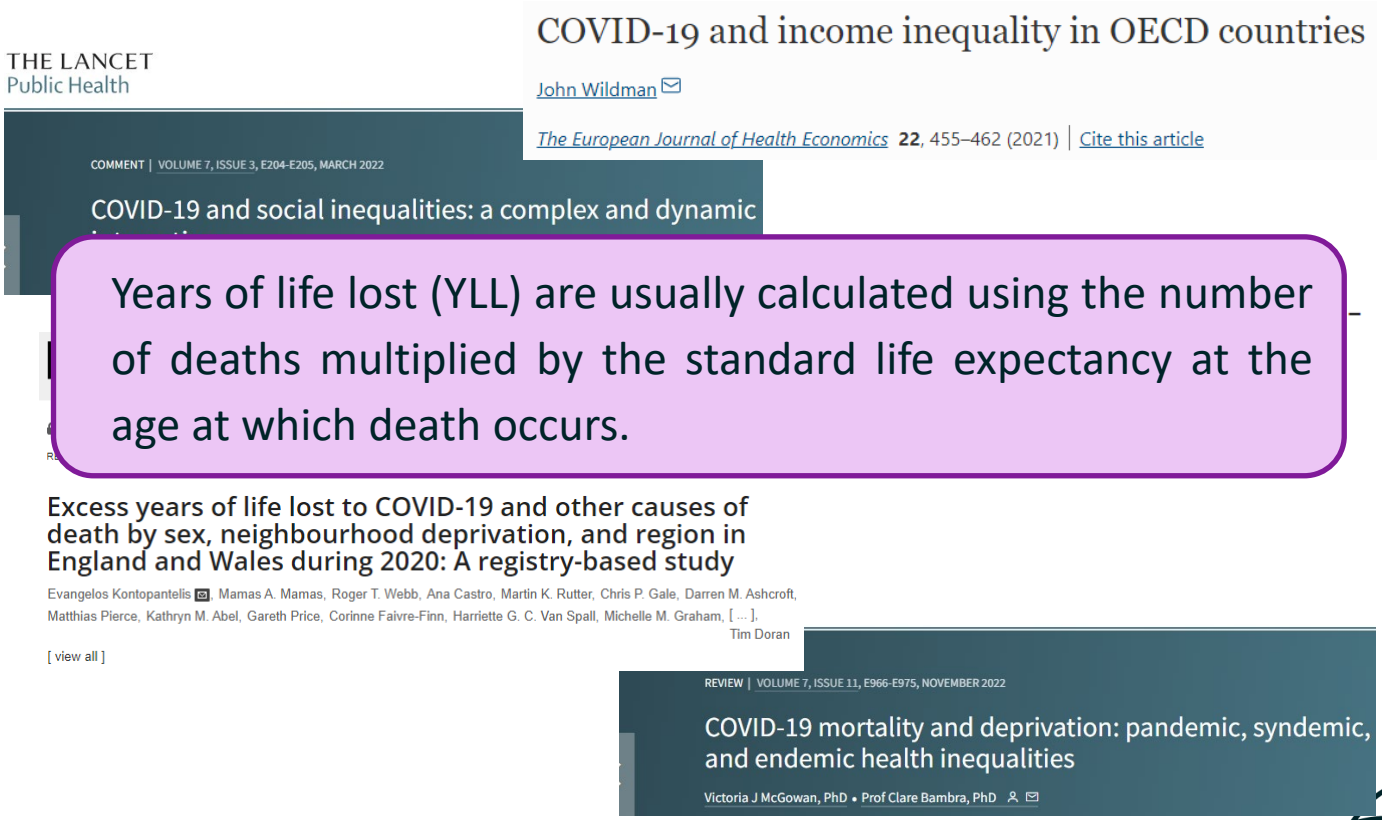
COVID-19 mortality and deprivation: pandemic, syndemic, and endemic health inequalities
Victoria J McGowan, PhD • Prof Clare Bambra, PhD

Covid-deaths by income in the Netherlands in 2020



Background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COMMENT | VOLUME 7, ISSUE 3, E204-E205, MARCH 2022
COVID-19 and social inequalities: a complex and dynamic
Years of life lost (YLL) are usually calculated using the number of deaths multiplied by the standard life expectancy at the age at which death occurs.
Excess years of life lost to COVID-19 and other causes of death by sex, neighbourhood deprivation, and region in England and Wales during 2020: A registry-based study
Evangelos Kontopantelis, Mamas A. Mamas, Roger T. Webb, Ana Castro, Martin K. Rutter, Chris P. Gale, Darren M. Ashcroft, Matthias Pierce, Kathryn M. Abel, Gareth Price, Corinne Faivre-Finn, Harriette G. C. Van Spall, Michelle M. Graham, [...], Tim Doran
[view all]
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Background

- Using population-based remaining life expectancy leads to an overestimation of years of life lost.
- Previous studies accounting for health status have estimated this overestimation to range between 1.3 and 3.9 years of life per death depending on the indicators of health status that were included.
- No study thus far has estimated socioeconomic differences in YLL while taking prior health into account.

Objective

Quantify YLL associated with covid-19 deaths by sex and **income** quartile while accounting for the impact of **pre-existing health** on remaining life expectancy for those dying from the disease.

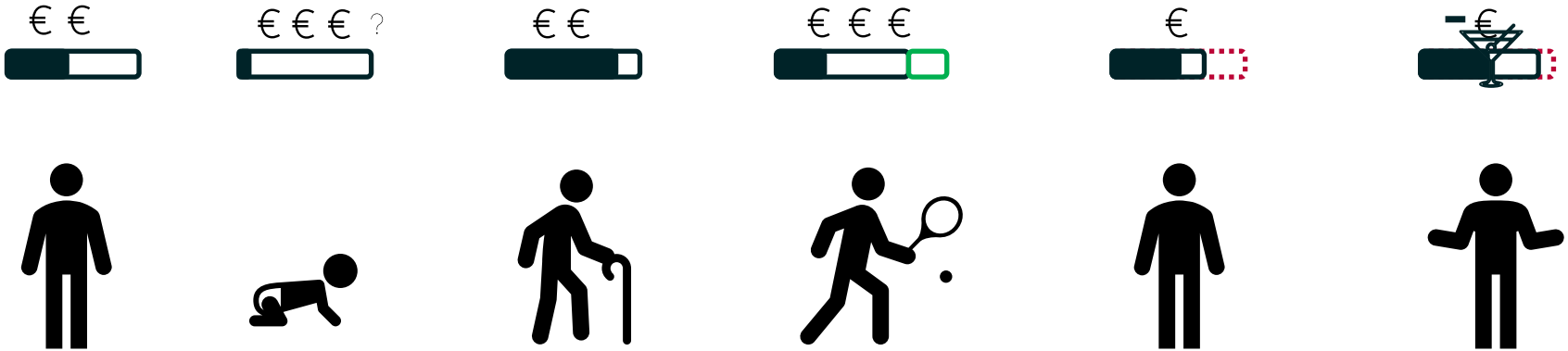
Data: CBS Microdata

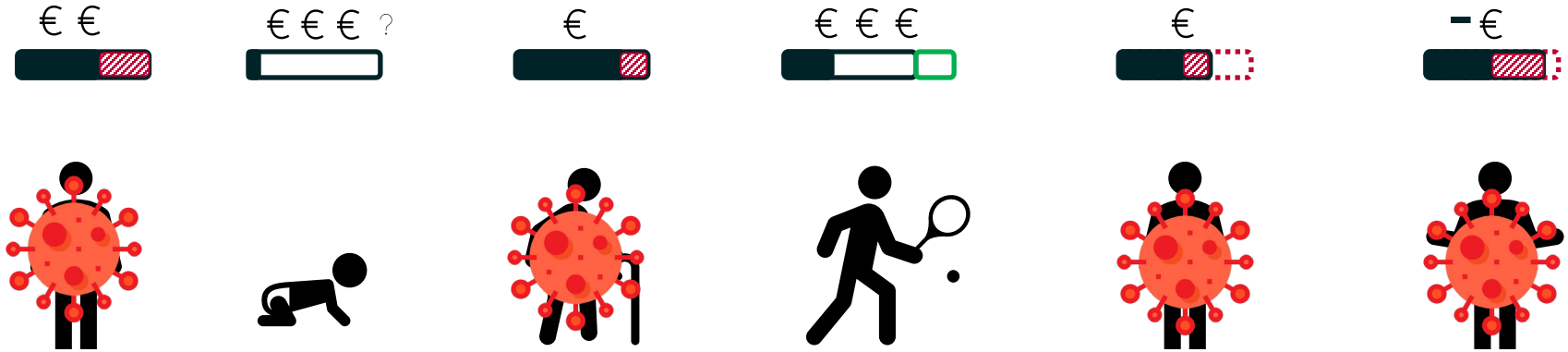
- Administrative data on each individual residing in the Netherlands:
  - Time of residence in the country (start/end date)
  - Personal characteristics (DOB and sex)
  - Death data (DOD, cause of death)
  - Disposable household income
  - Medication usage
  - Nursing home stay
  - Functional impairment
  - Hospitalizations *

- Years available 2011-2021

Methods

- Use machine learning methods to predict survival (data from 2011-2019) based on prior health care use (data from 2011) for all Dutch citizens
- Identify individuals who died of Covid-19 in 2020 & 2021
- Predict counterfactual life expectancy for those who died of Covid-19 based on their prior health care use (data from 2019)





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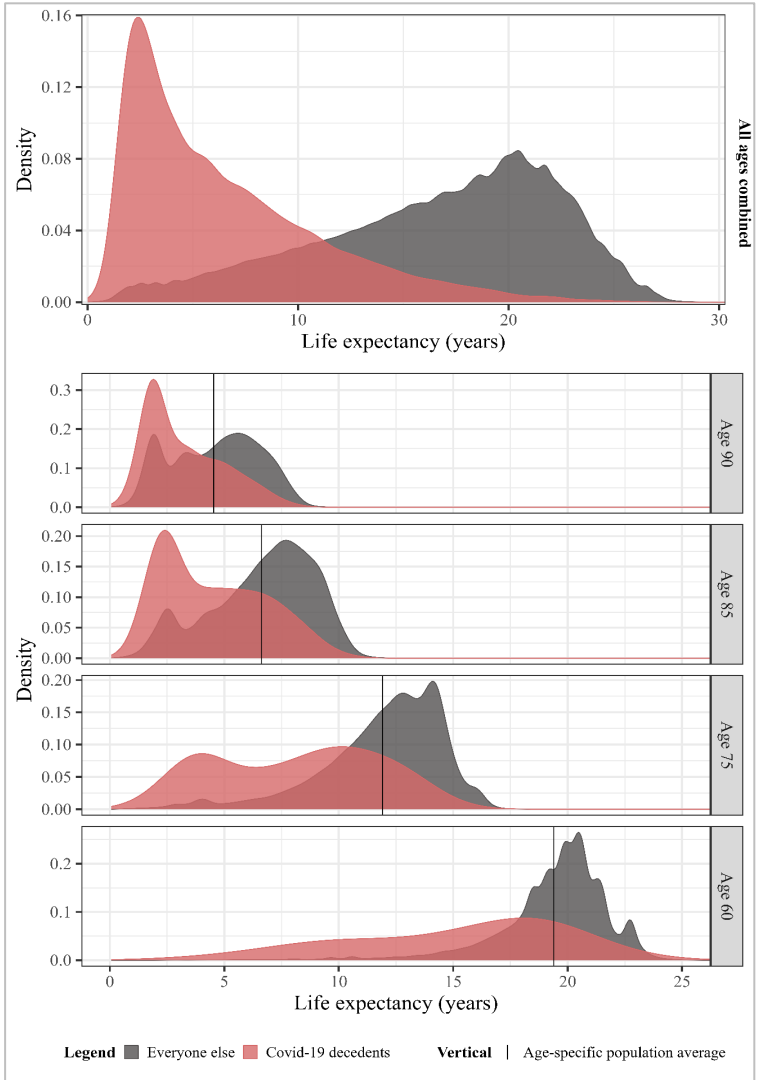
YLL = death * life expectancy

How do we calculate life expectancy?

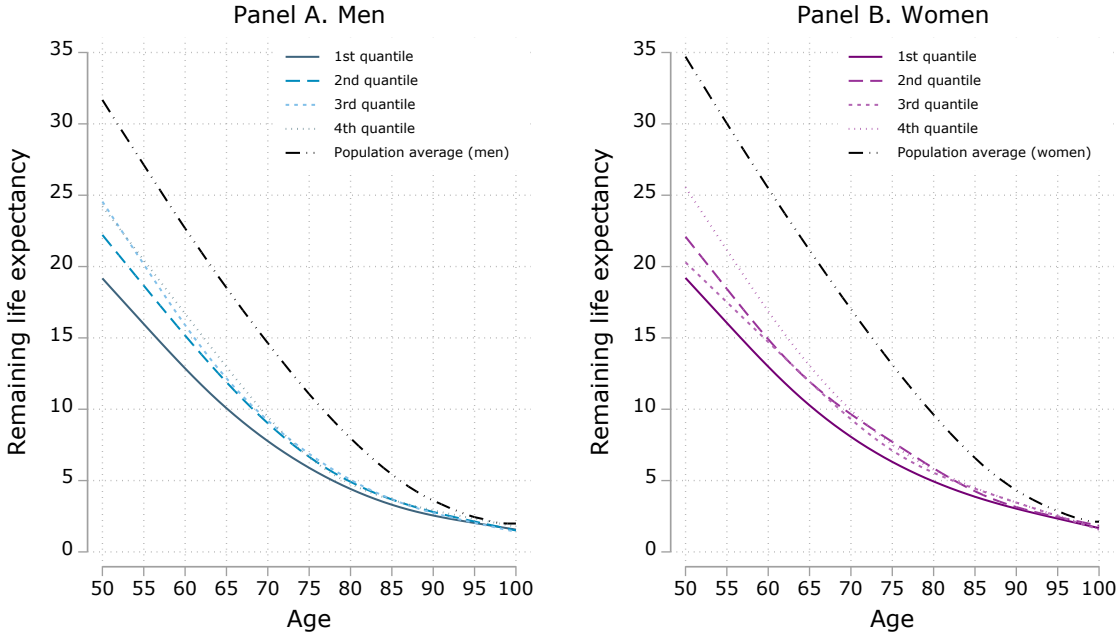
Using what data?

Results

Remaining life expectancy by gender for those who died of Covid-19 compared to those who did not die of Covid-19 as calculated using prediction model



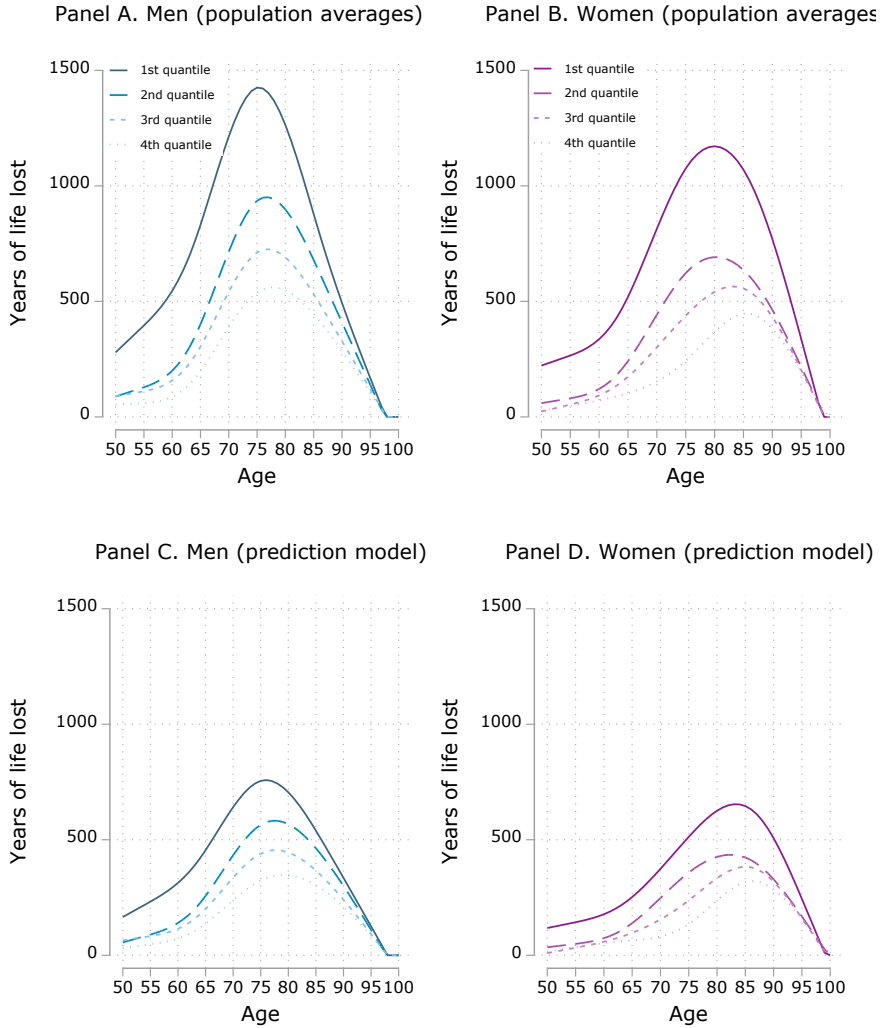
Results



Remaining life expectancy by gender for those who died of covid-19 as calculated using prediction model as well as Statistics Netherlands population-based estimates

Results

YLL to covid-19 for the 50+ population as calculated using population-based remaining life expectancy (A, B) and using our prediction approach (C, D).



Results

Table 2. COVID-19 deaths, average age at death and total and average years of life lost to COVID-19 for the population aged 50+ years, by sex and income quartile in The Netherlands in 2020

Sex and income quartile	Number of COVID-19 deaths[a]	Average age at death (years)	Years of life lost[a]			Average years of life lost		
			Life tables based on prediction model	Income-stratified life tables	Standard life tables	Life tables based on prediction model	Income-stratified life tables	Standard life tables
Men								
1st quartile (poorest)	3976 (37.3)	79	20 886 (37.4)	33 663 (37.3)	37 502 (40.6)	5.3	8.5	9.4
2nd quartile	2757 (25.9)	80.5	14 769 (26.4)	23 111 (25.6)	23 251 (25.2)	5.4	8.4	8.4
3rd quartile	2173 (20.4)	80.9	11 479 (20.5)	18 503 (20.5)	17 959 (19.4)	5.3	8.5	8.3
4th quartile (richest)	1744 (16.4)	81.6	8741 (15.6)	15 001(16.6)	13 697 (14.8)	5	8.6	7.9
Total	10 650 (100)	80.2	55 875 (100)	90 278 (100)	92 409 (100)	5.3	8.5	8.7
Women								
1st quartile (poorest)	3735 (40.1)	82.6	17 788 (39.6)	28 260 (38.9)	32 706 (43.7)	4.8	7.6	8.8
2nd quartile	2195 (23.5)	83.7	11 060 (24.7)	18 099 (24.9)	17 680 (23.6)	5	8.2	8.1
3rd quartile	1877 (20.1)	84.5	9099 (20.3)	15 241 (21.0)	14 265 (19.0)	4.9	8.1	7.6
4th quartile (richest)	1516 (16.3)	86	6921 (15.4)	11 038 (15.2)	10 255 (13.7)	4.6	7.3	6.8
Total	9323 (100)	83.8	44 868 (100)	72 638 (100)	74 906 (100)	4.8	7.8	8

[a] Number in brackets is the percentage within sex-group.

Conclusions

We show the relevance of correcting for underlying health when calculating YLL due to covid-19 – individual-based approach to estimating YLL. Correcting for underlying health also matters for analyzing socioeconomic differences in YLL.

When correcting for health status, age profiles of mortality for those who died of covid-19 were rather similar.

Using a standard approach relying on remaining life expectancy for the entire population would result in an overestimation of more then 3 years per death.

Total years of life lost in the Dutch population are lower by a third when using an individual-level survival prediction model.

We find a similar distribution of YLL over the income quartiles pointing towards a possibility that the unequal distribution of YLL is driven by the distribution of deaths across income quartiles.

Output

- 1 paper published in International Journal of Epidemiology
- 1 paper submitted
- 1 paper in the pipeline

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https://doi.org/10.1093/ije/dyad159
Original article

IEA International Epidemiological Association | OXFORD

Original article

Quantifying income inequality in years of life lost to COVID-19: a prediction model approach using Dutch administrative data

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Abstract

Background: Low socioeconomic status and underlying health increase the risk of fatal outcomes from COVID-19, resulting in more years of life lost (YLL) among the poor. However, using standard life expectancy overestimates YLL to COVID-19. We aimed to quantify YLL associated with COVID-19 deaths by sex and income quartile, while accounting for the impact of individual-level pre-existing health on remaining life expectancy for all Dutch adults aged 50+.

Methods: Extensive administrative data were used to model probability of dying within the year for the entire 50+ population in 2019, considering age, sex, disposable income and health care use ($n = 6\,885\,958$). The model is used to predict mortality probabilities for those who died of COVID-19 (had they not died) in 2020. Combining these probabilities in life tables, we estimated YLL by sex and income quartile. The estimates are compared with YLL based on standard life expectancy and income-stratified life expectancy.

Results: Using standard life expectancy results in 167 315 YLL (8.4 YLL per death) which is comparable to estimates using income-stratified life tables (167 916 YLL with 8.2 YLL per death). Considering pre-existing health and income, YLL decreased to 100 743, with 40% of years lost in the poorest income quartile (5.0 YLL per death). Despite individuals in the poorest quartile dying at younger ages, there were minimal differences in average YLL per COVID-19 death compared with the richest quartile.

Conclusions: Accounting for prior health significantly affects estimates of YLL due to COVID-19. However, inequality in YLL at the population level is primarily driven by higher COVID-19 deaths among the poor. To reduce income inequality in the health burden of future pandemics, policies should focus on limiting structural differences in underlying health and exposure of lower income groups.

Keywords: COVID-19, income inequality, The Netherlands, years of life lost, mortality.

Key Messages

- Individuals with a lower income and underlying health problems were more likely to suffer the fatal consequences of COVID-19.
- Using standard remaining life expectancy leads to an overestimation of years of life lost, which previous studies accounting for health status have estimated to range between 1.3 and 3.9 years per COVID-19 death depending on the indicators of health status included.
- Combining individual administrative data for the entire Dutch population on cause of death, income and health care use to produce estimates of years of life lost that take prior health status into account, reflects substantial inequality in the disease burden of COVID-19 deaths in The Netherlands in 2020 by income, with the lowest income group bearing 40% of the total of 100 743 years of life lost.
- To reduce income inequality in the health burden of future pandemics, policies should focus on limiting structural differences in underlying health and limiting the exposure of lower income groups.

Currently working on…

Disentangling unequal health burden by income of Covid-19 into 3 components

Differences in pre-existing health	Differences in vaccination uptake	Other: exposure/healthcare access

Preliminary findings

Differences in pre-existing health are more important than differences in vaccination uptake	Exposure/healthcare access plays a minor role