CEPOS

WE PAY MINIMUM FIVE TIMES AS MUCH FOR A LIFE YEAR WITH THE CORONA MEASURES THAN WE NORMALLY DO

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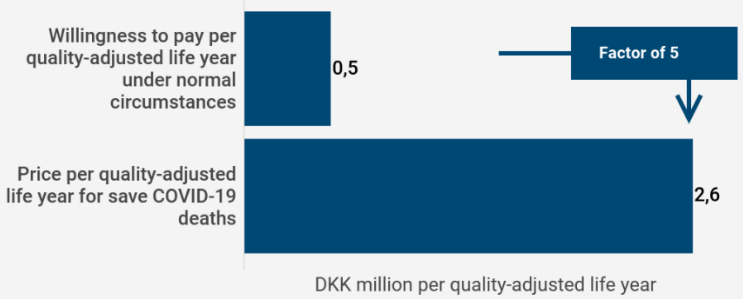
BY JONAS HERBY (T: +45 2728 2748)

CONCLUSIONS

- Even in a relatively optimistic scenario where the government's precautionary measures ensure that there are no fatalities due to COVID-19, we pay in the order of **five times** as much per quality adjusted life year gained than what we are normally willing to pay, cf. figure 1.
- If the government's precautionary measures only halve the excess mortality and cause a fall in GDP that is just as huge as during the financial crisis, the price per life year gained is over **20 times** higher than what we are normally willing to pay.
- There are several instances of the Danish Medicines Council not recommending the use of medicines that are too expensive in relation to the effect. In 2019, lenalidomide was rejected for treatment of bone marrow cancer, on the grounds that *"Maintenance treatment with lenalidomide is categorised as having important clinical added value. However, the current cost is very high and out of proportion to the clinical added value. Thus, the Danish Medicines Council does not recommend the drug as a standard treatment.*", cf. Medicinrådet (2019).
- The conclusions are the same if one compares the cost per saved lives due to the COVID-19 precautionary measures to the value of statistical life as calculated in the Secretariat of the Danish Economic Councils (2016) and at the same time takes into account that people who die due to COVID-19 are on average significantly older than the average.

Figure 1. We risk paying more than five times as much per life year gained for COVID-19 related deaths than what we are normally willing to pay.



PRECONDITIONS

- The Danish Health Authority (2020) estimates that COVID-19 may cause excess mortality in Denmark in the order of 1,680 to 5,600 patients during the first wave until summer, even when the effect of the precautionary measures taken since 11 March are not taken into account (mean = 3,640, although the Danish Health Authority has stated that it will probably be at the low end).
- During the financial crisis, GDP fell by 4.9%. Given that the Danish Ministry of Finance's forecast for 2020 is 1.5%. GDP growth costs a setback of the same magnitude, i.e. 6.4% of GDP = DKK 150 billion in market prices (This roughly corresponds to the estimate issued by the Confederation of Danish Industry (DI), cf. https://www.berling-ske.dk/oekonomi/coronakrise-vil-give-et-raedselsaar-for-dansk-oekonomi-minusvaekst-paa-67).
- Based on the death rate from a study by Imperial College (Ferguson et al. (2020)), the expected remaining life expectancy from Statistics Denmark and the fact that 99% of those who die due to COVID-19 already have one or more disorders, cf. Istituto Superiore di Sanità (2020), and quality-adjusted life years for Danes from Sørensen et al. (2009), the number of lost quality-adjusted life years (QALY) per death can be estimated at approx. 8 quality-adjusted life years (the calculation is described in more detail in the appendix).

CALCULATION

If the government's initiatives prevent all deaths in the first wave (3,640 deaths equivalent to 29,120 QALY) as a result of COVID-19 and the cost of the closure equals half a financial crisis (DKK 75 billion), it will cost society on average DKK 2.6 million per quality-adjusted life year gained.

That corresponds to more than 5 times as much than what we are normally willing to pay per quality-adjusted life year (DKK 500,000, cf. e.g. https://www.kristeligt-dagblad.dk/danmark/sundhedsoekonomer-dyrt-redde-et-liv-fra-corona).

There are other effects that affect the calculation (for example, the pressure on the healthcare sector that treats COVID-19 patients, spread of infection to other parts of the healthcare sector, as well as are many personal consequences of being largely isolated), but it is nevertheless remarkable that we pay SO much more with SUCH optimistic assumptions (if we save only half the number and the costs become half of the first year of the financial crisis, we pay more than 20 times the usual amount (DKK 10.3 million per quality-adjusted life year gained).

Calculated in the same way, the price per life saved is DKK 21 million. Initially, this is lower than the value of an average statistical life of DKK 34.4 million, cf. the Secretariat of the Danish Economic Councils (2016) and DTU Transport (2019). However, here it should be noted that a person who dies due to COVID-19 — as described above — is not the average. If adjusted for remaining

life expectancy, the willingness to pay is around DKK 8 million, and thus deaths due to COVID-19 deaths are a relatively expensive way to save lives compared to e.g. investments in road safety.

CONCLUSION

Naturally, the results do not imply that we should do nothing. Some precautionary measures will be good measured at cost per life years, while others will be very poor (here it is interesting to note that the Danish Health Authority did not support the closure of borders, among other things).

It is understandable that the government acted resolutely when it was felt that the situation was getting out of control. However, there has since been time to make the above considerations, and despite this, the government has not provided any evidence that their precautionary measures — which have resulted in major interventions in the lives of the individual citizen — are reasonable in relation to what we normally pay per life year gained. If we pay significantly more to save a COVID-19 patient than we do normally, it will mean that we have fewer resources in the future that may alternatively save more lives.

MAIN RESERVATIONS

- The government has not provided scenarios as to how many lives the precautionary measures will save compared to less restrictive measures. Thus, it is unknown as to how many lives the precautionary measures will ultimately save.
- It is still very uncertain as to how big the economic consequences will be as a result of the government's precautionary measures. Even without precautionary measures, we would most likely see a slowdown in economic activity.
- In an actual cost-effectiveness analysis, other factors as a result of the government's shut-down must be taken into account. Among other things, this applies to the impact on other parts of the health sector, on the health and quality of life of the population, etc.

APPENDIX

LOST LIFE YEARS FOR AN AVERAGE DEATH RELATED TO COVID-19

Ferguson et al. (2020) has estimated the mortality rate of infected individuals to be between 0.002% and 9.3% depending on the age of the infected person, cf. table 1.

Based on population figures and the remaining life expectancy from Statistics Denmark, the expected remaining life expectancy of a person who is the same age as someone who dies as a result of a COVID-19 infection can be calculated to be 13.1 years, provided that the proportion of infected are the same in all age groups.

However, an Italian study shows that 99% of those who die of COVID already have one or more diseases. Among other things, more than 75% had high blood pressure, approx. 35% had diabetes, one third had heart disease and 25% had atrial fibrillation, cf. Istituto Superiore di Sanità (2020).[1] Nearly half (48.5%) suffered from three diseases beforehand. This means that the people who die from COVID-19 could hardly expect to live as long as the average. For instance, diabetics on average live 4-8 years less than non-diabetics[2], and people with atrial fibrillation have twice the mortality rate than people with sinus rhythm[3]. To correct this, I have adjusted the remaining life expectancy of individuals who die from COVID-19 by deducting 10% of the remaining life expectancy in relation to the average remaining life expectancy.

Table 1 Mortality rate and life expectancy divided by age groups

Age group	*Number of people*	*Remaining life expectancy of the average population**	*Remaining life expectancy for people who die from Covid-19***	*Mortality rate among those infected*
0 to 9	*614,489*	*76.2*	*68.6*	*0.002%*
10 to 19	*681,911*	*66.3*	*59.7*	*0.006%*
20 to 29	*782,701*	*56.4*	*50.8*	*0.030%*
30 to 39	*686,808*	*46.6*	*42.0*	*0.080%*
40 to 49	*756,048*	*37.0*	*33.3*	*0.150%*
50 to 59	*800,444*	*27.8*	*25.0*	*0.600%*
60 to 69	*663,646*	*19.4*	*17.4*	*2.200%*
70 to 79	*564,390*	*12.0*	*10.8*	*5.100%*
80+	*272,326*	*5.6*	*5.0*	*9.300%*
Total/average	*5,822,763*	*41.1*	*37.0*	*1.296%*

*Note: * For each age interval, the expected remaining life expectancy is set to the remaining life expectancy of the middle of the interval. Thus, for the interval 10-19, the expected remaining life expectancy corresponds to the remaining life expectancy of 15-year-olds. For 80+-year-olds, the expected remaining life expectancy is estimated as the weighted average remaining life expectancy of 85-year-olds and 95-year-olds. ** For those who die from COVID-19, the expected life expectancy is reduced by 2½ years in order to take into account that 99% of cases from Italy have one or more medical conditions.*
Source: Ferguson et al. (2020) and Statbank Denmark (Folk1B and HISB1)

Based on population figures and the remaining life expectancy from Statistics Denmark, the otherwise expected remaining life expectancy of a person who dies as a result of a COVID-19 infection can be calculated to be 11.8 years, provided that the proportion of infected are the same in all age groups.[4]

[1] A summary of the Italian report can be read here: https://www.bloomberg.com/news/articles/2020-03-18/99-of-those-who-died-from-virus-had-other-illness-italy-says
[2] Source; https://diabetes.dk/aktuelt/nyheder/nyhedsarkiv/2016/vi-lever-laengere-med-diabetes.aspx
[3] Source: https://www.sundhed.dk/sundhedsfaglig/laegehaandbogen/hjerte-kar/tilstande-og-sygdomme/arytmier/atrieflimren-og-flagren/
[4] Calculated as the weighted remaining life expectancy for people who die due to COVID-19, i.e. ("Number of individuals" x "Mortality rate among the infected" x "Expected remaining life expectancy of individuals dying from COVID-19")/("Number of individuals" x "Mortality rate among the infected").

LOST QUALITY-ADJUSTED LIFE YEARS (QALY) FOR AN AVERAGE DEATH RELATED TO COVID-19

When calculating the socio-economic value of a life year in health economic analyses, the quality of the life year is corrected. The correction is made to take into account that people's assessment of the benefit of gaining an extra life year depends on their health in the year gained. A year of perfect health corresponds to a quality-adjusted life year of 1 QALY. Depending on how far a person is from having perfect health, QALY decreases accordingly.

The table below shows the average QALY for Danes depending on age. The second column of the table shows the average QALY for people in the given age group. That is, the quality of life they experience at the current age. The third column shows the expected average QALY for the remaining lifetime of the person. Fourth column shows the QALY for those people who die from an infection due to COVID-19. Here, it is taken into account that within each age group there are those who already have impaired health who end up dying as a result of an infection due to COVID-19.[5] The estimates in the fourth column are particularly uncertain, since — as far as is known — there are no calculation on the QALY among the people who die as a result of COVID-19. Instead, I have estimated QALY for those who die as a result of COVID-19 as QALY for the age group minus 0.1. The adjustment of 0.1 corresponds to the average difference in quality of life between a 65-year-old and an 85-year-old.

[5] Among other things, data from Italy shows that 99% of the dead already had one or more medical conditions, cf. https://www.bloomberg.com/news/articles/2020-03-18/99-of-those-who-died-from-virus-had-other-illness-italy-says

Table 2 Average quality-adjusted life years (QALY) depending on age

Age group	Average QALY in the age group	Average QALY for the remaining life expectancy of the age group	Corrected average QALY for the remaining life expectancy of the age group for those who die as a result of COVID-19
0 to 9	0.930	0.873	0.773
10 to 19	0.930	0.865	0.765
20 to 29	0.930	0.855	0.755
30 to 39	0.915	0.843	0.743
40 to 49	0.893	0.829	0.729
50 to 59	0.868	0.815	0.715
60 to 69	0.855	0.796	0.696
70 to 79	0.823	0.768	0.668
80+	0.740	0.740	0.640

Note: For 0 to 14-year-olds, QALY is set to the same value as for 15-19-year-olds. "Average QALY for the remaining life expectancy of the age group" is calculated as the average of QALYs for all the following age groups, with the specific age group's QALY counting half, while other age groups counting fully. "Corrected average QALY for the remaining life expectancy of the age group for those who die as a result of COVID-19" is calculated as the third column minus 0.1.
Source: The figures in column two are from Olsen og Jørgensen (2015), while columns three and four are based on own calculations.

Based on the information in table 1 and table 2 (fourth column), the expected quality-adjusted remaining life expectancy of an average person dying as a result of Covid-19 can be estimated at 8,0 quality-adjusted life years.[6]

If the same method of approach is used, but based on the third column in table 2 (as oppose to fourth column), the quality-adjusted remaining life expectancy of an average Dane can be calculated at 34.8 years. Thus, the loss in quality-adjusted life years for an average person who dies as a result of COVID-19 corresponds to around 1/5 (23%) of a quality-adjusted remaining life expectancy of an average Dane.

[6] Calculated as the weighted quality-adjusted remaining life expectancy of all deaths due to COVID-19, i.e. ("Number of individuals" x "Mortality rate among infected" x "Expected remaining life expectancy of individuals dying from COVID-19" x "Corrected average QALY for the remaining life expectancy of the age group of those who die as a result of COVID-19") / ("Number of individuals" x "Mortality rate among the infected" x "Corrected average QALY for the remaining life expectancy of the age group of those who die as a result of COVID-19") from Table 1 and Table 2.

Box 1 Discounting the future

In socio-economic analyses, future effects are usually discounted back, cf. Finansministeriet (2017). There are professional discussions about whether to discount future life years, and different methods are currently being used in different countries.

I have chosen not to discount the value of future life years explicitly, since life years late in the life cycle weigh just as heavily in the calculation as life years early in the life cycle. It reflects that the value of a life year in the future will be greater than at present, because in the future we will be wealthier. The approach involves implicit discounting, and thus, I follow the same approach that the Secretariat of the Danish Economic Councils (2001), as compared to the calculation of lifetime income, writes "The inclusion of income earned late in the course of life at the same weight as income earned early in the course of life has been chosen. It is thus assumed that the expected future real wage increase exactly correspond the gain normally associated with receiving income early in the course of life."

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