Expected mortality adjustment for distribution in age-groups

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Abstract

This article discusses the influence of a disturbance like covid on the calculation of life expectancy in year groups etcetera. Life expectancies in year-groups are usually adjusted in the beginning of the year based on the population in the beginning of the year. This is done with a percentage based on previous years. This percentage is a reflection of volume. With the pandemic the weak were hit heavily by covid. A consequence is that the distribution of life expectancy changes in the year groups. This increases the life expectancy and decreases the expected mortality in the year group. Then the calculation for the year groups has to be adjusted accordingly. In this article I give an example of such adjustment. One can accordingly adjust likewise statistics.

1 Introduction

This article discusses the influence of a disturbance like covid on the calculation of life expectancy in year groups etcetera.

In section 2 I give an example to show how the changed distribution affects the percentage with wich the expected mortality etcetera. In a second example I calculate the consequences for calculations with year groups and so on.

In section 3 an analysis follows.

In section 4 conclusion and recommendation.

2 Distribution of the life expectancy in a year-group

Suppose there is no covid. We have at 1-1-2021 a group of thousand 81 year old people. Based on numbers from previous years we expect 30% of these to die in 2021. This amounts to 1.000 x 30% = 300 people.

Now there is covid. Assume that in 2020 the covid pandemic is the only disturbing factor. We want to get the expected mortality for the year 2021, without covid or other disturbing factor in 2021, at 1-1-2021. Mortality from covid in 2020 has consequences for expected mortality in 2021 so we use this in our calculations. Suppose 350 people from the former group of 1.000 die in 2020 from covid. Thus remaining 650 people at 1-1-2021. From covid the weak, those with the lowest life expectancy, die first. Suppose that from the expected 300 deaths for 2021 without covid now 200 have died from covid. Thus 100 from remaining group of 650 die in 2021 and 550 in later years. Then the mortality rate is (100 : 650) x 100%= 15.4%. When the expected mortality of this group is determined on the basis of historical data we get an expected mortality of 30% x 650 = 195. This is an overestimation. The historical percentage is a correction for volume. It doesn't consider the changed composition of the group. The numbers have to be corrected for that. In this case we have to lower the expected mortality from 195 to 100.

This effect also works when we determine the remaining life expectancy. From this expected mortality is derived.

A simple example shows this effect. See table 1.

Table 1: Expectation 81-year old without pandemic

	2021	2022	2023	2024	2025	Total
Expected years to live	0,5	1,5	2,5	3,5	4,5	
Number	300	250	200	150	100	1.000
Percentage	30%	25%	20%	15%	10%	100%
Expected life years group	150	375	500	525	450	2.000
Expected average 2.000/1.000						2,00

Explanation : In group 1 we expect 300 people to die in that year. Hence for 'Expected years to live' per person a half (0.5) year. Etcetera.

We divide mortality by covid in 2020 over the five groups. For the first group 200 people die from covid in 220. The remaining 150 we divide over the remaining groups. This leads to a higher average life expectancy for the group as a whole. And thus to a lower expected mortality in the group. See table 2.

Table 2: Expectation 81-year old with covid in 2020, no covid in 2021

	2021	2022	2023	2024	2025	Total
Expected years to live	0,5	1,5	2,5	3,5	4,5	
Number	300	250	200	150	100	1.000
Mortality by covid in 2020	200	100	20	20	10	350
Mortality by covid in 2020 %	67%	40%	10%	13%	10%	35%
Left after death by covid in 2020	100	150	180	130	90	650
Percentage	30%	25%	20%	15%	10%	100%
Expected life years group	50	225	450	455	405	1.585
Expected average 1.585/650						2,44

Life expectancy per person in the group increases from 2,00 to 2,44 year. The groups of people who would live another 2,5, 3,5 en 4,5 years get a higher weight in the distribution. Note that after two years the remaining three years more or less go back to the 'old' distribution.

This increased life expectancy has the consequence that the expected mortality decreases in the coming year. Then the excess mortality (= actual mortality − expected mortality) increases.

3 Analysis

The examples above are to convey the idea that the distribution in year groups changes as a consequence of a disturbance like covid. The numbers and calculations are just to illustrade this effect.

When calculating and determinging expected and excess mortality a researcher can decide if, and when so, how the idea that de distribution in year groups changes through a disturbance like covid is relevant to the used techniques and resulting outcomes.

It shall not be easy to estimate the effects for a specific year group. We have no data for this (yet). Further research is needed for these estimates.

4 Conclusion and recommendation

The changed distribution of life expectancy within the age-group has consequences for the expected mortality and excess mortality. Especially in a situation with a major disturbance like the covid pandemic. Hence it is important to take this in consideration.

Develop methods to estimate the distribution within age-groups.