TAUB CENTER
FOR SOCIAL POLICY STUDIES IN ISRAEL

The War on Coronavirus and Its Financing by the Israeli National Health Insurance

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Abstract

How much should Israel invest in the battle against the coronavirus? Answering this question has become critical, not only because of the size of the investment but also due to the intergenerational division of its cost in light of the virus' mortality profile. We discuss this question in the context of the Israeli National Health Insurance Law (1994), which guarantees every resident a basket of publicly financed health services based on an intergenerational division of the burden. The health basket is updated annually and reflects — in monetary terms — social priorities with respect to the saving of (statistical) life or increasing longevity. In the spirit of the law and according to the criteria for updating the basket, Israeli society values every average year of life that is saved by medical means at about NIS 340,000, which is approximately double the annual 2019 GDP per capita.

The initial accepted assumption was that without any intervention, the level of coronavirus infection in the population would have reached 60%. If the State of Israel had chosen a "wait and see" policy, there would have been 84,000 coronavirus deaths in Israel based on the mortality scenario seen in China or Italy that were the only ones "knowns", in addition to South Korea, at the time. Using the health basket valuation for a year of life, the potential value of the lost years of life would have reached about 24% of the annual GDP in 2019, i.e. about NIS 342 billion. Thus, this figure represents the amount worthwhile for the state to invest in order to reach the alternate, much reduced mortality scenario of South Korea and to "buy" the lost years of life of about 83,500 people. This amount is significantly larger than the 4.2% of GDP that the Bank of Israel has estimated as lost due to the economy's shutdown. Nonetheless, if despite the lack of preventive measures, the total infection level would not have reached apocalyptic proportions, but rather only about 10% of the population, the number of deaths according to the Chinese scenario would have been 14,000 and a transition to the South Korean mortality scenario coupled with the reduction of the level of infection to 1% of the population (resulting in the deaths of only about 580 individuals) would have "bought" the equivalent of only about 3.8% of GDP (versus the loss of 4.2% of GDP due to the shutdown). Such a transition does not meet the Health Basket criteria. In other words the limit of the shutdown's "worthiness" in terms of GDP is in the range of a 10 to 12% level of infection rate according to the Chinese mortality scenario. Therefore, **in the context of this ex ante discussion**, anyone who believed that the rate of infection would be higher than 10% with mortality rates at least as high as those in China should have been prepared, in principle, to accept the GDP loss required to "buy" the desired lives.

Furthermore, the shutdown is also a major challenge to society with respect to the intergenerational division of the burden. To prevent the potential coronavirus deaths under the Chinese mortality scenario and at a 60% infection rate will require financing that is 5.5 times larger than the public expenditure on health services during normal times. This will be borne almost entirely by the younger

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generation while the "saved" years of life are those of the older generation. The bias of the subsidization due to the battle against coronavirus, which is largely to the benefit of the old, is the opposite of the normal situation, in which the subsidy implicit in the public health system is clearly biased toward the benefit of children in addition to the elderly. Therefore, even though there is a social connection between the generations, in economic terms, there is no direct and immediate connection between those who pay and bear the economic burden and those who benefit from the payment. Thus, it is important to minimize the damage to the younger generation as much as possible, not only in order to increase GDP but also in order to limit the level of societal tensions.

Introduction

In view of the large-scale and growing sacrifice of economic and social activity, to defeat the coronavirus and to reduce its mortality rate, an examination of the price that the population in Israel is paying for this war has been paramount. This sacrifice — which is being made primarily by the young and for the benefit of the old — is seen in the loss of employment and income and the far-reaching changes in behavior and social interaction and their impact on general welfare. Although the question of the "price of a life" is an ethical and moral one, the public discussion of the issue is legitimate and unavoidable.

The approach that the life of an individual should be saved at "any cost" and in particular the argument that "it's only money" is an oversimplification (in the best case), and, as shown in Italy where overstretched physicians had to decide who will live and who will die, is simply not realistic. It is not possible to provide all medical treatments to every patient, and not even to all those whose lives are hanging in the balance. Moreover, it appears that the concept of "health is number one" is appropriate for many but not for all. Smokers, for example, prefer to maintain this habit despite the harm to their health and the health of those around them; nonetheless, they do not bear the full medical costs that they impose on themselves nor those they impose on others due to their unhealthy behavior (Fuchs, 1974), particularly in a health system that is financed by a national health insurance plan.

As in other countries, Israel is faced with the question — even in normal times — of "who will live, with what quality of life and by what means." The answers to these question are regularly reflected in the decisions of managers and providers in the healthcare system and in government decisions in all facets of our lives. Every society, including Israel, decides in one way or another on its priorities and its willingness to pay in order to save life, lengthen life and maintain quality of life in various contexts: security, health, transportation, industry, housing, etc.

The comparison between the normative value of a life on the one hand and its positive value in monetary terms on the other is a complex task from every aspect, including conceptually. Nonetheless, decisions that rely on this comparison are consciously undertaken around the world.[1] We have adopted this approach in order to analyze in monetary terms the battle against coronavirus in Israel from two perspectives: the value of the lives saved by extreme preventative measures that sacrifice GDP and the intergenerational division of the burden in view of the age profile of the virus's mortality pattern.

Evaluating the willingness of society to bear the cost of preventing mortality is based on the process used by the Israeli Health Basket Committee when deciding on the adoption of new technologies and life-saving drugs. The process of adding medical procedures to the basket each year reflects societal willingness to invest, in monetary terms, in "buying life" and the principle of mutual responsibility. The latter implies that it is primarily the young who finance the Health Basket, while the main beneficiaries are the elderly.[2]

1 For example, the National Health Service in Britain approves a new drug by calculating the ratio of its price to an index of its benefit. In the US, decisions related to environmental protection and transportation are made according to the monetary value of a human life.

2 We are not a making value judgments on the way different societies, say the U.S., deal with the right to obtain medical services and treatment.

We apply the "value of a life-year" that is reflected in the decisions of the Health Basket Committee in order to estimate the value of life years (in terms of GDP) that would be lost under various scenarios regarding infection and mortality rates. These values reflect the worthiness of intense measures to prevent mortality as a result of the coronavirus.[3] We assume that these measures aimed — at the time — to reduce both the infection and mortality rates relative to those seen in the district of Hubei in China, which represent the worst case coronavirus mortality scenario, and bringing them closer to those of South Korea, representing the best case scenario, including the sacrifice in economic output.

We hope that the discussion and the results will provide policymakers and the public with a standard for an informed discussion of the costs and benefits of battling the virus.

The principles of the "value of life"

The question of the cost of medical care that a society is willing to pay in order to save life, to lengthen life and to improve the quality of life is one of the most complex issues facing a modern society. The question is particularly relevant in a society with a national health insurance system that imposes the costs of healthcare on society or the public. The issue is becoming even more complex in view of the skyrocketing prices of healthcare on the one hand and the aging of the population on the other, two factors that together reflect the exponential growth in capabilities of modern medical technology. Nonetheless, it must be considered in this context that not only healthcare and lifesaving medical technologies save lives. Lives can be saved also by means of a healthy lifestyle, the prevention of car accidents, etc. Even in the healthcare context, it is possible to save lives in Israel by more effectively organizing waiting times in the public health system, at a cost that is no more than adding new drugs to the Health Basket.

The normative valuation of life is itself a complex task. There are innumerable aspects of life that can be influenced and innumerable ways — both medical and non-medical — to do so. The choices often involve difficult ethical questions. For example, there can be a choice between lengthening the life of a patient who is defined as being in a vegetative state and lengthening the life of someone with a chance of returning to full functioning and again being able to enjoy life. Similarly, how should we compare restoring the health of a one-day-old baby and restoring the health (relative to his age) of an 80-year-old? Who has the authority to make these choices? The discussion of these questions generally involves two elements: age and ability to function and enjoy life. They become even more relevant in view of the age profile of mortality due to the coronavirus (Weinreb & Chernichovsky, 2020).

The Health Basket and the value of life in Israel

The National Health Insurance Law opens: "National health insurance according to this Law will be based on the principles of justice, equality, and mutual aid" (National Health Insurance Law, 5774 – 1994, paragraph 1).[4] To realize these goals in a world of rapid change in medical care, while taking into account other national goals that also contribute to health, a public budget is decided upon each year to finance the cost of including new technologies (primarily drugs) in the entitled medical care basket.

In parallel to the budget decision, the Public Committee to Expand the Basket of Health Services (known as the Health Basket Committee) meets annually in order prioritize the technologies to be adopted by the allotted budget. The Health Basket Committee bases its choices on diverse and complex medical,

3 In this context, a large part of the cost is the result of the large-scale quarantine. The direct cost of medical equipment and care is relatively small. The state has allocated NIS 10 billion to the health system to deal with the outbreak of the virus, which represents about 10% of the total national expenditure on healthcare each year, or in other words about 0.7% of GDP.

4 It is important to mention that the broader definition also includes the principle of efficiency, since a lack of efficiency will lead to injustice and a reduced ability to maintain mutual support.

economic, ethical, and social considerations, including the number of patients who will benefit from the addition of a particular technology or drug to the Health Basket.[5] The technologies and drugs are prioritized according to their contribution towards the health of patients with various diseases and are included in order until the designated budget is depleted (which in 2019 was half a billion shekels). In other words, the preferences of the Israeli society are reflected on the one hand by the decision on the budgetary allocation, which represents national priorities including saving of lives by non-medical means, and on the other hand by the Basket Committee's decision as to which technologies to include given the budget. Those decisions represent priorities within healthcare.

According to the ratio of the designated budget to the estimated number of years "purchased" by the adopted technologies, it is possible, in theory, to "translate" the **normative** valuation of a year of life into a **positive** valuation and to estimate the **social value** of a year of life in monetary terms. In this context, it is important to mention that this value does not represent either the private ability and willingness to pay for an additional year of life or the value in terms of output of an additional year of life. Furthermore, neither does it represent the actual cost of saving an average year of life in Israel, which comprises the average cost of both public and private healthcare.

Using the accepted approach, Shmueli and Engelchin-Nissan suggested adopting a value of NIS 200,000 (in 2006 prices) as the average value of a year of life (without adjusting for quality of life) and NIS 250,000 as the willingness to pay for a year of life (adjusted for quality) for the purposes of the Health Basket Committee in 2006–2007 (Shmueli & Engelchin-Nissan, 2008a; 2008b). Based on the lower estimate, we adjust the 2006 amount by about 60% according to the increase in GDP in current prices between 2006 and 2019. Thus, we assume that the willingness of Israeli society to pay for a year of life as reflected in the Health Basket decisions increases at the same rate as GDP or income. This assumption is in general correct and is the working assumption in calculations of this type, as concluded also by Shmueli and Engelchin-Nissan. This is particularly appropriate in the case of Israel, in view of the relatively constant rate of healthcare expenditure at about 7% of GDP. Additionally, we adjust for the increase in healthcare prices beyond the increase in GDP at a rate of about 6% over the period. This adjustment assumes that the allocation to the Health Basket on the margin remains constant in real terms and that it compensates for the change in healthcare prices relative to GDP, even if the Committee's budget is not adjusted explicitly.[6] After these two adjustments to the original estimate, the value of a year of life in Israel in 2019 is approximately NIS 340,000. This amount is more than twice GDP per capita in 2019 (about NIS 150,000).[7] Accordingly, in the various scenarios presented, we use an estimate of NIS 340,000 as the monetary value of a potentially saved year of life in the war against the coronavirus.

Estimating the value of potential lost life-years as a share of GDP

We will relate to the loss of life-years due to death or to the added years of life as a result of preventing death using life expectancy by age group.[8] The loss of life-years is presented in Column 2 of Table 1. However, it is accepted practice to assume that the value of future years of life is lower than that of present years. Accordingly, we discount the future years of life at a rate of 3% (which is the rate used in calculations by the National Insurance Institute in Israel), in order to obtain the discounted years of life presented in Column 3 of the table. Of course, the loss of years of life due to the coronavirus and the added years of life by preventing mortality due to the virus decrease with age (Column 2).

5 The decisions of the Basket Committee are guided primarily by considerations of life extension, rather than improvement in quality of life. See Chernichovsky & Bowers (2014) and Bowers & Chernichovsky, (2017).

6 The index of healthcare prices used here is a weighted index that takes into account both the public and private sectors (Chernichovsky, 2019).

7 This number is an average that represents social value. It may be that at high mortality levels, the value of life decreases at the margin. On the other hand, political leaders wishing to demonstrate success may invest more in order to prevent rising mortality rates.

8 The life expectancy of a population group, which is defined according to characteristics such as age, gender, ethnicity, sector, etc., is in general based on the mortality data of that group. In Israel, there is data according to distributions by age, gender, and sector (Jewish/Arab Israeli). We use a weighted table of the entire population in Israel.

Due to the longer life expectancy of the young, the discounting reduces to some extent the gap in the loss or addition of years of life between the age groups.

Table 1. Potential years of life saved in Israel, by age groups

Age group	Population size (millions)	Average per capita	Average per capita, discounted	Age group total, discounted	Share of age group out of total
	(1)	(2)	(3)	(4)	(5)
0-9	1.75	77.7	30.9	54	24.5%
10-19	1.46	67.7	29.7	43	19.6%
20-29	1.25	57.9	28.1	35	15.9%
30-39	1.17	48.2	26.1	30	13.8%
40-49	1.05	38.4	23.3	24	11.0%
50-59	0.81	29.2	19.8	16	7.3%
60-69	0.72	20.4	15.5	11	5.1%
70-79	0.43	12.2	10.4	4	2.0%
80+	0.26	7.3	6.7	2	0.8%
Total	8.88	50.5	25.8	221	100%

Source: Dov Chernichovsky and Benjamin Bental, Taub Center | Data: CBS, *Statistical Abstract of Israel 2019*, Table 3.6; https://tinyurl.com/y7wlboeg ; https://tinyurl.com/ycfxnktq ; https://tinyurl.com/uqejopk ; https://tinyurl.com/ya7ck59u

The total potential loss or gain in discounted life-years (which is presented in Column 4 of Table 1) is the basis for the following calculations. According to Column 3 and the estimated value of NIS 340,000 for a life-year, Israeli society should be prepared to invest up to NIS 10.5 million to save the life of a 5-year-old child but only up to NIS 2.3 million to save the life of an individual aged 80+.[9] Even though such a calculation involves a major ethical dilemma, it is nonetheless unavoidable since it represents the basic fact that the life expectancy of the elderly is less than that of the young.[10] It is important to emphasize that as a basis for the approach used here, a year of life is regarded as identical regardless of whose it is or its quality.

Based on these values, we calculate the value of lost life-years — in monetary terms — under various scenarios. The scenarios assume a uniform infection rate among the various age groups but take into account age-dependent mortality due to the coronavirus. We use two mortality scenarios which are presented in Table 2: the Chinese scenario (Hubei province) and the South Korean scenario. Consider, for example, the 60 to 69 age group, which in Israel includes 720,000 individuals (Table 1). On the assumption that the level of infection in the population is 5%, there will be about 36,000 infections in this group. According to the rate of mortality in China for this group (4.6%; Table 2), the number of dead will be 1,656, each of whom will lose an average of 15.5 discounted life-years.[11]

9 These numbers are only about one-third to one-quarter of the value of life of $9.3 million used by the US government in evaluating public projects (such as environmental quality projects). That value is based, among other things, on the findings of surveys regarding the willingness to pay in order to reduce the risk of death at given levels. See, for example, Greenstone & Nigan (2020). It should be mentioned that per capita health expenditure in the US is about three times as high as that in Israel. It is also important to emphasize that these numbers cannot be used to determine one society's willingness to pay for a life relative that of another society.

10 This is a somewhat simplistic approach, but it does not affect the basic conclusion. In the initial calculations of this kind by the World Bank and the WHO, relatively high values were attributed to the 20–30 age group, on which society depends both biologically and economically (World Bank, 1993). This approach is close to a previous and preliminary approach, which attributed a social value to an age group on the basis of income and wages (Fuchs, 1972). Nonetheless, the British approach, for example, tends to also recognize the value of "buying some additional time" with a patient who is fatally ill. This approach is also consistent with a society's willingness to bear the cost of the last year of life, which is about 60% of the cost of medical care over the entire life cycle.

11 For the sake of simplicity, the calculation does not take into account the connection that exists between life-threatening pre-existing conditions and the rate of mortality from the coronavirus.

According to the social value of NIS 340,000 per year and based on the mortality in this group, the aggregate loss will be about NIS 8,727 million, which is 0.62% of GDP for 2019 (which was NIS 1,409,032 million).

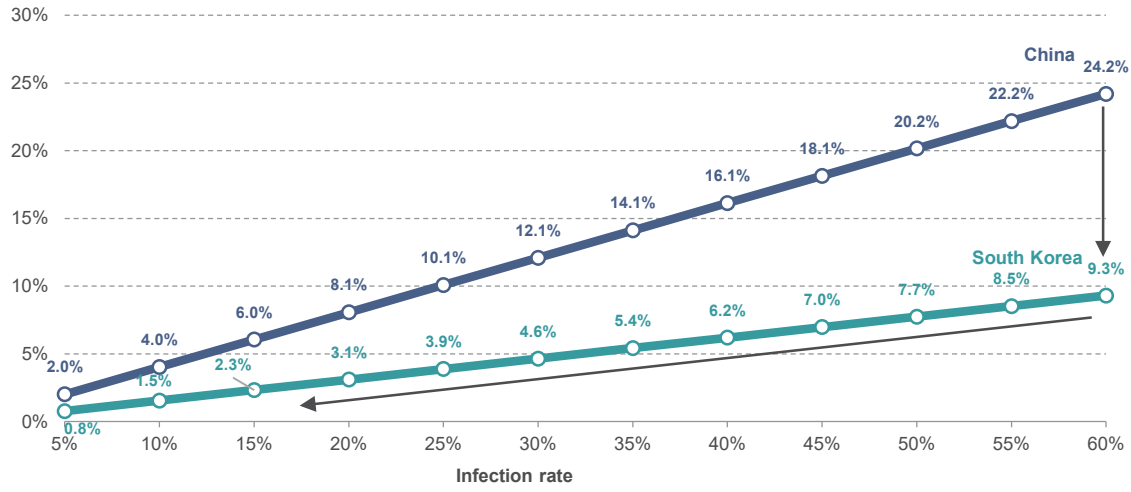
Table 2. Mortality rates of reported infected cases in China and South Korea, and value of years of life saved

Age group	Mortality rate (South Korea)	Mortality rate (China)	Average years of life lost by South Korea (NIS millions)	Average years of life lost by China (NIS millions)
	(1)	(2)	(3)	(4)
0-9	0.0%	0.01%	—	86
10-19	0.0%	0.02%	—	161
20-29	0.0%	0.09%	—	541
30-39	0.1%	0.18%	619	929
40-49	0.1%	0.40%	372	1,652
50-59	0.4%	1.30%	1,090	3,543
60-69	1.4%	4.60%	2,727	8,712
70-79	4.8%	9.80%	3,646	7,398
80+	8.2%	18.00%	2,463	5,386
Total	0.8%	3.30%	10,917	28,409

Source: Dov Chernichovsky and Benjamin Bental, Taub Center | Data: CBS, *Statistical Abstract of Israel 2019*; CDC; University of Bern; https://tinyurl.com/ycfxnktq ; https://tinyurl.com/uqejopk ; https://tinyurl.com/ya7ck59u

Accordingly, Figure 1 presents the value of lost life-years relative to GDP according to infection scenarios of up to 60% of the population, which is the expected rate of infection if the virus spreads without control (according to estimates from the Robert Koch Institute in Berlin which was adopted by Chancellor Angela Merkel for Germany). As another example, if the level of infection in Israel is 30% (about 2.7 million individuals), then according to the South Korean scenario the value of lost life-years will be about 5% of GDP.

Figure 1. Value of years of life lost as percentage of GDP (2019)



Source: Dov Chernichovsky and Benjamin Bental, Taub Center | Data: See Tables 1 and 2 in this document

Based on these assumptions, we can estimate the value of preventing mortality in the spirit of the National Health Insurance Law as it is reflected in the updating process of the Health Basket. We assume that this value is implied by the cost that reduce the level of infection and the number of patients that require intensive care, thereby lowering the mortality rate. For the sake of the discussion, we assume that, by lessening the load placed on the healthcare services, it is possible to avoid the Chinese scenario or the Italian one and to approach the South Korean scenario. In Figure 1, this implies a downward shift from the Chinese scenario curve to the South Korean scenario curve. Moreover, the policy of full social distancing works to reduce the level of infection. The result can be presented as a move leftward along the curve that represents the South Korean scenario. The result is the combination of these two effects.

According to the worst-case scenario of 60% infection and a mortality rate as in the Hubei province, Israel can expect about 84,000 deaths and a cumulative loss in years of life with a value of about 24.2% of GDP in 2019. According to this estimate, in a situation of 60% infection, it will be worthwhile for Israel to invest 14.9% of its GDP, namely about NIS 210 billion or 1.8 months of full economic activity, in order to reach the South Korean scenario. At this rate of mortality, Israel will still have about 35,000 deaths, about 49,000 less than the number based on the mortality rate in the Hubei province with the same infection rate. Every drop of a single percentage point from the 60% infection rate means a reduction of about 580 dead, whose value is about 0.155% of GDP, or in other words about NIS 2.188 billion. Therefore, according to the South Korean mortality scenario, a decline in the level of infection from 60% to 1% means a reduction in the number of dead from 34,890 to about 580 and in terms of GDP this implies a value of about 9.2% of GDP or NIS 129.14 billion. Hence, on the assumption that the value of each individual's life-years remains constant and is independent of the total number of deaths, the transition from a policy of "wait and see", which will lead to a 60% infection level at China's rate of mortality, to a policy that manages to achieve an infection rate of 1% and a mortality rate like that of South Korea, will lead to savings in life-years with a value of 24% of GDP.[12] In other words, in terms of the Health Basket, Israel should adopt such measures as long as their cost is less than 24% of GDP.

Intergenerational social tension

As mentioned, the social distancing policy to prevent infection reduces the rate of mortality, primarily among the elderly. However, most of the economic price, which is reflected in an unprecedented rate of unemployment and income loss, will be paid by the young who are still in the work force. Accordingly, the social distancing measures lead to a large-scale intergenerational transfer of income.

There is already an intergenerational transfer in place implicit in the National Health Insurance Law. It is reflected in public health expenditure and in the capitation mechanism that is used to allocate the majority of such expenditures to the health funds, which in normal times amounts to about 4.5% of GDP. The value of the potential lives saved calculated above is 5.5 times the size of this expenditure under the Chinese mortality scenario.[13] According to the capitation mechanism, the health funds receive an allocation according to the distribution of their members by age and gender, which reflects the expected cost of healthcare in each group. In contrast, the health tax that finances this expenditure is not dependent on age or health status, but rather mostly on an income.[14] The healthcare system in Israel therefore transfers income not only from high earners to low earners but also between the various risk groups in the population according to age and gender.

12 According to Eichenbaum, Rebelo & Trabandt (2020), which has spawned a lively debate in the US, a shutdown will cause a recession with a 22% loss of GDP in the US, in comparison to only 7% if such a measure is not imposed, but it will save 500,000 lives. This implies a loss of about $6 million per individual whose life is saved. According to the estimates of Greenstone & Nigam (2020), the social distancing in the US will save 1.7 million individuals with a total value of $8 trillion (more than one-third of US GDP).

13 For further details on the capitation mechanism, see Glazer & Masika (2005) and Chernichovsky (2010). In the absence of data, we assume as a first approximation that the distribution of expenditure on the coronavirus is in direct proportion to mortality, even if in reality this is not exactly the case. As mentioned, the expenditure of healthcare services on the last year of life is about 60% of the total expenditure over the life cycle.

14 The health tax is 6% of income with some exceptions.

To create a reference point, we assess the transfer in normal times between age groups according to the capitation formula. In order to calculate the share of the various age groups in the payment of the health tax, we calculated the share of income according to each age group's average income and its labor force participation rate, as presented in Table 3.[15] The two right-hand distributions represent the share of deaths according to the mortality rates in China and South Korea. The distribution in the center represents income and that on the left-hand side represents the allocation of public healthcare expenditure according to the capitation formula. The comparison between the two distributions shows that the contribution of the prime working age population (20–59) is significantly larger than its share of healthcare expenditure. The beneficiaries are the elderly, though also children whose share in the consumption of healthcare services is particularly high.

Table 3. Labor force participation rate, average monthly income per worker, and share of age group in total income, 2017

Age group	Population size (millions)	Participation rate	Average monthly income per worker, NIS millions	Total income, NIS millions (Columns 1*2*3)	Share of group in incomes
	(1)	(2)	(3)	(4)	(5)
0-9	1.75	0.0%	0.00	0.00	0.0%
10-19	1.4565	13.8%	3,633.29	729.47	1.8%
20-29	1.2472	68.2%	6,222.08	5,293.94	13.1%
30-39	1.1655	79.8%	10,876.32	10,121.62	25.1%
40-49	1.0452	81.8%	13,044.78	11,148.61	27.6%
50-59	0.8097	76.9%	12,676.33	7,891.77	19.6%
60-69	0.7184	52.1%	12,102.55	4,534.11	11.2%
70-79	0.4283	11.7%	12,000.24	602.95	1.5%
80+	0.2617	0.0%	0.00	0.00	0.0%
Total	8.8827				100.0%

Source: Dov Chernichovsky and Benjamin Bental, Taub Center | Data: CBS, 2019b, Tables 6, 16

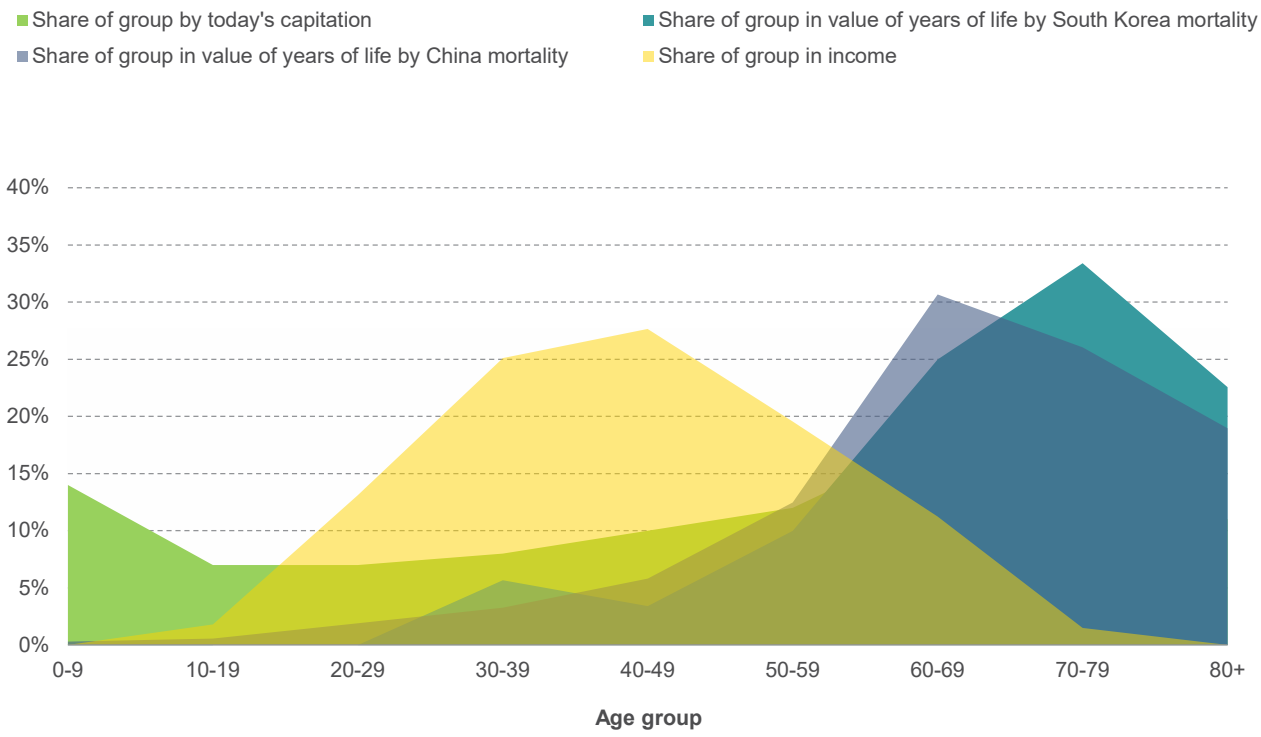
In the next stage of this conceptual exercise, we relate to deaths due to the coronavirus as a kind of "illness" and to the potential loss of years of life as a kind of "cost of care" and assume, for the sake of the discussion, that there is a hypothetical health fund whose sole purpose is to treat the victims of the coronavirus and which is compensated according to a capitation formula. Thus, the state gathers demographic information according to age group, estimates the incidence of the illness in each age group and multiplies it by the value of the lost life-years caused by the illness for each victim in the age group, and finally by the size of the group. The result determines the compensation owed to the hypothetical health fund for that age group. Finally, the state adds up the compensation amounts and imposes a "coronavirus tax" in order to finance the total amount of compensation. On the assumption that the tax is proportionate to income, its rate is determined by dividing the amount of compensation by total income.

Accordingly, we report in Figure 2 also the relative share of the various age groups in the loss of life-years according to the two mortality scenarios. It is particularly clear that the distribution of the loss of life-years is significantly biased rightward relative to the distribution of income and to a greater extent even than that reflected in the allocation of healthcare services in normal times according to the capitation formula. It can be seen that the distribution of lost life-years according to the mortality rate in South Korea is biased rightward relative to the distribution according to the mortality rate in China, since in South Korea the mortality rates in the older age groups were higher than in China.

15 The income figures are for 2017, with an adjustment to 2019 prices.

It should also be noted that in China mortality was observed among the under 30 group, including children, although the relative share of these age groups in the cost due to the coronavirus is much lower than their share in public expenditure in normal times.

Figure 2. Share of each age group in the value of years of life by South Korea and China, using the current capitation and income



Source: Dov Chernichovsky and Benjamin Bental, Taub Center | Data: National Insurance Institute, 2020; Tables 1-3 in this document

In order to underscore the size of the transfer between the age groups (and the risk), we now assume there is a privatized "coronavirus insurance" scheme. In such a case, the hypothetical health fund would offer an age-conditional insurance policy and each age group would need to pay a coronavirus premium in an amount that covers its risk. The premium as a share of income was determined according to the ratio of the expected damage to an average individual in each age group (i.e., the probability of a loss in years of life multiplied by their value) to the average income of his age group. The result of the comparison between the coronavirus tax and the coronavirus premium to be collected according to this calculation represents the intergenerational transfer. In particular, those age groups whose share of the loss of life-years is smaller than their share in income are the ones that transfer income to the age groups in which the connection between the two variables is reversed.

In order to complete the discussion, we calculated the rate of the coronavirus tax required to cover the value of life-years lost for each percentage point in the infection rate. This tax rate is based on the ratio between the aggregate value of the loss of life-years and the economy's total income. According to the South Korean mortality scenario, the resulting tax rate on income is about 0.5% for every percentage point of the level of infection while according to the Chinese mortality scenario, the tax rate is about 1.2%. The difference reflects the gap between the mortality probabilities between the two countries, which are significantly higher in the Chinese scenario than in the South Korean one.

These rates constitute the basis for presenting the intergenerational transfer. They make it possible to present — using a simple calculation — the ratio between the share of each group in income and its share in the loss of life-years as representing the gap between the coronavirus premium and the "coronavirus tax". In Table 4, we present this ratio. Using the South Korean scenario as an example, there is no mortality in the young age groups. Therefore, these groups would not buy coronavirus insurance to cover themselves against the effects of the coronavirus if it was available in the private market. Accordingly, any tax imposed on them is infinitely greater than the theoretical coronavirus premium. In both mortality scenarios, the coronavirus tax that would be imposed on the primary working-age age groups is larger than the coronavirus premium (relative to income) that would have been paid according to their implicit risk in the private insurance market. For example, in the South Korean mortality scenario, the rate of the coronavirus tax that would be imposed on the 50–59 age group is double the premium that they would pay for coronavirus insurance. In the Chinese mortality scenario, the rate of tax that would be imposed on them would be larger by about 60%. In the 60+ age group, the situation is reversed. In the South Korean mortality scenario, the 70–79 age group would pay a coronavirus tax of about 4% of the premium that would be collected from them for coronavirus insurance against the risk they constitute; in the Chinese mortality scenario the coronavirus tax that they would pay would be 6% of the coronavirus insurance premium. In the oldest group, which has no income, the ratio drops to 0 (as in the case of children in the Chinese scenario, not shown in table).

Table 4. Ratio between share of group in incomes and share in value of years of life

Age group	By South Korea mortality	By China mortality
19-10	Infinity	3.18
29-20	Infinity	6.89
39-30	4.43	7.68
49-40	8.12	4.76
59-50	1.96	1.57
69-60	0.45	0.37
79-70	0.04	0.06
80+	0.00	0.00

Source: Dov Chernichovsky and Benjamin Bental, Taub Center | Data: See Tables 1-3 in this document

The gap that emerges between the income distribution and the distribution of the loss of life-years across the age groups is liable to affect social solidarity. It is reasonable to assume that the more right-skewed the distribution of the value of saved life-years is, like that of South Korea relative to that of China, so intergenerational solidarity will weaken and the willingness of the young to bear the burden will be reduced. Nonetheless, the left part of the distribution of damage due to the coronavirus is also relevant. In China, as opposed to South Korea, the mortality rate among children was relatively high. Such a situation (which we, of course, hope will not occur) would increase the willingness of the working-age population to bear the burden.

Conclusion

According to estimates by the Bank of Israel, the economy will gradually return to full activity by the end of June 2020 and GDP will drop by 5.3% this year; on the other hand, in 2021 the economy will grow by 8.7%. On the assumption that without the crisis the economy would have grown at a rate of 3.5% in each of those years, at the end of 2021 GDP would have been about 7.1% higher than at the end of 2019, as opposed to the forecasted growth of 2.9% according to the Bank of Israel. In other words, and ignoring any discounting, these data point to a loss of 4.2% of GDP.[16]

16 See the statement by the Governor of the Bank of Israel on April 6, 2020 https://tinyurl.com/y7pyd537. Notice that this is an upper boundary for the loss that can be ascribed to the shutdown as GDP would have dropped purely as a result of the public's reaction to the catastrophic rate of illness and infection.

In comparison to the calculations presented, this damage is significantly less than the value of the lives saved, which according to the Chinese mortality scenario and level of infection of 60% in the absence of any preventative measures, would be about one-quarter of GDP. On the other hand, if despite the lack of preventative measures the level of infection is not believed to reach apocalyptic proportions but is supposed to reach only 10% of the population (instead of 60%) the number of deaths according to the Chinese scenario decreases to 14,000 and a transition to the South Korean scenario and a reduction in the level of infection to 1% of the population (a reduction in deaths to only about 580 individuals) would "buy" human life valued at only about 3.8% of GDP. Compared to the GDP loss of about 4.2%, such a gain in lives is already not worthwhile according to the standards of the Health Basket. In other words, the borderline infection rate rendering the shutdown "worthy" is in the range of a 10–12% according to the Chinese scenario. Therefore, in the context of this discussion, anyone who believed that the level of infection would have been higher than about 10% with at least the mortality rate of China should in principle have been prepared to sacrifice GDP at the rate implied by the government steps to date in order to gain the implied reduction in deaths.

In any case, due to the large-scale effect of the epidemic on the older community (a group that in general does not contribute to productive economic activity), which is significantly greater than the intergenerational transfer that occurs in normal times as a result of the National Health Insurance Law, the social distancing and the shutdown of economic and social activity which it causes lead to significant intergenerational tension. In normal times, the intergenerational transfer can also be understood in terms of insurance, since the young view the old as what they themselves will become in several decades. With respect to the coronavirus epidemic, and on the assumption that such an epidemic is an exceptionally rare event, this view cannot simply be taken for granted to the same extent. Accordingly, it is important to minimize the cost to the younger population, not just to increase GDP but also to reduce the potential level of tension in society.

References

English

Eichenbaum, M., Rebelo, S., & Trabandt, M. (2020). *The macroeconomics of epidemics*. NBER Working paper No. 26882.

Fuchs, V. (1972). The contribution of health services to the American economy. In V. Fuchs (Ed.), *Essays in the economics of health and medical care* (pp. 3-39). New York: NBER.

Fuchs, V. (1974). *Who shall live? Health, economics, and social choice*. New York. Basic Books.

Greenstone, M., & Nigam, V. (2020). *Does social distancing matter?* Becker Friedman Institute for Economics, University of Chicago.

World Bank (1993). *World development report 1993: Investing in health*. Washington DC: World Bank Group.

Hebrew

Bowers, L., & Chernichovsky, D. (2017). *Revisiting Israel's healthcare priorities*. Jerusalem: Taub Center for Social Policy Studies in Israel.

CBS (2018). *Labor force survey 2018*. Jerusalem: Central Bureau of Statistics.

CBS (2019a). *Statistical abstract of Israel 2019*, Number 70. Jerusalem: Central Bureau of Statistics.

CBS (2019b). *Household income and expenditure survey 2017*. Jerusalem: Central Bureau of Statistics.

Chernichovsky, D. (2010). The appropriate changes to the resource allocation mechanism in the National Health Insurance Law — the capitation mechanism. In G. Bin-Nun & R. Magnezi (Eds.), *Economic and social aspects of Israel's healthcare system* (pp. 57-75). Ramat Gan: The Israel National Institute for Health Policy Research.

Chernichovsky, D. (2019). The healthcare system: An overview. In A. Weiss (Ed.), *State of the nation report 2019: Society, economy and policy in Israel* (pp. 363-386). Jerusalem: Taub Center for Social Policy Studies in Israel.

Chernichovsky, D., & Bowers, L. (2014). *Health status and healthcare system budgeting in Israel in the context of disability-adjusted life years (DALYs)*. Jerusalem: Taub Center for Social Policy Studies in Israel.

Glazer, K., & Mesika, D. (2005). Mechanism of resource allocation between the health funds: Goals, developments and recommendations. In G. Bin-Nun and G. Ofer (Eds.), *Ten years of the National Health Insurance Act 1995-2005*. Ramat Gan: The Israel National Institute for Health Policy Research.

National Insurance Institute (2020). *Key calculations for the division of health insurance money between the health funds for 1.3.2020*. Jerusalem: National Insurance Institute.

Shmueli, A., & Engelchin-Nissan, E. (2008a). An economic examination of the updating of the National Health Insurance Package of Benefits 2006-2007. *Medicine — The publication of the Israel Medical Association*.

Shmueli, A. & Engelchin-Nissan, E. (2008b). A preliminary estimate of the value of statistical life in Israel and its implications to the technological update of the National Health Insurance Package of Benefits. *The Economic Quarterly* (Israel) 55(4), 467-487.

Weinreb, A., & Chernichovsky, D. (2020). *Anticipating the total mortality impact of coronavirus in Israel*. Jerusalem: Taub Center for Social Policy Studies in Israel.

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