











threat to mental health since World War II. The morbidity (including Long Covid), the deterioration of the economic situation and the loss of employment of many, together with the prolonged closures at home and away from work and school, the general uncertainty that prevailed during the pandemic, caused a deterioration in the mental state of the population and an increase in anxiety and depression. In particular, the rates of anxiety and depression among children and youth have risen dramatically. To this was added the anxiety and post-traumatic syndrome of patients, their relatives and the medical staff because of hospitalization or death in the isolated Covid wards. Sheffer et al. [11] estimated that the rate of mental illness increased by 60% between 2019 and 2020. Data from the Abarbanal Psychiatric Hospital on children and adolescents up to the age of 18 indicated that in 2021 compared to 2019, there was a 260% increase in suicidal thoughts, an increase of 410% of suicidal attempts, a 230% increase in anxiety and depression disorders, and a 460% increase in behavioral disorders. There was also a 30% rise in referrals for mental health care.

In this section, we estimated the costs of the increase in the rates of depression and anxiety in the population. In the absence of national and official morbidity data (the last national survey is from 2004), we use diverse pieces of information to arrive at a reasonable estimate of these costs.

One of the studies examined the anxiety levels among the population during the period 19/2/2020 to 1/4/2020 [16]. They identified a group - 'threat-sensitive' -, which makes up about 29% of the population, where a 100% increase in the level of anxiety was reported in the first four weeks of the crisis. In other words, 2.6 million Israelis experienced a dramatic increase in the level of anxiety. Assuming that these individuals experienced high anxiety for six months [17], this constitutes a loss of 0.85 million QALYs with monetary value of approximately NIS 400 billion.

In total, the costs of the epidemic in the health sector amount to NIS 476 billion (31% of 2019 GDP), the main part of which is the cost of the deterioration in mental health.

Two other important changes occurred in the health care system during the pandemic: a change in practice and the transition to remote medicine, and attrition of the medical staff, culminating in 15% of the medical staff members considering leaving their profession. The cost of these two changes was not included in this work.

### The cost in education

The spreading infection and closures caused changes in teaching and a shift to online teaching, which was not always able to replace direct teaching. A combination of technical difficulties in connecting and the reluctance of many pupils to use distant learning resulted in pupils losing teaching

material. In addition, the impact of the pandemic on pupils from different sectors and different socio-economic status was not uniform. At the same time, the socio-emotional condition of many pupils was affected by the fear and uncertainty regarding the health effects, the economic situation of the family, and due to the closing of the educational institutions and the lockdowns. All of these caused harm to Israel's future human capital, which is expected to be reflected in the quality of the workforce, productivity and output.

We focus on pupils in primary and secondary schools. We estimated the expected effect on the results in skills tests [18,19] and the significance of this effect on wages and future employment rates [20]. The connection between closures of the education system and the harm to the students' future achievements was studied before the current crisis, under different circumstances [3,21,22].

The estimate of the intensity of the harm to the education system is based on data regarding the closing of schools and distance learning [23]. We calculated the number of school days lost according to the effectiveness of online learning relative to face-to-face learning, assuming that the effectiveness of online learning was uniform for all pupils.

During 2020-2021, the education system was under complete closure for an average of 19 weeks, and in a hybrid-learning format for an average of 19 weeks. According to the National Parent Leadership survey, and the rate of access to end devices by pupils during the closures, we estimate that the effectiveness of online learning is 42% on average. Consequently, we estimate that on average, 16 study weeks were lost, which is equal to 0.46 a school year.

Previous studies have estimated that the loss of a year of schooling leads to a decrease of about one-third of a standard deviation in the average score of skills tests [18]. Other studies have shown for Israel that a decrease of one standard deviation in the skills test correlates with a significant decrease (25%-32%) in future salary (as an indicator of labor productivity) and a 9%-12% decrease in employment rate [20]. In our case, a loss of 0.46 years of schooling due to the virus leads to a future decrease of 3.4-5.4 % in wages and a decrease of 1.2-2% in employment rates.

Under plausible assumptions concerning the 12 cohorts of pupils, we estimated the expected cost of the pandemic in education at about NIS 160 billion or 11% of 2019 GDP.

The estimate presented may be an underestimation because the assessment of the effectiveness of online learning is upwards biased, and the estimate refers to harm from a lack of progress in learning only<sup>3</sup>.

<sup>3</sup> Blass (2020) [24] discussed other important aspects of Covid and their effects on education, learning and students' well-being. These aspects were not taken into consideration in our calculations, because they cannot be measured accurately.

## The cost of the increase in domestic violence

As was described above, the Covid pandemic worsened the welfare of households. Such worsening is often associated with increased domestic violence, in particular against women.

Three indicators of domestic violence in Israel were published in 2020-2021: The annual violence index of Wizo (women organization), the Parliament's research and information center, and the legal aid unit of the Ministry of Justice. These indicators point to an increase of about 25% in the number of violent incidents.

In the absence of Israeli data on the cost of an incident of domestic violence, we used several international studies that did this [25,26]. Based on these studies and a 25% increase in the number of incidents, we estimated the cost of the increase in domestic violence in 2020-2021 as NIS 5 billion (about 0.4% of 2019 GDP).

## The cost in transportation

Traffic limitations and the closures imposed on the public caused a decrease in well-being and autonomy. These limitations, together with the increase in the number of unemployed and workers in unpaid leave and the transition to working from home, caused a drop in total travel in 2020 and in part of 2021.

The CBS data (Quarterly for Transportation Statistics, 2022) shows a decrease of about 10% on average in the daily traffic volumes at selected interchanges in Israel. This decrease is expected to result in savings in the social costs of traffic accidents, pollutant emissions, and time spent in travel.

On average, during 2015-2019, 354 people were killed, 2,292 were seriously injured, and 21,241 were slightly injured in traffic accidents. In 2020, 305 people were killed, 2,072 were seriously injured, and 15,849 were slightly injured. That is, in 2020, 49 persons were "saved" from death, 220 were saved from serious injury, and 5,392 people – from minor injury. In 2021, 364 persons were killed, 2,459 were seriously injured, and 17,412 were slightly injured. The number of fatalities and seriously injured in 2021 was higher than the historical average; the number of lightly injured was lower than that.

The cost savings as a result of a drop in bodily and property damages in traffic accidents was calculated on the basis of the governmental Transportation Projects Procedure ("PRAT") which provides monetary values for damages according to the types of injuries and their severity, as well as for property damage. We estimated the 2020-2021 cost savings in bodily and property damages at approximately NIS 705 million.

Based on the travel tables published by the CBS (Vehicle Travel, 2020) and an increase of 2% in 2021 compared to 2019, on the "Green Book" produced by the Ministry of

Environmental Protection in 2020 presenting the costs of air pollutants, and based on the values recommended regarding carbon dioxide pollution, savings to the economy in 2020 reached NIS 700 million and an increase in these costs in the amount of NIS 150 million in 2021. In total for the years 2020-2021, the cost saving of the change in vehicle pollutant emissions reached NIS 550 million.

The CBS work-force surveys in the years 2019-2021 show that approximately 155 million travel hours were saved in the years 2020-2021 compared to 2019. According to the PRAT procedure, the value of an hour of travel to and from work is NIS 22, therefore the savings to the economy because of reducing travel times in the years 2020-21 amounts to approximately NIS 3 billion. We emphasize that the savings consist, first, of the decrease in the total number of working days, which is the main cause of the decrease and second from the shortening of the time to get to work because of reducing the load on the roads.

Therefore, in total, the saving to the economy as a result of the pandemic during 2020-2021 in the area of transportation is about NIS 5 billion (about 0.4% of 2019 GDP).

## International comparisons

As of the time the research was completed, we found one American study that estimates the social cost of the pandemic [27]. They calculated the loss of product, mortality, long-term disability, and an increase in anxiety and depression in the US. They estimated that the social cost of the Covid is approximately 16 trillion dollars, 90% of GDP in 2019. The paper was written in the fall of 2020 and was based on the assumption that the pandemic will continue until the fall of 2021, so it is likely that the actual cost until the end of 2021 is even higher. The authors did not include in their calculations the costs in education. They see the pandemic as the greatest threat to the well-being and prosperity of the American economy since the Great Depression of 1929.

In order to place, nevertheless, the economic consequences of the Covid in Israel in an international context, we examined three indicators: direct loss of GDP, loss of life years and loss of school days.

Figure 1 presents the economic consequences of Covid in direct loss of GDP and the monetary cost implied by premature mortality (the value of a life-year lost is three times the national GDP per capita) as percent of national GDP in 2019, according to OECD data. Based on these components, Israel (14% GDP) is below the OECD average (17%) in terms of the severity of the impact of the crisis.

Figure 2 shows the proportion of school days under full or partial closure in the OECD countries, during 2020 and 2021 (Data from: <https://data.humdata.org/dataset/global-school-closures-covid19>).

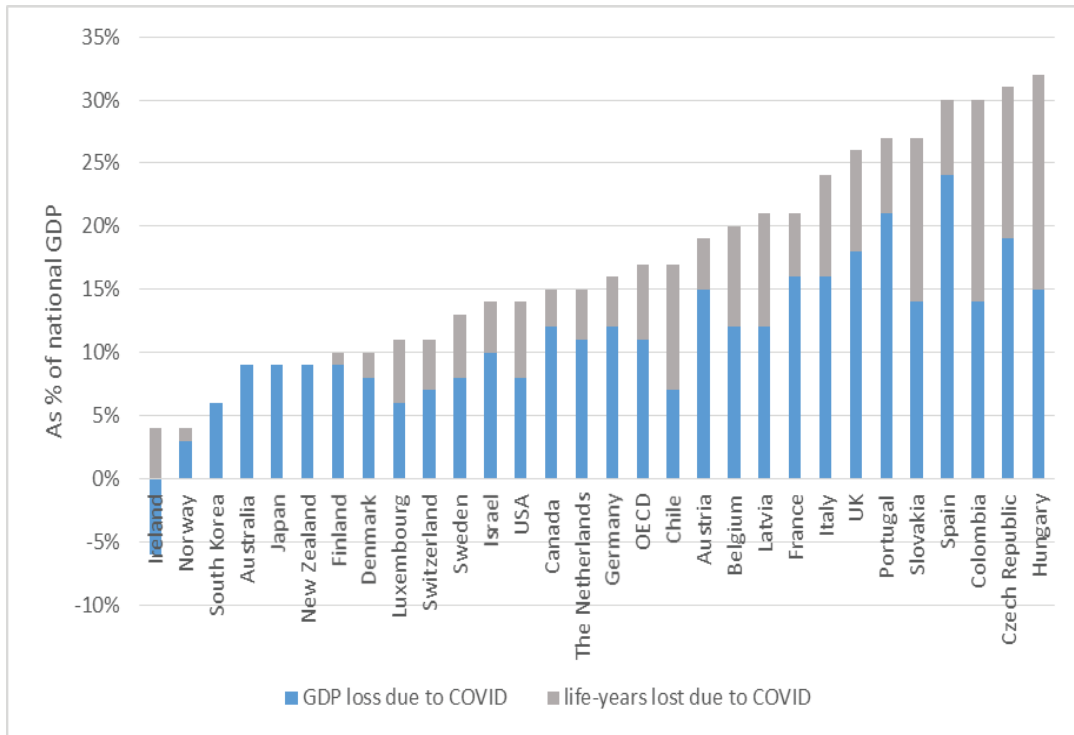


Figure 1: GDP loss and life-years lost because of Covid in the OECD.

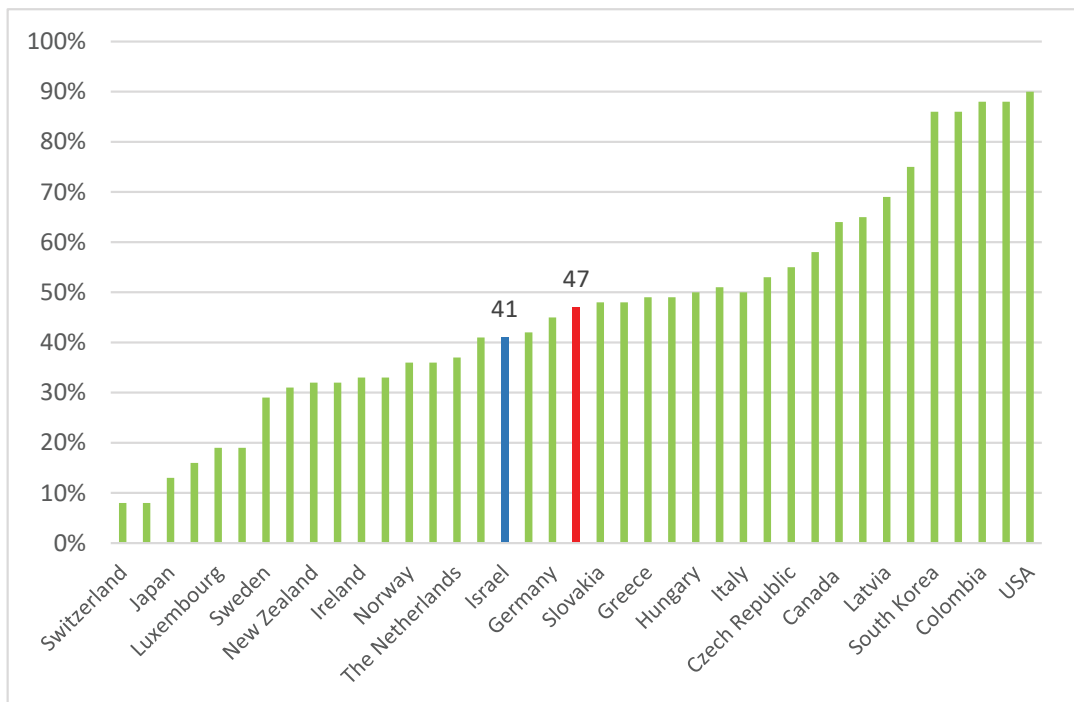


Figure 2: School days lost during 2020-2021 in OECD countries.



Here too, the Israeli rate (41%) is below the OECD average (47%). It should be noted that the above comparison does not capture the full cost of schools' closure, since it depends on the effectiveness and coverage of distant learning as well.

## Discussion

Table 1 summarizes the components of the social cost of Covid in Israel during 2020-2021.

**Table 1:** The social cost of Covid in Israel 2020-2021.

Cost domain	Cost	
	As percentage of 2019 GDP	In billions of NIS at current prices
Product loss	7.5	107
Fiscal cost	2.8	40
Health	33.4	476
Education	11.2	160
Violence in households	0.3	5
Transportation	-0.3	-5
Total	54.9	783

The social cost of Covid in 2020-2021 amounted to NIS 783 billion or 55% of GDP. This figure translates into a cost of about NIS 293 thousand per household on average. The loss of the product is a relatively small component of the cost: about half of the cost includes the social costs in health (the main component of which is the cost of deteriorated mental health) and in education (deterioration of human capital).

As we emphasized throughout the paper, there is a reasonable chance that our cost estimate is an underestimation: there were elements that we identified but could not quantify (for example, the increase in economic inequality), and it is likely that there are elements that we did not identify at all. However, it seems to us that the estimate we arrived at is a good indication of the order of magnitude of the social cost of Covid in Israel in 2020-2021.

## Conclusions

Many researchers and policy makers globally claim that the burden of the Covid pandemic during 2020-2021 is comparable to that of the Second World War. Due to its good healthcare system and the early and rapid vaccination campaign, Israel seems to go through the pandemic with relatively low burden. Nonetheless, the social cost of the pandemic in Israel during 2020-2021 was more than half the 2019 GDP, higher than the cost of any previous economic or national security crisis.

The political instability that characterizes the last few years in Israel has greatly reduced the power of the

government to introduce fundamental reforms and changes, the necessity of which has been clarified and strengthened with Covid. This enhances the fear that the cost of Covid as missed opportunities is immeasurably higher than the cost of Covid as a crisis, the focus of this work.

## Declarations

**Ethics approval of consent to participate:** not applicable

**Consent for publication –** not applicable

Availability of data and materials – the study collected and used an enormous amount of data from published and unpublished material. These sources are cited in the paper.

## Competing interests

AS, OP and ES have no competing interests.

## Funding

The study by funded by the National Institute for Health Policy Research

## Authors' contributions

OP and ES wrote the sections on loss of GDP, Fiscal costs and Education. AS initiated the study and wrote the remaining sections. All authors provided comments and suggestions on the full draft, and AS wrote the final version.

## Acknowledgment

Yoav Tuvia provided excellent research assistance.

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