The Coronavirus: Epidemiology, Economy, and Public Medicine—Facts and Policies

This report, “The Coronavirus: Epidemiology, Economy, and Public Medicine,” has been prepared by a broad multidisciplinary team, and encompasses the core issues facing decision-makers in selecting short-, medium-, and long-term measures for addressing the crisis. It deals with important lessons that can be learned from epidemics that occurred over the past century; analyzes the development of the coronavirus pandemic in Israel as well as measures taken to curb the spread of the virus and to lift the imposed lockdown; examines economic effects of the measures taken to curb the spread; assesses the capacity for coronavirus intensive care, and the capacity of testing and epidemiological tracing systems; examines the criteria that were applied to exit the full lockdown imposed from mid-March to mid-April; and proposes criteria and strategies to deal with various in-between stages that will develop going forward.

The main conclusions are as follows:

1. It is fundamental to acknowledge the unique nature of every epidemic that is engendered by a new virus and the uncertainty that surrounds it; this must be at the basis of decisions regarding health-related and public conduct.
2. Uncertainty about the duration and scale of the pandemic, the tendency of individuals and groups to overreact, moral hazard, scorning of instructions, and distrust of policymakers make the social and economic aspects of the crisis much more difficult to cope with.
3. It is crucial for the state to formulate action plans in advance, as did other countries that coped successfully with the current outbreak.
4. When an action plan is drafted, it is important for the state to adopt several “reference” countries. Austria, for example is roughly as populous as Israel (a population of about 9 million) and experienced the coronavirus outbreak at an early stage and with a similar intensity. It is crucial to stay in touch with experts in these countries in order to learn from them about the development of the pandemic, corrective measures taken, which of these measures were useful, and which were not. A situation in which we race ahead of these countries should be avoided.
5. Analysis of the epidemiological outcomes of the first wave yielded insights, which were translated into a reasonable basis for a model that can help forecast possible directions the pandemic may take in future waves.
6. Restraint based on rapid contact tracing, investigation, and detection (within forty-eight hours at the most) averts the grave economic damage that a sweeping lockdown creates.
7. Economic policy should be based on a clear and transparent set of rules that remain in effect for several months, giving economic stakeholders certainty both in entering the crisis and in exiting it.
8. The current analysis indicates that the country has a maximum capacity of 250 beds and intensive-care teams that are prepared today to deal with ventilated COVID-19 patients. It is necessary to promptly organize and train teams capable of administering care amid a large second wave, particularly one that may arrive in parallel with an influenza epidemic.
9. To break the chain of infection, test results should be obtained within twenty-four hours at most. Investigation, detection, and isolation should follow within another twenty-four hours. The insight that, in this case, speed matters more than perfection, should be understood and integrated across the board in the epidemiological system.
10. Criteria for intervention should be dependent on the characteristics of the outbreak, critical resources, and the limits of interplay between existing resources and the actual parameters of the epidemic. A hierarchy of actions (e.g., local measures and “smart lockdown”) should be constructed that, once adopted, would minimize the need to impose a full lockdown.
11. **It is crucial that an integral, synchronized government program be prepared, addressing a period of several months and dealing with all aspects of the coronavirus pandemic or similar epidemics. The program must be anchored in evaluation points as well as clear and transparent criteria for the public, which will serve to clarify the aspects involved in transitioning from one stage to the next as the epidemic evolves and progresses.**

Summary and Conclusions

This report, “The Coronavirus: Epidemiology, Economy, and Public Medicine,” is a joint effort by twelve researchers and physicians from various research disciplines (medicine, history of medicine, epidemiology, physics, and economics) and reflects the diversity of its members.[[1]](#footnote-2) Its purpose is to analyze the various aspects of this topic as researched by the team members, so that decision-makers may utilize it when discussing potential measures in the short-term (the next few weeks—as the first wave recedes and in view of an upturn in infected cases, the medium-term (a second wave anticipated in the winter, in a few months’ time), and the long-term (the years ahead). The topics we chose to address are core issues facing decision-makers today. In particular, we asked what lessons can be gleaned from epidemics that occurred over the past century, analyzed the development of the coronavirus pandemic in Israel and measures taken to curb it and to exit the lockdown, examined the economic repercussions of measures taken to suppress the epidemic, assessed the capacity of the coronavirus ICU and the epidemiological systems, and reviewed the criteria that were applied to exit the full lockdown imposed in mid-March in order to propose criteria for the treatment of various in-between stages that will develop going forward. The resulting report includes several chapters that the team members composed according to their respective professional specializations; however, it also reflects the team’s broad interdisciplinary discussions. We hope that the report encourages the formation of a series of in-depth discussions in multidisciplinary forums (that would also include, for example, psychologists, educators, epidemiologists, and medical professionals, in order to avoid a situation in which physicists or computer scientists, skilled in writing and solving equations and models, are those who determine how schoolchildren will study and how the detection and testing of “contacts” will take place).

The coronavirus pandemic, triggered by the SARS-CoV-2 virus that causes the disease known as COVID-19, began in December 2019 in Wuhan, Hubei Province, China, and then spread to most countries including Israel, where the first cases were discovered in February 2020. Most of the individuals who contract the virus present mild symptoms or none at all. In some 5 percent of cases, respiratory insufficiency and the need for mechanical ventilation and protracted intensive care are the main characteristics. The symptoms of the illness are not yet fully known. The outbreak, as stated, was detected in Wuhan, China, in December 2019; the World Health Organization declared it a global emergency on January 30, 2020, and a pandemic on March 11, 2020. At the present writing (June 1, 2020), more than 6.2 million cases and 375,000 deaths have been reported worldwide. In Israel, 17,106 persons have been infected and 285 have died.

Epidemics, be they bacterial or viral, have been around since the dawn of history. Detailed testimonies about their outbreak, the damage they cause, and the changes they precipitate have appeared in writings since antiquity. Although epidemics differ in their determinants and scale, societies have responded to them in similar ways at all times: with fear, anxiety, panic, and a search for the cause or causes. Epidemics trigger economic and human crises that sometimes culminate in revolutions and regime replacement. Although we tend to repress our memories of epidemics, they arrive every decade or so on average (see table in the appendix for historical background), with some recurring and others disappearing as if they had never been.

The modern world has no advanced ways of preventing and coping with pandemics except through the historical practices of isolation, personal and social protective devices, clothing, masks, and maintaining distance from one another. Nothing seems to have changed; we in the modern era cope just as they did in ancient Greece and Rome, during the Crusades, and in the Renaissance—with isolation, anxiety, mass hysteria, anger, and finger-pointing at some suspected culprit.

In what ways are we different from our ancestors? Primarily in our understanding of the epidemic; the fact that we live in a global world in which there are almost no boundaries, and large numbers of people can (for better or worse) move from place to place in the span of a day; in our use of advanced communication technologies that allows us to quickly locate those who have been in contact with infected individuals; and in the use of medical science to search for a vaccine or other medical solution to address the epidemic—though this too occurs after the fact. The development of a vaccine is applicable only to whatever caused the epidemic at hand. It does not serve to prevent the next epidemic, should it be caused by a different virus.

What has the world failed to do up until now? Our medical systems have failed to detect epidemics and nip them in the bud in scientific ways, and our societies have failed to create dedicated structures with which they can prepare for and cope with the emergency that accompanies any kind of epidemic. Such has been the case in our modern epidemics: tuberculosis, polio, cholera, malaria, AIDS, and Ebola fever have all caused social and economic damage. Nevertheless, many countries have not learned their lesson and few have prepared epidemic emergency contingency plans. It is worth noting that the medical profession is unable to predict the emergence or non-emergence of the second wave of an epidemic. (The table in the appendix table shows that about half of all epidemics had a second wave, stronger than the first in some cases and more limited in others.) To judge the importance of preparing such plans, one should bear in mind that several countries that experienced a large-scale SARS epidemic in 2003, such as South Korea and Taiwan, did prepare advance emergency plans; they thus managed to keep the coronavirus from spreading, maintained their citizens’ health, and kept the socioeconomic effects of the crisis in check. It is true, however, that these successes trace to preparations for a familiar virus, a member of the SARS family.

Would these plans have worked as well had SARS-CoV-2 been an altogether new and unfamiliar virus? This is the quintessential question on the public agenda of all countries. Will the world answer it differently than it did in the past? That’s a difficult question. **Acknowledging the uniqueness of each and every epidemic should be fundamental in establishing rules of health and public conduct for the current coronavirus pandemic**. It is important to realize that to cope with the spread of a pandemic at the personal and public levels, the public must be kept informed and its fears and concerns must be answered. **Uncertainty about the duration and scale of the pandemic, the tendency of individuals and groups to overreact, moral hazard, scornful responses to instructions, and distrust of policymakers only make the social and economic aspects of the crisis harder to cope with.** In the absence of public intervention, all these factors will cause a major decline in economic activity, a significant transformation of social activity, and a considerable increased in morbidity and mortality. What is needed, then, is a policy that integrates an epidemiological model and an economic model.

This report is comprised of a historical introduction and four chapters, each dealing with different aspect of the pandemic and ways to mitigate its harmful effects on health and the economy.

**Chapter 1** analyzes the development of the coronavirus pandemic in Israel and compares it with the way it developed in Austria, which we define as a suitable reference country because it resembles Israel in terms of population size (around 9 million) and the number of COVID-19 cases (approx. 16,000). Examined here are the insights that this development brings to the fore in regard to the spread and control of the pandemic. These insights should be fundamental for predictions of morbidity if a second wave erupts within a few months of the first. Our analysis of the epidemiological outcomes shows that the number of positive cases found in tests gives a good approximation of the number of people who will become seriously ill (including those placed in intensive care and on ventilation, and those expected to die). The analysis illustrates the impact of important events that exacerbate or suppress the development of the pandemic in Israel. When its results are compared with the outcomes of the SIR model, we find that, at least in regard to the direction of development of the epidemic in Israel, it is likely that the forecast given by the model by the end of March could have served as a reasonable proxy.

To test the results, Chapter 1 also compares the fit of the development of the pandemic in Israel with that in Austria and the fit of the SIR model with the progression of the epidemic in Austria. Developments in Austria, it is found, preceded those in Israel by around nine days, a fact that allowed the Israeli Prime Minister and the head of the National Security Council to announce the adoption of Austria as a reference country that foreshadows events in Israel. This decision gave Israel the advantage of being able to shorten the duration of the unknown by nine days. Our comparison of Israel and Austria showed that even though the countries were similar in the progression of the epidemic and the number of positive cases, the rate of serious and fatal infections was roughly twice as high in Austria as in Israel, mainly because in Austria the proportion of elderly people (age 65 and above) is roughly double that in Israel (20% vs. 11%, respectively).

By and large, the measures that abetted strong mitigation and de facto flattening of the coronavirus curve were similar in the two countries (March 22–April 8 in Israel and March 11–April 5 in Austria) and included stringent restrictions such as closing the borders for entry via air travel or land travel from neighboring countries, closing schools, instructing large numbers of workers to work from home, and shuttering places of entertainment and leisure, among other measures*.* Israel introduced more numerous and more vigorous measures than did Austria, possibly explaining the steeper initial mitigation of the epidemic in Israel (within three weeks in Israel compared with four weeks in Austria). Given that these measures were adopted so closely together in both countries, however, it is hard to tell them apart and test the effect of each separately.

Importantly, as the report was going through its final editing in late May and the pace of new infections had been slowing steadily for about two months, a troubling upturn in morbidity presented in Israel, attributed in large part to the reopening of schools, particularly high schools, in the preceding month. The decision to reopen the economy two weeks earlier than the Austrian plan (Austria reopened on May 17, while Israel did so on May 3 rather than May 26, the date in Israel that would have corresponded to the Austrian plan with “corona time” taken into account), marked a turn in the exit program and caused Israel to precede Austria by two weeks in calendar terms—the equivalent of three weeks in “corona time.” Thus Israel lost the ability to learn from Austria’s experience, even though this had been included in the program and announced in advance by the Prime Minister. An excellent example of the outcome may be seen in the corrective action that the Government of Austria took when it saw its country’s infection curve begin to rise in early May in ominous numbers and at a dangerous pace: the reopening of high schools was postponed by two weeks and the worrisome upward trend slowed accordingly. **In Israel, in contrast, where junior and senior high schools reopened on May 17 and all social distancing guidelines (e.g., pods in classrooms, among teachers, and in school buses) were rescinded, no corrective measures have been imposed as of the present writing (June 5),** notwithstandinglocal initiatives among municipal authorities, schools, and parents’ committees to revert to distance learning and pods. The Minister of Education refrained from reversing high-school exit steps **even though the COVID-19 infection data had already surpassed two of the three criteria for the re-imposition of local or full lockdown and despite the recommendation of the Ministry of Health.**

**Israel must draft an action plan in advance, as did Austria and other countries that are coping successfully with the current outbreak.** A well-grounded and reasoned plan for a period of approximately two months forward would allow all stakeholders to understand and align themselves with the direction of policy set forth, stabilize citizens’ expectations, and maintain discipline among the public and its leaders.

In **Chapter 2,** the impact of the pandemic on economic behavior in Israel is discussed, again with Austria as the reference country. It points to market failures originating in fear of infection and morbidity, making individuals less willing to enter the public sphere and go to work. These failures demonstrate the need for a public policy that will strive to stimulate economic activity and prevent large-scale loss of years of life.

In this chapter, we note the grave economic harm that a **sweeping lockdown** causes by severing physical contact among the population. As an alternative to a total lockdown, **restraint based on test, track, and trace (TTT)** is discussed—a modus operandi that would isolate only confirmed cases and their contacts (within forty-eight hours), “close the circle,” and break each infected person’s chain of contagion. Sweeping lockdowns appear to cause acute and unnecessary economic harm. When we calculated the years of life that such a lockdown would save, we found that the cost of each year saved is six to ten times that of a year of life saved by decisions of the “health basket” committee, which stands at around NIS 350,000.

Israel’s economic policy has responded to the dramatic shock by focusing on elements that the OECD countries, including Austria, also placed in the forefront: assuring a basic income for individuals who are unable to work due to the lockdown and/or the slump in demand, coupled with an incentive to maintain the existing occupational structure; providing bridging support for business’ financial flow and offering some compensation for the fixed expenses of businesses that are expected to continue functioning; and state-of-crisis macroeconomic fiscal and monetary policies that stimulate demand, allowing growth to resume under the best conditions possible.

Significant advantages of Austria’s economic policy over Israel’s are emphasized in this chapter. In respect of employment and assurance of personal income, the Austrian method of “corona part-time work” has a significant advantage of flexibility compared with Israel’s rigid policy of unpaid furloughs. Support of businesses’ fixed expenses—taxes, rent, and various contracts—is well defined and grounded in clear economic principles in Austria, as it is not in Israel. Austria’s government loan funds issue more generous government-guaranteed credit with greater simplicity via the banking system. In monetary matters, the ECB is more involved and interest is lower (negative) but liquidity is very high in both countries. Finally, we note **the importance of transparency in easing the sweeping lockdown in Austria, allowing the economic system to plan its steps in accordance with measures taken, and the crucial need to establish a clear set of rules in Israel, providing economic players with certainty both in entering the crisis and in exiting it.**

**Chapter 3** examines two aspects of organizational measures that the healthcare system must take to deal with the pandemic. The first is the number of seriously ill patients (a majority of whom are ventilated) who can be treated simultaneously in hospitals’ coronavirus ICUs, and ways to increase this number. The second aspect concerns the deployment of the public-health system to detect COVID-19 outbreaks and act to control them by breaking chains of infection that help the epidemic to spread.

In regard to the hospitals’ organizational measures, it is noted in this chapter that the capacity of the hospital system in terms of coronavirus ICU beds is capped mainly by the number of doctor and nurse teams that can be mobilized and trained, whether internally by the hospital staff or externally. The hospitals’ capacity is limited to around 250 individuals on ventilation and 500 in serious condition, for whom all hospital staff is mobilized (by adding 250 doctors and 1,200 nurses to a similar number of current staff) with other services shut down, with the exception of life-saving actions and assuming no parallel influenza epidemic. **To bolster the coronavirus teams and brace** **for a second wave that will coincide with a flu epidemic, immediate organization and training are needed.** Conversely, the system does have a problem with regards to ventilators, of which it has thousands.

As for public health, characterized by the “three P” principles—Promote, Prevent, Protect—the chapter focuses on those aspects that are relevant to pandemic outbreaks, with emphasis on the possibility of a second wave of COVID-19 in the upcoming winter. In the first part of the chapter, the number of tests required and the amount of time needed from administering the test to obtaining the results are discussed.[[2]](#footnote-3) The second part asks how much epidemiological-investigation and contact-tracing effort will be needed to trace those suspected of infection quickly enough to break the infection chain. The requisite public-health deployment to cope with the various tasks and constraints is discussed in the third section.

It seems to us that despite the professionalism, hard work, and devotion of the public-health system staff (epidemiologists, public-health experts, and teams of epidemiological and public-health nurses, including nurses who, in regular circumstances, work in “tipot halav” [family health centers] and school healthcare services and in emergencies serve on tracing teams), this immense and professional effort has not been utilized optimally, particularly due to the lengthy time (six to eight days) that it has taken to sample, test, and confirm a “coronavirus suspect” as a “confirmed carrier.”

We emphasize that for care to be effective, **test results should be obtained within twenty-four hours at most, and investigation, detection, and isolation should follow within another twenty-four hours.** **If the** **process takes longer than forty-eight hours, the chain is broken much less effectively. Therefore, we think it is preferable to test, detect, and isolate 60–70% of carriers and persons in contact with them within forty-eight hours rather than to trace everyone fully over a longer period of time.**

Before recruiting new case investigators who are not skilled in this work, it is important to ask whether it might be the right approach to reinforce and rely upon the current array of public-health services, which has been found to be highly organized and professional, and to ensure that the aforementioned hierarchy of criteria be clarified all along the chain of command among those involved.

In **Chapter 4,** we explain the implications of the phenomena described in chapters 1–3 in regard to the local healthcare system’s capabilities, list the measures that should be taken to control the coronavirus outbreak, and, insofar as these measures fail, describe the remedial steps that should follow. Criteria and strategies for exiting the lockdown in order to reduce the likelihood of a renewed outbreak are described in particular. The connection among the characteristics of the outbreak, the critical resources, and the limits of the interplay of these resources and the actual parameters of the pandemic are explained, **and criteria for exiting the lockdown regime, derived from these constraints and balances, are presented—with special emphasis on the constraint of the maximum capacity of the systems and teams that deal with ventilated patients. A hierarchy of actions is proposed: from a basic and compulsory coronavirus routine including social distancing, personal conduct, and deployment for rapid testing and case investigation, onward to stringent local measures, and thence to smart lockdowns at the national level in order to avoid a new across-the-board lockdown that would devastate the economy. Discussed in particular are the number of tests, the amount of time needed to obtain results, and the epidemiological investigation system that is needed to improve the likelihood of suppressing additional outbreaks by means of the TTT system only.** Local steps that will be necessary if the effort to avert an outbreak via TTT alone fails are discussed farther on. Finally, we present criteria that signal the need for remedial measures and possible measures of these types that may be chosen so that tolerable active economic life can be maintained along with enough of a margin to assure that medical staff resources will not be overwhelmed.

**The members of the team agree unanimously that an integral, synchronized government program should be prepared, addressing a period of several months and dealing with all aspects of the coronavirus pandemic or similar epidemics. The program must be anchored in evaluation points as well as clear and transparent criteria for the public, which will serve to clarify the aspects involved in transitioning from one stage to the next, as was done, for example, in Austria and Switzerland.**(See schematic figures for the Swiss programs [right-hand side] and the Austrian one [left-hand side], published about two weeks before the end of the sweeping lockdown and representative of corresponding programs in most European countries**.)**

**This is how Austria will return to routine life (planned measures):**

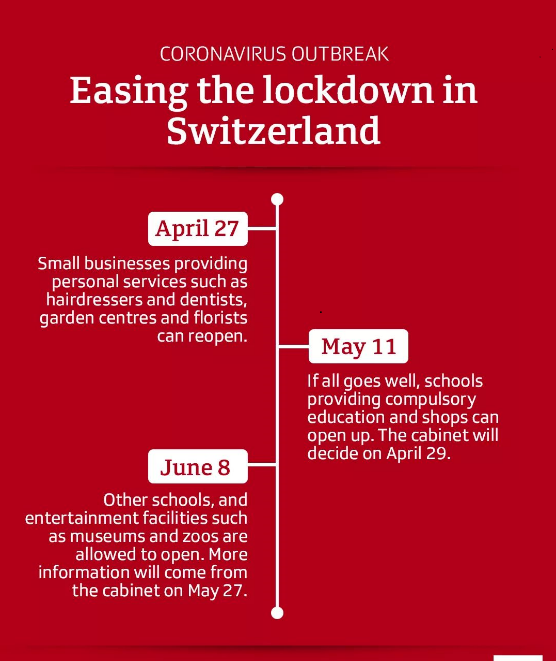
*April 14*Small shops will open for activity with a limit of one customer per 20 sq.m.

*May 1*All shops, including those in malls, will open for activity with mandatory wearing of masks.

*May 15*Schools, restaurants, gyms, and hotels will reopen for activity.

*June 30*Mass events will be allowed, whereas the lockdown limited encounters to two people.





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2. The report goes as far as May 31. Since early June, TTT performance has been increasing considerably due to a new instruction from the Ministry of Health to test all persons in contact with verified COVID-19 cases (e.g., testing of entire classes, grades, and schools after individual pupils and teachers are found to be carriers). The implications of this directive for the number of tests, the extent of laboratory testing, and the number of TTT teams will have to be examined. [↑](#footnote-ref-3)