

AMSE EVENTS AND CONFERENCES THAT WERE SUPPOSED TO TAKE PLACE THIS SEMESTER ARE CANCELLED OR POSTPONED DUE TO THE COVID OUTBREAK.

## Edito

As Albert Camus reminds us, plagues always take us by surprise. Covid-19 is no exception. Unknown a few months ago, it spread like wildfire and brutally impacted our societies and economies, as governments struggled to find the appropriate response. In these times of crisis, I believe that AMSE's three core missions – Research, Teaching and Outreach – are even more vital. Now more than ever, we must advance the knowledge needed for theoretically sound, evidence based policies, we must carry on the formation of society's citizens and decision-makers, adapting it to the difficult circumstances, and we must disseminate scientific knowledge clearly and transparently, a critical part of the fight against rumors, fake news and misbeliefs.

AMSE has a long-standing expertise in health economics, a field that has suddenly become critically important.

In this newsletter, AMSE researchers share their views and research findings on the economics of epidemics, testing, health systems in Middle-East and North-African countries, vaccination, and lockdown exit strategies. The lockdown has been a challenge for everyone and, in particular, for students and teachers of AMSE's graduate school. Elisabeth Barthélemy reports on the school's mobilisation to face the crisis. Our portrait of a former AMSE PhD student is about Nicolas Dromel, now Head of the Department of Large Research Infrastructures at the French Ministry of Higher Education, Research and Innovation.

Stay safe, and good reading !

Yann Bramoullé  
Scientific Director of AMSE

## News

A 2007 article by AMSE researcher **Yann Bramoullé** and Rachel Kranton from Duke University has been selected for a special issue of the Journal of Economic Theory, celebrating its 50th anniversary. This special issue offers open access to 50 influential articles published by JET during its first 50 years of existence. This article, titled « Public Goods in Networks », introduced and analyzed the first model of public good provision where agents interact on a network.

**Nicolas Berman**, researcher at AMSE, received the CNRS 2020 bronze medal rewarding early carrier research. At the crossroads of international economics, political economy and development economics, his research tries to understand how economic and political actors - households, firms, armed groups, political parties - respond to global fluctuations in today's integrated world. For instance, some of his recent works study the economic determinants of civil conflicts.

## Outline

### RESEARCH PERSPECTIVE

Economics of epidemics : old topic, new questions, by Raouf Boucekkine 2

### RESEARCH HIGHLIGHTS

"Test, test, test", but according to the dynamics of the pandemic, by Stéphane Luchini, Patrick Pintus and Miriam Teschl 6

Assessing health systems' capacity: preliminary evidence from MENA countries, by Mohammad Abu-Zaineh and Sameera Awawda 8

Vaccination in times of pandemic, by Olivier Chanel and Stéphane Luchini 10

### PUBLIC POLICY HIGHLIGHT

Lockdown exit strategies, by Bruno Ventelou 12

### AMSE SCHOOL

The school is mobilised to face Covid-19 crisis, by Elisabeth Barthélemy 14

Graduation projects with oral defence from home, by Elisabeth Barthélemy 17

### PORTRAIT

Nicolas Dromel, Head of Department, Large Research Infrastructures 18

# Economics of epidemics : old topic, new questions

By Raouf Boucekkine

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**COVID-19 is triggering a revolution in this area of economic research. I have never seen so many truly economic (or econometric) epidemiological models at once.**  
 ”



RaoufBoucekkine

Raouf Boucekkine is Professor of Economics at Aix-Marseille University since 2011. He is a Senior Member of the Institut Universitaire de France and Scientific Director of the network of French institutes for advanced studies (RFIEA). He obtained his PhD in economics from Université Paris 1 in 1993. He was an assistant, and then an associate professor at Universidad Carlos III de Madrid from 1993 to 1998, a professor at Université Catholique de Louvain from 1998 to 2013, and a Director General of the Institute for Advanced Study at Aix-Marseille (IM&RA) from 2015 to 2020.

The COVID-19 crisis is currently inspiring a huge number of urgent papers and research projects worldwide, in several disciplines. Many economists have discovered the standard structure of epidemiological models and associated totemic objects like the famous  $R_0$  (i.e, basic reproduction number of an infection). A good friend of mine, a well-respected econometrician, commented to me that he would never have suspected that these models were so simplistic before the COVID-19 tsunami of papers! It's true that when Susceptible – Infected – Recovered (SIR) or Susceptible – Exposed – Infected – Recovered (SEIR) models are applied to the current avalanche of new issues raised by COVID-19, the standard mathematical epidemiology models don't look so good. But we should remember that this is the first time that so many economists with no background in health economics have come face to face with the underlying epidemiological « fundamentals », as the current pandemic has grown increasingly puzzling.

Indeed, with quite a few exceptions (mainly related to malaria, see e.g Chakraborty et al, 2010), most economists previously modelled epidemiological shocks merely as transitory, and far less enduring, mortality/morbidity shocks. In the best case, the precise age profile of mortality is accounted for. That's what I've been doing for more than 15 years, never looking or even thinking of looking, at hospitalisations and/or infection dynamics. I think this is largely because researchers who came to this area because of AIDS (like me) or Ebola in Africa, quickly figured out that if any data makes some sense in this continent to track these major epidemics, it's mortality data. But COVID-19 is a completely different ball game: mortality is just one important statistic among others potentially available. Regarding certain issues like the optimal design of quarantines under health system capacity constraints, it is clearly less important than the number of patients in intensive care units, for example. In this sense, COVID-19 is triggering a revolution in this area of economic research. I have never seen so many truly economic (or econometric) epidemiological models at once.



## EPIDEMICS AND THE ECONOMICS OF DISASTERS

Indeed, the classical appraisal of the economic impact of epidemics belongs to what we could label the economics of disasters. Probably one of the earliest and most famous works in the field is that of Jack Hirshleifer (1966) on the Black Death (1348-50). Among several interesting conclusions, including the role of the Black Death in the demise of feudalism, he addressed quite a serious consideration: « Direct inferences can hardly be drawn from this 14th century catastrophe as to possible consequences of thermonuclear war...» (page 40). The report was commissioned in the mid-60s.

The analogy between wars and epidemics is made in much more recent publications and even textbooks. In chapter 5 of the economic growth textbook of Barro and Sala-i-Martin (1995), both wars and epidemics are described as departures from the equilibrium value of the human to physical capital ratio. An epidemic (resp. a war) is associated with relative scarcity of human (resp. physical) capital. In two-sector models à la Lucas-Uzawa, growth is driven by human capital accumulation, and the education sector is more human-capital-intensive. Accordingly, and contrary to wars, which are followed by neoclassical catching-up transitions (« miraculous growth »), the economies hit by epidemics recover much more slowly because of the relative scarcity of human capital (the engine of growth), inducing high operation costs (as wages go up) in the education

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sector. The analogy between wars and epidemics then breaks down.

## WHAT ABOUT HEALTH ?

The above formalisation of epidemic shocks leaves no room for a supposedly related central concept, health, and its companion, health policy, even though economic theory has been perfectly equipped to deal with it since the early 70s and Michael Grossman's work on health capital. One of the reasons for this early trend is that many researchers focused on short-lived epidemic episodes like the Spanish flu or the Black Death (at least its main wave). Both were long considered as shocks either on the initial human to physical capital ratio or on exogenous survival rates for one period or so. Behind this approximation, there is the belief that such « sudden » and « short » shocks will induce an unavoidable upsurge in mortality in the short-run and no long-term effect.





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It is only very recently that novel hypotheses like the fetal origins hypothesis have underlined the importance of the initial health endowment, thus strongly undermining the above-mentioned beliefs. Along with the fetal origins hypothesis, several cohort studies have identified specific long-term health effects of the Spanish flu « sudden » shock (see e.g Almond and Mazumder, 2005).

But the fact remains that health expenditures (private

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or public) and health policy and systems did become central earlier with the emergence of one enduring epidemic, AIDS. Tens of papers have been devoted to the evaluation of the short- versus long-term effects of AIDS, and the inherent (optimal) prevention/treatment public policies. More interesting probably by far than other epidemics before (at least in terms of the variety of questions raised), AIDS has inspired a dense literature on economic behaviour in response to epidemics. This includes compliance with prevention measures (e.g, use of condoms), and

health spending, saving, schooling and reproduction behaviours under AIDS (see e.g Boucekine et al., 2009). This behavioural dimension of economic research on epidemics is likely to be even more important with emerging diseases.

#### THESE EMERGING DISEASES ARE CHALLENGING

While uncertainty and risk are inherent in any epidemic, even the most studied and best characterised ones, the uncertainty and risk involved in the diseases emerging since the beginning of the century are particularly challenging. A key common factor is that many of these diseases are caused by respiratory viruses. Just like the Spanish flu one century before, their contagiousness can be formidable, as it is linked to the vital act of breathing (unlike vector-borne diseases such as malaria). We all recall the H1N1 virus a decade ago and the panic it caused in autumn 2009 in France (and the famous massive vaccine order by former Health Minister Bachelot). The current COVID-19 epidemic is a major source of uncertainty both for individuals and for the authorities, as its basic epidemiology is not yet understood in many respects. While quarantines seem to be useful in slowing down epidemic diffusion, their economic cost is huge. And the question of optimal design of quarantines (duration included) with or without (grouped or not) testing is extremely tricky, given the extent of the uncertainty.

Not to mention the obvious moral hazard problems:

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individuals confined (or subject to any kind of constraint) might not believe they are equally at risk of infection and might not comply with the rules despite penalties. This is probably true of many (infected) asymptomatic individuals, one of the peculiarities of COVID-19, especially the youngest. Of course, they, like the authorities, do learn over time: for example they learn whether confinement is making an impact on the epidemic, through the publication of daily statistics. But if information distribution is curbed, the moral hazard problem becomes more acute. What should the authorities announce at that stage,

other than the typical warnings? The authorities are learning too, just like the population. How can we capture this two-sided learning process (with obvious strategic ingredients) ? These are critical questions, as they also to a large extent determine the dynamics of the epidemics, and are crucial to grasp how deconfinement should be implemented. And this is only a very small subset of the deep behavioural questions posed by emerging diseases.

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# “Test, test, test”, but according to the dynamics of the pandemic

By Stéphane Luchini, Patrick Pintus and Miriam Teschl



## Stéphane Luchini

**Stéphane Luchini** has been a CNRS chargé de recherches at GREQAM-AMSE since 2001. He obtained his PhD in 2000 from Université de la Méditerranée. He is a member of the CNRS-INSERM Committee HS3P-CriSE “Health and Environmental Crises – Humanities, Social Sciences, Public Health”. He is interested in evaluating public goods using stated preference methods and experiments. His main domains of application are health economics, environmental economics and social justice.



## Patrick Pintus

**Patrick Pintus** is Scientific Deputy Director at CNRS-InSHS, Professor at Aix Marseille University, and he holds a PhD from École des Hautes Études en Sciences Sociales. He has held research and teaching positions at UCLA, Washington University in St Louis, the St Louis Fed, and Konstanz University. Most of his published academic research relates to expectations in macroeconomics, with recent emphasis on learning and uncertainty.



## Miriam Teschl

**Miriam Teschl** is maîtresse de conférence at the Ecole des Hautes Etudes en Sciences Sociales, based at AMSE. She has held positions at Robinson College, University of Cambridge and University of Vienna before coming to France. Her research is primarily in the interdisciplinary domain of economics and philosophy. Her main interests concern rationality and decision-making, theories of well-being and epistemology of economics.

The keynote of the current COVID-19 pandemic is uncertainty. Who could have known in early January, that by mid-March, most countries in the EU would opt for a generalised lockdown, and that borders would be closed within the Schengen. Now, as we slowly approach the end of generalised lockdown periods in many European countries, all we can say with certainty is that we don’t know whether the worst is behind us, or whether there will be a second wave of infections to bring public life at least partially to a hold. And yet, most public decision-making over the past months has relied on epidemiological models that, of course, had to start somewhere: that is, with assumptions.

In “normal” times, discussing the correctness of assumptions can be quite a pleasant pastime, in particular among economists. However, in the current situation, it would have been, and still is, fruitful to rely on the actual data available rather than on assumed probabilities. The purpose of using actual data, however, is not to count the number of people infected or cured, but to help visualise any acceleration or deceleration of harm. That is, what matters in times of radical uncertainty is to enhance understanding of the dynamic of the pandemic in real time, by offering a way to indicate when the pandemic is spreading rapidly and when it is slowing down (Luchini et al. 2020).

To do so, we propose an indicator that looks at whether the relationship between the number of positive cases over the number of total tests presents a convex or a concave trend (Baunez et al. 2020a). The intuition behind this relationship is simple: if with an increasing number of tests more and more people are found to be positive, the pandemic is spreading rapidly (convexity); if less and less people are found to be positive with an increasing number of tests, the pandemic is under control (concavity). Two important corollaries can be drawn from this: first, massive testing is crucial; second, whatever the public health policy chosen, the aim should be a concave relationship according to this indicator.

Obviously, the more local this indicator is, the better

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it will illustrate geographical variations. As this indicator is fed daily with the newest data, it can relatively quickly indicate any changes in the dynamic of the pandemic and can therefore easily be used for local trial-and-error policy. A third corollary therefore is that different policy responses, across regions within a country but also across countries, can better be observed and compared. The most sensible idea here is to have an open-access data-dashboard that helps compare policy responses across countries via this indicator, so that the most effective policies can be applied elsewhere as much and as rapidly as possible.

To represent how our indicator works, we use a scatterplot of the cumulative number of positive cases against the cumulative number of total tests. In Figure 1, we draw the hypothetical scenario of two regions, A and B. The curves are normalised by dividing raw data over the last data point available today. Comparing these two regions, we find that with the same fraction of tests, there are initially more positive cases in region A than in region B, but this trend is reversed as the fraction of tests increases at end date. This representation also tells us something about efficient distribution of tests (Baunez et al. 2020b). Tests, are a scarce resource and the best possible distribution is therefore crucial. Intuitively, we can say that tests are better used in a region where the pandemic is accelerating than

where it is slowing down, because with the same number of tests, more positive cases can be found in regions where the harm is increasing more rapidly.

Graphically, this means that tests should be distributed across regions or countries according to the slope of the tangent on those curves, as in Figure 1, which can be interpreted as the marginal benefit of an additional test at end date. For example, at endpoint, the slope of the tangent to the curve in region B is steeper than in region A, indicating that more tests should be attributed to this region so as to curb the pandemic. A positive test result enables the concerned person to be isolated in order not to infect others, thereby contributing to a deceleration of the spread of the disease. This shows that, albeit quite counter-intuitively, tests should not be allocated to regions with the highest number of cases, but to those where harm from the pandemic is accelerating. Policies like this require the right indicator, not just any simple time series or fancy models based on assumptions easy to get wrong in times of uncertainty. Our indicator does this job. And it shows that ready-to-use research does not necessarily need to be complicated and assumption-driven.

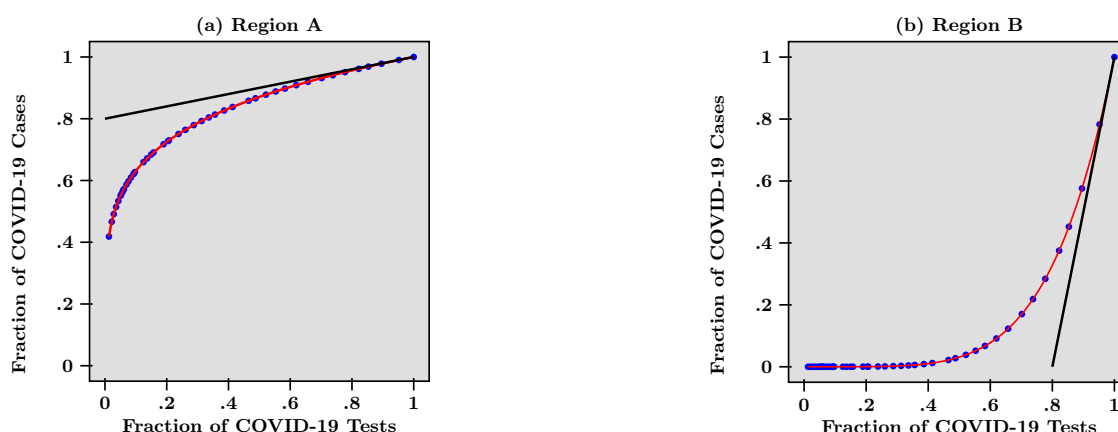
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**Figure 1**





# Assessing health systems' capacity to cope with the COVID-19 pandemic: preliminary evidence from MENA countries

By Mohammad Abu-Zaineh and Sameera Awawda

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**While a variety of factors may affect the spread of any infectious disease, health systems remain ultimately responsible for early detection, prevention and treatment.**

”



M. Abu-Zaineh

Mohammad Abu-Zaineh is maître de conférences at Aix-Marseille University where he received his PhD in economics in 2008. He is the founder and coordinator of AHEAD Network ([www.ahead-network.org](http://www.ahead-network.org)). Prior to joining AMSE, he held the INSERM-AMU Chair in Health Economics (2013-2018). His areas of expertise include health economics; public economics and microeconometrics.



Sameera Awawda

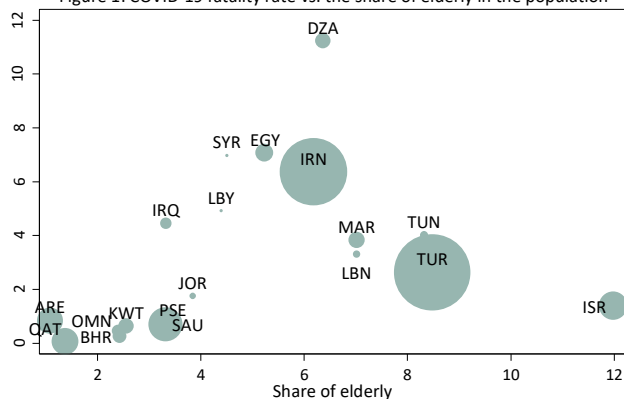
Sameera Awawda holds a PhD in Economics from Aix-Marseille University (2015-2019). She is currently Research Assistant at AHEAD Network. She worked as a research assistant at the French Research Institute for Development (IRD) in 2018-2019. Her research interests include health economics, microsimulation and inequality measurement.

With the spread of COVID-19 to the Middle-East and North African (MENA) region, many health experts share concerns about the capacity of these countries' health systems to halt such a pandemic. While a variety of factors may affect the spread of any infectious disease, health systems remain ultimately responsible for early detection, prevention and treatment. We assess and compare the readiness and capacity of the health systems in a set of MENA countries to respond to the current pandemic, using two mashup indices previously proposed to measure countries' detection capacity, risk of, and vulnerability to infectious diseases.

As of May 1st 2020, the MENA region countries had a total of 213 045 confirmed cases of COVID-19, while the total number of deaths stood at 4 907. Although most of the confirmed cases (69%) and deaths (84%) are concentrated in Turkey and Iran, COVID-19 fatality rates remain relatively low in these two countries (2.6% and 6.4%, respectively) as compared to other countries in the region (Algeria: 11.2% and Egypt 7.1%). Reported figures from developed countries suggest that the fatality of COVID-19 depends, inter alia, on the demographic structure of the population, with more than 80% of fatalities concentrated amongst the elderly. Although disaggregate data by age is not readily available in the MENA countries, the high fatality rates observed are in line with global trends: with the exception of Israel and Turkey, COVID-19 fatalities appear to be higher in countries with a higher share of elderly people (Figure 1). However, other factors pertaining to health systems' capacity may explain the discrepancies observed between countries.

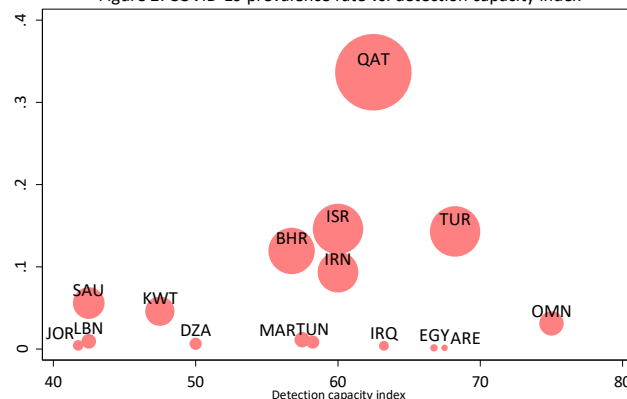


Figure 1: COVID-19 fatality rate vs. the share of elderly in the population



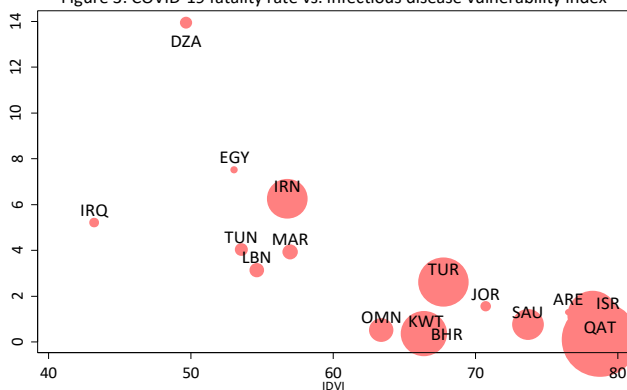
\* Source: Our World in Data 2020 and World Development Indicators.  
 \*\* Area of circles is proportional to number of COVID-19 confirmed cases as per 01/05/2020.

Figure 2: COVID-19 prevalence rate vs. detection capacity index



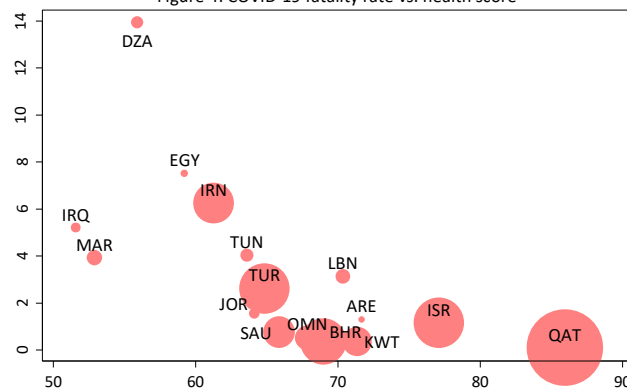
\* Source: Our World in Data 2020 and WHO (2018).  
 \*\* Area of circles is proportional to number of COVID-19 confirmed cases as per week 8.

Figure 3: COVID-19 fatality rate vs. infectious disease vulnerability index



\* Source: Our World in Data 2020 and Moore et al. (2017).  
 \*\* Area of circles is proportional to number of COVID-19 confirmed cases as per week 8.

Figure 4: COVID-19 fatality rate vs. health score



\* Source: Our World in Data 2020 and Moore et al. (2017).  
 \*\* Area of circles is proportional to number of COVID-19 confirmed cases as per week 8.

Figures 2 and 3 depict COVID-19 prevalence and fatalities reported in each country against, respectively, the capacity of the health systems and the countries' vulnerability to infectious disease. As shown in Figure 2, countries with a high prevalence of COVID-19 appear to have higher health system capacity. Moreover, countries with high vulnerability to infectious diseases (low score) report higher fatalities (Figure 3).

Once the vulnerability to infectious disease index (IDVI) is broken down into its components (the risk factors), it emerges that the health domain score is closely associated with the number both of COVID-19 cases and of fatalities. Figure 4 depicts the association between the health domain score and COVID-19 health outcomes in the MENA countries. As shown, countries with low health scores tend to have high fatality rates (Algeria and Egypt) indicating high vulnerability to infectious diseases. By contrast, countries with high health scores (Israel and Qatar) tend to have higher numbers of laboratory-confirmed cases. This may reflect their health systems' greater detecting and testing capacity.

Although preliminary, reported results suggest that the MENA countries are at moderate to high risk of the spread of COVID-19. Of the risk factors we study, the capacity of a country's health system (as measured by size of health workforce, health expenditure, health infrastructure and health status) emerges as key to curbing the spread of the disease.

All health sector stakeholders are urged to expand health systems' capacity to perform timely mass testing. This also entails implementing a set of targeted emergency responses that involve identifying, evaluating, and properly addressing all risk factors likely to be associated with the spread of COVID-19. In parallel, proper implementation of means-tested government benefits can help mitigate the adverse economic consequences of the pandemic on the most vulnerable groups, who may incur the double disease burden (health and economic losses). Should more detailed data be made available, further research will be required to thoroughly comprehend the dynamics of the current pandemic, its determinants, and consequences at both the micro and macro-levels.

# Vaccination in times of pandemic

By **Olivier Chanel** and **Stéphane Luchini**

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**Participants did not use the information provided by the feedback on others’ behaviours and opinions. In the end, it was the scientific information (...) that proved crucial, leading to a positive change in intentions to vaccinate.**  
 ”

If we want to stop the COVID-19 pandemic, we’ll need to acquire herd immunity (i.e. about 70% population coverage). This can be achieved through natural infection via contact with infected people (but it is not certain that this will protect people, especially those who have only been a vector) and/or through a mass vaccination campaign once a vaccine is available.

However, because compulsory vaccination is hard to imagine in modern democracies, governments need to convince the targeted populations to subscribe to the recommendations of health authorities through efficient and persuasive information campaigns. Economic theory suggests that since vaccination campaigns may be plagued by an externality problem, people do not take into account the positive effect their vaccination has on others and a type of prisoner dilemma arises.

Ten years ago, the 2009 swine flu (H1N1) pandemic demonstrated that the public’s support is essential for the success of a vaccination campaign. In total, instead of the targeted 75%, less than 9% of the French population was vaccinated (as in Germany, Italy, the United Kingdom, Belgium, China or Mexico, for example). Luckily, the consequences were mainly financial, since swine flu was less severe than a seasonal flu (partly because people over 60 benefited from immunity acquired during the 1957–58 influenza pandemic). But COVID-19 is a different story because the health stakes are higher.

## EXPERIMENT

An experiment conducted in December 2009 (which marked the first epidemic peak in France and the beginning of the vaccination campaign) to examine how different types of information can influence individual vaccination decisions may provide some interesting insights. We proposed an interactive one-hour experimental session to 175 general public participants, with immediate feedback via an electronic voting system recording participants’ choices in real time. Intentions to vaccinate were



Olivier Chanel

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elicited five times, a different type of information (the results of the votes) being provided before each elicitation. In step 1, initial intentions were based on the prior stock of information and experience of participants. Subsequent information concerned others' intentions regarding vaccination (step 2), public opinion about a swine flu vaccination campaign (2 positive and 2 negative slants, step 3), others' beliefs about a swine flu pandemic (2 quantitative subjective belief questions, step 4) and quantitative scientific information provided through experts (a 25-minute interactive round table with two renowned health academics, step 5).

## RESULTS

Initial intentions were found to increase with previous vaccination against flu, good self-assessed health status, positive attitude toward vaccination in general, high self-estimated level of knowledge about vaccination and using health professionals as information source. Intentions were found to decrease with being a female and consulting Internet for information. Participants did not react to the information provided in stage 2 about other participants' low level of intentions to vaccinate, which confirms that they were not thinking strategically (not "free-riding" on others' vaccinations). We also found that formulating opinions about the vaccination campaign (stage 3) and beliefs about the risk of contamination (stage 4) did not influence intentions to vaccinate, even when feedback about other people's opinions was provided. This means that participants did not use the information provided by the feedback on others' behaviours and opinions. In the end, it was the scientific information

provided in stage 5 that proved crucial, leading to a positive change in intentions to vaccinate. Overall, these results show that the individual attitude to vaccination is based on personal appraisal of the situation. Providing scientific information can help health authorities bring the public's willingness to vaccinate into line with optimal vaccination coverage.

## RECOMMENDATIONS

How can scientific information be propagated in the best and most practical way? Clearly, the conditions of stage 5 are difficult to replicate for a sizeable segment of the population during a pandemic, especially under the prevailing social distancing. A successful information channel needs to guarantee that people trust the information provided. Traditional media and Internet seem to be poor candidates: we found that people informed by these media rather than by medical professionals were less pro-vaccination. Two directions for optimal mass media communication of credible scientific information in addition to the family doctor seem possible. The first is healthcare websites provided by health practitioners, which offer an arena for constructive debates informing the public about health issues and public health interventions. The second is television broadcasts that present relevant objective health data, organise debates among health specialists and allow interactivity with viewers through telephone, SMS, Internet and surveys.

**Chanel O., Luchini S.,** Massoni S., Vergnaud J-C., «Impact of information on intentions to vaccinate in a potential epidemic: Swine-origin Influenza A (H1N1)» *Social Science & Medicine*, 72-2, 142-148.

# Lockdown exit strategies

This memo was published by the Collège des Économistes de la Santé.  
By Bruno Ventelou

“  
The priority is to protect  
at-risk populations susceptible  
to a severe form of the illness.  
”

The **College of Health Economists (CES)** is an association created thirty years ago. Today, it has a network of more than 300 members and aims to support and animate research in health economics

An array of documents are available on the Covid Crisis. These are the result of collective work between the Institute of Research and Documentation in Health Economy (IRDES), the University of Paris-Dauphine and the resource services of the French National Authority for Health (HAS); including the members of CES: Thomas Barnay, Julia Bonastre, Benoit Dervaux, Bruno Detournay, Florence Jusot, Pierre Levy, Sandy Tubeuf, Bruno Ventelou, and Jérôme Wittwer.



Bruno Ventelou

Bruno Ventelou joined GREQAM-AMSE as a CNRS directeur de recherche in 2005. He obtained his PhD in 1995 at EHESS Paris. He taught at ENS Cachan between 1994 and 1998 and was a researcher at FNSP (OFCE Paris) between 1998 and 2003. His research interests include health economics and macroeconomics.

The current debate on deconfinement strategies mainly highlights major sectoral or geographic options (like the red and green French administrative départements), but little attention is being directed at the populations that are a priority for protection. The Collège des Économistes de la Santé (the French College of Health Economics) is contributing to the debate on lockdown exit strategies by highlighting the interaction between the risk to certain populations of developing severe forms of Covid-19 (chronic comorbidity) and the labour market, in a global benefit-risk analysis. This analysis currently only encompasses the health issues involved in the different lockdown exit options. Three observations have been reached:

#### **OBSERVATION 1: EASING RESTRICTIONS IS ABOUT MANAGING THE RISK, NOT ELIMINATING IT**

The risk of Cov-19 infection will be relevant for a considerable period of time. Epidemiological assessments have demonstrated that herd immunity is extremely far from being reached for the whole of France. The virus will therefore continue to spread, and the risk of an epidemic rebound is very high. The lockdown helped reduce the spread of the virus. Exiting the lockdown entails fully accepting the risks related to reactivating the spread of the virus.

#### **OBSERVATION 2: BOTH ECONOMIC AND HEALTH COSTS RELATED TO AN EXTENDED LOCKDOWN ARE REMARKABLY HIGH**

Projections carried out by the Bank of France in mid-April on economic activity and the deficit of public administrations for the year 2020 are very worrying (-8% for GDP and 9% budget deficit). Extending the lockdown increases the probability of a deep and long-lasting crisis. The lockdown furthermore directly impacts people's health in two ways. It affects both their well-being and their physical and mental health and it generates risky behaviour (failure to seek care or addictions).





### **OBSERVATION 3: SEVERE FORMS OF THE ILLNESS ARE CONCENTRATED WITHIN IDENTIFIED SUB-POPULATIONS**

The international literature agrees on a group of risk factors associated with severe forms of Covid-19 infection. The prime risk factor is age. In addition, most patients with severe forms of Covid-19 infection have at least one comorbidity: hypertension and hypercholesterolemia are among the most frequent risk factors. The first results published by Santé Publique France (the French National Public Health agency) in April 2020 confirmed that 67% of cases with a severe form of Covid-19 had a comorbidity. Based on these three observations, the following strategic guidelines can be determined:

#### **GUIDELINE 1: EXIT**

It is best not to postpone the lockdown exit date as long as the occupancy rate of beds in intensive care units keeps declining. Every additional day of lockdown generates even greater indirect economic and health costs.

#### **GUIDELINE 2: PROTECT VULNERABLE POPULATIONS**

The priority is to protect populations at risk of developing a severe form of the illness. If a regulated lockdown based on age is deemed undesirable, a right to withdraw must be organised for employees at risk, those that suffer from comorbidities and are required to return to their place of work.

#### **GUIDELINE 3: SECTORAL APPROACH**

Limiting certain sectors from opening more than

proportionally reduces the economic benefits of a lockdown exit: the goal is to have all economic sectors return to general activity. Only those sectors that generate a high risk of virus propagation should be treated differently (entertainment, activities involving large groups). Public transportation and the reopening of schools need to be organised in ways that facilitate the return to work.

#### **GUIDELINE 4: THE ROLE OF THE WORKPLACE**

Every measure possible to prevent the spread of the virus without reducing work productivity must be implemented. Top of the list are complete reorganisation of movement patterns, the arrangement of work stations, places to eat and take breaks, measures of social distancing and hygiene within the company. This also includes regular medical screenings at work of people exposed to those having contracted the virus (via the public, patients, or clients).

Our message, explained in a note dated April 27, is therefore to encourage a rapid exit from lockdown while guaranteeing maximum protection for populations exposed to the risk of severe forms of Covid-19. This first memo will be followed in the days to come by a more extensive publication which, with the help of a projection model from the French Economic Observatory (OFCE), will specifically assess the economic impacts of different lockdown exit options.

# The school is mobilised to face Covid-19 crisis

By Elisabeth Barthélemy

Focusing on efficient delivery of service to students, AMSE has directed its efforts over the last few weeks - from the first day of the lockdown - towards ensuring continuity of courses, protecting its students and preparing their future. At the heart of our mobilisation lie high standards and caring.

## PEDAGOGICAL CONTINUITY

For several weeks now, the motto has been « stay home ». The University, the Faculty and the School are closed to students, who remain in lockdown. AMSE is set up to ensure pedagogical continuity with new technologies, practices and methods of teaching. "A huge amount of work has been done to set up and generalise operational distance learning for all courses; in record time, all were running" explains Tanguy van Ypersele, AMSE graduate school director.

Céline Poilly, Head of M1 Economics, confirms that "the faculties of the master 1 have joined forces to offer high-quality distance learning and to provide an academic monitoring system for students. I thank them for their strong commitment. They quickly took hold of the different tools and adapted the content of their courses to ensure that lessons are lively and meaningful, and to stimulate students' autonomy".

The school put in place its distance-learning programme using AMUConnect, an application made available by Aix-Marseille University that quickly became crucial in the current situation. It provides a means « to communicate orally and visually, share documents, share screens, write on a whiteboard, all while using relatively little bandwidth and allowing many users to join the virtual class. An app for smart phones and tablets is also available to bridge the potential digital divide" says Ewen Gallic, researcher/teacher at AMSE. This distance learning has been combined with enhanced and expanded use of the

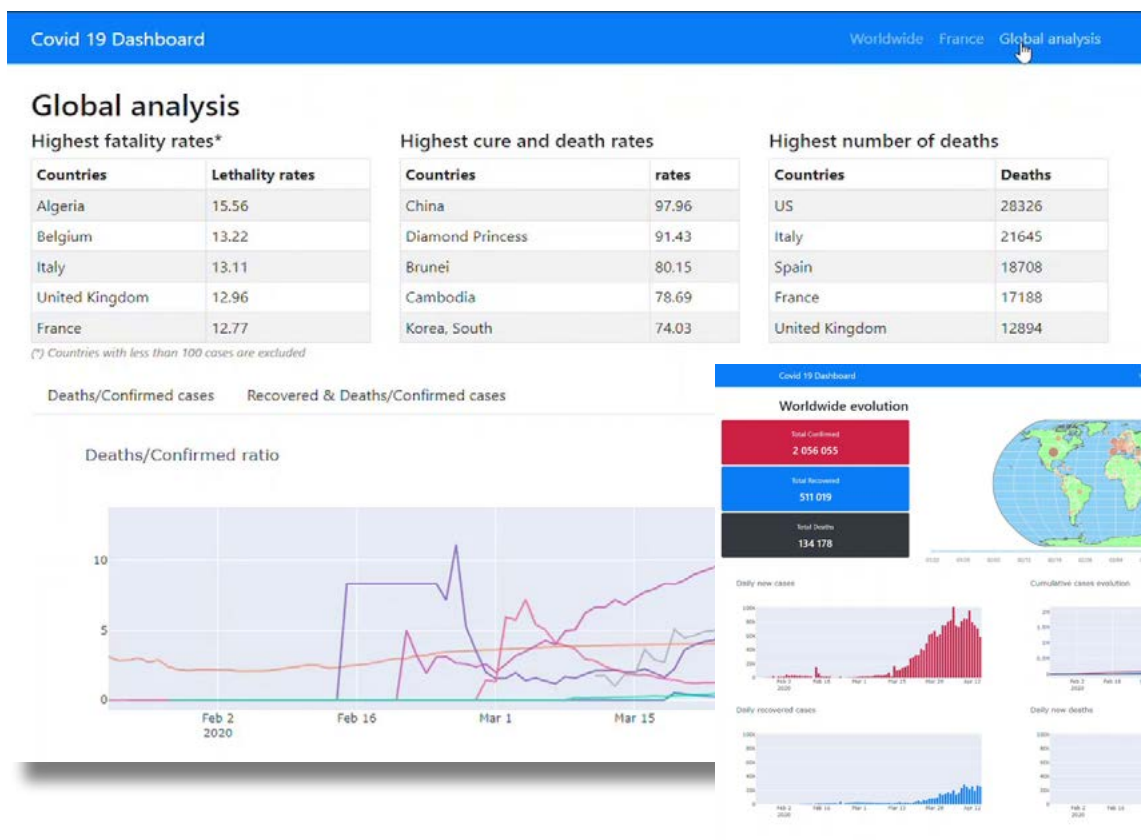
Ametice platform to post educational resources, to monitor and support students, offering various activities and online evaluations.

## GOODWILL

Goodwill and caring are the cornerstones of good working conditions in this lockdown period for students who are sometimes far from home and families. The teaching team and staff are very attentive and particularly responsive to their needs. «The students have taken up the challenge, remaining involved in their courses. They have shown they can adapt to these new teaching conditions. In the end, we believe that during this exceptional period, the students have really invested themselves in acquiring the same skills as under normal conditions» says Céline Poilly. Ewen Gallic adds «The students in Magistère Ingénieur Économiste were able to adapt immediately to the situation, responded quickly and complied with the exercises. They impressed me because, although the workload they were asked to handle was enormous, they met all our expectations.»

## INTERNSHIPS AND TELEWORKING

Some end-of-study internships started on the scheduled day, but by teleworking. An unconventional way to enter the business world, one that put our students to the test in terms of flexibility and working under crisis management conditions. «I consider myself very lucky to work in a company that wanted to maintain my internship» says Morgane Rahali, a student in M2 track Economic policy analysis, «my tutor at the Europlace Institute of Finance (Climate Economics Chair) is very attentive. During the literature review phase, I spend most of my days looking for information on existing articles and looking for areas of improvement. I exchange e-mails every day with my tutor and once a week we



have a videoconference”.

Jérémy Parenti, a student in the same track doing his internship at risingSUD, the economic development agency of PACA-Région Sud, explains «as soon as the lockdown was announced and despite this unprecedented situation, I was quickly contacted by my tutor who explained to me how we were going to work so that my internship could continue. I am therefore working remotely, like the whole risingSUD team, thanks to videoconferencing, screen sharing, instant messaging, file sharing and emails». For other students, internships will start as soon as sanitary conditions permit, conditional on government announcements and the evolution of the containment measures.

#### DATASCIENCE CHALLENGES

AMSE has got its students involved in challenges and kaggle competitions related to Covid-19. Thus, on the initiative of Sébastien Laurent, Head of M2 track Econometrics-Big Data-Statistics (EBDS), AMSE started a collaboration with “Business2ideas”, managed by Jean-Charles BRICONGNE (editor, Economist at the Banque de France). The www.b2ideas.eu platform aims to improve interactions between the professional sphere and the creative potential of higher education. The principle is simple: a challenge is posted with educational content and a reward that can be monetary, in-kind or symbolic.

Students, supervised by a teacher, compete anonymously to avoid discrimination and ensure that the best win!

“I offer students who were unable to start their internship in early April the opportunity to work in groups during this lockdown. The idea is to put into practice the skills they have acquired during their academic studies, as well as through their personal experience, and to work in groups on subjects of their choice linked to Covid-19” confirms Sébastien.

Done on a voluntary basis, this is an opportunity to come together during this period while acquiring new skills useful in the labour market. Several projects have been proposed, supervised by Sébastien Laurent, Pierre Michel, Ewen Gallic (researchers and teachers at AMSE) and Hervé Mignot (associate professor at AMSE, Partner in charge of Data Technologies & Data Science practice at Equancy). AMSE teams are involved in different challenges, 17 students in all.

Thomas Pical, an EBDS student and ex-president of AMSE Junior Entreprise, describes his work: “the main purpose of the project «Covid: JHU augmented dataset» is to provide a dashboard to monitor the evolution of Covid-19 around the world on a daily basis using graphs, updated automatically and available online. A detailed analysis for some countries such as France and the United States

will consider demographic data by administrative area (department or state). The set is developed on Python, which is a force for data processing. We are very happy with the first feedback we have had, and we would like to include an economic slant in our dashboard, with air traffic, for example”.

Apart from Thomas, other students working in this group have now returned home to Colombia, which can lead to late meetings because of time zone differences, but “the good news is that it allows continuous working; when I go to bed, they can continue the work and vice versa”.

Tatiana Maia-Ferreira has entered a kaggle competition that aims to use scientific papers to answer questions about Covid-19: «we have a total of 51,000 articles and must answer 8 main questions. Our goal is to create a «Question-Answer» search engine to answer any questions asked. We use what we have learned and done with Airbus Helicopters as part of our annual graduation project. This is helping us with the Topic Modelling part. We also want to apply a GAN model in X-ray images to predict future Covid patients. GAN, Generative Adversarial Network, is an artificial intelligence technique. Given a training set, this technique learns to generate new data with the same statistics as the training set. For example,

a GAN trained on images can generate new images, thereby increasing the number of images”.

Others students will take part in challenges on commercial real estate, posted on [www.b2ideas.eu](http://www.b2ideas.eu), on behalf of the ReFinE research and study network. Thus, Aimane CAF is working “to build a database of office prices and rents using a web scraping technique. This is an opportunity to acquire and implement a new technique. Remote cooperation allows us to forget about our daily lockdown routine for a while.»

Apart from data science, for which a hackathon based on web scraping has also been posted by the Lab’innovation Banque de France, other challenges on b2ideas can attract students in economics or marketing/communication. For example, a competition on economics and sustainable development posted by Banque de France. B2ideas is also open to new projects posted by AMSE staff, even outside the scope of the Covid crisis.

Our students are full of ideas and are involved in many projects. Exciting initiatives that give them a chance to get into action in the context of the health crisis.



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# Graduation projects with oral defence from home

By Elisabeth Barthélemy



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The 3rd year of the Magistère Ingénieur Economiste programme of study includes one graduation project called ESP, End-of-Studies Project. The purpose of an ESP is to enable students to carry out operational engineering data science work provided by our socio-economic partners and co-supervised by an academic from AMSE and the partner. A great way to check theory against real world applications, and a true transition to professional life. Djiby Balde, a student in Magistère Ingénieur Économiste and M2 Economics track Econometrics big data statistics, shares his experience.

## **DJIBY, COULD YOU PLEASE TELL US MORE ABOUT YOUR WORK ON ESP 2020?**

For almost 5 months, I and 4 other students, had worked with the digital transformation department of Airbus Helicopters on a project whose overall objective was to build a document search engine. Our part focused on “text summarisation”, aiming to generate a summary of documents belonging to the same class (or same topic). Using several Machine Learning techniques, we first performed topic modelling to classify the documents by topic, before finishing with extractive and abstractive summarisation.

## **WHAT LESSONS HAVE YOU LEARNED?**

This was a pure data scientist project. I was very pleased to work on it and gain valuable experience. It was a long-term project, carried out over nearly

six months in parallel with my studies. We were able to deepen our knowledge of Natural Language Processing/ Understanding (NLP/NLU) and to tackle new subjects. This allowed me to develop autonomy and to use knowledge learned in class. Working with others, I also learned how to take what each had to offer. In addition to the experience from my first internships completed in 2018 and 2019, the ESP gave me an understanding of how a company deals with problems using AI -Artificial Intelligence- techniques.

## **HOW DID THE DEFENCE GO?**

Despite the lockdown situation related to Covid-19, with my exams in progress, the first days of confinement had no real impact on me. However, all of us in the group were really concerned for ourselves, for families, team members and supervisors. Fortunately, AMSE and Airbus Helicopters set things up to ensure that the presentation went well and smoothly from home. We presented in such a way that people with no experience in data science could understand our work. I would like to take this opportunity to once again thank the entire AMSE team for investing their time and effort in this project, our academic supervisor Pierre MICHEL, and our professional supervisor Flavien RICHE (Data scientist at Airbus Helicopters – Amse alumnus), without forgetting the other students in the group.

# Nicolas Dromel

**Head of the Large Research Infrastructures department at the French Ministry of Higher Education, Research and Innovation.**



© Nicolas Dromel

## CAN YOU DESCRIBE YOUR PROFESSIONAL TRAJECTORY SINCE YOUR TIME AT AMSE?

While I was working on my doctorate under the direction of Patrick Pintus, I visited the European Central Bank, the University of California (UCLA), and the Center for Research in Economics and Statistics (CREST). After completing my PhD, I was recruited by the CNRS (French national center for scientific research) in 2008 as a research fellow. My first position was at the Centre d'Economie de la Sorbonne (CES), before joining the UMR Paris-Jourdan Sciences Economiques. I taught economics for several years in various schools (Paris School of Economics, Sciences Po, Ecole Polytechnique, and ENSAE) and universities (Cergy Pontoise, Paris 1 Panthéon-Sorbonne, NYU Abu Dhabi).

In 2017, I had the opportunity to join the Ministry of Higher Education, Research and Innovation. I first worked as a scientific advisor, then as a deputy head of department in the Directorate-General for Research and Innovation. In September 2019, I was appointed Head of the Large Research Infrastructures department and advisor to the Director-General.

## WHAT ARE YOUR CURRENT PROFESSIONAL COMMITMENTS?

In synergy with the Research and Innovation Strategy Directorate, and in collaboration with research organisms and universities, my department coordinates the French strategy for large national and European/international research facilities.

Large infrastructures such as observatories, supercomputers, gravitational-wave detectors,

particle accelerators, laser beams, oceanographic research vessels, data networks etc. provide essential conditions for future discoveries, and also reflect current scientific and technological advances.

On a daily basis, we work on financial, legal or diplomatic issues to help research infrastructures develop and perform best in supporting research. As many large infrastructures are shared between different countries, we often work at the European and international levels, in collaboration with our counterparts such as foreign ministries and the European Commission.

**HOW IS THE DEPARTMENT YOU HEAD RESPONDING TO THE CURRENT CRISIS?**

We are doing everything we can to ensure the continuity of our missions, and to deal with the problems caused by the crisis. While some facilities are seeing a drop in their utilisation rate, many infrastructures are under much more operational demand than usual, since they facilitate research on COVID-19 or on the consequences of the crisis. “Fast Track” procedures have been developed and implemented to simplify and accelerate access to top-notch equipment. Research infrastructures are contributing to finding solutions to the crisis by significantly supporting current research efforts.

This crisis demonstrates how much our society depends on research and innovation to find scientific and technological solutions for large-scale problems such as the current pandemic.

**HOW DO YOU FEEL ABOUT YOUR EXPERIENCE AT AMSE?**

My interest in economics, statistics and public policy analysis was developed there, when I was doing the Magistère Ingénieur Economiste program and then later during my PhD. AMSE’s research and training programs are renowned worldwide, making it one of Aix-Marseille University’s greatest strengths.

Economic theory provides powerful tools to think about incentives, trade-offs, strategic interactions, trade, markets, externalities, efficient and inefficient equilibria, public policies etc. Knowledge of statistics and econometrics helps to develop a solid and rigorous culture of data. These tools are becoming more and more essential in many sectors, in particular in central public administration, where I now work.

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**This crisis demonstrates how much our society depends on research and innovation to find scientific and technological solutions for large-scale problems such as the current pandemic.**

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Everybody knows that pestilences have a way of recurring in the world; yet somehow we find it hard to believe in ones that crash down on our heads from a blue sky. There have been as many plagues as wars in history; yet always plagues and wars take people equally by surprise.

...

All a man could win in the conflict between plague and life was knowledge and memories.

...

The whole town rushed outside to celebrate this crowded minute when the time of suffering had ended and the time of forgetting had not yet begun.

Albert Camus, *The Plague*, 1948

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