

# How we get COVID-19 under control

## men

### 1. Location and strategy

The pandemic COVID-19 virus is the greatest challenge for politics, society and the economy in Germany and Europe since the end of the Second World War. A look at the data from Asia and the reports from neighboring European countries show that **underestimating the magnitude of this challenge will lead to immense, irreversible damage.**

Most virologists, epidemiologists, doctors, economists and political scientists answer the question “what happens if nothing is done” with a worst-case scenario of over a million deaths in 2020 – for Germany alone. A team of experts from RKI, RWI, IW, SWP, University of Bonn/University of Nottingham Ningbo China, University of Lausanne and University of Kassel confirms these figures with an overall model developed for Germany.

Avoiding **this worst case scenario is therefore a top strategic priority** and, according to the calculations and recommendations of this team of experts, is not only absolutely necessary, but also still possible.

What should I do?

- 1) **Communication:** The worst case with all the consequences for the population in Germany is unambiguously, decisively and transparently.
- 2) **Unity:** Avoiding the worst case scenario should be defined as a central political and social goal. Politics and citizens must act as a unit.
- 3) **Comprehensibility:** Citizens must be able to understand that the following measures must and can only be implemented for their well-being with their help.
  - a. Social contacts must be reduced to a minimum for a certain period of time (social distancing) and an end to these measures **must be made dependent on the verifiable public impact** of these measures .
  - b. The impact of the measures can best be understood in real time **by expanding testing** for all citizens. Citizens with self-suspicion and the entire circle of contacts of citizens who test positive should be tested consistently. Large-scale testing conveys to citizens affected by exit restrictions **that the state is taking active crisis action.** We need to switch from the “We test to confirm the situation” method to the “We test to confirm the situation” method (South Korea demonstrates this impressively). A central recording of all tests that have been carried out and will be carried out in the future is essential. A **determination of the national testing capacity** (capacities for tests, medical personnel for implementation, evaluation) and its greatest possible **increase are overdue.** This allows monitoring of the spread and containment to be shared with all citizens. This makes it possible to intervene step by step in economic and social processes appropriate to the situation and **to increase the acceptance and usefulness of measures that restrict freedom.**

c. Even if the epidemic is successfully contained, **the capacity for the necessary medical care must be** increased. The situation will worsen because not only intensive medical care for the seriously ill with ventilators, but also oxygen supply on an outpatient and inpatient basis will also be necessary for those who are moderately ill (China proves this). d. The **federal government must launch a comprehensive mobilization campaign** . The current crisis caused by COVID-19 is a hard blow to trust in the institutions. This must be counteracted because the government must become a mobilizing factor. Motto: "Something very threatening is coming to us

Yes, but we have recognized the danger and are acting decisively and carefully. We need all forces in society to come together and work.

Then we will avert the danger." **In order to mobilize society's perseverance, hiding the word case is not an option.** If you want to avert danger, you have to know it.

## 2. Model calculation for strategy development

The key reason why the major threat posed by COVID-19 was not seen until recently is the difficulty of intuitively understanding **exponential growth**. Modeling should help to understand the dynamics of COVID-19. To do this, we need to know, among other things, the speed of spread and the mortality rate of the virus. Since the beginning of the outbreak in Wuhan (PRC), the mortality rate of the virus has been repeatedly downplayed, citing a possible "unreported figure". Asymptomatic and mild cases have hardly been tested and would therefore reduce the actual mortality rate if these unknown cases were taken into account. This and other arguments have long led to an underestimation of the danger posed by the virus. Only the dramatic situation in Italy has led to some rethinking, although unfortunately all indicators suggest that the peak of new infections there is still far from being reached. If unsuccessful containment measures are taken, the situation is expected to worsen by more than a factor of ten in terms of the number of cases and deaths, even in the regions that have already been hit hardest.

Estimating the **mortality rate** can best be done using data from South Korea. There, the various outbreaks were successfully brought under control with minimal exit restrictions, primarily through **efficient testing and isolation**. This would not have been possible if there had been a significant number of unreported cases that had not been found. There was never a call for self-isolation for mild symptoms, which wouldn't have been of much use in the flu season and with a virus that is contagious for a very long time. Through the systematic contact search, a large number of people who had no symptoms at all were tested. **Therefore, a very small number of unreported cases can be expected in South Korea.** The case fatality rates per age group can therefore be viewed as a good reference, which can easily be increased since deaths are still being reported regularly, although few new cases are being added. These numbers are also consistent with the numbers from China outside Hubei, where testing was much more intensive. **Distributing the cases across the different age groups and the age pyramid in South Korea gives an average case fatality rate of currently 1.1%. Adjusted for the age structure for Europe, the average case fatality rate is 1.8% with the best hospital care.**

The data from South Korea should therefore be viewed as minimum values for the final case fatality rate when an outbreak has subsided and all infected people have been cured or dead. During the exponential spread, one can assume a provisional (English: naive) case fatality rate of around 1%. In a very moderate scenario, the RKI is currently assuming a mortality rate of 0.56%.<sup>1</sup> Further modeling will work with a case fatality rate of 1.2%.

We assume that 5% of infected people will need to be **hospitalized** and of these, 30% will need intensive medical care and a further 20% will need at least ventilation using appropriate equipment. The RKI assumes a hospitalization rate of 4.5%, of which 25% require intensive care.<sup>2</sup> In addition, we assume that the length of stay in the intensive care unit is ten days if the patients are transferred as quickly as possible to avoid this extreme to be able to use scarce resources for the next patients. We set nine days for ventilation on a ventilator and eight days for patients who require a hospital stay without such support. **Mortality rates** vary depending on the condition

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<sup>1</sup> [https://www.rki.de/DE/Content/InfAZ/N/Neuhaftes\\_Coronavirus/Modellierung\\_Deutschland.html](https://www.rki.de/DE/Content/InfAZ/N/Neuhaftes_Coronavirus/Modellierung_Deutschland.html)

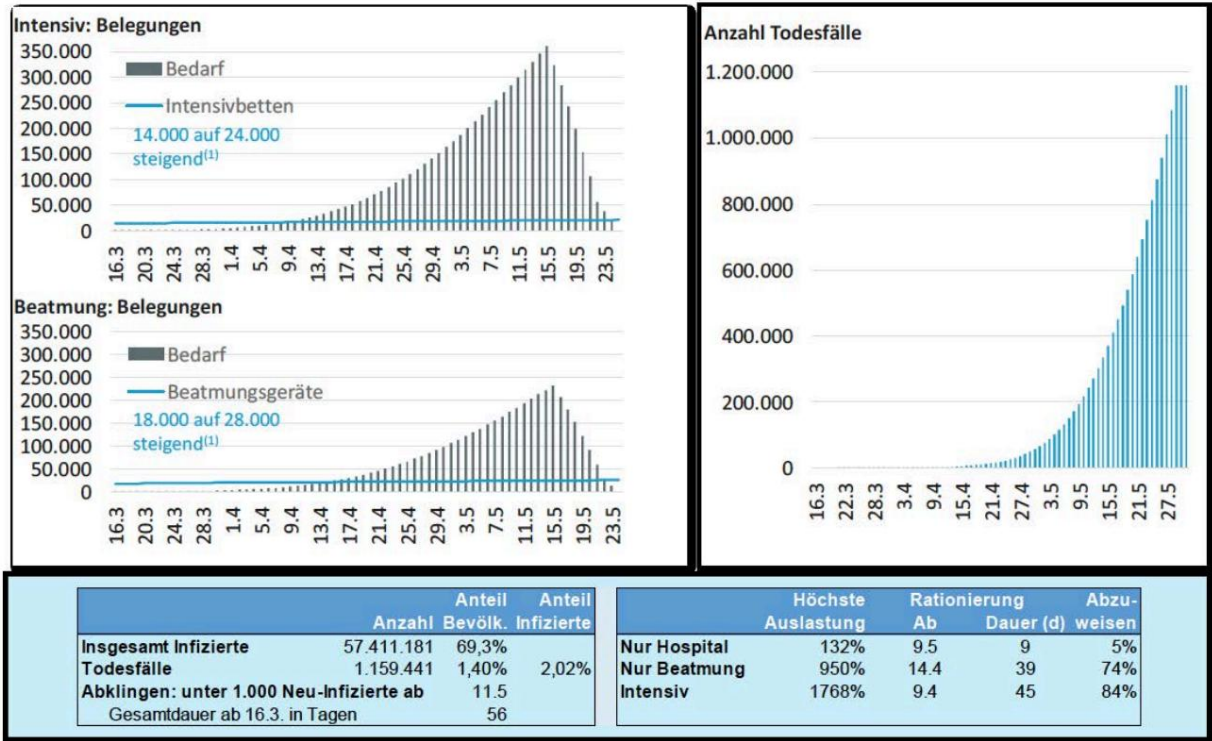
<sup>2</sup> *ibid*

type of action differentiated. Based on the total number of infected people, it is **1.2%** in the model with good hospital care and 2.0% in the case of rationing due to insufficient hospital care - in each case based on the population of all infected people.

As far as hospital care capacity is concerned, we assume that 14,000 intensive care beds are currently available for people infected with COVID-19. Another 14,000 are available for patients with other diseases. However, these may not be enough to provide adequate care for emergencies (e.g. heart attacks, strokes, etc.). We also assume that there are 18,000 ventilators for people infected with COVID-19 and almost 300,000 beds in hospitals and rehabilitation clinics. We also assume that it will be possible to gradually increase these numbers over the next few weeks - to 24,000 "free" intensive care beds, 28,000 ventilators and an additional 60,000 beds in hotels and exhibition halls.

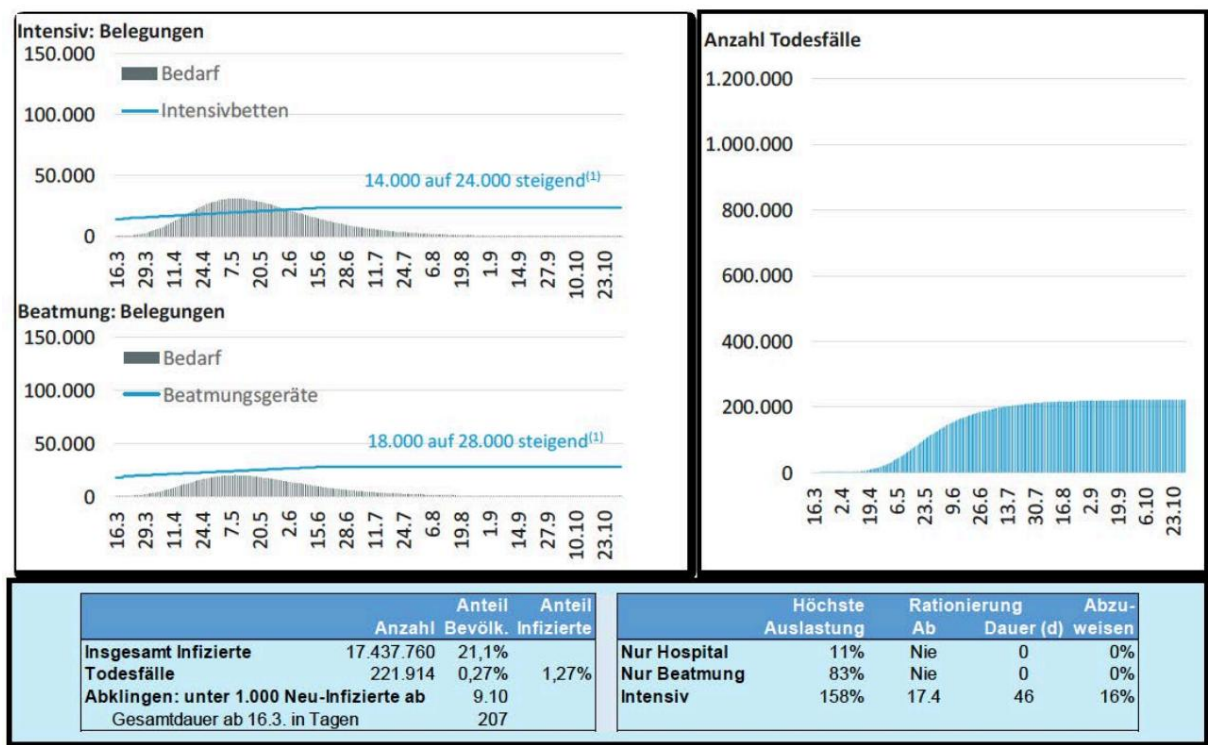
In terms of the **speed of spread**, the number of reported infected cases in Germany currently appears to be doubling approximately every three days. Initial measures to reduce physical contact, such as banning large events and minimizing travel, should lead to an extension of the time until the number of infected people doubles. In the worst case scenario, we assume that the doubling time increases from three to six days by April 14th - and to nine days by the end of April. Under these **worst-case** assumptions, the number of infected people will still increase rapidly and will relatively soon make up 70% of the population. A massive overload of the healthcare system is therefore to be expected (**Figure 1**). Over 80% of patients requiring intensive care would have to be turned away from hospitals due to a lack of capacity. This takes into account that additional intensive care beds and ventilators will be made available in the near future. The rationing phase could last two months. In this scenario, more than a million deaths would be expected.

Figure 1: "Worst case" scenario



In order to avoid this worst case and achieve a more positive **expansion case**, the measures to reduce physical contact must be much more far-reaching. If it is possible to extend the time until the doubling to six days by the beginning of April and continue at this pace to nine days until mid-April, it can be possible to place significantly less strain on the capacities of the healthcare system. Nevertheless, we expect **temporary over-utilization of intensive care capacities**. However, in total “only” around 15% of patients requiring intensive care would have to be rejected (**Figure 2**). However, there are always enough ventilators available. This statement applies under the premise that additional equipment and intensive care beds will be made available in the next few days and weeks. **However, due to this time extension, the state of emergency will last significantly longer than in the worst case mentioned above**, seven months in the model. Only around 20% of the population would then be infected with the virus. The number of deaths would be around 220,000. However, the negative macroeconomic effects of the **expansion case** would be enormous (see below).

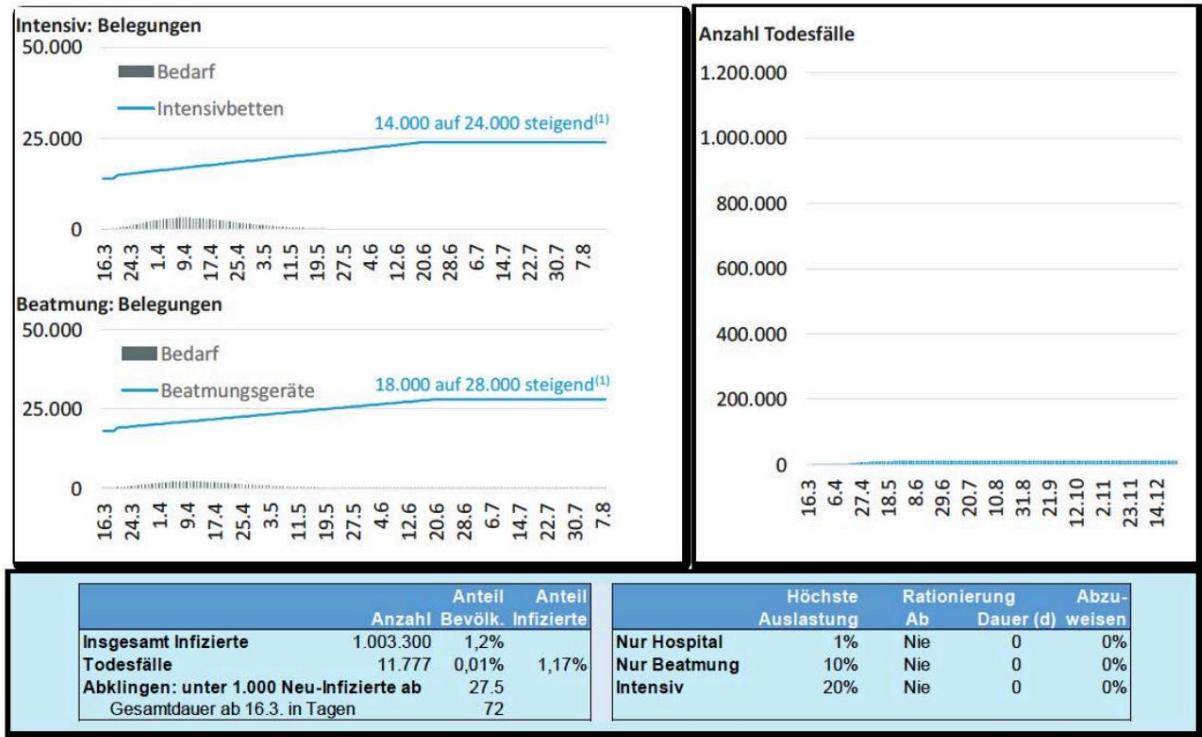
Figure 2: “Stretch” scenario



Finally, we consider the “Hammer and Dance” scenario described below and most discussed internationally among experts (Figure 3). If the spread of the virus could be effectively controlled through **extensive testing and isolation**, the effects would be much milder. In the present model, around **a million people** would become infected, but only around **12,000 would die**. The mortality would therefore be 1.2%. In total, this situation could last around two months. However, since only a very small part of the population would be immunized at least against the currently prevailing virus, continued high vigilance would then have to be maintained.

persistence.

Figure 3: “Hammer and Dance” scenario



### 3. Economic and social consequences

The German economy is a high-performance machine that, year after year, provides a high level of material prosperity and public goods such as comprehensive health care and public safety that are accessible to all citizens. Their performance is supported by a high degree of division of labor within and outside the country. The prerequisite for this is that the majority of all existing companies and employees are operational and the integrity of the entire system is not called into question.

This is exactly what makes the national economy as vulnerable as a high-performance engine, because only the simultaneous functioning of all its components can ensure the functionality of the entire system. In normal operation, moderate economic fluctuations can be effectively smoothed out over time, especially through social security systems. As long as the machine is running more or less at full speed, small system malfunctions are not a serious problem. Each working day, more or less, translates into a slightly larger or smaller GDP in the final calculation. But this "normal world" is now suspended, we are in unknown territory.

If the measures proposed here to contain and control the Covid-19 epidemic do not work, the entire system could be called into question in the sense of a "meltdown".

There is a risk that this will change the community into a completely different basic state, even leading to anarchy. Accordingly, it would be naive to assume that a decline in GDP by a double-digit percentage, say beyond 20%, would mean a linear continuation of the losses from missing a few days of work and would otherwise not call the entire system into question. For this reason, the strategy of **containment** - which dominates all other considerations - must be combined with precautions to keep the economic consequences as low as possible.

The absolute prerequisite for this is that the strategy to contain and control Covid-19 is actually consistently enforced. If one were to proceed too timidly, there would be a risk of health care capacities being overloaded, as would be the case if a strategy was initially successful but then relaxed too early. The only viable option is therefore likely to be the establishment of a two-stage strategy: It requires (i) the **strict suppression of new infections** implemented as quickly as possible until the reproduction rate is close to 1, and (ii) a comprehensive and consistent system of **individual testing and isolating the identified cases** .

This would allow the rest of the economy to quickly return to something approaching normal operations and open up the prospect that this crisis will not be bigger than the economic and financial crisis of 2009. It would of course be best if this second stage could be initiated immediately and thus avoid economic losses. But that is not possible, the **testing capacities** must first be **built up** . As long as this has not happened, the only option left is "The Hammer" of strong social distancing, regardless of the exact infection status of everyone affected.

The time purchased with this first stage must be rigorously linked to the development of the testing strategy for the second stage. From an economic perspective, it is important to provide acute support services to households and companies during this time and to create the basis for ensuring that the conditions for a restart of economic activities are in place when entering the second stage.

The provision of extensive financial resources for the financial sector can only be part of the economic policy decisions. Because various factors make the current



Crisis (even with comparable contraction rates) more serious than the economic crisis of 2009. The crisis at that time originated in the financial sector and particularly affected industry. The COVID-19 crisis is having a broader impact on economic life, is also affecting service providers and will therefore have a greater impact on the labor market. At the same time, the stabilization measures in 2009 were able to concentrate on the financial sector as a key systemically important element. Such a "quarantine" of a sector is impossible with COVID-19. **Even at comparable contraction rates, the COVID-19 crisis will be broader, deeper and longer than the financial crisis.**

**Scenarios of economic developments** This conclusion can be illustrated using rough rough calculations that ignore the diverse adjustment processes and complications. The estimates presented here are based on national accounts-based bottom-up estimates of the significance of the crisis for the different economic sectors. No macroeconomic modeling is deliberately aimed at here, as its functionality is doubtful in view of the significant and, above all, dynamic changes in numerous variables for the current situation. The values determined for the development of GDP and value creation in the industry are based on numerous assumptions and assumptions. Each one is vulnerable on its own, but they serve to establish an initial overall picture in various scenarios. The settings are rather conservative, so they represent the upper middle of possible developments and are not worst-case scenarios.

What is crucial is that the scenarios do not differ or only differ indirectly based on the spread of the virus infection in Germany, but rather based on the politically enforced and medically necessary reactions to it. The duration of the interruption to the normal division of labor and market processes (here nationally) is the key influencing factor

**Scenario 1: "Rapid control"** The first scenario assumes that the spread of the epidemic can be slowed down after an initial period of exit restrictions and that the number of cases will fall significantly within six weeks. This corresponds to a period until the end of the Easter holidays and is therefore largely similar to the current status quo, supplemented if necessary by the enforcement of bans on gatherings. A further restriction through exit restrictions is not assumed here.

In view of the economic consequences but also the social inequality consequences of prolonged homeschooling, it seems urgent to return kindergartens and schools to normal operations after the Easter holidays. As the infection progresses controlled through intensive testing, tracking and isolation, if necessary banning large events or selective interventions. Social and economic life is largely returning to normal. This scenario corresponds to the positive experiences from East Asia.

After the phase of exit restrictions of 1.5 months, essential industrial sectors are expected to face another month of massive disruption due to closed borders and the associated interrupted supply chains. This assumes that the pandemic has a comparable time profile, at least in Europe; Developments in the USA are particularly uncertain, but the dependencies on inputs are lower there.

The phases of the slump are followed by two months of reduced disruption, during which economic activity gradually returns to normality. Catch-up effects are taken into account for a further three months, which in each of these months compensate for a third of the economic performance lost in a crisis month.

This scenario results in a 4 percent drop in GDP compared to the reference scenario and can be viewed as the economic best case. For the industry this means a minus of 9 percent cent. For comparison: In the global economic crisis of 2009, GDP fell by 6 percent and industrial value added fell by 19 percent. The state budget would face additional expenditure and reduced revenue in the order of 80 billion euros. The developments assumed here would lead to a somewhat weaker decline in GDP than in 2009, but the service sector would be more severely affected. However, the downward risks contained therein make it plausible to assume a downward dynamic that is broadly comparable to the global economic crisis.

**Scenario 2: "Return of the crisis"** The second

scenario assumes that exit restrictions of two months will be able to massively contain the spread of the infection. Afterwards, a largely normal economic life is possible. However, in the second half of the year the epidemic will return in no less dramatic dimensions. Such a development can also be expected for the following year.

Economic activity would be significantly reduced in the months of lockdown, but would gradually return to normal in the following two months. Due to the expected renewed outbreak of the disease, there will be no catch-up effects. In the fall there will also be two months with exit restrictions and two months of recovery.

This scenario means a decline of 11 percent for the economy as a whole and a decline of 19 percent for industry. In industry this is similar to the crisis of 2009, but in the service sector the decline is much more pronounced. However, this scenario is much more critical than the crisis of 2009 because a double wave of infections would also be expected next year. The crisis would therefore last twice as long, which would not be comparable to 2009 and the subsequent upswing year of 2010.

**Scenario 3: "long suffering"** The third

scenario assumes that the epidemic will not be contained quickly. Exit restrictions of four months are necessary, i.e. until the summer holidays in mid-July.

Afterwards, no significant restrictions on economic life will be imposed. Accordingly, significantly subdued economic activity is assumed for four months and a return to normality in another two months. There will be catch-up effects in three more months, but only to a lesser extent due to the experience of the crisis and the high level of uncertainty.

A decline of 9 percent is expected for the economy as a whole and 15 percent for industry. This is probably an optimistic assumption. Possible self-reinforcing effects that occur over the long period of the crisis are not taken into account here. If a systematic downward spiral occurs, not just a collapse to a lower level that is stable for four months, deeper cuts are to be feared; this also applies to a further extension.

tion.

**Scenario 4: "Abyss"** The fourth

scenario assumes an uncontrolled and uncontrollable development. It is not possible to contain the virus epidemic. Exit restrictions will be in place for the rest of the year

committed. This means a permanent reduction in economic activity to a lower level. A further reduction in economic output is assumed after four months of exit restrictions.

In this situation, GDP would collapse by 32 percent and industry by 47 percent. If second-round effects continue to intensify and negative expectations become established, an accelerated downward dynamic cannot be ruled out. This scenario amounts to an economic collapse, the social and political consequences of which are difficult to imagine.

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#### Assessment

The estimates show, despite all the uncertainties, that scenario 1 ("Quick Control") must be worked towards under all circumstances. Scenario 4 ("Abyss") would be an unimaginable economic catastrophe that would lead to socially unimaginable consequences.

The treatment of the sick would probably be questioned rather than a permanent shutdown of the country being accepted. Scenario 3 ("long suffering") threatens to become such if the exit restrictions are extended further and transform into scenario 4 ("abyss"). On this path it is never clear whether it leads to the abyss - this will release negative dynamics that accelerate downward trends. Scenario 2 ("Return of the crisis") represents a sharp contraction with no return to old levels next year.

Scenario 1 ("**Quick Control**") offers the chance to emerge from the crisis with an economic balance similar to the global economic crisis of 2009. This is bad enough, but it would be a glimmer of hope. What is crucial is that, on the one hand, we succeed in stopping the exponential spread of the virus and reducing the infection rate ( $R_0$ ) to below 1 before Easter. On the other hand, it must be possible to prevent a return to uncontrolled waves of infection through interventions that do not destroy economic and social life in Germany. To do this, the infection rate must be kept at a maximum of around 1. Comprehensive testing, the identification of contact persons via electronic movement profiles, the isolation of sick people and suspected cases, and, if necessary, the prohibition of major events or access restrictions for retirement facilities can contribute to this. However, permanent or even longer exit restrictions must be avoided.

#### Necessary economic policy measures Phase I of the COVID-19 fight

was initiated at the latest with the partial exit restrictions from March 16, 2020 with school closures, mobility restrictions, business closures, office and production closures, etc. and tightened by bans on gatherings, etc.

In order to reduce the rate of new cases after the end of the exit restrictions (Phase II) and then keep it at a stable level so that another uncontrolled outbreak can be prevented, extensive health policy measures are necessary (see Section 4).

These measures and the necessary structures must be implemented and set up at short notice in order to be able to credibly enter Phase II after the Easter holidays. **Only with a foreseeable end to the exit restrictions can a return to the previous economic and social life be guaranteed.**

In order to limit the economic damage beyond this, the following economic policies are:

Measures required, some of which have already been decided:

- The expansion of short-time work to limit unemployment, as was the case in the 2009/10 financial crisis, has already been decided. This also reduces the companies' solvency risks.

- ~~Liquidity support to ensure the short-term viability of the affected companies via development banks (credit aid) and tax deferrals as already decided.~~
- ~~Direct company transfers, limited in time, for companies that are stuck in a supply shock and a demand shock at the same time and that, beyond the liquidity problems, have been hit economically by the COVID-19 crisis.~~
- ~~Participation in companies through a sovereign wealth fund. The economic stabilization fund now being planned should also provide for capital participation in large companies. State participation must be provided with a clear perspective of exit after the crisis. Responsibility for small businesses lies at the federal state level, simply because of the proximity and administrative advantages.~~
- ~~Tax relief to limit massive losses caused by the economic crisis. There are opportunities here for a positive impulse from the crisis, which can also be seen as the starting signal for a renewed upswing.~~
- ~~Stabilization of municipal finances, which are coming under massive pressure due to additional spending as a result of the public shutdown and the expected collapse in trade tax. The federal states must fulfill their responsibility here.~~
- ~~Economic measures after the end of the crisis when demand-side stimulus is necessary.~~

A particular economic policy challenge is likely to be that the exit from crisis mode with a widespread standstill of public life places different demands on the different sectors.

- If the restrictions on public life can be gradually lifted after Easter, the consumption areas should be quickly reactivated. The  
People want and can consume. State aid would remain in most cases  
cases limited to liquidity bridging plus one-off transfers.
- Business activity could then also start again in many, especially company-related service areas, e.g. auditors, inspections, car service.  
For deferrable services such as construction work, the expectation of sustainable stabilization is crucial.
- During the crisis phase, internationally active companies are limited both by a lack of supplies, especially from abroad, and by the unavailability of workers. The latter will ease when the schools and daycare centers reopen; a contribution to the former can only be made through the availability of transport capacities etc. at the national level. The asymmetry with regard to the time profiles of the economic crisis in other economies remains a persistent burden for an internationally interconnected economy like Germany's. Here companies are required to be flexible in adapting. However, this would also mean that internationally active companies would be able to rely on economic policy support for longer (for example through equity investments).

Especially against this background, the economic policy response to the current crisis cannot remain purely national. Likewise, it is not enough to leave responsibility for the European dimension of the economic policy response solely to the European Central Bank (ECB). Rather, what is needed is a coordinated fiscal strategy at the European level. These efforts

must include financial support for other EU countries that would otherwise be financially overburdened by containing the crisis (especially Italy). In addition to the ECB's PEPP, other instruments must therefore be used, such as existing or newly established credit lines from the European Stability Mechanism ESM or COVID-19 community bonds. The discussion about the

specific instruments should not obscure the need for a coordinated fiscal strategy.

## 4. Conclusions for action and open communication

### 4 a. Make the worst case clear!

We need to move away from communication that is centered on case fatality rates. With a case fatality rate that sounds insignificant in percentage terms, which primarily affects the elderly, many then unconsciously and unacknowledgedly think to themselves: "Well, that's how we get rid of the old people who are dragging our economy down; there are already too many of us on earth anyway ", and with a bit of luck I'll inherit a little earlier." These mechanisms have certainly contributed to the downplaying of the epidemic in the past.

In order to achieve the desired shock effect, the concrete effects of an infection on human society must be made clear:

- 1) Many seriously ill people are taken to the hospital by their relatives, but are turned away and die in agony at home, struggling to breathe. Choking or not getting enough air is a primal fear for every person. The same applies to the situation in which you cannot do anything to help relatives whose lives are in danger. The images from Italy are disturbing.
- 2) "Children will hardly suffer from the epidemic": False. Children will easily get attached to their parents, even with exit restrictions, for example with the neighborhood children. If they then infect their parents and one of them dies in agony at home and they feel like they are to blame because, for example, they forgot to wash their hands after playing, it is the most terrible thing a child will ever experience can.
- 3) Consequential damage: Even if we only have reports of individual cases so far, they are significant but an alarming picture. Even people who appear to have healed after a mild course can relapse. Apparently, people experience relapses at any time, which then suddenly end in death due to heart attack or lung failure because the virus has found its way unnoticed into the lungs or heart. These may be isolated cases, but they will constantly hover like the sword of Damocles over those who were once infected. A much more common consequence is fatigue and reduced lung capacity that lasts for months and probably years, as has often been reported by SARS survivors and is now the case with COVID-19, although of course the duration cannot yet be estimated.

In addition, arguments should also be made historically, according to the mathematical formula:

$$2019 = 1919 + 1929$$

One only needs to look at the figures presented above regarding the assumed mortality rate (more than 1% with optimal health care, i.e. well over 3% due to overload during infection), compared to 2% for the Spanish flu, and regarding the expected economic crisis if containment fails, then this formula will make sense to everyone.

4 b. Make "worst case avoidance" a strategic goal for Germany and the EU It should be clear to everyone that individual countries in the EU can hardly be successful on their own in the fight against the virus. Economic and human exchange is far too close. Political shockwaves know no boundaries. A meltdown in a single EU member state would have widespread effects. That is why an active role for the EU is more important than ever. Germany can take on a pioneering role here not only politically, but also organizationally and industrially, both in containing the epidemic (production/procurement of test kits and PCR machines, development of mobile testing stations) and in measures to mobilize society to cushion it the social and political consequences.

#### 4c. Communicate action planning to the population 4 c 1 High testing capacity

By far the most important

measure against a virus like SARS-CoV-2 is testing and isolating the infected people. Both people with self-suspect and the entire circle of contacts of people who tested positive should be tested. If there is insufficient testing capacity, testing can be limited to patients with severe pneumonia and post-mortem for all suspected cases in order to at least be able to accurately determine the number of deaths. However, any failure to test will certainly lead to a rapid, exponential spread of the virus.

The desired testing capacity (here assuming simultaneous strict exit restrictions over several weeks) can be determined using rules of thumb (provisional findings, need to be refined). In the exponential phase, a provisional (naive) case fatality rate (deaths divided by confirmed cases) of 1% can be assumed in European countries if a majority of all cases are found through testing. If the case fatality rate is below this value, it must be assumed that the number of deaths is not being counted correctly. If the case fatality rate is above that, to find dead people, under very good conditions you need 20\* more tests than the number of cases you want to find. Calculation example \* 100, that's how many cases we would have to find. To them too Germany at the end of March: we estimate the actual number of deaths is 500-1000 (strongly underreported). This means that 50,000 to 100,000 cases would have to be found. If you want to find a large proportion of them, you would need, for example, 100,000 to 200,000 tests per day over the course of 10 days, or half of them over 20 days (which makes the period with exit restrictions longer and the risk of failure greater).

As soon as the estimated necessary testing capacity is reached, the number of new cases found per day will initially skyrocket. If the estimate was correct, it comes down again after the time period (e.g. after 10 days). If not, the necessary testing capacity was underestimated and must be increased urgently to achieve the desired result.

Testing requires innovative solutions to make both the evaluation in the laboratory and the collection of throat swabs less time-consuming. Protecting those in contact with potentially infected people is extremely important. This was achieved in South Korea with drive-in and telephone booth testing stations, where the throat swabs are carried out by the people being tested themselves, without direct contact with the testing staff. In order to send a positive signal to the population and to solve the problem of access to the test stations, especially for people without their own car, mobile test stations in the form of delivery vans could also be developed. Overpressure inside the car (through air filters or temporarily through compressed air bottles) prevents viruses from penetrating. The throat swabs are taken in a laboratory chapel

bagged, sealed, disinfected with alcohol and stored, with all actions carried out using rubber gloves. In this way, an approach to the population can also be signaled and a presence in all neighborhoods can be marked.

The massive testing must be supported by an efficient contact search for people who have tested positive, some of which can be done manually according to the procedure that the RKI already suggests ("Who have you been in contact with since five days before the symptoms began?"). In the longer term, the use of **big data** and **location tracking** is needed to make testing faster and more efficient inevitable.

All people who test positive must be isolated, whether at home or in a quarantine facility; this needs to be clarified in more detail. Even individual quarantine at home (without roommates) can easily lead to further infections in the same apartment block if handled improperly.

Once these measures have been implemented, they can immediately contain the small outbreaks that are likely to flare up again and again, relatively inexpensively, for several years.

#### 4 c 2 Reduce social contacts

To support massive testing and especially when there are relatively large numbers of cases (more than a few dozen per day) or when testing capacity cannot be ramped up quickly enough, "social distancing" measures are needed: working from home, banning mass events in sports, etc Culture, closure of schools and universities, closure of even small social events such as sports clubs, closure of restaurants and bars, closure of all non-essential shops, up to the closure of all non-essential businesses.

Everyone can assess the effects of each measure themselves: it's about reducing the chances of infection. If there are football games with 50,000 participants every now and then in a big city, but millions meet each other on public transport every day, the closure of football games is little more than symbolic, especially with a virus that barely spreads beyond one Distance of 2 meters is contagious.

In the current phase of the epidemic, we can (hopefully) assume that testing capacity can be ramped up very quickly. Based on this, it is better to have a very strict but short period of exit restrictions, just until the testing and isolation measures take effect. A longer period of exit restrictions is neither economically nor socially sustainable.

A probably plausible but optimistic schedule for Germany in the next few weeks could look like this: consisting of a combination of testing and isolation with an accompanying strict but short exit restriction. The reproduction factor at generation=4 indicates how quickly the virus spreads: R=2.2: unchecked exponential spread (\*2.2. every four days); R=1: linear propagation. R<1: Decrease in epidemic.

First cautious estimate of the course of the containment strategy against Covid-19

Time frame	Reproduction factor measures	R=2.2
Before March 16th		Only very loose preventive measures School
From March 16th	R=1.6	closures, social distancing Comprehensive and
From March 23rd	R=1.2	stricter exit restrictions Test capacity massively increased to 50,000
From April 6th	R=0.8	per day Test capacity to 100,000 per day
From April 13th	R=0.5	

From April 20th	R=0.8	Gradual easing of exit restrictions; Resumption of school operations as soon as this is possible without the epidemic flaring up again. Testing capacity of 200,000 per day, efficient and well-
From April 27th	R=0.5	rehearsed contact search by hand and through big data (location tracking, etc.)

\*The R information in this table is estimated based on observational data from all countries for which reliable data is available and from specialist publications. When modeling the course of the epidemic, these values are input parameters. Simulations cannot determine the value R and its change during the epidemic more precisely; they always remain initial assumptions.

Regarding the number of new cases found every day, we expect that it will only start to fall from April 13th or perhaps even from April 20th (apparent inflection point), as we have a large backlog of cases that have not yet been found, which will only slowly decrease as testing capacity ramps up needs to be processed. We expect the actual inflection point of the infections to be on April 6th.

**4 c 3 Increase beds and oxygen capacity** Even if the epidemic is successfully contained, the existing capacity for the necessary hospital care can easily be overwhelmed. Efforts should not focus on the abstract concept of "intensive care unit beds" but on the specific infrastructure required, in particular the oxygen supply and the number of ventilators as well as the corresponding staffing levels. The peak of the corresponding demand will not be reached until approximately three weeks after the peak of new infections has been reached.

**4 c 4 Distanced together: Social responsibility for Covid-19 containment through Germany-wide and transparent education and mobilization campaign** The current crisis caused by COVID-19 has the potential to permanently shake trust in the democratic institutions in Germany. This can and must be counteracted.

This works best when the state – federal, state and local – acts proactively and in a coordinated manner and thus becomes active and visible not as a "paralyzing" factor but as a mobilizing factor.

The most important message from the communication from state actors: The virus is a risk for everyone. It will change our lives in the short, medium and long term. We have recognized the risk, are working together at all levels, are guided by scientific and practical evidence and are acting decisively but not in panic. Only with all forces in society coming together and working together can we slow down the number of new infections and ultimately contain the virus. The state needs the help of all citizens; only then can we contain the virus as quickly as possible and guarantee democratic coexistence (both political, social and economic).

This requires comprehensive and coordinated information and clarification as well as concrete instructions from all state authorities. We must assume that a significant part of the population who has informed themselves through media reports and social media suspects that the number of cases and the number of deaths are currently being greatly underestimated. The bot

The fact that testing capacity is now being massively increased will probably be met with relief. The announcement that this could lead to a sharp increase in the number of cases and deaths in the short term is probably already expected. It is important to make it clear right from the start and to communicate aggressively **that successful measures will only have a considerable delay in affecting the number of new infections found and the number of deaths.**



In addition to comprehensive information and clarification from state authorities, the state is particularly dependent on civil society solidarity. This **“togetherness” must be thought about and communicated** with. This requires a common narrative (#we stay at home, or “distanced together” - “physical distance – social solidarity”) and, in the best case, many faces (celebrities, politicians, scientists) who deal with the Identify campaign.

The mobilization campaign for (even) stronger civil society solidarity is aimed at two different communities: the **physical neighborhood community** and the **online community**. The neighboring community is mobilized to help care for those in home quarantine and to shield risk groups. Here it is important to include the large number of civil society institutions, for example church associations, as well as political foundations (local offices) and the association system (e.g. sports clubs, shooting clubs, neighborhood assistance, etc.). Direct contact with this community can be established through mobile testing stations, so that the community is in constant contact with the local health authorities responsible for containing the epidemic, practically on their doorstep. At the same time, support services can be created for them (apps for communication, coordination). These helpers should be thanked politically now and called upon to step up their activities and at the same time be praised for their own initiative. What is important, however, is networking and coordination so that assistance can be coordinated efficiently.

The online community also has a very important role. Without mobilization and solidarity, it increases the spread of misinformation and can lead to radicalization. However, part of the community can safely be involved in cushioning the social effects of the exit restrictions, the protection of risk groups and the quarantine. There are already important offers in this regard, these should and must be expanded (medical care, psychological offers or simply shared leisure activities online).

Here too, civil society institutions can help (see above) as can celebrities (e.g. We Kick Corona initiative by Joshua Kimmich and Leon Goretzka, #we stay at home). It would also be conceivable to call for a **joint “fact check”** of information and further **hackathons** to overcome the challenges using digital approaches. Here too, it is important to promote a feeling of “collectively distant”.

Older people can also find their way around smartphones and social media relatively easily, but often need technical help and, above all, personal advice on how to navigate the various platforms successfully. In order to counteract a generational conflict (millennials infecting older people), children, teenagers and young adults could and should be actively involved in the education and information campaign.

Only with social cohesion and distanced from one another can this crisis not only be overcome with not too much damage, but also point the way forward for a new relationship between society and the state.