UNIVERSITÄT PADERBORN
Die Universität der Informationsgesellschaft

Center For International Economics

Working Paper Series

Working Paper No. 2021-09

COVID-19 and Triage - A Public Health Economic Analysis of a Scarcity Problem

Bernard M. Gilroy, Marie Wegener and Christian Peitz

November 2021

CIE Center For International Economics

COVID-19 and Triage - A Public Health Economic Analysis of a Scarcity Problem

Bernard M. Gilroy, Marie Wegener and Christian Peitz

JEL: I11, E10, J01

Abstract

With the outbreak of the corona pandemic in Wuhan in 2019 and in early 2020 in Europe, the political and media discourse has been dominated by many health economic issues and discussions, ranging from systemic relevance to multiple shortages of vaccines, nurses, testing capacity and medical protective equipment. In the event of a scarcity of resources, the German Ethics Council[1] recommended preparing for a possible "*triage scenario*" at the beginning of the pandemic.[2] The aim of the article is to find out how advanced the current burden on intensive care units in Germany is due to the Corona pandemic and how close Germany is to a possible triage scenario. Therefore, the situation of German hospitals over a period of 30 years prior to the Corona pandemic is examined, and a comparison with OECD nations is made. This is followed by an analysis of the situation during Corona (with a focus on intensive care bed utilisation). [3] Finally, the development and application of the triage scenario is examined, followed up by a brief discussion to what extent a triage system is compatible with the welfare state.

Existence of a Possible Scarcity Problem in the German Hospital Sector?

For a general overview: Health care spending in Germany in 2019 accounted for € 410,849,000, which equates to a share of health care spending in gross domestic product of 11.9 %.[4] Hospital spending in total were € 100,763,000, making hospital

[1] The council consists of 26 members and, according to its legal mandate, processes ethical social, scientific, medical and legal issues and their consequences for society.
[2] Fedorova (2020).
[3] It is not intended to assess the policies that have been taken regarding the pandemic, or the classification of systemically relevant professions. This study cannot fully cope with possible shortage problems in all existing care areas and therefore provides an overview of the most basic resources of the hospital sector in Germany.
[4] Federal Statistical Office (2020).

spending with a share of 24.5 % the third highest share of health care spending.[5] As figure 1 shows, total health care expenditures have increased as well as expenditures for hospitals.

What is very striking, however, is the successive fall in the share of hospitals to the total expenditures (red line in figure 1) over the years.

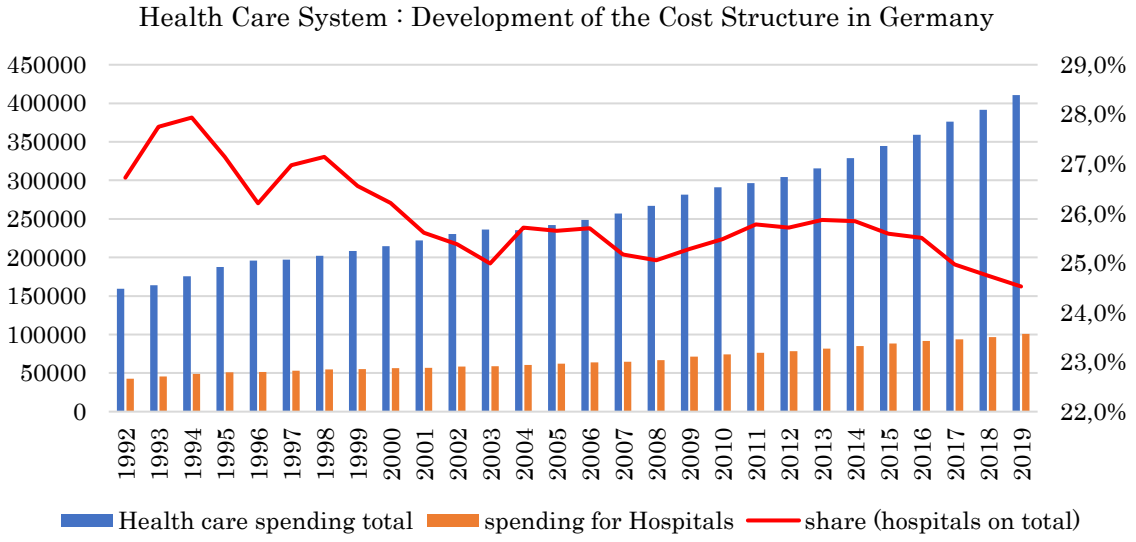

Figure 1: The development of health care costs (1991-2019).[6]

We want to go into a little bit more detail about the hospital situation: figure 2 shows the development of hospitals from 1991 to 2019 in Germany, as well as the percentage change compared to the previous year. There has also been a steady decline in the number of hospitals on record the last 30 years. There were 2,411 in Germany in 1991. Whereas only 1,914 hospitals were recorded in 2019, accordingly nearly 500 hospitals were dismantled over the years.[7] This means the number of hospitals decreased by more than 20 %.[8] In addition, the proportion of privately-owned hospitals increased. In 1991, 14.8 % were privately-owned, where in 2019 nearly 38 % hospitals (from the total) belonged to a privately-owned consortium.[9] The number of public hospitals decreased from 46 % to 28.5 %. The proportion of

[5] The highest being outpatient facilities (204,256,000) and inpatient/partial hospital facilities (149,406,000).
[6] Own illustration based on data from the Federal Statistical Office (2021).
[7] It should be noted that the statistics do not distinguish between a closure and a possible merge of hospitals.
[8] Federal Statistical Office (2021).
[9] Federal Statistical Office (2021).

non-profit hospitals decreased by 5.3 %.[10] Nevertheless, there were only about a fifth in 2019 (19.3 %) of the beds set up in private, one third in non-profit and thereby non-profit capacity accounting for about every second bed in public hospitals.[11]

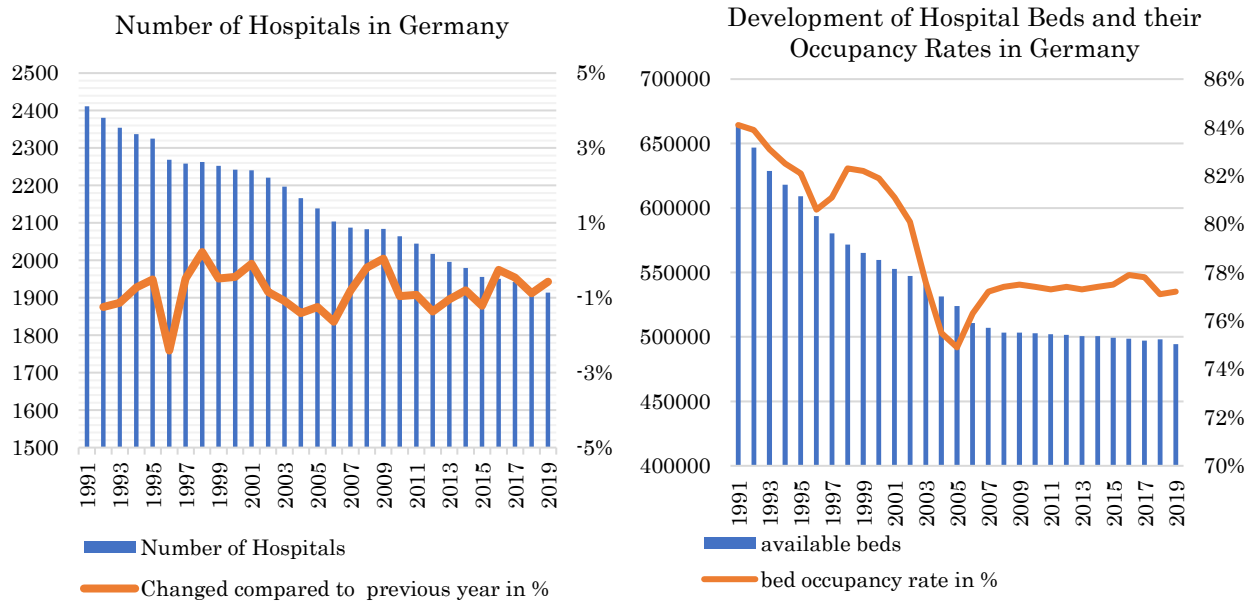

Figure 2: The development of hospitals and the development of hospital beds and their occupancy rates in Germany from 1991-2019.[12]

In addition to the decline in the number of hospitals, a reduction in the number of beds of more than 25 % (665,565 to 494,326 beds) can be determined over the past 30 years.[13] Nevertheless, the average bed occupancy has fallen by around 8.3 % (from 84.1 % to 77.1 %) during the same period. In contrast to the normal beds available, an increase in intensive care beds can be recorded. These rose by a total of around 30 % from 20,200 intensive care beds in 1991 to 26,319 intensive care beds in 2019.[14] To be able to put the bed occupancy into a ratio, a recommended maximum occupancy can be used as a guide. Hospitals usually plan with an

[10] Federal Statistical Office (2021). In the case of hospital ownership, it can be distinguished between a public (e.g. regional authorities (federal, state, district or municipality)), non-profit (e.g. parishes, foundations or associations) and private (commercial companies) ownership.
[11] Federal Statistical Office (2021).
[12] Own illustration based on data from the Federal Statistical Office (2021).
[13] Beds that are ready for use for full patient treatment. The occupancy rate is calculated as the number of beds effectively occupied (bed-days) for curative care (HC. 1 in SHA classification) divided by the number of beds available for curative care multiplied by 365 days, with the ratio multiplied by 100.
[14] Aerzteblatt (2020) and Federal Statistical Office (2021).

average bed occupancy of 85 % up to 90 %.[15] According to Kuntz, Mennicken and Scholtes (2015), a turning point has already been reached at 92.5 %, at which more preventable deaths occur. In addition, it should be noted that the average value of the bed occupancy does not say anything about the occupancy rate in high phases.

In addition to the decline in hospitals and the number of beds available, an increase in the number of treatment cases in Germany can be recorded over the same observation period (see figure 3). While the clinics recorded around 14.6 million patients in 1991, around 19.4 million people were treated in 2019.[16] In addition to the increasing number of cases, however, the length of stay is also noticeable, which has halved within 30 years. While the average patient stayed in hospital for around 14 days in 1991, the average length of stay in 2019 was 7.2 days.[17] The increase in the number of cases can be explained in part by the demographic development and the associated gradual aging of the population.[18] The decrease in length of stay can be attributed, among other things, to the "German Diagnosis Related Groups" accounting system introduced in 2003. In contrast to the previous Federal Care Rate Ordinance, bills are based on flat rates and not on care days. To determine the flat rate per case, groups are formed according to medical and financial expenditure. If the specified limit length of stay is not adhered to, hospitals run the risk of economic losses. In addition, patients are now treated more frequently on an outpatient or pre- or post-hospital basis, instead of being treated as a full inhouse-patient as before. Accordingly, it cannot be concluded that the reduced length of stay is associated with a better health status of the population. Rather, the choice of forms of treatment has changed for reasons of cost.[19]

[15] Green (2005).
[16] Federal Statistical Office (2021).
[17] Federal Statistical Office (2021).
[18] Blum and Offermanns (2012).
[19] Baumann (2006).

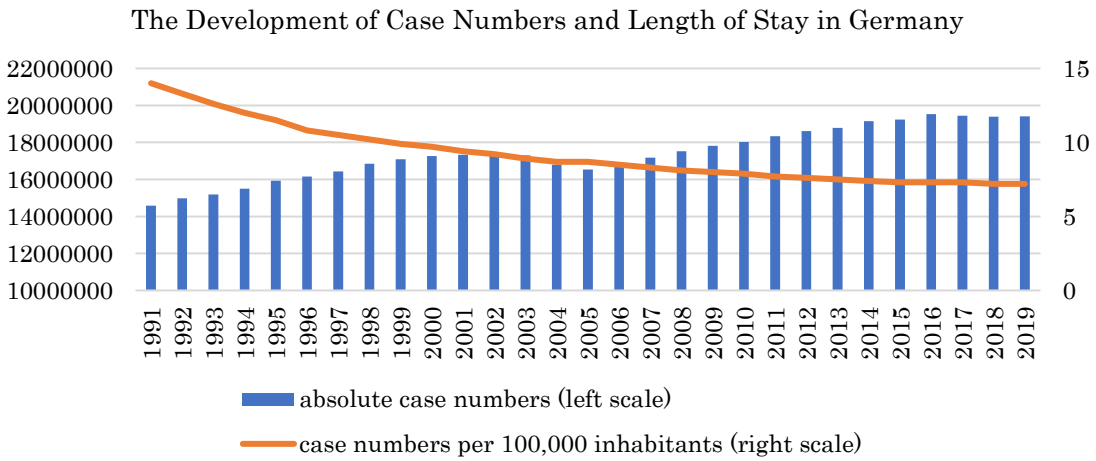

Figure 3: The development of case numbers and length of stay in Germany from 1991-2019.[20]

Another undeniably important resource is the staff. Contrary to the presumption of a scarcity problem, it can initially be established that both the number of people in the medical service profession and in the non-medical service profession has increased on average over the last 30 years (including students/trainees). The total number of employees rose by approx. 16.6 %. In the medical service area, there has been an increase of around 80 % (from 109,072 to 196,470) over the last three decades, and in the non-medical sector area an increase of around 9.7 % (from 1,002,553 to 1,100,193).[21] In connection with the reduced number of hospitals, the argument can be put forward that the proportion of staff per hospital has increased over the past few years.

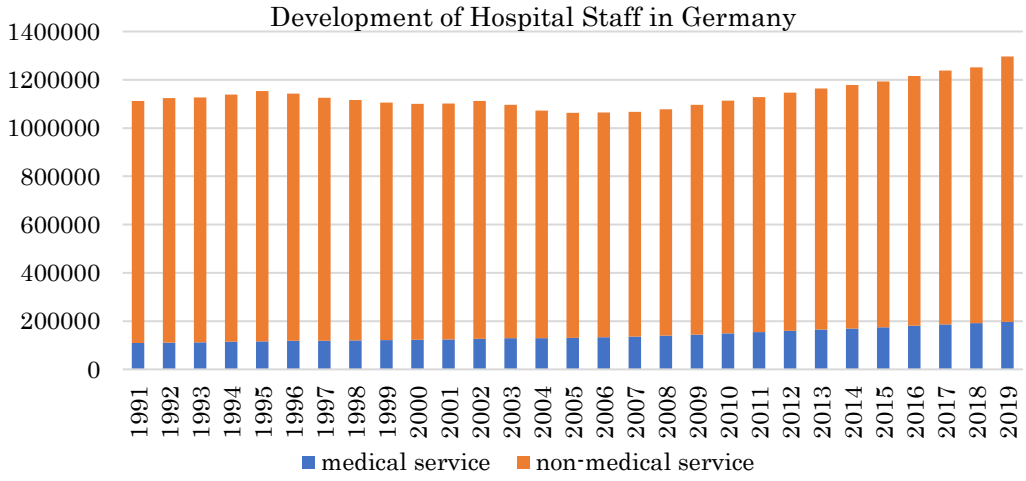

Figure 4: The development of hospital staff including medical and non-medical service in Germany from 1991-2019.[22]

[20] Own illustration based on data from the Federal Statistical Office (2021).
[21] Federal Statistical Office (2021).
[22] Own illustration based on data from the Federal Statistical Office (2021).

So far, there has been a decrease in hospitals by more than 20 % and in available beds by 25 %, as well as an increase in the number of treatment cases by around 33 %.[23] On the other hand, the bed occupancy fell by around 8.3 %, the length of stay was halved, and the proportion of staff rose by around 16.6 % overall.[24] These results do not seem to support the proposition of the expected scarcity problem. Rather, despite the decline in equipment such as the number of hospitals and fewer beds available, more patients seem to have been treated. This could possibly be due to the halved average time that patients spend in hospital, as well as to the increased number of staffs. At this point the notion can rather be put forward that in the last 30 years the hospital sector has been made more economical and efficient. Even if a possible economic improvement and not necessarily a resource problem can be identified based on the number of cases, the previous values cannot be used to provide a conclusive answer, whether the available resources fundamentally guarantee adequate patient care. The German Medical Association warned in 2018 that the needed supply of doctors could not keep up with the growing number of cases and demographic change.[25] For example, weekly working hours between 60 and 80 hours are no exception in hospitals.[26] In addition, Germany is faced with the problem of an increasing number of older doctors who will be retiring from working life in the foreseeable future.[27]

To be able to put the hospital situation in Germany into perspective, the following briefly compares the number of hospital and intensive care unit beds (ICUs) as well as the staff in the OECD countries.

Compared to other countries of the Organization for Economic Co-operation and Development (hereinafter OECD), a highly intensive care bed density of 33.9 intensive care beds per 100,000 inhabitants can be accounted for Germany. After Germany, Austria follows with 28.9 and the USA with 25.8 intensive care beds per 100,000 inhabitants. About the level of hospital beds, Germany ranks at 6 beds per

[23] Federal Statistical Office (2021).
[24] Federal Statistical Office (2021).
[25] German Medical Association (2018).
[26] Moreover, Germany is already dependent on doctors from abroad. In 2018 according to Kopetsch (2008), 54,000 doctors immigrated to Germany, 72 % of whom work in the hospital sector. But the so called "braindrain" offers only a shift of the problem, but does not eliminate it.
[27] Yamamura (2009).

1,000 inhabitants compared with 33 OECD member states third place. Only Korea and Japan achieve better results than Germany with values of 7.1 and 7.8 hospital beds per inhabitant. Regarding hospital staff, Germany also achieved high values in an OECD comparison, both for the number of doctors and nursing staff per 1,000 inhabitants (see Figure 5 below). Only Norway and Switzerland achieve higher scores than Germany for both doctors and nursing staff. All three countries also have comparatively high expenditures for the health sector.[28]

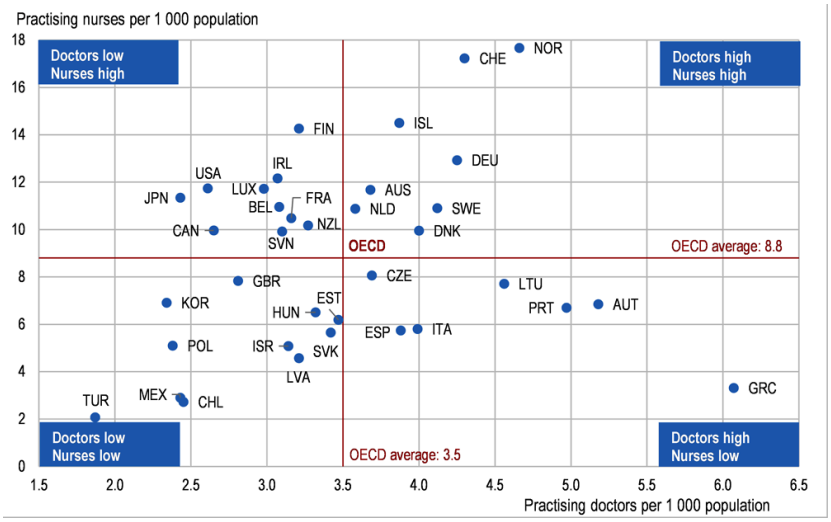

Figure 5: Comparison of the number of doctors and nurses per 1,000 population for selected OECD countries.[29]

Overall, for the investigation of a possible scarcity problem in the hospital sector in the normal situation for Germany, it can be stated that no direct scarcity can be determined based on the available data. A comparison with OECD countries has also shown that Germany is at a high level in terms of hospitals, intensive care beds and staff. Nevertheless, precautions should be taken regarding demographic change. Relying on skilled labour migration from abroad does not offer a sustainable solution either. In addition, a more intensive examination of the working conditions such as the working hours is needed.

Existence of a Possible Scarcity Problem in the German Hospital Sector during the Corona Pandemic?

In the following, it will be predicted when the available intensive care beds in Germany would have been fully occupied under the additional load of Corona

[28] OECD (2020).
[29] OECD (2020).

patients. For this purpose, the current data set available at the time of writing will be used.

According to the Robert Koch Institute, the number of confirmed COVID-19 cases on the deadline of the study (27. April 2021) was 3,310,301 with a 7-day incidence of 168 cases/100k inhabitants.[30] There was a total of 23,911 beds in intensive care units at that time.[31] Of these 21,076 were occupied, representing an occupancy rate of approximately 88 %.[32] Corona patients in turn occupied 5,050 ICU beds (about 21 % of the total ICU beds). [33] It can be concluded that the ratio of Corona intensive care patients to other intensive care patients is about 1:5. Consequently, of the 2,835 available beds, only 21 % are also available for COVID-19 patients at this time. figure 6 shows these two limits: [34]

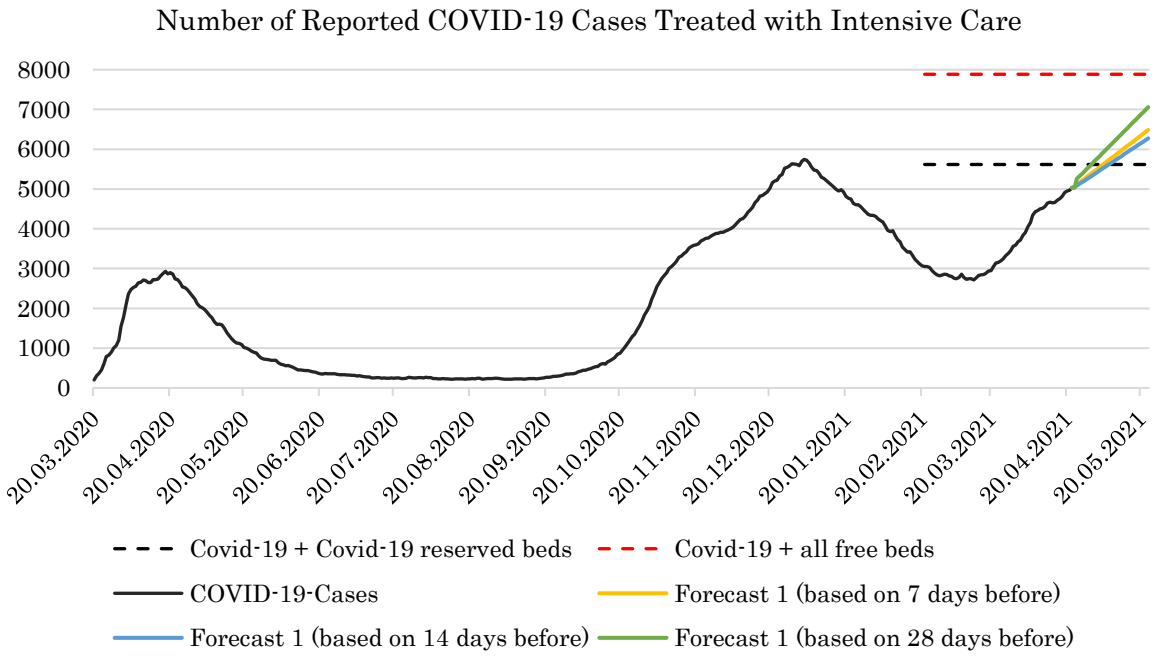

Figure 6: The development of Corona case numbers in Germany and possible development scenarios based on 18. December 2020.[35]

[30] It should be noted that at the conclusion of this article (4. May 2021), the number of those requiring intensive care had decreased slightly to 4,946. The total number of people infected with COVID-19 on 4. May 2021 was 3,433,516 with a 7-day incidence of 141.4, which has also decreased.
[31] German Interdisciplinary Association for Intensive Care and Emergency Medicine (2021).
[32] German Interdisciplinary Association for Intensive Care and Emergency Medicine (2021).
[33] The highest value of intensive care bed occupancy by corona patients was measured on 3. January 2021 with 5,745 occupied intensive care beds.
[34] This does not include patients who either die in the ICU or are discharged/transferred.
[35] Own presentation based on data from Radtke (2021).

The three forecasts are based on the closing date of the article and the 5,050 COVID-19 patients on 27.4.2021 and show that without the political interventions the reserves would have quickly exceeded the capacity limits of the intensive care units with the growth rates of the previous weeks. Triage on a large scale would have been almost essential at this point. Fortunately, however, the increased vaccination tempo and the federal emergency brake with contact and curfews regulations led to falling incidences and infection figures. High infection figures correlate with a certain delay with the high burdens in intensive care units, which must be avoided at all costs. Here, the situation in April 2021 is different from that in 2020. The average age is much lower, but the length of stay in intensive care units is now much longer. Based on the hospital situation 30 years before Corona as well as during the Corona pandemic, no concrete indication of shortage problems or the use of triage in Germany can be found, even if the situation during Corona is in part very much at the limit. Nevertheless, attention should be paid to future developments, especially regarding medical personnel. Moreover, the analysis was limited to the hospital sector only. However, triage can also take place at other facilities. For example, on 31. January 2021, there were 2,216,363 Corona infected persons, of whom 56,945 died (about 3 % of all infected persons).[36] Of those infected, 18,506 people (about 32 %) died in intensive care units. 68 % of the deaths take place in other facilities that are not precisely documented. This suggests that pre-triage of corona patients prior to ICU admissions is possible.

The Concept of "Triage": A Scarcity Problem?

The triage forms a system that, like systemic relevance, has not only existed since the beginning of 2020, but is widely discussed in public due to the outbreak of the corona pandemic. The triage system is also part of the emergency care in congested hospitals in other countries such as Italy.[37]

The northern Italian province Bergamo became one of the deadliest killing fields for the virus in the Western world. Bergamo was the epicentre of the first wave of

[36] Vgl. Robert Koch Institut (2021 (b)).
[37] Lintner (2020).

the pandemic in Europe and has become a symbol of tragedy. At the end of March (2020), Italian health authorities had counted 12,428 virus-related deaths. The Italian National Institute of Statistics says there had been more than 25,000 excess deaths at that stage. That's a gap of more than 12,000 deaths, the vast majority of which are believed to be linked to the virus.[38] Given the 568 per cent rise in deaths in Bergamo, Italy during the March period the army was commanded to assist in the cremation of the dead. The images of army vehicles driving numerous coffins from Bergamo shocked the world. Up to 70 coffins a day were picked up by soldiers from Bergamo in the spring of last year - the morgues there were completely overcrowded due to the deadly pandemic. There was little time left for the burial of the corona dead who remained in Bergamo. Many of them were not given a tombstone; instead, the graves were provisionally marked with signs showing the names and photographs of the deceased.[39]

The triage (from the French "*trier*", to sort),[40] which is used in today's medicine, originally comes from food selection and was primarily shaped by military medicine.[41] The so-called "*battlefield triage*" was later used in integrated emergency and catastrophe medicine.[42] The triage includes *the rule of urgency of treatment*, which states that those most severely affected are to be treated first, as well as the later added rule of sorting out the "hopeless cases", which are not treated directly.[43] In addition, the *maximization rule* was also applied, the aim of which is to save as many human lives as possible.[44] In contrast to the military, five-stage rather than three-stage decision-making processes are often used in the clinical sector.[45] The triage and the associated rules are found in extreme situations for medical care use. An extreme situation can be defined based on overloaded medical capacities due to relatively few medical staff who suddenly must care for many patients with scarce medical resources.[46] In the case of such

[38] Clench (2020).
[39] Zeit Online (2021).
[40] Mitchell (2008).
[41] Michel (2020).
[42] Michel (2020).
[43] Hogan und Burstein (2007).
[44] Lübbe (2001).
[45] Hilt (2013).
[46] Michel (2020).

an extreme situation, the triage means dividing those in need of treatment into different urgency cohorts. Classical triage situations include, for example, major industrial accidents, high-loss military actions or natural disasters.[47] The triage system in Germany is still a very new way of integrating it into everyday hospital life. Triage systems were initially established in the USA in the 1960s, and in the following years other systems developed in Italy, Australia, England, and Canada, among others. It was only in 2004 that Germany introduced a variant of triage, the so-called *Manchester Triage System* (hereinafter MTS), in German hospitals.[48]

In the USA, the problem of financing and the provision of resources stood in the foreground in contrast to quality assurance. The establishment of a triage system was intended to prevent harming patients whose financial status and the associated settlement of the bill is questionable.[49] Great Britain, on the other hand, was confronted with the problem of increasing emergency patients. In addition to actual emergencies, patients with normal illnesses increasingly visited the emergency rooms. To avoid incidents caused by waiting times, it became necessary to sort the patients according to the urgency of treatment.[50] In Germany the problem of the increasing number of ambulant and intensive patient cases can also be seen as the cause of the introduction of a triage system.[51]

A general triage sorting procedure exists within disaster medicine. The "hopeless cases" (seriously injured people with damage of more than 50% and a low chance of survival) initially receive no treatment apart from possible pain-relieving treatment and pastoral care, just like the slightly injured. The remaining patients are categorized into three emergency categories. Category 1 includes people who are acutely life-threatening and whose lives can only be saved through immediate treatment. The second category treats patients who, in relative terms, have better chances of survival, but who nevertheless need rapid treatment in view of a favourable long-term result. The third category is then divided into those people who can reasonably be expected to receive somewhat delayed treatment.[52] The

[47] Schmidt (1996).
[48] Hilt (2013).
[49] Hilt (2013).
[50] Hilt (2013).
[51] Hilt (2013).
[52] Lübbe (2001).

main criterion of triage is both the patient's will and the clinical outlook for success, which is measured, among other things, using the *Clinical Frailty Scale* (hereinafter CFS).[53] The CFS serves primarily as an instrument for the assessment of persons aged 65 and over within the holistic view of the patient. The CFS is divided into nine different levels, ranging from "very fit" to "terminally ill".[54] On the basis of CFS, people can be identified who are at high risk and cannot expect any improvement in their state of health through treatment such as an intensive care intervention. However, it is important to emphasize the fact that this procedure is not suitable for people under the age of 65.[55] It must first be determined whether a possible indication exists. If not, treatment will be discontinued. If there is an indication for ventilation, for example, the next step must be in accordance with the patient's wishes. If the patient does not want treatment, treatment is excluded. If the patient has requested treatment directly or, for example, through a living will, the final step must be to use the triage system to decide whether treatment can be carried out with the available resources.[56] When deciding between treatment and non-treatment, in the case of COVID-19 infections, age, the probability of survival, the highest potential lifetime and the maximization of benefits for the largest possible number of people play a role.[57]

As early as 2009, a study in Great Britain found that in the event of a pandemic, according to the British triage guidelines, approx. 46% of the normal intensive care patients would not have been treated due to their degree of illness. About 69% of these patients would have died because of neglecting treatment.[58] The triage method is highly controversial.

Compatibility of the welfare state and triage?

Michel (2020) asks the provocative question of whether, if a decision is made based on age or frailty in corona patients, other criteria such as the systemic relevance of the people should not also be decisive. Accordingly, social position, intelligence

[53] Michel (2020).
[54] German Association for Geriatrics (2020).
[55] German Association for Geriatrics (2020).
[56] Michel (2020).
[57] Michel (2020).
[58] Ettel and Fuest (2020).

or attractiveness could be conceivable decision criteria. This line of thought clarifies the problem with the compatibility of triage with the German constitution and the German welfare state. Thus, the German Interdisciplinary Association for Intensive Care and Emergency Medicine tries to justify the triage procedure deontologically, and to replace the selection of patients by the "clinical likelihood of success" instead of the life value determination. An attempt is made to prevent a decision based on age or lifespan and to replace it with the objective medical-biological status of the person.[59] The problem would be defined in terms of resource allocation rather than social benefit, i.e., accepting the death of people if as many as possible can be saved in return. Nevertheless, the underlying methods of classification, such as CFS, which is based on age, remain the same. It is not compatible with the German constitution to regard a 20-year-old as more valuable than an 80-year-old, or to assign less value to a previously ill.[60] Therefore, Michel (2020) sees the use of triage not only as a serious failure of health care, but also a violation of human rights.

The question now arises how possible ways out of triage could look like. Decision-making procedures that are made completely independently of the person's profile - such as chronological serial treatment or a random determination of the treatment sequence - also do not seem to offer any health-related solution.[61] Another possibility is to avoid and prevent the need for treatment in the hospital to avoid triage situations from the beginning. In the case of corona, special additions were made for patient directives, which were recommended to the risk groups. The will regarding different stages of ventilation as well as the decision not to be admitted to a hospital in the first place in case of COVID-19 can be recorded there. However, Michel (2020) sees the increased use of living wills merely as a shift of the triage system into a pre-triage, which would ultimately shift medical care only to the palliative sector. The chosen way out of the triage shows the social interaction of a country with older and sick or handicapped, but

[59] Michel (2020).
[60] See Article 1, Paragraph 1 of the Basic German Law: "Human dignity is inviolable. Respecting and Protecting each individual is an obligation of all state power", Article 3, Paragraph of the Basic German Law: "All people are equal before the law" and Article 3 Paragraph 3 of the Basic German Law: "Nobody may be disadvantaged because of their handicap".
[61] Lübbe (2004).

also with socially disadvantaged people. It should be noted that the state of health and the lifespan of a person depend significantly on the respective income and social status.[62] A solution that would make life and death decisions irrelevant would be a solution to the problem of scarcity. Michel (2020) sees the key to the triage system as promoting the healthcare and nursing care landscape and improving general accessibility. Appropriate training as well as adequate payment of the specialist staff are required for this. In 2018, the gross monthly salary of nursing professionals in hospitals was € 3,543, making it the highest salary among nursing staff in Germany. The lowest remuneration was paid to helpers in the care of the elderly in outpatient care at € 1,939 per month.[63] By improving such conditions an alternative to triage could be found.

Nursing and caregiver personal need our solidarity – especially after the prevention of a blanket collective agreement in 2021 for higher wages and improved working conditions for the care of the elderly by Caritas.[64] The German Caritas Association is the umbrella organization of the organized Caritas (Latin for charity, high esteem) and welfare association of the Roman Catholic Church in Germany. It is in the legal form of a registered association (eV) and a central association of over 900 individual organizational units - most of them as independently registered associations. It is part of the league of the so-called leading associations of voluntary welfare in Germany. The leading associations work together in the Federal Working Group for Independent Welfare Care.[65]

As an association of around 6,200 legally independent sponsors with around 693,000 employees, the association is the largest private employer in Germany.[66] In addition, around 500,000 volunteers are involved in the Caritas facilities.

Nurses and caregivers complain of chronic overload in the workplace, now there are further hardships due to the corona crisis for nurses and caregivers on top. It is an industry particularly affected by corona, in which true nightmares are currently playing out again and again: In the care sector, the risk of corona

[62] Michel (2020).
[63] Radtke (2020).
[64] Wegener (2021).
[65] German Caritas Association (2019).
[66] Hank (2006).

infection for employees is particularly high – recently during past January an entire hospital in Berlin had to be completely quarantined because of an outbreak of around 30 cases with the coronavirus mutation B.1.1.7.[67] For the approximately 1,700 employees at the Humboldt-Clinic in Berlin this meant "commuting quarantine" - they were only allowed to travel between their home and the clinic.[68] But the basic problem of piling up frustration is "the promises made by politics to care not kept", for example insufficient protection.[69] Employees who are particularly at risk due to their age or previous illnesses still had to continue to work. Health and safety laws were suspended in the pandemic, which made it possible to work more than allowed. The industry service "pflege-online" reports on other cases in which even nurses with positive test results had to continue working because of the shortage of care staff.[70] Figures from the Federal Employment Agency seem to indicate a wave of layoffs caused by the pandemic: Between the end of March and the end of July, the health care sector had around 9,000 fewer employees, with declines between 0.44 and 0.6 % for sick and elderly care. But the numbers had already recovered by the end of August.[71] Looking at the year, the health care sector is one of the few sectors that increased employment contracts subject to social security contributions in 2020. The short-term employment decline cannot be clearly explained. It can be your own terminations or employment contracts that have been terminated by the employer or have expired. Or vacancies could not be filled promptly, for example because job interviews were missing.

The industry is desperately looking for personnel. The number of vacancies that cannot be filled is large. The number of calculated open vacancies that are additionally required is even greater. In the particularly poorly paid geriatric care sector, it currently takes an average of six months to fill a vacancy.

[67] Bayrischer Rundfunk (2021).
[68] Emundts (2021).
[69] Emundts (2021).
[70] Emundts (2021).
[71] Emundts (2021).

Conclusion

What are the key points for policy decision makers?

As Germany is experiencing the third COVID-19 pandemic wave, intensive care unit (ICU) bed capacity is an important determinant within the discussed Triage Debate and the needed intensive public health economic and social analysis of this scarcity problem causing the Triage Debate.

In Germany, as argued by Gandjour (2021) among others the provision of ICU bed reserve capacity appears to be cost-effective even for a low probability of bed utilization. When comparing the provision of additional capacity, i.e. elimination of the scarcity problem, to no intervention from a societal perspective the marginal cost-effectiveness ratio (MCER) of the last bed added to the existing ICU capacity is €21,958 per life-year gained assuming full bed utilization. The net monetary benefit (NMB) decreases with an additional expansion but remains positive for utilization rates as low as 2%. In Germany, the provision of a staffed ICU bed reserve capacity appears to be cost-effective even for a low probability of bed utilization. The necessary implementation policies of hospital pandemic preparedness and response capacity strengthening COVID-19 mitigation strategies are life-saving alternatives to controversial Triage debates.

It can be stated that the examinations of the selected criteria of the hospital sector both before and during Corona do not indicate a lack of resources or the use of triage. However, it is important to note that the situation under Corona in Germany was certainly often on the verge of a severe lack of resources - especially regarding nursing staff. The international comparison shows that Germany has good resources in the hospital sector overall. However, the future development should be examined more closely and critically, especially regarding staffing. In addition, an analysis of other health care sectors such as old people's homes are necessary in order to actually be able to rule out a general triage scenario in Germany.

Bibliography

[1] Aerzteblatt (2020): *Zahl der Krankenhausbetten geht stark zurück*. From: https://www.aerzteblatt.de/nachrichten/117181/Zahl-der-Krankenhausbetten-geht-stark-zurueck. Last access: 11. January 2021.

[2] Baumann, Lothar (2006): *Bettenauslastung in den meisten Fachabteilungen der Krankenhäuser trotz Bettenabbau rückläufig*, Statistisches Monatsheft Baden-Württemberg.

[3] Bayrischer Rundfunk (2021): *Berliner Klinik schließt wegen Corona-Mutation*. From: https://www.br.de/nachrichten/deutschland-welt/berliner-klinik-schliesst-wegen-corona-mutation,SMwj0Mc. Last access: 24. April 2021.

[4] Blum, Karl and Offermanns, Matthias (2012): *Einflussfaktoren des Fallzahl- und Case Mix-Anstieges in deutschen Krankenhäusern*, Deutsches Krankenhaus Institut.

[5] Clench, Sam (2020): *Coronavirus: Bergamo, Italy suffered 586 per cent rise in deaths during March*. From: https://www.news.com.au/lifestyle/health/health-problems/coronavirus-bergamo-italy-suffered-568-per-cent-rise-in-deaths-during-march/news-story/68a3a4950b1d6e14a4f7b136cb885bcb. Last access: 24. April 2021.

[6] Emundts, Corinna (2021): *Pflegebranche am Limit*. Die Tagesschau. From: https://www.tagesschau.de/inland/gesellschaft/neuer-pflegenotstand-durch-corona-101.html. Last access: 24. April 2021.

[7] Ettel, Anja und Fuest, Benedikt (2020): *Nur 28.000 Betten – auf Deutschlands Intensivstationen wird es eng*, Die Welt, Springer publisher.

[8] Federal Statistical Office (2021): *Gesundheit – Grunddaten der Krankenhäuser*, special series 12, volume 6.1.1.

[9] Federal Statistical Office (2020): *Gesundheitsausgaben im Jahr 2018 um 4% gestiegen*, press release no. 164.

[10] Fedorova, Maria (2020): *Was der Ethikrat zu Triage und Exit-Strategien empfiehlt*, Bayrischer Rundfunk. From: https://www.br.de/nachrichten/

deutschland-welt/was-der-ethikrat-zu-triage-und-exit-strategien-empfiehlt,RvwIWwp. Last access: 29. January 2021.

[11] Gandjour, Afschin (2021): *How many Intensive Care Beds are Justifiable for Hospital Pandemic Preparedness? A Cost-effectiveness Analysis for COVID-19 in Germany*. Applied Health Economics and Health Policy.

[12] German Association for Geriatrics (2020): *Clinical Frailty Scale (CFS)*.

[13] German Caritas Association (2019). From: https://www.caritas.de/diecaritas/wir-ueber-uns/wofuerwirstehen/wofuerwirstehen. Last access: 06.05.2021.

[14] German Medical Association (2018): *Ergebnisse der Ärztestatistik zum 31. Dezember 2018 – Montgomery: Es ist höchste Zeit, den Ärztemangel ernsthaft zu bekämpfen*. From: https://www.bundesaerztekammer.de/ueber-uns/aerztestatistik/aerztestatistik-2018/. Last access: 10. Jan 2021.

[15] German Interdisciplinary Association for Intensive Care and Emergency Medicine (2020): *Entscheidungen über die Zuteilung intensivmedizinischer Ressourcen im Kontext der COVID-19-Pandemie*, second revised version.

[16] German Interdisciplinary Association for Intensive Care and Emergency Medicine (2021): *Intensivregister.* From: https://www.intensivregister.de/#/index. Last access: 06. May 2021.

[17] Green, Linda V. (2005): *Capacity Planning and Management in Hospitals*, Operation Research and Management Science, Springer publisher.

[18] Hank, Rainer (2006): *Die heimlichen Geschäfte der Wohltäter. Frankfurter Allgemeine Zeitung*. From: https://www.faz.net/aktuell/wirtschaft/caritas-co-die-heimlichen-geschaefte-der-wohltaeter-1382329.html. Last access: 24. April 2021.

[19] Hilt, H. (2013): *Triage in der Notaufnahme – Qual oder Qualität*, Springer publisher.

[20] Hogan, David E. and Burstein, Jonathan L. (2007): *Disaster Medicine*, Wolters Kluwer, Philadelphia.

[21] Kopetsch, Thomas (2008): *Ärztewanderung: Das Ausland lockt*, Deutsches Ärzteblatt.

[22] Kuntz, Ludwig; Mennicken, Roman und Scholtes, Stefan (2015): Stress on the Ward: Evidence of Safety Tipping Points in Hospitals, Institute for Operations Research and the Management Sciences.

[23] Lintner, Martin M. (2020): *Das Triage-Problem in Italien während der COVID-19-Pandemie*, in Kröll, Wolfgang; Platzer, Johann; Ruckenbauer, Hans-Walter; Schaupp, Walter (publisher.): Die Corona-Pandemie. Bioethics in science and society, Nomos publisher.

[24] Lübbe, Weyma (2001): *Veralltäglichung der Triage? Überlegungen zu Ausmaß und Grenzen der Opportunitätskostenorientierung in der Katastrophenmedizin und ihrer Übertragbarkeit auf die Alltagsmedizin*, Springer publisher.

[25] Lübbe, Weyma (2004): *Tödliche Entscheidung – Allokation von Leben und Tod in Zwangslagen*, Mentis publisher.

[26] Michel, Karin (2020): *Wege aus der Corona-Triage? Kritische Bemerkung zur „tödlichen Entscheidung"*, Ecclesiastical Document Server.

[27] Mitchell, Glenn W. (2008): *A Brief History of Triage*, in Disaster Medicine and Public Health Preparedness Volume 2, Cambridge University Press.

[28] OECD (2020): *Beyond Containment: Health systems responses to COVID-19 in the OECD*.

[29] Radtke, Rainer (2020): *Verdienst von Pflegekräften in Deutschland nach Einrichtung im Jahr 2018*, Statista.

[30] Radtke, Rainer (2021): *Täglich gemeldete Neuinfektionen und Todesfälle mit dem Coronavirus (COVID-19) in Deutschland seit Januar 2020*, Statista by John Hopkins University.

[31] Robert Koch-Institut (2021 (b)): Täglicher Lagebericht des RKI zur Coronavirus-Krankheit-2019 (COVID-19) vom 31. January 2021. From: https://www.rki.de/DE/Content/InfAZ/N/Neuartiges_Coronavirus/Si-

tuationsberichte/Jan_2021/2021-01-31-de.pdf?__blob=publicationFile. Last access: 23. February 2021.

[32] Schmidt, Volker (1996): *Veralltäglichung der Triage*, Journal for Sociology, De Gruyter.

[33] Wegener, Basil (2021): *Caritas verhindert Altenpflege-Tarifvertrag*. From: https://www.n-tv.de/panorama/Caritas-verhindert-Altenpflege-Tarifvertrag-article22387308.html. Last access: 24. April 2021.

[34] Yamamura, Sakura (2009): *„Brain Waste" ausländischer Ärztinnen und Ärzte in Deutschland*, Wirtschaftsdients, Journal for Economic Policy.

[35] Zeit Online (2021): Italien gedenkt in Bergamo seiner 103.000 Corona-Toten. From: https://www.zeit.de/politik/ausland/2021-03/italien-corona-tote-pandemie-opfer-bergamo-gedenkfeier?utm_referrer=https%3A%2F%2Fwww.bing.com%2F. Last access: 24. April 2021.

Recent discussion papers

2021-09	Bernard M. Gilroy Marie Wegener Christian Peitz	COVID-19 and Triage - A Public Health Economic Analysis of a Scarcity Problem
2021-08	Bastian Schäfer	Bandwidth selection for the Local Polynomial Double Conditional Smoothing under Spatial ARMA Errors
2021-07	Sebastian Letmathe Jan Beran Yuanhua Feng	An extended exponential SEMIFAR model with application in R
2021-06	Yuanhua Feng Bastian Schäfer	Boundary modification in local polynomial regression*
2021-05	Bastian Schäfer Yuanhua Feng	Fast Computation and Bandwidth Selection Algorithms for Smoothing Functional Time Series*
2021-04	Yuanhua Feng	Uni- and multivariate extensions of the sinh-arcsinh normal distribution applied to distributional regression
2021-03	Sebastian Letmathe Yuanhua Feng André Uhde	Semiparametric GARCH models with long memory applied to Value at Risk and Expected Shortfall
2021-02	Claus-Jochen Haake Walter Trockel	Socio-legal Systems and Implementation of the Nash Solution in Debreu-Hurwicz Equilibrium
2021-01	Thomas Gries Paul Welfens	Testing as an Approach to Control the Corona Epidemic Dynamics and Avoid Lockdowns
2020-10	Fatma Aslan Papatya Duman Walter Trockel	Non-cohesive TU-games: Efficiency and Duality
2020-09	Yuanhua Feng Jan Beran Sebastian Letmathe Sucharita Ghosh	Fractionally integrated Log-GARCH with application to value at risk and expected shortfall
2020-08	Fatma Aslan Papatya Duman Walter Trockel	Removed from the CIE series
2020-07	Thomas Gries Veronika Müller	Conflict Economics and Psychological Human Needs
2020-06	Thomas Mayrhofer Hendrik Schmitz	Prudence and prevention – Empirical evidence*
2020-05	Daniel A. Kamhöfer Hendrik Schmitz Matthias Westphal	Marginal College Wage Premiums under Selection into Employment*
2020-04	Thomas Gries	Income polarization and stagnation in a stochastic model of growth: When the demand side matters
2020-03	Nico Stoeckmann	A note on Bergstrand's 1985 gravity model
2020-02	Papatya Duman Walter Trockel	Nash Smoothing on the Test Bench: Hα -Essential Equilibria
2020-01	Joachim Heinzel Simon Hoof	Oligopolistic Upstream Competition with Differentiated Inputs