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REVIEW
ΑΝΑΣΚΟΠΗΣΗ

Worldwide responses of health systems to the financial challenges of the COVID-19 pandemic

The SARS-CoV-2 coronavirus (COVID-19) pandemic is a major public health issue; it is the greatest challenge facing humanity in the 21st century, and a sharp increase in the prevalence of the disease has resulted in an increase in morbidity and mortality in many countries. The global health community, in an effort to reduce the spread of the virus, has been taking precautionary measures to address the crisis and alleviate the economic impact of the pandemic on healthcare services. Global information exchange is vital for health systems to meet these challenges. Health systems, even those in developed countries, appear to have been unprepared to meet this challenge, partly because of pre-existing problems. This study identifies some important features of health systems around the world, and the policies implemented by those responsible for addressing this global health crisis caused by SARS-CoV-2. In addition, it highlights the government decisions and mechanisms that were implemented to strengthen and finance health systems, and to mitigate the cost of the pandemic. The response of health systems to the requirements created by the coronavirus pandemic shows adaptation to successive changes, allowing recovery and satisfaction of their needs for the protection of public health.

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ΑΡΧΕΙΑ ΕΛΛΗΝΙΚΗΣ ΙΑΤΡΙΚΗΣ 2023, 40(2):184–191

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Μέτρα αντιμετώπισης των οικονομικών προκλήσεων της πανδημίας COVID-19 στα συστήματα υγείας παγκοσμίως

Περίληψη στο τέλος του άρθρου

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1. INTRODUCTION

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the greatest challenge that public health has had to face in the 21st century.[1] The virus and the consequential COVID-19 infection emerged in Wuhan in Hubei Province, China on 9th December 2019. The first official report of the disease was published on 31st December of the same year.[2] Three months later, in March 2020, with the world already counting 118,000 infections and 4,291 deaths from the virus, the World Health Organization (WHO) declared the outbreak of a pandemic.[3] The absence of a targeted therapy or a vaccine, along with an acknowledged shortage of protective personal equipment, diagnostic tests and intensive care unit (ICU) capacities, forced governments all over the world to implement measures to provide extra support to their health systems. In the environment created by the pandemic, the rapid increase of infected, hospitalised and intubated patients has been putting extreme pressure on health systems, financially and in other ways, and has brought them to the verge of collapse.[4–6]

It is clear that the COVID-19 pandemic has highlighted

many of the inadequacies and insufficiencies of health care systems in both developed and developing countries.[7] In view of the pressures and financial strains induced on health systems by COVID-19, the purpose of this study was to conduct a rapid literature review and present the weak points or "black spots" of health systems in dealing with the crisis, the policies implemented by various different governments in their efforts to relieve the pandemic-induced impact, and the potential applications of telemedicine in the health care sector. The evidence collected here can contribute to the ongoing international discussion on new procedures and policies to help health systems overcome their lack of preparedness to manage crises such as that caused by the present "invisible enemy".

2. HEALTH CARE SYSTEMS AND COVID-19

2.1. The United States

The United States (US) is one of the countries that has suffered the most from the pandemic.[8] Perhaps the biggest problem that the US health system had to deal with was the system itself. Specifically, it is mostly a privatised system, and public health services are highly fragmented and financed by a complex mixture of federal, state and local sources. Approximately 74% of the population has private insurance, the cost of which (for most people under the age of 65 years) is paid for by the employer, and only a small percentage of the work-force is self-insured. A small percentage has mixed private-public health insurance coverage, and a significant percentage of the population is uninsured or underinsured.[9] According to 2020 data, 9% of the population was uninsured even before the pandemic, and about 44 million Americans were underinsured. Sadly, a part of the population, mainly African-Americans and Hispanic-North Americans, avoided doctor visits altogether, because of inability to cover this medical expense.[8,10]

The general financial crisis caused by the pandemic, and the consequent layoffs, resulted in about half the US population whose insurance was covered by the employer becoming uninsured as result of joblessness.[11,12] The situation was made worse by the high costs of hospitalization for COVID-19 patients with a severe clinical picture. For example, the cost of a 12-day ICU admission of a patient on mechanical support was estimated at $ 80,000.[10] The financial impact has resulted in large numbers of patients being undiagnosed and untreated, and spreading the virus in an uncontrolled fashion, many of whom were African-Americans who, due to comorbidities, were at greater risk of severe clinical manifestations when infected with the virus.[12] Another problem the US healthcare system has had to deal with over the past years is the constantly decreasing state and federal financial support for health organizations.[8,12] For example, the Center for Disease Control and Prevention (CDC) has seen its budget cut by up to 10%, regrettably resulting in layoffs. It is of note that since 2008, about 50,000 people working in health organisations have been fired,[8] and the absence of experienced personnel has been deeply felt in the fight against the virus.[12]

2.2. Europe, Canada and Australia

The health systems of the United Kingdom (UK) and France were severely tested by COVID-19. In the UK, the funding cuts to the National Health Service (NHS) in recent years have resulted in understaffing of hospitals and insufficient beds and equipment in comparison with other countries of similar size, and the available medical staff was barely adequate to meet the needs of the population even before the virus.[13,14] In France, the lack of medical staff and non-renewal of the stock of protective equipment led to the collapse of the national health system in a country that spends more than 10% of its gross domestic product (GDP) for public health.[15] In contrast, the health systems of the Nordic countries, Canada and Australia, being supported by precautionary measures, such as social distancing, self-isolation measurements and limitation of public gatherings to 500 people, taken by their governments, along with health aid packages, were able to withstand the pressure of the pandemic.[16–19]

2.3. Southern Europe

In southern Europe, the effects of the recent economic crisis on health care became clear during the pandemic. Italy spends only 6.6% of its GDP on health and Greece only 5%, percentages well below the European Union (EU) average of 7.2%.[20,21] Regarding Spain, one of the countries initially suffering the most from the coronavirus, there was a severe shortage of diagnostic tests, equipment, beds and nursing staff, which restricted the capabilities of the health system.[22] The same problems were observed in Italy, another country that was devastated by the virus.[6,20] Greece, in spite of facing economic problems since 2010 due to austerity measures which inevitably weakened the NHS, managed, through the enforcement of strict lockdown measures by the government, to withstand COVID-19 pressure in the first wave.[21] Specifically the government, in spite of the limited resources and the major deficiencies

in the NHS, tried to control the spread of the virus, and to avoid a situation similar to that in Italy and Spain, just four weeks after the first case of SARS-CoV-2 was diagnosed in the country, and with only 695 confirmed cases and 17 deaths enforced a nationwide strict lockdown with closure of nonessential facilities and educational institutions, and a strict and tightly monitored movement restriction order. In the health sector, the Greek government partially suspended all elective surgeries and initially designated 13 hospitals, mainly located in metropolitan areas such as Attica, Thessaloniki and Patra, as COVID-19 reference hospitals. As a result, Greece was initially the European country with lowest prevalence of infected people (4/10,000 inhabitants).[21,23]

2.4. Low- and middle-income countries

Cases of special interest were low- and middle-income countries in Africa, Asia and Latin America, whose health systems were already fragile, and where shortages of medical staff, logistics and training were constant daily circumstances.[7, 24–28] In these countries, the funding available for health has been constantly reduced, and in 16 Latin American countries the expenditures for health are lower than 4% of the GDP.[24] On the other side of the globe, in India, there is an almost unbelievable disproportion in the quality of health care between public and private hospitals, with the former lacking even basic equipment. A typical example is respirators, obviously necessary in the fight against the coronavirus, the majority of which are located in private urban hospitals.[30] SARS-CoV-2 found these countries with their hospitals already overloaded with patients suffering from infectious diseases, such as tuberculosis and pertussis, and vector-borne diseases such as malaria and yellow fever. Taking into account that a large part of the population in these countries is malnourished and lives below the poverty line, it is no wonder that the additional burden of COVID-19 was almost unbearable.[24,29,31,32]

In Turkey, an upper middle-income country, in the first year of the pandemic, the total cost of care of hospitalized and outpatient COVID-19 patients constituted 2% of health expenditures and 3.8% of social security expenditures; the 2020 annual direct medical costs caused a medical cost burden that corresponded to 0.8 per thousand of Turkey's GDP.[33] In summary, health systems throughout the world were shown to have been underfunded, understaffed, underequipped and overloaded, even before the outbreak of the COVID-19 infection, but the aggravating factors due to the pandemic are testing even the best prepared countries.

3. POLICIES TO COPE WITH THE "INVISIBLE ENEMY"

3.1. Precautionary measures

Because of the lack of a targeted therapy and the fact that the vaccination became available and began about a year after the outbreak of the pandemic, governments around the world initially instituted precautionary measures to contain the spread of the virus and reduce the pandemic reproduction index,[4] thus reducing the number of people infected and consequently needing admission to a hospital, and particularly to an ICU. These measures included: awareness campaigns for frequent and thorough hand washing, curfews and lockdowns, school and university closures, restaurant closures, border closures, teleworking, multiple diagnostic tests, isolation of infected individuals and protection of vulnerable groups.[3,5,20–25,34–38]

The effectiveness of these measures varied among countries. For example, in France and England delay in implementing the measures, combined with the low-level rate of population diagnostic tests, resulted in a rapid and continuous increase in cases, leading to signs of collapse of the health services.[39,40] Conversely, a study from Australia, a country that immediately took strict precautionary measures, provides evidence that timely implementation was the key factor in reducing the number of critically ill patients, thus resulting in a lower national economic burden. According to that study, when the measures are taken early, the pandemic will cost Australia between 3.33% and 6.04% of its GDP, while delaying them could increase the respective figures to 13.1% and 47.9%.[41]

Sweden followed a more relaxed policy than other countries, as there were no specific measures imposed on the population, and the government made only strict recommendations. This approach, according to some studies, led to a reduction in the number of cases, although smaller than that in Sweden's neighbouring countries, where strict measures were enforced. Thus, the Swedish system, despite withstanding the COVID-19 pressure, eventually suffered more than the health systems of Norway or Denmark.[5,8,36]

The greatest challenge was that of implementing protective measures for the populations in the developing countries. These countries, especially in the Asian Pacific region, are characterized by large families, in which elderly and younger people live together.[32] A significant part of the population lives below the poverty line, in poor hygienic conditions, and is malnourished. In many of those countries, the cancellation of traditional cultural and religious gatherings to avoid crowding appeared to be a considerable problem. The combination of these factors

resulted in many instances of non-compliance with the social isolation measures intended to protect the vulnerable groups.[25,30,32]

3.2. Financial support packages

Many developed countries, in their efforts to strengthen health systems and motivate medical staff, have approved financial support packages. According to the Federal Social Security Agency, while dealing with the COVID-19 pandemic, German hospitals were strengthened with funds of up to € 9.4 billion.[42] England has allocated £ 4.5 billion to support hospitals, and France announced that € 8 billion are to be given to health professionals, in addition to their salaries.[43] Italy has spent € 660 million for the recruitment of 20,000 new employees.[20] In the USA, in order to support the health system, the government approved two aid packages through respective legislative acts. The first package is the Families First Coronavirus Response Act (FFCRA), under which private insurers together with Medicare, Medicare Advantage, and Medicaid are required to cover the costs of diagnostic tests throughout the pandemic. Under the same legislation, $ 1 billion was released from the Public Health and Social Services Emergency Fund to cover the costs of diagnostic tests for the uninsured citizens. The second legislative act is the Coronavirus Aid, Relief, and Economic Security (CARES) Act, which refers to the allocation of 2.2 trillion for the future coverage of diagnostic tests by private entities, and vaccination of the population, when the vaccine became available. The same legislation provides $ 100 billion to support hospitals and healthcare providers.[11] Australia has allocated $ 10 million for COVID-19 diagnostic tests.[19] Finland has allocated € 398 million for dealing with the pandemic, and another € 200 million for unforeseen events.[44] Countries such as Lithuania and Slovenia have given up to a 100% salary bonus as motivation to increase the productivity of available medical staff in treating COVID-19 patients.[43] One problem that many countries had to face was a shortage of protective medical equipment and medical devices necessary for the treatment of patients with COVID. China, the main supplier of protective equipment to the USA and Europe, reduced its exports by 15%, because of high domestic consumption.[45] In addition, President Trump in the US called on 3M to suspend the exports of N95 masks to Canada and Latin America.[16] In order to solve this problem Germany, like many other countries, turned to domestic production of protective equipment such as masks.[46] Australia went a step further, and started a domestic production of ventilators.[9]

4. DISCUSSION

Both developed and developing countries, in an effort to cope with the pressure of large number of patients with COVID-19, reduced scheduled patient admissions for diagnostic, surgical, or invasive treatments so that most of their hospital staff and available beds could be used in the fight against the new coronavirus.[23,31,37,42,44,47–49] In Germany, 25–30% of the ICU beds were kept empty to be used, if necessary, for the treatment of patients with SARS-CoV-2. For the same reason, empty beds were maintained in hospitals in Canada and Ireland.[41] In other countries, such as Finland, operating rooms were turned to ICUs in order to increase the capability to treat infected patients.[43] It should be noted, however, that these measures were partly responsible for a second wave of overload, as many cancelled procedures eventually had to be rescheduled and performed soon after the pandemic.[41] Some countries, including Greece, Poland, Czech Republic, Finland and Italy, designated specific public hospitals for the exclusive treatment of patients with SARS-CoV-2.[21] In an effort to support the public health system, Australia signed a five-year contract with 657 private hospitals at a total cost of $1.3 billion, in order to increase its resources for the fight against the coronavirus.[19]

During the wait for vaccines to be developed, and even after vaccination of the population started, governments went to great lengths to protect their population and the national health systems, and most are continuing to do so. Undoubtedly, the measures affecting the general population the most are those related to social distancing and quarantine, but these, unfortunately, are not the only measures that needed to be taken. Some countries are battling equipment scarcity by starting their own production. Others are attempting to support their healthcare systems with financial support packages, while others try to regulate the inflow of patients in their hospitals by postponing some treatments and procedures, and or designating specialized COVID hospitals. What is clear is that these are reactionary and short-term measures which, although important for handling the current crisis, will most likely not leave the countries with better health systems in the long run. The social isolation forced on the general population, and the pressure applied on health services by the pandemic has turned many countries to tele-health and telemedicine.[30,43,50–53] This shift entails the use of telecommunications and information technology (IT) (e.g. telephones, e-mail, applications such as Zoom and Skype, remote patient monitoring devices, etc.) to assess the health of an individual, diagnose and suggest the ap-

propriate treatment.[5,-55] Telemedicine allows patients with mild illnesses to receive their needed care, while minimizing their exposure to other patients with serious illnesses or, nowadays, to potential SARS-CoV-2 carriers. One example is the field of oncology, which can use telemedicine to monitor and manage chemotherapy and its side effects, palliative care and patient follow-up remotely.[53] Regarding surgical patients, telemedicine can be used for pre-operative consultations, and also in postoperative monitoring and care.[56] Through video conferences, telemedicine can also be used to assess and triage patients with SARS-CoV-2, and also to monitor those who are in home isolation.[52,57]

Despite the numerous potential applications of telemedicine and the solutions it can offer in the present crisis, the real question is whether society is ready for it. The idea is not new, as telemedicine has been around for years, but until the SARS-CoV-2 era it had not found the suitable ground to grow and prosper.[52,55] As a result, it is currently unfeasible to launch its widespread use, as the appropriate application boundaries need to be established, and a series of practical issues need to be resolved. Both the legal framework for telemedicine and the compensation system are largely underdeveloped and unclear.[55,58,59] As telemedicine removes borders, an international regulatory framework for these services needs to be established.[51,55,58] In addition, it is uncertain whether the various telemedicine platforms can fully comply with the principles of medical confidentiality and privacy.[59,60]

Another important question is whether every citizen possesses the technological equipment and, more importantly, the know-how and overall capability to seek medical care through telemedicine. It could be expected that the problem of technological equipment and know-how would concern mainly the developing countries, but it appears that technological inequality is also present in several developed countries.[30,61,62] In addition, it is not clear which medical specialties, could use telemedicine to the greatest advantage, and to what extent. In surgical specialties such as cardiothoracic surgery, although telemedicine appears to have a place in preoperative assessment, it is not yet clear if this is beneficial.[61] In a world where social media, webinars, teleworking and Zoom are becoming the new normal, telemedicine is the natural next step. Although some authors remain sceptical about telemedicine, partly due to the absence of the appropriate infrastructure,[63] or suggest that it has not been used appropriately in the pandemic,[64] COVID-19 experience has shown that it is generally accepted by physicians and patients, and can be used successfully in the diagnosis, treatment and monitoring of disease in many patients. A major question is whether governments will have prepared a legal, financial and technological system in time to support the demands of the telemedicine services that are currently developing throughout the world.

5. CONCLUSIONS

COVID-19 revealed the unpreparedness of health systems for a major challenge like this. In most countries the state healthcare system was inadequately funded and staffed, leading to an immediate overload with the onset of the COVID-19 outbreak. In an effort to address the problem immediately, governments took various precautionary measures to reduce the spread of the virus, while at the same time trying to support their health systems and prevent them from collapsing. Most of these measures were, and remain, "band-aid" solutions, focussing mainly on overcoming the crisis. In this current situation of unknowns, the one certain thing is that, after the pandemic, health care needs to be restructured, strengthened and modernized. The time to modernize healthcare services and to invest in research of the potential implications and the logistics of telemedicine has arrived. Legal and financial policies and strategies need to be discussed, infrastructure needs to be improved and solid foundations must be laid not only nationally, but also on a global scale, in order to respond more efficiently and effectively to the next pandemic, whenever it may appear.

ΠΕΡΙΛΗΨΗ

Μέτρα αντιμετώπισης των οικονομικών προκλήσεων της πανδημίας COVID-19 στα συστήματα υγείας παγκοσμίως

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Η πανδημία της νόσου του κορωνοϊού (COVID-19) αποτελεί ένα μείζον ζήτημα για τη δημόσια υγεία, καθώς συνιστά τη μεγαλύτερη πρόκληση που κλήθηκε να αντιμετωπίσει η ανθρωπότητα τον 21ου αιώνα. Η απότομη αύξηση του επιπολασμού της νόσου είχε ως αποτέλεσμα την αύξηση της νοσηρότητας και της θνητότητας σε πολλές χώρες. Η παγκόσμια κοινότητα υγείας, στην προσπάθειά της να μειώσει την εξάπλωση του ιού, εφαρμόζει προληπτικά μέτρα για την αντιμετώπιση της κρίσης και την ανακούφιση των οικονομικών επιπτώσεων που προκαλούνται από την πανδημία στην υγειονομική περίθαλψη. Η παγκόσμια ανταλλαγή πληροφοριών είναι ζωτικής σημασίας για τα συστήματα υγείας ώστε να ξεπεράσουν τις εν λόγω προκλήσεις. Τα συστήματα υγείας, ακόμη και αυτά των ανεπτυγμένων χωρών, λόγω ήδη υπαρχόντων προβλημάτων, φαίνεται να ήταν απροετοίμαστα για την αντιμετώπιση της συγκεκριμένης πρόκλησης. Η παρούσα μελέτη εντοπίζει κάποια σημαντικά χαρακτηριστικά στοιχεία των συστημάτων υγείας ανά τον κόσμο, αλλά και πολιτικές που εφαρμόστηκαν από τους υπευθύνους για την αντιμετώπιση της παγκόσμιας αυτής υγειονομικής κρίσης από τον SARS-CoV-2. Επιπρόσθετα, αναδεικνύει τις κυβερνητικές αποφάσεις και τους μηχανισμούς που τέθηκαν σε εφαρμογή με σκοπό την ενίσχυση και τη χρηματοδότηση των συστημάτων υγείας, μετριάζοντας το κόστος της πανδημίας. Η ανταπόκριση των συστημάτων υγείας στις απαιτήσεις του κορωνοϊού προσαρμόζεται σε διαδοχικές αλλαγές, επιτρέποντας την ανάκαμψη και την ικανοποίηση των αναγκών τους, με στόχο την προστασία της δημόσιας υγείας.

Λέξεις ευρετηρίου: COVID-19, Πανδημία, Πολιτικές υγείας, Συστήματα υγείας, Τηλεϊατρική, Χρηματοδότηση

References

1. SINGER DRJ. Health policy and technology challenges in responding to the COVID-19 pandemic. *Health Policy Technol* 2020, 9:123–125
2. MAFFIOLI EM. How is the world responding to the novel coronavirus disease (COVID-19) compared with the 2014 West African Ebola epidemic? The importance of China as a player in the global economy. *Am J Trop Med Hyg* 2020, 102:924–925
3. KAVALIUNAS A, OCAYA P, MUMPER J, LINDFELDT I, KYHLSTEDT M. Swedish policy analysis for Covid-19. *Health Policy Technol* 2020, 9:598–612
4. BALMFORD B, ANNAN JD, HARGREAVES JC, ALTOE M, BATEMAN IJ. Cross-country comparisons of Covid-19: Policy, politics and the price of life. *Environ Resour Econ (Dordr)* 2020, 76:525–551
5. KAMERLIN SCL, KASSON PM. Managing coronavirus disease 2019 spread with voluntary public health measures: Sweden as a case study for pandemic control. *Clin Infect Dis* 2020, 71:3174–3181
6. BOCCIA S, RICCIARDI W, IOANNIDIS JPA. What other countries can learn from Italy during the COVID-19 pandemic. *JAMA Intern Med* 2020 180:927–928
7. DA'AR OB, HAJI M, JRADI H. Coronavirus disease 2019 (COVID-19): Potential implications for weak health systems and conflict zones in the Middle East and North Africa region. *Int J Health Plann Manag* 2020, 35:1240–1245
8. GAFFNEY A, HIMMELSTEIN DU, WOOLHANDLER S. COVID-19 and US health financing: Perils and possibilities. *Int J Health Serv* 2020, 50:396–407
9. DE LEW N, GREENBERG G, KINCHEN K. A layman's guide to the US health care system. *Health Care Financ Rev* 1992, 14:151–169
10. GALVANI AP, PARPIA AS, PANDEY A, ZIMMER C, KAHN JG, FITZPATRICK MC. The imperative for universal healthcare to curtail the COVID-19 outbreak in the USA. *EClinicalMedicine* 2020, 23:100380
11. KING JS. Covid-19 and the need for health care reform. *N Engl J Med* 2020, 382:e104
12. BLUMENTHAL D, FOWLER EJ, ABRAMS M, COLLINS SR. Covid-19 – implications for the health care system. *N Engl J Med* 2020, 383:1483–1488
13. ALDERWICK H, DUNN P, DIXON J. England's health policy response to Covid-19. *Br Med J* 2020, 369:m1937
14. KIRCHHOF P. A tale of two countries: How decentralized organ-

ization and long-term investment build resilient healthcare systems. *Eur Heart J Qual Care Clin Outcomes* 2020, 6:201–203
15. FRAIOLI P (ed). France's response to COVID-19. *Strategic Comments* 2020, 26:iv-vi; doi: 10.1080/13567888.2020.1805910
16. CHATTU VK, ADISESH A, YAYA S. Canada's role in strengthening global health security during the COVID-19 pandemic. *Glob Health Res Policy* 2020, 5:16
17. LINDSTRÖM M. The COVID-19 pandemic and the Swedish strategy: Epidemiology and postmodernism. *SSM Popul Health* 2020, 11:100643
18. URSIN G, SKJESOL I, TRITTER J. The COVID-19 pandemic in Norway: The dominance of social implications in framing the policy response. *Health Policy Technol* 2020, 9:663–672
19. HIGGINSON S, MILOVANOVIC K, GILLESPIE J, MATTHEWS A, WILLIAMS C, WALL L ET AL. COVID-19: The need for an Australian economic pandemic response plan. *Health Policy Technol* 2020, 9:488–502
20. ARMOCIDA B, FORMENTI B, USSAI S, PALESTRA F, MISSONI E. The Italian health system and the COVID-19 challenge. *Lancet Public Health* 2020, 5:e253
21. GIANNOPOULOU I, TSOBANOGLOU GO. COVID-19 pandemic: Challenges and opportunities for the Greek health care system. *Ir J Psychol Med* 2020, 37:226–230
22. THE LANCET PUBLIC HEALTH. COVID-19 in Spain: A predictable storm? *Lancet Public Health* 2020, 5:e568
23. ILIOPOULOS DC. COVID-19: A Greek perspective. *J Card Surg* 2020, 36:1637–1640
24. LITEWKA SG, HEITMAN E. Latin American healthcare systems in times of pandemic. *Dev World Bioeth* 2020, 20:69–73
25. MBUNGE E. Effects of COVID-19 in South African health system and society: An explanatory study. *Diabetes Metab Syndr* 2020, 14:1809–1814
26. DAVIES N, SWEENEY S, TORRES-RUEDA S, BOZZANI F, KITSON N, BARASA E ET AL. The impact of coronavirus disease 2019 (COVID-19) on health systems and household resources in Africa and South Asia. *MedRχiv* 2020, doi: 10.1101/2020.05.06.20092734
27. KHALID A, ALI S. COVID-19 and its challenges for the healthcare system in Pakistan. *Asian Bioeth Rev* 2020, 12:551–564
28. NEPOMNYASHCHIY L, DAHN B, SAYKPAH R, RAGHAVAN M. COVID-19: Africa needs unprecedented attention to strengthen community health systems. *Lancet* 2020, 396:150–152
29. LONE SA, AHMAD A. COVID-19 pandemic – an African perspective. *Emerg Microbes Infect* 2020, 9:1300–1308
30. THIAGARAJAN K. Covid-19 exposes the high cost of India's reliance on private healthcare. *Br Med J* 2020, 370:m3506
31. DAHAB M, VAN ZANDVOORT K, FLASCHE S, WARSAME A, RATNAYAKE R, FAVAS C ET AL. COVID-19 control in low-income settings and displaced populations: What can realistically be done? *Confl Health* 2020, 14:54
32. DE GUZMAN R, MALIK M. Dual challenge of cancer and COVID-19: Impact on health care and socioeconomic systems in Asia Pacific. *JCO Glob Oncol* 2020, 6:906–912
33. OKSUZ E, MALHAN S, GONEN MS, KUTLUBAY Z, KESKINDEMIRCI Y, TABAK F. COVID-19 healthcare cost and length of hospital stay in Turkey: Retrospective analysis from the first peak of the pandemic. *Health Econ Rev* 2021, 11:39
34. WANG Q, SHI N, HUANG J, CUI T, YANG L, AI J ET AL. Effectiveness and cost-effectiveness of public health measures to control COVID-19: A modelling study. *MedRχiv* 2020, 1–25; doi: 10.1101/2020.03.20.20039644
35. DORN F, KHAILAIE S, STOECKLI M, BINDER SC, LANGE B, LAUTENBACHER S ET AL. The common interests of health protection and the economy: Evidence from scenario calculations of COVID-19 containment policies. *MedRχiv* 2020, doi: 10.1101/2020.08.14.20175224
36. SJÖDIN H, JOHANSSON AF, BRÄNNSTRÖM Å, FAROOQ Z, KRIIT HK, WILDER-SMITH A ET AL. Erratum to: COVID-19 healthcare demand and mortality in Sweden in response to non-pharmaceutical mitigation and suppression scenarios. *Int J Epidemiol* 2021, 50:352
37. THOMPSON RN, HOLLINGSWORTH TD, ISHAM V, ARRIBAS-BEL D, ASHBY B, BRITTON T ET AL. Key questions for modelling COVID-19 exit strategies. *Proc Biol Sci* 2020, 287:20201405
38. CHAMBOREDON P, ROMAN C, COLSON S. COVID-19 pandemic in France: Health emergency experiences from the field. *Int Nurs Rev* 2020, 67:326–333
39. ATLANI-DUAULT L, CHAUVIN F, YAZDANPANAH Y, LINA B, BENAMOUZIG D, BOUADMA L ET AL. France's COVID-19 response: Balancing conflicting public health traditions. *Lancet* 2020, 396:219–221
40. ANDERSON RM, HOLLINGSWORTH TD, BAGGALEY RF, MADDREN R, VEGVARI C. COVID-19 spread in the UK: The end of the beginning? *Lancet* 2020, 396:587–590
41. GRAFTON RQ, PARSLOW J, KOMPAS T, GLASS K, BANKS E, LOKUGE K. Health and economic effects of COVID-19 control in Australia: Modelling and quantifying the payoffs of "hard" versus "soft" lockdown. *MedRχiv* 2020; doi: 10.1101/2020.08.31.20185587
42. COVID-19 HOSPITAL RELIEF ACT. Financial support for hospitals. Available at: https://www.ingsa.org/covid-19-policy-tracker/europe/Germany
43. REED S. Resuming health services during the Covid-19 pandemic: What can the NHS learn from other countries? Briefing 2020, Nuffield Trust. Available at: https://www.nuffieldtrust.org.uk/files/2020-07/resuming-health-services-web.pdf
44. TIIRINKI H, TYNKKYNEN LK, SOVALA M, ATKINS S, KOIVUSALO M, RAUTIAINEN P ET AL. COVID-19 pandemic in Finland – preliminary analysis on health system response and economic consequences. *Health Policy Technol* 2020, 9:649–662
45. BAMBER P, FERNANDEZ-STARK K, TAGLIONI D. Why global value chains remain essential for COVID-19 supplies. VoxEU, 2020. Available at: https://voxeu.org/content/why-global-value-chains-remain-essential-covid-19-supplies
46. GEREFFI G. What does the COVID-19 pandemic teach us about global value chains? The case of medical supplies. *J Int Bus Policy* 2020, 3:287–301
47. CORONINI-CRONBERG S, MAILE EJ, MAJEED A. Health inequalities: The hidden cost of COVID-19 in NHS hospital trusts? *J R Soc Med* 2020, 113:179–184
48. ROEHR B. The health of private insurance in the US during Covid-19. *Br Med J* 2020, 370:m2606
49. ANOUSHIRAVANI AA, O'CONNOR CM, DI CAPRIO MR, IORIO R. Economic impacts of the COVID-19 crisis: An orthopaedic per-

spective. *J Bone Joint Surg Am* 2020, 102:937–941
50. McMAHON M, NADIGEL J, THOMPSON E, GLAZIER RH. Informing Canada's health system response to COVID-19: Priorities for health services and policy research. *Healthc Policy* 2020, 16:112–124
51. WIJESOORIYA NR, MISHRA V, BRAND PLP, RUBIN BK. COVID-19 and telehealth, education, and research adaptations. *Paediatr Respir Rev* 2020, 35:38–42
52. KEESARA S, JONAS A, SCHULMAN K. Covid-19 and health care's digital revolution. *N Engl J Med* 2020, 382:e82
53. AL-SHAMSI HO, AL-HAZZANI W, AL-HURAIJI A, COOMES EA, CHEMALY RF, ALMUHANNA M ET AL. A practical approach to the management of cancer patients during the novel coronavirus disease 2019 (COVID-19) pandemic: An international collaborative group. *Oncologist* 2020, 25:e936–e945
54. GADZINSKI AJ, GORE JL, ELLIMOOTTIL C, ODISHO AY, WATTS KL. Implementing telemedicine in response to the COVID-19 pandemic. *J Urol* 2020, 204:14–16
55. KICHLOO A, ALBOSTA M, DETTLOFF K, WANI F, EL-AMIR Z, SINGH J ET AL. Telemedicine, the current COVID-19 pandemic and the future: A narrative review and perspectives moving forward in the USA. *Fam Med Community Health* 2020, 8:e000530
56. GILLMAN-WELLS CC, SANKAR TK, VADODARIA S. COVID-19 reducing the risks: Telemedicine is the new norm for surgical consultations and communications. *Aesthetic Plast Surg* 2021, 45:343–348
57. PORTNOY J, WALLER M, ELLIOTT T. Telemedicine in the era of COVID-19. *J Allergy Clin Immunol Pract* 2020, 8:1489–1491
58. OHANNESSIAN R, DUONG TA, ODONE A. Global telemedicine implementation and integration within health systems to fight the COVID-19 pandemic: A call to action. *JMIR Public Health Surveill* 2020, 6:e18810
59. HARE N, BANSAL P, BAJOWALA SS, ABRAMSON SL, CHERVINSKIY S, CORRIEL R ET AL. Work group report: COVID-19: Unmasking telemedicine. *J Allergy Clin Immunol Pract* 2020, 8:2461–2473.e3
60. BARNEY A, BUCKELEW S, MESHERIAKOVA V, RAYMOND-FLESCH M. The COVID-19 pandemic and rapid implementation of adolescent and young adult telemedicine: Challenges and opportunities for innovation. *J Adolesc Health* 2020, 67:164–171
61. RAJASEKARAN K. Access to telemedicine – are we doing all that we can during the COVID-19 pandemic? *Otolaryngol Head Neck Surg* 2020, 163:104–106
62. AJIBADE A, YOUNAS H, PULLAN M, HARKY A. Telemedicine in cardiovascular surgery during COVID-19 pandemic: A systematic review and our experience. *J Card Surg* 2020, 35:2773–2784
63. OMBONI S. Telemedicine during the COVID-19 in Italy: A missed opportunity? *Telemed J E Health* 2020, 26:973–975
64. PEINE A, PAFFENHOLZ P, MARTIN L, DOHMEN S, MARX G, LOOSEN SH. Telemedicine in Germany during the COVID-19 pandemic: Multi-professional national survey. *J Med Internet Res* 2020, 22:e19745

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