

## Functioning of Health Care During the COVID-19 Pandemic – Review of Literature

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### Abstract

**Purpose:** A review of the literature on reorganization of the health care system in selected medical specializations during the COVID-19 pandemic.

**Design/methodology/approach:** A review and analysis of available scientific literature from ScienceDirect, Google Scholar, PubMed and other scientific sources, and data analysis using Microsoft Excel. Articles were found using specific keywords, then they were assessed in detail against the criteria set by the authors.

**Findings:** The COVID-19 pandemic caused many organizational changes in health care. As a result of activities limiting the spread of COVID-19 in medical facilities, the following were observed: increased use of telemedicine to contact medical staff, limited access to physicians of various specialties, delayed diagnosis and treatment in many fields of medicine and also increased financial investment in the health care. Additionally, the pandemic reduced social contacts. It is forecast that after the pandemic, there will be an increase in demand for medical consultations due to undiagnosed and untreated patients during the pandemic.

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**Research limitations/implications:** A lack of scientific study with long-term data, a survey on a small group of respondents, studies from countries with different degrees of development (a more difficult comparative analysis), discrepancy of data in some studies due to insufficient research on the new virus – SARS-CoV-2.

**Originality/value:** The work collects data from various medical disciplines and presents the possible impact of reorganization on the post-pandemic situation. The article is original because of the combination of medical and management aspects of the health care organization during the pandemic.

**Keywords:** COVID-19, telemedicine, reorganization, access.

**JEL:** I100, I150

## Funkcjonowanie ochrony zdrowia podczas pandemii COVID-19 – przegląd literatury

### Streszczenie

**Cel:** przegląd literatury naukowej na temat reorganizacji w systemie ochrony zdrowia w wybranych specjalizacjach medycznych podczas pandemii COVID-19.

**Projekt/metodologia/podejście:** przegląd i analiza literatury dostępnej w ScienceDirect, Google Scholar, PubMed i w innych źródłach naukowych oraz opracowanie danych liczbowych z wykorzystaniem Microsoft Excel. Znalaziono artykuły, korzystając z określonych słów kluczowych, a następnie poddano je szczegółowej ocenie pod względem ustalonych przez autorów kryteriów.

**Wyniki:** pandemia COVID-19 spowodowała wiele zmian organizacyjnych w placówkach ochrony zdrowia. W wyniku działań ograniczających rozprzestrzenianie się COVID-19 w podmiotach leczniczych zaobserwowano: wzrost znaczenia telemedycyny w kontaktach z pracownikami ochrony zdrowia, utrudniony dostęp do lekarzy różnych specjalizacji, opóźnienie w diagnostyce i leczeniu w różnych dziedzinach medycyny, a także zwiększenie nakładów finansowych na ochronę zdrowia. Dodatkowo pandemia spowodowała zredukowanie kontaktów społecznych. Prognozy dotyczące sytuacji po pandemii pokazują, że będzie miała ona wpływ na wzrost zapotrzebowania na konsultacje lekarskie z powodu pacjentów niezdiagnozowanych i nieleczonych w związku z sytuacją epidemiologiczną.

**Ograniczenia/implikacje badawcze:** brak badań zawierających długoterminowe dane, badania przeprowadzane na niewielkich grupach badawczych, badania przeprowadzane w krajach o różnym stopniu rozwoju (trudniejsza analiza porównawcza), rozbieżność danych w niektórych pracach wynikająca z braku dostatecznej liczby badań nad nowym wirusem.

**Originalność/wartość artykułu:** praca zbiera dane dotyczące różnych dziedzin medycyny oraz możliwego wpływu reorganizacji w systemie ochrony zdrowia na sytuację po pandemii. Artykuł jest oryginalny pod względem połączenia aspektów medycznych oraz kwestii zarządzania w pracy personelu medycznego podczas pandemii COVID-19.

**Słowa kluczowe:** COVID-19, telemedycyna, reorganizacja, dostęp.

### 1. Purpose

A review of the literature on reorganization of the health care system in selected medical specializations during the COVID-19 pandemic. A description of the limitations on access to health protection arising from the pandemic and the actions taken to reduce the risk of infection of patients and medical staff with SARS-CoV-2 virus in medicinal entities.

## 2. Methodology

A review and analysis of available scientific literature from ScienceDirect, Google Scholar, PubMed and other scientific sources.

Publications were searched by keywords: health care of COVID-19, effects of the pandemic in health care, reorganization of health care, restrictions in access to health care due to the pandemic, organizational changes in the health care system, effects of the pandemic on the health care system, health care COVID-19, health care during a pandemic, telemedicine in COVID-19 pandemic, cost-effectiveness of telemedicine, economic effects of pandemic.

After analyzing the titles and abstracts of the articles in databases, 161 source items were selected, of which 68 have been used in this review after analyzing the whole text. The most important criteria for including an article were: the year of publication (almost exclusively articles published after the outbreak of the COVID-19 pandemic, i.e. from 2020–2021, were used), an appropriate research sample (only those studies with the largest research samples were selected), language of publication (only articles in Polish and English were included).

As for the exclusion criteria, the most important of them were: the language of the publication (sources in a language other than Polish and English were rejected) and year of publication (publications issued before 2019 were rejected).

Then, the articles were assessed in terms of content and the analysis included studies directly related to the broadly understood functioning of the health care system in the times of the COVID-19 pandemic. Because the medical specialty range is very broad, it was decided to analyze the situations in selected non-surgical and surgical specialties which are most frequently resorted to by patients and for which the data available was the largest. The publications selected for the manuscript were mainly from developed countries where health-care spending (as a percent of GDP) is higher than in Poland and as these countries submitted the largest amount of data.

The data requiring processing in order to create graphs was elaborated using the functions of Microsoft Excel 2010.

## 3. Introduction

The severe acute respiratory syndrome coronavirus (SARS-CoV-2) is a novel, zoonotic, single-stranded RNA betacoronavirus from sub-family Orthocoronaviridae (Gangqiang et al., 2020). The virus was identified in Wuhan, China in December 2019. On December 20, 2020, 74 299 042 confirmed cases of COVID-19, including 1 669 982 deaths, were reported to WHO (Dotters-Katz & Hughes, 2020; WHO, 2020). The disease varies

in severity from a cold to pneumonia and death. COVID-19 is airborne contagion (Dotters-Katz & Hughes, 2020).

On March 11, 2020, the World Health Organization (WHO) declared a global COVID-19 pandemic (Gangqiang et al., 2020). The pandemic has a significant impact on every area of life. The rapid spreading of coronavirus SARS-CoV-2 is a real challenge for the whole world. One of the most important strategies during the pandemic are social distancing measures and providing access to health care. To provide access to health care, it was necessary to introduce numerous changes in the functioning of different fields of medicine. The concept of functioning includes a comprehensive organization of the health care, access to medical help for a community, limitations and challenges which must be faced to ensure safety and access to professional treatment.

One of the forms which allows to control the virus and provides access to medical consultation is telemedicine (TM) (Vidal-Alaball et al., 2020). The main role of TM is to consult mildly ill patients, older patients and patients with chronic diseases, which minimizes their exposure to other ill patients. TM can also be used to triage COVID-19 (Portnoy, Waller, & Elliott, 2020). Despite TM's advantages, this is a very difficult issue because normal physical examination is not possible. It is a problem especially in younger children because they have nonspecific symptoms. In these cases, particularly important is a detailed description of patients' complaints (Mahajan, Singh, & Chandrika, 2020).

The SARS-CoV-2 pandemic caused a delay in diagnosing and treating diseases. The reasons for this situation depend on the health care (delayed surgical operations, understaffing, a small amount of personal protective equipment) and on patients (travel and financial problems) (Kumar & Dey, 2020). COVID-19 has also caused, for example, drastic changes in cancer management and has a negative impact on cancer treatment (Bogani et al., 2020; Glasbey & Bhangu, 2020; Ürün et al., 2020). During the initial phase of the SARS-CoV-2 pandemic, approximately 2.3 million oncological operations were postponed because of the risk of in-hospital transmission. Hospitals also reduced elective surgery activity to release surgical team members to other works (Glasbey & Bhangu, 2020). COVID-19 is a high risk to oncological patients who have different predisposing factors, treatment-related immunosuppression and comorbidities (Bogani et al., 2020; Ürün et al., 2020).

The pandemic created challenges for management in the health care. Delays in deliveries caused problems to hospitals such as the lack of personal protective equipment (Iyengar, Vaishya, Bahl, & Vaish, 2020; Fanelli, Lanza, Francesconi, & Zangrandi, 2020). Medical facilities had to restructure logistics, improve coordination, develop crisis management plans and conduct training for medical staff (Fanelli et al., 2020).

The COVID-19 pandemic also changed the economic field. The health care required more funds to organize telemedicine, temporary hospitals, vaccines and others (Business Insider, 2020; Minister Zdrowia, 2020; Narodowy Fundusz Zdrowia, 2021; Ojczyk, 2021; Skóbel, Kocemba, & Rudka, 2021). These aspects show how many medical fields are affected by the COVID-19 pandemic and its huge impact on ill people all over the world.

The topic of the article is important because it describes the scale of problems with access to health care during the pandemic. The data contained in the work reveals how some decisions in changing the organization of medical facilities have affected the functioning of patients in the health system. Additionally, the pandemic has proved that solutions introduced because of it could be useful on a large scale in primary health care in the future (Jazieh & Kozlakidis, 2020; Vaccaro, Getz, Cohen, Cole, & Donnally, 2020).

#### 4. General Practitioners

One area of medicine that has been affected by the SARS-CoV-2 coronavirus pandemic is family medicine (general practitioners). One of the problems of general practitioners is risk of infection, so stationary visits are limited to the minimum. Currently, telemedicine is of great importance. Its main advantage is the speed of operation and the ability to service a large number of patients (Brown, Gregory, & Gray, 2020; Liu et al., 2020). Unfortunately, telemedicine does not allow direct examination of the patient. There is also scientific evidence that remote consultation is less effective than a direct visit. Physical examination reduces the number of additional tests (e.g. laboratory). It also helps to develop the relationship and trust between the patient and the physician, and telemedicine does not allow such relationships to be built (Brown et al., 2020; de Zulueta, 2020). Some patients, due to limitations in access to electronic equipment or its operation, cannot use a video transmission and then the diagnosis is based only on a medical interview. 10% of Americans do not have a smartphone and 27% do not have access to broadband internet (Rajasekaran, 2020). In Poland, these indicators are even lower – over 24% of people do not have access to a smartphone and 29.5% do not have access to the internet (UKE, 2019). Age is a factor that limits access to telemedicine (Zhai, 2021). Among seniors (60+) in Poland, only 30% of people use the internet. Besides limitations in access to telemedicine, this can cause social consequences (UKE, 2019a). Disability, especially in the field of speech and hearing, is also one of the most important factors influencing the limitations in accessing online medicine (Zhai, 2020).

Benefits for the patients resulting from telemedicine include the fact that patients do not have to travel to the doctor's office, which saves their time and facilitates access for people who live far away from health care units (Brown et al., 2020). Locke et al. conducted a survey on telemedicine and stationary visits. The study involved 102 people. 23% of respondents said they preferred

a visit to the office, while 45% did not take a position on the matter. 33% of respondents indicated that they did not agree with the statement that they preferred an in-office visit. The authors divided data into categories: age, gender, proximity to hospital and type of visit. Only proximity to the hospital was statistically significant ( $p < 0.05$ ). Patients living close to the medicinal center were more likely to have a stationary visit (Locke et al., 2020).

For doctors, paradoxically, telemedicine means more work – even by  $\frac{1}{3}$ . Additionally, the COVID-19 pandemic is having an impact on their mental health, especially burnout. Even before the SARS-CoV-2 pandemic burnout among general practitioners affected 33% doctors. In the face of new challenges, these indicators can be even higher. Medical burnout is a huge economic loss – only in the United States it is estimated at USD 4.6 billion annually (Brown et al., 2020).

In addition to the mental health impact of the pandemic, health care must also struggle with the shortage of workers and equipment (de Sutter et al., 2020). Family medicine (general practitioners), in the face of the pandemic, had to introduce numerous changes in the procedures. General practitioners have a huge role in patient care and also they are of great importance in fighting with the COVID-19 pandemic (de Sutter et al., 2020; Sahin & Sahin, 2020).

## 5. Cardiology

Cardiac patients infected with COVID-19 have a higher risk of complications: development of acute respiratory distress syndrome, myocardial infarction, cardiogenic shock, thromboembolic event, thrombosis and its consequences (Bonow, O’Gara, & Yancy, 2020). During the COVID-19 pandemic, a reduced number of cardiological consultations is observed, probably because of the fear of infection (Cannata, Bromage, & McDonagh, 2020).

During the pandemic, 40% fewer myocardial infarctions were registered in the UK. There was also a 46% reduction in ordering laboratory tests of cardiac troponin T, a 87% reduction in doing 12-lead electrocardiograms and others, e.g. routine dobutamine stress echocardiograms were completely canceled (Omar et al., 2020). In patients with myocardial infarction, an extension of time was observed from the first symptoms to medical action (from 82 minutes before the pandemic to 318 minutes during the pandemic) (Rodríguez-Leor, 2020). This could result in a significantly increased number of patients and an increase in cardiac mortality after the pandemic (Cannata et al., 2020; Omar et al., 2020). Despite data presenting a reduction in the number of myocardial infarctions, in the future, a significant increase in the demand for treatment of COVID-19 complications (myocarditis, myocardial infarction, heart failure) is possible (Omar et al., 2020).

The COVID-19 pandemic restricts access for emergencies, which may be due to difficult transport of patients between hospitals, a reduced number

of available beds and fewer physicians because of their virus infection. To improve the organization, it is worth appointing the leader who will be responsible for monitoring the patients flow, staff shortages and necessary equipment (National Health Service, 2020).

To limit the spread of COVID-19, teleconsultations, virtual clinics and restricted referral of urgent patients to specialists were introduced. According to a UK research study, this strategy contributed to a 80% reduction in referrals from primary care to cardiology specialists and a 93% reduction of stationary visit for cardiac reasons (Omar et al., 2020). Medical visits should be restricted only for urgent cases: myocardial infarction, advanced heart failure and uncontrolled arrhythmias. Planned hospital admissions and visits should be postponed. An additional problem may be access to imaging tests, especially computer tomography, which is used for lung examination in patients with COVID-19 (National Health Service, 2020). The discussions about patients' cases at meetings of multidisciplinary teams were not abandoned, but they were changed to video meetings. Cardiological rehabilitation was introduced as online exercises programs and patients were equipped with sphygmomanometers (Omar et al., 2020).

## 6. Nephrology

Patients with severe kidney disease are usually older people with concomitant diseases (Suri et al., 2020). In consequence, the risk of complications related to COVID-19 infection is much higher. Therefore, it is recommended to use telemedicine, limit face-to-face visits only to necessary cases, regularly measure blood pressure and weight by patients at home (Suri et al., 2020; White et al., 2020). Multidisciplinary care should also use online communication (White et al., 2020).

In order to reduce the risk of COVID-19 infection in hemodialysis patients, it is beneficial to increase the distance between dialysis stations, to apply barriers between them and to create new stations in isolation rooms (Suri et al., 2020). An important strategy that also reduces the spread of COVID-19 is waiting for a visit outside of the hospital or in a patient's car, disinfecting the dialysis stations and pressure cuffs (Kligerb & Silberzweig, 2020). Patients with COVID-19 should be dialyzed in isolation rooms, but if this is not possible, they should be dialyzed together after other patients (Suri et al., 2020).

Difficulties may also be caused by a reduced number of medical staff because of infection or quarantine or by limited access to creation of arteriovenous fistulae (Suri et al., 2020; White et al., 2020). In some hospitals in the USA, there was a problem with access to hemodialysis even in patients with acute kidney injury (AKI) (Suri et al., 2020). This situation may require extending staff working time, limiting time of dialysis or if it is possible, reducing the number of dialysis from 3 to 2 per week (Patel et al., 2020; Suri



et al., 2020). An alternative solution to this problem is peritoneal dialysis with online follow-up visits. As a result of the COVID-19 pandemic, donor programs are restricted and there is a necessity of administering COVID-19 tests for potential donors. This caused a decrease in the number of kidney transplants (Patel et al., 2020).

## 7. Gastroenterology

During the COVID-19 pandemic, limited access to gastroenterological visits and investigation was noted. A survey from the USA noticed partial or complete closure of clinics in 75.3% of institutions, but 95.9% of institutions use telemedicine. The same scientific study shows a reduction in the number of endoscopic procedures by at least 90% in 64.8% of institutions and postponed screening colonoscopy in 97.3% of institutions (Forbes et al., 2020).

Endoscopic procedures are associated with the high risk of COVID-19 infection of personnel and next patients as a result of exposure to the aerosol. Therefore, it is necessary to use advanced personal protective equipment, abide by the rules of sterilization of endoscopes and of disinfection of operating rooms (Danese et al., 2020; Tay, Teh, Wang, & Ang, 2020).

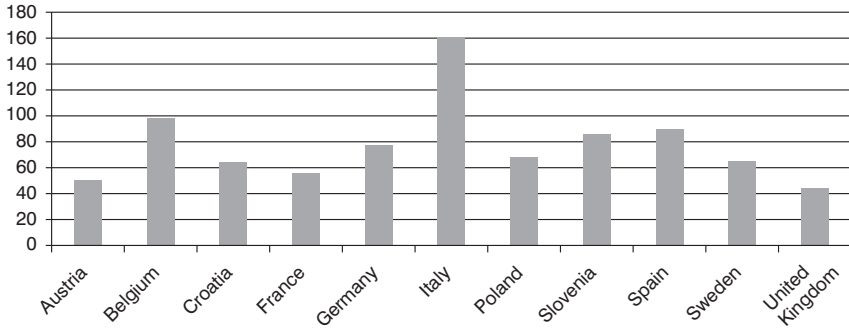
Patients treated with immunosuppressants for inflammatory bowel diseases or organ transplants may have a greater risk of contracting COVID-19. For this reason, in order to limit their hospital visits, if there is a need to introduce a new medication, preparations which patients can make at home are preferred (Danese et al., 2020). Another scientific study in the USA shows that 95.2% of physicians believe that telemedicine can be useful after the COVID-10 pandemic and 87.5% believe that it would increase access to physicians in gastroenterology (Keihanian, Sharma, Goyal, Sussman, & Girotra, 2020).

## 8. Surgery

The COVID-19 pandemic impact on surgery was very severe. The main problem is the reduction in the number of surgical operations performed (Ng, Ho, Dharmaraj, Wong, & Choong, 2020; O'Reilly-Shah et al., 2020; Shafi, Atieh, Harky, Sheikh, & Awad, 2020).

One of studies evaluated the use of mobile application for anesthesiologists for dose determination for general anesthesia to assess the problem of reducing the number of operations. The application is mainly used for the calculation of children's anesthesia doses (75% of the applications for children < 12 years old). Therefore, the study illustrates the most impact on child surgery. Doctors around the world use the application, so this is one of the few studies that analyze the impact of the pandemic on surgery globally. In most of the countries analyzed, the number of applications has decreased significantly, which shows that the problem of the operations canceled by the coronavirus SARS-CoV-2 pandemic is really serious (O'Reilly-Shah et al., 2020).





Baseline: 1 September to 1 November 2019

Fig. 1. Change in app use as a percentage of baseline (selected countries). Source: Based on O'Reilly-Shah, V. N., Van Cleve, W., Long, D. R., Moll, V., Evans, F. M., Sunshine, J. E., ... Jabaley, C. S. (2020b). Impact of COVID-19 response on global surgical volumes: an ongoing observational study. *Bulletin of the World Health Organization*, 98(10), 671–682. <https://doi.org/10.2471/blt.20.264044>.

Another scientific work also provides data on the decline of operations during the pandemic. One hospital in London saw a significant decrease in the number of operations performed especially after 23 March, when the pandemic broke out in the UK.

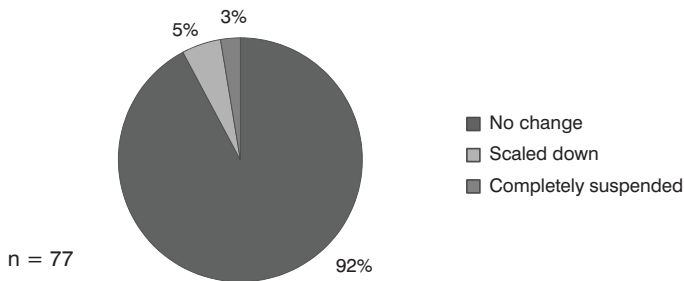


Fig. 2. Emergency surgery state (questionnaire survey). Source: Based on Ng, J. J., Ho, P., Dharmaraj, R. B., Wong, J. C. L., & Choong, A. M. T. L. (2020). The global impact of COVID-19 on vascular surgical services. *Journal of Vascular Surgery*, 71(6), 2182–2183. e1. <https://doi.org/10.1016/j.jvs.2020.03.024>.

The main problem of the COVID-19 pandemic is the limitation of access to surgical operations for patients with side effects. For patients, a revoked operation is not only an emotional but also an economic and social impact, not least because of absenteeism at work caused by the disease. The effect can also be the reduced average life of those patients whose operations

have been canceled. The factors that determine the effects most strongly are the duration and intensity of the ongoing pandemic (Søreide et al., 2020). The pandemic has a negative impact on doctors, especially those who are just acquiring surgical skills. A limited number of operations have affected education, the conduct of surgical examinations and the conduct of surgical research (Al-Benna, 2020).

## 9. Oncology

The COVID-19 pandemic is causing many organizational problems in oncology. Difficult decisions caused by the pandemic can also have a great impact on increased mortality of oncology patients (Lancet Oncology, 2020). In the UK, an over 50% reduction in referrals of patients from general practitioners to oncologists was observed because of closure of GP practices (Leung, Lin, Chow, & Harky, 2020). Scientific data from the United States and from the UK shows that the pandemic has significantly influenced the treatment of patients with active cancer (Hui et al., 2020; Lancet Oncology, 2020).

The ways the COVID-19 affected oncology patients	
Anti-cancer treatments continued	41%
Unable to attend the clinic due to curfew	38%
My doctor advised me not to come to appointment	20%
I was worried about catching COVID-19 in the hospital	17%
My anti-cancer treatments stopped or were delayed	11%
Unable to attend due to transportation issues	7%
News and social media have impacted me	5%
I have asked to stop or hold treatment	2%
My family has asked me not to attend	1%

*Tab. 1. The ways COVID-19 affected oncology patients. Source: Based on Tashkandi, E., BaAbdullah, M., Zeeneldin, A., AlAbdulwahab, A., Elemam, O., Elsamany, S., ... Jazieh, A.R. (2020). Optimizing the Communication with Cancer Patients During the COVID-19 Pandemic: Patient Perspectives, Patient Preference and Adherence, 14, 1205–1212. <https://doi:10.2147/PPA.S263022>.*

Particular attention was given to an extended diagnosis and screening time. It could result in many thousands of undetected and untreated cases (Lancet Oncology, 2020; Leung et al., 2020). In the survey, 22% of oncological patients answered that COVID-19 has no effect on them, but

78% of respondents noticed that the virus affects many aspects of treatment (Tashkandi et al., 2020).

In the United States, 71.5% of surgeons reported cancelling or postponing cancer surgery. 64.4% of oncologists and 73.4% of radiation oncologists reported altering their patients' plans (Glasbey & Bhangu, 2020; Hui et al., 2020). Some elective surgical operations were performed in the case of patients with resectable cancer with risk of progression and patients with cancer who would not respond to the alternative treatment (Glasbey & Bhangu, 2020). According to the research in the UK, the pandemic reduced the numbers of patients who receive chemotherapy by 30%. In the group of these patients, there are people whose therapy was postponed by the hospital or people who postponed it themselves (Leung et al., 2020). In another scientific study, physicians declared that they had altered a treatment plan because of patients' age (80%) and concomitant diseases (90%) (Ürün et al., 2020). These problems affect patients because of the particular nature of their disease. They require frequent oncological consultations, but COVID-19 might be a greater risk to them than to the general population (Hui et al., 2020; Ürün et al., 2020).

Patients with cancer are predisposed to complications caused by COVID-19 because of treatment-related immunosuppression, comorbidities and the cancer itself. The challenge for oncologists is to make a choice between a high risk of infection for their patients and benefits from the treatment of cancer (Ürün et al., 2020). The significant point is patients' attitude to continuing oncological treatment, which physicians should consider in their opinion. The Indian research shows that 68% of patients want to continue their chemotherapy and 72% of patients are afraid that cancer will progress and that they could contract infections (Ghosh et al., 2020).

The SARS-CoV-2 pandemic caused significant changes in treatment. In the UK, the systemic anticancer therapy is, for example, administered at home or elsewhere outside the hospital, which reduces a patient's risk of infection. Alternative, oral chemotherapy is recommended in these cases. In some cancers, the period between doses of medications is extended, which also reduces the number of hospital visits. Another recommendation is to stop maintenance chemotherapy, which is usually associated with maintenance immunotherapy, and only immunotherapy is ordered to continue. This treatment aims at reducing the toxicity of therapy. Another method is prescribed prophylactic daily granulocyte-colony stimulating factors (G-CSF), which assists in preventing neutropenic fever (Leung et al., 2020).

Scientific data reveals that 80% of oncologists have used telemedicine during the COVID-19 pandemic (Ürün et al., 2020). In a questionnaire survey, respondents indicated phone calls as the best form of communication

and cancer patients benefit from new ways of communication with their physicians (Tashkandi et al., 2020).

An American scientific study presents an important point, which is “COVID-19-free surgical pathways”. The results of the research indicate that pulmonary postoperative complications are decreasing in “COVID-19-free surgical pathways” compared to postoperative SARS CoV-2 infection because the method of isolation reduces the risk of viral infection. The “COVID-19-free surgical pathways” are the most effective in regions with the highest incidence of SARS-CoV-2. However, when these pathways and separate hospitals for only elective surgery are created, it can have a negative impact on other medical institutions (understaffed) (Glasbey & Bhangu, 2020).

A delay in treatment (surgery, radiotherapy, chemotherapy) reduces the efficacy of a therapy, survival rate and quality of life (QOL). This situation has a psychological impact on patients, such as fear of cancer progression or recurrence. Also patients who required palliative treatment, in case of a delay, may experience exacerbation of symptoms. Particularly important for these patients is the relation between the patient and the physician, which ensures a reduction of mental stress (Kumar & Dey, 2020).

After the pandemic, as increased requirement for oncology consultations is forecast because of delayed diagnostics and deferred treatment. This situation will pose a threat of an ineffective health care system, which could cause increased oncology patients mortality (Hui et al., 2020; Lancet Oncology, 2020).

## 10. Obstetrics and Gynecology

COVID-19 has a significant impact on obstetrics departments. Scientific studies show that the risk of infection and mortality in pregnant women is at the same level as in non-pregnant women of the same age (Dotters-Katz & Hughes, 2020; Osanan, Vidarte, & Ludmir, 2020). However, other scientific research indicates an increased risk of COVID-19 infection and a severe course of the disease during pregnancy, first of all pneumonia and respiratory failure (Boelig et al., 2020; Chua, Lee, Sulaiman, & Tan; 2020; Stephens, Barton, Bentum, Blackwell, & Sibai, 2020). Severe maternal infection can also result in fetal complications: rupture of membranes, preterm delivery, Cesarean section, fetal heart rate abnormalities, stillbirth, neonatal death and admission to the intensive care unit (Boelig et al., 2020; Stephens et al., 2020).

The pandemic caused a reorganization in obstetrics departments that prevents the spread of the virus (Jago, Singh, & Moretti, 2020; Osanan et al., 2020; Stephens et al., 2020). The main preventive strategy is the use of telemedicine on a large scale (Jago et al., 2020; Osanan et al., 2020). During

the first medical consultation of the patient and during the consultation which takes place 6 months after the last consultation, a video call should be used (Bindra, 2020). Another change in the organization of obstetrics department work is a reduction of the number of visits in hospitals and a limited number of people present at the delivery (Boelig et al., 2020; Jago et al., 2020; Stephens et al., 2020). An important point in avoiding the spread of virus is also to instruct a patient that two weeks before the anticipated date of delivery it is recommended that a pregnant woman take administrative leave or start a home office and practice social isolation (Boelig et al., 2020).

Significant information is that COVID-19 infection during pregnancy is not an indication for hospitalization. In pregnant women with a mild course of the disease and without concomitant diseases, the COVID-19 infection can be treated symptomatically at home with access to a physician by telehealth visits (Dotters-Katz & Hughes, 2020). In the case of severe COVID-19 infection, delivery at 32 weeks should be taken into consideration (Stephens et al., 2020). For routine prenatal care, telemedicine, routine ultrasonography with an online consultation after imaging, a medical home visit and “drive through” (visit in a car) can be used (Dotters-Katz & Hughes, 2020; Osanan et al., 2020).

The pandemic also resulted in creating separate departments for infected patients, which caused the cancellation of planned leave for physicians. To prevent the spread of the virus among medical staff, physicians groups which are responsible only for one work area are created: screening team, suspect team, COVID team, non-COVID team, teleconsultation team, outpatient department team – OPD team. These physicians should work only in one group of people and they should not change their work area and shift work (Mahey et al., 2020). Another change in the organization is the recommendation to minimize the contact of a newborn with the COVID-19 positive mother’s body fluids (no delay in clamping the umbilical cord) and to isolate a newborn after delivery from the COVID-19 positive mother despite the absence of confirmation of vertical COVID-19 transmission (Chua et al., 2020; Dotters-Katz & Hughes, 2020; Jago et al., 2020; Stephens et al., 2020). This situation may have an impact on mothers’ increased levels of stress, anxiety and postpartum depression (Chua et al., 2020; Jago et al., 2020). Additionally, a pregnant woman is also affected by isolation from social life at home and from family members in the hospital due to the pandemic. To reduce the negative effects of isolation, the patient can be offered online meetings with relatives, chats with medical supports or other pregnant women and applications that help manage stress (Jago et al., 2020).

The most important factor influencing a woman’s health during pregnancy is undelayed access to appropriate medical care, which reduces the risk of

maternal and perinatal mortality. Delays during the pandemic may be caused by pregnant women's fear of infection, restricted transport, isolation due to the infection of COVID-19 and fewer obstetrics personnel (Osanan et al., 2020). A significant problem for pregnant women in access to a physician is the inability to choose a convenient date for them. The pandemic caused additional difficulties connected with the use of telemedicine, e.g. patients have no access to technology, and high costs for hospital. One of the options to reduce the need for visits to physicians is to propose the purchase of a scale and sphygmomanometer for home, but this will increase patients' expenses (Fryer, Delgado, Foti, Reid, & Marshall, 2020).

The changes are observed also in the field of gynecological oncology. The Society of Gynecologic Oncology (SGO) and the American College of Surgeons recommend limitation of medical visits and surgical operations to the necessary minimum. USA research reported that the average number of patients treated per week decreased by 61.6% and that delays in gynecological and oncological surgery were 2–4 weeks. A questionnaire survey in which respondents were physicians indicates that 96.1% of respondents notice that elective surgeries were cancelled, 81.3% notice that outpatient visits were cancelled and 95.7% experience a policy to encourage telemedicine. The greatest concerns of physicians are: delay in care, access to medical supplies and access to oncology treatment (Nakayama, El-Nashar, Waggoner, Traughber, & Kesterson, 2020).

In Italy, physicians reported that they had modified the gynecological method of treatment: resignation from surgical operations for other treatment to perform less radical surgical operations without lymphadenectomy. The type of surgical operations was also changed. 21% of physicians noticed a reduced number of laparoscopic surgeries. This situation is caused by the risk of exposure to aerosol from artificial pneumoperitoneum, which probably caused the transmission of COVID-19. This procedure is possibly safer for physicians but laparoscopic surgeries have fewer postoperative complications and make a hospital stay shorter, which results in less exposure to COVID-19 (Bogani et al., 2020). However, another study suggests that laparoscopic surgery does not result in increased exposure to COVID-19. This statement is based on the experience with another virus epidemic in which it was proved that the transmission of the virus during laparoscopic surgery to medical staff was virtually 1%. Even if it is possible that limited viruses may be transported by air, the operating room is a safe place because of the air filtration and circulation, sterile operative field and personal protective equipment (Morris, Fader, Milad, & Dionisi, 2020).

After the COVID-19 pandemic, a surgical backlog, patients with delayed treatment and returning to the original treatment regimen for delayed oncological patients will be the greatest challenge (Nakayama et al., 2020).

## 11. Pediatrics

There have also been changes in pediatrics due to the COVID-19 pandemic. During the pandemic, there was a significant decrease in the number of fractures among children. Before the pandemic, this was  $22.5 \pm 9.1$  / d, while during the pandemic it was  $9.6 \pm 5.1$  / d with  $p < 0.001$ , indicating high statistical significance. During the pandemic, an increase in the number of injuries at home and on the bicycle was recorded. However, the number of injuries related to sports and play in playgrounds decreased (Bram et al., 2020). The number of cases of infectious diseases other than COVID-19 such as common cold, bronchiolitis, acute otitis or gastroenteritis, also decreased. However, there was no difference in the number of urinary tract infections that were a control test in the study. Social distance does not affect the frequency of their occurrence (Angoulvant et al., 2020).

Children go through COVID-19 more mildly than adults, so the pandemic problem does not affect them directly but indirectly. Pediatricians are much more exposed to illness and severe courses (Christakis, 2020; Rezaei, 2020).

One of these indirect effects of the pandemic is the impact on mental health. Parents of many children are uncertain about the economic and health future and parents' stress affects health, from changes in the regulation of cortisol, as well as the function of the brain. Some children have lost their parents, grandparents or other relatives as a result of the pandemic, and without them they will also be affected in the future (Christakis, 2020).

Telemedicine is also used in pediatrics. This seems to be a safe form of treatment for pediatric patients, as diagnosis has been shown to be highly effective. In addition, pediatricians who, as mentioned earlier, are more exposed to COVID-19 are protected from infection (Haimi, Brammli-Greenberg, Baron-Epel, & Waisman, 2020; Rezaei, 2020).

## 12. Psychiatry

The COVID-19 pandemic contributed to a significant mental health deterioration in people (Sokół-Szawłowska, 2020; Talarowska, Chodkiewicz, Chodkiewicz, & Nawrocka-Miniszewska, 2020; Xiong et al., 2020). The systematic review of Xiong J. et al., based on a study of 19 pieces of research, has shown that the main problems are: anxiety, depression or post-traumatic stress disorder (PTSD) but also psychological distress and stress.

Women, young people (especially those with student status), chronic patients or unemployed people are particularly vulnerable. The risk factor is also the over-selling of information on pandemics, including in social media. The review includes data from the USA, Turkey, Spain, China, Nepal, Denmark, Italy and Iran (Xiong et al., 2020). The study on the



Polish population of Talarowska et al. has also shown a negative impact of the SARS-CoV-2 pandemic on people's mental health. The survey covered over 440 people. The main complaints are problems in the day-to-day operation, lack of satisfaction, exhaustion and sleep problems. Around 10% of people admitted that during the pandemic of the coronavirus, they had suicidal thoughts (Talarowska et al., 2020). Also, the review work of Sokół-Szawłowska based on literature from pre-pandemic and pandemic times has shown that quarantine has an impact on human mental health, mainly increasing the risk of anxiety and depression (Sokół-Szawłowska, 2020). Taking into account the data presented above, it is important that psychiatric care during the COVID-19 pandemic period works as efficiently as possible.

The main concern arising from stationary treatment is, as in other areas of medicine, the risk of SARS-CoV-2 infection in the personnel or patients (Kelly, 2020; Lazzari, Shoka, Nusair, & Rabottini, 2020). Therefore, the Scientific Section of Telemedicine of the Polish Psychiatric Association has issued recommendations about the conduct of online visits. It is noted that telemedicine is an effective and safe way of treating psychiatric patients and can even be more effective in many aspects than outpatient treatment (Krzystanek et al., 2020). However, one of the main problems is the decision which patients require fixed stationary treatment and who can participate in online treatment (Lazarri et al., 2020). The main challenges currently facing psychiatrists are: awareness of the risk of infection, introduction of remote work where possible and rostering in a reasonable manner (Kelly, 2020).

The COVID-19 pandemic is currently one of the biggest threats to public health. Because of the scale of the impact on mental health, psychiatric care is extremely important in these times, so attention must be given to ensuring the widest possible access to mental care.

### 13. Economy

Telemedicine is an alternative to other treatments and is economically viable. This applies to different areas of medicine (Atmojo, Sudaryanto, Widiyanto, & Arradini, 2020; Avidor, Loewenstein, Waisbourd, & Nutman, 2020; Eze, Mateus, & Cravo Oliveira Hashiguchi, 2020; Farabi et al., 2020; Jong et al., 2020). In addition, it does not necessarily mean that patient satisfaction is reduced (Atmojo et al., 2020; Eze et al., 2020). Telemedicine requires the implementation of appropriate software and patients must have telecommunications equipment so the most benefits of this form of healthcare are derived by highly developed countries. In underdeveloped countries, telemedicine can be more limited in its benefits (Farabi et al., 2020). However, even in highly developed countries, it has

been shown that telemedicine can be uneconomic. An example of this might be teledermatology, where the online consultation time is longer than for a visit to the office. There was no evidence of cost-effectiveness of teleconsultation for patients with heart failure (Eze et al., 2020). One systematic review provides data on the cost-effectiveness of screening programs for diabetic retinopathy. The main factors that influence the cost-effectiveness of these telemedicine programs are the doctor's time and the cost of traveling (Avidor et al., 2020). However, data on the cost-effectiveness of telemedicine (in the example of emergency medicine) in rural areas is limited (Tsou et al., 2020). In view of the above, it should be noted that there are many studies to confirm that telemedicine is cost-effective. However, there is evidence that not all areas of medicine are cost-effective in the form of telemedicine. Therefore, a thorough analysis of available scientific research should be carried out when deciding whether to introduce telemedicine for cost-cutting reasons.

Besides telemedicine, there were also other expenses that had to be financed from public funds to ensure the health care during the pandemic. In Poland, over PLN 50 million was allocated to construction of temporary hospitals to provide places to hospitalize infected patients. Additionally, PLN 19 million was collected for the subsequent restoration of these hospital of their previous function (Minister Zdrowia, 2020).

Another expense were COVID allowances for medical staff for which the Polish National Health Service transferred PLN 5.71 billion from the beginning of the pandemic. The COVID allowance is 100% addition to basic salary, but not more than PLN 15 thousand, for medical personnel working with infected or potentially infected patients (Ojczyk, 2021).

An additional cost related to the pandemic will be the rehabilitation program for patients after COVID-19, introduced in Poland in April 2021. Rehabilitation lasts from 2 to 6 weeks, it is refunded by the Polish National Health Service and it costs PLN 188 per one patient daily (Narodowy Fundusz Zdrowia, 2021).

The financing of the vaccination against SARS-CoV-2 is also a significant expense, but there is no reliable data available to inform about funds allocated for this purpose. Poland estimated the spending of PLN 38.05 on one vaccine, in 2020 the Polish government bought up to 100 thousand vaccines, in the forecasts for 2021 it is supposed to buy over 60 million and in 2022 over 1.5 million (Business Insider, 2020).

Expenditure on the health care in Poland has been stable for several years at 4.4–4.6% of GDP. The pandemic caused an increase in health costs, but for the present moment, there is no official data available for 2020 on health care expenditure as % of GDP (Skóbel, Kocemba, & Rudka, 2021).

## 14. Limitations of the Study

The results of this study should be viewed in the light of certain limitations. The main of them are: issues with the sample and selection of data and limited access to relevant data, a lack of previous research studies on the topic and a lack of studies on long-term effects of the pandemic (the COVID-19 pandemic is a new phenomenon and therefore limits the availability of high-quality scientific data). Time constraints and the choice of techniques used to collect and analyze the data were also important. A limited number of keywords was used, and therefore access to some items was limited.

## 15. Conclusion

The COVID-19 pandemic affects many aspects. One of them is social life – social distancing, fear of infecting oneself and family members, uncertainty of the future, closure of cultural, entertainment or sports centers. All of these factors may cause psychological problems: stress, anxiety, depression or PTSD. Up to 10% of the population had suicidal thoughts. Changes in social life could cause problems in the day-to-day operation, lack of life satisfaction, exhaustion and sleep problems. Especially among the elderly, technological limitations may result in social exclusion.

Medicine also had to make changes to adapt to the new situation as much as possible. Differences in limited access to health care were significant although data from developed countries was analyzed. The main risk is the transmission of SARS-CoV-2; therefore, telemedicine is used where it is possible. Reducing the number of consultations in different areas of medicine, reducing the number of operational procedures, increasing the space between stations for dialysis, canceled oncology operations and chemotherapy are examples of strategies to reduce the risk of infection. These actions, especially in the case of oncology, can have an impact on increasing the mortality of oncological patients and the collapse of the after-pandemic health system, when patients with delayed diagnosis or canceled treatment are reported. Despite the fact that children pass through COVID-19 relatively softly, the pandemic will, in spite of all, have a significant impact on their lives: the loss of close people, their parents' stress of the future, and mental health problems in children due to social isolation will definitely be significant. Reducing the number of people who can participate in childbirth and isolation of mothers with COVID-19 from newborns increases maternal stress. In addition, a very important factor influencing the good condition of mother and fetus is the lack of delay in access to doctors, which is unfortunately difficult in times of pandemic.

Comparing various areas of medicine, there are some differences in changes which occurred during the pandemic as a result of specificity of individual medical specializations. Although telemedicine was introduced wherever possible and fulfilled its role in primary health care, psychiatry and pediatrics, it was less important in surgery, gynecology, obstetrics and oncology. The medical specialization which could not afford to use telemedicine used other methods to reduce the transmission of the virus, for example: limiting the number of elective surgeries, restriction of hospital visits and administering oncological treatment at home.

In our work, we also briefly looked at the cost-effectiveness of telemedicine. There is a lot of evidence that telemedicine is economically profitable, but it is not a rule because there are specialties such as dermatology, where online consultation is not cost-effective. In addition, data from rural areas is limited. The COVID-19 pandemic required additional financial resources, for example for: telemedicine, creation of temporary hospitals and their functioning, paying out a COVID allowance, purchase and distribution of vaccines.

The pandemic highlighted public health worldwide and problems which are infectious diseases. The scale of infectious diseases has proved to be global, shows understaffing and underfunding of medicine in many countries. There is a need for additional studies on the long-term effects of the pandemic. It seems important to analyze the transfer of financial resources to health care during the pandemic and whether there will be a similar increase in health financing in the future. Subsequent research would need to include more medical specialties when enough data becomes available to get a complete view of the impact of the pandemic. Information from low-developed and developing countries will provide more comprehensive data.

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