Medical Research Archives

ESMED
European Society of Medicine

OPEN ACCESS

Published: January 31, 2023

Citation: Ozah E, Akerele W, et al., 2022. A Review Article on Impact of Coronavirus Disease on Patients in the Health Care Setting: A Tale or Reality, Medical Research Archives, [online] 11(1). https://doi.org/10.18103/mra.v11i1.3512

DOI
https://doi.org/10.18103/mra.v11i1.3512

ISSN: 2375-1924

REVIEW ARTICLE

A Review Article on Impact of Coronavirus Disease on Patients in the Health Care Setting: A Tale or Reality

Ehiremhen Ozah*[1], William Akerele[2], Esteem Tagar[3]

[1]Urology Unit, Department of Surgery, Irrua Specialist Teaching Hospital, Irrua, Edo State, Nigeria
[2]Paediatric Surgery Unit, Department of Surgery, Irrua Specialist Teaching Hospital, Irrua, Edo State, Nigeria
[3]General Surgery Unit, Department of Surgery, Irrua Specialist Teaching Hospital, Irrua, Edo State, Nigeria

***Correspondence:** e.ozah@yahoo.com

ABSTRACT

Background: Coronavirus disease had a devastating effect on the World, with significant disruption in healthcare, the burgeoning impact is still unfolding. The inequities and fragilities amongst nations particularly low and medium economic countries whose patients are dependent on out of pocket expenditure to access healthcare, has occasioned varied consequence of the pandemic on patients in the health care setting and it has reshaped how health care is practiced.

Aims: The aim of this review article was to assess the impact of Coronavirus disease on health care utilization by non -COVID patient during the pandemic.

Methods: The review article was carried out with a search engine focused on articles related to impact of Coronavirus disease published between December 2019 till date, which were identified and reviewed.

Conclusion: The review article gave an insight to the significant disruptions in health care services amongst patients witnessed across countries of the world, the disparities in the disruptions were due to heterogeneity amongst nations, national policies and health policies during the pandemic and the socioeconomic realities that ensued. Outpatient services witnessed varying reduction across the globe ranging between 30-50%. Sub-Saharan Africa witnessed disruption as much as 50% depending on load of COVID-19 infection amongst populace. The reason for the interruptions across the world was the fear of contracting the disease, access to health care setting due to lock down and shortage of health care personnel, in addition in sub-Saharan Africa, the economic down turn occasioned by the pandemic reduced household income which in turn reduced expenditure on health since most countries were dependent on out of pocket expenditure to fund health care services.

In-patient care was also not spared of the disruptions witnessed even though emergency care was prioritized. Overall, there was a reported reduction in admissions for respiratory diseases due to non- pharmacological measures aimed at stemming COVID-19 infection which was equally effective for other respiratory diseases. In some countries like United States the reduction in hospital admissions was paralleled by increasing mortality particularly amongst Hispanic blacks as more acute and severe cases were deemed to have presented for admissions. Surgical priority was maintaining emergency services and prioritization of cancer care, there was a measurable reduction in surgical procedures as elective surgeries were postponed or cancelled. Most laparoscopic and endoscopic procedures were cancelled because of the perceived notion that they are aerosol generating and could increase transmission of COVID-19 infection from asymptomatic carriers, however US jettisoned cancellation of its surgical procedures after 35 days considering that it could not cope. The psychosocial impact of the pandemic and health care access spiraled into increasing anxiety and depression for both health care workers and patients, while the fear of stigmatization was rife from contracting the disease.

The consensus therefore was to strengthen adaptive measures and reconfigure health care to mitigate this impact in future pandemic, while allowing telehealth to take center stage.

Keywords: Covid-19, Emergency Care, Healthcare, Impact, Inpatient, Outpatient, Psycho-Social, Telemedicine

INTRODUCTION

Coronavirus disease (COVID-19) took the world by storm and impacted millions of lives. Worldwide, 624 million people were infected by the virus with 6.5 million deaths, Europe recorded the highest number of infected patients (259.7 million cases), followed by the Americas with (179.3 million cases) and Africa recorded the least number of cases(9.3million) as at June 2022[1]. Coronavirus disease is caused by respiratory virus known as SARS-CoV2[2]. It was first reported in Wuhan city, Hubei Province of China, in December 2019[3]. It was declared a pandemic by World Health Organization on March 11,2020[4]. Coronavirus disease manifest with diverse symptoms which include fever, dry cough, dyspnea, loss of smell and other non-specific symptoms[5], it causes symptoms not just in the elderly and individuals with underlying conditions but even in young adults and persons with no or few chronic underlying medical conditions[6].

During emergencies as these, primary care services are overwhelmed, compromising routine care in those with non-communicable diseases[7]. The pandemic created an unprecedented disruption in health care, this include a reduction in number of health care visits, delay in diagnosis and initiation of treatment with an increase in the advocacy for telehealth[8]. This impact no doubt re-shaped health care and how it is practiced, globally the impact is varied as research show certain social determinants of health (like poverty, race, ethnicity) may cause disproportionate impact of COVID-19 on particular groups[9]. Several non- pharmaceutical measures were adopted by different countries in controlling the spread of the virus ranging from quarantine, local lock down, closing borders, patient level isolation, social distancing, use of face mask, closure of bars and restaurants aimed at considerably reducing the disease[10,11], as no vaccine or treatment was available. However, these measures affected the physical and mental health and quality of life of restricted patients[12,13].

United Nations has stated that the coronavirus pandemic revealed overt inequities, fragilities and unsustainable practices and it has exerted tremendous impact across the globe[14]. Guidelines were developed for care of patients during the period for protection of both patients and the physician[15]. Treatment and clinical visits were postponed, adjusted or modified to reduce exposure to patients and physicians[16], thus the pandemic was expected to affect the people's life overtly or covertly. This review is aimed at assessing the impact of Coronavirus disease on health care utilization by non-COVID patients during the pandemic across the globe. This could provide insight on how to respond and curtail current and future health challenges by developing adaptive strategies to improve health care access and healthcare utilization following newer waves of the COVID -19 pandemic or following other emerging communicable diseases.

METHODS

The review article was carried by authors with a bid to organize, evaluate and identify trends in the literature on impact of COVID-19 on health care utilization by non-COVID patients during the pandemic. A review of researches was done to identify studies on impact of Coronavirus disease on patients. Articles reviewed were mainly cross sectional and cohort studies.

Search engine was focused on data bases such as PubMed, Google scholar, Medline and Scopus on articles published between December 2019 and June 2022. Relevant articles published on impact of COVID-19 0n patients where identified while employing key words such as COVID-19, healthcare, impact, patients. During the search a total of 108,256 research articles were identified, articles published in English language were sought for and this further reduced it to 38,682 articles. Studies identified were assessed for relevance to the review, duplicates were also identified and excluded. Full text of 70 articles identified to be relevant were downloaded, these studies cut across all regions of the World.

Eligibility criteria

Inclusion criteria include:

Studies published in English language on impact of coronavirus disease on patients in healthcare setting.

Availability of full text.

These studies must have been published in peer reviewed journals.

The eligible studies include original articles, designs were cross sectional and cohort studies.

Studies include humans, all ages, sex, not infected by COVID-19

Studies published from December 2019 to June 2022.

Exclusion criteria include:

Studies not published in English language.

Study selection, data extraction, analysis and reporting

Studies in this review was selected by two reviewers independently using eligibility criteria. Accuracy was assessed by a third author. Data was extracted from eligible studies.

DISCUSSION

This review presents the patients perspective on the impact of COVID -19 on health care service utilization by non- COVID patients across the globe. Some findings were consistent across the World, why others were peculiar to geographical region, certain cofounders like age influenced impact of COVID -19 on patients in seeking health care[17], others were poverty, race and ethnicity[9]. Considering the inequities in healthcare, African countries are still unable to meet the declaration that 15% of their budget be committed to healthcare, with the pandemic, the levels of poverty is likely to increase, leaving individuals more vulnerable to catastrophic out of pocket expenditure[18], leaving a frightening loss of several billions of dollars in gross domestic product in the African continent[19]. Assessing the impact of COVID -19 on limiting health care services may still be underestimated due to recurring surges of COVID-19 with new strains, even though some evidence suggest resilience amongst humans and adoption of coping skills[20], the psychological and behavioral impacts of COVID-19 on the healthcare environment are only just coming to the fore[21], some adverse effects were identified while the pandemic raged such include a significant reduction in physical activity[22], increased depressive symptoms[23] and frequent use of alcohol[24].

Concerted efforts of health care providers were aimed at redirecting energies to telehealth, while this innovation has some advantages in the face of the pandemic, there are challenges posed with providing the cultural and social aspects of care that are more easily achieved with in- person care[25]. The challenges of poor internet connectivity and lack of institutional service in developing world were other major challenges to this innovation[26].

This review will provide an insight to the impact on various aspects of health care including the psychosocial impact, why the impact evolves.

IMPACT ON HEALTH CARE SETTINGS

The perceived risk of COVID-19 as an emerging disease to patients and health care givers in various aspects of health care including outpatient care, in patient services, delivery of surgical services including oncology care was a major driver to its impact on patients, however it was relative depending on diverse cultural, social and psychological factors[27].

Outpatient care: Many patients reported difficulty in assessing routine health care visits and missed doses of their prescription drugs during the pandemic, a survey by health care workers in low and medium income countries (LMICs) corroborated this view, the reason for this was attributed to reluctance to visit clinics, the other reasons adduced were fear of contracting COVID-19, difficulty accessing routine health care visits due to infection control measures(e,g lockdowns), this impact is thought to have worsened with the emergence of newer strains of the virus[28-30], this translates to a gap in care because in some studies up to (10%) of patient reported having not visited their GP in 6 months[31]. These findings were similar across countries including high income countries[32]. A cross-sectional study carried out in Lagos, Nigeria on Pediatric surgical patients revealed a decline in patient visit to the outpatient clinic including new and follow up cases, with progression of disease in about 2.2% of patients, no patient sought care at another facility during the period of the pandemic[26], this observation followed commencement of lockdown in a bid to curtail spread of the COVID-19 virus. In sub-Saharan Africa, countries like Ethiopia and Nigeria had clear health service provision inequality, inequity and disparities in accessing essential primary health care and skilled health care professional before COVID-19[33], this was further burdened by the pandemic[34]with substantial interruption in more than half of the total essential health services in Nigeria, Ethiopia and Burkina Faso, this include maternal, child health and other services[35].

The impact was thought to depend on case load of COVID in each country and the robustness of a country's health care system before the pandemic, the interruption appeared to have been exceedingly high in Nigeria compared with those in Burkina Faso and Ethiopia[35]. Child health care was found to have been particularly interrupted than other services including these of maternal and reproductive health care[35]. Other factors that contributed to the disruption include lack of

personal protective equipment, staff shortages, fear and stigma, and stay at home orders[35]. Government hospitals and clinics were more affected by this disruption than private hospitals because they served as hubs for treatment of COVID -19[36]. It was also noted that there was an increase in outpatient prescriptions during the pandemic particularly antimalarials and antimicrobials, this increase were more for services that were interrupted even without proper assessment[35]. The United Nations Children's Fund (UNICEF) projected a 30% reduction in overall essential nutrition service coverage at the start of the pandemic[37]. Significant disruptions to human immunodeficiency (HIV), tuberculosis (TB) and malaria services in both Asia and Africa were recorded, HIV testing fell by 41%, TB referrals declined by 59%, and malaria diagnosis declined by 31%[38]. It is expected that this disruption in health services will have devastating effect which is still unquantifiable. It is anticipated that mortality will increase by 10% in countries with higher HIV burden because of COVID related interruption of the medical supply chain[34]. A survey in Nigeria, in 10 states across geopolitical zones reported a decline of 2-6% in service delivery during the period of the lock down and 10% decline after the lock down, these difficulties were attributed to drugs going out of stock, lack of transportation and harassment by law enforcement agents[39].

A multicenter study in Mumbai, India on impact of COVID-19 pandemic on non-COVID patient's management in Urology reported disruptions[40], with stone disease and its complications the main reason for outpatient visit, while malignancy was the reason in 1.58% of cases. Reasons to justify the low patient patronage was negative image of public hospitals in local media[40]. Consistent with reports across the World, a study conducted in Japan demonstrated a decrease in outpatient clinic prescriptions, with drugs for respiratory diseases most affected and antineoplastic least affected[41], it correlates with other studies carried out in Japan that revealed a temporary decline in physician visit by patients with chronic conditions[42]. A study carried out in Korea reported a decline in outpatient visits for all cause and chronic diseases than was expected in 2020[43], in this study there were discrepancies in clinic attendance amongst patients with different chronic diseases, the decline in outpatient visits were more pronounced in these with respiratory, neurological and liver diseases (11.5%,7.1% and 6.2%) respectively, it was less with diabetes, malignant neoplasm , heart disease, thyroid conditions and mental and behavioral disorders[43]. Several studies across Korea reported that the delay in seeking or avoid seeking care was for the fear of being infected by COVID-19[44,45], this perceived risk fluctuated depending on the pandemic wave[46]. A retrospective study carried out in Shanghai, China demonstrated a 30% decline in outpatient visits in primary care in the first half of 2020, compared to similar period in the preceding year[47], this was supposedly due to health authorities actively discouraging patients from face to face visits to hospital outpatient department except it was absolutely essential, another reason for the decline was that patients entertained fears of possible COVID-19 transmission while moving through communities or attending health care facilities because media reports emphasized a greater chance of being contaminated in high disease areas[48]. A rebound of patient visit was noticed by June 2020, compared to similar period in the preceding year. There was no change in pattern of male, female distribution over this period under review[47], significant reduction amongst patients with respiratory disease was noted with 50% reduction as against cardiovascular diseases (CVD), Endocrine, gastrointestinal and hematological conditions that witnessed a 20% reduction in clinic visits[47]. Factors that may have contributed to reduced respiratory disease consultations is the restrictions, use of face masks and social distancing[49], which may have reduced the rate of other respiratory infections. It was noted that there was no significant difference in outpatient visit amongst the middle aged, this was not unexpected though because they were more mobile, and their perceived risk of contracting or dying from COVID-19 was minimal[47].

In England, a study amongst under 25 to assess impact of COVID-19 on outpatient visits revealed a sharp fall in outpatient appointments as at March 2020 and had not returned to pre-pandemic levels in March 2021, this period saw a 23.5% reduction as compared to levels between 2017-2019, this fall affected all ages and sexes, though babies under 1 year had their physical appointments preserved[50]. During the pandemic in England, face to face outpatient appointments were avoided as much as possible, where it was still essential, a one patient , one room policy was adopted to minimize the risk of infection[51-53], this was consistent with other national research in England that demonstrated reductions in secondary health care service, including outpatient activity for all age group[54,55]. Across all ages it was estimated by the British Medical Association that in England between April and June, 2020 there were between 2.47 million and 2.6million fewer first outpatient attendances than expected[56],this was also corroborated by the Health Foundation whom reported a fall of 4.4 million in outpatient appointments in England in

May, 2020 compared with May, 2019 and 4 million fewer General Practitioner referrals to outpatient between January and October , 2020 compared with same period in 2019, even though the study noted referrals for cancer had returned to pre-pandemic level by October , 2020[57]. The reason for the fall in outpatient activity reflects a reduction in health seeking behavior and changes in health system pathways, including a move towards remote consultations[50]. While many outpatient services manage chronic disease conditions, a number manage acute and severe presentations like diabetic foot disease and it is well recognized that diabetic foot syndrome is associated with high levels of morbidity and mortality[58], therefore a 5-year mortality is put at >50% which is similar to or worse than in many cancers[59]. Conversely, these patients are also at risk of COVID-19 infection, hence early adoption of virtual remote consultation to assist and prioritize foot clinic attendance based on clinical needs were adopted, however diabetic foot requires visual assessment of disease making it different from many chronic diseases[60]. Image based digital tools were adopted, together these tools allow clinician and patients to share photographic records of foot disease, in some instances diabetic foot community visits were redesigned to doorstep visit to minimize contact and exposure to both patients and health care staff [60]. Furthermore, in Switzerland reports were consistent with findings on reduction in outpatient visit particularly during the first wave and a return to pre-pandemic level afterwards[54,55], all general practitioners reported patients cancelling appointments while 50% of the practitioners felt that the chronically ill suffered from inadequate medical care and that their health deteriorated due to delayed consultations[54]. Consultations dropped by 40% and 50% respectively amongst general practitioners and specialist during the pandemic[61]. A web based cross sectional survey across Europe in December, 2020, stated that COVID-19 limited the number of face to face appointment in primary care and outpatient clinic for non- communicable diseases in 90%(35) of European countries studied, though it accelerated telehealth and remote consulting, nevertheless not all modes of teleconsultation and options for requesting chronic medical medication prescriptions were equally available across Europe[62]. Teleconsultations over phone were available in all countries studied (39), prescriptions could be requested by phone in 89.7% of countries, the mean number of available teleconsultation services was significantly lower in upper middle- income countries compared to high income countries[62]. Prescription for face to face consultation could be delivered in 82% of countries, home delivery of prescriptions was not possible in two-thirds of European countries[62].

In Ontario, Canada there was a change in visit trend for all visits and for specific diagnoses, new consultations decreased by 10% during the pandemic. There were several factors influencing the pattern of visit, with patients who were older men without an email more likely to be seen in-person, the condition being managed also determined whether it will be in-person visit or virtual, majority of heart failure patient were in-person visits in contrast to diabetes care which was nearly always virtual[63], consistent with this findings was a study of visit trends to Veterans Affairs clinics in the United States during the first 10 weeks of the pandemic, which showed a decrease in in-person visits by 56%[64]. Like most research work suggested, reasons for change in health seeking behavior as evidenced in reduction in hospital visits were due to fear of COVID-19 infection. A study in Brazil revealed that highest number of subjects who failed to seek health care were in North and Northeast regions of Brazil[65], this was not unexpected as this region demonstrated highest seroprevalence of the virus[66]. A report from Australia showed that physical consultation decreased by 22.1%[67].

Inpatient care: The impact of COVID -19 on in-patient admission was consistent across the globe even though there was heterogeneity across geographical areas and specialty, this difference could be attributed to difference in resilience of National health system[68].

A retrospective study conducted in Port Harcourt, Nigeria, the reduction in admission in the children emergency room was remarkable, a decline of 6.6% was noted between January and July, 2020, compared to same period in 2019, but there was a 29% increase in admissions for bronchopneumonia, the parental fear and anxiety to symptoms of this disease entity as regards its similarity to COVID -19 may have accounted for this[69], admissions for diarrheal diseases doubled over the same period in 2020 compared to previous year[69], pediatric surgical admissions reduced by 19%, in this study[56], there was a contrasting difference to a national survey carried out in Nigeria amongst pediatric surgeons which revealed a 31% drop in pediatric surgical cases, which was due to lack of personal protective equipment (PPE) for theater staff, lockdown and social distancing strategies put in place to reduce the spread of COVID -19[70,71]. Another study conducted in North Central Nigeria which cut across all age group also reported a reduction in hospital admissions, the study compared ward occupancy between April and June 2019 and same period in 2020 during the COVID -19 pandemic[72]. Admissions were mainly due to

cases from emergencies as elective procedures were postponed, the recorded reduction in ward occupancy of 46.7% which was not as marked as the decline in clinic attendance and elective surgical procedures, presumably because emergency admissions and procedures were still ongoing[72]. Another survey in South west Nigeria amongst health workers confirmed a decline in health care utilization during the COVID-19 pandemic, patients requiring hospitalization were mainly these with chronic diseases and these requiring surgical procedures[73].

Sierra Leone, a country in sub- Saharan Africa like Nigeria reported a significant decrease in admissions after the first case of COVID-19 was reported, this decline continued into the 3rd quarter of 2020, this reduction in health care utilization was not equally distributed across patient group, adult surgical and medical ward saw the largest decrease while pediatric admissions saw no significant change[74]. The reduction in hospital admission was less compared to what was witnessed during Ebola in Sierra Leone that saw weekly hospital admission reduce by 51% compared to this study where there was a decline of 14.7% and 13.2% respectively for the first two months of COVID-19[75]. The reduction in healthcare utilization in Sierra Leone was due to barriers created by poor finances as healthcare relies mainly on out of pocket expenditure as people suffered from income loses during the pandemic, this also explained why services under the free health care like caesarean sections were resilient[76]. The study revealed that initial fear was that COVID-19 was fatal, however perception shifted maybe due to prior Ebola experience[75]. The study in South Africa was carried out mostly in rural setting, it was noted that national lock down was not associated with reductions in all cause daily admissions[77]. South African government in response to the pandemic implemented five levels of lock down in 2020 with level 5 prohibiting non- essential movement, this commenced on the 26th March, 2020[78], restrictions were eased incrementally till the lowest level (level1) was achieved in September 21, 2020[79]. However, total admissions, including admissions for adult men increased from level 4 to 3, admissions for women and for communicable diseases were largely unchanged[77]. Admissions for children under 5 fell sharply during level 5 lock down[77], reasons for reduced under 5 admissions could include reduction in viral illnesses following shut down of schools[80]. There was a concurrent drop in admissions for respiratory diseases particularly amongst children, which were mostly due to pneumonia[77], this highlighted the vulnerability of children and their dependence on carers who may have being concerned about protecting their young and themselves from COVID-19 infection[77]. Admissions in non-communicable diseases and trauma did not decrease significantly at the beginning of the lock down, it also did not change significantly as lock down was eased[81]. A significant finding in this study was that all-cause mortality reduced during level 5 lock down despite maintaining admission trend, this supports the hypothesis that the acutely ill may have been unable to access hospital care possibly leading to death at home[77], reduction in admission of the severely ill may have been offset by the observed increase in admissions of younger and healthier adults[77].

In China where COVID-19 was first reported there was substantial reduction in patients' admissions, with a progressive restoration following the nadir of health care utilization which coincided with the initial outbreak of COVID -19, this trend was apparent for all health facilities and throughout the country[82]. There was a 47.7% decrease in inpatient visits compared to same period pre-pandemic, the reduction was comparable in both public and private hospitals[82], the lack of knowledge of the virus and the fear of contracting it was responsible for the abrupt drop in health care utilization, health care providers also delayed elective care to reduce the risk of transmitting the virus to patients or health care workers[83]. More developed regions showed significant reduction in healthcare utilization[82]. Iran was similarly affected following a high incidence of COVID-19, with steep reduction in hospitalizations, this was noticed for all non -COVID-19 disease which include infectious and parasitic diseases, neoplasm, mental and behavioral disorders, Nervous system diseases, diseases of genitourinary system, respiratory system diseases, pregnancy and childbirth, pueperium[84]. The first wave signaled the most significant decrease in hospitalization in Japan, particularly in May,2020. This decrease was particularly striking in pediatric care as it persisted through till November,2020, this was mainly due to a reduction in respiratory diseases[41], even though admissions were low, there was no observed increase in mortality in the ensuing months[41].

In Croatia a survey carried out showed that general admissions fell by 21% over the study period[85], the greatest dip in admission was witnessed in April 2020, after WHO declared COVID-19 a pandemic[85]. Disease specific decline in admission for conditions not related to COVID-19, included cardiovascular disease, with a decline of 26% during the study period, stroke witnessed a decrease of 15% of cases, a disruption in cancer care was also recorded, with a decline of 14% in admissions related to cancer care and other neoplasms[85], the reason for this is multifactorial and

include the reorganization to address the perceived requirement for COVID-19 in the hospital system , the reluctance of individuals with health care needs to seek hospital care, hospital staff shortages due to infection and illness among health workforce and reduction in elective procedures by hospitals[85]. In United Kingdom(UK) the decline in admissions for cardiovascular disease was put at 58%[86], another study reported 40% reduction in stroke cases also in the UK[87] a study projected that cancer mortality rate will increase in the following categories: breast (9%), colorectal (16%), lungs (5%) and esophageal tumors (6%)[88]. The disruption in health services and health seeking behavior in the United kingdom also included emergency services with reduction in emergency department visit reported for both children and adults[54,55]. Switzerland like most European countries recorded a decline in in elective admissions, due to attempts at saving resources, specifically 32% reduction was observed in the first wave compared to similar period in the preceding year, a rebound in elective admissions was noticed post 1st and 2nd wave due to deteriorating health of this patients[52]. In Germany a study reported a 10-20% decline in cancer related hospital admissions[89], all cause admissions into the emergency room in Germany declined by approximately 30% from February to April 2020[90].

A decline was noted for non -SARS-CoV medical admissions in the US during the pandemic, this was paralleled by increase in mortality over same period between March and April, 2020 when it peaked and then November 2020 through to January 2021[91], the postulations for this increased in non -COVID-19 death was that these who were hospitalized had more severe disease and higher chances of death, possibly due to delay in seeking care for fear of exposure to SARS-CoV-2[92]. It was posited that the impaired access to health care due to the pandemic had it worst toll on population already experiencing disparities in health care access[93], the estimations is that non-Hispanic blacks which account for 6.9% of the US populations accounted for 28% of the excess death from non-SARS-CoV-2 cases in 2020[94]. A second reason was lack of critical hospital resources due to the pandemic[95]. Emergency department admissions were not spared by this trend as the Department of Veterans Affairs, the largest health care system in the United states reported a 41% decline in admissions to the emergencies in the first 16 weeks of 2020 due to COVID -19 compared to same period in 2019[96].

Procedures/oncology treatment: The COVID-19 pandemic repurposed and reconfigured surgical practice, these measures were meant to maximize critical care capacity, in a bid to mitigate the inevitable increase in cases of SARS-CoV-2[97]. The surgical priority of health care is the maintenance of emergency capabilities, including trauma, elective and other routine procedures have been cancelled or postponed[98]. The consensus agreement is that oncological surgeries be prioritized by various professional bodies, the NHS England recommends that patients be classified into priorities 1-3 based on clinical needs i.e. emergency operations within 24hours-72hrs; those aimed to be operated within 4 weeks and those classified as surgeries that could be deferred for 10-12 weeks[99]. Similarly, the American College of Surgeons classified cancer workload into 3 phases viz; semi urgent (operation within 3 months), urgent (receive an operation within few days), emergent (within few hours)[100]. The cancellations involving surgeries particularly elective surgeries may have had potentially devastating consequences on health systems globally[101], this will in turn impact on overall, health, productivity and loss of scarce resources particularly in low and medium income countries.

At the start of the pandemic, the World Bank estimated the 12-week cancellation of surgeries to be 68.3-70.0%, the least rate of cancellation was expected in sub-Sahara Africa, due to low level of surgical support[102]. In United States 91% of surgeries are elective, while in Europe 75% of surgeries are considered elective while in Africa the estimate is put at 43%[18], therefore a large number of surgeries performed in Africa are emergencies[103]. In a cross- sectional survey conducted in Nigeria, elective surgeries were suspended in 92% of centers at the time of this survey[104]. In Nigeria with an estimated population of 200million, it is estimated in a report that 85% of children will have a surgically treatable condition at 15yrs[105], cancellation of elective surgeries in a survey on pediatric surgical cases in Lagos University Teaching Hospital was noted, this was to stem the spread of the coronavirus, of these cases 2.2% had progression of their symptoms. Emergency surgeries progressed uninterrupted, with an average 0-6 per week during the pandemic, pre-pandemic , there was an average of 1-5 emergency surgeries weekly[26], no new emergency case presented the week total lock down commenced and no patient scheduled for elective surgeries presented in emergency, the perioperative mortality prior to lock down was put at 20% but increased to 30% during the lock down[26] , this increase may have been due to either delay in presentation for fear of contracting COVID -19 or accessibility to hospital care due to lockdown. Suspension of laparoscopic care was

observed in this study due to heightened predisposition to contracting the virus by healthcare workers if patients had asymptomatic infection[26]. There was increased financial burden on the patient/parents because health care expenditure in this part of the world was mainly out of pocket expenditure, additional cost was incurred in procuring personal protective equipment (PPE) by the patient for emergency procedures[26]. During the pandemic, emergencies were taking on case to case basis[69]. Another study in Jos, Nigeria showed a 76.4% reduction in elective surgery cases compared to corresponding period in 2019. Evaluation of the number of postponed surgeries during the lockdown and performed surgeries during the same period in 2019 revealed that performed surgeries are <50% of planned surgeries, these are thought to be a consequence of measures to stall the spread of SARS-CoV-2 in Nigeria[26].

A retrospective study on impact of COVID-19 on health care utilization in Sierra Leone, surgeries decreased by 13.9% from the 1st quarter to 2nd quarter, Hernia repair were worst hit with 60.7% decline, in contrast Caesarean sections witnessed an increase of 12.7%, by the 3rd quarter there was rebound to normal in terms of volume of elective surgeries[74]. The policy to postpone elective surgeries[98], meant to redistribute resources in favor of catering for COVID-19 infection and make critical bed space available may have been responsible for this, in addition the policy to have negative COVID-19 results before surgery may also have contributed to the decline[74]. A single center descriptive cross-sectional study in Addis Ababa, Ethiopia, revealed a significant drop in all operations performed during the pandemic which was 19% for emergencies and 32% for elective procedures[106]. An increase in weekly cancellation rate for elective surgeries was significant, COVID-19 positivity was the most important reason for these cancellations, pre-COVID era cancellation rate stood at 13.6% but rose to 21.3%, the highest recorded was 27.4% five months after COVID-19 Five months after COVID-19 was declared a pandemic[106].

Consistent with the trend in Africa, in a study carried out in Mumbai, India reported that in a tertiary care public hospital, surgical wards were converted into dedicated COVID facilities to deal with surge in COVID-19 patients, elective operative procedures were suspended[33], the focus was on emergency and semi emergency procedures which also witnessed some reduction, even though they were given priority for transport, diagnosis and management[33]. Laparoscopic surgeries, and surgeries involving general anesthesia was avoided due to the risk of aerosol generation and transmission of COVID-19 to health care workers[37], urinary diversion, treatment of sepsis were fast-racked, while neoadjuvant chemotherapy were administered to patients requiring cancer surgeries. Patients scheduled for radical prostatectomy were placed on gonadotrophin releasing hormone analogue (GnRH)[37]. Children and patients with malignancy, trauma, obstetric and gynecological emergencies were given priority[37]. Similar report was noticed in a retrospective study carried out in Japan in 26 anonymized hospitals, the number of upper gastrointestinal (GI), lower GI endoscopies and bronchoscopies decreased by 40%, 46% and 41% respectively in May,2020. Prostate biopsies also decreased by 44%, though the number of patients on chemotherapies and those who had hemodialysis reduced, this was however marginal, 9% and 5% respectively[38]. Perhaps the nadir in admissions for malignant neoplasms during the 2nd wave which was more than as it was witnessed in the 1st wave could be the reason for a reduction in diagnostic procedures. This postponement of elective and preventive surgeries may have long term consequence whose magnitude cannot be estimated[38]. Lei et al[107], in China reported on the clinical characteristics and outcome on 34 surgical patients operated in Wuhan City, Hubei Province, the findings were that undiagnosed COVID-19 may have been exacerbated by surgery, as 7 of these patients died postoperatively and 44.1% required critical care support, the mortality rate was greater than the percentage of the general population of patients hospitalized with COVID-19(26.1%).

Notably a 26% reduction in endoscopic diagnostic procedure was recorded in Croatia, the study also reported a disruption in cancer care[85]. In comparison an Italian study reported a 32% drop in oncology related procedures between March and June 2020[108], similarly in Italy another study, reported 75% decline in elective surgeries, a 30% reduction in emergency surgeries and an overall 68% decrease in all operative activities[109]. The Royal Surgical Colleges of Great Britain advised that Laparoscopy should only be performed in select cases where it can be justified clinically, taking into cognizance its high risk of transmission of SARS-CoV-2 to the surgical team[110]. A population based observational study in England and Wales in 2020 reported that there was a 33.6% reduction in overall volume of surgical activity with postponement of 1.5 million surgical procedures. Semi urgent and elective surgeries witnessed a substantial reduction of 38.6% and emergency surgeries declined by 13.4%, the reduction in emergency surgeries may have been accounted for by reduction in injuries, due to lock down and

restrictions put in place to stem the spread of the virus, the other reason adduced may have been conservative management of many of the emergent conditions, it is predicted that about 2.4 million surgical cases would be outstanding by the end of 2021 which represent 6 months of surgical activity[111]. The United Kingdom(UK) National Health Service(NHS) according to its records, implied that the wait list of people awaiting treatment in England at the end of February 2021 was the highest ever recorded and was put at 4.7 million, with a rise on the elective list for routine operation by 73% who have waited for more than 52 weeks between December 2020 and February 2021[112]. The impact in Austria from a survey carried in a tertiary hospital, also revealed a drastic reduction in surgical activity, this was due to the need to preserve hospital capacity in preparation for the pandemic, the study compared surgical activity from March 15 to April 14, 2020 and compared the surgical activity to similar periods over the previous 5 years, total surgical activity was reduced by 65.4%, this reduction was across all surgical specialties[113]. The reduction in elective surgeries was 88.7%, oncological procedures witnessed a 47.8% decline and a 35.3% decline in emergency surgeries, patients were noted to be generally sicker as reflected in the ASA scores[113].

The United States of America(US), was not left out in the voyage of decline in surgical activity, as a retrospective cohort study involving 49 US states, across all ages and sex, a decrease in surgical volume of 48% was recorded, this decrease was recorded across all major categories of specialty, organ transplant surgical procedures witnessed least decline of 20.7%, however, caesarean sections did not witness change in baseline volume compared with similar periods in 2019, pre-pandemic[114]. There was rebound to the 2019 levels during the COVID surge, the explanation for the initial decline was due to compliance to curtail elective procedures and perform only urgent and emergent procedures. During the COVID surge, surgical procedure volume was determined by individual hospitals and systems rather than National or local policy, this may have played a role in the rebound[115]. The American College of Surgeons(ACS) and other major surgical specialty society initially recommended minimizing, postponing, or canceling elective surgical procedures and they also released guidelines for triage of elective surgical procedures, in the same vein the center for Medicare and Medicaid Services(CMS) and US Surgeon General also issued statements and recommendations for postponement of non-essential procedures[115,116]. These recommendations were short-lived as a turnaround was witnessed 35 days after ACS recommendation to curtail elective procedures, a new position was published jointly by ACS, American Society of Anesthesiologists, Association of American Registered Nurses and American Hospital Association providing guidance for resumption of elective surgical procedures since it was considered US did not have the framework for sudden contraction in surgical procedure volume[117]. Consistent with finding across most continent of the World a study from Australia showed a decline in public hospital planned surgical activity by 32.6%[67].

Psychosocial impact: The psychosocial impact of COVID-19 is thought to be universal[26]. Coronavirus disease pandemic has been the most challenging and devastating event of the millennium, to almost all people globally, resulting in global anxiety and distress within communities worldwide, this represent a traditional psychological response to a condition that has brought the world to its knees and to which it has no control over[118]. A cross sectional survey in 8 European countries from April to June, 2020 revealed higher rates of depression , anxiety and stress amongst medical and non-medical professionals[119], there are two major contributing factors to the abnormal psychosomatic outcomes in the general population, these were expected to continue because the COVID-19 pandemic was in evolution, the other reason is the extremely un-savoring information about the pandemic in the media[120]. The fear of stigmatization from being COVID-19 infected as well as quarantine were rife and contributed to reduction in health care utilization[73].

The burden of psychosocial impact was captured in study of 44,000 participants in Belgium after the COVID-19 outbreak, the number of people reporting fear of contracting the disease, anxiety increased significantly[121] , these impact applied also to LMIC, where a study showed that COVID-19 impacted adversely on mental health of the non-COVID populace where depressive disorder increased substantially compared to a survey carried out before the pandemic[122] ,the mental health of patients was that of increased feeling of stress, loneliness[28]. In contrast, Korea had witnessed a steady increase in patient with mental health and behavioral disorders prior to the pandemic, adjusting for the increasing trend over the years prior to the pandemic, mental and behavioral disorders in 2020 was 4% lower than expected[40], this may be explained by hesitation to seek healthcare among patients with anxiety and depression during the pandemic. Worthy of note is that the perceived risk of COVID-19 is relative, with

the perception of the risk influenced by diverse cultural, social and psychological factors, as shown in a study amongst Japanese patients who felt less fear and isolation than US patients, these perceptions are thought to influence the psyche of the patients generally[27].

Some authors allude to the fact that children are more prone to boredom, anxiety, irritability and fear of infection arising from proper education from parents or guardians, the psychological treatment should be aimed at controlling fear, indeed fear is causal in this setting and protective against infection. With the advent of the pandemic, proper parenting, online education and inculcation of healthy habits can provide the desired prevention but may lead to obsession for cleanliness and gets incorporated into their psyche leading to development of obsessive compulsive disorder (OCD), young adults developed anxiety due to reduced coping skills, while the elderly had irritability, anger, fear and anxiety and cognitive decline[123]. The initial desire to avoid infections at all cost resulted in avoidance of contact with non-household members, this often resulted in increased psychological and emotional burdens which were not sustainable indefinitely, however negative emotions, including fear and anxiety fluctuated throughout the pandemic, and decreased while the pandemic lasted[124].

CONCLUSION

Reconfiguration and adaptation of health care to face the challenges of curbing COVID -19 pandemic determined the impact of COVID -19 on non-COVID patients in the healthcare setting. This was largely influenced by heterogeneity of national health policies and resilience of the health care sector in coping with the sweeping changes. The diverse socio-cultural inclination across nations also played a vital role on the impact as it essentially determined how the pandemic was perceived. The review identified a decline in both outpatient and in-patient visits by patients, while there was a considerable reduction in oncology care, even though priority was given to cancer care. However, emergency care was also prioritized, despite these most countries of the world witnessed a reduction in its activities, this decline was not as significant as evidenced in routine outpatient and inpatient care. The disruption ranged from between 30-50% in most cases except in Africa in most of the times because health care utilization is thought to be low prior to pandemic due mainly to out of pocket expenditure.

National policies were varied across nations, United States witnessed a short-lived postponement in elective surgeries after 35 days unlike other nations of the World. Globally the priority was on emergency procedures but a marginal reduction in volume was noted including in sub-Sahara Africa where most procedures are emergencies because its populace relies on out of pocket expenditure to access healthcare. Caesarean section volume remained unchanged irrespective of elective or emergency. The negative psychosocial impact was grave. Telemedicine served as an alternative to in-person visit. The long- term impact are still being awaited, while there has been no overwhelming evidence of increasing mortality, but studies on the long term impact of COVID-19 may unravel mortality figures and how the health sector has truly fared. The lessons from the pandemic is to be proactive, reconfigure health resources in anticipation of future pandemic and increase advocacy for telemedicine and strengthen the frame work for its development across the globe.

CONFLICT OF INTEREST

The authors have no conflict of interest to declare

FUNDING

The study was not supported financially by anybody

REFERENCES

1.World Health Organisation. WHO Coronavirus disease (COVID-19) dashboard.2022. Accessed October, 24,2022.

2. World Health Organisation. Coronavirus. 2020. https://www.who.int/health-topics/coronavirus#tab=tab.1

3. Bogoch II, Watts A, Thomas-Bachl A, Huber C, Kraener MUG, Khan K. Pneumonia of unknown aetiology in Wuhan, China: potential for international spread via commercial air travel. J Travel Med 2020;27:taa0 008

4. Mahase E. COVID-19: WHO declares pandemic because of "alarming levels" of spread, severity and inaction. Br Med Journal Publishing Group; 2020. http//www.bmj.com/content/368/bmj.

5. Huang C, Wang Y, Li X et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet 2020;395(10223): 497-506

6. Tenforde MW, Kim SS, Lindsell CJ, Rose EB, Shapiro NI, Files DC, et al. Symptom duration and risk factors for delayed return to usual health amongst outpatients with COVID-19 in a multistate healthcare system network in United States, March-June 2020. Morbidity and mortality weekly report 2020;69(30):993

7. Ochi S, Hodgson S, Landeg O, Mayner L, Murray V. Disaster drivers, evacuation and medication loss: a systematic literature review. PLOS Curr. 2014;6:ecurrents.disfa4176 30b41766a

8. Leung MST, Lin SG, Chow J, Herky A. COVID-19 and oncology service transformation during pandemic. Cancer Med.2020 Oct;9(19):7171. doi:10.1002/can4. 3384. Epub 2020 Aug 18. PMD:32810386;PMDCID:PMC7461476

9. Abrams EM, Szefler SJ. COVID-19 and the impact of social determinants of health. Lancet Respir Med. 2020;8(7): 659-661. https:// doi org/10.1016/S2213-2600(20)30234-4

10.Courtemanche C, Garuccio J, Pinkston J, Yebowitz A. Strong social distancing measures in the United States reduced the COVID-19 growth rate. Health Affairs 2020;39(7). https://doi.org/10

11. Qian M, Jiang J. COVID-19 and social distancing. Journal of Public Health: from theory to practice 2020. https://doi.org/10.1007/s10389-020-01321-z. PMID:32837835

12. de Matos DG, Aider FJ, Almeida-Neto PFD, Moreira OC, Souza RFD, Marcal AC. Et al. The impact of measures recommended by government to limit the spread of coronavirus (covid-19 on physical activity levels, quality of life and mental health of Brazilians. Sustainability. 2020;12(21):9072

13. Tran BX, Nguyen HT, Le HT, Lat Kin CA, Pham HQ, Vu LG, et al. Impact of COVID-19 on economic wellbeing and quality of life of the Vietnamese during the national social distancing. Frontiers in Psychology. 2020;11

14. United Nations. UN Research Roadmap for the COVID-19 Recovery, 2020. https://www.un.org/en/pdfs/UNCOVID19ResearchRoadmap.pdf

15. Burki TK. Cancer guidelines during the COVID-19 pandemic. Lancet Oncol. 2020; 21:629-630

16. Bini SA, Schilling PL, Patel SP, et al. Digital Orthopaedics: A glimpse into the future in the midst of a pandemic. J Arthroplasty 2020;35:S68-S73

17. Ozah E, Irekpita E. The Impact of Coronavirus Disease (COVID-19) on Patients Visiting Outpatient Urology Clinic in a Nigerian Tertiary Hospital: A Cross Sectional Study. Central African Journal of Public Health 2021; 7:182-188

18. Mazingi D, Navarro S, Bobel MC, Dube A, Mbanje C, Lavy C. Exploring the Impact of COVID-19 on Progress Towards Achieving Global Surgery Goals. World J Surg. 2020;44(8):2451-2457 (doi: 10.1007/s00268-020-05627-7)

19. Rosenthal PJ, Breman JG, Djimde AA, John CC, Kamya MR, Leke RGF, et al. COVID-19: Shining the light on Africa. Am J Trop Med Hyg. 2020; 102(6): 1145-1148

20. Hamm ME, et al. Experiences of American Older adults with pre-existing depression during the beginnings of the COVID-19 pandemic: A multicity, mixed-methods study. Am J. Geriatr. Psychiatry 2020;28:924-932

22. Yamada M. et al. Effect of the COVID-19 Epidemic on physical activity in community dwelling adults in Japan: A cross-sectional online survey. J. Nutr. Health Aging 2020;24:1-3

23. Ettman CK. Et al. Prevalence of depression symptoms in US adults before and during the COVID-19 pandemic. JAMA Netw. Open 2020; 3:e2019686-e2019686

24. Pollard MS, Tucker JS, Green HD. Changes in adult alcohol use and consequences during the COVID-19 pandemic in the US. JAMA Netw. Open 2020;3:e2022942

25. Pfender E. Mental health and COVID-19:implications for the future of telehealth. J Patient Exp 2020;7(4):433-435. https://doi.org/10.1177/2374374373520948436

26. Seyi-Olajide JO, Bode CO, Ihediwa OC, Elebute OA, Alakaloko FM, Ladipo-Ajayi OA. et al. Impact of coronavirus disease 2019 pandemic on

paediatric surgery in sub-Saharan Tertiary Hospital: An Observational Study. Niger Postgrad Med J 2022;29:102-109

27. Bernacki K, Keister A, Sapiro N, Joo SJ, Mattle L. Impact of COVID-19 on patient and healthcare professional attitudes, beliefs and behaviors toward the healthcare system and on the dynamics of healthcare pathway. BMC Health Services Research 2021;;21:1309. https://doi.org/10.1186/s12913-021-07237-y

28. Devi R, Goodyear-Smith F, Subramaniam K, McCormack J, Calder A, Parag V. et al. The Impact of COVID-19 on the care of Patients with Non-communicable Diseases in Low and Middle- Income Countries: An Online Survey of Patient Perspectives. Journal of Patient Experience 2021; 8:1-8

29. Bullen C, McCormack JC, Calder A, Parag V, Subramaniam K, Majumdar A, et al. The Impact of COVID-19 on care of people living with non-communicable diseases in low and middle income countries: an online survey of frontline healthcare workers in nine countries . Primary Health Care Res Dev. 2021; doi:10.1017/S146342362100030X

30. Kirby T. New variant of SARS-CoV-2 in UK causes surge of COVID-19. Lancet Respir J. 2021;9: E20-E21. Doi:10.1016/S2213-2600(21)00005-9

31. Diabetes New Zealand. Annual diabetes check-up. 2020. Accessed July 14, 2021. https://www.diabetes.org.nz/diabetes-check-ups

32. Palmer K, Monaco A, Kivipelto M, Onder G, Maggi S, Michel JP, et al. The potential long term impact of the COVID-19 outbreak on patients with non-communicable diseases in Europe: cosequences for healthy ageing. Ageing Clin Exp Res. 2020; 32:1189-1194. Doi:10.1007/s40520-020-01601-4

33. Agarwal A, Mann C, Abdella E, Mitiku W, Alebachew A, Berman P. Recurrent Cost in Primary Health care in Ethiopia: Facility and disease specific cost and their components in government primary hospital and health centers. BMC Health Serv Res 2020;20:389

34. Walker PGT, Whittaker C, Watson OJ, Baguelin M, Winskill P, Hamlet A, et al. The impact of COVID-19 and strategies for mitigation and suppression in low and middle income countries. Science. 2020;369(6502):413-422

35. Assefa N, Sie A, Wang D, Korte ML, Hemler EC, Abdullahi YY, et al. Reported Barriers to Health care Access and Service Disruptions Caused by COVID-19 in Burkina Faso, Ethiopia, Nigeria: A telephone Survey. Am J. Trop. Med. Hyg. 2021; 105(2):323-330

36. Karkee R, Morgan A. Providing maternal health services during the COVID-19 pandemic in Nepal. Lancet Glob Health. 2020;8:e1243-e1244

37. Headey D, Heidkamp R, Osendarp S, Ruel M, Scott N, Black R, et al.Impacts of COVID-19 on childhood malnutrition and nutrition related mortality. Lancet. 2020;396(10250):519-521

38. The Global Fund: The impact of COVID -19 for HIV, TB, Malaria Services and System for Health: A Snapshot from 502 health facilities across Africa and Asia. Available from https://theglobalfund. Org. [last accessed on 2022 Mar 29]

39. Adelekan B, Goldson E, Abubakar Z, Mueller U, Alayande A, Ojogun T, et al. Effect of COVID-19 pandemic on provision of sexual and reproductive health services in primary health facilities in Nigeria: a cross sectional study. Reprod Health 2021;18:166

40. Jibhakate NA, Patwardhan SA, Sawant AS, Pathak HR, Patil BP, Kamal H. Impact of COVID-19 pandemic on non-CVID patient's management in urology: a public hospital experience in Mumbai. Afr J Urol 2021; 27:96. https://doi.org/10.1186/s12301-021-00196-0

41. Yagamuchi S, Okada A, Sunaga S, Kurakawa KI, Yamauchi T, Nangaku M, et al. Impact of COVID-19 pandemic on healthcare service use for non-COVID-19 patients in Japan: retrospective cohort study. BMJ Open 2022;12: e060390. doi:10.1136/bmj-2021-060390

42. Osawa I, Goto T, Asami Y, et al. Physician visits and medication prescriptions for major chronic diseases during the COVID-19 pandemic in Japan: retrospective cohort study. BMJ Open 2021;11:e050938

43. Sim B, Nam EW. The impact of COVID-19 on Outpatient Visits for All Cause and Chronic Diseases in Korea: A Nationwide Population Based Study. Int. J. Environ. Res. Public Health 2022;19: 5674. https://doi.org/10.3390/ijerph19095674

44. Czeisler ME, Marynak K, Clarke KEN, Salah Z, Shakya I, Thierry JM, et al. Delay or Avoidance of Medical Care Because of COVID-19 Related Concerns-United States, June 2020. MMWR Morb. Mortal. Wkly. Rep. 2020;69: 1250-1257

45. Mantica G, Riccardi N, Terrone C, Gratarola A. Non -COVID-19 visits to emergency departments during the pandemic: The impact of fear. Public Health 2020;183: 4363

46. Mainews. 72.5% of the People Responded Positively to the Policy of Participation in COVID-19 Testing and Treatment of Local Hospitals. Available Online: http://www.bosa.co.kr/news/articleView.html?idxno=2169759 (accessed on 1 May 2022)

47. Xu Z, Fan J, Ding J, Feng X, Tao S, Zhou J, et al. The Impact of COVID-19 on Primary Care General Practice Consultations in a Teaching Hospital in Shanghai, China. Front. Med. 2021;8: 642496. doi:10.3389/fmed.2021.642496

48. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72314 case from the Chinese Center For Disease Control and Prevention. JAMA. 2020;323:1239-1242. doi: 10.1001/jama.2020.2648

49. Sun S, Fu C, Cong J, Li Y, Xie S, Wang P. Epidemiological features and trends of influenza incidence in mainland China: a population based surveillance study from 2005 to 2015. Int. J Infect Dis. 2019; 89:12-20

50. Bottle A, Neale FK, Foley KA , et al. Impact of COVID-19 on outpatient appointments in children and young people in England : an observational study. BMJ Open 2022;12: e060961. doi:10.1136/bmjopen-2022-060961

51. Browne C, Davis NF, Mac Craith ED, Lennon GM, Galvin DJ, Mulvin DW. Prospective evaluation of virtual urology outpatient clinic. Ir. J. Med. Sci. 2018; 187: 251-254. https://doi.org/10.1007/s11845-017-1615-y

52. Evans D, Harman J, Middleton SD, Anakwe RE. Developing a virtual fracture clinic for hand and wrist injuries. J. Hand Surg. Eur. 2018;43:893-894. https://doi.org/10.1177/1753193418778472

53. Sultan AA, Acuna AJ, Samuel LT, Rabin JM, Grits D, Gurd DP, et al. Utilization of telemedicine virtual visits in pediatric spinal deformity patients: a comparison of feasibility and patient satisfaction at a large academic center. J. Pediatr. Orthop. 2020. https://doi.org/10.1097/BPO

54. Williams TC, MacRae C, Swann OV, et al. Indirect effects of the COVID-19 pandemic on pediatric healthcare use and severe disease: a retrospective national cohort study. Arch Dis Child 2021;325:1676-1679

55. Wyatt S, Mohammed MA, Fisher E, et al. Impact of the SARS-CoV-2 pandemic and associated lockdown measures on attendances at emergency departments in English hospitals; a retrospective database study. Lancet Reg Health Eur 2021;2: 100034

56. British Medical Association. The hidden impact of COVID-19 on patient care in the NHS in England, 2020 Jul. Available: https://www.bma.org.uk/media/2841/the-hidden-impact-of-covid_web-pdf.pdf

57. Thorlby R, Fraser C, Gardner T. Non-COVID-19 NHS care during the pandemic/ the Health Foundation. Available: https://www.health.org.uk/news-and-comment/charts-and-infographics/non-covid-19-nhs-care-during-the-pandemic [Accessed7 May 2021]

58. Chammas NK, Hill RLR, Edmonds ME. Increased mortality in diabetic foot ulcer patients: the significance of ulcer type. J Diabetes Res 2016; 2016:2879809

59. Armstrong DG, Wrobel J, Robbins JM. Guest editorial: are diabetes related wounds and amputations worse than cancers? Int Wound J 2007; 4:286-287

60. Deogon GS, Robbins T, Randeva MS, Kyrou I, Sankar S, Randeva HS, et al. Managing high acuity outpatient services during the COVID-19 pandemic :lessons from the acute diabetes foot service. Future Healthcare Journal 2020;7(3):e77-e79

61. Deloitte. What will be the impact of COVID-19 pandemic on healthcare systems? June, 2020. https://www2. Deloitte.com/fr/fr/pages/covid-insights/articles/impact-covid19-healthcare-systems. html.[last accessed 2020sep 28]

62. Kardas P, van Boven JFM, Pinnock H, Menditto E, Wettermark B, Tsiligianni I, et al. Disparities in European healthcare system approaches to maintaining continuity for non-communicable diseases during the COVID-19 outbreak. The Lancet Regional Health-Europe 2021; 4:100099

63. Pendrith C, Nayyer D, Chu C, O'Brien T, Lyons OD, Agarwal P et al. Outpatient visit trends for internal medicine ambulatory care sensitive conditions after the COVID-19 pandemic: a time series analysis. BMC Health Services Research 2022;22:198. https://doi.org/10.1186/s12913-022-07566-6

64. Baum A, Kaboli PJ, Schwartz MD. Reduced in-person and increased telehealth outpatient visits during COVID-19 pandemic. Ann Intern Med. 2021;174(1):129-131

65. Horta BL, Silveira MF, Barros AJD, Hartwig FP, Dias MS, Menezes AMB, et al. COVID-19 and outpatient care: a nationwide household survey. Report in Public Health 2022;38(4): e00194121

66. Hallal PC, Hartwig FP, Horta BL, Silveira MF, Struchiner CJ, Vidaletti LP, et al. SARS-CoV-2 antibody prevalence in Brazil a result from two successive nationwide serological household surveys. Lancet Glob Health 2020;8: e1390-1398.

67. Sutherland K, Chessman J, Zhao J. Sara G, et al. Impact of COVID -19 on healthcare activity in NSW, Australia. Public Health Res Pract. 2020;9:30(4):3042030

68. Haldane V, De Foo C, Abdalla SM, et al. Health Systems Resilience in managing the COVID-19 pandemic: lessons from 28 countries. Nat Med 2021:27:964-980

69. Yarhere IE, Oragui O. Reduced admissions in the children's emergency room during coronavirus -19 pandemic in the University of Port Harcourt teaching Hospital, Nigeria, Niger J Med 2022;31:378-382

70. Ogundele IO, Alakaloko FM, Nwokoro CC, Ameh EA. Early impact of COVID-19 pandemic on

paediatric surgical practice in Nigeria: A national survey of paediatric surgeons. BMJ Open 2020;4: e000732
71. Rosa F, Covino M, Sabia L, Quero G, Fiorillo C, Cozza V, et al. Surgical emergencies during SARS-CoV-2 pandemic lockdown: what happened? Eur Rev Med Pharmacol Sci 2020;24:11919-11925
72. Ode MB, Shitta A, Peter SD, Amupitan I, Yilleng SB. The effect of COVID-19 Pandemic on Elective Surgical Services in Jos, North Central, Nigeria. Journal of Biosciences and Medicine 2021;9:29-37
73. Afolalu OO, Atekoja OE, Oyewumi ZO, Adeyeye SO, Jolayemi KI, Akingbade O. Perceived impact of coronavirus pandemic on uptake of healthcare services in South West Nigeria. Pan African Medical Journal. 2021;40(26). 10.11604/pamj.2021.40.2628279
74. Sevaile S, Youkee D, van Duinen AJ, Bailey E, Bangura T, Mangipudi S, et al. The impact of COVID-19 pandemic on hospital utilization in Sierra Leone . BMJ Global Health 2021;6: e005988.doi:10.1136/bmjgh-2021-005988
75. Bolkan HA, van Dunien A, Samai M, et al. Admission and surgery as indicators of hospital functions in Sierra Leone during the West African Ebola outbreak. BMC Health Serv Res 2018:18: 846.
76. Phull M, Grimes CE, Kamara TB, et al. What is the financial burden to patients of accessing surgical care in Sierra Leone? A cross sectional survey of catastrophic and improverishing expenditure. BMJ Open 2021;11:e039049
77. McIntosh A, Bachmann M, Siedner MJ, Gareta D, Seeley J, Herbst K. Effect of COVID-19 lockdown on hospital admissions and mortality in rural KwaZul-Natal. South Africa:interrupted time series analysis. BMJ Open 2021;11:e047961.doi:10.1136/bmjopen-2020-047961
78. South Africa Department of Health. Disaster management Act 2002(Act No57 of 2002) Alert level 5 during the coronavirus COVID-19 lockdown, government Gazzette no 43148:398 2020
79. South Africa Department of Health. Disaster management Act 2002(Act no 57 of 2002) Alert level1 during coronavirus COVID-19 lockdown , government Gazette No43725:999 2020.
80. Li Y, Reeves RM, Wang X, et al. Global patterns in monthly activity of influenza virus, respiratory syncytial virus, parainfluenza virus and metapneumovirus: a systematic analysis. Lancet Glob Health 2019;7:e1031-1045
81. Moustakis J, Piperidis AA, Ogunrombi AB. The effect of COVID -19 on essential surgical admissions in South Africa: a retrospective observational analysis of admissions before and during lockdown at a tertiary healthcare complex. S Afr Med J 2020;110:910
82. Xiao H, et al. The impact of the COVID-19 pandemic on health services utilization in China :time series analysis for 2016-2020. Lancet Reg Health West Pac 2021;9:100122
83. Madhuripan N, Cheung HMC, Alicia Cheong LH, Jawaher A, Willis MH, Larson DB. Variable influencing radiology volume recovery during the next phase of coronavirus disease 2019(COVID-19) pandemic. J Am Coll Radiol. 2020;17:855-864
84. Ahmadi S, Kazemi-Karyani A, Badiee N, Byford S, Mohammadi A, Piroozi B, et al. The impact of COVID-19 pandemic on hospital admissions for nine diseases in Iran: insight from an interrupted time series analysis. Cost Effectiveness and Resource Allocation 2022;20: 58. https://doi.org/10.1186/s12962-022-00394-9
85. Kalanj K, Marshall R, Karol K, Tijak MK, Oreskovic S. The impact of COVID-19 on Hospital Admissions in Croatia. Front Public Health 2021; 9:720948. doi:10.3389/fpubh2021.720948
86. Ball S, Banerjee A, Berry C, Boyle JR, Bray B, Bradlow W, et al. Monitoring indirect impact of COVID-19 pandemic on services for cardiovascular diseases in the UK. Heart. 2020; 106: 1890-1897. doi:10.1136/heartjnl-2020-317870
87. Padmanabhan N, Natarjan I, Gunston R, Raseta M, Roffe C. Impact of COVID-19 on stroke admissions, treatments, and outcome at a comprehensive stroke centre in the United Kingdom. Neurol Sci. 2021;42: 15-20. doi:10.1007/s10072-020-04775-x
88. Maringe C, Spicer I, Morris M, Purushotham A, Nolte E, Sullivian R, et al. The impact of the COVID-19 pandemic on cancer deaths due to delays in diagnosis in England, UK: a national population-based modelling study. Lancet Oncol. 2020; 21:1023-1034. doi: 10.1016/S1470-2045(20)30388-0
89. Reichardta P, Bollmann A, Hohenstein S, Glass B, Untcha M, Reichardt A, et al. Decreased incidence of oncology admissions in 75 Helios hospitals in Germany during the COVID-19 pandemic. Oncol Res Treat. 2021;44 :71-74. doi:10.1159/00512935
90. Tschaikowsky T, Becker von Rose A, Consalvo S, Pfluger P, Barthel P, Spinner CD, et al. Numbers of emergency room patients during the COVID-19 pandemic. Notfall und Rettungsmedizin. 2020. https://doi.org/10.1007/s10049-020-00757-w PMID: 32837303
91. Dang A, Thakker R, Li S, Hommel E, Mehta HB, Goodwin JS. Hospitalizations and Mortality From Non-SARS-CoV Causes Among Medicare Beneficiaries at US Hospitals During the SARS-CoV-2 Pandemic. JAMA Network Open

2022;5(3):e221754. doi:10.1001/jamanetworkopen.2022.1754
92. Santi L, Golinelli D, Tampieri A, et al. Non-COVID-19 patients in times of pandemic: emergency department visits, hospitalizations and cause specific mortality in Northern Italy. PLoS One.2020; 16(3): e0248995. doi:10.1371/journal.pone.0248995
93. Mackey K, Ayers CK, Kondo KK, et al. Racial disparities in COVID-19 related functions, hospitalizations and death: a systematic review. Ann Intern Med. 2021; 174:362-373. doi:10.7326/M20-6306
94. Cronin CJ, Evans WN. Excess mortality from COVID and non COVID causes in minority populations. Proc Natl. Acad Sci. USA.2021;118(39): e21013866118. doi:10.1073/pnas.2101386118
95. Janke AT, Mei H, Rothenberg C, Becher RD, Lin Z, Venkatesh AK. Analysis of hospital resource availability and COVID-19 mortality across the United States. J. Hosp Med. 2021;16(4): 211-214. doi:10.12788/jhm.3539
96. Baum A, Schwartz MD. Admissions to Veterans Affairs Hospitals For Emergency Conditions During the COVID-19 Pandemic. JAMA. 2020;324(1):96. https://jamanetwork.com/journals/jama/fullarticle/2767061 PMID:32501493
97. World Health Organisation, Coronavirus disease, https//www.who.int/emergencies/diseases/novel-coronavirus-2019 accessed April2, 2020.
98. Stevens S. Next step on NHS response to COVID-19. https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/03/urgent-next-steps-on-nhs-response-to-covid-19-letter-simon-stevens.pdf 2020
99. NHS England. Clinical guide for the management of noncoronavirus patients requiring acute treatment: Cancer,https//www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/03/specialty-guide-acute-treatment-cancer-23-march-2020.pdf 2020. Accessed April 2, 2020.
100. American College of Surgeons , COVID-19 guidelines for triage of cancer surgery patients, https://www.facs.org/covid-19/clinical-guidance/elective-case/cancer-surgery, 2020. Accessed April 2, 2020
101. Soriede K, Hallet J, Matthews JB, et al. Immediate and long term impact of the COVID-19 pandemic on delivery of surgical services. Br J Surg 2020; https://doi.org/10.1002/bjs.11670
102. Dmitri N, Omar MO, James CG, Elizabeth L, Joana FFS, Tom EFA, et al. Elective surgery cancellations due to COVID-19 pandemic: global predictive modelling to inform surgical recovery plans. BJS. 2020;107:1441-1449
103. Salako O, Okunade K, Allsop M, Habeebu M, Toye M, Oluyede G, et al. Upheaval in cancer care during the COVID-19 outbreak. Ecancermedicalscience. 2020:14: 97. doi:10.3332/ecancer.2020.ed97
104. Ogundele IO, Alakaloko FM, Nwokoro CC, Ameh EA. Early Impact of COVID-19 Pandemic on Paediatric Surgical Practice in Nigeria: A National Survey of Paediatric Surgeons. BMJ Paedatr Open.2020;4(1). doi:10.1136/bmjpo-2020-000732
105. Bickler SW, Telfer ML, Sanno-Duanda B. Need forpaediatric surgery care in an urban area of the Gambia. Trop Doct 2003;33: 91-94
106. Ademe Y, Genetu A, Laeke T, Taye M, Bekele A. Impact of COVID-19 on Surgical Volume: Single Center Experience from Addis-Ababa, Ethiopia. Ethop J Health Sci 2022; 32 (1):37 doi:http://dx.doi.org/10.4314/ejhs.v32i15
107. Lei S, Jiang F, Su W, Chen C, Chen J, Mei W, et al. Clinical Characteristics and Outcomes of Patients Undergoing Surgeries during the Incubation Period of COVID-19 Infection. EClinicalMedicine 2020, https://doi.org/10.1016/j.eclinm.2020.100331.
108. Di Bidino R, Cicchetti A. Impact of SARS-CoV-2 on provided health care. Evidence from the emergency phase in Italy. Front Public Health. 2020;8:583583. doi:10.3389/fpubh.2020.583583
109. Daodu O, Panda N, Lopushinsky S, Varghese TK Jr, Brindle M. COVID-19-Considerations and Implications For Surgical Learners. Ann Surg. 2020;272(1):e22-e23
110. Association of Surgeons of Great & Ireland, Association of Coloproctology of Great Britain and Ireland, Association of Upper Gastrointestinal Surgeons, Royal College of Surgeons of Edinburgh, Royal College of Surgeons of England, Royal College of Physicians and Surgeons of Glasgow, Royal College of Surgeons in Ireland, updated General Surgery guidance on COVID-19, 2nd revision, https://www.resed.ac.uk/news-public-affairs/news/2020/april/updated-general-surgery-guidance-on-covid-19-2nd-revision-7th-april-2020,2020 April 9, 2020.
111. Dobbs TD, Gibson JAG, Fowler AJ, Abbott TE, Shahid T, Torabi F, et al. Surgical activity in England and Wales during the COVID-19 pandemic: a nationwide observational cohort study. Br J Anaesth. 2021 Aug; 127(2):196-204. doi:10.1016/j.bja.2021.05.001. Epub2021
112. NHS. Waiting list hits 14 year record high of 4.7 million people. BMJ.2021;373:n995. doi:10.1136/bmj.n995

113. Abram J, Gasteiger L, Putzer G, Spraider P, Mathis S, Hell T et al. Impact of COVID-19 Related Lockdown on Frequency of Acute AND Oncological Surgeries- Lessons Learned from an Austrian University Hospital. Front Public Health 2021; 9:625582. doi:10.3389/fpubh.2021.625582.
114. Mattingly AS, Rose L, Eddington HS, Trickey AW, Gullen MR, Morris AM, et al. Trends in US Surgical Procedures and Health Care System Response to Policies Curtailing Elective Surgical Operations During the COVID-19 Pandemic. JAMA Network Open. 2021;4(12): e2138038. doi:10.1001/jamanetworkopen.202138038. https://jamanetwork.com/accessed November25,2022.
115. Centers for Medicare and Medicaid Services. Non emergent, elective medical services and treatment. Recommendations. Accessed November 17,2021. https://www.cms.gov/files/document/cms-non-emergent-elective-medical-recommendations.pdf.
116. American College of Surgeons. COVID-19: elective case triage guidelines for surgical care. Accessed November 17,2021. https://www.facs.org/-/media/files/covid19/guidance_for_triage_of_nonemergent_surgical_procedures.ashx
117. Centers for Medicare and Medical Services. Opening up America again: Centers for Medicare & Medicaid Services(CMS) recommendations:re-opening facilities to provide non-emergent non-COVID 19 healthcare: phase1. Accessed June8,2021, https:www.gov/files/document/covid-flexibility-reopen-essential-non-covid-services.pdf
118. Vindegaard N, Benros ME. COVID-19 pandemic and mental health consequences: systematic review of current evidence. Brain Behav Immun. 2020;89:531-542. doi:10.1016/j.bbi.2020.05.048
119. Lim J, Broughan J, Crowely D, O'Kelly B, Fawsitt R, Burke MC, et al. COVID-19's impact on primary care and related mitigation strategies: A scoping review. Eur J Gen Pract 2021;27(1):166-175. Available from: https://doi.org/10.1080/13814788.2021.1946681 PMID:34282695
120. Yao H. The more exposure to media information about COVID-19, the more distressed you will feel. Brain Behav Immun.2020; 87:167-169. doi:10.1016/j.bbi.2020.05.031
121. Vahratian A, Blumberg SJ, Terlizzi EP, Schiller JS. Symptoms of Anxiety or Depressive Disorder and Use of Mental Health Care Among Adults During the COVID-19 Pandemic-United States, August 2020-February 2021. MMWR Morb Mortal Wkly Rep 2021;70:490-494
122. Seo JH, Kim SJ, Lee M, Kang JI. Impact of the COVID-19 pandemic on mental health service use amongst psychiatric outpatients in a tertiary hospital. J Affect. Disord.2021;290:279-283
123. Saladino V, Algeri D, Auriemma V, The psychological and social impact of COVID-19: New perspectives of well being. Frontiers in Psychology. 2020;11:577684
124. Spurr L, Tan HL, Wakeman R, et al. Psychosocial impact of the COVID-19 pandemic and shielding in adults and children with early onset neuromuscular and neurological disorders and their families: a mixed method study. BMJ Open 2022;12:e055430. doi:10.1136/bmjopen-2021-055430