

Study of Telehealth in Oncology Care: A COVID-19 Response

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Abstract - The pandemic has sparked a rapid shift toward virtual consultations in oncology. This is due to the need to decrease physical contact inside hospitals and cancer centres in order to minimize the risk of infection. The use of telehealth in routine cancer treatment during the pandemic has benefitted for patients and clinicians due to social distancing and reduced patient footfall. This study therefore focusses on the various interventions in tele-oncology and its impact on the virtualization of the practice in oncology during and post pandemic. The secondary study is based on the secondary data available from various government agencies and in the cancer care. Amongst the important sources of data are from National Cancer Registry, National Cancer Guidelines, National Comprehensive Cancer Network. A deep literature review is also carried out from various databases like Medline, Google Scholar, ProQuest, JSTOR and Science Direct. The decline in patients was due to the delay in four major causes which was delay in surgeries, delay in chemotherapy, conduct of fewer diagnosis and change in treatment protocols. Despite the fact that millions of cancer patients around the world are experiencing delays in diagnosis and care as a result of the pandemic's resource diversion, there is an increasing hope that telemedicine will play a key role in alleviating the backlog cancer cases. A process model of oncology care is presented to highlight the bottlenecks and the use of tele-oncology at specific pathways to reduce those bottlenecks. Some bottlenecks will continue to exist, such as imaging and pathology processes, where technology currently does not provide assistance. Many in-person visits can be transferred to virtual platform after a patient enters active treatment. Continued use of telemedicine for postoperative visits and systemic therapy surveillance will reduce patient travel burden and infection risk. Prior efforts to advance the digital patient experience have also been sluggish to deploy, but the pandemic revealed that it was possible to do so rapidly and successfully.

Key Words: cancer care, cancer care in COVID-19, digital health solutions in oncology, lung cancer, palliative care in oncology, telehealth in oncology, teleoncology in COVID-19

1. INTRODUCTION

The outbreak of COVID-19, was confirmed in Wuhan, China, in late January 2020. COVID-19 became a global pandemic in just two months. The implementation of social distancing measures with respect to people's interactions with the environment have changed. To prevent the spread of disease, states have issued directives restricting personal travel, closing non-essential movements, and people confined to home. The first half of 2020 saw the rise of COVID-19 as a pandemic, which had an immediate and drastic effect on cancer treatment. COVID-19 has disrupted health-care delivery around the world, putting strain on healthcare system. Many cancer patients, who need regular visits and intensive use of the health-care system to handle illness and treatment related issues, have had their health-care delivery disrupted by the crisis. This vulnerable population is at maximum risk of serious COVID-19 exposure and mortality, as well as an elevated cancer burden due to tumour growth, delayed cancer diagnosis or treatment as well as the pause or disruption of their routine medical treatment. Despite the fact that cancer prevention and screening are critical for individual and population health, the cancer industry is undergoing significant changes as a result of the outbreak of the pandemic. COVID-19-related disruptions have impacted almost every area of cancer control and prevention infrastructure, including cancelled cancer screening programmes, postponed elective procedures, dismantled therapeutic regimens, and furloughed health care providers. Remote working technologies has taken a major shift both for the patients and the providers to avoid the exposure of the virus. In this situation, digital solutions have proven to be able to strengthen the healthcare system in emergency situations. Technology is playing a critical role during the pandemic. These technologies may have a long-term effect in addition to COVID-19. The virtual care also was an emergency strategy during the onset of the pandemic for treating the cancer patients. The pandemic has sparked a rapid shift toward virtual consultations in oncology. This is due to the need to decrease physical contact inside hospitals and cancer centres in order to minimize the risk of infection. The virtual experience in consultation has proved both positive and negative simultaneously for the patients and the doctors. Tele-oncology has also proved to increase both accessibility

and affordability in providing cancer services. Cancer tele-genetics, telepathology, remote chemotherapy monitoring, symptom management, survivorship treatment, palliative care, and ways to improve access to cancer clinical trials, some of which could utilise mobile technology, are all examples of effective tele-oncology strategies. Tele-health has made this possible despite social constraints and can be used for all types of care, including outpatient, surgical planning, chemotherapy delivery (tele-chemotherapy), and clinical trials also called as tele-trials. The use of tele-health in routine cancer treatment during the pandemic has benefitted for patients and clinicians due to social distancing and reduced patient footfall. This study therefore focusses on the various interventions in tele-oncology and its impact on the virtualization of the practice in oncology during and post pandemic.

2. Objectives

- a) To conduct a detailed analysis of cancer cases worldwide and its effect of COVID 19 on cancer care (US, UK and India)
- b) To put forward some of the digital solutions in the care pathway of lung cancer, bottlenecks associated and tele-palliative care plan for cancer patients.
- c) To review the digital technologies used in the oncology care and the advancements during the pandemic

3. Methodology

The present study is based on the secondary data available from various government agencies and in the cancer care. Amongst the important sources of data are from National Cancer Registry, National Cancer Guidelines, National Comprehensive Cancer Network. A deep literature review is also carried out from various databases like Medline, Google Scholar, ProQuest, JSTOR and Science Direct. The data of the outcomes of the study has also been collected from white papers of consulting firms and oncology journals including ASCO, National Cancer Institute.

Inclusion Criteria	Exclusion Criteria
Articles taken from the start of the COVID (2020-2021)	Articles pre- COVID
Full text articles	Peer- reviewed and abstracts
Original research, Meta-analysis, Systematic review, Scoping review	Newspaper articles, conference presentations, blogs
English language articles	Articles related to only oncology
Technology related articles related to oncology	Other language articles
	Questionnaire studies

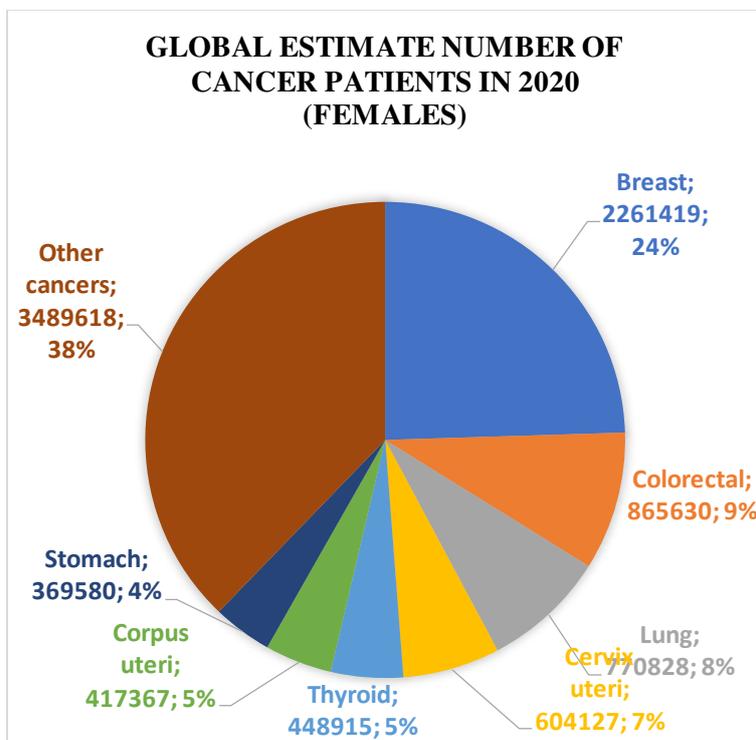
4. Results

Global Cancer Scenario

According to the International Agency for Research on Cancer (IARC), out of five people one will develop cancer during their lifetime, and one in eight men and one in eleven women will lead to death. According to the above figures, more than 50 million people will be alive within five years of a cancer diagnosis. Globally, ageing demographics and socioeconomic risk factors remain the key drivers of this rise.

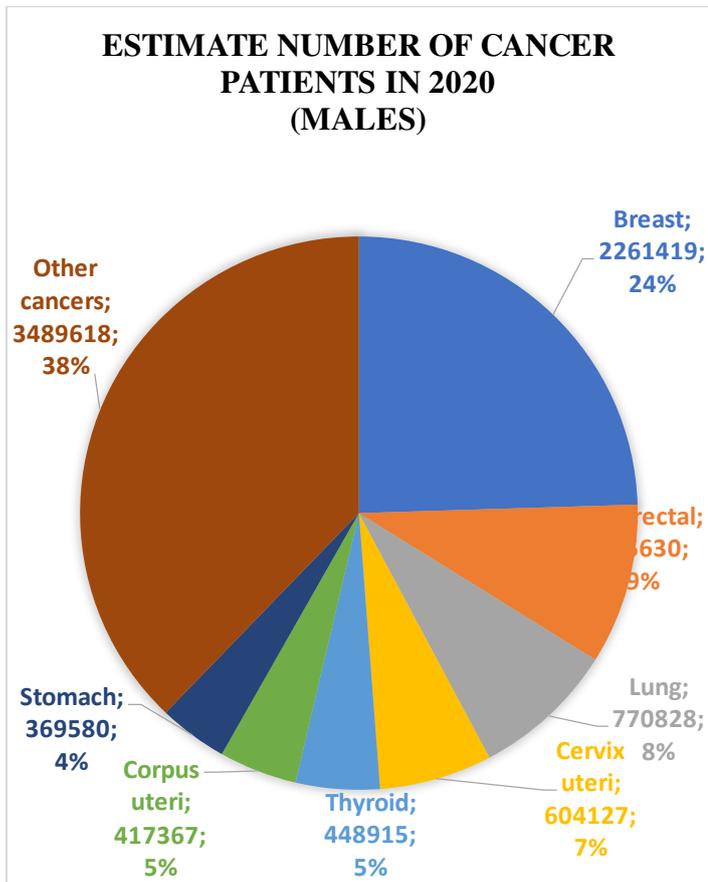
Breast cancer affects one out of every four women worldwide. Women are more likely to develop colorectal, lung, cervical, and thyroid cancers.

Fig 1: Global estimate number of cancer patients in 2020



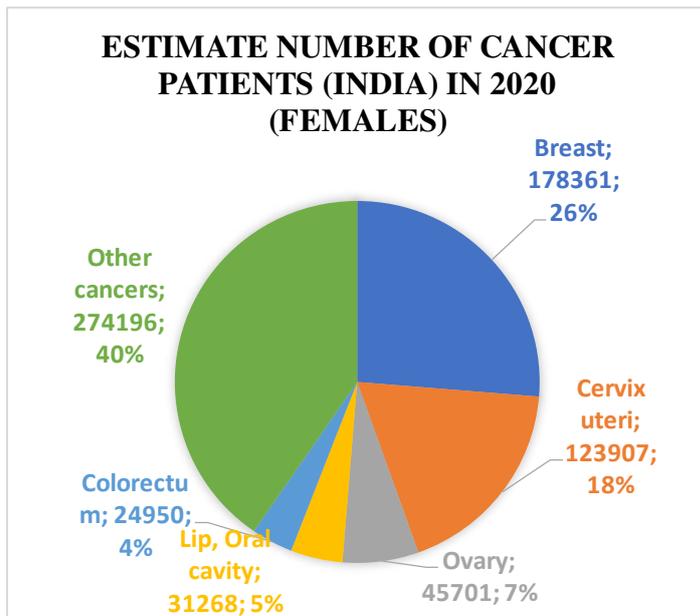
The common cancer cases in men are lung cancer and prostate cancer, which together account for approximately one-third of all male cancers.

**Fig 2: Estimate number of cancer patients in 2020
India Cancer Scenario**



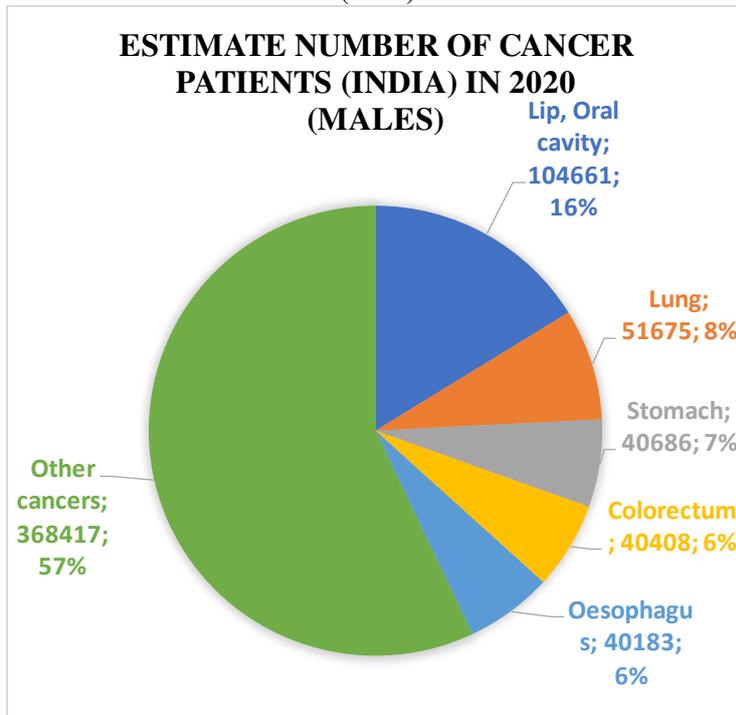
For the year 2020, the measure of incidence of cancer patients in India is 646,030 (94.1 per 100,000) for males and 678,383 (103.6 per 100,000) for females. Cancer affects one in every 68 men (lung cancer), one in every 29 women (breast cancer), and one in every nine Indians.

Fig 3: Estimate number of female cancer patients in India (2020)



In 2020, the five most common cancers for males (lung, throat, prostate, tongue, and stomach) will account for 36 percent of all cancers, while the five most common cancers for females (breast, cervix uteri, ovary, corpus uteri, and lung) will account for 36 percent of all cancers.

Fig 4: Estimate number of female cancer patients in India (2020)



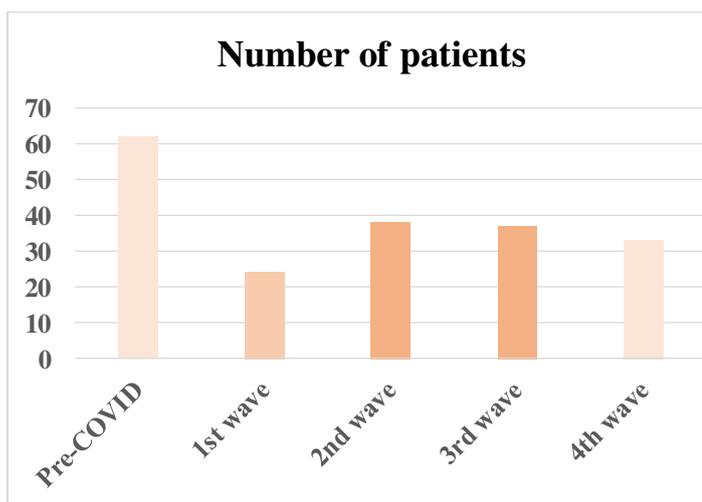
Effect of COVID on cancer care in UK

The COVID 19 pandemic and attempts to stop it from spreading had an effect on routine cancer treatment. Treatment delays and a decrease in the number of patients receiving cancer-directed care were exacerbated by the nationwide lockdown, travel restrictions, and fear of contracting COVID.

In a recent survey conducted by IQVIA by 100 physicians, the impact of COVID 19 has affected the cancer care amongst the people of UK.

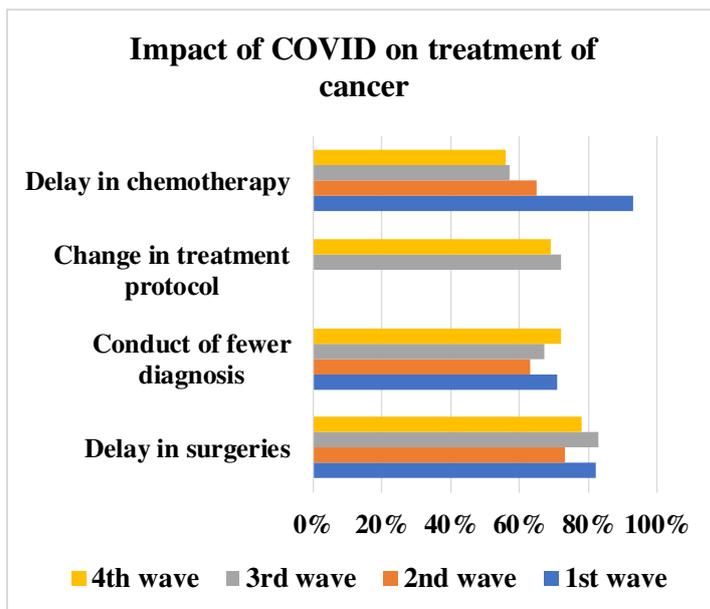
During a survey conducted, during pre-COVID and different waves of the pandemic, it was found that 62 patients visited per week to the oncologists. During the lockdown process, the number of patients reduced to 24 patients. And during the subsequent waves, the number slightly increased to 38, 37 and 33 patients respectively. But the number was less as it was pre-COVID.

Fig 5: Number of patients visits in various waves of pandemic in UK (Source: IQVIA)



The decline in patients was due to the delay in four major causes which was delay in surgeries, delay in chemotherapy, conduct of fewer diagnosis and change in treatment protocols.

Fig 6: Impact of COVID-19 crisis on cancer treatment practice in UK (Source: IQVIA)

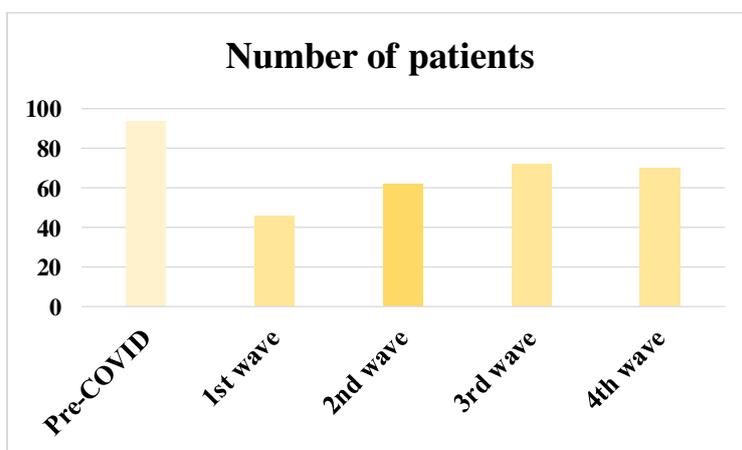


The impact was overall affected but deep diving into the types of cancers which has affected are the lung cancer (55%), breast cancer (38%) and colorectal cancer (34%). Delay in early screening and postponing of biopsies are impacting diagnosis with lung, breast and colorectal cancer.

Effect of COVID on cancer care in US

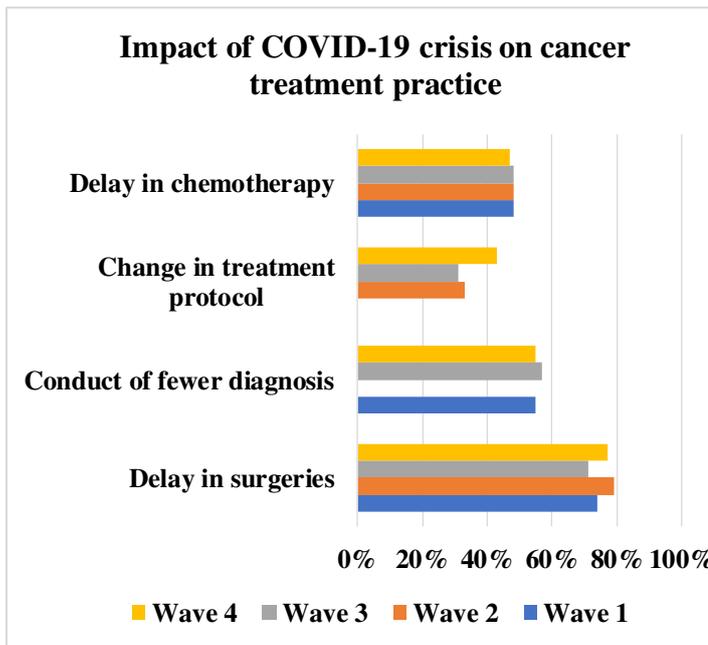
During a survey conducted prior to COVID and during various waves of the pandemic, it was discovered that 94 patients visited oncologists once a week. The number of patients was reduced to 46 during the lockdown procedure. The number of patients increased marginally in subsequent waves, to 62, 72, and 70 patients, respectively. However, compared to pre-COVID, the number was lower.

Fig 7: Number of patients visits in various waves of pandemic in US (Source: IQVIA)



The decrease in patients was attributed to four main causes: delays in operations, chemotherapy, fewer diagnoses, and treatment protocol changes.

Fig 8: Impact of COVID-19 crisis on cancer treatment practice in US (Source: IQVIA)



The effect was felt throughout the board, but the types of cancers that were most affected were breast cancer (80%), colorectal cancer (64%) and lung cancer (58%). Lung, breast, and colorectal cancer diagnoses are being hampered by delays in early screening and postponement of biopsies.

Effect of COVID - Cancer care in India

A lot of unprecedented events occurred in India after the declaration of a full nationwide lockdown to prevent the spread of the virus. But there were various healthcare utilizations which was seen at a decline rate such as drop in immunization in children, reduction in institutional deliveries. Cancer was also not left behind. There were many unprecedented events seen in decline of cancer patient footfalls.

Table: Impact of COVID on cancer care in India (2020)

Impact Indicator	Percentage/Number
Inaccessibility of life saving surgeries and treatment	70%
Postponement of chemotherapy treatment and follow-ups	
Decrease in patient footfall for cancer care in private clinics	50%
Postponement of cancer surgeries	59.7%
Cancellation of life-saving cancer surgeries	51,100

(Source: The Lancet)

Besides these, there were several other problems that resulted in the loss of life such as failure to follow up on routine cancer treatment, inability in operating emergency surgeries, and unable to return home after chemotherapy centre.

Despite the fact that millions of cancer patients around the world are experiencing delays in diagnosis and care as a result of the pandemic's resource diversion, there is an increasing hope that telemedicine will play a key role in alleviating the backlog cancer cases.

Transformation into Tele- Oncology- A Silver Lining

According to the estimates supplied by Cancer Research UK, COVID-19 has resulted in a backlog of 24 million people requiring cancer care in early June.

Therefore, the use of telemedicine has increased dramatically from about 10% before COVID-19 to around 75% since the peak of the pandemic. The unintended result of telemedicine is that a general practitioner handling cases on a regular basis has risen dramatically. This shift was made possible by the rapid adoption of digital technologies. As health-care systems move forward in minimizing the backlog in treatment of cancer, use of telemedicine will be crucial.

Recent guidelines and standard operating procedures from European Society of Medical Oncology and National Health Service England have bolstered the adoption of telemedicine practice in cancer care. Total triage is proposed in this guidance, in which an in-person appointment is given only after completion of electronic consultation. To reduce the need for hospital visits, the National Health Service (NHS) England recommends using mobile or video consultation in the treatment of cancer patients who do not have COVID-19. In the event that NHS employees must be quarantined for whatever occasion, video conferencing may be used to attend multidisciplinary team meetings.

In order to successfully incorporate and integrate telehealth into cancer care, it must first be determined which in-person services can be delivered safely and effectively using this technology. According to ASCO paper, COVID-19-positive infections, nonurgent high-risk patient populations, and symptom management are all appropriate telemedicine visit types.

Transformation of tele-oncology is surely helping in solving the cancer backlogs but the process of deployment and the implementation is a major concern in the ongoing pandemic.

Mapping of Digital Health Applications in Oncology Care Pathway- Effect of COVID-19 on lung cancer treatment

Cancer treatment is one example of where deferring medical care could be crucial, as the danger of metastasis increases without treatment. However, surgeries and laboratory examinations are frequently postponed. Also, post-operative care and follow up tests were halted, putting cancer treatments at risk. However, this may result in an increase in readmission rates. COVID-19 also hampered cancer diagnosis, as physician consultations and diagnostic examinations were frequently postponed due to resource constraints.

To address the above process-oriented approach during the pandemic, a process model of oncology care is presented to highlight the bottlenecks and the use of tele-oncology at specific pathways to reduce those bottlenecks.

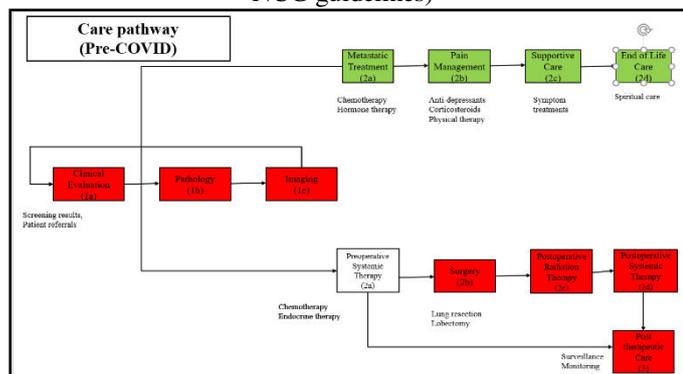
A lung cancer care model will be presented in the following sections. The example was chosen because COVID 19 has had a major impact on oncology patient treatment procedures. The high vulnerability to the virus is caused by cancer and subsequent cancer treatment that relies on immune suppressing drugs.

In the below figure, processes 1a, 1b and 1c describes the diagnostic phase while 2a,2b, 2c and 2d (upward process) describe the treatment phase where palliative care must be chosen and 2a, 2b, 2c and 2d (downward process) describes curative therapy for small cell and non-small cell lung cancer. And process 3 represents the process of post therapy care.

The diagnosis is the first step in lung cancer treatment. Clinicians examine the patient's health and confirms about the risk factors. The confirmation of a lung cancer diagnosis necessitates an assessment of the disease's stage, treatment selection, and follow-up tests such as imaging (ultrasound, MRI and PET-CT) and a biopsy. If the cancer can be treated, surgery options include surgery (lobectomy) and lung resection. Adjuvant therapies, such as chemotherapy, are examples of systemic therapies. However, if the cancer cannot be treated, palliative care for the patient is chosen.

The bottlenecks in cancer care provision (red marked), including surgeries, lab evaluations, diagnostic processes, and postoperative care. These major bottlenecks (processes) are highlighted in red in the lung cancer treatment process model.

Fig 9: Care pathway of lung cancer (Drafted from NCCN and NCG guidelines)



Clinical evaluation as bottleneck

The exposure of virus and crowded patients can make the normal asymptomatic patient vulnerable to COVID. So, the backlogs of screening and clinical examination is also reduced during the pandemic making it worse to develop the symptoms more.

Diagnosis as bottleneck

Many patients have been afraid of being exposed to the virus or of burden of healthcare services, until seeking

cancer screening and diagnosis. Most types of endoscopy procedures generate aerosol, increasing the risk of COVID transmission.

Surgery as bottleneck

Surgery has also been reduced as theatre space and ventilators have been requisitioned to provide additional critical care capacity for COVID-19 patients.

Also, reports of patients developing COVID-19 after being admitted to the hospital have made patients more hesitant to have surgery. As a result, many cancer centres have turned to various treatment modalities and ultimately surgeries are postponed.

Radiotherapy as bottleneck

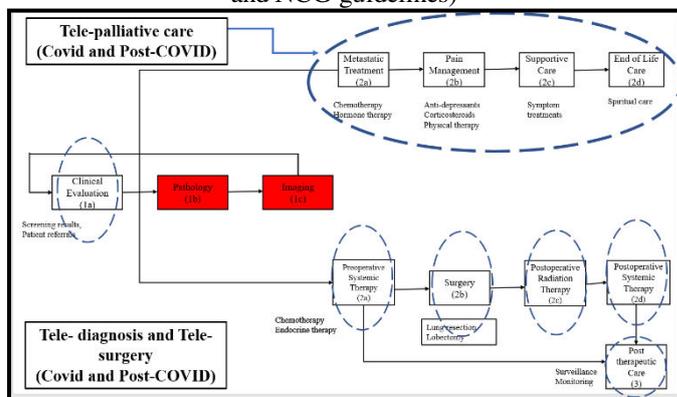
Radiotherapy has always played an important role in cancer treatment, both as palliative and curative treatment. As the pandemic unfolded, radiation therapy is frequently used to replace or postpone with a higher infection risk.

Systemic treatment as bottleneck

Systemic treatments may put the patients at greater risk of infection and worsen their outcomes if they develop COVID-19.

Digital health solutions to close some bottlenecks

Fig 10: Care pathway of lung cancer (Drafted from NCCN and NCG guidelines)



Clinical evaluations

Through teliagnosis and tele-oncology procedures, the exposure of virus transmission can be reduced which will ultimately save the patient from developing symptoms. Usage of artificial intelligence and mapping the care pathway to the electronic health record will reduce the transmission of virus more.

Treatment and tele-palliative care

Some forms of systemic therapy and palliative care can be conducted through digital technologies such as pain management, spiritual care and end of life care which does not require in-person visit during the pandemic and this will be the new normal.

Curative Therapy

Curative therapies such as chemotherapy are now being conducted through technology using a virtual consultation through a nurse in the home-based care or

any injectibles that the patient can administer themselves in the home itself getting instructions from the tele-physician at the other side.

Pathology and imaging to remain as bottlenecks

However, some bottlenecks will continue to exist, such as imaging and pathology processes, where technology currently does not provide assistance. Smartphone cameras may be used for medical imaging, but in the case of lung cancer, these technologies are unable to capture medically useful images. As a result, these technologies cannot be used for imaging procedures.

Tele-palliative Care Plan amid COVID- 19

Palliative medicine is an important part of cancer treatment that can be delivered in a variety of settings, including outpatient clinics, inpatient consultations, dedicated palliative medicine units, long-term care facilities, and home care. Because of the growing complications in cancer patients, there is a concern that these patients will be receiving delayed necessary care and medical services, such as palliative care and supportive care.

Due to the ongoing COVID-19 pandemic, palliative care and oncology providers face unique challenges. Telepalliative care is the use of telehealth services to provide palliative care to patients. During the ongoing pandemic, it holds a lot of promise for meeting the needs of patients with advanced cancer.

According to several studies, telehealth is both cost-effective and has high levels of patient satisfaction. Telehealth have proven to be a cost-effective way to overcome travel-related barriers.

Palliative Care via tele-route

Palliative care physicians can interact with patients, demand for medical history, and check for any symptoms using audio-visual platforms for videoconferencing. To supplement their clinical assessment, physicians can use a virtual physical exam combined with patient self-examination. These measurements can be used to estimate the patient's current functional status and evaluate certain physical characteristics such as vital signs, general physical appearance, cardiorespiratory status, skin and extremity changes, and changes in performance status.

Initial assessment

Palliative care physicians can interact with patients, demand for medical history, and check for any symptom by using audio-visual platforms for videoconferencing. Physicians can supplement their clinical evaluation with a virtual physical exam supplemented by patient self-examination. Telemonitoring or home-based telehealth services can be used for ongoing patient monitoring and palliative care delivery. These also allow for remote monitoring of symptoms after the patient begins systemic chemotherapy.

Special Virtual visits

Virtual visits can also be used to detect signs of psychological distress and emotional stress. Telehealth services like videoconferencing help maintain a

connected relationship by allowing doctors to interact with and respond to their patients' cues. Before beginning a consultation, the clinician should make comfortable the patients before starting with the virtual visit.

Remote monitoring of symptoms

Telemonitoring can be used for ongoing patient monitoring and palliative care delivery. These also enable remote symptom monitoring once the patient begins chemotherapy.

Follow-up virtual visits

Follow-up virtual visits can be conducted via videoconferencing. During these visits, any supportive care that may be required can be discussed. When patients and their families are dealing with a lot of uncertainty, having access to a tumor board or multidisciplinary board of doctors can help with their emotional well-being.

Case Study and Flow chart for Telepalliative Care plan for Cancer

Ms X is an old woman with metastatic pancreatic cancer and aggravating pain in her back. She considered initiating chemotherapy of the second line and was referred to as the palliative treatment programme. Ms. Smith lives alone, and on days of chemotherapy her neighbour drives her to and from the clinic. The reduction in clinical staff associated with COVID-19 has reduced the range of palliative clinical service. In 14 days, the next clinical meeting will be available.

So, a clinical pathway is shown for palliative care about the steps followed and where in digital health/telehealth/telepalliative care can be opted so that Ms X will not visit the clinic and can be treated in her home itself.

The clinical pathway is drafted from the National Comprehensive Cancer Network (NCCN guidelines) and a flowchart is shown in the below figure.

Telehealth Plan

- The palliative care provider can address the pain of the patient during an initial virtual visit, which is a common symptom for cancer patients. Uncontrolled pain may result in hospitalisation that can increase your risk of exposure to COVID-19.
- The location and nature of the pain are known to help the oncology team to determine the etiology of the pain and inform their subsequent management, aggravating and related factors and relationships of pain and posture.

- Then the initiation of chemotherapy is started which can be a virtual visit for administering of injectibles which a nurse can be available for Ms X in the home.
- After the chemotherapy, reassessment is done by the doctor to see any alarming changes through remote monitoring.
- If any alarming changes and depending on the pain and severity, Ms X can be continued with remote palliative care or need hospitalization.

Fig 12: Palliative Care plan for cancer patient (NCCN guidelines)

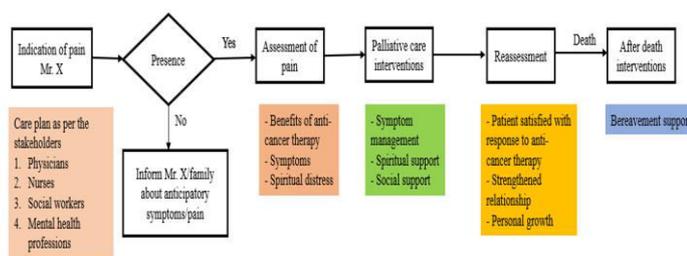
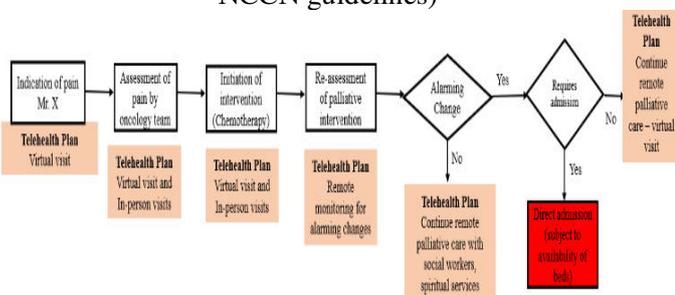


Fig 13: Tele-palliative care plan for metastatic pancreatic cancer (Drafted from Palliative Care as per NCCN guidelines)



5. Recommendation

It is improbable that oncology will return to pre-pandemic conditions. To ensure fairness of access to healthcare for patients and their families, adaptation to a "new normal" in cancer care would necessitate ongoing reconsideration of various interactive, economic, and physiological components of cancer care. The interpersonal and technological repercussions of the telehealth shift will need to be addressed based on patient situations and capacities, as well as the growing financial systems of oncologists across the country. Virtual clinic visits and phone call evaluation for routine visits that do not require physical examination or activities related to oncological concerns can aid in the reduction of hospital visits for clinical encounters (cancer survivorship, palliative care, chemotherapy, online education). Before returning to normal hospital operations, communication and care coordination must

be addressed. Organizations must invest in proper infrastructure, such as adequate technology and Internet speed, as well as provider training on how to use telehealth effectively.

In the digital era, virtual connecting of electronic health records with diagnostic tools will allow for a better sharing of health information in order to provide the right care at the right time. Portable cameras equipped with technology to detect skin changes and rashes connected with radiation and chemotherapy, as well as computer-based interactive tools that analyse cancer-related symptoms, may be included. Data gathered from the delivery of care to cancer patients during COVID-19 will also be used to develop care models and policies.

6. CONCLUSIONS

The online version of the volume will be available in LNCS Online. Members of institutes subscribing to the Lecture Notes in Computer Science series have access to all the pdfs of all the online publications. Non-subscribers can only read as far as the abstracts. If they try to go beyond this point, they are automatically asked, whether they would like to order the pdf, and are given instructions as to how to do so.

Acknowledgement

The authors wish to thank Professor Divya Aggarwal, Associate Professor, International Institute of Health Management and Research (IIHMR), New Delhi for continuous motivation and encouragement.

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