

In partnership with the
Lung Ambition Alliance



Learning Lessons from across Europe: Prioritizing Lung Cancer after COVID-19

JANUARY 2021



Contents

3	Foreword
4	Introduction
6	Methodology
7	Summary of recommendations
8	Steps to diagnosis
11	Making initial care and treatment choices
13	Support throughout treatment
15	Clinical trials
16	Additional priority recommendations
17	Conclusion
18	Contributors
19	Endnotes

The World Economic Forum

The World Economic Forum is the International Organization for Public-Private Cooperation. The Forum engages the foremost political, business, cultural and other leaders of society to shape global, regional and industry agendas.

The Forum launched the COVID Action Platform to coordinate action by business, combined with global, multistakeholder cooperation at exceptional scale and speed to:

Galvanize the global business community for collective action

Understand the global, industry and region-specific impact of the pandemic, improve coordination and pursue opportunities for collective action

Protect people's livelihoods and facilitate business continuity

Develop and share tools and best practices, and amplify trusted information

Analyse and codify the impact of the outbreak and support collective response measures

Mobilize cooperation and business support for the COVID-19 response

Coordinate and deploy the assets and capabilities of business and other stakeholders

The Lung Ambition Alliance

The Lung Ambition Alliance is a non-profit partnership between AstraZeneca, the International Association for the Study of Lung Cancer (IASLC), Guardant Health and the Global Lung Cancer Coalition (GLCC) aimed at eliminating lung cancer as a cause of death. Our first step towards this ambition will be to double five-year survival rates by 2025.

The Lung Ambition Alliance is intended to be a collaborative, cross-community effort bridging the commercial and non-profit sectors to bend the survival curve in lung cancer faster and improve outcomes for patients globally.

This report has been developed by the World Economic Forum and the Lung Ambition Alliance, in collaboration with AstraZeneca. The Lung Ambition Alliance is a partnership with the International Association for the Study of Lung Cancer (IASLC), the Global Lung Cancer Coalition (GLCC), AstraZeneca and Guardant Health. The drafting of the report was supported by ENGINE MHP on behalf of AstraZeneca.

Document number: Z4-30338
Date of preparation: January 2021



Elissa Prichep
Lead, Platform for Shaping
the Future of Health and
Healthcare, World Economic
Forum



Giorgio Scagliotti
Past president, Interim Chief
Scientific Officer, International
Association for the Study of
Lung Cancer



David Fredrickson
Executive Vice-President,
Oncology Business at
AstraZeneca

Foreword

Prior to the pandemic, lung cancer was the leading cause of cancer deaths across the world.

The COVID-19 pandemic has had significant and far-reaching impacts across the world – with lives and livelihoods lost, society disrupted, and public services strained like never before. While individual countries' health systems have marshalled specific responses to the dynamic demands of the pandemic, there continue to be myriad additional health needs that must be addressed. Even as we start to turn a corner with the introduction of vaccines for COVID-19, the repercussions of the pandemic on health systems and care delivery are likely to be with us for the longer term, and action is required to ensure the needs of patients are met across the globe.

Even prior to the pandemic, lung cancer was the leading cause of cancer deaths across the world.¹ Globally there are over 1 million diagnoses of lung cancer every year.² Health services have made heroic efforts to respond to the pandemic, but shifting resources in some cases has had a detrimental impact on services beyond COVID-19, including patients with cancer. Lung cancer patients and the care they need have been acutely affected by this due to the potential similarity in symptoms of the two conditions and the redeployment of front-line staff and resources from respiratory departments.

During the initial stages of the pandemic, we observed early signs and signals of the adverse impact on cancer patients – concerns about accessing essential medical services, reduced clinic capacity for non-COVID-19 care, and fewer people being referred and diagnosed with lung cancer. Additionally, we learned of changes occurring in the delivery of care and treatment by healthcare professionals to maintain continuity of support to those with suspected or confirmed lung cancer. Use of relevant diagnostics to screen and monitor cancer has dropped dramatically due to the

postponement of non-essential visits. We know that each country across Europe has had a different experience of the pandemic, and we want to share the accumulated lessons learned and suggestions for long-term system resilience in the hope that there is an opportunity for us to emerge from this crisis better able to deliver care for lung cancer patients over the long term.

We are immensely grateful to the healthcare professionals, patient representatives, industry partners, policy-makers and others who have given their time and expertise to this project. They generously shared their experiences, ideas and thoughts to guide a set of recommendations on the way forward for lung cancer services, learning the lessons of 2020. We have started this project in Europe and believe that the lessons here will be helpful for countries around the world. We also hope to be able to run similar projects in other regions in the future.

As we learn from the early phases of the pandemic and move into a new normal, with vaccines on the horizon and new ways of working, we must rapidly return to the work of improving cancer outcomes. While improving over time, the outcomes for lung cancer patients were already dramatically below those with other cancers before the pandemic. If we can make progress in lung cancer services, this will provide a beacon for all cancer services. We hope this report will help governments, health systems, healthcare professionals and others to come together to understand the effect of the pandemic on lung cancer care, to address the immediate impact of the pandemic on lung cancer services and to ensure their resilience in the longer term so that we can go further than ever before to improve patients' outcomes.

Introduction

The past few years have seen considerable advances in treatment options for lung cancer, yet prognosis remains poor.



Lung cancer is the leading cause of cancer death worldwide. Trends in incidence and mortality vary between countries, but globally lung cancer is the most common cancer and is responsible for one in every five deaths from cancer.³ The past few years have seen considerable advances in treatment options for lung cancer, yet prognosis remains very low. In Europe, fewer than ~15% of people with lung cancer survive up to 5 years.⁴ One of the main reasons for this poor prognosis is that a large proportion of lung cancer cases are detected at an advanced stage, when treatment options are limited. Prognosis for lung cancer is highly dependent on the stage at which it is diagnosed: a person diagnosed with stage IV lung cancer has a ~15% chance of surviving one year – as compared to over 80% if detected at stage I.⁵

Lung cancer is typically diagnosed at a later stage, and this occurs for many different reasons.⁶ People often do not have symptoms until their disease has progressed; symptoms may initially not appear to be serious; people may not understand their own risk of lung cancer or, because of the strong link with smoking and the associated stigma, they may be fearful of coming forward to seek help. Symptoms of lung cancer can be similar to those of other conditions, such as chronic obstructive pulmonary disease, another smoking-related disease, and now COVID-19 disease, leading to delays in diagnosis. Patients may also face other barriers such as a lack of access to healthcare. By the time an accurate diagnosis is made, patients may no longer be eligible for effective treatments.

The COVID-19 pandemic has had a dramatic impact on the early detection of lung and other cancers. In the first few months of the pandemic, screening programmes in many countries were suspended, diagnostic tests and procedures deferred and only the most urgent symptomatic cases were referred for diagnostic follow-up. The ensuing delays in diagnosis have led to a high number of avoidable cancer deaths. For example, a study in England estimated that these delays will lead to a 4.8 – 5.3% increase in avoidable lung cancer deaths over the next five years.⁷ As healthcare systems emerge from ‘crisis mode’, they face a significant backlog of cases, which may further delay a return to normal service levels.

During the initial peak of the COVID-19 pandemic, when many people were asked not to leave their homes, there was a significant reduction in the number of people accessing healthcare services for non-COVID-19 related conditions. This has affected many different conditions, including cancer. The World Health Organization found that 55% of countries reported disruption to cancer treatment and diagnosis services.⁸

This is likely to have exacerbated some of the existing challenges people faced in being diagnosed with lung cancer. In the UK some services reported up to a 75% reduction in the number of people

being urgently referred with suspected lung cancer in the peak of the pandemic.⁹ Similarly, the redeployment of frontline staff and resources to respiratory departments for care of COVID-19 patients may have also had a disproportionate impact on treatment for lung cancer.¹⁰

Current excess healthcare capacity to catch up on missed tests and associated cancer treatments would require providers to shift priorities to make time and space in schedules and facilities as well as the cooperation of patients to return to healthcare providers. Both of these could be further disrupted by economic factors or the reintroduction of strict social distancing due to re-emergence of the outbreak seen in Europe in the Autumn of 2020.

Even prior to the pandemic, there was an urgent need to take action to improve lung cancer outcomes across Europe. The COVID-19 pandemic has heightened this need; but potentially also provided opportunities for lessons to be learnt that could be adopted in the longer term as innovations have been seen throughout the lung cancer pathway in response to the changes and restrictions imposed during the pandemic.

The World Economic Forum and the Lung Ambition Alliance formed a platform to distil this learning. This report is based on insight shared by clinicians, patient representatives, policy-makers and industry partners from five European countries: France, Germany, Italy, Spain, the United Kingdom, and the World Health Organization. Sharing these experiences will help to reflect the scale of impact of the pandemic on lung cancer patients, demonstrating an urgent need to recover services and improve outcomes for patients. It will also play a role in identifying those innovations that will have the greatest impact for patients in the short and longer term to support the resilience of lung cancer services in the future.

The policy recommendations in this report are grouped according to four priority areas, with the aim of covering the journey that most lung cancer patients will go through:

- Steps to diagnosis
- Initial care and treatment choices
- Support throughout treatment
- Clinical trials

There are also cross-cutting recommendations that underpin the pathway. The recommendations are aimed at European, national and regional actors, who all need to come together to learn the lessons of the impact of COVID-19 on lung cancer services to deliver change for the future.

Methodology

The COVID-19 Taskforce harnessed the insights of experts from the Lung Ambition Alliance, World Economic Forum and associated partners to inform the development of this report.

Participants were selected on their association with the two organizations, as well as their knowledge and profession in relation to oncology.

Extensive desk research was undertaken to examine the global impact on cancer and health services of the COVID-19 pandemic. The scope of this research included clinical guidelines, review of patient and healthcare provider (HCP) surveys and individual case studies by country and region.

The first Taskforce meeting was held on 7 October 2020. The meeting provided an overview of the initial response to COVID-19 in terms of oncology services and lessons learned from the impact of the pandemic. Individual experiences were discussed during this meeting, as well as proposed approaches in shaping the Taskforce and the recommendation outputs.

Several structured working group meetings and interviews followed this meeting, with each recorded and transcribed, identifying the themes and patterns discussed. Each theme was analysed to gain further understanding of the participants' comprehension and motivation – resulting in the categorization of themes into four pillars of priority as we worked towards shaping policy recommendations:

- Steps to diagnosis
- Initial care and treatment choices
- Support throughout treatment
- Clinical trials

As further investigation into these pillars was undertaken, it emerged that there were underlying enabling factors that would need to be taken into consideration:

- Data collection and sharing
- Patient information and communication
- Regional capacity and system organization

All documentation has undergone rigorous review from the Taskforce participants and compliance analysis.

Taskforce objectives were to identify innovations in how to resume lung cancer services and manage the backlog of patients needing care. Policy recommendations were drafted across the pillars, looking at the safeguarding and strengthening of lung cancer services during and following the COVID-19 pandemic.



Summary of recommendations

The Lung Alliance Ambition, in partnership with the World Economic Forum, calls for policy-makers (governments, Ministries of Health, regulators etc.) around the world, to increase investment in technology, and make greater use of real-world data. This will help to identify and address the impact of COVID-19 on lung cancer patients, support patients throughout their lung cancer treatment journey and drive improvements in care.

As the healthcare landscape has changed throughout the pandemic, policy-makers also need to communicate with healthcare professionals about the similarities in symptoms between lung cancer and COVID-19, continuing to reassure people that services are open and safe and encourage them to identify and return to appropriate services. Our report, *Learning Lessons from across Europe: Prioritizing Lung Cancer after COVID-19* makes the following additional recommendations:

- **Screening and diagnosis:**
Strategies are needed to identify lung cancer patients more proactively, such as through targeted screening programmes for those people at risk
- **Improve capacity:**
Greater investment is needed to enhance capacity across the healthcare system (primary care and secondary care) to ensure swift referrals to improve diagnosis and access to appropriate treatment
- **Integration of innovation:**
Greater investment in and integration of new innovations and technologies is needed to aid more accurate diagnosis and identify appropriate treatment options
- **Clinical trials:**
Greater analysis of data collection and usage is needed to improve and validate the use of real-world data within and inform clinical management outside of clinical trials

Steps to diagnosis

Lung cancer mortality remains one of the highest among all cancers, with the key driver being the difficulty in detecting lung cancer in the early stages of the disease.¹¹

Early diagnosis of lung cancer is considered a key driver for longer-term survival, so ensuring patients present as early as possible is a primary goal for lung cancer services.¹²

In Spain, the number of new cancer patients fell by 21% during the first wave of the pandemic compared to the same period in the previous year.¹³ A similar picture was experienced in the UK, with referrals to a lung cancer specialist dropping by 75% in some areas.¹⁴ It is therefore crucial that early diagnosis be considered as a critical path to ensuring that lung cancer patients are identified as a priority.

Early diagnosis of lung cancer relies on patients and professionals recognizing the potential risks or signs and symptoms and taking action to address these. When people present at healthcare services with potential symptoms of lung cancer, they need to be referred quickly for further investigations to get a definitive diagnosis as fast as possible. All of these steps in the process were disrupted by the COVID-19 pandemic.

Using data to identify at-risk patients

Screening is an important method of identifying cancer earlier before symptoms develop. The Dutch-Belgian NELSON trial has been the largest European randomized lung cancer screening trial, recruiting a total of 13,195 men (primary analysis) and 2,594 women (subgroup analysis) between the ages of 50 and 74. When male participants were randomly assigned to undergo CT screening or no screening, with follow-up spanning 10 years, there was shown to be a 26% reduction in lung cancer deaths compared to the control group.^{15,16}

The NELSON trial is the third study showing a significant reduction in lung cancer mortality, in addition to the previously reported National Lung Screening Trial (NLST) and Multicentric Italian Lung Detection (MILD) studies.^{17,18}

Despite evidence supporting the success of lung cancer screening there is still no national programme implemented anywhere in Europe.¹⁹ The UK National Screening Committee (NSC) is currently reviewing the results from the NELSON trial and other sources to determine if a national programme will be initiated, but urgency is required.²⁰

It is important that the impact of COVID-19 on risk-taking behaviour, such as smoking, is identified and monitored to ensure that modelling of the likely future demand for lung cancer services is accurate. More information is needed on changes in individual behaviour and the impact of the pandemic on people's interactions with health systems to inform the future public health messaging on tobacco cessation resources available.

There are estimates that the number of at-risk people not being identified for lung cancer has increased during the pandemic. Collection of real-time data to stratify the number of people that could be at risk of lung cancer down to a demographic level is essential to gain a renewed understanding of this picture. This will be necessary to develop strategies for proactive outreach that can be used to prioritize people at increased risk of lung cancer, expedite their triage and ultimately restore lung cancer presentation to pre-COVID-19 levels. Data collection should be conducted at regional and national levels and entered into data hubs and/or patient registries which can be analyzed in real time.

Public health awareness and patients' recognition of risks and symptoms of lung cancer

The COVID-19 pandemic has exacerbated healthcare disparities across populations and has created confusion among the public, including those at risk of lung cancer. Ensuring that individuals are aware of their own risk of lung cancer and how to identify the potential signs and symptoms is necessary to encourage people to present at healthcare services. Messaging for those at risk of lung cancer has reportedly been inconsistent during the pandemic, with 89% of French people stating that messages on cancer prevention and awareness were reduced or invisible during the COVID-19 pandemic.²¹ These have been replaced by messages emphasizing the need to stay at home to protect health services, resulting in patients taking the decision not to present with health concerns. The Taskforce discussed the fact that misinformation surrounding COVID-19 continues to be spread via social media and was considered to be a contributor to the fear of exposure to COVID-19 within healthcare environments. People were more fearful of a COVID-19 diagnosis than a cancer diagnosis during the height of the pandemic; restoring confidence among the general public so that they visit their doctor is vital to ensure that lung cancer cases are not missed.²² An immediate return to previous volumes of testing and care will require substantial reallocation of resources and will likely last months after social distancing rules are relaxed. This has been identified as a key recommendation. In addition to this, sharing messages with patients about the typical risks associated with lung cancer should continue, acting as a reminder that these still exist and that actions, such as smoking cessation, are to be encouraged.

Clinical identification of differentiating symptoms

The overlapping clinical features of lung cancer and COVID-19 have added complexity for people in distinguishing lung cancer from possible COVID-19. This also applies to healthcare professionals being able to swiftly identify patients who need to be referred to secondary care with suspected lung cancer. There is a real need to boost public and professional awareness about the similarities between lung cancer and COVID-19 symptoms and encourage people whose symptoms persist to seek medical advice even after a negative COVID-19 test result. An example of best practice in differentiating cancer vs. COVID-19 can be found in a UK suggested mitigations paper, looking at the overlapping symptoms of the two conditions.²³

Technology has also been employed in some scenarios to help assist with triage and mitigate the problems caused by overlapping symptoms. A software platform in Russia is being used retrospectively to review 20,000 CT scans a month and detect malignant tumours from scans of COVID-19 damaged lung tissues.²⁴

The use of an artificial intelligence (AI) system developed by an Italian start-up was initially validated on 520 radiographs collected during the first wave of the pandemic.²⁵ Here, AI has proved capable of estimating the probability of lung infection by the virus in patients undergoing chest X-rays, "comparing" the current exam with all previous imaging and detecting 89% of COVID-19 cases while processing each X-ray in less than a minute.²⁶

Differentiation of the Cs in lung cancer: cancer vs. COVID

Work has been done in the UK by members of the Lung Cancer Clinical Expert Group to clarify the distinction between lung cancer and COVID-19. This group has developed a suggested mitigation resource for the overlapping symptoms in order to help differentiate lung cancer from COVID-19. Their findings are provided in the following table.²⁷

A Features more suggestive of lung cancer	B Indeterminate features	C Features more suggestive of COVID-19 infection
<p>Overlapping symptoms are unaccompanied by COVID-19 symptoms:</p> <ul style="list-style-type: none"> - Unexplained persistent cough - Unexplained persistent breathlessness - Fatigue of duration >4 weeks - Persistent or recurrent chest infection <p>May be accompanied by more specific red-flag symptoms of lung cancer including:</p> <ul style="list-style-type: none"> - Haemoptysis - Chest pain - Weight loss - Appetite loss <p>And examination/other findings:</p> <ul style="list-style-type: none"> - Finger clubbing - Supraclavicular lymphadenopathy or persistent cervical lymphadenopathy - Chest signs consistent with lung cancer - Thrombocytosis <p>Also consider risk factors for lung cancer:</p> <ul style="list-style-type: none"> - Smoking history - Age - Asbestos exposure 	<ul style="list-style-type: none"> - Cough, unclear onset and persistent breathlessness, unclear onset and persistence - Unclear if any fever - Flu-like symptoms lasting >3 weeks - Feeling of chest tightness - Difficulty in taking a deep breath - Fatigue with duration <4 weeks - Recurrent chest infections of possible features of COVID-19 - No other clear red-flag symptoms 	<p>Acute onset of:</p> <ul style="list-style-type: none"> - Dry cough - Breathlessness - Fever - Myalgia - Loss of smell - Loss of taste <p>Close contact with a confirmed/highly suspected case of COVID-19</p> <p>Initial flu-like symptoms for 1–2 weeks with onset of respiratory symptoms from 7–10 days.</p>
<p>Action:</p>	<p>Action:</p>	<p>Action:</p>
<p>Arrange an urgent nasal/oropharyngeal swab for SARS-CoV-2 PCR and if negative:</p> <p>Refer for chest X-ray or direct to lung cancer service for CT and triage on the National Optimal Lung Cancer Pathway</p> <p>If PCR positive, manage according to current COVID-19 guidelines and review after 2 weeks if hospital admission not required; consider 2-week wait referral in patient recovered from COVID-19 in whom lung cancer suspected</p> <p>If symptoms require urgent attention, consider emergency admission</p>	<p>Arrange a nasal/oropharyngeal swab for SARS-CoV-2 PCR and if negative:</p> <p>Ask patient to self-isolate for 14 days and then review symptoms; if persistent refer as for A</p> <p>If PCR positive, manage according to current COVID-19 guidelines and review after 2 weeks if not admitted to hospital</p> <p>If symptoms require urgent attention, consider emergency admission</p>	<p>Manage patient according to the latest guidelines on the management of COVID-19</p>

Figure 1: Taken from Differentiation of the Cs in lung cancer: cancer vs. COVID providing a suggested mitigation for the overlapping symptoms of cough, breathlessness and fatigue.

Authors: Matthew Evison, Seamus Grundy, Simon Bailey, Richard Booton, Rajesh Shah, Neil Bayman, Fiona Blackhall, Colin Lindsay, Liz Toy, Matthew Hatton, Denis Talbot, Sanjay Popat, David Gilligan, Yvonne Summers, Douglas West, Andrew Wilcock, Richard Lee, David Baldwin and members of the Lung Cancer Clinical Expert Group.

Access to COVID-safe services

A key barrier to people accessing health services to seek a diagnosis of lung cancer during the pandemic has been concern about the risk of COVID-19 infection in healthcare settings. Messages about the need to stay at home to avoid infection or to protect health services were more powerful than messages about services remaining open. While these messages are now getting through—and in some countries there have been major publicity campaigns to encourage people to seek health advice—there is still a need to demonstrate the efforts that have been taken to make services COVID-19-secure or COVID-19-safe.^{28,29,30} There is also a great need for investment in separate COVID-19-free clinical spaces for the delivery of lung cancer care.³¹ This will require consideration of physical spaces, equipment and cleaning plus additional clinical and diagnostic workforce capacity in primary and secondary care so patients can be seen and referred to specialist care quickly.

Recommendations

Acute

- Ministries of Health need to communicate with healthcare professionals about the similarities in symptoms between lung cancer and COVID-19 and encourage appropriate triage and referral of patients
- Ministries of Health must invest in COVID-19 free-clinical spaces to reassure people that services are open for them to communicate any concerns they may have about their lung health
- Governments should work with patient advocacy groups to launch public health awareness campaigns for lung cancer, responding to perceived misinformation, to encourage people to present and return to health services

Recovery

- Ministries of Health need to urgently consider and invest in strategies to identify lung cancer patients, such as targeted screening programmes

Build resilience

- Governments and health systems need to consistently collect real-time data at national and local level to evidence the impact of the pandemic on lung cancer patients and stratify high-risk patient groups
- Ministries of Health must ensure there is sufficient capacity at primary care level for patients to be seen and swiftly referred to specialist care

Making initial care and treatment choices

Cancer incidence continues to rise in the EU, which means the volume of patients entering cancer pathways is rising.³² In addition, the growing capacity constraints in health systems have made it challenging to tackle delays in lung cancer pathways.³³ The arrival of COVID-19 has exacerbated this problem, due to the reduced availability of diagnostic services, pausing of therapies and redeployment of specialist staff. A survey of 528 oncologists from across the five largest countries in Europe identified lung cancer as the third most affected cancer by delays to diagnosis due to the pandemic.³⁴

Achieving a diagnosis

Timely diagnosis and patient access to care and treatment are acknowledged as a key factors for improved cancer outcomes and there have been significant efforts to accelerate diagnosis in the lung cancer pathway.³⁵ Delays in moving a patient through the lung cancer pathway can have negative implications on cancer outcomes. The National Optimal Lung Cancer Pathway (NOLCP) in England aims to speed up diagnosis and treatment times and specifies that the maximum pathway length should be 49 days; however, the national cancer wait times target has remained unchanged at 62 days.³⁶

It is estimated that in England, delays in diagnosis due to system pressures caused by COVID-19 could result in an additional 1,372 lung cancer deaths five years following diagnosis.³⁷ Addressing the causes of delays in diagnosis as a result of COVID-19 is essential to ensure that the impact on lung cancer patients is not exacerbated any further.

In Italy, a survey of 95 oncologists (that received 79 responses) reported that the number of consultations for suspected lung cancer reduced by almost half (46.8%) and that 55.7% of oncologists reported a reduction in new diagnoses of non-small cell lung cancer (NSCLC).³⁸

Reduced access to diagnostic equipment, such as CT scanners, and diagnostic staff capacity have contributed to delays in diagnosis. The European Society for Medical Oncology (ESMO) published guidance advising that low-dose CT scans be temporarily withheld, due to the risks of patients entering a hospital environment at the peak of the pandemic.³⁹ Surgical biopsies were also postponed at the beginning of the pandemic due to their invasive nature, and the production of aerosol potentially spreading the COVID-19 virus.⁴⁰ The risk of potentially vulnerable patients and clinicians conducting the procedure getting infected was considered too great. As a result, the number of patients being diagnosed via invasive biopsies fell dramatically.⁴¹

New diagnostic tests that can quickly and efficiently provide a diagnosis without surgical interventions were trialled at The Royal Marsden and The Institute of Cancer Research (ICR), London. This pilot involved the implementation of liquid biopsy that can detect tiny amounts of cancer in the blood. This diagnostic method suggested that patient care could be improved. Increasing the rapid detection of biomarkers compared to tissue testing led to timely treatment decisions when biopsy access was limited.⁴²

Technology is also being employed to shorten the time from a suspicion of a lung cancer diagnosis to initiation of treatment by enabling efficient communication with patients. A patient navigation platform pilot in Romania is being used to ensure the timely and continuous delivery of information, education and mobilization of patients with lung cancer through the pathway.⁴³ This is with a view to establishing a precise diagnosis quicker and therefore offering the patient the most appropriate treatment.

Initiating treatment

Multidisciplinary team (MDT) meetings are an important part of decision-making about many lung cancer patients' treatment options. During the peak of the pandemic, many of these meetings moved to virtual platforms in a bid to ensure that management of patient care was maintained and patients received the most appropriate treatment. In Italy, MDTs were delayed or performed virtually in almost half of cases (48.1%), according to a study investigating the clinical management of NSCLC patients during the first wave of the pandemic.⁴⁴ Virtual MDTs have allowed more decision-makers to attend than was previously possible with a physical meeting and have overcome restrictive timing and geographical barriers.⁴⁵ However, it has taken time for teams to adjust to this way of working and in some instances infrastructure, such as internet bandwidth, training and access, has not been sufficient to support implementation.⁴⁶ It is essential to promote MDT excellence and provide support and training where appropriate.⁴⁷

The COVID-19 pandemic has had an impact on the treatments that were chosen for lung cancer patients. For example, cancer patients receiving cytotoxic chemotherapy are particularly vulnerable to COVID-19, resulting in oncologists recommending that chemotherapy treatment be paused or withheld.⁴⁸ This was also affected by the capacity and resource constraints felt during the pandemic, as specialist staff were redirected to care for COVID-19 patients.⁴⁹ A similar situation was seen for surgical procedures, again due to the risk for patients and clinicians conducting procedures as well as the capacity constraints caused by additional cleaning and PPE requirements in operating theatres.

Changes were seen to radiotherapy provision to reduce the number of visits patients needed to make to hospitals. Accelerating the roll-out of stereotactic ablative radiotherapy (SABR) across the UK's National Health Service two years earlier than planned is an example of one of the decisions taken by health systems to try to address the ongoing need for treatment for lung cancer. This treatment method requires fewer doses than standard radiotherapy so can help relieve clinical capacity and prevent vulnerable patients from entering a hospital setting unnecessarily.⁵⁰

During the recovery phase of the pandemic patients who required a diagnosis began to come forward again however, delays are not subsiding.⁵¹ Where the lung cancer pathway has experienced severe interruption, measures should be taken to help mitigate the impact on lung cancer patients and prioritize their swift access to services.

Recommendations

Acute

- Ministries of Health need to provide support to ensure that health services can continue to use innovative data infrastructure
- Ministries of Health need to explore and appropriately accelerate the integration of new technologies to help with more accurate and better diagnosis

Build resilience

- Ministries of Health must take into consideration the changes in treatment options and ensure further investment in new diagnostics and treatment innovations
- Ministries of Health must ensure there is sufficient diagnostic capacity through investment in workforce and equipment to prevent delays in lung cancer diagnosis
- Ministries of Health must ensure there is sufficient capacity at secondary care level for patients to be seen swiftly

Support throughout treatment

Ongoing care for lung cancer patients receiving treatment pre-pandemic has become particularly important, as studies are showing a significant delay in lung cancer patients returning to treatment and services as a result of COVID-19.⁵²

Patients are facing negative effects on their mental and emotional health due to fear of returning to health services. A recent study *Fears and Perception of the Impact of COVID-19 on Patients with Lung Cancer* documented that although patients were more worried about their cancer than COVID-19, it was apparent that quarantine had negative impacts on the patients' quality of life.⁵³

With an estimated 28 million elective surgeries cancelled across the world during roughly 12 weeks of COVID-19 disruption, there is a continued need to support those patients already receiving treatment at the start of the pandemic.⁵⁴ A clear challenge to this is the lack of data on service provision, including information broken down by region.

Using data and technology

On a European level, there is a need for increased data sharing – not only on a country-by-country basis, but also within countries at a regional level. DATA-CAN, the UK's Health Data Research Hub for Cancer, has shown how real-time data can be a vital component of the response to COVID-19 and is currently establishing a Real Time Data Network (RTDN).⁵⁵ The global TERA-VOLT consortium was also established in 2020 in response to

the COVID-19 pandemic and is a physician-led syndicate focusing on the impact of the pandemic on patients with thoracic malignancies.⁵⁶ There is also a role for new technologies such as machine learning to analyse and interpret data collected. Gemelli ART (Advanced Radiation Therapy) of the Agostino Gemelli IRCCS University Hospital Foundation in Italy has developed the GENERATOR Tracer RT protocol, a mobile application that allows the collection and analysis of patient data through an artificial intelligence system, monitoring the health status of these patients as they undergo radiation treatment.⁵⁷ Data such as this would enable services to understand their current demand, identify patients who were no longer accessing services and plan capacity to address the larger than expected number of patients now in the system following the pandemic. The data will also be useful to understand the impact of the pandemic on lung cancer patients' outcomes from the point of diagnosis throughout their treatment journey. However, considerations must be taken to align with national consent and data privacy laws.

Communicating with patients

There is a need to ensure appropriate patient information and communication throughout a patient's treatment, not only with regards to the treatment they are receiving but also their wider health and how they can manage their risk of COVID-19.

How to keep in touch with patients at the peak of the pandemic was a challenge and, in many cases, new technology was used to maintain contact. Spain saw a three-fold increase in follow-up consultations taking place by telephone in comparison to 2019 while in the UK, the use of telemedicine for general medical consultations has risen from 10% prior to the COVID-19 pandemic to approximately 75% during the pandemic peak.^{58,59} Telemedicine has been beneficial for patients who live some distance from their treatment centre and in assisting patients who are very unwell. It is important to recognize that telemedicine will not be right for all patients or all types of appointment. Face-to-face appointments are still a critical part of the patient pathway, particularly for initial consultations. Where possible, services should ensure that patients can be supported by family members and carers at their appointments (both face-to-face or virtual).

Collecting information on patient experience during the pandemic will also be crucial to understand how clinical services have changed. The Christie NHS Foundation Trust in England plans to publish results in January 2021 from questionnaires and interviews conducted with a cohort of 800 patients, that aims to establish from a patient perspective, where additional support or services will be required or where improvements can be made.⁶⁰

Regional alignment

Finally, when considering patients' needs during COVID-19, clinical guidelines and the emerging disparities must also be addressed. Variations and duplications of guidelines are apparent when examining COVID-19 responses across Europe. It is not always possible to implement initiatives at a national level, due to regional management of health services in certain countries. However, where national efforts have been made, there have been some successes. For example, Italian qualifying examinations have been waived and medical

students will bypass the standard accreditation process to support the expansion of the medical workforce.⁶¹ There has also been a radical increase in hypofractionated radiotherapy schedules during the COVID-19 pandemic, which aims to give the same biological doses within fewer hospital trips.⁶² While there can be important differences between regions and therefore their healthcare needs, this must not lead to unwarranted variation in access to treatment and care, and duplication of effort, for example, in developing guidance, should be avoided.

Recommendations

Acute

- Governments and health systems need to strengthen data infrastructure with improved interoperability, focus on increased analytics to identify improvements to care and reduce redundancies, expanding the use of and access to telehealth-based services

Recovery

- Ministries of Health need to collect real-time data at national and local level to evidence the impact of the pandemic on lung cancer patients and systems

Build resilience

- Health systems need to establish data collection and analysis to identify the uptake of updated clinical guidelines during and after the pandemic, ensuring alignment not only across Europe, but within national regions, reducing treatment variation and duplication
- Ministries of Health must ensure that there is sufficient patient information throughout the treatment process, including adequate information on the impact of risks associated with COVID-19 and how they should be managed



Source: Unsplash/
1582719367079

Clinical trials

Disruptions to clinical trials during the pandemic were apparent in how they are conducted, monitored and regulated. However, the rapid adaptation to the changing circumstances, including the accelerated development and approval of new technologies, has offered opportunities to learn how regulatory processes could be adapted in the long term. These lessons are already being considered as part of the Horizon Europe Framework Programme for Research and Innovation's Mission on Cancer.⁶³

Recruitment into clinical trials

Across Europe, most clinical trial sites were paused and recruitment was interrupted. Only 14% of institutions in Europe continued to enrol patients at the usual, pre-COVID-19 rate.⁶⁴ There is a need for more information to be collected on how many studies remained open for active enrolment, and the ongoing impact of COVID-19 on the number of studies that are being performed. The impact of COVID-19 on research could have significant implications for the outcomes for lung cancer patients, as research has shown that cancer patients treated in research-active hospitals are likely to experience better outcomes.⁶⁵

While centres did not see a significant reduction in the number of patients willing to take part in trials, there are reservations from patients about the added risks of COVID-19 infection if they enrol. This proves the need for clear communication to reassure patients about what is involved in taking part in a clinical trial.

The development of telemedicine services has had a significant impact on clinical trials, and much of the correspondence with patients taking part has been done virtually. Virtual visits, increased self-reporting and blood collections being done locally have all assisted with trial maintenance throughout the pandemic. A recent survey of clinicians in the US showed that 90.3% of respondents believed telehealth for patients taking part in clinical trials could improve the process, a further 77.4% believed that remote review of patients could also have a probable positive impact.⁶⁶

Monitoring and regulation

During the pandemic, in some cases ethical assessment of studies for potential COVID-19 treatments has led to a waiver of requirements for informed consent to accelerate approval times.⁶⁷ Other flexibilities include an increased use of telephone communication or video calls for participant monitoring⁶⁸ and reducing the number of times patients are assessed during a trial. There is an opportunity to identify appropriate changes to the processes of clinical trials that could be adopted in the longer term for other studies of national and international interest.

The COVID-19 pandemic has driven the use of real-world evidence and other trends such as decentralized data collection via digital health or telemedicine. There is an opportunity to build on this and allow real-world data to be more widely accepted to support the approval and reimbursement process by enabling iterative reviews of real-world evidence.

Recommendations

Acute

- The European Medicines Agency and corresponding national regulatory bodies along with Ministries of Health must consider undertaking an analysis of the approach to clinical trial data collection and submission during the COVID-19 pandemic to validate the use of real-world data within clinical trials, including new methods of data collection and virtual monitoring
- Real-world evidence data collection and utilization also need to be analyzed to inform clinical management outside of clinical trials

Build resilience

- The European Medicines Agency and corresponding national regulatory bodies along with Ministries of Health need to identify and analyze best practice examples in strengthening recruitment and patient inclusion in clinical trials e.g. remote monitoring, expanded recruitment geographies, etc and update regulations accordingly

Additional priority recommendations

Improving lung cancer services for the future

The COVID-19 pandemic has highlighted and exacerbated existing challenges to improving the outcomes for lung cancer patients. There has been disruption throughout the treatment journey from patients seeking a diagnosis, through treatment initiation to the ongoing support and care patients need. It is likely that the COVID-19 pandemic will lead to an increase in late diagnosis for lung cancer, undoing much of the progress that has been made in recent years. Delays in diagnosis across England for lung cancer is predicted to lead to 4.8-5.3% increase in additional deaths in comparison to pre-pandemic figures.⁶⁹ There is also a risk that the incidence of lung cancer may appear to fall in some places, as people who have died from lung cancer without ever being able to access a diagnosis or services are not captured in official statistics.

The historically poor outcomes for lung cancer patients combined with the specific impact of the COVID-19 pandemic on lung cancer services require action to be taken across health services to deliver significant improvements.

Data collection and analysis

Not all countries currently collect national level data on lung cancer. The absence of lung cancer registries and the inability of health systems to access data in real time can affect how they plan and manage services. Understanding the anticipated need for services and being able to analyze outcomes can lead to better resource utilization by health services and to improved decision-making for patients. The need for data collection is now greater than ever, to enable health systems to understand the impact of the COVID-19 pandemic on risk taking, health seeking behaviours, service provision and outcomes.

Workforce and capacity

The ability of health services to effectively direct resources and deploy their workforce where need is greatest has been used to great effect to respond to the COVID-19 pandemic. This prioritization must now be applied to lung cancer. Lack of access to equipment such as CT scanners, radiotherapy machines and infusion suites can have an impact on patients' outcomes by adding delays to their treatment journey. Similarly, ensuring there is an adequately resourced lung cancer workforce encompassing not only surgeons, respiratory physicians, medical and clinical oncologists and radiologists but also clinical nurse specialists or nurse navigators, physiotherapists, smoking cessation teams and others, is an important part of delivering high-quality care for patients. Securing lung cancer services for the long term will require significant and sustained investment in capacity at all stages in the pathway.

Recommendations

Build resilience

- Health systems need to improve data collection, sharing and analysis on lung cancer at all levels to ensure that accurate data on patients and their outcomes are captured, monitored in real time and responded to with changes to service provision when trends are identified
- National and regional governments need to ensure that data-collection systems are in place to ensure that any changes in the incidence of lung cancer are fully understood. There is a need to proactively identify patients who have not accessed services during the pandemic. Services will also need to consider capacity planning for changes in the proportion of people diagnosed with late-stage lung cancer
- Ministries of Health need to invest in the lung cancer workforce and physical service capacity to ensure that lung cancer services are more robust and future-proofed to deliver high-quality care for all lung cancer patients and are able to withstand future shocks of a magnitude similar to the COVID-19 pandemic. This must involve improving services beyond the pre-pandemic benchmark if we are to see any improvement in lung cancer outcomes in the short and long term

Conclusion

The multistakeholder collaboration that led to the above recommendations represents the unwavering commitment of providers, policy-makers, business leaders and others to improve outcomes for lung cancer patients. While forward progress was temporarily stalled due to the COVID-19 pandemic, coming together to reflect on experiences, barriers, and lessons from delivering lung cancer care during a pandemic offered promise for short-term solutions and future advances in care delivery. It is the hope of those engaged in this work that the recommendations inform the choices of European policy-makers in addressing lung cancer care and offer a framework for those in other regions of the world to collate learnt experiences and develop recommendations that will improve access and outcomes for lung cancer patients everywhere.

Contributors

David Baldwin

Chair, UK Clinical Expert Group for Lung Cancer and Mesothelioma

Fabrice Barlesi

Chief Medical Officer & Head of Clinical Research, Gustave Roussy

Tracy Baroni Allmon

Head, Global Oncology Access & Reimbursement Policy, Patient Value, Policy & Access, Takeda Oncology

Arnaud Bernaert

Head, Platform for Shaping the Future of Health and Healthcare, World Economic Forum

Luca Boldrini

Consultant Radiation Oncologist, Fondazione Policlinico Universitario "A. Gemelli" IRCCS, Rome, Italy

Cristian Silviu Buşoi

MEP Romania, Chair of ITRE Committee, President of the European Parliament Intergroup for the Fight Against Cancer

Mary Luz Campillo

Medical Affairs & Business Development Lead, Iberia, Guardant Health

Lucy Dance

Global Director Oncology Policy, Lung Cancer, AstraZeneca

David Le Duc

Associate Director, Oncology Patient Affairs, AstraZeneca

Iris Faul

Senior Director, Medical Affairs & Business Development, Europe, LatAM and Canada, Guardant Health

Karen Fitzgerald

Head of Policy & Implementation Research, Cancer Research UK (CRUK)

Jesme Fox

Secretary, Global Lung Cancer Coalition

Bernard Gaspar

President, Spanish Lung Cancer Patient Association (AEACaP)

Nicolas Girard

Professor, Medical Oncology, Institut Curie, Paris and Paris Saclay University

Charis Girvalaki

EU Affairs Manager, European Cancer Patient Coalition (ECPC)

André Ilbawi

Cancer Team Lead, Department of Noncommunicable Diseases, WHO

Sam Janes

Professor of Respiratory Medicine, University College, London

Mark Krueger

Principal, Pharmections

Mark Lawler

Associate Pro-Vice-Chancellor and Professor of Digital Health, Queen's University Belfast; Scientific Director DATA-CAN, the UK's Health Data Research Hub for Cancer; European Cancer Organisation Board Member and Co-Chair of the European Cancer Organisation's Special Network on COVID-19 and Cancer

Mihaela Militaru

Senior Director, EU Patient Insights & Advocacy, Oncology & Endocrinology, Merck

Adam Nosal

Head of Market Access and Innovative Value Strategies, Oncology Europe and Canada, AstraZeneca

Clive Peedell

Consultant Clinical Oncologist, on behalf of the British Thoracic Oncology Group (BTOG)

Sebastian Schmidt

Head of Strategy and Medical Affairs CT, Siemens Healthineers

Ricky Sharma

Vice-President Clinical Affairs, Varian Medical Systems

Ian Walker

Vice-President, International, Guardant Health

Michael Zaiac

Head of Medical Affairs Oncology Region Europe, Novartis

Endnotes

1. "WHO report on cancer: setting priorities, investing wisely and providing care for all", World Health Organization, February 2020, Available at: <https://www.who.int/publications/i/item/who-report-on-cancer-setting-priorities-investing-wisely-and-providing-care-for-all> [Accessed January 2021]
2. "WHO report on cancer: setting priorities, investing wisely and providing care for all", World Health Organization, February 2020, Available at: <https://www.who.int/publications/i/item/who-report-on-cancer-setting-priorities-investing-wisely-and-providing-care-for-all> [Accessed January 2021]
3. Bray F, Ferlay J, Soerjomataram I, et al. "Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries." *CA: A Cancer Journal For Clinicians* 68(6), 2018: 394-424
4. European Respiratory Society, European Lung white book: Lung Cancer. Available at: <https://www.erswhitebook.org/chapters/lung-cancer/> [Accessed January 2021]
5. Cancer Research UK. "Why is early diagnosis important?" [Updated 26/06/18]. Available at: <https://www.cancerresearchuk.org/about-cancer/cancer-symptoms/why-is-early-diagnosis-important> [Accessed January 2021]
6. Ellis, Peter, "Delays in the diagnosis of lung cancer", *Journal of Thoracic Disease*, # 3(3), 2011: 183-188. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3256519/pdf/jtd-03-03-183.pdf> [Accessed January 2021]
7. Maringe C, Spicer J, Morris M, 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 Oncology* 21(8) 2020: 1023-34
8. "Pulse survey of continuity of essential health services during the COVID-19 pandemic, interim report", World Health Organization, August 2020, Available at: https://www.who.int/publications/i/item/WHO-2019-nCoV-EHS_continuity-survey-2020.1 [Accessed January 2021]
9. "COVID-19 matters: a review of the impact of COVID-19 on the lung cancer pathway and opportunities for innovation emerging from the health system response to the pandemic", UK Lung Cancer Coalition, October 2020, Available at: <https://www.uklcc.org.uk/wp-content/uploads/2020/10/UKLCC-COVID-19-Matters-Report-Oct-2020.pdf>. [Accessed January 2021]
10. "COVID-19 matters: a review of the impact of COVID-19 on the lung cancer pathway and opportunities for innovation emerging from the health system response to the pandemic", UK Lung Cancer Coalition, October 2020, Available at: <https://www.uklcc.org.uk/wp-content/uploads/2020/10/UKLCC-COVID-19-Matters-Report-Oct-2020.pdf>. [Accessed January 2021]
11. "LuCE Report on Lung Cancer - challenges in lung cancer in Europe", Lung Cancer Europe, 2016, Available at: <https://www.lungcancereurope.eu/wp-content/uploads/2017/10/LuCE-Report-final.pdf>. [Accessed January 2021]
12. Buccheri, G, "Lung cancer: clinical presentation and specialist referral time", *European Respiratory Journal*, # 24(6), 2004: 898-904, Available at: <https://erj.ersjournals.com/content/24/6/898> [Accessed January 2021]
13. Kaosenlared, "This affects cancer survival, delayed COVID-19 treatment" [Press release], 22 December 2020, Available at: <https://kaosenlared.net/asi-afecta-a-la-supervivencia-del-cancer-el-retraso-en-el-tratamiento-por-la-COVID-19/> [Accessed January 2021]
14. "COVID-19 matters: a review of the impact of COVID-19 on the lung cancer pathway and opportunities for innovation emerging from the health system response to the pandemic", UK Lung Cancer Coalition, October 2020, Available at: <https://www.uklcc.org.uk/wp-content/uploads/2020/10/UKLCC-COVID-19-Matters-Report-Oct-2020.pdf>. [Accessed January 2021]
15. de Koning, Harry, "Reduced lung-cancer mortality with volume CT screening in a randomized trial, *The New England Journal of Medicine*, 382(6), 2020: 503-513.
16. "NELSON study shows CT screening for nodule volume management reduces lung cancer mortality by 26 percent in Men", IASLC, 2018, 2018 WCLC Press Program Press Release De Koning 9.25 FINAL .pdf (iaslc.org)
17. Aberle, Denise, "Reduced lung-cancer mortality with low-dose computed tomographic screening", *New England Journal of Medicine*, 2011, 365(5), 2011: 395-409.
18. Pastorino, U, Prolonged lung cancer screening reduced 10-year mortality in the MILD trial: new confirmation of lung cancer screening efficacy, 30(7), 2019: 1162-1169.
19. Daiwei, Han, "An update on the european lung cancer screening trials and comparison of lung cancer screening recommendations in europe", *Journal of Thoracic Imaging*, 34(1), 2019: 65-71.
20. "Lung cancer screening", Cancer Research UK, Available at: <https://www.cancerresearchuk.org/health-professional/screening/lung-cancer-screening#lungscreening0>. [Accessed January 2021]
21. "PARIS: COVID-19, will the second wave be that of cancers?", Presse Agence, 2020, Available at: <http://www.presseagence.fr/lettre-economique-politique-paca/2020/09/02/paris-covid-19-la-deuxieme-vague-sera-t-elle-celle-des-cancers> [Accessed January 2021]
22. Vrdoljak, Eduard, "Cancer and coronavirus disease 2019; how do we manage cancer optimally through a public health crisis?", *European Journal of Cancer*, 132, 2020: 98-99.

23. "Differentiation of the Cs in lung cancer: cancer vs. COVID", Healthy London, 2020, Available at: https://www.healthylondon.org/wp-content/uploads/2020/03/Differentiation-of-the-Cs-in-lung-cancer_-Cancer-vs.-COVID.pdf [Accessed January 2021]
24. Healthcare IT News, "Moscow DOH uses AI platform to detect lung cancer symptoms" [Press release], 21 August 2020, Available at: <https://www.healthcareitnews.com/news/emea/moscow-doh-uses-ai-platform-detect-lung-cancer-symptoms> [Accessed January 2021]
25. "Artificial intelligence alongside the radiologist to 'quickly unmask' the COVID patient with lung disease: the trial begins at San Luigi", Universita Degli Studi Di Torino, 2020, Available at: https://www.unito.it/comunicati_stampa/intelligenza-artificiale-fianco-del-radiologo-smascherare-rapidamente-il-paziente [Accessed January 2021]
26. "Artificial intelligence alongside the radiologist to 'quickly unmask' the COVID patient with lung disease: the trial begins at San Luigi", Universita Degli Studi Di Torino, 2020, Available at: https://www.unito.it/comunicati_stampa/intelligenza-artificiale-fianco-del-radiologo-smascherare-rapidamente-il-paziente [Accessed January 2021]
27. "Differentiation of the Cs in lung cancer: cancer vs. COVID", Healthy London, 2020, Available at: https://www.healthylondon.org/wp-content/uploads/2020/03/Differentiation-of-the-Cs-in-lung-cancer_-Cancer-vs.-COVID.pdf [Accessed January 2021]
28. Sassuolo2000, "Health and prevention: in Emilia Romagna awareness campaigns against colorectal cancer" [Press release], 1 December 2020, Available at: <https://www.sassuolo2000.it/2020/12/01/salute-e-prevenzione-in-emilia-romagna-campagne-di-sensibilizzazione-contro-il-cancro-colorettale/> [Accessed January 2021]
29. "Cancer doesn't wait for corona to pass", Nederlandse Federatie van Kanker patiënten organisaties, 2020, Available at: <https://www.kankerwacht.net/wie-zijn-wij> [Accessed January 2021]
30. Spain Society, "TeleCRIS appeals to invest in cancer research" [Press release], 15 December 2020, TeleCRIS apela a invertir en investigación sobre el cáncer. Available at: <https://elmirandesoria.es/nacional/sociedad/telecris-apela-a-invertir-en-investigacion-sobre-el-cancer> [Accessed January 2021]
31. "Creating safe spaces for cancer services", Cancer Research UK, 2020, Available at: <https://www.cancerresearchuk.org/get-involved/campaign-for-us/creating-safe-spaces-for-cancer-services> [Accessed January 2021]
32. EU Science Hub, "2020 Cancer incidence and mortality in EU-27 countries" [Press release], 22 July 2020, Available at: <https://ec.europa.eu/jrc/en/news/2020-cancer-incidence-and-mortality-eu-27-countries> [Accessed January 2021]
33. Woznitza, Nick, "Increasing radiology capacity within the lung cancer pathway: centralised work-based support for trainee chest X-ray reporting radiographers", Journal of Medical Radiation Sciences, 2018, vol. 65, no. 3, pp. 200-208
34. "The impact of COVID-19 on cancer treatment - eu5 report", IQVIA, 2020, Available at: <https://www.iqvia.com/library/publications/the-impact-of-COVID-19-on-cancer-treatment-eu5-report> [Accessed January 2021]
35. "UK lung cancer care outcomes: a comparison with Europe", ABPI, 2017, Available at: <http://cancercomparator.abpi.org.uk/resources/ABPI%20lung%20cancer%20briefing%20July%202017.pdf> [Accessed January 2021]
36. "National Optimal Lung Cancer Pathway for suspected and confirmed lung cancer: referral to treatment", NHS England and Cancer Research UK, 2020, Available at: https://www.cancerresearchuk.org/sites/default/files/national_optimal_lung_pathway_aug_2017.pdf [Accessed January 2021]
37. Maringe, Camille, "The impact of the COVID-19 pandemic on cancer deaths due to delays in diagnosis in England, UK: a national, population based, modelling study", The Lancet Oncology, 2020, vol. 21, no. 8, pp. 1023-1034
38. Bertaglia, Valentina, "Italian Survey on the clinical management of non-small cell lung cancer patients during the COVID-19 pandemic: a lesson for the second wave", Critical Reviews in Oncology/Hematology, 2021, vol 157, 103189
39. Passaro, Antonio, "ESMO Management and treatment adapted recommendations in the COVID-19 era: Lung cancer", ESMO Open Cancer Horizons, 2020, Available at: https://esmoopen.bmj.com/content/5/Suppl_3/e000820 [Accessed January 2021]
40. The Royal Marsden, "Using liquid biopsies as an alternative diagnostic test to protect patients and staff" [Press release], 7 May 2020, Available at: <https://www.royalmarsden.nhs.uk/using-liquid-biopsies-alternative-diagnostic-test-protect-patients-and-staff> [Accessed January 2021]
41. The Royal Marsden, "Using liquid biopsies as an alternative diagnostic test to protect patients and staff" [Press release], 7 May 2020, Available at: <https://www.royalmarsden.nhs.uk/using-liquid-biopsies-alternative-diagnostic-test-protect-patients-and-staff> [Accessed January 2021]
42. "A pilot of diagnostic circulating tumour (CT) DNA next generation sequencing (NGS) assessment in patients with suspected advanced lung cancer during the COVID-19 pandemic", IASLC Worldwide virtual event, 2-3 October 2020
43. Federation of Cancer Associations of Romania (FABC), "Navigator for bronchopulmonary cancer patients shortens time from suspicion to diagnosis" [Press release], 30 September 2020, Available at: <https://fabc.ro/comunicate/comunicat-de-presa-navigatorul-pentru-pacientii-cu-cancer-bronhopulmonar-scurteaza-timpul-de-la-suspiciune-la-diagnostic/> [Accessed January 2021]

44. Bertaglia, Valentina, "Italian survey on the clinical management of non-small cell lung cancer patients during the COVID-19 pandemic: a lesson for the second wave", *Critical Reviews in Oncology/Hematology*, 157, 2021: 103–189
45. "Resource pack for virtual cancer multidisciplinary team working" Q Community - The Health Foundation, 2020, Available at: <https://q.health.org.uk/idea/2020/resource-pack-for-virtual-multidisciplinary-team-working/> [Accessed January 2021]
46. Sillero-Rejon, Carlos, "Virtual multidisciplinary team meetings for the older population", The National Institute for Health Research Applied Research Collaboration West, 2020, Available at: <https://arc-w.nihr.ac.uk/COVID-response/rapid-reports/virtual-multidisciplinary-team-meetings-for-the-older-population> [Accessed January 2021]
47. Carman, Eva-Maria, "Identifying work system components and constraints of cancer multidisciplinary team meetings", *Contemporary Ergonomics and Human Factors*, 2020, Available at: <https://publications.ergonomics.org.uk/uploads/Identifying-work-system-components-and-constraints-of-cancer-multidisciplinary-team-meetings.pdf> [Accessed January 2021]
48. Bi, Jianping, "Does chemotherapy reactivate SARS-CoV-2 in cancer patients recovered from prior COVID-19 infection?" *European Respiratory Journal*, 56(4), 2020;
49. Lai, Alvina et al., "Estimated impact of the COVID-19 pandemic on cancer services and excess 1-year mortality in people with cancer and multimorbidity: near real-time data on cancer care, cancer deaths and a population-based cohort study" *BMJ Open*, 10(11), 2020. Available at: <https://bmjopen.bmj.com/content/10/11/e043828> [Accessed January 2021]
50. NHS England, "Convenient modern cancer treatment for patients during COVID-19 pandemic" [Press release], 11 June 2020, <https://www.england.nhs.uk/2020/06/convenient-modern-cancer-treatment-for-patients-during-COVID-19-pandemic> [Accessed January 2021]
51. "Impact of COVID-19 on cancer treatment - Germany", IQVIA, 2020, Available at: https://www.iqvia.com/-/media/iqvia/pdfs/library/publications/impact-of-COVID-19-on-cancer-treatment-germany.pdf?_=1607702328851 [Accessed January 2021]
52. Zhou Sha, "The impact of the COVID-19 pandemic on lung cancer patients", *Annals of Palliative Medicine*, 9(5), 2020: 3373-3378, Available at: <http://apm.amegroups.com/article/view/52221/html> [Accessed January 2021]
53. Catania, Chiara, "Fears and perception of the impact of COVID-19 on patients with lung cancer: a mono-institutional survey", *Frontiers in Oncology*, 2020, Available at: <https://www.frontiersin.org/articles/10.3389/fonc.2020.584612/full> [Accessed January 2021]
54. World Economic Forum, "28 million elective surgeries may be cancelled worldwide: how non-COVID-19 medical care is suffering" [Press release], 27 May 2020, Available at: <https://www.weforum.org/agenda/2020/05/covid-19-elective-surgery-cancellation-cancer-pandemic/> [Accessed January 2021]
55. Lai, Alvina, "Estimated impact of the COVID-19 pandemic on cancer services and excess 1-year mortality in people with cancer and multimorbidity: near real-time data on cancer care, cancer deaths and a population-based cohort study" *BMJ Open*, 10(11), 2020. Available at: <https://bmjopen.bmj.com/content/10/11/e043828> [Accessed January 2021]
56. The TERAVOLT Global Consortium, 2020. Available at: <http://teravolt-consortium.org/> [Accessed January 2021]
57. Gemelli Generator, "Gemelli: an app dedicated to cancer patients and staff for monitoring during the pandemic" [Press release], 18 November 2020, Available at: <https://gemelligenerator.it/per-te-paziente-news/gemelli-una-app-dedicata-a-pazienti-oncologici-e-personale-per-il-monitoraggio-durante-la-pandemia/> [Accessed January 2021]
58. Kaosnared, "This affects cancer survival, delayed COVID-19 treatment" [Press release], 22 December 2020, Available at: <https://kaosnared.net/asi-afecta-a-la-supervivencia-del-cancer-el-retraso-en-el-tratamiento-por-la-COVID-19/> [Accessed January 2021]
59. McCall, Becky, "Could telemedicine solve the cancer backlog?", *The Lancet Digital Health*, 2(9), 2020: E456-E457, Available at: [https://www.thelancet.com/journals/landig/article/PIIS2589-7500\(20\)30194-1/fulltext](https://www.thelancet.com/journals/landig/article/PIIS2589-7500(20)30194-1/fulltext) [Accessed January 2021]
60. "Impact of COVID-19 on lung cancer patients", *Clinical trials.gov*, 2020, impact of COVID-19 on lung cancer patients - full text view - *ClinicalTrials.gov* [Accessed January 2021]
61. Khamees, Deena, "In crisis: medical students in the COVID-19 pandemic", *Society for Academic Emergency Medicine*, 4(3), 2020: 284-290, Available at: <https://onlinelibrary.wiley.com/doi/full/10.1002/aet2.10450> [Accessed January 2021]
62. Portaluri, M, "Hypofractionation in COVID-19 radiotherapy: A mix of evidence based medicine and of opportunities", *Radiotherapy and Oncology*, 2020, vol. 150, pp. 191-194, [https://www.thegreenjournal.com/article/S0167-8140\(20\)30361-3/pdf](https://www.thegreenjournal.com/article/S0167-8140(20)30361-3/pdf) [Accessed January 2021]
63. "Conquering cancer, mission possible", European Commission, 2020 Available at: https://ec.europa.eu/info/publications/conquering-cancer-mission-possible_en [Accessed January 2021]
64. Upadhaya, Samik, "Impact of COVID-19 on oncology clinical trials", *Nature Reviews Drug Discovery*, 2020, Available at: <https://www.nature.com/articles/d41573-020-00093-1> [Accessed January 2021]
65. Selby, Peter, "How can clinical research improve European health outcomes in cancer?", *Journal of Cancer Policy*, 20, 2019. Available at: [sciencedirect.com/science/article/abs/pii/S2213538318300894](https://www.nature.com/science/article/abs/pii/S2213538318300894) [Accessed January 2021]

66. Waterhouse, David, "Early impact of COVID-19 on the conduct of oncology clinical trials and long-term opportunities for transformation: findings from an american society of clinical oncology survey", *JCO Oncology Practice*, 2020, Available at: <https://ascopubs.org/doi/full/10.1200/OP.20.00275> [Accessed January 2021]
67. Santoliquido, Angelo, "Incidence of deep vein thrombosis among non-ICU patients hospitalized for COVID-19 despite pharmacological thromboprophylaxis", *Journal of Thrombosis and Haemostasis*, 18, 2020: 2358–2363. Available at: <https://onlinelibrary.wiley.com/doi/epdf/10.1111/jth.14992> [Accessed January 2021]
68. "Managing clinical trials during Coronavirus (COVID-19)", Medicines and Healthcare products Regulatory Agency, 2020, Available at: <https://www.gov.uk/guidance/managing-clinical-trials-during-coronavirus-covid-19#managing-ongoing-and-halted-trials> [Accessed January 2021]
69. "The impact of the COVID-19 pandemic on cancer deaths due to delays in diagnosis in England, UK: a national, population-based, modelling study", *The Lancet*, 1 August 2020, Available at: [https://www.thelancet.com/journals/lanonc/article/PIIS1470-2045\(20\)30388-0/fulltext](https://www.thelancet.com/journals/lanonc/article/PIIS1470-2045(20)30388-0/fulltext). [Accessed January 2021]



COMMITTED TO
IMPROVING THE STATE
OF THE WORLD

The World Economic Forum, committed to improving the state of the world, is the International Organization for Public-Private Cooperation.

The Forum engages the foremost political, business and other leaders of society to shape global, regional and industry agendas.

World Economic Forum
91–93 route de la Capite
CH-1223 Cologny/Geneva
Switzerland

Tel.: +41 (0) 22 869 1212
Fax: +41 (0) 22 786 2744
contact@weforum.org
www.weforum.org