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LUNG CANCER MISSION 2024-2034

STRATEGIC DOCUMENT WITH ROADMAP UPDATE

STATUS AS OF 2025

LUNG CANCER MISSION
2024-2034

STRATEGIC DOCUMENT with roadmap update 2025

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– for a full list of Signatories, see page 40

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FOREWORD AND EXPERT COMMENTS

Foreword

PROF. DR HAB. N. MED. RODRYG RAMLAU

President of the Polish Lung Cancer Group
Director of the Oncology Institute and Head of the Oncology Teaching Department at the Karol Marcinkowski Medical University in Poznań

Dear Sir/Madam,

It has been a year since the publication of the first edition of the orientation paper "Lung Cancer Mission 2024-2034" – a joint initiative of clinical experts, scientific societies and patient organizations, which became the foundation for setting strategic directions for the development of lung cancer treatment in Poland. Today, when presenting an updated version of the document, marked by a sense of responsibility, we summarize the changes that have taken place in recent months and identify the most urgent needs and specific solutions that can realistically improve the efficiency of diagnostics, treatment and patient management.

The past 12 months have brought about significant progress, but also highlighted the scale of the challenges that still lie ahead. The most important ones include: ***the need to drive the percentage of early diagnoses,*** *including, but not limited to* ***by implementing a low-dose computed tomography (LDCT) screening program into the basket of guaranteed healthcare services, streamlining the process and securing financing for comprehensive predictive diagnostics, as well as implementing a model of competence centers in Poland - Lung Cancer Units****. These are the three strategic pillars that should shape the country's policy concerning combating lung cancer for the years to come.*

This update to the Lung Cancer Mission 2024-2034 provides not only a progress overview, but also an in-depth analysis of new areas – from the role of patient rehabilitation to the importance of psycho-oncological, dietary and coordinated management. The document also includes new expert comments from fields such as thoracic surgery, psycho-oncology, molecular diagnostics and nursing care.

I believe that the presented "roadmap" will not only help better understand the current systemic challenges, but also to inspire the implementation of consistent solutions that will translate into a ***shorter diagnostic and therapeutic journey, better quality of treatment and longer life for patients****.*

Thank you to everyone who contributed to drafting the document – experts, representatives of patient organizations, health care institutions and partners. It is through our joint commitment that we can realistically shape the future of oncology in the area of lung cancer in Poland.

Foreword

PROF. DR HAB. N. MED. DARIUSZ M. KOWALSKI

Secretary General of the Polish Lung Cancer Group
Head of the Conservative Department at the Pulmonary and Thoracic Cancer Teaching Department, National Institute of Oncology at the National Research Institute in Warsaw

Dear Sir/Madam,

Lung cancer remains one of the biggest challenges in modern oncology, but recent years have brought about more and more reasons for optimism. We are witnessing real changes, both in terms of an increase in the importance of advanced predictive diagnostics, as well as access to modern treatment methods. The B.6 drug program is gradually being expanded to include more ***innovative molecularly targeted therapies and immunotherapies*** *with proven efficacy, including as part of* ***perioperative treatment****, which is becoming the new standard of care in selected patient groups. This is a major step toward improving treatment outcomes.*

It is also encouraging to see progress in the ***works to implement the Lung Cancer Units model*** *- specialized centers that provide patients with comprehensive, coordinated interdisciplinary management. However, we are still waiting for their formal introduction into the system. Their operation has the potential to fundamentally improve the quality of diagnostics, reduce the time to treatment initiation, and ensure consistency of clinical management in accordance with current medical knowledge.*

We are also hopeful to see the announcement of the ***inclusion of a low-dose computed tomography (LDCT) screening program*** *into the basket of guaranteed healthcare services. This is a strategic decision that could save thousands of lives by detecting cancer at its early, curable stages.*

The update of the "Lung Cancer Mission 2024-2034" document shows that changes in Poland are moving in a good direction - more and more decisions are systemic, long-term and evidence-based. This paper summarizes the progress made over recent months, identifies key challenges, as well as presents specific recommendations and solutions, from prevention and diagnosis to rehabilitation and psycho-oncological support.

I believe that thanks to the consistent cooperation of the expert community, public administration bodies, patient organizations and system partners, in the coming years Poland can become a country where lung cancer will more and more often be detected earlier and treated effectively.

Foreword

PROF. DR HAB. N. MED. TADEUSZ ORŁOWSKI

Vice President of the Polish Lung Cancer Group, Head of the Surgery Teaching Department at the Institute of Tuberculosis and Lung Diseases in Warsaw
Polish Thoracic Surgeons Club

Dear Sir/Madam,

Advances in diagnostics, treatment and care organization result in improved prognosis and quality of life for patients. Efforts to ***increase the rate of early detection of lung cancer*** *are particularly important, allowing radical management to be implemented with curative intent.*

A low-dose computed tomography (LDCT) screening program*, which allows for detecting cancer in its earliest, asymptomatic stages, is of great importance in this context. Undoubtedly, a pilot project for the program that has been implemented in recent years has proven its effectiveness - the key now is to* ***introduce it into the basket of guaranteed healthcare services and ensure its continued funding and prevalence nationwide****. Only a nationwide, well-organized and well-funded screening program can bring long-term improvements in lung cancer survival rates in Poland.*

Modern minimally invasive surgical techniques, including ***robotic surgery****, are becoming increasingly important and forming an indispensable part of treatment at many centers around the world. Robotics in thoracic surgery is not only about technological prestige, but above all* ***real clinical benefits*** *- greater surgical precision, lower complication risk, shorter hospitalization time and faster recovery for the patient. However, its dissemination requires* ***adequate systemic support*** *- proper pricing of procedures and their reimbursement, so that modern treatments are available at reference centers throughout the country.*

In the coming years, the development of robotic surgery, the integration of screening programs and further strengthening predictive diagnostics should become key elements of the national strategy against lung cancer. I believe that the consistent implementation of these measures, supported by the implementation of the ***Lung Cancer Units*** *model, will allow to achieve real improvements in treatment outcomes and bring us closer to the standards of the best European centers.*

Comment

MATT YEINGST
Chief Development Officer
International Association for the Study of Lung Cancer (IASLC)

On behalf of the International Association for the Study of Lung Cancer (IASLC), it is an honor to contribute this foreword to the updated Mission Lung Cancer 2024–2034 report. The Polish Lung Cancer Group has produced a rigorous, forward-looking strategic plan grounded in evidence, driven by collaboration, and aligned with global best practices in thoracic oncology. It reflects not only the significant progress made across Poland in recent years but also the clarity and ambition required to transform lung cancer outcomes over the next decade.

IASLC has been privileged to partner closely with leaders in Poland through our Health Systems Project on Biomarker Testing, which examines diagnostic pathways and identifies opportunities to strengthen predictive testing in India, Poland, and the United States. Through site visits, workflow mapping, and cross-country comparison, the project has affirmed a core principle of modern cancer care: comprehensive, timely biomarker testing is essential to ensuring that patients receive the right treatment at the right time. The insights from Poland—its clinical excellence, multidisciplinary engagement, and commitment to improvement—have contributed meaningfully to the global framework now being finalized.

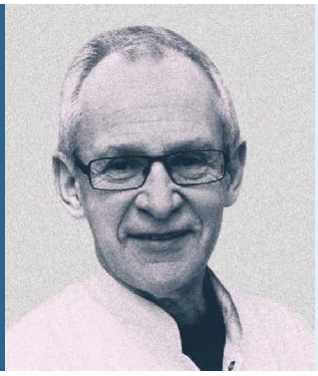
The Polish Lung Cancer Group's Mission Lung Cancer 2024–2034 embraces these priorities with precision. Its focus on expanding LDCT screening, strengthening molecular diagnostics, implementing multidisciplinary Lung Cancer Units, and improving coordination across the full patient journey aligns closely with IASLC's global strategic pillars. Equally important is the report's attention to areas often underrecognized in national cancer plans: rehabilitation, psycho-oncology, oncology nursing, nutritional support, and the critical role of patient organizations.

Poland's leadership is evident. The country has expanded access to innovative therapies, strengthened thoracic surgery capabilities, and increased the use of predictive diagnostics. he next step—outlined so clearly in this report—is to integrate these advances into a cohesive system that ensures consistent, equitable, and timely care for all patients with lung cancer.

IASLC applauds the Polish Lung Cancer Group and its partners for their vision, dedication, and evidence-based approach. Mission Lung Cancer 2024–2034 is more than a document; it is a practical roadmap that will guide meaningful progress in prevention, early detection, diagnostics, treatment, and survivorship.

We look forward to continued collaboration as Po- land advances this work and contributes to improving lung cancer outcomes worldwide.

Comment



PROF. DR HAB. N. MED. MACIEJ KRZAKOWSKI

President of the Polish Society of Clinical Oncology,
National Consultant in Clinical Oncology Head of the
Pulmonary and Thoracic Cancer Teaching Department
Attorney for the Director for Postgraduate Education
National Oncology Institute – National Research Institute
in Warsaw

Another LUNG CANCER MISSION (2025 update) paper is important because it identifies courses of action that are of great significance for improving the prognosis of patients diagnosed with lung cancer. Recommendations include improving the efficiency of primary prevention (reducing exposure to tobacco smoke) and secondary prevention (conducting a nationwide population-based early lung cancer detection program), diagnostics (accelerating diagnosis and identification of clinical and molecular characteristics in thoracic cancer cases), as well as ensuring that decisions concerning treatment are taken by multispecialty teams, along with exploiting the possibilities offered by combined management (especially in early and locally advanced stages).

Modern treatment of patients diagnosed with lung cancer and other primary thoracic cancers relies heavily on the use of molecularly targeted drugs and immune checkpoint inhibitors, while the benefits of these methods are best seen in advanced and early-stage patients.

Regardless of the unchallenged advances made within the scope of identifying the causes and studying the course of lung cancer, along with new treatment options, the prognosis for patients remains unsatisfactory, due to, among other factors, the inadequacies of the healthcare system and the inadequate use of currently available methods of diagnosis and treatment. Funding limitations for anti-cancer management are prominent among the systemic barriers. An early lung cancer detection program and a system of competence centers for thoracic cancer are also still not in place.

All of the issues mentioned are of interest to the Lung Cancer Mission. I encourage everyone to read the following paper. I hope that readers of this document will also include decision-makers.

Comment

PROF. DR HAB. N. MED. PIOTR RUTKOWSKI

President of the Polish Society of Oncology Chairperson of the Medical Research Agency Council Chairperson of the Health Minister's National Oncology Strategy Team
Attorney for the Director of the National Oncology and Clinical Trials Strategy
National Oncology Institute – National Research Institute in Warsaw

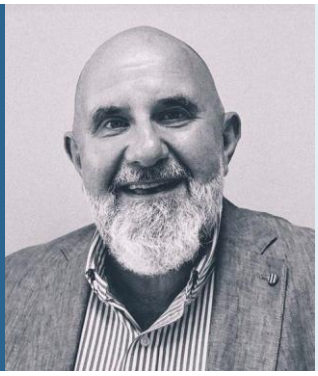
Lung malignancies continue to be a leading problem in terms of the incidence and number of cancer deaths in our country. Another challenge is the persistently high rate of smokers in Poland (with an increased proportion of women) and the insufficient effectiveness of anti-tobacco prevention and of the activities promoting such prevention at all levels of state healthcare and social policy.

The good news is that analyses indicate a gradual (yet too modest) improvement in the survival rate of lung cancer patients diagnosed between 2013 and 2019, which is probably related to the introduction and broad availability of effective systemic therapies for lung cancer patients.

Unfortunately, lung cancer diagnosis still takes too long on average, is fragmented and fails to provide full accessibility to molecular testing.

The hope for improving this situation may lie in the announced implementation of Lung Cancer Units, which are an essential component of oncological care advocated in the assumptions for the National Oncology Strategy. A low-dose computed tomography screening program for high-risk groups should be introduced simultaneously into the screening standard.

Comment



PROF. DR HAB. N. MED. CEZARY PIWKOWSKI
President of the Polish Society of Cardiothoracic Surgeons,
Head of the of Thoracic Surgery Department,
Wielkopolskie Center of Pulmonology and Thoracic Surgery

Surgical treatment of early-stage lung cancer patients still remains the most effective treatment option. Since surgical treatment of lung cancer patients has been centralized at thoracic centers in Poland, combined with significant funding increases in recent years and the activity of the entire community of thoracic surgeons, the level of Polish thoracic surgery, based on the available data, should be considered very high. As a result of the rapid development of minimally invasive video-assisted thoracoscopic surgery (VATS), currently more than 50% nationwide, and in the leading centers with the most experience, more than 80% of anatomical lung resections for oncological reasons are performed using minimally invasive techniques. These figures place Polish thoracic surgery among the leading European countries.

Unfortunately, despite these impressive results, unmatched among other surgically treated cancers (prostate cancer, colorectal cancer), we are still waiting for the inclusion of Robotic-Assisted Thoracic Surgery (RATS) into the thoracic surgery services basket. Efforts to secure this addition have been undertaken by the thoracic surgery community for three years. Hopefully, the inclusion of this initiative into the “Lung Cancer Mission 2024–2034” project will result in a quick and positive conclusion to the process.

We have high hopes for the planned implementation of a low-dose computed tomography lung cancer screening program. This program should ensure that more patients are diagnosed at an early stage of the disease, where surgical treatment using minimally invasive methods, including robotics, is the optimal course of management. This percentage, currently reaching approximately 20% of patients with newly diagnosed lung cancer in Poland, is far too low.

Finally, I want to mention the importance of optimizing perioperative care for patients confirmed eligible for surgical lung cancer treatment within the framework of the ERAS (enhanced recovery after surgery) guidelines, a contemporary comprehensive formula for perioperative care focused on improving patient outcomes. This protocol is more and more often introduced into clinical practice at thoracic surgery centers in Poland. Unfortunately, such an important element of optimal patient preparation prior to elective procedures at an ERAS clinic, often also called pre-rehabilitation, is still not reimbursed in any way by the system.

In conclusion, I would like to emphasize that implementing the above-mentioned initiatives as soon as possible is the only way to maintain a high standard of surgical treatment for lung cancer patients in Poland.

Comment

DR N. MED. ANDRZEJ TYSAROWSKI
President of the Polish Personalized Medicine Coalition
Head of the Cancer Genetic and Molecular Diagnostics Laboratory
National Oncology Institute – National Research Institute
in Warsaw
Medical Laboratory Genetics Voivodship Consultant

Over the recent years, oncology has undergone an unprecedented transformation. Cancer treatment is no longer based solely on well-known methods such as chemotherapy, radiation therapy or surgery. More and more often doctors rely on modern therapies that work extremely precisely, targeting cancer cells directly. This approach is referred to as molecularly targeted treatment.

Genetic diagnostics has had a huge impact on this development. By using advanced techniques for studying DNA and RNA, we are able to understand more and more about which genetic changes lead to cancer and which of the cancer's "weak points" can be exploited during treatment. This is the reason behind referring to the 21st century as the era of genomics and personalized medicine – therapies tailored to the individual patient, their genes and the nature of the underlying disease.

Current progress in molecular biology is extremely dynamic. New technologies emerge every year, allowing to diagnose cancers faster, more accurately and at an earlier stage.

This development is particularly evident in oncological genetic diagnostics: tests that used to take weeks can now be done in a matter of days, sometimes even hours.

However the key factor for reaping the benefits of modern methods is speed. The shorter the time between the moment when disease is suspected and the genetic test result arrives, the sooner optimal treatment can be implemented. That is why it is so important to ensure that not only the analysis process is efficient, but also that the entire material circulation – from sample collection to its delivery to the laboratory – is as efficient as possible. Changes need to be introduced into the system in parallel to enable the financing of modern molecular biology technologies so that modern genetic testing can be implemented.

The LUNG CANCER MISSION (2025 update) paper provides an extensive discussion of various aspects of lung cancer diagnosis and treatment, emphasizing the very important role of genetic diagnostics in this type of cancer.

Comment

DR N. ZDR. SEBASTIAN ARTUR ZDOŃCZYK
President of the Polish Society of Psychooncology

Lung cancer diagnosis is a difficult and challenging moment in the lives of patients and their loved ones, both in medical and psychological terms. Patients need to face not only the signs and symptoms of their disease, along with treatment effects, but also tremendous anxiety, feelings of insecurity, lowered mood or loss of security. In such situations, psycho-oncological support becomes extremely important to help the patient navigate a new reality and adapt to it, tame emotions and get actively involved in the treatment process.

Current modern oncology is based on a holistic approach that perceives the patient not only through the lens of the disease and the need for treatment, but also as a person with an individual history, emotions, values, needs and social relationships. The cornerstone for this is a multidisciplinary team that includes physicians of various specialties, nurses, a psycho-oncologist, a physiotherapist, a nutritionist, a medical caregiver, a social worker and often a clergyman or an occupational therapist. Each member of the team has a specific, complementary role and together they create a space for comprehensive patient care. A psycho-oncologist has a particularly important function and should accompany the patient at every stage of treatment: from diagnostic testing, through the diagnosis itself, therapeutic decision-making, up to the stage of recovery and adaptation to life after the disease. Psychological assistance is needed both during the consultation meeting, hospitalization and in specialty outpatient clinics, such as oncology outpatient clinics, wherever the patient experiences difficult emotions, stress and anxiety.

Modern oncology treatment in Poland is more and more often provided within the framework of secondary outpatient care, which should integrate medical and psychological care with rehabilitation in a single facility. Such an arrangement promotes better coordination of activities, a smooth flow of information and most importantly, bestowing a sense of safety upon the patient.

However, it should be noted that psycho-oncology is not only about supporting the patient and their relatives. It also provides important support for the medical team, who are confronted with human suffering, uncertainty and the limitations of therapy on a daily basis. Working in oncology places an enormous emotional burden on doctors, nurses and other members of the treatment team. The psycho-oncologist, who is part of the team, has a dual role here. On the one hand, they support the patient in coping with the disease; on the other hand, they support medical personnel, helping them to maintain emotional balance, communicate with patients and cope with professional stress. Through their professional activities, they participate in team meetings, they can support team members in difficult situations, deliver training, provide crisis intervention or workshops to reinforce resilience.

Modern oncology understands that professional patient care also involves caring for those who provide that care. Integrated psycho-oncology support helps build a culture of cooperation, empathy and understanding, which translates not only into staff well-being, but most importantly into the quality of patient care. In conclusion, psycho-oncological support is an indispensable part of comprehensive therapy for lung cancer patients.

Comment

PROF. DR HAB. N. MED. AGNIESZKA MASTALERZ-MIGAS
National Consultant in Family Medicine Board President of the Polish Society of Family Medicine Head of the Family Medicine Chair and Department at the Medical University of Wroclaw
Editor-in-chief of the “Primary Care Physician” (Lekarz POZ) journal.

The area of lung cancer prevention, diagnostics and treatment requires improvements and cooperation between primary health care and specialty care facilities, which will result in improved treatment outcomes and greater patient comfort. It is also a matter of better organization and better screening particiaption rates.

Primary care physicians are often the first point of contact for patients, which means that their ability to identify signs and symptoms can significantly affect early diagnosis and treatment initiation. This also creates an opportunity to implement prevention programs, as well as to encourage participation and refer to programs provided by specialty entities, such as LDCT.

Currently patients are often exposed to the lack of system coordination in the diagnostic and therapeutic process, which may lead to treatment delays and, consequently, significantly impacts survival times and possibility of a cure. Improving communication and coordination between different levels of healthcare is key to shortening the patient journey and ensuring that patients have access to appropriate therapies in a timely manner.

It should also be noted that in the course of oncological treatment the patient also uses services provided as part of primary health care and rules should be set up for this cooperation through the creation of guidelines for such aspects as check-ups, vaccinations, as well as education on the ability to recognize and treat the most common adverse reactions. An opportunity to conduct doctor-to-doctor consultations, created as part of the system (using the existing e-consultation framework), is essential.

It is also important to create standards of post-treatment care and rules for referring a patient who completed oncology treatment for follow-up care at the primary healthcare facility, including a description of recommendations for the primary healthcare team and additional funding for such care to cover, among other things, follow-up examinations.

Providing coordination for oncology care at the system level will benefit everyone, including, above all, the patient.

Comment

PROF. DR HAB. N. MED. EDYTA SZUROWSKA
Former President of the Polish Medical Radiology Society
Head of the 2nd Radiology Laboratory Medical University of Gdańsk Head of the Radiology Laboratory University Clinical Center

Lung cancer is the most common cause of cancer deaths in men and women, mainly due to late diagnosis. Randomized clinical trials have unequivocally demonstrated that screening based on low-dose computed tomography (LDCT) among smokers can detect lung cancer at an early stage, when surgical treatment is most effective.

As the radiology community, we are very pleased with the announcement concerning the introduction of a population-based early detection program for lung cancer. The first screening examinations in Poland were carried out 17 years ago at a few selected academic centers. Prevention is an area of medicine where well-planned and consistently implemented systemic measures can realistically reduce mortality over a relatively short period of time. At the same time, we are aware that the implementation of this program will involve new challenges not only for us radiologists or electroradiologists, but all healthcare professionals involved in further diagnosis and qualification, especially from centers that have not conducted pilot projects.

In order for screening to be effective, it must not be "population-based in name only" but actually available to and acceptable for the intended target group.

This implies the need to implement targeted educational activities, work more closely with family doctors and other stakeholders, and create a system that ensures a sufficiently high level of participation in the first and subsequent rounds of LDCT.

Equally important is a data infrastructure (platform) that enables standardized data collection, integration and analysis of information from the entire screening journey. The central registry should include epidemiological data, clinical history (including pack-years), LDCT findings, further diagnostics (e.g. biopsies) and treatment, as well as specific quality indicators. Uniform, high-quality data is essential to evaluate the effectiveness of a screening program.

Decision-supporting tools for radiologists, such as CAD (Computer Aided Diagnosis), volumetric assessment algorithms or models based on artificial intelligence are playing an increasingly important role in computed tomography laboratories. They can increase efficiency, standardize imaging reports and reduce interpretive variability or false positives. However, they require careful validation, regular quality monitoring and proper implementation in clinical practice. The Polish Medical Radiology Society provides training to prepare radiologists and residents for getting involved in lung cancer screening.

Comment

DR N. MED. JANINA KSIĄŻEK

President of the Field Branch of the Polish Oncology Nursing Society in Gdańsk
Institute of Nursing and Obstetrics, Surgical Nursing Laboratory, Medical University of Gdańsk

The development of minimally invasive techniques and systemic treatment, including immunotherapy, is a huge advance in lung cancer treatment and brings new hope for many patients. Immunotherapy is revolutionizing cancer treatment, but its unique toxicity profile is forcing changes in multidisciplinary teams involving nurses. Patient education is key to identifying and treating side effects associated with modern treatments. Patients must not be burdened with the entire responsibility for self-monitoring.

Effective management of nursing resources is key to providing quality care to lung cancer patients. As demand for nursing services increases with the widespread use of targeted therapies and immunotherapies, there is an urgent need to make advice provided by an oncology nurse a standard part of the treatment process.

Improving patients' access to care provided by oncology nursing specialists will significantly improve patient outcomes and their quality of life. Such a change could serve as a catalyst for patient access to evidence-based professional nursing. An oncology patient should be able to receive care as part of primary healthcare and secondary outpatient care, where a specialist nurse could provide education on the skills necessary to recognize and minimize the most common adverse effects, as well as monitor the course of therapy for such events. The current healthcare model in Poland does not guarantee patients equal access to specialized oncology nurses services.

Systemic changes are needed to guarantee equal access to specialized oncology nurse services for patients. Therefore, the **introduction of oncology nursing advice as part of secondary outpatient care remains important**.

Comment

PROF. DR HAB. N. MED. JOANNA DIDKOWSKA
Head of the Epidemiology and Primary Cancer Prevention Laboratory and the National Cancer Registry, National Oncology Institute – National Research Institute in Warsaw

The “Lung Cancer Mission 2024–2034” report is the first such comprehensive document pointint out the most important factors determining the current situation in Poland for this type of cancer. I find it particularly valuable to highlight the challenges faced by primary and secondary lung cancer prevention. Despite fairly widespread knowledge of the cause-and-effect relationship between smoking and lung cancer, people are still not spurred to reflect on their own health.

The report presents a wide range of recommendations for specific actions that can significantly change the perception of lung cancer in Poland.

Given that smoking tobacco is still the most important risk factor for lung cancer, the scope of primary prevention tasks outlined in the Report in terms of both education and treatment from tobacco dependence is impressive.

Recommendations should also emphasize efforts to drive participation rates among doctors, nurses, psychologists in training courses on the diagnostics and treatment of nicotine dependence, funded by the National Health Program, and the fact that fiscal tools (price of cigarettes) are very effective in reducing smoking prevalence. Congratulations to the Authors!

Comment

PROF. DR HAB. N. MED. RENATA LANGFORT
President of the Polish Society of Pathologists.
Head of the Pathomorphology Laboratory,
National Tuberculosis and Lung Diseases Research Institute in Warsaw

Lung cancer remains one of the most dangerous forms of cancer in both men and women, due not only to the widespread smoking habit, but also to late diagnosis.

The vast majority of patients receive a diagnosis when the neoplastic process is advanced and treatment options are limited.

An additional problem is the imperfect organization of the healthcare system, the lack of an established and clear diagnostic pathway, not only for the patient, but also for the primary healthcare physician.

Unlike other cancers, such as breast, colorectal or prostate cancer, diagnosing patients with suspected lung cancer is more varied, requiring multi-center cooperation and involvement of physicians from different specialties. Lack of proper coordination of the diagnostic and therapeutic process, as well as the lack of clearly outlined management stages significantly affect treatment delay.

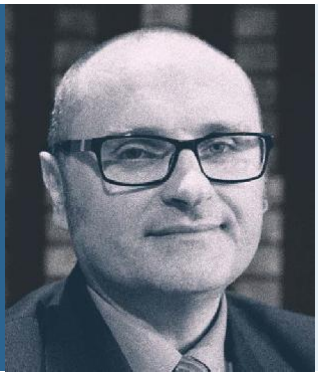
In addition, pathomorphological evaluation of material collected from patients with suspected lung cancer in units located outside the hospital structure, lacking experience in diagnosing thoracic cancers, lacking adequate diagnostic facilities, and without the opportunity to participate in multidisciplinary team (MDT) meetings often affects the quality of the diagnosis. The pathomorphological diagnosis is not comprehensive, does not include assessment of predictive factors (immunohistochemical evaluation of PD-L1 protein expression), and the material is not qualified nor submitted for molecular testing.

“Lung Cancer Mission 2024-2034” is the result of the involvement of specialists from various fields who deal with the diagnosis and treatment of lung cancer patients and who are best qualified to notice the existing barriers to improving diagnostic and therapeutic outcomes.

I hope that the presented document will become a “milestone” in the process of improving the care provided to lung cancer patients and will affect the treatment outcomes and the patients’ quality of life.

Comment

DR HAB. N. MED. IZABELA ŁACZNAŃSKA
Cancer Molecular Diagnostics Laboratory,
Lower Silesian Center for Oncology, Pulmonology and Hematology Polish Society of Human Genetics



DR HAB. N. MED. ARTUR KOWALIK, PROF. UJK
Molecular Diagnostics Laboratory,
Genetic Engineering Laboratory,
Świętokrzyskie Oncology Centre in Kielce, Medical Biology Laboratory, Institute of Biology, Jan Kochanowski University of Kielce, Polish Society of Human Genetics

An area that undoubtedly requires improvement and cooperation is, above all, the journey of lung cancer patients so that they would be referred to centers that offer comprehensive genetic diagnostics to enable the planning of optimal treatment in the shortest possible time. The availability of comprehensive NGS genetic diagnostics for lung cancer patients also needs to be improved.

Improved accessibility to genetic diagnostics is linked to the systematic revision of the amount of funding provided by the National Health Fund for testing in connection with the accumulated knowledge of molecular markers and the expanding panel of genetic variants that need to be tested in order to optimally qualify patients for personalized treatment. Support for personnel training at medical diagnostic laboratories, who perform oncogenetics testing, is equally important.

Comment

DR JERZY GRYGLEWICZ
Healthcare expert,
Lecturer and MBA Project Leader at the Lazarski University in Warsaw and expert of Center of Value Based Healthcare

Cancer, in particular lung cancer, is prioritized as a health problem in the strategic documents of the European Union and Poland.

EU's goal in its efforts related to fighting cancer should be to increase the 5-year survival rate of patients diagnosed with cancer. It is assumed that approximately 40% of cancer cases in the EU are preventable; one should bear in mind that prevention is more effective than any treatment and constitutes the most cost-effective long-term strategy for cancer control.

Europe's Beating Cancer Plan was unveiled in February 2021 and is the EU's response to the growing challenges and changes in cancer control, representing political commitment to take any and all possible measures in the fight against cancer. It supports member states' efforts to prevent cancer and ensure a high quality of life for oncology patients, cancer survivors, their families and caregivers.

In the context of lung cancer, special attention is paid to identifying high-risk profiles, starting with tobacco smokers and former heavy smokers.

Member States should further research how to reach and invite the target group – addicted smokers. The National Recovery and Resilience Plan (NRRP) is a policy document that provides funding for structural reforms and investments in oncology care. In the case of lung cancer, it can significantly affect the provision of infrastructure funding in comprehensive Lung Cancer Units.

The National Transformation Plan indicates that the most important risk factor responsible for the loss of the highest number of healthy life years for men and women is smoking (approx. 5,700 DALYs per 100,000 population), which is also the leading cause of lung cancer.

The most important goal of the National Cancer Strategy is to increase the number of people surviving five years after completing cancer therapy and to reduce the incidence of cancer, including lung cancer. Patients' quality of life during and after cancer treatment is also expected to improve.

Comment

ALEKSANDRA WILK
Director of the Lung Cancer
Section TO SIĘ LECZY Foundation

In recent years, huge breakthroughs have been made in both the diagnostics and treatment of lung cancer. More and more modern, effective therapies are emerging every year – both molecularly targeted therapies and immunotherapies – with the B.6
drug program gradually being expanded to include them. Unfortunately, still too few patients have a real chance to take advantage of these opportunities. The problem is no longer strictly about the lack of access to drugs, but rather quite significant delays in diagnostics, failure to perform the full range of predictive tests and, as a result,
too few patients qualified for treatment in time.

Clinical data show that more than half of lung cancer cases in Poland are diagnosed at an advanced stage, when the chances of radical treatment are minimal. Meanwhile, we have a tool that could change this – an early lung cancer detection program relying on low-dose computed tomography (LDCT). The pilot program has confirmed the effectiveness of this approach, but we are still waiting for it to become a nationwide prevention program. This should become a priority – just like mammography in breast cancer or colonoscopy in colorectal cancer. Early detection of the disease simply means better chances for a cure.

Another problem lies with molecular and immunohistochemical diagnostics – still insufficiently fast, lacking coordination and evenly spread access in different regions of the country.

Meanwhile, the choice of optimal treatment and the patient's eligibility for personalized treatment depend on it. Without a full panel of molecular tests, the patient is "blindly" assigned to treatment, often depriving them of the benefits stemming from the use of modern drugs that could add entire years to their survival.

From the patients' perspective, one of the most painful problems is that the disease is progressing faster than the system. We have many cases in Poland in which patients are waiting for weeks to see their test results, while their cancer progresses. Sometimes a patient dies before being confirmed eligible for a specific treatment. This should not happen in the 21st century, considering what medicine has to offer.

That is why it is so important to implement a comprehensive care model – Lung Cancer Units. This means not only better coordination, but also actually shortening the diagnostic and therapeutic journey, improved quality of diagnosis, faster therapeutic decisions and better treatment outcomes. In Western European countries, this model has brought about tangible benefits: patients have their dedicated coordinator, test results are discussed by a multidisciplinary team and the time from diagnosis to treatment initiation is reduced to just a few days.

There is great potential in Polish oncology, we have great specialists and increasingly better treatments. Now we need to do everything we can for the system to catch up to the progress made in medicine, so that the patient is not left alone between stages of diagnosis and every patient has access to comprehensive, modern and fast care. In lung cancer, time really does matter.

Comment

ELŻBIETA KOZIK
President of the PARS Oncology Movement Association

From our organization's perspective, the biggest problem for lung cancer patients remains the long waiting time for test results, difficult access to specialists and flawed coordination of the diagnostic process. Patients point out a convoluted and poorly organized diagnostic journey, devoid of clear rules and information. Such a situation really reduces their chances of getting diagnosed quickly and initiating treatment, often meaning weeks or months of uncertainty, stress and anxiety.

We focus on the diagnosis stage, because this is the starting point that is crucial to the patient's further chances. Our research indicates that more than half of patients present to their primary care physician with symptoms that should already trigger oncological vigilance – prolonged cough, change in its nature, chest pain or shortness of breath. Unfortunately, the PCPs too rarely decide to refer patients for lung cancer diagnostics. Patients are treated symptomatically, and the time to appropriate referral increases significantly.

This crucial moment should be shortened, and patients with suspected lung cancer should be referred as soon as possible to specialized centers that provide comprehensive diagnostics. All too often, the Oncological Diagnostics and Treatment Card (karta Diagnostyki i Leczenia Onkologicznego, DiLO) is not issued in a timely manner or at all, delaying the initiation of a proper oncology pathway.

The same pattern is repeated in the accounts of patients and their relatives – confusion, lack of information and a sense of helplessness in the face of the system. Patients and their relatives need clear guidance and support from oncology coordinators to lead them through the stages of diagnosis and treatment. With each day of waiting for a result, each subsequent referral and distant test date, the disease progresses. An additional barrier, robbing the patients of the chance for modern treatment, is limited access to molecular diagnostics. Therefore, from our organization's perspective, the overriding goal remains to shorten and simplify the diagnostic pathway – and this is where we are focusing our efforts today.

LUNG CANCER MISSION 2024–2034

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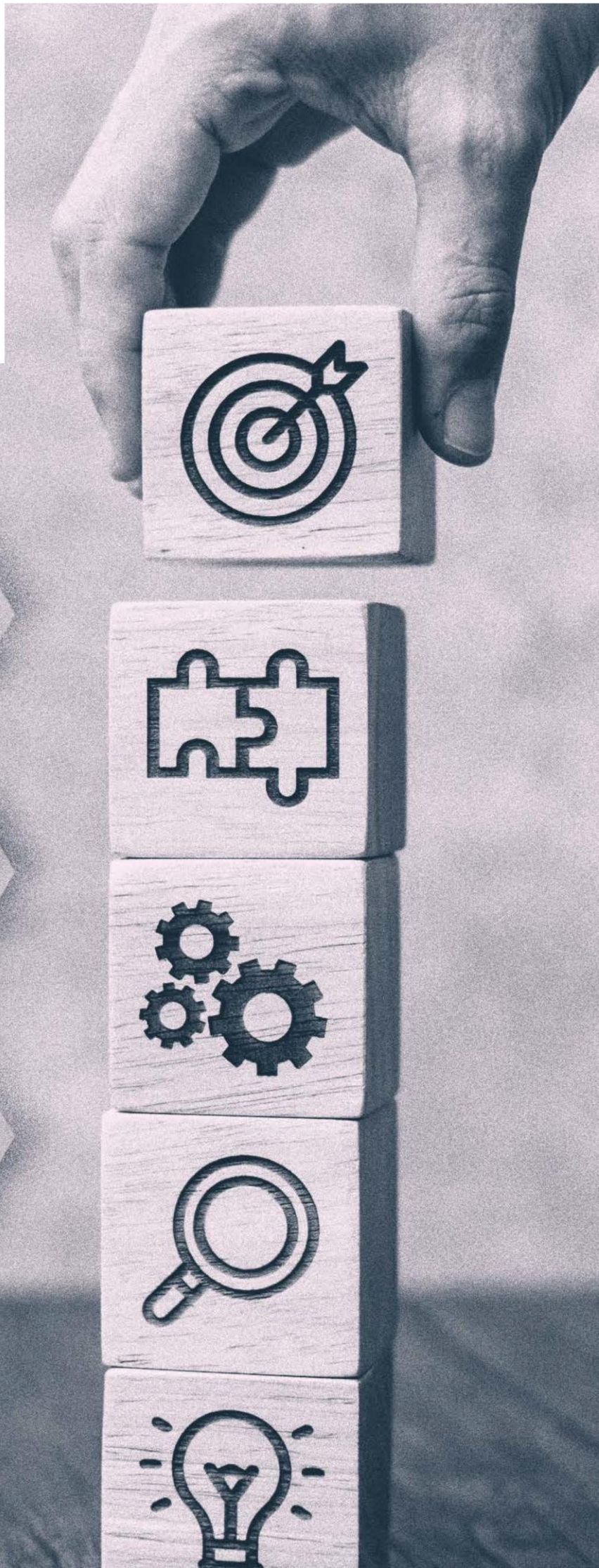


1.1. LUNG CANCER ROADMAP 2025
overview of changes in lung cancer patient management

Basic epidemiological data and indicators [1]

Cancer incidence in Poland

192,922

Lung cancer incidence (C34)

21,045

Projected lung cancer incidence in 2040

even

36,700

Lung cancer deaths (C34)

22,155

Projected lung cancer deaths in 2040

even

31,600

85% NSCLC

15% SCLC

Structure of primary diagnoses of C34, lung cancer

Local stage - approx. 20%.

Regional stage - approx. 35%.

Generalized stage - approx. 45%.

22% of lung cancer deaths occur before age 65

High lung cancer incidence (Poland compared to the EU)

82.1/100,000 people [2]
(EU average: 66.1/100,000)

Very high lung cancer death rate (Poland compared to the EU)

70,5/100,000 people [3]
(EU average: 52/100,000)

approx.20%

5-year age-standardized net survival rate of lung cancer patients [4]

33%

5-year age-standardized net survival rate for locoregional lung cancer

5%

5-year age-standardized net survival rate for metastatic cancer (generalized disease)

System of care for lung cancer patients

2024

Number of treated patients

79,368

Number of healthcare services provided

838,639

2025 (Jan-Sep)

Number of treated patients

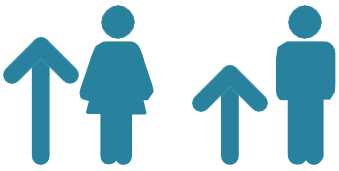
69,180

Number of healthcare services provided

582,218

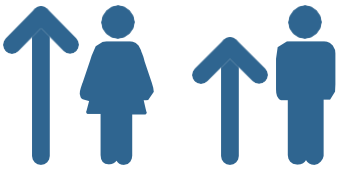
In recent years, there has been a steady increase in the number of patients treated and services provided

13% 6%



In the last 2 years, the number of women treated for lung cancer increased **by more than 13%** (from 31.7 thousand to 35.8 thousand), while for men the increase was about **6%** (from 41.2 thousand to 43.6 thousand)

23% 15%



An increasing intensity of treatment is observed – the number of services between 2022 and 2024 increased by **about 23% in women and about 15% in men**

Value of services	
2023	Almost 2.2 billion
2024	Almost 2.6 billion
2025 Jan-Sep	Almost 2.2 billion

Primary Care

Primary care covered **34,335 patients** diagnosed with lung cancer, accounting for almost **50% of all patients** who received NHF services for this indication in 2024.

SOC

Secondary outpatient care (SOC) covered **58,286 patients** and **244,569 services** but **the value of services amounted to only PLN 65.9 million, i.e. approximately 2.5% of the total cost of care.**

This indicates, among other things, **low pricing of secondary outpatient care services** and underutilization of this form of care in the process of coordinating diagnostics, treatment and follow-up of patients.

Hospitalizations

90% of the total cost of care

SOC

2.5% of the total cost of care

HOSPITAL TREATMENT (HOSPITALIZATIONS)

The largest share in the healthcare service structure is taken up by **hospital treatment**, which was provided to **45,572 patients**, accounting for approximately **78%** of all people receiving healthcare services from the Polish National Health Fund related to a diagnosis of lung cancer in 2024.

In 2024, there were **258,698 hospitalizations with a total value of PLN 2.37 billion**, accounting for **more than 90% of the total cost of care.**

PALLIATIVE CARE

Palliative and hospice care benefited **15,810 patients**, who received **219,881 services** worth **PLN 189.8 million.**

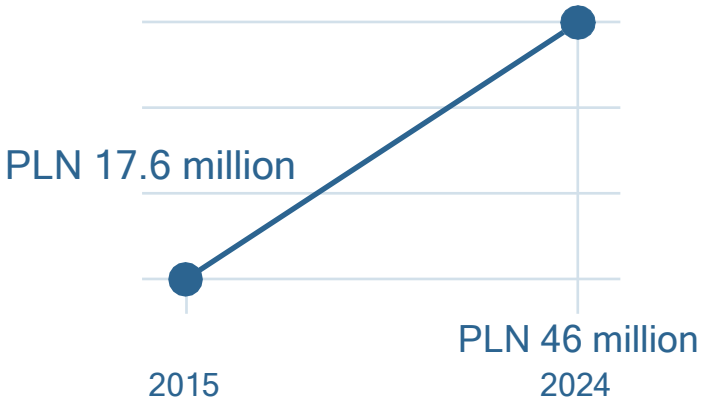
This represents **the second most valuable category of services after hospital treatment.** The data supports the fact that **a significant percentage of lung cancer patients still end up in the system at an advanced stage of the disease.**

PILOT PROGRAMS

In 2024, **31,453 patients** received healthcare services as part of **pilot programs** (including the early lung cancer LDCT detection program).

The number of **80,315 services and the value of PLN 9.2 million** indicate a relatively small financial scale, but high systemic importance.

Value of separately contracted services



Therapeutic rehabilitation

<400 patients

per year

SEPARATELY CONTRACTED SERVICES

The increase in the value of **separately contracted services** from PLN 17.6 million in 2015 to more than **PLN 46 million in 2024** reflects, among other things, the development of **molecular testing, immunohistochemistry assays and diagnostic procedures** in the area of lung cancer.

A 70% increase in the number of services in a decade shows **the increasing emphasis on predictive diagnostics.**

REHABILITATION

Therapeutic rehabilitation covered **less than 400 patients per year**, and nursing services covered **less than 100 patients**.

Reimbursement values in these categories are symbolic (less than PLN 1 million per year), confirming the **lack of systemic approach to rehabilitation and supportive care** in lung cancer. There is an apparent **gap in supportive care** and a lack of continuity after hospital treatment completion.

IMAGING DIAGNOSTICS

The number of patients referred for CT increased by about 30% between 2015 and 2024, and nearly doubled for PET, while the number of X-ray and ultrasound examinations fell by several dozen percent.

This trend is confirmed by the growing use of modern, high-value imaging methods in accordance with modern oncology diagnostic standards.

The problem is long waiting times for tests and results, and significant differences between regions of Poland.

MOLECULAR DIAGNOSTICS

The number of molecular tests performed for lung cancer diagnostics in 2019–2022 fluctuated around 35% of newly detected cases.

More than 8,500 tests were performed in 2023 and **more than 10,500 tests in 2024** (almost 50% of newly diagnosed lung cancer cases).

Nearly 60% of lung cancer cases are detected at an advanced stage, when systemic treatment should be considered, and molecular testing plays a key role in patient qualification process.

The number of patients undergoing **diagnostic tests** under the drug program **increased from 1,024 in 2015 to 10,521 in 2024, and as many as 9,052 between January and August 2025.**

This means that **in 2025 the number of diagnostic tests could exceed 13,000** (trend analysis).

The value of testing reimbursements nationwide has increased by more than 70% between 2022 and 2024, demonstrating both the increasing funding of the National Health Fund and the effective implementation of the demands of the oncology community and the Lung Cancer Mission.

More testing translates directly into better therapy matching and an increasing percentage of patients treated in the drug program.

In 2022, the majority of molecular tests were single gene tests (e.g., EGFR, ALK, ROS1), whereas **starting 2023, NGS panels** are performed **increasingly often.**

Increasing the availability of next-generation sequencing significantly improves the **efficiency of predictive diagnostics**, shortens the treatment qualification time, and reduces the number of repeat tissue material collections.

The number of molecular tests, including advanced NGS panels, is still too small nationally, too often tests are performed sequentially and wait times for results remain too long.

Estimated molecular testing demand gap

Tests/examinations completed

↑ +49% within two years

Estimated gap

Variant 1.

If the need to test all patients with NSCLC is accepted:

coverage ≈ 10.5 thousand/18 thousand ≈ 58%

a gap of about 7,000-8,000 tests/year

Variant 2.

Testing mainly at an advanced stage

~70-75% NSCLC = 13-14 thousand

a gap of about 3,000-4,500 tests/year

Despite a marked increase in the number of molecular tests performed, the real needs are still not being met. **There is a shortage of at least 3,000-4,500**, and by full standards **as many as 7,000-8,000 tests per year**.

Up to 30% of the tissue material collected for testing is undiagnostic or inadequate, indicating the need for access to multigene genetic testing from liquid biopsy (ctDNA) in both inpatient and outpatient settings, a procedure that is not reimbursed.

No data available on PD-L1 protein expression evaluation testing performed (immunohistochemistry assay)

Despite the fact that PD-L1 protein expression evaluation is one of the key tests in the predictive diagnostics of lung cancer patients, determining the administration of immunotherapy, there is no official data (National Health Fund) on the number of patients who underwent this test, the number of services provided and their value due to the lack of separation of this procedure (no separate code).

The National Health Fund does not reimburse innovative technologies and diagnostic tools in lung cancer: tests using liquid biopsy and circulating tumor DNA (ctDNA) in both inpatient and outpatient settings, tests from fresh material (peripheral blood/fluid biopsy) ordered from the outpatient level, comprehensive CGP genomic profiling by NGS as an isolated procedure, predictive immunohistochemical tests for PD-L1 protein expression.

DRUG PROGRAM

Between 2022 and 2025, the B.6 drug program was updated 7 times, expanding the availability of therapies that comply with clinical guidelines.

The B.6 drug program: Treatment of patients with lung cancer (C34) and pleural mesothelioma (C45) reached the second highest total reimbursement amount among all oncological drug programs in 2024, with NHF spending on the program amounting to **nearly PLN 1.3 billion** [5].

Increase in the number of patients

The number of treated patients increased year after year. In 2019, there were about 3,300, and four years later in 2023 the number tripled, exceeding 10,000 patients, and in 2024 there were more than 12,200 patients treated. The growth of the number of patients treated as part of the drug program is on average about 20-25% per year.

Increase in the number of active substances in the drug program and in perioperative treatment, including adjuvant treatment, subsequent lines and expansion of reimbursement indications.

More than 50% of the active substances currently recommended by ESMO (18 out of 35) are currently reimbursed.

Slight increase in number of service providers

2023 - 109 service providers

2024 - 111 service providers

Between 2015 and 2018, most of the drug program services were provided in the **classic hospitalization** mode.

From 2019, there is a **marked increase in the number of one-day hospitalizations**, which have become the **primary form of providing treatment**

2019	2024	Jan-Aug 2025
1,899	8,253	→ 7,512

▲ More than 4-fold growth in 5 years

The drug program is also increasingly **shifting to a one-day model** in line with European practice - less invasive, more cost-effective, and better suited to patients' needs.

An increasing number of patients are being treated in an outpatient setting, from 304 patients in 2015 to 3,062 in 2024 and as many as 3,005 between January and August 2025.

The progressive **implementation of molecular testing and immunohistochemistry assays** can be observed as an eligibility condition for targeted treatment and immunotherapy.

At the same time, this indicates the growing burden on pathomorphology and genetic diagnostics departments, which requires standardization and ensuring even regional access.

WAITING TIMES

Excessively long waiting times for diagnostic tests and test results

Excessively long time from tissue specimen collection to treatment initiation

Shortest time	Longest time
Kujawsko-Pomorskie 37 days	Pomorskie 57 days
Zachodniopomorskie 44 days	Opolskie 57 days
Łódzkie 46 days	Warmińsko-Mazurskie 57 days

KEY SYSTEMIC ACTIONS NOTED DURING THE PAST YEAR

Issuance by the Agency for Health Technology Assessment and Tariff System (Agencja Oceny Technologii Medycznych i Taryfikacji, AOTMiT) of key positions on systemic and organizational solutions as a basis for their further procedure:

Comprehensive oncological care for service recipients with lung cancer and other thoracic cancers. Assessment of the justification of qualifying a service as a guaranteed healthcare service.

Qualification of the healthcare service "Early lung cancer detection program using low-dose computed tomography (LDCT) in persons with increased, defined risk" as a guaranteed healthcare service.

Qualification of the healthcare service "Robotic thoracic surgery for lung and other thoracic cancers" as a guaranteed healthcare service.

KEY SYSTEMIC ACTIONSNOTED DURING THE PAST YEAR

Reimbursement of further innovative therapies, including perioperative treatment with immunochemotherapy, preoperative and postoperative treatment with immunotherapy and molecularly targeted therapies, and expansion of indications.

Extension of the LDCT lung cancer prevention program in its current form with the announcement of its inclusion into the healthcare services basket from 2026.

Finalizing the final form of the Lung Cancer Units competency centers model; work is underway at the Ministry of Health on a regulation to implement it.

SOLUTIONS NOT REALIZED IN 2025

A nationwide screening program funded by the National Health Fund has not been implemented

Lung Cancer Units have not been implemented

Comprehensive genomic profiling (CGP) and molecular (genetic) NGS testing
from liquid biopsy (ctDNA) have not been reimbursed

Accreditation of Pathology Diagnostic Units has not been renewed, which translates into the inability to bill pathomorphology tests, including, among others, the PD-L1 protein expression evaluation

1.2. Key current challenges and recommendations

PROPHYLAXIS

CHALLENGES

A very high percentage of cigarette smokers, including a steadily increasing number of female smokers.

Lack of a comprehensive anti-smoking policy program in Poland.

A negligible number of anti-smoking clinics funded by the National Health Fund.

Underutilization of PCPs in smoking prevention as part of coordinated care.

Low awareness of lung cancer risk among women.

Low percentage of diagnoses at early stages that allow for radical treatment.

RECOMMENDATIONS

Establishing a network of comprehensive anti-smoking (smoker assistance) clinics, at least 16, one in each voivodship.

Conducting mandatory PCP training in anti-smoking counseling.

Immediate implementation of the LDCT screening program for early detection of lung cancer in at-risk groups into the basket of healthcare services and its nationwide promotion (information campaign targeting men and women).

Screening women for lung cancer risk during other screening tests, e.g., mammography, and referral for LDCT screening if necessary.

Expanding the scope of occupational medicine examinations to include referral for lung X-ray and chest LDCT.

DIAGNOSTICS

CHALLENGES

Fragmentation, delays in diagnostics and often failure to perform comprehensive tests, preventing proper qualification for treatment.

Long waiting times for imaging testing and results.

Too few predictive tests ordered for NSCLC patients, still too few advanced NGS tests.

Lack of reimbursement for comprehensive genomic profiling and liquid ctDNA biopsy in inpatient and outpatient settings.

Lack of data on the number of PD-L1 protein evaluation tests performed (no separate code in the NHF basket).

Suspension of the accreditation process for Pathology Diagnostic Units (PDUs).

Problems with funding PD-L1 predictive factor testing.

RECOMMENDATIONS

Standardization of imaging examination descriptions and quality control of examinations.

Implementation of the obligation to issue a simultaneous (conditional) referral for molecular testing together with a referral for pathomorphological testing.

Reimbursement of key procedures in predictive diagnostics: ctDNA and CGP NGS testing.

Resuming the Pathology Diagnostic Unit accreditation process and increasing the number of certified pathomorphology departments.

Providing the PD-L1 protein evaluation test with a dedicated code in the basket of healthcare services to monitor the number of tests performed and the effectiveness of the diagnostics.

Changing the criteria for funding the PD-L1 predictive factor test by providing the ability to bill the test to centers without a certified pathomorphology laboratory.

Providing funding mechanisms for comprehensive predictive testing, e.g., through the use of funds from the Medical Fund.

TREATMENT

CHALLENGES

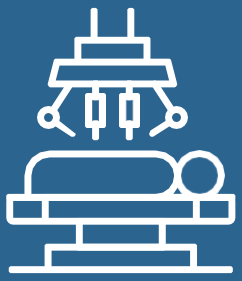
Treatment waiting times are lengthening, and the percentage of patients who started treatment within 63 days has dropped.

Immunotherapy and targeted therapy are used about 50% less frequently in Poland than recommended by the European Society for Medical Oncology.

Failure to take advantage of drug program opportunities – too few patients included in the program among those likely to benefit from innovative treatment (contributed to by delays in diagnosis, failure to perform a full panel of predictive tests, fragmentation of the treatment process and lack of coordination, staff shortages, lack of knowledge of specialists about current reimbursable treatment options).

Many therapies recommended by ESMO are still not reimbursed in the drug program, there are apparent gaps in access to treatment for narrow groups of patients, among others.

Low use of robotic surgery in thoracic surgery and lack of separate pricing for VATS and RATS procedures.



RECOMMENDATIONS

Improving coordination of the diagnostic and therapeutic process between centers and specialists within the National Oncology Network, basing treatment on Multidisciplinary Teams (MDTs) and implementing Lung Cancer Units.

Training of thoracic surgery specialists in the area of current diagnostic and treatment standards (due to new perioperative treatment options).

Providing each oncology center with real access to an oncology care coordinator and standardize the tasks and competencies of coordinators.

Introducing solutions to promote treatment in outpatient settings with reduced use of hospitalization (e.g. appropriate pricing of these procedures).

Introducing a system for evaluating and rewarding the quality of the effects of diagnostic and therapeutic procedures.

Funding for comprehensive rehabilitation (including prehabilitation) of thoracic cancer patients.

Reimbursing more innovative therapies with proven efficacy – filling gaps in treatment.

Pricing and reimbursing VATS and RATS (minimally invasive surgery) surgical procedures.

ORGANIZATION AND FUNDING

CHALLENGES

Lack of full funding for predictive testing, key to treatment qualification.

Lack of funding for molecular testing from liquid biopsy, which is applicable when tissue material is undiagnostic (up to 30% of cases).

Lack of Lung Cancer Units and mechanisms to reward the quality of treatment according to standards.

The diagnostic and therapeutic management recommendations issued in 2024 are too general and do not include an up-to-date predictive diagnostic pathway (molecular and immunohistochemical testing).

RECOMMENDATIONS

Improving treatment efficiency and spending effectiveness through optimal funding and use of predictive diagnostics (avoiding the administration of ineffective therapies and improving survival rates).

Immediate implementation of the Lung Cancer Units model to ensure coordination and comprehensiveness of care for lung cancer patients.

Updating diagnostic and therapeutic recommendations in lung cancer.

Making treatment finances dependent on performing predictive tests in accordance with standards.

1.3. Lung Cancer Mission – Joint Declaration of Scientific Societies and Organizations

In May 2024, a group of experts representing various disciplinary specialties signed a joint orientation declaration to address the health, social and economic impact of the increasing lung cancer incidence and excess mortality in Poland.

DECLARATION
LUNG CANCER MISSION 2024–2034

The purpose of this "Declaration" is to counteract the negative health, social and economic consequences of the increasing incidence and excess mortality of Polish women and men from lung cancer, the most common cause of death among cancer diseases in Poland.

Poland is among the EU countries with the highest cancer mortality rates. The goal of the joint effort is to reduce the lung cancer death rate from 24% to about 15% and to increase the 5-year survival rate from 14% to at least 20% (for the entire population of lung cancer patients) over the next 10 years.

Tobacco smoke remains the main and modifiable risk factor, contributing to about two-thirds of cancer deaths in Poland. In this context, primary prevention efforts that reduce the percentage of smokers in the population cannot be overestimated. Health policy measures including education, legislation and fiscal policy should be promoted and supported, aiming to reduce tobacco initiation among children and adolescents as much as possible, as well as to gradually reduce the smoking rate in the adult population.

The most pressing problems and challenges in oncology care for lung cancer patients in Poland include: fragmentation and dispersion of patient care among many centers, "piecemeal" performance of healthcare services, lack of rules for cooperation between pulmonology, thoracic surgery and oncology centers, too long time for pathomorphological and molecular diagnostics, too long time from the start of the diagnostic process to treatment implementation, lack of comprehensive patient care and uniform standards of management throughout the country. The prolongation of the diagnostic and therapeutic process is influenced by the transfer of patients between centers, multiple repetitions of diagnostic tests, long waiting times for certain tests and their results, and lack of patient care coordination.

Comprehensive and effective lung cancer patient care requires multidisciplinary cooperation and the development of solutions accepted by a wide range of experts involved in the process of diagnostics and treatment of this cancer, based on current clinical guidelines and epidemiological and scientific data.

Due to the above, the process of creating and implementing the LUNG CANCER MISSION involved representatives of the most important scientific societies and organizations that are essential for the proper functioning of oncological care for lung cancer patients.

We believe that we should strive to improve the coordination and quality of care for lung cancer patients regardless of their place of residence or social status. This should translate into shorter diagnostic time and optimal therapy initiation time. The target patient care model should be Lung Cancer Units, where lung cancer diagnosis and treatment will be handled by specialized centers with extensive experience and a multidisciplinary team of specialists. Given the complexity of the diagnostic and therapeutic process and the progress that is being made in this area (the emergence of new diagnostic and treatment methods), it is necessary to ensure the coordination and quality of diagnostic procedures, including imaging, endoscopic and biopsy procedures, as well as pathomorphological and molecular diagnostics.

Warsaw, on 24 June 2024.

SIGNATORIES TO THE DECLARATION

Prof. dr hab. n. med. Rodryg Ramlau – President of the Polish Lung Cancer Group

Prof. dr hab. n. med. Dariusz M. Kowalski – Secretary General of the Polish Lung Cancer Group

Prof. dr hab. n. med. Tadeusz Orłowski – Vice-President of the Polish Lung Cancer Group

Prof. dr hab. n. med. Agnieszka Mastalerz-Migas – President of the Polish Society of Family Medicine

Prof. dr hab. n. med. Maciej Krzakowski – President of the Polish Society of Clinical Oncology Prof. dr hab. n. med. Piotr Rutkowski – President of the Polish Society of Oncology Prof. dr hab. n. med. Jacek Fijuth – President of the Polish Society of Oncological Radiation Therapy Prof. dr hab. n. med. Renata Langfort – Former President of the Polish Society of Pathologists

Prof. dr hab. n. med. Olga Haus – President of the Polish Society of Human Genetics

Prof. dr hab. n. med. Edyta Szurowska – President of the Polish Medical Radiology Society

Dr hab. n. med. Beata Jagielska – Director of the National Oncology Institute of the National Research Institute

Prof. dr hab. n. med. Joanna Didkowska – Head of the NIO-PIB Department of Epidemiology and Primary Cancer Prevention, National Cancer Registry

Prof. dr hab. n. med. Cezary Piwkowski – President of the Polish Society of Cardiothoracic Surgeons Dr n. med. Małgorzata Czajkowska-Malinowska – President of the Polish Lung Association Aleksandra Wilk – Director of the Lung Cancer Section, TO SIĘ LECZY Foundation

Dr n. med. Andrzej Tysarowski – President of the Polish Personalized Medicine Coalition

Dr n. zdr. Sebastian Artur Zdończyk – President of the Polish Society of Psychooncology

Dr n. med. Janusz Meder – President of the Polish Oncology Union

Dr n. med. Janina Książek – Polish Oncology Nursing Society (President of the Field Branch in Gdańsk)

Elżbieta Kozik – President of the PARS Oncology Movement Association

1.4. The world in the fight against cancer – IASLC strategy for 2024–2029

The International Association for the Study of Lung Cancer (IASLC), of which the Polish Lung Cancer Group is a member, is the largest international organization of clinical experts in the prevention, diagnostics and treatment of lung cancer, which develops standards and recommendations, educates medical professionals and promotes access to comprehensive, innovative care for lung cancer patients.

IASLC decided to update the strategic plan, primarily due to rapid advances in lung cancer research, diagnostics and treatment options. As medical breakthroughs continue to change the landscape of lung cancer, IASLC has recognized the need to review its priorities and chart a course that addresses current trends, promotes accessibility and ultimately improves patient outcomes.

The new strategy is based on the foundations of innovation, collaboration and a patient-centered approach. IASLC seeks to foster a global network of experts, researchers, healthcare professionals and patient advocates who work together to accelerate progress in preventing, diagnosing, treating and improving lung cancer survival. The vision includes not only a focus on medical breakthroughs, but also a commitment to reducing health disparities, increasing access to care and improving patients' quality of life.

The IASLC strategy assumes that the overarching goal of its efforts is to **"defeat lung and other thoracic cancers worldwide in the 21st century"**. The strategic plan defined the main challenge as **"overcoming inequalities in access to lung/thoracic cancer education, research and treatment worldwide."**

The strategic plan is based on three new organizational pillars: scientific collaboration, global education and promoting accessible multidisciplinary care.

Pillars of IASLC 2024–2029 strategy [6]

WSPÓLNOTA NAUKOWA	SCIENTIFIC COMMUNITY
GLOBALNA EDUKACJA	GLOBAL EDUCATION
PROMOCJA DOSTĘPNEJ, MULTIDYSCYPLINARNEJ OPIEKI	PROMOTING ACCESSIBLE MULTIDISCIPLINARY CARE
MULTIDYSCYPLINARNA WSPÓŁPRACA	MULTIDISCIPLINARY COLLABORATION
WSPARCIE CZŁONKÓW	MEMBER SUPPORT
GLOBALNE WŁĄCZENIE	GLOBAL INCLUSION
ZAANGAŻOWANIE DO PACJENTÓW	COMMITMENT TO PATIENTS

Pillar 1: Scientific collaboration

The three outcomes that define the first pillar are:

- generating new scientific knowledge that influences care outcomes from a global perspective;
- facilitating the development of scientific research by increasing resources;
- inclusion, training and supporting researchers
- involved in lung cancer treatment.

Pillar 2: Global education

The three outcomes that define the second pillar are:

- expanding the availability
- and value of available knowledge;
- expanding IASLC educational offer;
- providing a sustainable centralized science repository.

Pillar 3: Promoting accessible, multidisciplinary care

Third pillar outcomes include:

- establishing multidisciplinary global standards for prevention, detection and treatment of thoracic malignancies;
- aligning and implementing global standards for regional and local equal access and timely care;
- providing assistance to government agencies, enabling them to effectively expand access to care and improve patient survival outcomes.

The new IASLC strategic plan is expected to be the driving force that will shape the future of lung cancer research, advocacy and care. By focusing on innovation, cultivating collaboration, and putting patients at the center, IASLC aims to reduce the global burden of lung cancer and improve the lives of the growing number of people affected by the disease.

1.5. Pillars of the Lung Cancer Mission and planned objectives in Poland to be achieved in 10 years

Lung Cancer Mission 2024 is the orientation statement of the Polish Lung Cancer Group, which was created in a multidisciplinary collaboration with clinical experts and scientific societies. It is a response to the increasing incidence of lung cancer in Poland and to the emergence of a number of breakthrough technologies in the diagnosis and treatment of lung cancer, which can contribute to a significant increase in the percentage of complete cures and improved survival rates, provided that access to screening is widespread, the patient journey is shorter and less convoluted, and the model of comprehensive patient care becomes the standard throughout the country.

The overarching goal of the Lung Cancer Mission is to counteract the negative health, social and economic consequences of the increasing incidence and excess mortality of Polish women and men from lung cancer, the most common cause of death among cancer diseases in Poland.

Specific objectives include:

- Deepening multidisciplinary collaboration in the care of patients with suspected and post-diagnosis lung cancer.
- **Reducing diagnostic time and accelerating the time to optimal therapy initiation.**
- **Reducing the lung cancer death rate** (maximum) over the next 10 years from 24% to approx. 15%.
- **Increasing the 5-year survival rate** (maximum) over the next 10 years from 14% to at least 20% (for the entire population of lung cancer patients).

An in-depth analysis of the situation in the area of lung cancer in Poland, through the eyes of a group of domain experts, jointly mapping the most pressing barriers and challenges, as well as recommendations, intended to improve the coordination and quality of care for patients with lung cancer, regardless of their place of residence or social status.

Pillars of the Lung Cancer Mission 2024–2034

INTER-ENVIRONMENTAL COLLABORATION

Sustained inter-environmental collaboration to improve early detection rates and treatment outcomes of lung cancer patients in Poland, involving family physicians, thoracic surgeons, surgeons, clinical oncologists, radiation therapists, pulmonologists, pathomorphologists and diagnosticians, radiologists, psychologists and other specialists involved in the diagnostic and therapeutic process and the recovery process. An important role in this process is played by the patient, who should participate in the decision-making process.

MONITORING THE STATE OF CARE

Monitoring the status of oncology care for lung cancer patients on a continuous basis with inter-environmental cooperation (experts and patients) in dialogue with the Ministry of Health and other healthcare institutions to ensure systematic improvements in the efficiency of care, to bridge local disparities in access and quality of care, and to respond efficiently to emerging problems/challenges in the organization and financing of care. Monitoring the effects of lung cancer treatment in Poland (incidence, deaths, survival, time to progression).

COMPREHENSIVE CARE AND STANDARDS

Implementing models of comprehensive care for lung cancer patients and standardizing standards of management, while individualizing therapy to allow translation of the ongoing tremendous progress in understanding lung cancer biology and the development of increasingly effective and precise diagnostic and therapeutic technologies, through effective models of patient care coordination and inter-center collaboration, based on mutually accepted principles and criteria. Providing affordable and easily accessible information to patients and their relatives about current diagnostic and therapeutic possibilities.

As part of the implementation of the Lung Cancer Mission, the Polish Lung Cancer Group will annually present the results of an audit of the situation in lung cancer care, with a view to the stated goals and short- and long-term recommendations, continuing to collaborate and consult with experts and decision-makers, in favor of increasing access, efficiency and quality of comprehensive oncology care.

LUNG CANCER IN THE STATE STRATEGIC DOCUMENTS

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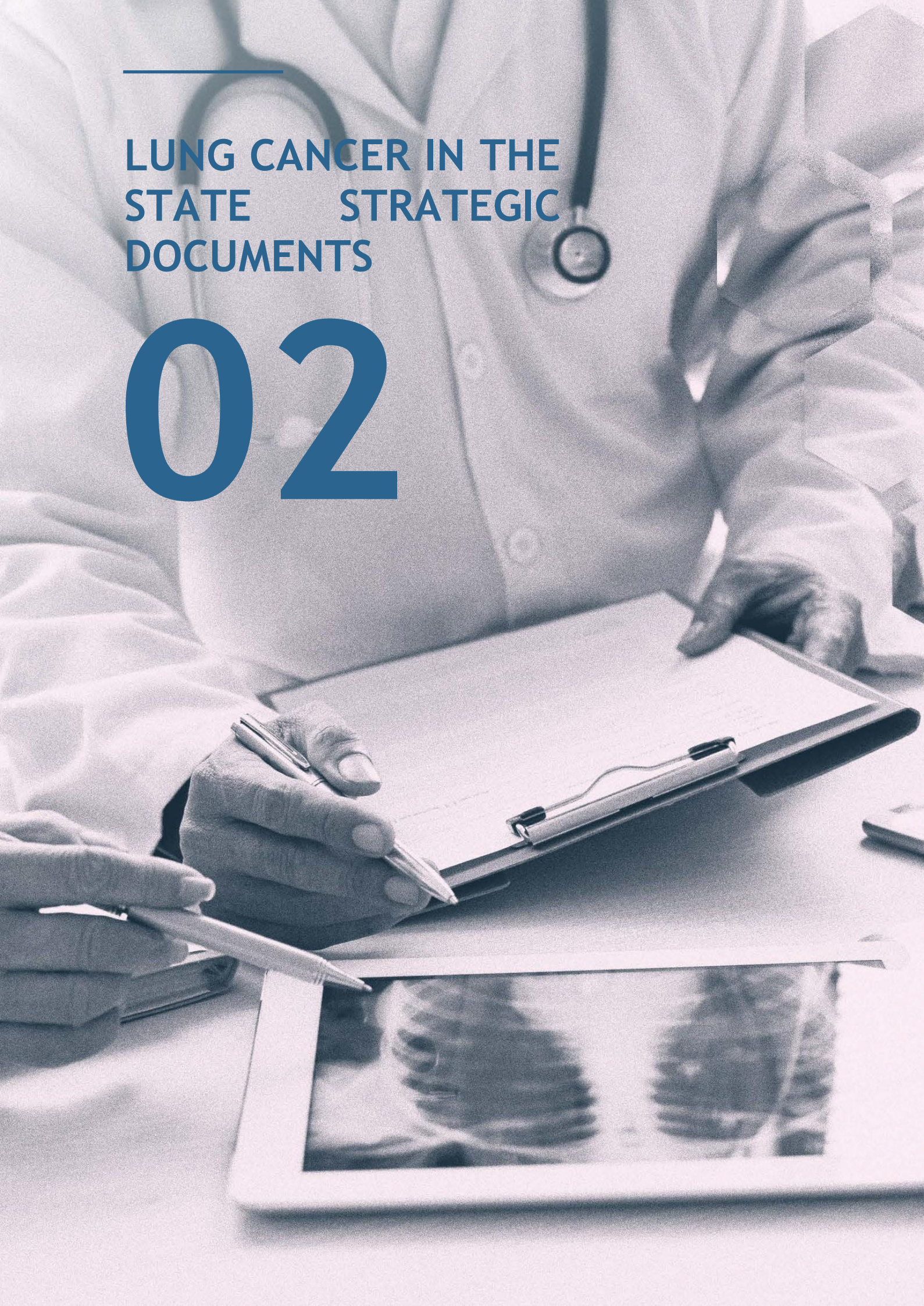

2.1. National Recovery and Resilience Plan (NRRP)

The National Recovery and Resilience Plan (NRRP) is a policy document that sets out goals for rebuilding and building Poland's socioeconomic resilience after the COVID-19 pandemic crisis, as well as structural reforms and investments to achieve them. The document forms the basis for applying for support from the European Recovery and Resilience Facility (RRF). The time horizon for the plan's implementation closes at the end of August 2026 and creates a potential opportunity for Poland's healthcare system to receive around EUR 4.5 billion in funding.

Within the framework of the NRRP in the area of healthcare, the implementation of the task called "Efficiency, accessibility and quality of the healthcare system" is envisaged.

The document identifies **milestones** (tasks to be completed for the EU funds to be transferred), including tasks **in the area of oncology care**:

IMPLEMENTED

Milestone

"The entry into force of the National Oncology Network Act [7] *and relevant legislation establishing the rules of the network by introducing a new structure and a new model of oncology care management*", which will ensure that all patients, regardless of where they live, receive oncology care based on the same diagnostic and therapeutic standards.

The legal acts implementing the National Oncology Network are aimed at:

- improving the organization of the oncology care system by providing patients with access to the highest quality diagnostic and therapeutic processes and comprehensive care along the entire "care pathway" in the areas of primary health care (podstawowa opieka zdrowotna, POZ), secondary outpatient care (ambulatoryjna opieka specjalistyczna, AOS), hospital treatment and rehabilitation;
- creating a new organizational structure and a new management model for oncology care, including monitoring centers;
- improving the quality of life of patients during and after cancer treatment.

IMPLEMENTED

Milestone

"The entry into force of the regulation on the list of voivodship monitoring centers within the Cancer Network" [8]. The regulation provides for the establishment of voivodship monitoring centers, which are healthcare entities selected within the National Oncology Network in each of the 16 voivodships, specializing in oncology care, providing comprehensive oncology treatment and monitoring, at SOLO III reference level.

IMPLEMENTED

Milestone

"Evaluation of the oncology care network "Report on the evaluation of the national oncology care network, including those containing indicators of the quality of oncology care.

The final report on the National Oncology Network pilot program was published in 2023 [9].

According to current assumptions, the National Oncology Network as a systemic solution is to be implemented nationwide from 2025.

IMPLEMENTED

Milestone

"The entry into force of the act on the list of criteria for qualifying hospitals for levels of oncology care security."

The Regulation of the Minister of Health introduced a list of criteria based on which cancer hospitals are assigned to the various levels of oncology care security of the National Oncology Network [10].

The center categorization criteria are derived from:

- coverage (including, among others, the population covered; healthcare services covered; the need to ensure access to care at the right time);
- equity (including, among others, equity in the provision and use of healthcare services);
- effectiveness;
- quality of care;
- availability of resources (including, among others, human and financial resources).

IN PROGRESS

Milestone

"Call for proposals for hospitals (belonging to the National Oncology Network) and cooperating outpatient care centers (AOS)"

The first call for proposals for hospitals (belonging to the National Oncology Network) and cooperating outpatient care centers (AOS) for the purchase or modernization of equipment or for investment in infrastructure.

Recruitment will be based on categorization criteria and clear and transparent procedures. Investments in infrastructure or the purchase of medical equipment will contribute to improving the quality of care and ensuring comprehensive access to timely hospital care.

Eligibility Criteria:

- Only hospitals and Cooperative Centers qualified for the National Oncology Network that are part of the structures of these hospitals will be supported;
- Selected investments, including those targeting outpatient care centers that cooperate with hospitals, cannot be supported by EU funds other than the RRF.
- Support only covers the scope of activities related to the provision of health services financed by the National Health Fund and does not include commercial activities.

From 17 October to 2 December 2024 the call for proposals for "Development and modernization of infrastructure of tertiary care centers and other medical entities" is open. The call for proposals is carried out within the framework of the D1.1.1. investment of the NRRP [11].

The NRRP also emphasized **the role of the primary care physician**, who should deal with all health problems, regardless of age, gender or any other characteristics of patients. The primary care physician should focus not only on the sick, but also on the healthy members of the population, to keep them from getting sick. The task of the primary care physician is to systematically carry out preventive and screening activities such as periodic examinations in healthy children and adults, assessment of risks in the workplace, residential environment, school, addiction counseling, **preventive measures against infectious diseases and cancer.**

In addition, the measure titled *"Improving the efficiency of the functioning of the healthcare system, availability and quality of healthcare services, especially in key areas due to epidemiological risks and civilization diseases and the demographic situation"* identifies **oncology** among the 8 medical fields that will be prioritized in the distribution of funds allocated for infrastructure investments.

2.2. National Transformation Plan (NTP)

The National Transformation Plan (NTP) was published by the Ministry of Health on 15 October 2021. It aims to strengthen healthcare resources and processes and improve the efficiency of public spending on healthcare services and investments in the health sector, at the national and regional levels, considering the health needs of the population.

The first National Transformation Plan was set by the Minister of Health for the period from 1 January 2022 to 31 December 2026. The NTP is an implementation document that sets out specific measures to be taken to ensure that citizens and residents of the country have access to quality health services.

As indicated in the document, cardiovascular diseases and cancers account for almost 75% of all deaths and more than 40% of DALYs (disability-adjusted life years) in Poland. The number of deaths, prevalence and incidence of cancer in Poland will increase until 2028. Meanwhile, in the EU, these indicators are projected to trend downward (except for the number of deaths). In Poland in 2019, the dominant group of risk factors affecting DALYs and deaths were behavioral, or lifestyle-related, factors. They were responsible for the loss of about 49% of years lived in health and about 44% of deaths.

The impact of behavioral risk factors on DALY loss in the EU was about 26% lower than in Poland.

The risk factors responsible for the loss of the highest number of healthy life years for men and women combined are respectively:

- **tobacco smoking** (about 5,700 DALYs per 100,000 population),
- high blood pressure [12] (about 4,200 DALYs per 100,000 population),
- high BMI [13] (about 4,100 DALYs per 100,000 population),

It should also be noted that other health risks are listed in the document, including, among others: alcohol intake, environmental pollution, occupational risks and low physical activity, which are factors that can affect the potential neoplastic disease incidence.

The National Transformation Plan, among other things, recommended the following activities in the area of broadly defined preventive health care:

01 Strengthening the development of research activities and designing new public health solutions, particularly in changing the health habits and attitudes of Poles. Activities will be related to the implementation of the National Health Program (NHP) and the team dedicated to the development of epidemiological studies at the Agency for Medical Research (ABM).
Expected results of the action: Implementation of an innovative and high-quality public health activities.

02 Development of a pilot and implementation of a health education model for schools and kindergartens, e.g. by introducing periodic educational meetings for elementary and secondary school students on promoting healthy lifestyles. Activities will be carried out as part of the National Oncology Strategy (NSO) task: conducting a pilot as part of educational activities for cancer prevention and the formation of health-promoting attitudes as part of health education in the school setting and the promotion of healthy lifestyles, as well as implementation of the Educational Health Program at Schools.

Expected results of the action: Increased awareness among children and adolescents concerning lifestyle improvements and reduction of the impact of lifestyle risk factors in younger age groups.

03 Public campaigns targeting men, breaking down barriers preventing active healthcare use, as well as campaigns targeting the public, encouraging them to get screened and activating their families in this regard. Campaigns will be implemented, among others, within the National Cancer Strategy tasks framework, i.e. the "I plan for a long life" campaign.

Expected results of the action: Increased awareness of preventive healthcare and improved participation in preventive examinations (understood as an examination that is meant to potentially detect a disease at an early enough stage.

04 An amendment to the Regulation of the Minister of Health of 6 November 2013 on guaranteed healthcare services in the field of health programs (Polish Journal of Laws of 2020, item 2209) regarding ***treatment and prevention of nicotinism***.

Expected results of the action: Successively reducing the percentage of smokers and improving the effectiveness and accessibility of comprehensive anti-smoking counseling and treatment of nicotine dependence syndrome.

05 Creating system mechanisms to coordinate health promotion activities implemented at the district and municipal levels. Activities will be related to the development of assumptions for systemic changes in public health in Poland – Regulation of the Minister of Health of 20 July 2021 on the establishment of a team for systemic changes in public health (Official Journal of the Ministry of Health, item 53).

Expected results of the action: Improving the quality and relevance of the activities of public institutions (local and governmental) planning and implementing health-promoting policies (implemented under various regulations and financed from various sources).

In addition, in terms of inpatient treatment, it was indicated that it is necessary:

- In order to reduce excessive hospitalizations, which are the cause of unjustified costs, it is recommended to ***increase the availability of diagnostic tests in outpatient settings***, particularly through regulations that favor the provision of these services in secondary outpatient care (e.g., adequate pricing of services, quality indicators).
- It is necessary ***to continue the process of centralization and concentration of services in centers with adequate facilities and experience for rare diseases and other diseases requiring complex and comprehensive treatment***.
- At the same time, scheduled and one-day forms should be developed to secure the population in treatment services while optimizing costs.
- Indicators of the quality of services provided should be used on a larger scale. These indicators should be analogous to those used in comparisons with other countries. It is also advisable to introduce indicators based on declarative measures from surveys completed by patients, assessing the procedures performed and the overall quality of services. The increase in the quality of services provided in hospital treatment should be further promoted, including by strengthening the role of accreditation in health care while ensuring that its standards are updated, implementing a system of reporting adverse events not based on blame, and giving more weight to the quality indicator in the algorithm for calculating contract amounts, and consequently increasing the role of paying for the quality of services.

2.3. Healthy Future. Strategy Framework for the Health System for 2021–2027, with a perspective of up to 2030.

The strategic document "*Healthy Future. Strategy Framework for the Health System for 2021-2027, with a perspective of up to 2030*" constitutes public policy within the meaning of the concept of the development management system of the Republic of Poland, implemented based on the Act on the Principles of Development Policy. The purpose of developing and implementing this strategic document is meeting the obligations of the Republic of Poland as a member of the European Union. In connection with the possibility of using EU funds for the implementation of certain activities under the cohesion policy funds, all member countries are required to meet the basic conditions for the perspective of 2021–2027 in each area.

The "*Healthy Future*" document presents, among others, an analysis of the implementation of preventive examinations based on a report by the Supreme Audit Office:

- Participation in cancer prevention programs is not high enough. According to a report following an audit by the Supreme Audit Office of preventive healthcare in 2012–2015, educational campaigns related to these programs were not adequately effective.
- According to the Supreme Audit Office, the effects of prevention programs are also unsatisfactory in relation to the funds spent on them. For example, between 2011 and 2016, more than PLN 1.1 billion was spent on the National Cancer Program (more than PLN 2.6 billion since its implementation in 2006); however, none of the program's main goals have been achieved.
- The number of people participating in preventive examinations, including screening, has not increased; cancer detection has not improved either. According to the Supreme Audit Office report, this is due to, among other things, the lack of coordinated patient education, the lack of consistent secondary prevention system, and the difficulty in obtaining the Oncological Diagnostics and Treatment Cards for some patients.

Due to the above, systemic measures are being taken to improve this situation. Since February 2020, **the National Oncology Strategy (Narodowa Strategia Onkologiczna, NSO)** has been in effect to organize comprehensive and coordinated oncology care in Poland. One of its five main goals is ***increasing the level of screening enrollment and improving the quality of screening***.

The "*Healthy Future*" document emphasizes that carrying out preventive activities brings short- or long-term tangible benefits to society in the form of improved health awareness of the population, improved health status of the population, increased detection of diseases at an early stage of development, reduced number of people with complications of diseases and permanent disability, reduced number of illnesses and deaths and reduced cost of treatment, as well as lower financial losses to the economy (sickness benefits, production losses).

The recommendations of the aforementioned document mention, among others, the need for:

- Updating and/or developing health programs/policies for key civilization diseases.
- Promoting health and pro-health attitudes – with a particular focus on activities for children, adolescents and the elderly, as well as mental health.
- Intensive health education, including behavioral intervention programs in at-risk groups (obesity, stimulants, sedentary lifestyle, exposure to excessive stress).
- Expanding the coverage of the preventive vaccination plan.

- Implementing screening programs in high-risk groups.
- Developing and promoting periodic preventive health checkups for adults implemented as part of primary healthcare.
- Widespread coverage of service recipients over 40 years of age with preventive laboratory diagnostics, under the program "Prevention 40 Plus" for the most common health problems.
- Raising the role of secondary prevention (education of medical personnel).
- Integrating the healthcare and social welfare systems to strengthen the commitment to health promotion at each social service supply place.
- Strengthening and integrating mechanisms for identifying and monitoring the occurrence of health risks.

2.4. National Oncology Strategy – primary and secondary prevention

The National Oncology Strategy (NSO) is a multi-year program for 2020–2030 introducing comprehensive changes in Polish oncology. The strategy was adopted by the Council of Ministers in a resolution dated 4 February 2020 [14].

The most important goal of the National Oncology Strategy is to increase the number of people surviving five years after completing cancer therapy and to reduce the incidence of cancer. Patients' quality of life during and after cancer treatment is also expected to improve.

The National Oncology Strategy guides the development of the oncology healthcare system, identifying 5 areas that are key to reversing unfavorable epidemiological trends, improving the effectiveness of oncology therapies and adapting system solutions to the needs of cancer patients: investment in human resources, investment in education – primary prevention, investment in the patient – secondary prevention, investment in science and innovation and investment in the oncology care system.

The following actions are planned for primary prevention:

- educating children, adolescents and adult Poles on how to consciously take care of their health to reduce the risk of cancer,
- promoting healthy nutrition and introducing solutions to reduce the use of tobacco products,
- introducing free HPV vaccination for girls and boys,
- modifying the program for the prevention of tobacco-related diseases (including chronic obstructive pulmonary disease (COPD)).

In terms of secondary prevention, the following are planned:

- measures to facilitate access to available screening tests, allowing for earlier cancer detection,
- introducing new screening tests,
- involving primary care and occupational health physicians (Prevention 40 Plus) in cancer detection.

In terms of investment in innovations and the oncology care system, the following are planned:

- increasing opportunities for oncology patients to participate in clinical trials,
- facilitating access to innovative cancer therapies,
- increasing the number of reimbursable drugs in oncology,
- ensuring that all cancer patients receive the highest quality treatment,
- increasing access to modern medical equipment,
- improving the quality of life of cancer patients, including better access to various forms of rehabilitation,
- support for the development of palliative and hospice care.

Reports on the implementation of the National Oncology Strategy for 2023

In May 2024, the Ministry of Health presented a report on the implementation of the National Oncology Strategy for 2023. In the field of primary prevention, the following tasks were realized, among others:

- Developing comprehensive solutions for health education in the school setting and the promotion of healthy lifestyles, e.g. by developing an Educational Health Program at Schools, to strengthen this area of teaching in schools and raise the health competencies of children and adolescents.
- Increasing the reach of social campaigns by standardizing and intensifying activities aimed at health education and promoting healthy lifestyles, in terms of: promoting physical activity and healthy nutritional choices, promoting tobacco-free living and raising awareness of the UV radiation effects.
- Establishment of Smoking Help Clinics, coordinating educational activities in the field of tobacco prevention as part of the National Smoking Help Network.
- Introducing periodic examinations relating to the patient's lifestyle, e.g. smoking, alcohol consumption, nutrition, physical activity.
- Conducting medical staff training (inpatient, primary care and occupational medicine) in primary prevention, especially in the treatment of tobacco dependence syndrome.

In terms of secondary prevention, the following tasks were carried out:

- Implementing incentive tools for occupational health teams to cover workers in high-risk groups for screening.
- Introducing periodic examinations carried out in the framework of occupational medicine, considering the history of participation in preventive screening for breast cancer, colorectal cancer, cervical cancer, as **well as tobacco diseases and lung cancer**, and skin cancer (dermatoscopic examination).
- Developing solutions to implement an obligation for primary healthcare teams to cover "local" populations of high-risk individuals with screening tests.
- Developing solutions to involve Public Health Centers in actively inviting Poles for screening.
- Using alternative forms of communication with the patient – direct contact through electronic communication means, Internet Patient Account, social media, preventive call-centers, etc.
- Conducting public campaigns and operating hotlines (NHF/oncology centers) aimed at raising awareness among Poles of the benefits of regular screening.
- **Conducting a lung cancer screening program and working to introduce public funding (NHF) for lung cancer and prostate cancer screening** in high-risk groups.

2.5. Screening program for lung cancer detection

The lung cancer prevention program is implemented by the Ministry of Health, funded by the National Oncology Strategy (from 2021 to 2025), and consists of low dose computed tomography scans in a population at high risk for lung cancer. Individuals eligible for testing are the ones who are identified for the study by screening center physicians or primary care physicians and are qualified for testing.

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Program objectives:

- → increasing the percentage of lung cancer cases detected in early stages by performing low-dose computed tomography (LDCT) examinations among the Program-covered population, increasing the cure rate (5-year survival),
- → reducing lung cancer mortality,
- → reducing the cost of cancer treatment nationwide (treating cancers at earlier stages),
- → increasing access to LDCT for people at high risk for lung cancer.

Eligibility Criteria:

01 people aged 55–74:
- → whose tobacco consumption is greater than or equal to 20 pack-years and are active smokers,
- → whose tobacco consumption is greater than or equal to 20 pack-years and have quit smoking for no more than 15 years (referring to the last period of abstinence),

02 people aged 50–74:
- → whose tobacco consumption is greater than or equal to 20 pack-years and are active smokers,

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- → whose tobacco consumption is greater than or equal to 20 pack-years and have quit smoking for no more than 15 years (referring to the last period of abstinence), and who have been diagnosed with one of the risk factors:
- → were exposed due to their occupation to silica, beryllium, nickel, chromium, cadmium, asbestos, arsenic compounds, diesel exhaust, coal combustion smoke, soot,
- → radon exposure,
- → have had lung cancer, lymphoma, cancer of the head and neck region, or smoking-dependent cancers, such as bladder cancer, kidney cancer, esophageal cancer, stomach cancer,
- → close family members (first-degree relatives) had lung cancer,
- → suffer from chronic obstructive pulmonary disease (COPD) or idiopathic pulmonary fibrosis (IPF)

In 2023, screening was carried out under 31 contracts, concluded with entities selected as implementers in 2021 and 2022, in the following voivodships: Lower Silesia, Lublin, Lubusz, Łódź, Lesser Poland, Subcarpathian, Kuyavian-Pomeranian, Warmian-Masurian and West Pomeranian. A total of 16,028 LDCT lung examinations were performed in 2024.

Preventive testing using LDCT under the National Oncology Strategy lasts until mid-2025 (the program has been extended by the Ministry of Health). To date, a total of 81,457 examinations have been conducted (as of 31 October 2024)

Moreover, it should be noted that **the Mobile Low-Dose Computed Tomography Center** has now been introduced into the program's implementation [15], which is a concept under the SOLACE Project, an initiative of the European Respiratory Society and the European Society for Radiology. European consortia are formed by 33 centers from 15 European countries. The Institute of Tuberculosis and Lung Diseases (Instytut Gruźlicy i Chorób Płuc, IGICHP) is the Polish partner of the SOLACE project. The goal of the project is to improve accessibility of the examination for at-risk individuals in communities located far from diagnostic centers. The LDCT Mobile Center will be directed to locations selected based on analysis of the results of the National Lung Cancer Early Detection Program. The project is funded by the EU4HEALTH program and co-financed by the Polish Ministry of Health.

The screening program for early detection of lung cancer in at-risk groups using low-dose computed tomography (LDCT), so far implemented as part of the National Cancer Strategy (NSO), **is expected to be included into the basket of guaranteed healthcare services in 2026**, according to the Health Ministry's announcement (postponing the planned implementation by one year from 2025 to 2026). It will become **a permanent, nationwide screening program**, operating on par with existing screening for breast cancer (mammography), cervical cancer (cytology) and colorectal cancer (colonoscopy) that has been in place for years.

The President of the Agency for Health Technology Assessment and Tariff System has issued a positive ***Recommendation No. 10/2020 of 30 November 2020 on recommended medical technologies, activities carried out within the framework of health policy programs and the conditions for implementation of these programs, regarding lung cancer detection*** [16]. The President of the Agency recommended that health policy programs conduct LDCT screening among individuals aged 55–74, with a history of tobacco consumption of ≥30 pack-years and a period of tobacco abstinence ≤15 years, conduct information and education activities directed at lung cancer prevention among those eligible for LDCT screening, and conduct lung cancer training for medical personnel.

This is **a key step for improving lung cancer outcomes in Poland**, as early detection of the disease, at a stage when radical treatment is possible, directly translates into survival rates. Establishing the program in the guaranteed service system will ensure its **financial stability, continuity of implementation and equality of access** in all provinces. Currently the participation in LDCT testing varies significantly between regions, leading to **inequalities in access to diagnosis and treatment** and limiting the effectiveness of prevention efforts.

A prerequisite for the success of the program is its widespread availability, the appropriate distribution of the centers implementing the tests, and an aggressive information and promotion campaign, targeting at-risk groups (people over 50, smokers or former smokers).

It is also crucial to involve primary care physicians who can effectively identify those eligible for the program and refer them for examinations.

A sustained, well-funded and widely promoted LDCT program is an investment that will dramatically improve early detection of lung cancer, reduce the number of cases diagnosed at an advanced stage and lower mortality from this cancer in the coming years.

2.6. European Union's recommendations on reinforcing prevention and early detection of cancers, including lung cancers

Malignant neoplasms are one of the European Commission's top public health priorities. On 16 February 2022, the European Parliament adopted the final report of the Special Committee on Beating Cancer (BECA). It indicated that Europe's Beating Cancer Plan should realistically address the critical needs of patients currently requiring timely diagnosis and effective, innovative and affordable cancer treatment methods. At the same time, it should address the challenges of complications related to cancer and comorbidities, as well as the related care, at the same time addressing the legitimate expectations of the more than 12 million cancer patients or cancer survivors and their families faced with returning to a "normal life".

EU's goal in its efforts related to fighting cancer should be to increase the 5-year survival rate of patients diagnosed with cancer. It is assumed that **approximately 40% of cancer cases in the EU are preventable**; one should bear in mind that prevention is more effective than any treatment and constitutes the most cost-effective long-term strategy for cancer control.

Europe's Beating Cancer Plan [17] was unveiled in February 2021 and is the EU's response to the growing challenges and changes in cancer control, representing political commitment to take all possible measures in the fight against cancer. It supports member states' efforts to prevent cancer and ensure a high quality of life for oncology patients, cancer survivors, their families and caregivers. The plan is based on a few key areas where the EU can contribute the most value:

- prevention,
- early detection,
- diagnosis and treatment,
- quality of life of oncology patients
- and cancer survivors.

One of the most important activities is early detection of neoplastic diseases through the European screening program. The plan also implies a revision of the Council's 2003 recommendation on cancer screening.

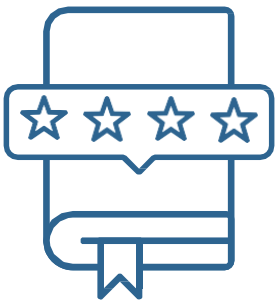
Based on the scientific opinion of the Group of Chief Scientific Advisors, on 20 September 2022 the Commission presented a proposal for new cancer screening recommendations [18]. The annex to the aforementioned Council Recommendation contains technical specifications for the listed screening examinations for five types of cancer.

Current recommendations for lung cancer are as follows:

Considering the preliminary evidence for screening with use of low dose computed tomography, and the need for a stepwise approach, countries should explore the feasibility and effectiveness of this program, for instance by using implementation studies. The program should integrate primary and secondary prevention approaches, starting with high-risk individuals.

Special attention should be given to the identification and targeting of high-risk profiles, starting with tobacco smokers and ex-smokers who used to smoke heavily. Member States should further research how to reach and invite the target group – addicted smokers. Furthermore, attention should be given to the identification and targeting of other psychoactive substances and their risk profiles.

Poland is one of the pioneers of LDCT-based screening and was one of the first countries to implement an LDCT-based screening program (pilot phase: 2021–2024) with precise eligibility criteria. The lung cancer prevention program is to be funded by the Polish National Health Fund [NHF] as a guaranteed healthcare service starting in 2025.



TOBACCO SMOKING AS A MAJOR HEALTH RISK FACTOR AND A PRIMARY CAUSE OF LUNG CANCER

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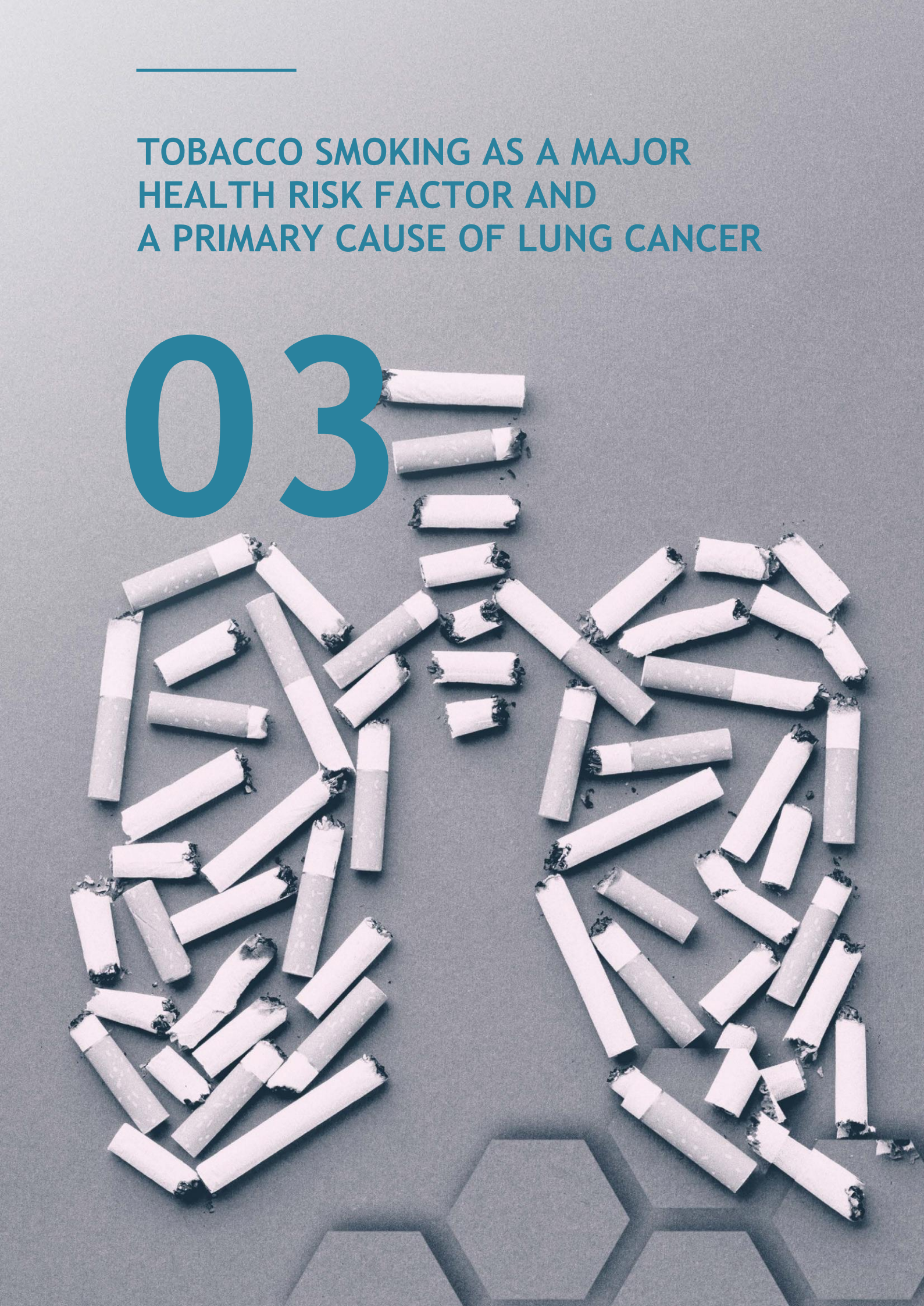


3.1. Tobacco smoking – main risk factor the development of lung cancer

Tobacco smoking remains **the most serious risk factor for lung cancer** and one of the leading causes of preventable deaths worldwide. According to the latest **Global Burden of Disease (GBD 2023)** data, **more than 8.7 million people** die each year from diseases related to tobacco smoking, including approximately **1.3 million dying from passive exposure to tobacco smoke** [19].

In Poland, the consequences of tobacco smoking are particularly pronounced. Some **90% of lung cancer cases** occur in people who currently smoke or have smoked in the past. Despite downward trends in the number of smokers over the past two decades, the scale of the problem remains alarming, especially among women and young adults. It is estimated that **approximately 25–28% of adult** Poles smoke cigarettes, **and each year more than 70,000 deaths** are directly related to tobacco-induced diseases [20].

Mortality from lung cancers among men is still among the highest in Europe, but in recent years there has been **an increase in cases among women** due to the delayed effects of past increases in the number of smokers in this population.

> Between 2000 and 2020, the percentage of female smokers in Poland has been declining at a slower rate than in men; high levels of smoking persist in some cohorts (especially in those aged 40–59). Estimates for adult Polish women indicate that approximately **19–24%** of women currently smoke (depending on the survey and definitions); these percentages are much higher than the WHO targets [21].

Consequently, **mortality from lung cancer in women** in 2016 exceeded that from breast cancer – this phenomenon is confirmed e.g. by data from the Polish National Cancer Registry (NCR) from 2016: lung cancer accounted for **approximately 17% of cancer deaths among women** (breast cancer: 14%). The trend continues in subsequent years.

3.2. Carcinogenicity of tobacco smoke and negative effects on public health and the economy

Cigarette smoke contains more than **7,000 chemical substances**, of which at least **70 are proven carcinogens**. Most of them are formed because of high-temperature (370–800°C) combustion processes. The International Agency for Research on Cancer (IARC) classifies tobacco smoke as a **Group 1 carcinogen**, meaning that its carcinogenic effects on humans are indisputable [22].

Tobacco smoking has drastic consequences for public health. Not only does it cause the development of lung cancer, but also many other cancers: oral, pharyngeal, laryngeal, esophageal, bladder, kidney, pancreatic, gastric, colon, as well as cervical and breast cancers. However, the effects of smoking spread much beyond the field of oncology – they affect virtually all organs and systems of the body. Tobacco smoke and the toxins it contains cause chronic inflammation, oxidative stress and vascular endothelial damage, leading to the development of **cardiovascular diseases** such as coronary artery disease, arterial hypertension, atherosclerosis and strokes. Smoking accounts for approximately **20% of all cardiovascular deaths** and the risk of death from ischemic heart disease is up to **twice as high** in smokers compared to non-smokers [23]. As regards respiratory diseases, the effects of smoking are equally destructive. Long-term exposure to tobacco smoke constitutes the main cause of **chronic obstructive pulmonary disease (COPD)**, which entails irreversible damage to the airways and loss of pulmonary compliance. It is estimated that more than **2 million people** in Poland are living with COPD, most of whom are current or former smokers [24]. Smoking also significantly increases the risk of developing **idiopathic pulmonary fibrosis**, more frequent respiratory infections and a more severe course of influenza or COVID-19. Adverse effects of smoking are also observed in the form of **metabolic disorders and endocrine diseases** – smoking disrupts lipid metabolism, increases insulin resistance and the risk of developing type 2 diabetes. In women, it accelerates osteoporotic processes and worsens infertility treatment outcomes.

Finally, tobacco smoking negatively affects **healing processes, recovery and the effectiveness of oncological therapies** – both surgical and systemic. In patients with neoplastic diseases, **continued smoking is associated with a higher risk of disease recurrence, postoperative complications and a poorer response to immunotherapy and targeted treatment.**

Tobacco and nicotine dependence is **a disease entity** coded as F17 – **Mental and behavioral disorders due to use of tobacco** in the International Classification of Diseases (ICD-10). It includes both physical nicotine dependence, as well as mental and behavioral components. The World Health Organization (WHO) highlights that nicotine dependence meets the criteria for a chronic, recurrent disease that requires systemic treatment and support. Nicotine dependence treatment should include medical intervention, pharmacotherapy and behavioral support – analogous to the treatment of other chronic diseases. Treatment of nicotine dependence is therefore a key element in the prevention of tobacco-induced diseases, including lung cancer.

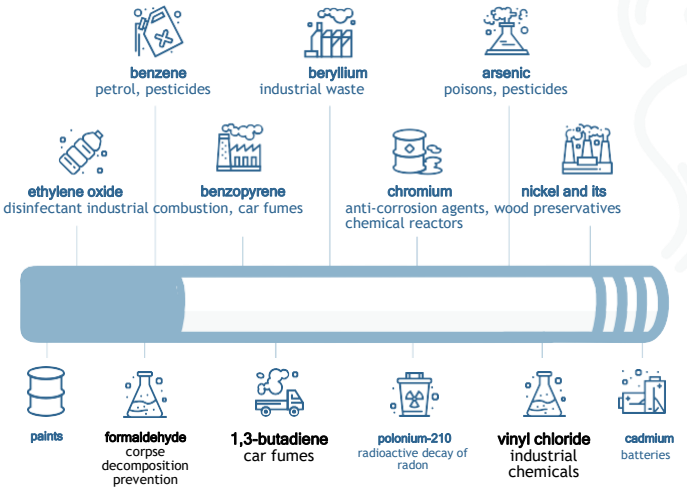
The total impact of tobacco smoking on population health and the economy is enormous – it includes not only an increase in morbidity and mortality from civilization diseases, but also reduced quality of life, increased sickness absenteeism and extremely high indirect costs due to loss of labor productivity. **Therefore, reducing tobacco and nicotine use and implementing effective dependence prevention and treatment strategies remains one of the most economically effective health measures** that can realistically improve the health of the population and reduce pressure on the healthcare system.

In 2022, the economic (direct and indirect) costs of tobacco smoking in Poland were estimated at **more than PLN 40 billion per year**, the vast majority of which are the costs of lost productivity and premature deaths [25].

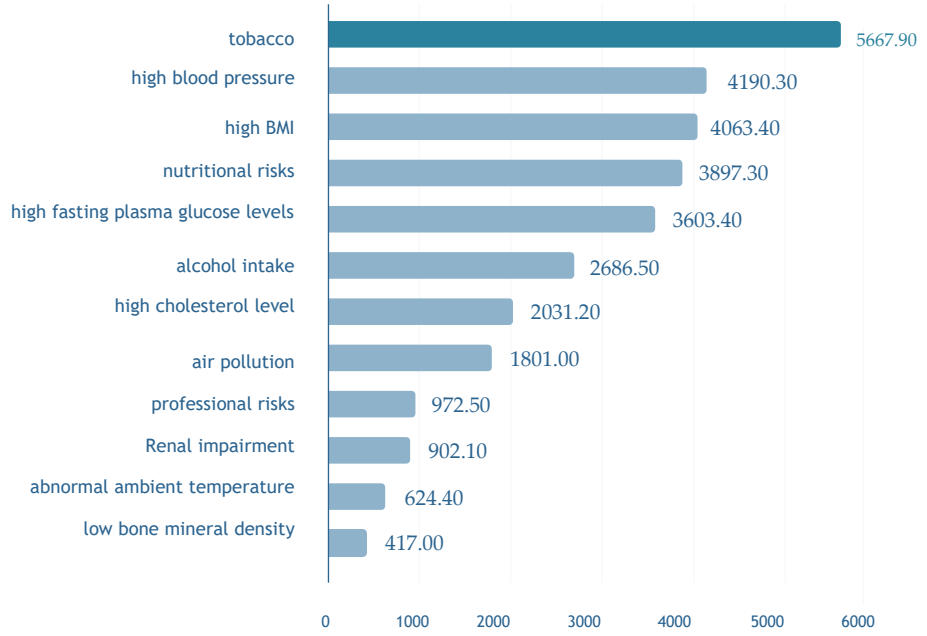
3.3. Alternative nicotine products – a serious public health threat

In recent years, the nicotine product market has undergone dynamic changes. **Electronic cigarettes, tobacco heaters and nicotine sachets**, often mistakenly perceived as "safer" alternatives to traditional cigarettes, are gaining popularity.

Selected toxic substances in tobacco smoke [26]



The greatest health risk factors in Poland [27]



The **WHO *Electronic Nicotine Delivery Systems: Evidence Update*** report of 2024 shows that these products still contain **nicotine with a strong addictive potential** and **toxic substances**, including formaldehyde, acrolein, heavy metals and ultrafine particles. Studies indicate that their **long-term use leads to respiratory epithelial damage, lung dysfunction and airway inflammation**, driving the risk of neoplastic, cardiovascular and respiratory diseases [28].

Alternative nicotine products are also not indifferent to **people diagnosed with lung cancer or other oncological diseases**. Research performed in the USA and South Korea [29, 30] has shown that oncology patients who continue to use e-cigarettes or heated products **have poorer treatment outcomes, are more likely to suffer from postoperative complications and have lower immunotherapy effectiveness**. The effects of nicotine on the tumor microenvironment and immune functions may limit the effectiveness of anti-cancer treatments.

Importantly, **nicotine initiation among young people** is more and more often observed through alternative products – especially flavored e-cigarettes. According to the ECDC (European Centre for Disease Prevention and Control), more than 20% of students in Poland between the ages of 15 and 17 admitted to having used e-cigarettes in the past month, which poses a real threat to public health and potentially reverses positive trends seen in smoking reduction.

3.4. Smoking and the stigmatization of lung cancer patients

In the public's view, lung cancer patients are often seen as responsible for their own cancer, due to its association with tobacco smoking [32]. Many cancers and other civilization diseases are the result of lifestyle and daily habits, but most often, lung cancer patients are blamed for their choices (cigarette smoking).

Many studies and compilations, both Polish and international, confirm the occurrence of patient stigmatization due to tobacco smoking and draw attention to its consequences.

Specifically, a study entitled *Multilevel Opportunities to Address Lung Cancer Stigma across the Cancer Control Continuum* [33] published in the *Journal of Thoracic Oncology* highlighted that in many countries, efforts to reduce the social acceptance of smoking have, admittedly, resulted in lower smoking rates (e.g., Finland, USA), but anti-nicotine campaigns have, in the long run, led to unintended "demonization" and stigmatization of patients.

With this in mind, physician-patient communication requires empathy and understanding of the fact that the patient is struggling with nicotine dependence. The negative emotions, depression and mental crisis that often follow a cancer diagnosis can be escalated by the critical attitude of others, which translates into a reduction in the patient's motivation and commitment to the treatment process for both the underlying disease and the nicotine dependence itself.

As part of the 2022 lung cancer patient opinion survey [34], the following findings were collected:

- In most patients who smoked cigarettes before their cancer diagnosis, smoking was of a compulsive nature (daily) – 87% of respondents. 26% of respondents declared that they continued smoking cigarettes after a lung cancer diagnosis. 38% of respondents smoked a pack or more of cigarettes, while approximately 59% smoked between a few and a dozen or so cigarettes per day.
- 34% of patients declared that they had been the subject of stigmatization by others, including most often by medical personnel (64%), friends and acquaintances (40%),
  as well as strangers (36%) and family (34%). Stigmatization and condemnation most involved: perception of the patient as the person responsible for the disease (67%), comments made by medical personnel regarding the impact of smoking on the disease (45%) and statements that a patient who smoked should pay for their treatment themself (21%).
- Half of the respondents had a feeling of guilt in relation to their illness. Patients indicated the following as the main causes behind their feeling of guilt: long time of tobacco smoking (63%), feeling that they could have taken better care of themselves (50%), as well as ignoring the symptoms, being blamed by others.
- Approximately 14% of patients indicated that stigmatization has affected their decisions related to diagnosis and treatment. Most commonly, respondents indicated procrastination in initiating diagnostics (56%), procrastination in initiating treatment (13%) and failure to initiate diagnosis and treatment (13%).
- Similarly, approximately 14% of patients indicated that the feeling of guilt affected their treatment decisions and, as a result, an overwhelming number of respondents delayed their decisions regarding treatment initiation (58%).

3.5. "Nicotine dependence treatment" guidelines – 2022 Polish Experts Group recommendations

A group of experts composed of:

- prof. dr hab. n. med. Małgorzata M. Bała,
- prof. dr hab. n. med. Piotr Jankowski,
- prof. dr hab. n. med. Jacek Jassem,
- mgr Magdalena Cedzyńska,
- dr hab. n. med. Łukasz Balwicki,
- dr n. med. Małgorzata Czajkowska-Malinowska,
- dr n. med. Agnieszka Jankowska-Zduńczyk,
- dr n. med. Dorota Lewandowska,
- dr hab. n. med. Filip Mejza,
- dr hab. n. med. Joanna Pazik,
- dr hab. n. med. Elżbieta Puścińska,
  dr n. med. Joanna Zając,
- mgr Jakub Szymański,
- mgr Dorota Korycińska

has developed guidelines for the treatment of nicotine dependence in July 2022 [35].

Among other things, the experts recommend:

- Recording information on the use of tobacco products in each patient's medical records, which is recommended to be updated upon each contact with the patient. Nicotine dependence is a disease, therefore the management after its diagnosis, as included in medical records, should be the same as for any other chronic disease.

- All healthcare professionals should provide counselling with respect to tobacco smoking cessation to all smokers, including pregnant women. Scientific data from Cochrane systematic reviews, which include studies conducted in diverse populations, indicate that counselling of any intensity concerning the subject of cessation of smoking, provided by a physician or nurse, was associated with a higher likelihood of smoking cessation when compared with no counselling or the usual care.
- Offering group counselling to all smokers except pregnant women.
- Offering telephone counselling to all smokers except pregnant women. Research data from a Cochrane systematic review indicate that additional proactive phone counselling (repeated contact) provided to people who contacted the helpline,
  compared to the control treatment (self-help materials, brief counselling), as well as proactive phone calls initiated to people who did not previously reach out to this helpline, on top of the self-help materials, minimal intervention, brief counselling, pharmacotherapy, financial incentives, compared to the same interventions other than telephone calls, increased the likelihood of smoking cessation within ≥6 months.
- Use of nicotine replacement therapy (NRT) in all smokers except pregnant women and use of NRT along with behavioral support in smoking pregnant women. A very important aspect of the use of NRT is the use of nicotine doses and administration route adequate to the strength of dependence and the number of cigarettes smoked.
- Use of bupropion or varenicline or cytisine in all smokers except pregnant women.
- Combining pharmacological treatment with behavioral support in all smokers.
- Regular training on nicotine dependence treatment for all healthcare professionals. The healthcare system should facilitate organizing and attending such training.
- For several years, certified training courses have been funded by the National Health Program and organized by the interdisciplinary team at the National Research Institute of Oncology in Warsaw.
- Reducing the cost of treating nicotine dependence for the patient – public funding for the cost of anti-tobacco interventions.

Although the recommendations have been published, they are yet to see large-scale practical implementation.

3.8. Systemic actions to reduce tobacco and nicotine use in Poland

Combating tobacco smoking is one of Poland's key public health priorities and an integral part of international commitments under ***the World Health Organization's Framework Convention on Tobacco Control*** **(WHO FCTC)**. However, despite the implementation of many legislative and educational measures, the effectiveness of national efforts to reduce tobacco use remains insufficient in relation to the scale of the problem.

Anti-tobacco policies and their effectiveness

Over the past two decades, Poland has introduced a series of regulations meant to reduce tobacco consumption and protect non-smokers. Key activities include:

- **Ban on advertising and promoting tobacco products** (in effect since 1999
- **Ban on smoking in public places** (2010, with further amendments),
- **Introduction of pictorial warnings on packaging** (2016),

- → **Approximation of regulations governing e-cigarettes and novelty products with those applicable to traditional cigarettes** (EU directive implementation – 2017),
- ☆ **Increasing excise duty** applied to tobacco and nicotine products.

While these measures led to a significant decline in the number of smokers in the first decade of the 21st century, the rate of this decline has slowed markedly in recent years. According to **Eurobarometer 2024**, the percentage of adult Poles who smoke cigarettes (daily or occasionally) is approximately **27%**, which is above the European Union average (23%).

An additional problem is the increased use of alternative products – especially e-cigarettes and nicotine sachets – among adolescents and young adults, which poses a new challenge for dependence prevention.

Support system for nicotine addicts – organizational barriers

Poland lacks a coherent **nicotine dependence treatment system** that would be funded by the Polish National Health Fund. According to a report by the National Institute of Public Health – National Institute of Hygiene (2024), there are only **three comprehensive tobacco dependence treatment outpatient clinics** in the country – in Warsaw, Gdansk and Zabrze – offering behavioral and pharmacological therapy conducted by an interdisciplinary team (physician, psychologist, nurse, dietician). Many voivodeships do not operate even a single facility of this type.

Moreover, **there is no separate pricing of healthcare services provided by the Polish National Health Fund** for nicotine dependence treatment, which results in these healthcare services not being commonly offered as part of primary health care or secondary outpatient care. In practice, patients can mostly rely on the **Smoking Helpline** (tel. 801 108 108) operated by the National Research Institute of Oncology or limited support as part of mental health outpatient clinics.

In 2024, as part of the National Oncology Strategy, the "Prevention of Tobacco-induced Diseases, including COPD" program was continued, but its scope does not include dependence therapies, only education and screening activities.

Despite growing public awareness and numerous educational activities, Poland is still below the WHO's recommended level of advancement in terms of a comprehensive anti-tobacco policy. The lack of systemic funding for nicotine dependence treatment and the inadequate number of specialized outpatient clinics represents one of the most serious gaps in the country's public health system.

Integrating anti-nicotine efforts into the broader context of **cancer and respiratory disease prevention** – including through LDCT programs and the *Lung Cancer Units* care model – should become an integral part of the country's health strategy. Only this way will it be possible to permanently reduce the number of smokers and contain the epidemic of tobacco-induced diseases, which cost Poland the lives of more than 70 thousand citizens and billions of PLN in economic losses every year.

3.6. Recommendations for organizational and systemic changes to reduce health consequences associated with smoking cigarettes

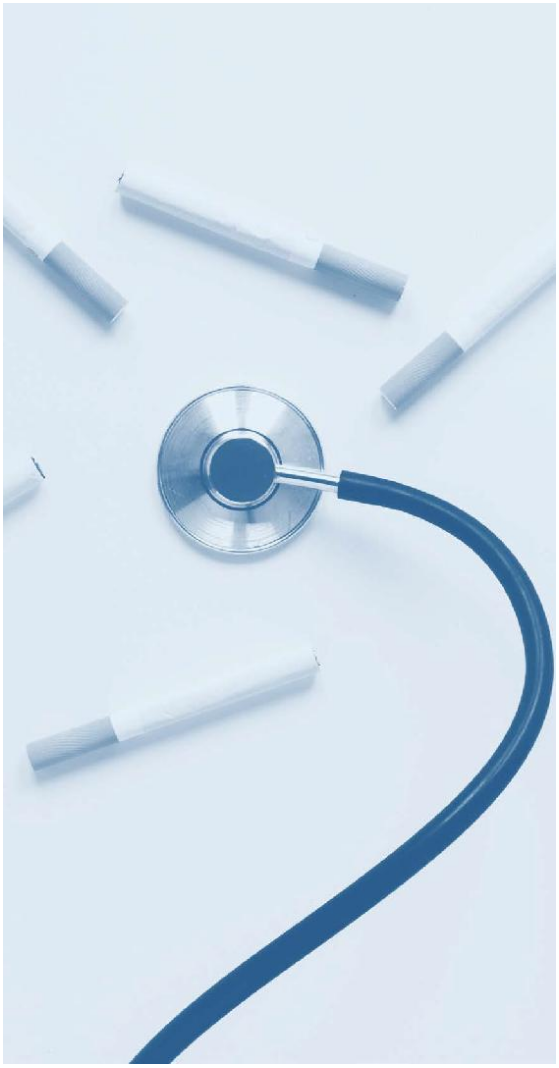
Tobacco smoking remains **the most important modifiable risk factor for lung cancer** and one of the main public health challenges in Poland. Reducing its incidence is key not only to reducing the number of new lung cancer cases, but also to improving treatment outcomes, reducing respiratory and cardiovascular morbidity, and lowering the socioeconomic costs of tobacco-induced diseases.

Despite legislative and educational advances in recent years, the **effectiveness of national preventive and therapeutic measures is still insufficient**.

The smoking rate remains above the EU average, and access to specialized smoking cessation assistance is drastically limited.

Therefore, **an integrated approach** is needed that would combine:

- primary prevention and social education,
- effective treatment of nicotine dependence as part of the guaranteed healthcare services system,
- legal and fiscal regulations limiting the availability of nicotine products,
- integration of anti-nicotine measures into the care provided to oncology and pulmonology patients.

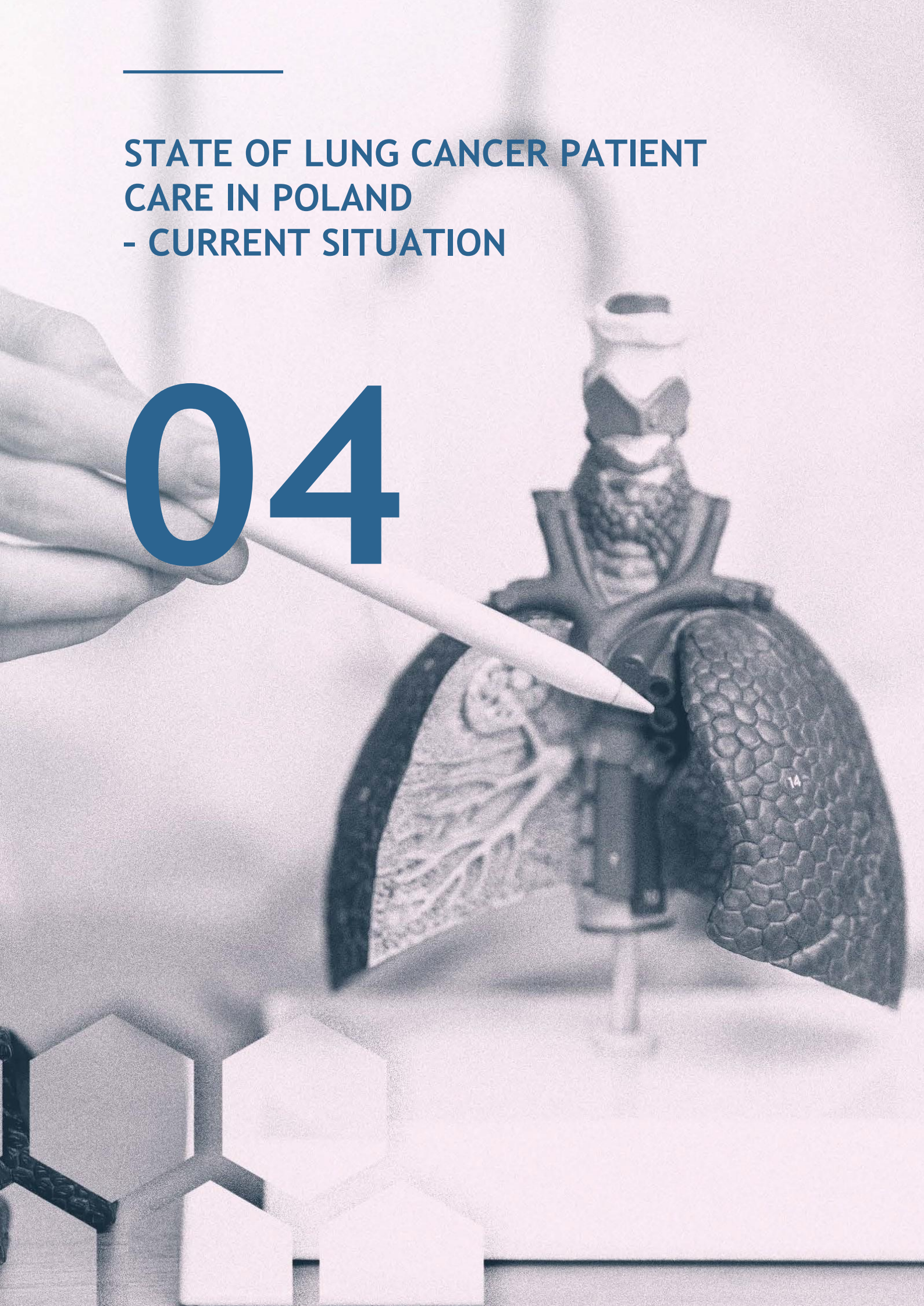


Directions for change:

- Increase the availability and effectiveness of nicotine dependence treatment programs, including reimbursement of pharmacological therapies and anti-nicotine counselling provided as part of primary healthcare. Ensure that all nicotine products, including e-cigarettes and heated products, are subject to regulations and advertising restrictions.
- Develop programs and policies that limit the attractiveness and availability of nicotine products (including alternatives).
- Ensure full implementation of low dose computed tomography (LDCT) screening for high-risk groups and its promotion among both men and women.
- Patients with oncological diseases should be actively supported in complete cessation of nicotine use (of any nicotine products).
- Develop coordinated care at the primary healthcare level, including expansion of the competences of primary healthcare facilities in brief anti-nicotine intervention and training of medical personnel.
- Increase funding for social campaigns and prevention programs, especially those targeting adolescents and women.
- Reinforce control and enforcement measures concerning the sales ban for nicotine products, including alternative products, to minors.
- Increase taxation on all forms of nicotine (including novelty products and e-cigarettes) and allocate of a portion of the revenues derived from excise duty to fund nicotine treatment programs.
- Incorporate nicotine dependence treatment into the standard of care for patients with respiratory and oncological diseases.

STATE OF LUNG CANCER PATIENT CARE IN POLAND - CURRENT SITUATION

04



4.1. Lung cancer patient care – current status

Lung cancer remains one of the most frequently diagnosed and deadliest cancers in Poland, posing a key challenge to the healthcare system. Every year, more than **21 thousand new cases of lung cancer** are diagnosed in our country, and the number of deaths remains at approximately **22 thousand per year**, accounting for nearly **one-fifth of all cancer deaths**.

In recent years, we have seen gradual improvements in the organization, financing and quality of care provided to lung cancer patients. Implemented system-wide reforms – such as the **National Oncology Strategy, the oncology bundle, the National Oncology Network** or the development of specialized organ units (including *Breast Cancer Units*) – have set a new organizational standard for oncological care in Poland. As part of these activities, work on a ***Lung Cancer Unit*** model, intended to enable comprehensive and coordinated care for lung cancer patients at specialized multidisciplinary centres, is entering its final stages. Particularly noteworthy is the fact that reimbursed access to innovative molecularly targeted and immunocompetent therapies is systematically expanding, both in early-stage and disseminated disease.

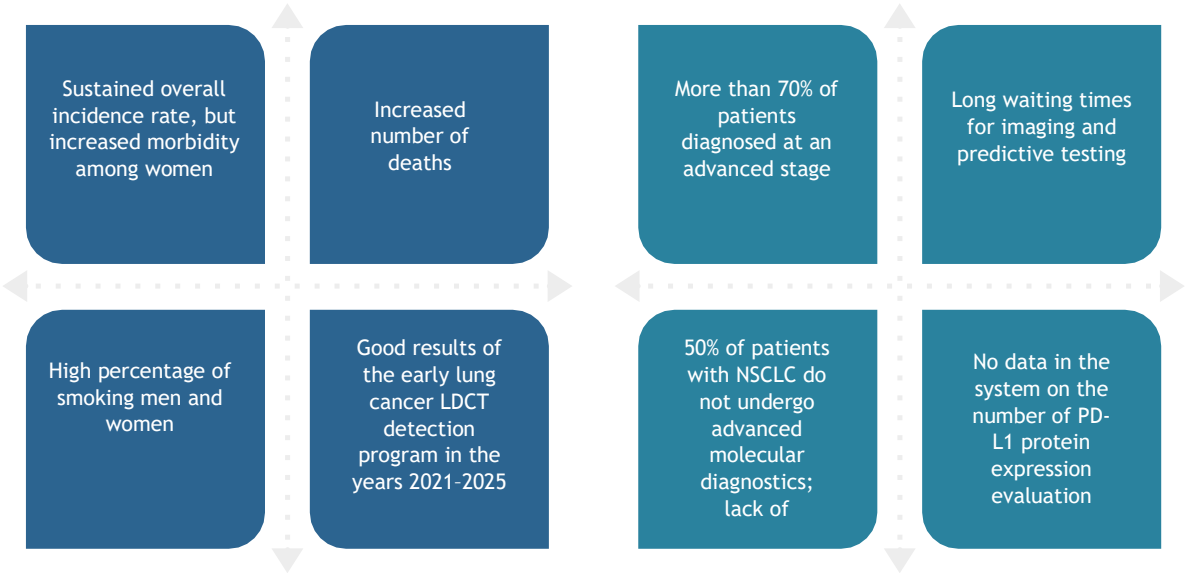
Prevention and preventive measures

For years, Poland has been implementing legislative and educational measures to reduce tobacco smoking – a major risk factor for lung cancer – which included introducing a ban on advertising tobacco products, a ban on smoking in public places and tobacco-induced diseases prevention programs as part of primary healthcare.

There is also a **Smoking Helpline** and local anti-nicotine initiatives. Despite these measures, **the percentage of adult smokers in Poland remains among the highest in the European Union**, which still generates a huge health and economic burden.

In the years 2021–2025, a **lung cancer screening with low-dose computed tomography (LDCT) program** co-funded by the EU was implemented in Poland. This program has enabled tens of thousands of at-risk individuals to be screened and has shown effectiveness in increasing detection rates in the early stages of the disease.

Work is currently underway to **include the program in the basket of guaranteed healthcare services** and ensure its **permanent financing from the budget of the Polish National Health Fund**. This is a step of strategic importance that can make a real difference in improving population survival in the coming years.



Diagnosis and patient pathway

Early diagnostics remains a key factor in improving lung cancer treatment outcomes, but in Poland more than **70% of cases** are still diagnosed at advanced stages (III-IV). In recent years, however, access to modern diagnostic methods – **computed tomography (LDCT, CT, PET-CT), endoscopic and pathomorphological examinations, as well as molecular (genetic) testing,** including next-generation sequencing (NGS) and immunohistochemistry assays *(PD-L1)* – has improved. Challenges continue to include **uneven regional access**, lack of comprehensive coordination of diagnostics and excessive results waiting times, as well as lack of reimbursement for comprehensive molecular testing and liquid biopsy. A positive change is the increase in the number of advanced molecular testing procedures performed in Poland.

Average time from material collection to molecular testing result:
17–21 days (ESMO target: ≤10 days)

Approximately 30–40% of patients still do not have a complete molecular profile prior to the treatment initiation.

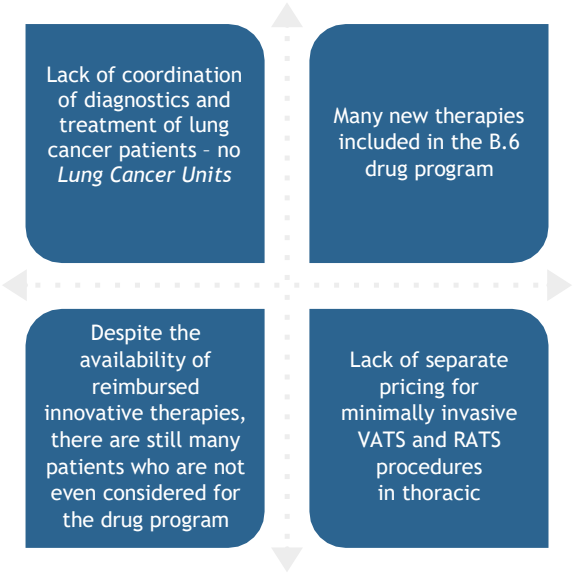
Treatment and access to new therapies

Between 2022 and 2025, access to lung cancer treatment in Poland has improved significantly. The B.6 drug program has been expanded several times to include **new immunotherapeutic molecules and targeted therapies**, including combination therapies, in line with current guidelines (ESMO, Polish Society of Clinical Oncology). Access to **perioperative treatment (neoadjuvant and adjuvant)** has also been increased, which is an important step toward a personalized therapeutic approach and achieving a higher percentage of complete cures and increasing radical treatment options.

Today, lung cancer treatment available in Poland covers a wide range of methods: surgery, radiation therapy, chemotherapy, chemoradiotherapy, immunotherapy, immunochemotherapy and molecularly targeted therapies.

More and more thoracic surgery centers are implementing **minimally invasive techniques (VATS, RATS)**, including robotic surgery, which benefits both patients and the system through shorter hospitalizations, fewer complications and faster return to activity. However, solutions are still needed for **reimbursement of robotic procedures and clarification of their pricing**.

Between 2022 and 2025, the B.6 drug program was updated 7 times, extending access to the newest therapies in line with clinical guidelines. There are still regional differences in practical access to modern drugs.



Organization of care and system challenges

Despite significant progress, lung cancer patient care in Poland still needs further improvement. Outstanding challenges include:

- lack of comprehensive *Lung Cancer Units*,
- insufficient coordination between care levels (primary healthcare - secondary outpatient care - hospital),
- regional differences in access to diagnostics and treatment,
- excessively long waiting times for diagnostic test/examination results and treatment inclusion,

- → failure to perform full predictive diagnostics (molecular testing, immunohistochemistry assays) justified by histopathological examination results,
- → lack of reimbursement for some of the necessary services, i.e. comprehensive genomic profiling or molecular testing using liquid biopsy.

In parallel with improving the availability of therapies, it is necessary to increase investment in respiratory rehabilitation, psycho-oncological support and nutritional care – areas that are still underfunded, despite their crucial importance to the patients' quality of life and treatment effectiveness.

In recent years, Poland has made measurable progress in the organization of lung cancer care – especially in terms of access to modern therapies and molecular diagnostics. However, it still requires systematic efforts focused on ensuring early detection, equalization of regional access and implementation of an integrated model of comprehensive care as part of ***Lung Cancer Units***. Only this approach will bring treatment outcomes for Polish patients closer to the European average and improve long-term survival rates.

4.2. Epidemiology and forecasts

Compared to other European Union countries, **Poland records a moderate level of cancer morbidity** – below the EU average of **571.5 cases per 100 thousand people**.

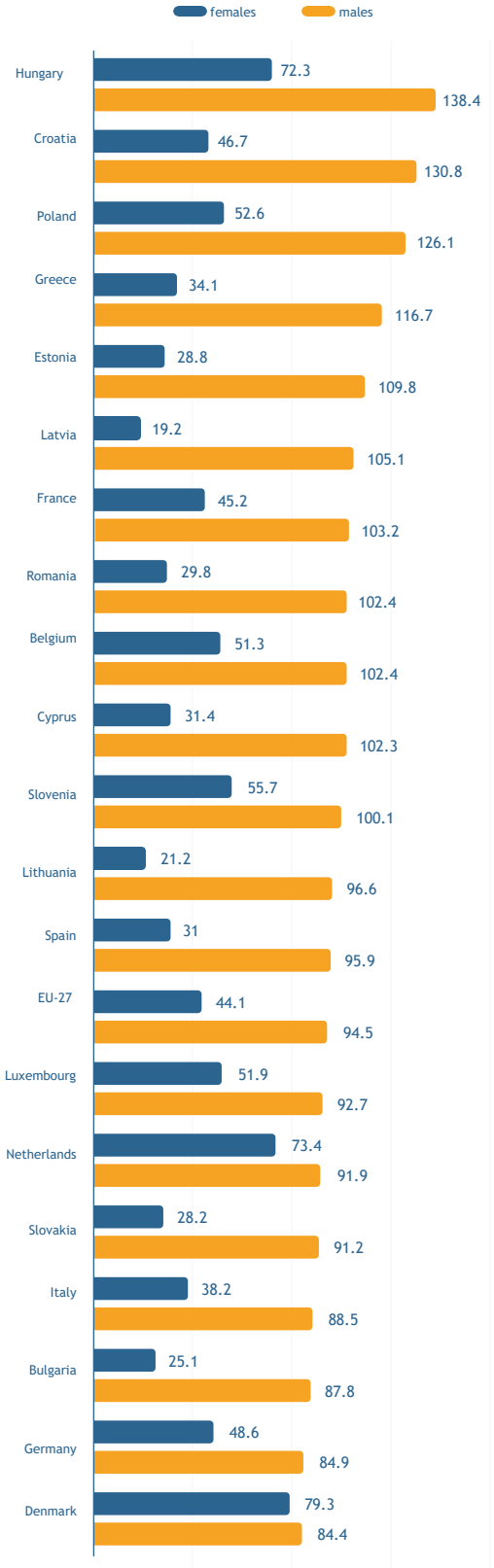
However, the situation is far worse in terms of **mortality from neoplastic diseases**. According to the ***European Cancer Information System (ECIS)*** data for 2022, **Poland had the highest cancer death rate in the entire European Union – 330.5 per 100 thousand people**, while the **average for the EU countries was 264.3 per 100 thousand** [36].

Between **2012 and 2022**, the number of **new cancer cases** worldwide rose from approximately 14.1 million to approximately **20.0 million** (an increase of approximately **42%**), and the number of **deaths** rose from approximately 8.2 million to **9.7 million** (an increase of approximately 18%) [37]. According to projections by the *International Agency for Research on Cancer (IARC)*, **the number of new cases in Europe will increase by more than 20% by 2045, while the number of deaths could rise by approximately 32%** (assuming no additional improvement factors in terms of prevention and treatment) [38].

Poland has seen a significant increase in both cancer incidence and death rates over the decades (a trend resulting from, among other things, an aging population and changes in exposure to risk factors). According to the Polish National Cancer Registry (NCR), more than **1.2 million people** in Poland have a neoplastic disease. More than **192 thousand new cases** of cancer were reported **in 2023**.

Since the mid-1960s, the number of cancer cases and deaths in the Polish population has increased approximately 2.5-fold.

Lung cancer incidence rate (per 100,000 inhabitants) in Europe in 2022 by sex and country [39]



Types and histological subtypes of lung cancer:

- **non-small cell cancer (NSCLC)**
  - accounts for approximately 85% of cases:
  - → ***adenocarcinoma*** - approx. 45%.
  - → ***squamous cell carcinoma*** - approx. 30%.
  - → ***large cell carcinoma*** - approx. 5%.
  - → **unspecified cancer** (*NOS*) - approx. 5%.
- **small cell cancer (SCLC)** - approx. 15% of cases, biologically and clinically distinct (more aggressive, metastasizing more quickly).

Lung cancer accounts for 1/6 of cases among men, while among women, breast cancer with good prognosis is dominant (1/5 of cases). Factors contributing to the increased incidence rate primarily include the society aging process, tobacco smoking and air pollution. **Since 2000, the number of newly diagnosed lung cancer cases in men has decreased by 22%, while in women it has increased by 95%.** Unfortunately, this is reflected in mortality, where lung cancer accounts for more deaths among women than breast cancer. However, lung cancers among men still accounts for approximately 60% of cases in terms of both morbidity and mortality.

Lung cancer is the leading cause of deaths from neoplastic diseases in Poland: **in 2023, 22,155 people died** from it, and **21,045 heard the diagnosis.** It accounts for 11% of all new cases and as much as 22% of cancer-related deaths in the country [40].

The small difference between the number of cases and deaths is due to the late diagnosis of cancer and reporting the actual metastasis site instead of the primary cancer as the cause of death on a death certificate.

In 2023, there were **192,922 new cases** of cancer in Poland. Compared to the previous year, an increase of approximately 6% in the overall number of malignant neoplasm cases was recorded (over the years, the increase has remained at approximately 2% per year).

Meanwhile, the number of new cases of **malignant neoplasm of bronchus and lung (C34)** diagnoses **in 2023 was 21,045** (an increase of 1.5% compared to 2022), **including 12,254 among men and 8,791 among women** (an increase of 4.1% compared to 2022). Diagnosis of mesothelioma of pleura, C45, was noted in 315 cases (an increase of 13% compared to the previous year), and diagnosis of malignant neoplasm of other and ill-defined sites in the respiratory system and intrathoracic organs, C39, was noted in 21 cases.

Number of patients diagnosed with C34 in 2024 by age [41]

Age group	Number of cases
0-4	0
5-9	1
10-14	2
15-19	2
20-24	4
25-29	11
30-34	26
35-39	44
40-44	101
45-49	249
50-54	531
55-59	1249
60-64	2852
65-69	4971
70-74	5462
75-79	3303
80-84	1390
85 and more	847

The number of deaths in 2023 amounted to **22,155** for lung and bronchial cancers (an increase of 5.7% compared to 2022), including **13,553 deaths among men and 8,602 among women** (an increase of 8.6%). In the case of mesothelioma of pleura, the number of deaths was 305, and for malignant neoplasm of other and ill-defined sites in the respiratory system and intrathoracic organs it was 167.

It should be noted that approximately **22% of lung cancer deaths occur before the age of 65**, i.e. in the productive age. Premature deaths in the professionally active population lead to significant economic and social costs, including the loss of working years and increased healthcare and nursing expenses.

Lung cancer remains the leading cause of cancer **deaths** among both men and women. Lung cancer (C34) **incidence rate** dynamics are growing more slowly than for all cancers combined, but **death dynamics** are significantly higher (especially in women), sustaining the **unfavorable survival gap**.

Number of patients diagnosed with C34 in 2024 by voivodship [42]

Region	Number of cases
Dolnośląskie	1747
Kujawsko-Pomorskie	1612
Lubelskie	1250
Lubuskie	470
Łódzkie	1592
Małopolskie	1210
Mazowieckie	2902
Opolskie	448
Podkarpackie	843
Podlaskie	510
Pomorskie	1411
Śląskie	2367
Świętokrzyskie	846
Warmińsko-Mazurskie	1090
Wielkopolskie	1798
Zachodniopomorskie	949

According to ECIS *(European Cancer information System)*, **Poland has one of the highest incidence rates of tracheal, bronchial and lung cancers among all EU countries** in 2022 [43]. The average incidence rate for tracheal, bronchial and lung cancer in EU countries was 66.1/100,000 people, while in Poland the rate was 24% higher - 82.1/100,000. **Poland also had the second highest death rate caused by tracheal, bronchial and lung cancer among all EU countries - 70.5/100,000 people (EU average: 52/100,000).**

The data confirms that, compared to the European Union average, **higher mortality from lung cancer** is maintained in Poland despite improved access to modern therapies (extensive drug program, immunotherapy, targeted therapies, perioperative treatment). This points to **organizational deficiencies**: excessively delayed diagnosis, unequal access to imaging and predictive diagnostics, as well as shortcomings in care coordination.

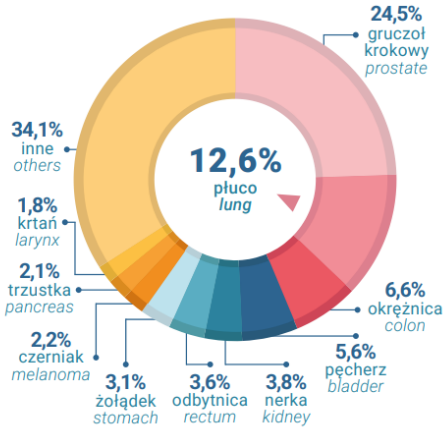
Current epidemiological data is all the more alarming, as the incidence of lung cancer can be significantly reduced by modifying just one risk factor - tobacco smoking - that is, through an effective anti-tobacco policy. On the other hand, systemic changes are consistently needed to improve survival rates: an increase in early diagnoses, improvements in the diagnostic process and organization of care, as well as further improvements in access to comprehensive diagnostics and innovative therapies.

Structure of primary diagnoses of C34, lung cancer [45]

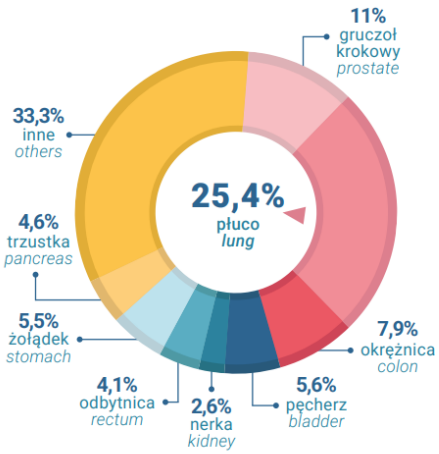
Local stage	± 20%
Regional stage	± 35%
Generalized stage	± 45%

Structure of cases and deaths among men in 2023 [44]

Structure of cases among men

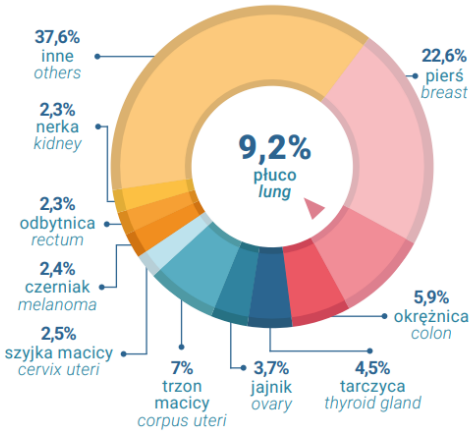


Structure of deaths among men

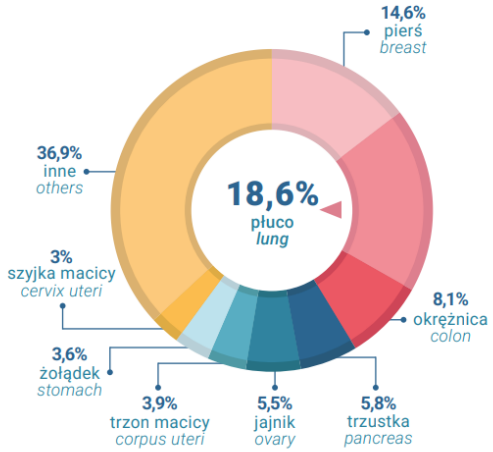


Structure of cases and deaths among women in 2023 [43]

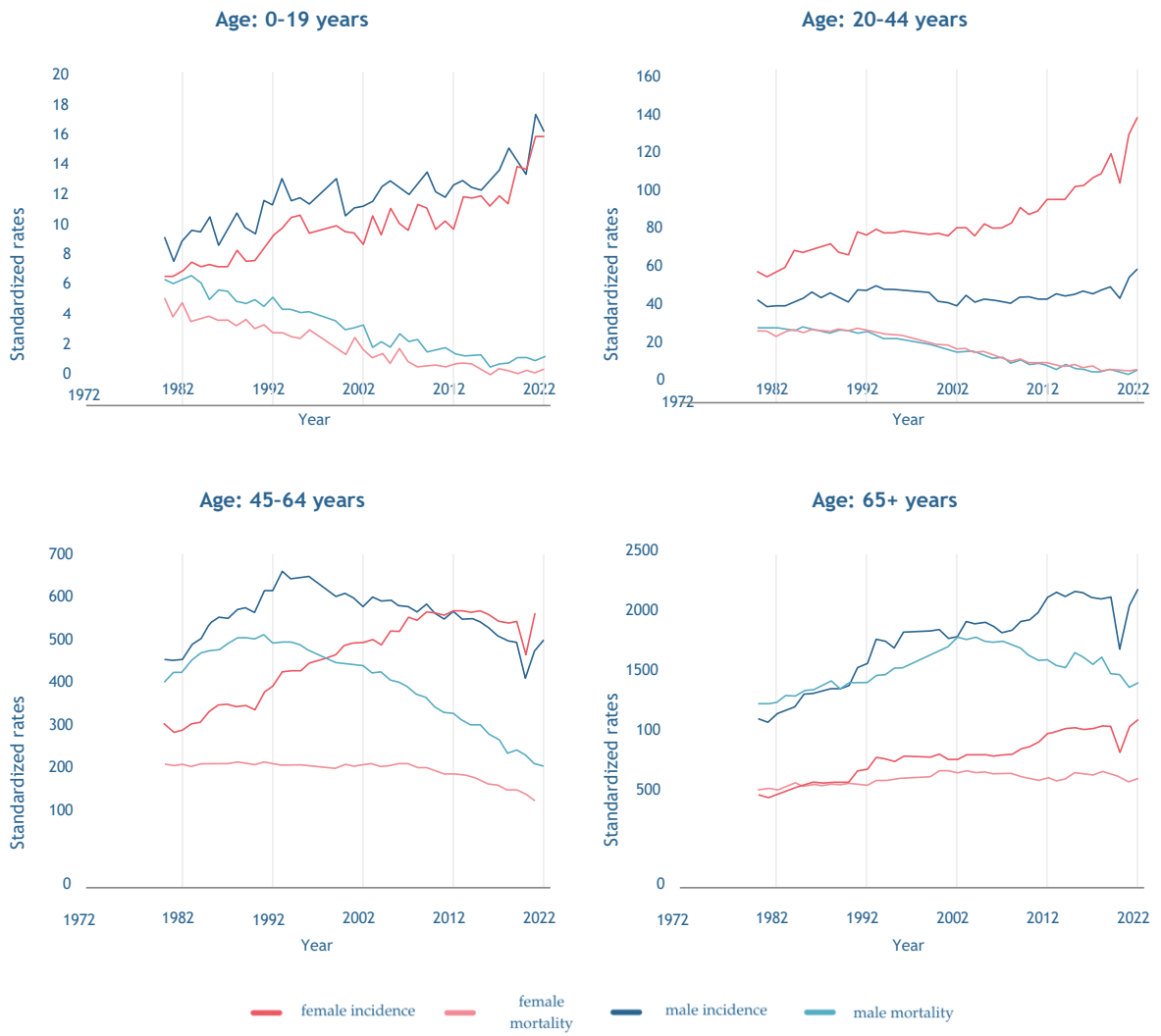
Structure of cases among women



Structure of deaths among women



Trends in overall morbidity and mortality from malignant neoplasms in Poland between 1980 and 2022 by sex and age groups [46]



According to data from the *Global Burden of Disease* study [47], the most important risk factors leading to deaths from malignant lung neoplasms in Poland were:

- **tobacco smoking (60 deaths from tobacco smoking-induced lung cancer per 100 thousand population),**
- particulate matter in the air (12 deaths per 100 thousand population),
- residential asbestos exposure (9 deaths per 100 thousand population),
- high fasting blood glucose level (8 deaths per 100 thousand population),
- passive smoking (4 deaths per 100 thousand population), consuming small amounts of fruit (4 deaths per 100 thousand population), radon (3 deaths per 100 thousand population),
- silica (2 deaths per 100 thousand population), indoor air pollution (1 death per 100 thousand population),

The greatest risk factor is tobacco (cigarette) smoking, and its impact is greater than all other risk factors combined.

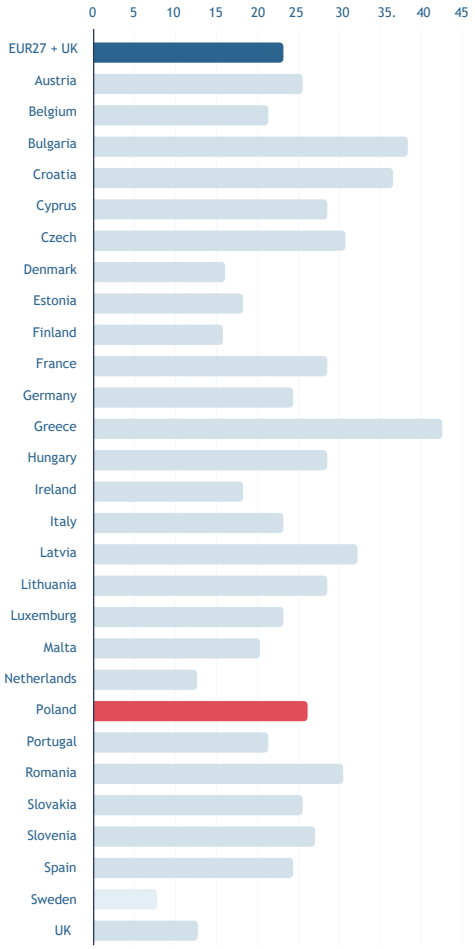
In Poland, tobacco smoking is widespread with **approximately 8 million adults smoking**, which significantly affects the citizens' quality and length of life. **Regular (daily) tobacco smoking is declared by 30.8% of Polish men and 27.1% of women**. Poles start smoking early, smoke heavily (men – 20 cigarettes per day, women – 15) and for a long period of time (20 years on average). The following populations are especially eager to reach for cigarettes: low-educated, originating from poorer social strata, unemployed, as well as housewives. These groups most often bear the health-related and socioeconomic costs of smoking and require specialized, reimbursed treatment for tobacco dependence and tobacco-induced diseases.

According to the analysis presented, a **positive correlation between the number of smokers and lung cancer morbidity is found in the following 13 voivodeships**: Dolnośląskie, Kujawsko-Pomorskie, Lubelskie, Lubuskie, Łódzkie, Małopolskie, Mazowieckie, Podkarpackie, Podlaskie, Śląskie, Warmińsko-Mazurskie, Wielkopolskie and Zachodniopomorskie). A negative correlation is observed in 3 voivodeships: Opolskie, Pomorskie, Świętokrzyskie.

Correlation between the percentage of smokers and lung cancer morbidity by voivodeship [49]

Voivodeship	Percentage of smokers	Standardized incidence rate per 100 thousand population
dolnośląskie	10,87	53
kujawsko-pomorskie	11,26	73
lubelskie	10,13	53
lubuskie	11,93	68
łódzkie	10,88	61
małopolskie	9,41	50
mazowieckie	10,66	56
opolskie	11,86	43
podkarpackie	8,52	48
podlaskie	9,71	47
pomorskie	10,10	68
śląskie	10,65	52
świętokrzyskie	9,55	57
warmińsko-mazurskie	10,77	68
wielkopolskie	10,55	57
zachodniopomorskie		

Percentage of smokers in European countries [48]



4.3. Survival rates

Data from the *European Cancer Inequalities Registry* [50] indicate that the situation of oncology patients in Poland is worse than the European average: mortality from neoplastic diseases is 15% higher and improves slower than the average for EU countries, risk factors are at a higher level, and screening programs are less popular.

Survival rates in patients with lung cancer remain low compared to most other cancer types.

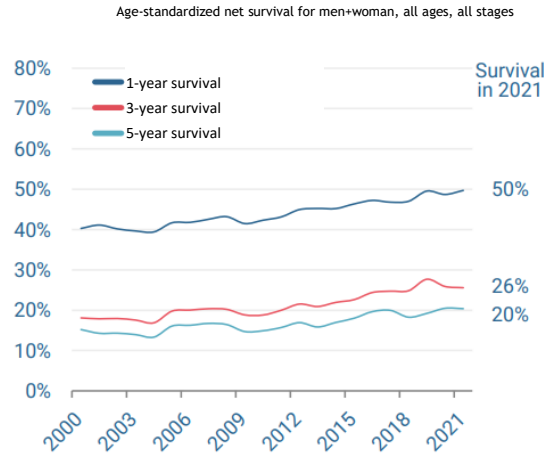
The results of the CONCORD-3 study [51] showed that the survival rate in Poland (in the analyzed period between 2010 and 2014) was slightly lower than the EU average – 14% compared to 15% [52].

According to data from the National Cancer Registry, the 5-year age-standardized net survival rate for lung cancer patients reached 20% in 2021 compared to 15% in 2000. 1-year survival rate recorded a slight improvement from 40% in 2000 to 50% in 2021.

5-year survival rates in lung cancer patients [53]

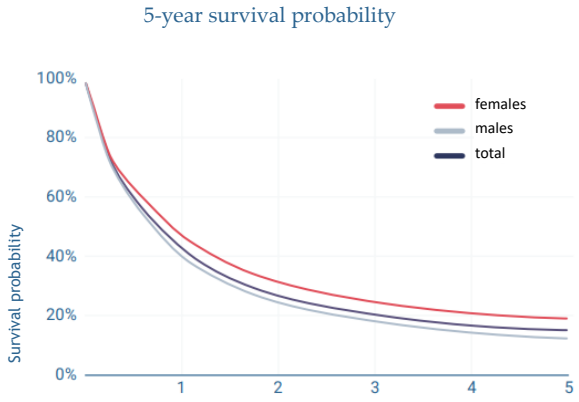
Range of years	Sex	Relative	Observed	Standardized
2000-2005	Both	14.10	11.80	14.10
2005-2010	Both	15.90	13.50	15.90
2010-2015	Both	15.80	13.80	15.80

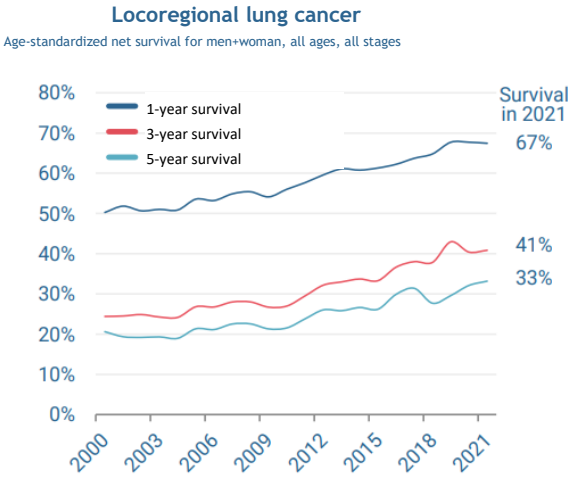
1-, 2- and 5-year survival rates in lung cancer patients in Poland in between 2000 and 2021 [56]



Source: Didkowska et al. (2024) with data from the National Cancer Registry

5-year survival probability among men and women diagnosed with lung cancer [54]

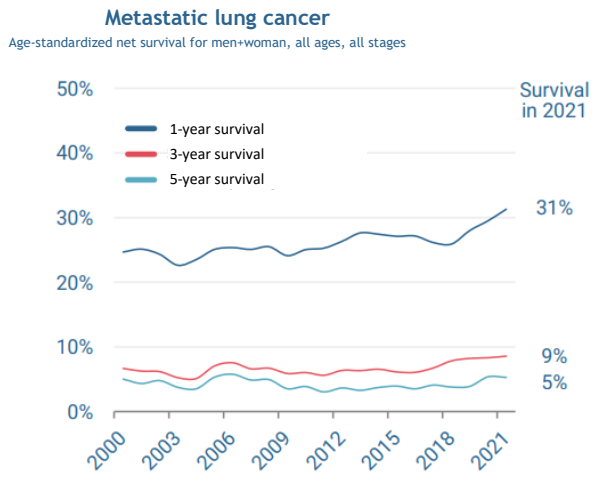




Source: Didkowska et al. (2024) with data from the National Cancer Registry

Survival rates vary depending on the stage of lung cancer at the time of diagnosis. Data from the National Cancer Registry shows that 1-year and 5-year survival rates in lung cancer are highest if the tumor is diagnosed early, at the locoregional stage

- 67% and 33%, respectively (in 2021), and the lowest if the diagnosis is established at the metastatic stage;
- 31% and 5%, respectively (in 2021). In the case of lung cancer of unknown stage at the time of diagnosis, the 1-year survival rate was 46% and the 5-year survival rate was 21% in 2021 [55].



Source: Didkowska et al. (2024) with data from the National Cancer Registry

The 1-, 2- and 5-year survival rates in lung cancer patients in Poland indicate **limited but noticeable improvements in treatment outcomes over the past two decades** – mainly in the short-term survival. This progress results from the development of diagnostics, as well as access to targeted therapies and immunotherapies after 2018, but **the lack of systemic changes in the organization of the patient pathway and delaying diagnosis excessively** limit the long-term effects.

It is noteworthy that from 2021 the situation in terms of lung cancer treatment has changed significantly. In recent years, we have seen a **real therapeutic breakthrough,** with many modern therapies introduced into clinical practice, including **perioperative treatment with immunotherapy and targeted therapy, consolidation therapies** in patients with locally advanced lung cancer, and **further lines of systemic treatment** in patients with disease progression. Therapeutic regimens enabling the **achievement of sustained remission and even complete cure** in some patients have also emerged.

Survival data for subsequent years can therefore be expected to gradually improve. Nevertheless, the effects of this progress are not yet fully visible in Poland – mainly due to **too late diagnosis of the disease, delays in molecular diagnostics and organization of the patient pathway,** as well as **insufficient coordination between centers.** Still too many patients are not being considered for drug programs, despite the fact that they meet the clinical criteria and could benefit from the program. These factors significantly limit the potential impact of modern therapies on improving survival rates in the lung cancer patient population in Poland.

4.4. Basic data on healthcare for lung cancer patients

4.4.1. Healthcare services

According to data form the Polish National Health Fund, the **number of patients receiving healthcare services related to the diagnosis of malignant neoplasm of bronchus and lung (C34) in 2024** was **79,368**, while in the period between January and August 2025 – as many as 69,180. The number of healthcare services provided in this group of patients was **838,639** in **2024** and 582,218 in the period between January and August 2025,
respectively.

Healthcare services provided to patients with C34 diagnosis (number of patients, number of services, value of services) between 2015 and 2025 [58]

Year	Number of patients	Number of healthcare services	Value of reported healthcare services
2015	73,918	570,905	613,300,857.19
2016	74,091	587,353	624,787,267.61
2017	74,093	580,828	669,373,867.87
2018	74,103	572,542	765,799,540.49
2019	74,779	617,926	965,444,338.14
2020	70,333	638,310	991,613,761.12
2021	70,555	675,176	1,173,607,928.70
2022	72,938	709,591	1,633,678,887.83
2023	76,529	777,114	2,191,169,110.82
2024	**79,368**	**838,639**	**2,678,723,317.50**
Jan-Aug 2025	69,180	582,218	1,681,078,070.77

In 2024, the highest number of patients diagnosed with malignant neoplasm of lung received healthcare services in the Mazowieckie voivodeship (13,083) and the Silesian (9,710) and Wielkopolskie voivodeships (7,664), while the lowest in southeastern Poland, which coincides with the incidence data. The distribution of healthcare services provided to patients in the period between January and August 2025 is similar.

Healthcare services provided to patients with C34 diagnosis (number of patients, healthcare services, value of healthcare services) in 2024 and in the period between January and August 2025 by voivodeship [59]

Year	Voivodeship	Number of patients	Number of healthcare services	Value of services
Jan-Aug 2025	Wielkopolskie	6,568	52,556	125,237,466.10
Jan-Aug 2025	Dolnośląskie	6,016	46,333	128,614,750.94
Jan-Aug 2025	Śląskie	8,516	70,664	202,260,422.33
Jan-Aug 2025	Lubelskie	3,517	31,792	103,395,300.44
Jan-Aug 2025	Lubuskie	1,901	12,708	40,496,093.82
Jan-Aug 2025	Kujawsko-Pomorskie	4,993	48,353	104,163,409.14
Jan-Aug 2025	Podkarpackie	3,042	25,053	80,590,494.70
Jan-Aug 2025	Warmińsko-Mazurskie	3,268	25,254	69,720,738.57
Jan-Aug 2025	Małopolskie	5,393	33,818	118,128,339.98
Jan-Aug 2025	Zachodniopomorskie	3,359	26,318	59,863,150.09
Jan-Aug 2025	Świętokrzyskie	2,408	20,646	60,056,086.24
Jan-Aug 2025	Podlaskie	1,721	12,888	43,023,582.38
Jan-Aug 2025	Opolskie	1,202	6,493	27,147,023.10
Jan-Aug 2025	Łódzkie	5,255	37,175	140,961,655.90
Jan-Aug 2025	Mazowieckie	11,180	92,112	274,761,466.39
Jan-Aug 2025	Pomorskie	5,938	40,055	102,658,090.64

Analysis of the data in terms of the number of patients treated, the number of healthcare services provided and their value over the period between 2015 and 2025 shows that while the number of patients has not changed significantly, the **number of healthcare services and the expenditures on treatment have increased dramatically**. In 2015, the value of all healthcare services provided to patients with C34 diagnosis amounted to **PLN 613 million**, and just four years later – **PLN 965 million;** currently, it exceeds **PLN 2.5 billion**. That's an increase **of more than 300%** compared to 2015, demonstrating the rising cost of oncological care – the result of both reimbursement of innovative therapies (including drugs in the B.6 program) and increased access to imaging and predictive diagnostics.

In the last 2 years, between 2022 and 2024, the number of women treated for lung cancer increased **by more than 13%** (from 31.7 thousand to 35.8 thousand), while for men the increase was approximately 6% (from 41.2 thousand to 43.6 thousand). This means that the sex gap in terms of morbidity is steadily shrinking, which is in line with the trend of increasing incidence rate among women observed in Poland and Europe.

Healthcare services provided to patients with C34 diagnosis (number of patients, number of services, value of services) between 2015 and 2025 [60]

Year	Sex	Number of patients	Number of healthcare services	Reimbursement value
2022	F	31,709	308,998	707,052,306.02
2022	M	41,229	400,593	926,626,581.81
2023	F	33,796	344,777	957,552,771.24
2023	M	42,720	432,324	1,233,616,339.58
2024	F	35,773	379,410	1,195,227,238.99
2024	M	43,581	459,215	1,483,496,078.51
Jan-Aug 2025	F	32,035	266,959	759,048,266.84
Jan-Aug 2025	M	37,145	315,259	922,029,803.93

Increasing treatment intensity is observed in both groups – the number of healthcare services has increased by **approximately 23% in women and approximately 15% in men** between 2022 and 2024, which may indicate greater availability or more frequent use of health services (diagnostics, treatment, follow-up).

The increase in the value of reimbursed healthcare services is also dynamic:

- → in women – from **PLN 707 million** (2022) to **PLN 1.195 billion** (2024), i.e. **+69%**,
- → in men – from **PLN 926 million** to **PLN 1.483 billion**, i.e. **+60%**.

Data confirms the **continuously increasing incidence rate and associated increasing cost of lung cancer treatment in Poland**, especially among women. Despite improvements in the availability of therapies and diagnostics, the growing number of patients and value of reimbursements indicate a **growing burden on the healthcare system** and the need for more effective primary prevention – especially reduction of tobacco smoking.

The largest share in the healthcare service structure is taken up by **hospital treatment**, which was provided to **45,572 patients**, accounting for approximately **78%** of all people receiving healthcare services from the Polish National Health Fund related to a diagnosis of lung cancer in 2024.

In 2024, there were **258,698 hospitalizations with a total value of PLN 2.37 billion**, accounting for **more than 90% of the total cost of care** in this group of patients. This confirms that the care system for lung cancer patients in Poland remains hospital-centric, with relatively small share of outpatient, rehabilitation or home care. Such a high value of hospital healthcare services also indicates the **large share of systemic therapies** (immunotherapy, targeted treatment) financed through hospitalization and drug programs in the hospital setting.

Primary care covered **34,335 patients** diagnosed with lung cancer, accounting for almost **50% of all patients** who received NHF services for this indication in 2024.

Types of healthcare services provided to lung cancer patients in 2024 [61]

Service name	Number of patients	Number of healthcare services	Value of services
Primary care	34,335	92,478	n/a
Secondary outpatient care	58,286	244,569	65,949,295.84
Hospital treatment	45,572	258,698	2,366,090,365.65
Therapeutic rehabilitation	377	5,517	545,095.17
Dental treatment	<5	<5	141.00
Separately contracted health services	8,739	9,942	46,434,251.42
Nursing and caregiving services	48	685	547,409.70
Palliative and hospice care	15,810	219,881	189,806,813.99
Emergency medicine	3,637	4,348	n/a
Emergency care and sanitary transport	196	200	n/a
Pilot programs	31,453	80,315	9,212,516.46

92,478 healthcare services were provided (an average of approximately 2.7 per patient). Where no financial value is reported ("n/a"), this results from the **fixed (capitation-based) financing of primary healthcare**, which does not assign costs to individual services and makes comparisons with secondary outpatient care or hospitalizations difficult. The role of the primary healthcare in the lung cancer patient pathway is crucial but **underutilized** today. The primary healthcare setting is where patients with the first symptoms (chronic cough, hemoptysis, shortness of breath, weight loss) most often appear, and it is there that **early identification of symptoms**, prompt referral for imaging diagnostics (chest X-ray/CT) and – if cancer is suspected – **issuance of a DILO card** and urgent referral to secondary outpatient care/oncological diagnostics should take place. Primary healthcare also has a natural competence for **anti-nicotine counselling**, follow-up of comorbidities (COPD, cardiovascular diseases, diabetes), monitoring of adverse effects of treatment, vaccinations (against influenza, pneumococci, COVID-19) and **post-hospitalization care** (continuation of prescriptions, medical certificates, coordination of follow-up visits).

In light of the current data – with a very high proportion and cost of hospital treatment – **reinforcing the role of primary healthcare** (standardization of management pathways, fast X-ray/LDCT tracks for high-risk individuals, systemic support for brief anti-nicotine interventions) can **shift diagnoses to earlier stages**, reduce unnecessary hospitalizations and improve continuity of care. It should be noted that the real volume of oncological contacts as part of primary healthcare may be **underestimated** – in practice, family physicians often code symptoms (R- codes) instead of C34 diagnoses, which does not fully reflect the real extent of primary healthcare engagement in care over this population.

Secondary outpatient care (SOC) was extended **58,286 patients** and **244,569 services** – almost as many as hospitalizations – but the **value of services amounted to only PLN 65.9 million, i.e. approximately 2.5% of the total cost of care.** This indicates, among other things, **low pricing of secondary outpatient care services** and underutilization of this form of care in the process of coordinating diagnostics, follow-up and monitoring of treatment.

In practice, this means that many patients end up at the hospital instead of being managed in an outpatient setting – this burdens the system and generates higher costs.

Palliative and hospice care benefited **15,810 patients**, who received **219,881 services** worth **PLN 189.8 million**. This represents **the second most valuable category of services after hospital treatment**. The data supports the fact that **a significant percentage of lung cancer patients still end up in the system at an advanced stage of the disease**. The increase in expenditures in this area (compared to previous years) should be viewed positively, but at the same time it indicates the **need to shift the focus toward earlier diagnostics and causal treatment**.

In 2024, **31,453 patients** received healthcare services as part of **pilot programs** (including the early lung cancer LDCT detection program). The number of **80,315 services and the value of PLN 9.2 million** indicate a relatively small financial scale, but high systemic importance. – it is this area of healthcare that can contribute to **shifting lung cancer diagnoses to earlier stages of the disease development**.

The increase in the value of **separately contracted services** from PLN 17.6 million in 2015 to more than **PLN 46 million in 2024** reflects, among other things, the development of **molecular testing, immunohistochemistry assays and diagnostic procedures** for lung cancer. A 70% increase in the number of services in a decade shows **the increasing emphasis on predictive diagnostics**.

Therapeutic rehabilitation covered **less than 400 patients per year**, and nursing services covered **less than 100 patients**. Reimbursement values in these categories are symbolic (less than PLN 1 million per year), confirming the **lack of systemic approach to rehabilitation and supportive care** in lung cancer. There is an apparent **gap in supportive care** and a lack of continuity after hospital treatment completion. There is still no reimbursement for the important element of proper preparation of patients for thoracic surgeries, which is prehabilitation.

Number of healthcare services provided to lung cancer patients in 2024 by healthcare service category

- drug program (healthcare services) – 20%
- drug program (medications) – 19%
- chemotherapy (medications) – 18%
- chemotherapy (healthcare services) – 16%
- conservative procedures – 6%
- interventional procedures (e.g. surgical treatment, bronchoscopy) – 4%
- external beam radiation therapy – 3%
- healthcare services related to radiation therapy – 4%
- other – approx. 10%.

In 2024, **conservative and systemic hospitalizations** (chemotherapy, elective treatment) **were dominant**, confirming the **hospital-centric nature of oncological care** in Poland. **The relatively low number of patients who underwent surgery (16.5 thousand)** indicates that only a small percentage of the disease cases is diagnosed at the early/locoregional stage. **Radiation therapy (approximately 11 thousand patients)** is an important part of combination treatment, but its contribution does not compensate for the lack of early surgical interventions. **Oncological drug programs generate the highest costs** but also reflect the modern direction of therapy – personalization and targeted treatment. **5.5 thousand patients admitted to emergency departments** are an indicator of insufficient coordination and late diagnosis of complications – patients often seek help only in acute situations.

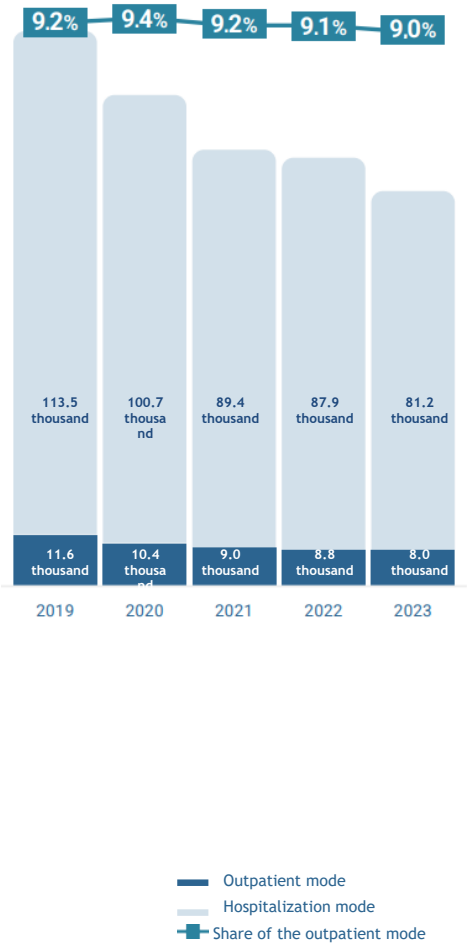
Healthcare service categories, number of patients, number and value of healthcare services provided to patients with C34 diagnosis in 2024 [62]

Health care service type	Number of patients	Number of healthcare services	Value of services
Chemotherapy – medications	17,543	82,157	34,715,764.43
Procedural DRG	16,491	18,909	372,594,686.51
Anesthesiology and Intensive Care Unit (AICU)	804	853	4,848,662.43
Brachytherapy	131	137	1,008,253.99
External beam radiation therapy	11,070	13,232	228,038,359.02
Conservative DRG	19,533	28,331	198,964,401.61
Non-oncological drug program – healthcare services	<5	<5	451.79
Chemotherapy – healthcare services	15,415	75,640	110,691,113.92
Comprehensive Oncological Care, services other than DRG, AICU, radiation therapy, EADT	44	53	7,345.53
Oncological drug program – medications	11,784	88,302	1,179,514,614.29
Non-oncological drug program – medications	<5	<5	9,104.40
Oncological drug program – healthcare services	11,788	91,787	120,505,837.23
Emergency Department/Admissions Room	5,445	6,530	23,641.27
Healthcare services related to radiation therapy	11,526	17,084	38,952,587.07
OTHER	24,550	36,533	69,455,477.97
EADT	69	345	6,708,206.32
Chemotherapy – drugs from 1t	84	109	51,861.98

The negligible share of rehabilitation, homecare or comprehensive care models (only 44 patients covered by comprehensive care) confirms that the system is still failing to realize the goals of integrated care.

The number of patients, hospitalizations and visits provided to patients with a primary (lung cancer) or secondary (C34 or D38) diagnosis has been steadily increasing since 2013, with a periodic decrease in hospitalizations during the coronavirus pandemic period (2020-2021). In recent years, there has been a reduction in the number of patients treated with chemotherapy and radiation therapy in favor of systemic therapies.

Number of chemotherapy administrations to patients in the C34 indication 2019–2023 [63]



Estimated use of reimbursed therapies

- → Immunotherapy - 65% of patients with indications
- → Molecularly targeted drugs - 30% of patients with indications

Drug program

The B.6 drug program: Treatment of patients with lung cancer (C34) and pleural mesothelioma (C45) reached the second highest total reimbursement amount among all oncological drug programs in 2024, with NHF spending on the program amounting to **nearly PLN 1.3 billion** [64]. The dynamic development of this program in recent years is evidenced by both the increase in the number of active substances and the number of patients treated as part of this program.

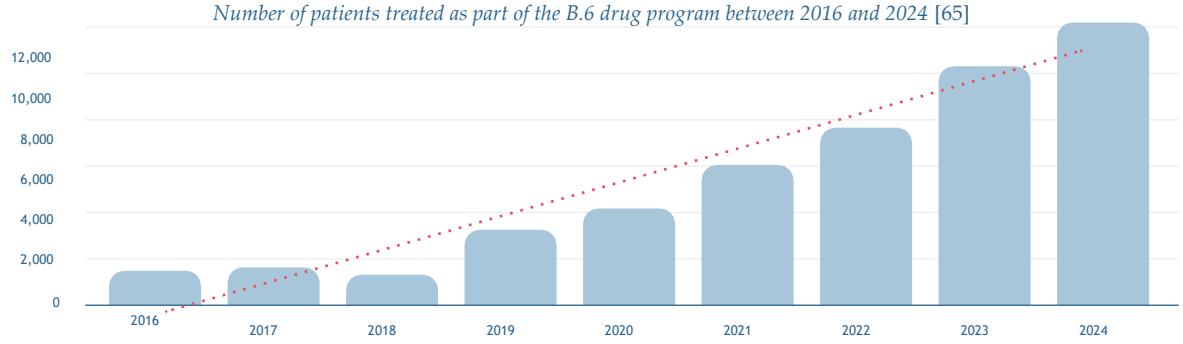
In 2019, 10 active substances were available in the drug program, while in 2024 the number increased to 18. The **number of patients treated** is also increasing every year. In 2019, there were about 3,300, and four years later in 2023 the number tripled, exceeding 10,000 patients, and in **2024** there were more than **12,200** patients treated. There was also a slight increase in the number of service providers executing the drug program - 96 in 2019, with an increase of 14% in 2023 to reach 109 service providers, and **in 2024 - 111** (an increase of almost 2% compared to the previous year).

In 2015, less than 1.5 thousand patients benefited from the B.6 drug program, while in 2024 - **already more than 12 thousand patients** (diagnostics + treatment in various modes). That's an **eightfold increase** within a decade, reflecting:

- → **expansion of reimbursement indications** for new drugs (immunotherapy, molecularly targeted therapies),
- → **better access to molecular diagnostics**, **prolonged survivals** and longer treatment time as part of the program.

Since 2020, the dynamics of growth of the number of patients treated as part of the drug program are on average **about 20-25% per year**. This is the fastest growing drug program in oncology in Poland.

Number of patients treated as part of the B.6 drug program between 2016 and 2024 [65]



12,200	1,324	30.05%
Maximum value in 2024	Minimum value in 2018	Medium-term rate of changes between 2016 and 2024

Key indicators regarding the B.6 drug program between 2016 and 2024 [66]

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024
Number of patients	1 491	1 656	1 324	3 274	4 176	6 028	7 687	10 304	12 200
Number of service providers	84	87	86	96	99	101	101	109	111
Number of outpatient visits	1 695	2 111	3 333	5 712	8 129	8 757	12 100	15 290	20 170
Number of one-day hospitalizations	1 264	1 384	2 715	12 439	18 836	27 714	37 777	50 012	61 515
Number of hospitalizations	2 521	2 954	1 389	3 869	3 877	6 717	8 774	11 788	12 228
Number of other services	2 691	3 548	3 982	10 032	14 106	18 694	24 980	34 949	47 273
Share of outpatient visits	30.93%	32.73%	44.82%	25.94%	26.36%	20.28%	20.63%	19.83%	21.48%
Share of one-day hospitalizations	23.07%	21.46%	36.51%	56.49%	61.07%	64.17%	64.41%	64.87%	65.5%
Share of hospitalizations	46%	45.81%	18.68%	17.57%	12.57%	15.55%	14.96%	15.29%	13.02%
Expenditures on medications in drug programs	32 601 672	28 705 140	64 346 266	211 237 114	313 039 360	478 690 128	698 220 163	941 066 480	1 000 000 000
Expenditures accompanying the execution of drug programs	5 190 636	5 762 259	5 213 707	16 027 160	20 782 102	32 887 697	55 465 657	85 724 264	106 666 938
Total expenditures on drug programs	37 792 308	34 467 399	69 559 972	227 264 274	333 821 462	511 577 825	753 685 820	1 026 790 744	1 294 870 414
Average expenditure per patient	25 347	20 814	52 538	69 415	79 938	84 867	98 047	99 650	106 137

According to the announcement of the Minister of Health - list of reimbursed medicines as of 1 October 2025, 18 active substances for the treatment of lung cancer are reimbursed [67].

One substance*(atezolizumab*) is available in both intravenous and subcutaneous forms, the others in either oral or intravenous form. Currently, 51% (18/35) of the active substances recommended by the European Society for Medical Oncology *(ESMO*) are reimbursed in Poland [68]. In addition to the active substances reimbursed under the B.6 program, *larotrectinib* is also reimbursed for the treatment of lung cancer (as part of the B.144 DP: Treatment of patients with solid tumors with the neurotrophic tyrosine receptor kinase [NTRK] gene fusion).

Drugs available in oral, intravenous and subcutaneous forms reimbursed under the B.6 program since 1 October 2025 [69]:

AFATINIB

Indication:
first-line treatment of advanced NSCLC patients with confirmed presence of mutations in the *EGFR* gene

OSIMERTINIB

Indication:

a. consolidation treatment of locally advanced, inoperable NSCLC with confirmed presence of mutations in the *EGFR* gene
b. first-line treatment of NSCLC in monotherapy or in combination with chemotherapy according to a regimen including a platinum derivative and pemetrexed
c. second-, third- and subsequent-line treatment of patients with NSCLC with confirmed presence of mutations in the *EGFR* gene after failure of prior treatment with afatinib, dacomitinib, erlotinib, gefitinib
d. adjuvant treatment of NSCLC with confirmed presence of mutations in the *EGFR* gene after radical surgical treatment

ALECTINIB

Indication:

a. treatment of NSCLC patients with the *ALK* gene rearrangement after radical resection – adjuvant treatment
b. first- and subsequent-line treatment of NSCLC patients with the *ALK* gene rearrangement (patients after failure of prior chemotherapy or after failure of treatment with crizotinib)

ATEZOLIZUMAB

ADJUVANT TREATMENT

Indication:
treatment of NSCLC patients with *PD-L1* expression on tumor cells after radical resection and postoperative chemotherapy

PEMBROLIZUMAB

ADJUVANT TREATMENT

Indication:
adjuvant treatment of NSCLC patients after radical surgical treatment

NIVOLUMAB with chemotherapy

PREOPERATIVE TREATMENT

Indication:
initial (neoadjuvant) treatment of NSCLC patients eligible for radical surgical resection, in combination with chemotherapy

PEMBROLIZUMAB

PERIOPERATIVE TREATMENT

Indication:
perioperative treatment of NSCLC patients in combination with neoadjuvant platinum compound-based chemotherapy before surgery, and subsequently in monotherapy after surgery

CRIZOTINIB

Indication:
first- and subsequent-line treatment of NSCLC patients with the *ALK* or *ROS1* gene rearrangement (patients after failure of prior chemotherapy)

BRIGATINIB

Indication:
first- and subsequent-line treatment of NSCLC patients with the *ALK* gene rearrangement (patients after failure of prior chemotherapy or after failure of treatment with crizotinib)

LORLATINIB

Indication:
first- and subsequent-line treatment of NSCLC patients with the *ALK* gene rearrangement (patients after failure of treatment with a second-generation *ALK* inhibitor)

ENTRECTINIB

Indication:

first- and subsequent-line treatment of NSCLC patients with the *ROS1* gene rearrangement (patients after failure of prior chemotherapy)

PEMBROLIZUMAB

Indication:

first-line treatment of NSCLC patients (applies only to patients who have not previously received immunotherapy or immunochemotherapy)

ATEZOLIZUMAB

Indication:

first-line treatment of NSCLC patients (applies only to patients who have not previously received immunotherapy or immunochemotherapy)

CEMIPLIMAB

Indication:

first-line treatment of NSCLC patients (applies only to patients who have not previously received immunotherapy or immunochemotherapy)

CEMIPLIMAB

IN COMBINATION WITH CHEMOTHERAPY

Indication:

first-line treatment of NSCLC patients (applies only to patients who have not previously received immunotherapy or immunochemotherapy)

NIVOLUMAB WITH IPILIMUMAB

Indication:

first-line treatment of NSCLC patients (applies only to patients who have not previously received immunotherapy or immunochemotherapy)

DURVALUMAB WITH TREMELIMUMAB

Indication:

first-line treatment of NSCLC patients (applies only to patients who have not previously received immunotherapy or immunochemotherapy)

NIVOLUMAB

Indication:

subsequent-line treatment of NSCLC patients in all types of non-small cell lung cancer (applies only to patients who have not previously received immunotherapy or immunochemotherapy)

ATEZOLIZUMAB

Indication:

subsequent-line treatment of NSCLC patients in all types of non-small cell lung cancer (applies only to patients who have not previously received immunotherapy or immunochemotherapy)

NINTEDANIB

Indication:

subsequent-line treatment of patients with adenocarcinoma type of lung cancer (patients after failure of previous chemotherapy, immunotherapy, chemoimmunotherapy)

SOTORASIB

Indication:

treatment of NSCLC with the *KRAS* G12C gene mutation after failure of at least one prior line of systemic treatment (immunotherapy or immunochemotherapy or chemotherapy with platinum compounds)

DURVALUMAB

Indication:

consolidation treatment of locally advanced, inoperable NSCLC

ATEZOLIZUMAB

Indication:

first-line treatment of small cell lung cancer (SCLC) (in combination with carboplatin and etoposide during the induction phase)

DURVALUMAB

Indication:

first-line treatment of small cell lung cancer (in combination with a platinum derivative (cisplatin or carboplatin) and etoposide in the induction phase)

NIVOLUMAB WITH IPILIMUMAB

Indication:

first-line treatment of patients with pleural mesothelioma (patients previously not receiving systemic treatment)

Medicinal products for the C34 indication reimbursed under the chemotherapy catalog [70]:

- carboplatin
- cisplatin
- cyclophosphamide
- docetaxel
- doxorubicin
- epirubicin
- erlotinib
- etoposide
- gefitinib
- gemcitabine
- isophosphamide
- irinotecan
- lanreotide
- methotrexate
- octreotide
- paclitaxel
- pemetrexed
- topotecan
- vincristine
- vinorelbine

Service types and number of patients who were provided with services as part of the B.6 drug program – Treatment of patients with lung cancer and pleural mesothelioma in between 2022 and 2025 [71]

Year	Healthcare service type	Number of patients
2022	Outpatient mode	2,001
2022	Hospitalization	2,834
2022	One-day hospitalization	5,147
2022	Diagnostics	6,171
2023	Outpatient mode	2,450
2023	Hospitalization	4,017
2023	One-day hospitalization	6,856
2023	Diagnostics	8,420
2024	Outpatient mode	3,062
2024	Hospitalization	4,292
2024	One-day hospitalization	8,253
2024	Diagnostics	10,521
Jan-Aug 2025	Outpatient mode	3,005
Jan-Aug 2025	Hospitalization	3,208
Jan-Aug 2025	One-day hospitalization	7,512
Jan-Aug 2025	Diagnostics	9,052

Between 2015 and 2018, most of the drug program services were provided in the **classic hospitalization** or **diagnostic** mode.

From 2019, there is a **marked increase in the number of one-day hospitalizations**, which have become the **primary form of providing treatment** - 2019: 1,899 patients / 2024: 8,253 patients / Jan-Aug 2025: already 7,512 patients (indicating that the number of patients could exceed 10 thousand by the end of 2025). The data confirms that the drug program is increasingly **shifting to a one-day model** in line with European practice - less invasive, more cost-effective, and better suited to patients' needs.

Similarly, an increasing number of patients are being treated in an outpatient setting (at oncology outpatient clinics or day departments) - **from 304 patients in 2015 to 3,062 in 2024 and as many as 3,005 between January and August 2025.**

More and more patients can be treated **without the need for hospitalization**, which is part of the trend of an inverted healthcare pyramid.

The number of patients undergoing **diagnostic tests** under the drug program **increased from 1,024 in 2015 to 10,521 in 2024, and as many as 9,052 between January and August 2025.** This means that **in 2025 the number of diagnostic tests could exceed 13,000** (trend analysis). The data support the progressive **implementation of molecular testing and immunohistochemistry assays** as an eligibility condition for targeted treatment and immunotherapy. At the same time, it indicates the growing burden on diagnostic laboratories, which requires standardization and ensuring even regional access, which remains to be a major problem in Poland. Until 2020, the program only covered **non-small cell lung cancer (NSCLC)**. Since 2021, it was **expanded to include small cell lung cancer (SCLC)**, and from 2023 - also **pleural mesothelioma**, which also influenced a rapid increase in the number of patients. These changes confirm that the program has become a **comprehensive platform for the treatment of thoracic cancers**, covering different histological types and disease stages.

The Agency for Health Technology Assessment and Tariff System (Agencja Oceny Technologii Medycznych i Taryfikacji, AOTMiT) recently assessed the following therapies:

- **Serplulimab** in combination with chemotherapy for first-line treatment of extensive-stage small cell lung cancer [72];
- **Durvalumab** as a consolidation treatment in a population of patients with limited small cell lung cancer (stage I-III) who have not experienced disease progression after platinum derivative-based chemoradiotherapy [73];
- **Amivantamab** in combination with chemotherapy or **lazertinib** (lazertinib in combination with amivantamab) for the treatment of advanced non-small cell lung cancer with the presence of mutations in the EGFR gene [74,75];
- **Tislelizumab** in the treatment of non-small cell lung cancer after previous treatment with platinum derivatives [76];
- **Tislelizumab** for 1st-line treatment of non-small cell lung cancer of the non-squamous type [77].

Drugs registered in the European Union and recommended by the European Society for Medical Oncology for the treatment of non-small cell lung cancer, still not available in the current reimbursement status in Poland:

- **Dabrafenib in combination with trametinib** in NSCLC patients with the presence of a pathogenic variant in the BRAF gene (V600E);
- **Ceritinib** as monotherapy for the first-line treatment of adult patients with anaplastic lymphoma kinase (ALK)-positive advanced NSCLC; **Ramucirumab in combination with erlotinib** is indicated for the first-line treatment of adult patients with metastatic NSCLC with activating mutations in the epidermal growth factor receptor (EGFR) gene;
- **Dacomitinib** as monotherapy is indicated for the first-line treatment of adult patients with locally advanced or metastatic NSCLC with activating mutations in the gene encoding the epidermal growth factor receptor (EGFR);
- **Selpercatinib** in monotherapy is indicated for the treatment of adults with advanced NSCLC with the presence of RET gene fusion who have not been previously treated with a RET gene inhibitor and patients with advanced solid tumors with the presence of RET gene fusion in cases where non-RET-targeted treatment methods have limited clinical benefit or have been exhausted;
- **Amivantamab** in combination with lazertinib in the first-line treatment of adult patients with advanced NSCLC with EGFR exon 19 deletions or exon 21 (L858R) substitution mutations;
- **Tepotinib** as monotherapy is indicated for the treatment of adult patients with advanced NSCLC with mutations leading to mesenchymal-epithelial transition factor gene exon 14 (METex14) skipping who require systemic therapy following prior treatment with immunotherapy and/or platinum compound-based chemotherapy;
- **Capmatinib** in monotherapy in adult patients with advanced NSCLC with alterations leading to mesenchymal-epithelial transition factor gene exon 14 (METex14) skipping, who require systemic therapy following prior treatment with immunotherapy and/or platinum compound-based chemotherapy; **Deruxtecan trastuzumab** as monotherapy for the treatment of adult patients with advanced NSCLC with an activating HER2 (ERBB2) gene mutation, who require systemic treatment following platinum derivative-based chemotherapy in combination with or without immunotherapy.
- **Adagrasib** as monotherapy for the treatment of adult patients with advanced NSCLC with KRAS G12C mutation and disease progression after at least one prior systemic therapy;

- **Tislelizumab** in combination with platinum derivative-containing chemotherapy as neoadjuvant treatment, and then continued as monotherapy as adjuvant treatment, is indicated for the treatment of adult patients with resectable NSCLC at high risk of recurrence;
- **Sugemalimab** in combination with platinum derivative-based chemotherapy is indicated for the first-line treatment of adults with metastatic NSCLC with no sensitizing EGFR mutations, or ALK, ROS1 or RET genomic tumor aberrations.

- **Binimetinib** in combination with encorafenib is indicated for the treatment of adult patients with advanced NSCLC with the presence of a BRAF V600E mutation.
- **Repotrectinib** as monotherapy is indicated for the treatment of adult patients with ROS1-positive advanced NSCLC;
- **Capmatinib and savolitinib** in NSCLC patients with the presence of a pathogenic variant in the MET gene (skipping mutation in exon 14).

Imaging diagnostics

Data analysis regarding **imaging diagnostics in the years 2015-2025** indicates that there has been a marked change in the structure of imaging performed for lung cancer in Poland over the past decade. The number of computed tomography (CT) and PET/CT scans -which are key to accurate diagnosis and assessment of treatment effects - is growing rapidly, while the importance of X-ray, ultrasound and scintigraphy is steadily declining.

The number of patients referred for CT increased by about 30% between 2015 and 2024, and nearly doubled for PET, while the number of X-ray and ultrasound examinations fell by several dozen percent. This trend is confirmed by the growing use of modern, high-value imaging methods in accordance with modern oncology diagnostic standards.

Molecular diagnostics

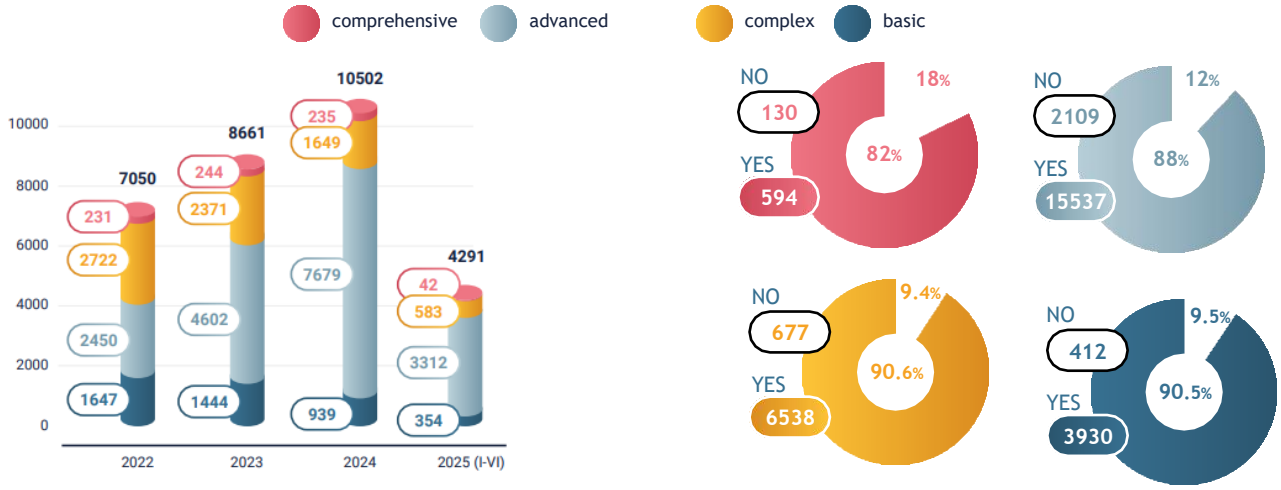
The number of molecular tests performed for lung cancer diagnostics in 2019-2022 fluctuated around 35% of newly detected cases. **More than 8,500 tests were performed in 2023** and **more than 10,500 tests in 2024** Importantly, still almost 60% of cases are detected at an advanced stage, when systemic treatment should be considered, and molecular testing plays a key role in the patient qualification process.

Diagnostic imaging services between 2022 and 2025 [78]

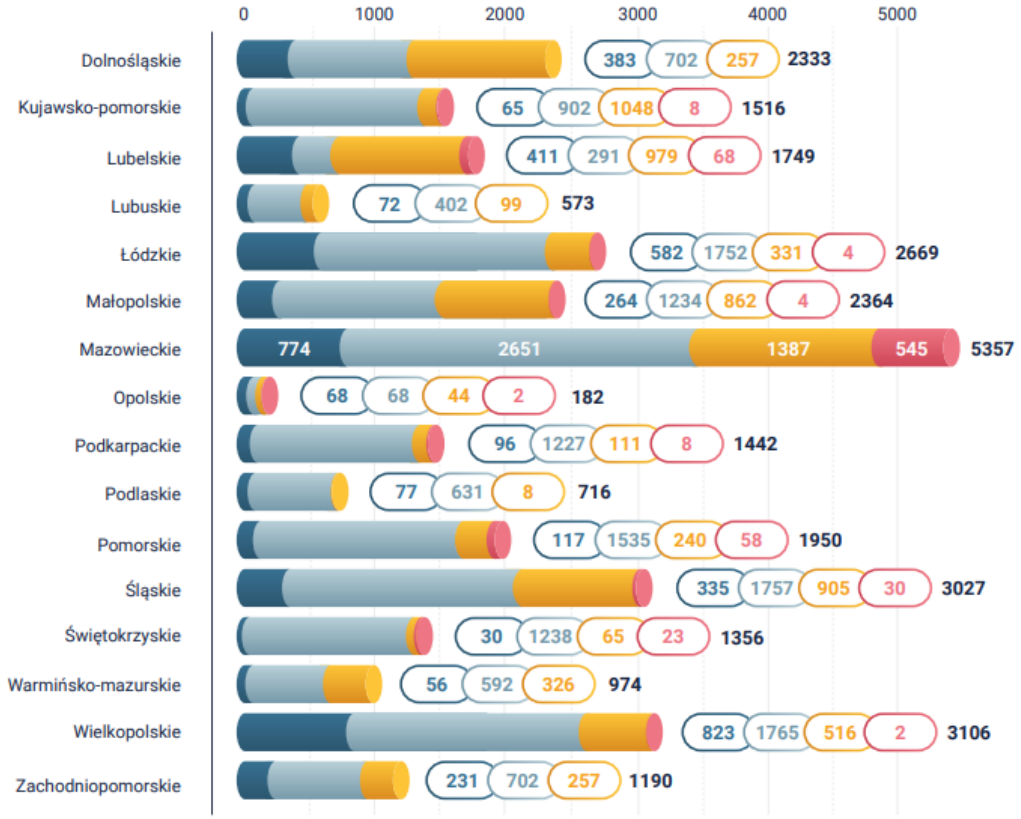
Year	Healthcare service type	Number of patients	Number of patients
2022	PET	8,252	9,426
2022	MRI	3,361	4,477
2022	X-RAY	27,501	43,482
2022	SCINTIGRAPHY	1,196	1,357
2022	CT	44,036	86,918
2022	Ultrasound	16,303	21,145
2023	PET	8,814	10,012
2023	MRI	3,647	4,763
2023	X-RAY	28,689	44,283
2023	SCINTIGRAPHY	1,198	1,333
2023	CT	46,365	88,775
2023	Ultrasound	15,981	20,619
2024	PET	9,021	10,428
2024	MRI	3,925	5,081
2024	X-RAY	29,786	47,074
2024	SCINTIGRAPHY	1,156	1,276
2024	CT	49,384	94,456
2024	Ultrasound	15,041	19,291
Jan-Aug 2025	PET	3,005	3,005
Jan-Aug 2025	MRI	3,208	3,208
Jan-Aug 2025	X-RAY	7,512	7,512
Jan-Aug 2025	SCINTIGRAPHY	9,052	9,052
Jan-Aug 2025	CT	7,512	7,512
Jan-Aug 2025	Ultrasound	9,052	9,052

Types of molecular testing performed in hospitals in the years 2022–2025[a] (based on the NHF data[b]) [79]

The service (completed examination) applies to a patient from the same voivodeship branch as the service provider in the years 2022–2025[a] (based on the NHF data[b]) [79]



Share of molecular testing in diagnostics by voivodeship in the years 2022–2025a (based on the NHF datab) [79]



[a] Data for 2025 for the period between January and June [b] For the purpose of calculations, the field value of "<5" was averaged and the value of "2" was assumed.

Since 2022, a **steady and significant increase in the number of molecular testing performed** has been observed, both overall and in most voivodeships. In 2023, the number of services increased on average **by 22%** compared to 2022, and by another 21% in 2024. Currently, advanced testing (small NGS panels) dominates.

As the number of testing increases, so does the **total value of reimbursements**, reflecting the growing importance and cost of molecular diagnostics. The average value of services in each voivodeship has increased by **20-35%** over the past two years. This is a result of both a greater number of orders and an increase in the percentage of **advanced testing (next-generation sequencing, NGS)** compared to single biomarker tests.

In 2022, the majority of testing were single gene tests (e.g. *EGFR, ALK, ROS1*), while **from 2023**, **NGS panels** are **increasingly** being performed. Increasing the availability of these tests significantly improves the **efficiency of predictive diagnostics**, shortens the qualification time for treatment and reduces the number of repeat material collections.

The value of testing reimbursements nationwide has increased by more than 70% between 2022 and 2024, demonstrating both the increasing funding of the National Health Fund and the effective implementation of the demands of the oncology community and the Lung Cancer Mission.

More testing translates directly into better therapy matching and an increasing percentage of patients treated in the drug program. But still, relative to needs, the number of tests and their scope are too small to optimally refer patients for treatment.

Given that about **21 thousand lung cancers** are diagnosed in Poland each year, of which about **85% are NSCLC**, that means **18 thousand patients** potentially require more extensive predictive diagnostics (and at least all patients at advanced stages and more often also as part of perioperative treatment).

Estimated molecular testing demand gap

Tests/examinations completed:
7,050 (2022) 8,661 (2023) 10,502 (2024)

Estimated gap: →

Variant 1. If the need to test all patients with NSCLC is accepted: coverage ≈ 10.5 thousand / 18 thousand ≈ 58%
a gap of about 7,000–8,000 tests/year

Variant 2. Testing mainly at an advanced stage
~70–75% NSCLC = 13–14 thousand patients a gap of about 3,000–4,500 tests/year

On this basis, it can be concluded that despite a marked increase in the number of molecular testing performed, the real needs are still not met. **There is a shortage of at least 3,000-4,500**, and by full standards **as many as 7,000-8,000 tests per year**.

The following may prove to be helpful in closing the gap: fully funding of advanced and comprehensive **NGS/CGP** panels as separate procedures, possibility of performing liquid **ctDNA** biopsy when material is scarce or of undiagnostic nature, standardization of time from biopsy to result, and equalization of regional differences in access to testing.

Genetic (molecular) testing in neoplastic diseases - billing products funded by the NHF:

- → Basic genetic testing in neoplastic diseases (e.g., analysis of a single gene or its fragment, allows detection of a known mutation in a specific gene; methods used: e.g., *EGFR* PCR) (product code: 5.53.01.0005001)
- → Complex genetic testing in neoplastic diseases (combinations of cytogenetic and molecular testing that go beyond a single simple assay, but do not yet reach the level of, for example, karyotype analysis by G-banding with parallel *FISH* analysis using 2 probes or *FISH/ISH* with ≥2 probes, or molecular testing involving ≥2 simple tests) (product code: 5.53.01.0005002)

- → Advanced genetic testing in neoplastic diseases (e.g., next-generation sequencing [NGS], which allows for testing of multiple genes and alterations in genetic material at the same time, according to the appendix to the NHF order, for example: gene expression profile [GEP] or NGS sequencing involving a dozen to a few dozen amplicons, the so-called small NGS) (product code: 5.53.01.0005003)
- → Comprehensive genetic diagnostics of neoplastic diseases (e.g., the NGS CGP testing, which is not reimbursed as a separate procedure in Poland; comprehensive genetic diagnostics in Poland is mainly used to assess germinal predisposition) – separately contracted services (product code: 5.10.00.000004)

The billing of a given type of testing is carried out as part of hospitalization – it can be demonstrated only on the day of hospitalization, during which the material for genetic testing was collected, and not before the result is received. There is a lack of procedures that allow diagnostics in an outpatient setting, especially using fresh material – peripheral blood for genetic testing with the use of liquid biopsy.

Currently, the NHF reimburses:

- → single-gene PCR testing, e.g. *EGFR* and *KRAS*, and single-gene FISH testing, e.g. *ALK*, *ROS1*, and complex testing such as genetic testing involving ≥2 simple tests (e.g., PCR for two and more different biomarkers,
- → "small NGS panels", the so-called hot-spot from tissue material (covering a dozen or so of genes, including single nucleotide variants; such a panel does not test entire gene coding sequences, but only selected fragments – the so-called hot spots).

Despite the reimbursement of advanced molecular testing, including NGS sequencing of up to 40 amplicons (sequences/genes), which can include the NGS panel, it is still not optimally used in molecular diagnostics, although the number of tests is steadily increasing and the number of facilities not performing these panels is decreasing.

Barriers include the lack of an on-site laboratory at medical facilities, lack of equipment and adequately trained personnel, lack of a contract for such testing with an external laboratory, or lack of laboratory certification for the NGS technology (very high cost, long accreditation procedure lasting up to 2 years).

NHF does not reimburse innovative technologies and diagnostic tools:

- → multi-gene testing using liquid biopsy and the use of *circulating tumor DNA* (ctDNA) in both inpatient and outpatient settings,
- → tests of fresh material (peripheral blood/liquid biopsy) ordered from the outpatient level,
- → comprehensive genomic profiling (CGP) by NGS as a separate procedure,
- → predictive immunohistochemistry assays for *PD-L1* protein expression.

Assessment of PD-L1 expression (immunohistochemistry assay)

Despite the fact that PD-L1 protein expression evaluation is one of the key predictive tests for lung cancer patients, determining the administration of immunotherapy, there is no official data (National Health Fund) on the number of patients who underwent this test, the number of services provided and their value due to the lack of separation of this procedure (no separate code).

Currently, *PD-L1* protein expression assays are billed by medical centers, for example:

- → as part of the histopathological examination of cancer (code: 5.07.00.0000010 – Histopathological examination of cancer with an assessment of the malignancy grade and histological type), as part of the "Immunohistochemistry assays" service (e.g. 5.07.00.0000005) – if the pathomorphology laboratory reports the number of immunohistochemical stains performed,
- → within a hospitalization, diagnostic procedure or oncology bundle (DiLO) – then the cost of the PD-L1 assay is "included" in the cost of the entire service and is not reported separately,

→ if the pathomorphology laboratory is accredited by the Ministry of Health, it can bill the assay under the pathological DRG – special examination.

The lack of separation of *PD-L1* testing in the NHF reporting system means that **there is no way to monitor its actual availability, quality and timeliness** nationwide. In practice, it is not known how many patients with lung cancer have *PD-L1* evaluation performed, at what time from the material collection, and in how many cases the result forms the basis for qualification for immunotherapy. This is a serious systemic problem that **makes it difficult to assess the effectiveness of the diagnostic-therapeutic pathway**, prevents analysis of regional differences in availability of testing and **limits control over the quality of predictive diagnostics**. Without reliable data on *PD-L1* testing, it is also impossible to fully assess the effectiveness of public spending on immunotherapies – since it is not known what proportion of patients actually receive treatment that is compatible with the biological profile of their cancer.

Conclusions

In Poland, the percentage of patients diagnosed at an early stage remains too low. Analyses by the National Cancer Registry demonstrate that **half of patients are diagnosed with lung cancer only at the generalized stage**, which significantly limits the options for effective treatment.

However, it should be noted that the latest data for 2024 and 2025 already include the effects of implementing programs such as the **National Oncology Network** and **the National Oncology Strategy**, which postulate improved coordination of diagnostics, better access to molecular testing and standardization of the patient pathway.

The system of care for lung cancer patients in Poland remains dominated by hospitalizations, which translates into high costs and limited efficiency.

Outpatient, rehabilitation and long-term care are underdeveloped – they require strengthening and better coordination.

High expenditures on palliative care reflect the problem of late diagnosis and the need to improve early diagnostics.

The development of pilot programs (e.g. LDCT) and the implementation of *Lung Cancer Units* may shift the focus from symptomatic treatment to effective prevention and causal treatment in subsequent years. **The number of advanced imaging examinations (CT, PET/CT) performed is growing.**

The growth of PET/CT is closely related to **personalized medicine** (selection of immunotherapies/targeted treatments) – even distribution of laboratories and access in the regions is necessary. Further development of **low-dose CT (LDCT)** in screening can further increase the number of patients who will service from advanced examinations, which requires good organization and provision of adequate funding for these services.

There has been a marked increase in the number of molecular testings performed in lung cancer patients, but a gap of up to 7 thousand tests is still evident.

There is a lack of funding for the key tools in the molecular diagnostics of lung cancer which are comprehensive genomic profiling (CGP) and liquid ctDNA biopsy.

There is a lack of separation of *PD-L1* testing in the NHF reporting system, which means that **there is no way to monitor its actual availability, quality and timeliness** nationwide. There is a lack of management standard for the diagnostic pathway in lung cancer, which would condition, for example, NHF funding.

Simple tools to streamline the predictive diagnostics pathway such as **simultaneous conditional referral for molecular (genetic) testing** are not being used. **Key recommendations in the scope of oncological care regarding the organization and clinical management of thoracic cancers** [80] (September 2024) do not include advanced NGS diagnostics and immunohistochemistry assays (PD-L1), without which it is currently not possible to qualify a patient with NSCLC for optimal therapy (under or outside of a drug program).

4.5. Patient pathway and waiting times for services

In Poland, there is not a single, standardized, formal pathway for a lung cancer patient in the healthcare system that defines the sequence, timeframe for diagnostics and treatment across the country. The management and time to diagnosis vary widely between voivodeships, and urban and rural areas.

As many as 39% of patients is diagnosed at a metastatic stage of lung cancer associated with the worst prognosis and only 15-20% at the early, locoregional stage.

Differences in access to services, as well as in their comprehensiveness and quality are apparent. Meanwhile, diagnosing the disease at early stages is a necessary condition for improving patient survival.

A patient with suspected lung cancer is referred for diagnostic tests/examinations most often by a primary care physician or a specialist such as a pulmonologist issuing a **DiLO card** (fast-track cancer pathway), which specifies maximum times for basic and in-depth diagnostics for all cancer patients, but in many cases the procedures are not carried out within the indicated timeframes. Importantly, primary care physicians now have the option of ordering a computed tomography (CT) scan if suspicious lesions are seen on X-ray. This is an element that, if fully utilized, can reduce the time for initial diagnostics.

Patients may also be referred for specialized tests/examinations as a result of participation in a lung cancer prevention program. In addition, currently as part of coordinated care in the PHC setting, the family physician can spend additional dedicated time on a preventive consultation with the patient, during which they can discuss, among other things, the risk of tobacco smoking, the performed and recommended preventive tests/examinations, or family medical history.

According to the NHF data, in 2024, about 45% of PHC facilities participated in the coordinated care program (as of mid-year), covering about 50% of patients.

The diagnostic pathway most often begins with:

- → computed tomography (CT) examination – 59% of all patients or
- → material collection (tissue biopsy) – 36% of all patients.

The remaining problem is often the long waiting time for tests/examinations and results – many patients undergo the same tests/examinations repeatedly due to delays in diagnostics and referring patients from one medical facility to another (tests/examinations expire or are unreliable).

Many patients also choose to undergo tests/examinations in the private sector (with their own funds) because of the aforementioned long waiting times.

There has been a steady increase in the percentage of patients who had undergone diagnostic tests/examinations (CT, PET or material collection) under NHF coverage within 180 days prior to treatment initiation. Positron emission tomography (PET) is performed relatively infrequently, most often as a next step following CT and material collection.

Median survival depending on the time from diagnosis to treatment initiation [81]

Patients who started treatment **within 30 days** from diagnosis

14.8 months

Patients who started treatment **over 30 days** from diagnosis

11 months

Average waiting time for diagnostic tests/examinations in 2023 [82]

computed tomography of the chest	64 days
pathomorphological diagnosis	52 days
positron emission tomography examination	44 days
total	160 days

Waiting time for treatment
The shortest and longest average times from pathomorphological examination to treatment initiation in 2023 by province [83]

Shortest time	
Kujawsko-Pomorskie	37 da
Zachodniopomorskie	44 da
Łódzkie	46 da

Longest time	
Pomorskie	57 da
Opolskie	57 da
Warmińsko-Mazurskie	57 days

The time from the first diagnostic test/examination to treatment initiation is too long, for example; the time from material specimen collection to chemotherapy initiation was on average 50 days, and the time from the first computed tomography scan to surgical treatment was on average 75 days (data for 2021).

Reasons for such a situation include, among other things, referring the patient from one center to another, repeated diagnostic tests/examinations, long waiting times for certain tests/examinations or their results, and the lack of patient care coordination. The availability of pulmonology and oncology services shows considerable variation between voivodeships. The greatest variation was seen in pulmonology wards, with the lowest availability in Podlaskie, Kujawsko-Pomorskie and Zachodniopomorskie Voivodeships.

It should be noted that the scope of data necessary for diagnosis has increased significantly. In the case of non-small cell carcinoma (NSCLC), it is necessary to determine the cancer subtype (squamous-cell, glandular, neuroendocrine, NOS), and in the case of the latter three, molecular testing and evaluation of *PD-L1* protein expression should additionally be performed. There is also a change in the structure of the most common lung cancer subtypes with more and more adenocarcinomas being diagnosed. This makes it necessary to conduct more and more testing for predictive factors.

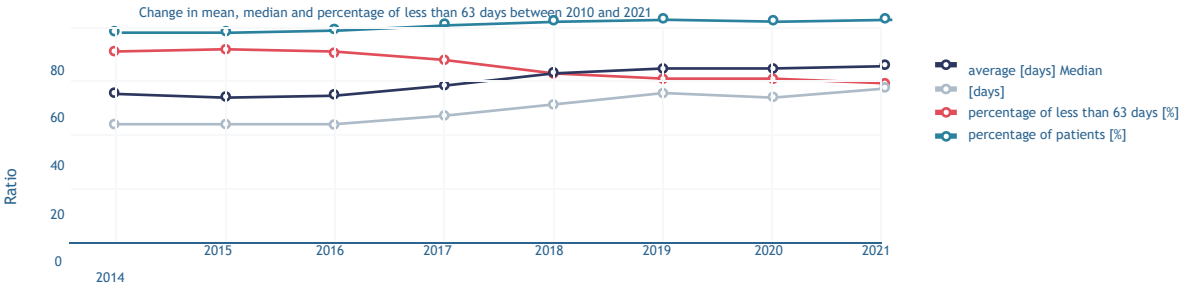
Number of DiLO cards issued [65]

2018	slightly over 234 thousand
2019	over 254 thousand
2020	over 238 thousand
2021	nearly 300 thousand
2022	over 320 thousand
2023	over 360 thousand
2024	over 402 thousand
2025 (Jan-Aug)	over 330 thousand

DiLO cards issued in 2024 by PHC, SOC and hospital [84]

Pri	SOC	Hospit
142,273	179,271	81,369

Waiting time from computed tomography to treatment in 2021 [85]



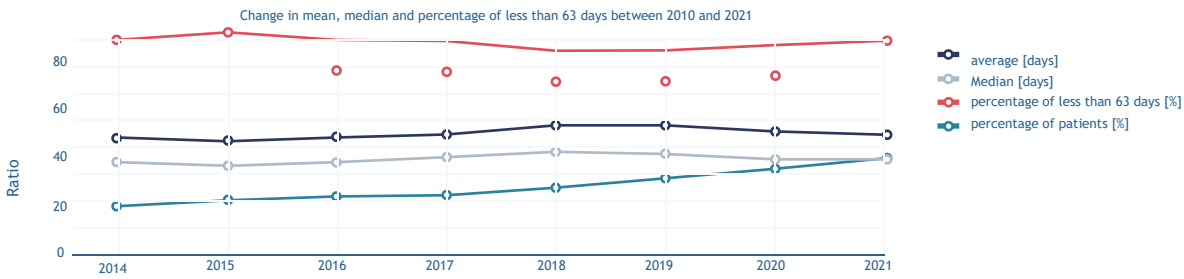
64 days Mean value in 2021	56 days Median in 2021	88.2% Percentage of patients with CT performed in 2021
58% Percentage of patients who started treatment within 63 days from examination in 2021		12,183 Number of patients with CT performed in 2021

Percentage of patients with PET scan performed under NHF coverage within 180 days prior to treatment initiation by the type of first therapy [86]

Percentage of patients with PET					
Yea	Surgery	Radiotherap	Chemotherapy	Immunotherap	Molecularly
2014	35%	16%	14%	-	24%
2015	36%	18%	15%	-	22%
2016	40%	20%	17%	-	22%
2017	44%	20%	16%	25%	22%
2018	43%	23%	19%	25%	27%
2019	48%	27%	21%	31%	23%
2020	54%	28%	25%	29%	23%
2021	60%	33%	29%		28%

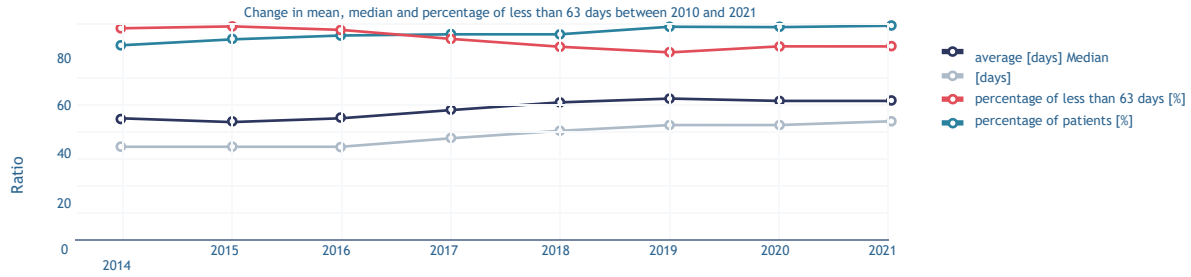
Waiting time from PET scan to treatment in 2021 [87]

44 days Mean value in 2021	35 days Median in 2021	35.57% Percentage of patients with PET performed in 2021
79% Percentage of patients who started treatment within 63 days from examination in 2021		4,913 Number of patients with PET performed in 2021



Waiting time from tissue specimen collection scan to treatment in 2021 [88]

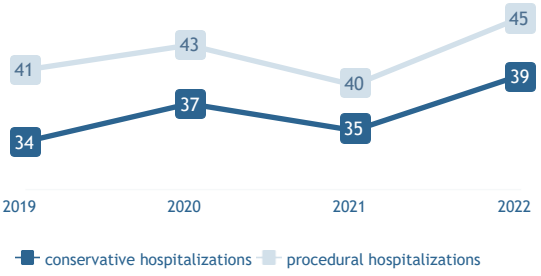
52 days Mean value in 2021	44 days Median in 2021	79.64% Percentage of patients with material collection performed in 2021
72% Percentage of patients who started treatment within 63 days from examination in 2021		11,000 Number of patients with PET performed in 2021



Number of specialists per 100 thousand population by voivodeship (as of 31°December°2021) [89]

Area	Clinical oncology	Oncological radiation therapy	Thoracic surgery	Lung
Poland	2.7	2.0	0.7	6.9
Dolnośląskie Kujawsko-	2.8	2.4	0.8	6.3
Pomorskie	1.6	1.9	0.8	5.4
Lubelskie	2.9	3.0	0.8	7.9
Lubuskie	2.5	2.3	1.0	5.4
Łódzkie	3.1	2.0	0.8	8.3
Małopolskie	2.3	2.3	1.1	8.4
Mazowieckie	4.7	1.8	0.6	6.6
Opolskie	1.4	1.9	0.1	8.3
Podkarpackie	2.4	1.9	0.6	7.1
Podlaskie	2.8	3.1	0.8	5.5
Pomorskie	3.2	2.8	0.6	5.8
Śląskie	3.3	3.1	0.7	6.3
Świętokrzyskie	2.1	2.0	0.9	8.1
Warmińsko-Mazurskie	3.8	2.3	0.6	6.5
Wielkopolskie	2.5	2.0	0.4	5.5
Zachodniopomorskie	3.0	2.0	1.0	6.5

Average waiting time for hospitalization with cancer diagnosis between 2019 and 2021 [90]



In recent years, a decrease in the timeliness of initial and in-depth diagnostics performed under the oncology bundle by about 10% has been observed [91].

Predictive testing as part of the diagnostic pathway of a lung cancer patient

In Poland, molecular (genetic) testing is recommended for patients with non-small cell lung cancer of the non-squamous type. They typically include testing for *EGFR* and *KRAS* mutations and *ALK* and *ROS1* gene rearrangements. More and more often centers are ordering next-generation sequencing (NGS) testing (mostly advanced testing – small NGS panels) that evaluate from several to a dozen or so of genes, including *BRAF, MET, RET, HER2 and NTRK1-3.*

Some medical facilities perform these tests in-house at their own genetic diagnostic laboratories; however, the majority still orders such testing from external laboratories (in Poland, they are mainly performed by 1 laboratory with relevant certificates).

Incomplete reimbursement of molecular testing and immunohistochemistry assays, and staff shortages (pathomorphologists, medical genetics laboratory specialists) still limit the scale of tests performed in clinical practice. Meanwhile, improving accessibility to molecular testing and immunohistochemistry assays has a direct impact on the number of patients qualified for the drug program as well as EADT and clinical trials, which remains suboptimal.

According to a Polish analysis (POL-MOL) [92] conducted by a group of Polish experts in a group of 1001 non-small cell lung cancer patients diagnosed in 2019, **only 34% underwent both molecular testing and PD-L1 evaluation, 18% underwent molecular testing only, and 15% underwent PD-L1 testing only. Molecular testing was not performed in 33% of patients**.

In terms of cancer types, the testing pattern was similar in patients with non-squamous lung cancer and malignant neoplasm (NOS), while it differed significantly in patients with squamous cell lung cancer. The frequency of molecular testing increased with the disease stage in all groups. In patients with squamous cell carcinoma, about 30% tested positive for *EGFR, ALK* and *ROS1* mutations, confirming the need to test at least a preselected subgroup of patients. 49 patients had at least one test ordered that was not performed. In 21% of cases, the reason was low-quality tissue; in another 21%, insufficient tissue amount; and in 12% – both low-quality tissue and insufficient tissue amount. In another 17% of cases, the decision not to perform additional testing was based on positive EGFR test results. In the remaining 29% of cases, the reason was "other" or unknown.

The POL-MOL study showed relatively high rates of *EGFR* and *ALK* biomarker testing in patients with advanced non-squamous NSCLC and malignant neoplasm (NOS). However, testing rates for less common mutations were much lower in our population than in Western European countries or the USA. Moreover, testing rates were lower in patients with squamous cell lung cancer. Meanwhile, the latest guidelines recommend that all patients with advanced non-small cell lung cancer – both non-squamous and squamous – be screened not only for *EGFR, ALK* and *PD-L1*, but also for *ROS1* and *BRAF* mutations. In-depth molecular testing for rare mutations (such as *MET, RET, HER2* and *NTRK*) is strongly recommended for advanced disease.

The results indicate that recommendations for predictive diagnostics are not followed in clinical practice in Poland. This is in line with data from a report by the *London School of Economics and Political Science*, which demonstrated a significant gap between the demand for and provision of testing for certain cancers – such as lung cancer – in Poland compared to other European countries.

In light of the reimbursement of more targeted therapies and immunotherapies in recent years, it is necessary to perform predictive testing in patients with non-small cell lung cancer as a standard.

In order to improve the process of predictive diagnostics in lung cancer, experts affiliated within the Lung Cancer Mission developed in 2025 the ***Recommendations for a molecular diagnostic pathway and biomarker assessment in non-small cell lung cancer*** [93], which identify optimal management pathways for molecular diagnostics and immunohistochemistry assays to improve treatment efficacy in NSCLC patients.

They define the optimal scope and sequence of molecular testing necessary for the effective qualification of patients with NSCLC for molecularly targeted treatment and immunotherapy, in accordance with current medical knowledge and the availability of drugs in Poland (both under the B.6 and B.144 drug programs, and early access under the emergency access to drug technology [EADT] procedure and clinical trials). They also indicate current standards for molecular diagnostics (including the use of single-gene assays, NGS and CGP panels, liquid biopsy with ctDNA NGS) for different clinical situations and patient groups, considering the rationalization of biological material use and cost-effectiveness.

Current management algorithms for lung cancer therapy require a thorough analysis of each case, the performance of comprehensive diagnostics and the evaluation of results during treatment. Due to the complexity of genomic data (molecular/genetic testing), consultations with clinical experts are essential. Therefore, the qualification of stage II or III patients should now include the possibility of perioperative treatment in multidisciplinary teams at the stage of initial diagnostics, i.e. before causal treatment initiation, based on the results of diagnostic tests/examinations: pathomorphological evaluation, imaging, molecular, immunological and immunohistochemical testing.

Experts estimate that approximately 70% of lung cancer patients receive neoadjuvant (pre-operative) treatment, mainly chemotherapy or chemoradiotherapy, but currently also immunochemotherapy. Currently, the drug program allows for perioperative treatment with pre-operative immunochemotherapy and following a surgery – with complementary immunotherapy.

At the national level, approximately **10.2%** of lung cancer **patients** were treated **outside the voivodship in which they reside**. The smallest number of such cases was recorded in the **Opolskie** voivodship **(3%)**, which indicates a relatively good availability of healthcare services in the region. In contrast, the highest percentage of patients moving for treatment was observed in the following voivodships: Warmińsko-Mazurskie (23%), Kujawsko-Pomorskie (20%) and Lubelskie (20%).

Analysis of voivodeship data reveals a **clear relationship between the percentage of patients treated outside their residence area and the average burden on service providers.** In regions with low patient migration, such as the Opolskie Voivodeship, facilities provide fewer services per center. In contrast, in the Kujawsko-Pomorskie and Lubelskie Voivodeships, where the percentage of patients from outside the region is high, the **burden on the centers is among the highest in the country** – which may indicate an **insufficient number of specialized treatment sites** in these areas [94].

In general, as practice shows, modern systemic treatment available in the drug program for several years, is used too infrequently most often as the next line of treatment for advanced disease. The reasons for such a situation are the delays in imaging, histopathological and molecular (genetic) diagnostics, as well as the insufficient number of ordered predictive testing.

In 2020, only 50% of patients diagnosed with advanced lung cancer received active treatment. Despite improvement, there are still many patients in Poland who are treated inconsistently with the current medical knowledge and contrary to the availability of therapies (new drugs in the drug program) which, in most cases, means chemotherapy. Immunotherapy and targeted therapy are used about 50% less frequently in Poland than recommended by the European Society for Medical Oncology.

It should be noted that in September 2024, the Ministry of Health published key oncology care recommendations for the organization and clinical management of thoracic cancer [95], which point out the most important elements of diagnosis and treatment that should be implemented for a lung cancer patient (including, depending on the type of cancer [non-small cell/small cell] and stage).

This is a step in the right direction – towards treatment standardization. However, it should be noted that guidelines should be updated at least annually, due to the rapid advances in the diagnosis and treatment of lung cancer.

Also, no mechanisms were included that would allow to oversee compliance with these recommendations or the consequences if they are not followed. At the same time, it should be stressed that treating an oncology patient currently requires individualization and personalization, so it is not possible to "rigidly" define all stages of diagnosis and treatment that would apply to all patients. Standards and guidelines indicate causal relationships of therapeutic management, depending on stage, patient prognosis, presence of specific predictive factors and response, with an increasing role of combination (perioperative) treatment.

The publication of the following recommendations resulted directly from Article 24 section 1 of the National Oncology Network Act, which stipulates that the Minister of Health shall publish a notice with key oncology care recommendations, regarding the organization and clinical management for specific disease units or medical fields for publicly funded healthcare services, with a view to standardizing management in clinical practice and improving the quality of such care.

Key oncology care recommendations for the organization and clinical management of thoracic cancers [96]

No.	Recommendation	Strength of recommendation
01	*In a patient with suspected lung cancer, a pathomorphological diagnosis shall be made in accordance with the organizational healthcare standards for pathomorphology and using the guidelines for pathomorphology laboratories and departments.*	(-)
02	*Pathomorphological diagnosis should be supplemented with the results of immunohistochemical tests and, for patients with diagnosed advanced lung cancer, EGFR, ALK and ROS1 gene status tests, in order to detect abnormalities that facilitate the optimal choice of systemic treatment.*	I, A
03	*In lung cancer, the result of the pathomorphological examination involves the determination of the histological tumor type and subtype, and in the case of post-operative examination involves lung cancer diagnosis (histological type and subtype and malignancy grade), lymph node, blood vessels and lymphatic vessels status determination, surgical margin and tumor grade assessment in accordance with the current pathomorphological classification.*	IV, A
04	*In patients with suspected lung cancer, family history should be collected and risk assessment considered.*	I, A
05	*A patient with suspected lung cancer should be interviewed and undergo a physical examination, chest scans (X-ray, CT, and in justified cases - MRI) and bronchofiberoscopy.*	IV, A
06	*Based on the tissue or cytological material examination, molecular genetic evaluation should be carried out (if there are enough tumor cells in the sample).*	II, A
07	*Non-small cell and small cell lung cancer should be staged in accordance with the principles and criteria of the current TNM classification.*	IV, A

No.	Recommendation	Strength of recommendation
08	*Treatment initiation should be preceded by lung cancer pathomorphological diagnosis based on the examination of tissue or cellular material.*	IV, A
09	*The diagnosis of unspecified non-small cell lung cancer is recommended only if the histological type and subtype cannot be determined.*	IV, A
10	*In a patient with diagnosed lung cancer with features of mediastinal lymph node involvement on imaging studies, the nature of the suspicious lesions should be pathomorphologically confirmed when qualifying for lung parenchyma resection.*	IV, B
11	*In a patient qualified for parenchyma resection, radiotherapy or chemotherapy with radical intent, a positron emission tomography scan should be performed.*	II, A
12	*In a patient diagnosed with stage I-II and IIIA non-small cell lung cancer classified as N1, the recommended management is parenchyma resection and removal of lymph nodes in the mediastinum and hilum.*	I, A
13	*A patient diagnosed with stage I-IIIA non-small cell lung cancer who is not eligible for resection and stereotactic radiotherapy should receive conventional radical radiotherapy or radiochemotherapy.*	II, A
14	*A patient diagnosed with locally advanced non-small cell lung cancer who is not eligible for resection should receive radical radiochemotherapy.* *Sequential treatment is allowed only if the inability to use both methods simultaneously is clinically justified. If chemotherapy is contraindicated, exclusive radiotherapy is recommended (recommended dose of 60-66 Gy in both situations, covering the primary tumor and lymph nodes in the hilum and mediastinum on the tumor side).*	I, A
15	*A patient diagnosed with stage I-III small cell lung cancer should receive concurrent radiochemotherapy, and in case of contraindications to concurrent radiochemotherapy - chemotherapy and then radiotherapy.*	I, A
16	*Patients with stage I-III small cell lung cancer showing response to radiochemotherapy or chemotherapy should be treated with selective central nervous system irradiation (recommended dose of 25 Gy in 10 fractions and starting treatment within 2-5 weeks after completion of radiochemotherapy or chemotherapy).*	I, A
17	*Multidirectional measures should be carried out to reduce the patient's exposure to tobacco smoke components (active and passive smoking).* *The patient should be given access to early rehabilitation, specialized psychological assistance and, if required, psychiatric consultation.*	I, A
18	*Once treatment is completed, a patient care plan should be developed, establishing the tasks for the oncologist and primary care physician regarding patient follow-up for post-treatment complications and early detection of a potential recurrence.*	(-)
19		(-)

Coordination of patient care

Care coordination is a key component of an effective and patient-friendly oncology system. In accordance with the **National Oncology Network** Act, effective from 2023, each patient diagnosed with a malignancy – including lung cancer – should have a designated **oncology coordinator** who is responsible for the organization and continuity of their diagnostic and therapeutic process.

The coordinator's role has been defined as an integral part of the NON model. Each center in the network is **required to provide coordinated care to the patient**, including identifying a person who will be the **patient's** regular point of contact throughout the treatment process. The coordinator's responsibilities include, but are not limited to the following:

- ☆ to organize diagnostic tests and secondary care visits,
- ☆ to monitor the course of treatment and the healthcare service dates,
- ☆ to facilitate communication between the patient, treating physician, treatment team and administrative staff,
- ☆ to provide the patient with information about the next stages of therapy, available forms of support and possible accompanying measures (e.g., rehabilitation, psychological care, dietary care),
- → to ensure that the patient receives adequate information and feels comfortable throughout the therapeutic process.

In the case of lung cancer, where the diagnostic pathway is complex and requires the cooperation of multiple specialists (pulmonologist, pathomorphologist, radiologist, thoracic surgeon, clinical oncologist, radiotherapist, diagnostician), the coordinator role is **particularly important to ensure smooth and timely treatment**. Properly organized coordination allows to avoid gaps between the diagnostic and therapeutic stage, shortens the time from disease suspicion to treatment initiation, and reduces the risk of patients falling through cracks in the system.

The implementation of the National Oncology Network in 2024 made it **mandatory to hire and fund coordinators at each network center** while setting basic rules governing the functioning of this position. The coordinator should be a person dedicated to this role full-time, with adequate training in the organization of oncology care, patient communication and basic medical knowledge. The NON guidelines also emphasize the need for the coordinator to be involved in the care quality monitoring system – including by reporting on the completion of various stages of the patient pathway.

Although introducing the coordinator function is one of the most important elements of the oncology system reform, **the scope of authority and standards of work of coordinators still need to be clarified and standardized nationwide**. At many centers, these tasks are still performed by nurses or administrative staff as part of additional duties, which limits the effectiveness of this function. A fully professional coordinator role should include **both organizational support, as well as providing adequate information and emotional care** for the patient and their family. Standardization of competencies and providing adequate personnel resources in this area are prerequisites for the NON system to achieve its goals – to provide consistent, effective and accessible oncology care for every patient in Poland.

Target model for comprehensive patient care

The target and recommended direction for the development of the lung cancer care system in Poland is the establishment of **specialized competence centers - *Lung Cancer Units (LCUs)***. This model is based on an integrated, multispecialty care structure that brings together all the key elements of diagnosis, treatment and monitoring of a lung cancer patient in a single facility. Its goal is to **provide the patient with a comprehensive and coordinated therapeutic pathway**, including, among others, imaging and molecular diagnostics, eligibility confirmation provided through a multidisciplinary consultation meeting, surgical, systemic and radiotherapy treatment, as well as rehabilitation and psychological care.

As a result, the patient is managed by a single team of specialists, according to a common treatment plan and established standards of management.

In practice, this means eliminating one of the biggest problems in Polish oncology – **the dispersion of care and the lack of smooth transition between the stages of diagnosis and treatment**. The LCU will not only shorten the time between disease suspicion and initiation of treatment but also provide full continuity of care after causal therapy – including monitoring of treatment effects, follow-up of complications, respiratory rehabilitation and support for comorbidities.

According to the model being developed, the Lung Cancer Unit should include specialists in pulmonology, thoracic surgery, clinical oncology, radiation therapy, pathomorphology, molecular genetics, radiology, rehabilitation, as well as an oncology coordinator and support and administrative staff responsible for patient pathway planning. The center should have access to modern molecular diagnostics (NGS, FISH, IHC, PCR) to personalize therapy in accordance with current international guidelines (ESMO, NCCN, IASLC).

Works on implementing the LCU model in Poland have reached **an advanced stage**. Although this solution has not yet been formally included in the catalog of guaranteed healthcare services, it has been **evaluated by the Agency for Health Technology Assessment and Tariff System** in a position paper ***Comprehensive oncological care for service recipients with lung cancer and other thoracic cancers***, published **on 30 April 2025** [97]. The report confirms the rationale for qualifying this type of care as a guaranteed healthcare service and indicates that the implementation of LCUs can bring significant clinical, organizational and economic services.

The rationale provided by the Agency emphasized that the introduction of LCUs will allow:

- → to streamline the patient pathway and reduce diagnostic and therapeutic delays,
- → increase the percentage of early-stage diagnoses, by reducing the time to access molecular diagnostics and a consultation meeting,
- → provide comprehensive treatment within a single facility, with full access to all therapeutic methods,
- → improve patients' clinical outcomes and quality of life,
- → rationalize the cost of care by reducing hospitalizations and tests repeated at different facilities,
- → and enable systemic monitoring of treatment quality and health effects.

From the patient's point of view, the operation of Lung Cancer Units means simplifying and organizing the treatment pathway – one center, one team of specialists, one treatment plan. For the health care system, this is a step toward greater efficiency, transparency and standardization of oncology care.

Introducing LCU as a guaranteed healthcare service should be treated as a priority stage in the development of the National Oncology Network and a condition for real improvement in the quality and results of lung cancer treatment in Poland.

In conclusion, the lung cancer patient pathway needs to be shortened and better coordinated, while tertiary procedures should be performed by or in cooperation with reference centers. Currently, too many patients are missing the opportunity to have effective combination treatment implemented that would allow to cure or stop the progression of the disease. Thanks to efficient diagnostic and therapeutic management based on modern diagnostic and treatment methods, patients who would have lived with advanced-stage lung cancer for several up to a dozen months just 10 years ago are now living for years, with the disease taking a chronic form.

Optimizing the patient pathway through its efficient coordination, adherence to diagnostic and therapeutic guidelines and quality control of procedures are priorities on the way to improving treatment outcomes in Poland.

4.6. Patient journey vs. system costs

The direct costs of treating lung cancer patients in Poland are steadily increasing and represent a significant burden on the budget of the Polish National Health Fund. These expenses primarily include hospital services, systemic treatment (chemotherapy, immunotherapy, molecularly targeted therapies in B.6 drug program), imaging and molecular diagnostics, as well as outpatient and palliative care (described in section 4.3.1).

Hospital services and systemic treatment account for the largest share of direct costs and their value is growing dynamically as more patients are confirmed eligible for modern therapies with high efficacy but also high unit price. Increased spending is also observed in the area of **molecular diagnostics**, which is becoming an indispensable part of the therapeutic pathway – it enables the selection of targeted treatment and immunotherapy, which results in improved treatment outcomes, but at the same time increases the initial cost of care.

However, increasing direct costs should be interpreted in the context of **clinical and social effectiveness** - modern therapies, although more expensive, lead to improved quality and length of life for patients, reduced hospitalizations, and reduced indirect costs from lost productivity and long-term care.

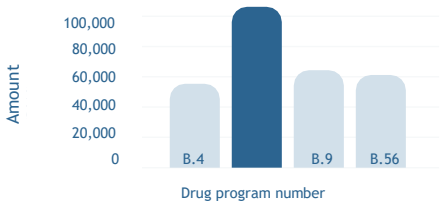
Any patient with genetic (pathogenic) changes who did not undergo a full predictive diagnostics receives therapy based on speculation, which is often less effective or completely ineffective against the cancer biology. This means not only personal tragedy for the patient and their family, but also huge costs for the system:

- → the need to fund therapies that will not work,
- → increased number of complications and hospitalizations,
- → the need for subsequent lines of treatment, which are more expensive and less effective,
- → premature deaths that generate social and economic costs (loss of working years, pensions, benefits paid by the Social Insurance Institution).

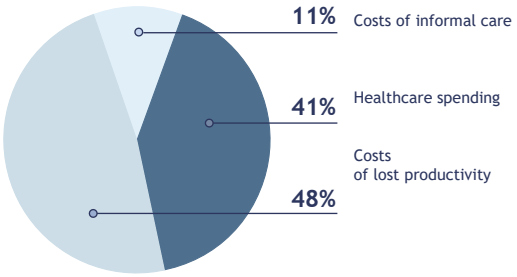
PD-L1, liquid biopsy) allows personalized (targeted, immunocompetent) treatment to be selected right away – reducing hospitalizations, reducing therapy toxicity and prolonging patient survival. It is an investment that pays off in both health and economic terms. Each month of delay in diagnosis incurs costs not only in the form of patient lives lost, but also millions to the system – because treatment in advanced stages of the disease is many times more expensive and less effective than radical therapies implemented early on.

Reducing diagnostic times is closely linked to the need to improve the organization and financing of tests by the public payer. Current regulations do not allow, for example, the billing of a molecular test performed from blood collected in the outpatient setting. Meanwhile, the analysis of free circulating tumor DNA (ctDNA) from tumor cells is increasingly used in lung cancer, and the material examined is peripheral blood (liquid biopsy). A ctDNA test can be considered – instead of a tissue biopsy – if the material cannot be collected or the tissue amount is insufficient for molecular analysis, as well as in case of disease progression in order to assess the p.Thr790Met (T790M) resistance variant. Currently, this test is reimbursed only for hospitalized patients, which is inefficient due to the additional costs associated with hospitalization and waiting time for hospital admission. This leads to delays in the diagnostic process, which in turn can affect the postponement of starting therapy.

Comparison of average reimbursement per patient in drug programs in 2023 (B.4 – colorectal cancer, B.6 – lung cancer, B.9 – breast cancer; B.56 – prostate cancer) [98]



Costs generated by lung cancer cases in Poland [99]



Oncology patients should get better access to comprehensive genomic profiling, which allows simultaneous assessment of molecular changes in several hundred predictive markers and identification of genomic signatures - such as homologous recombination deficiency (HRD), microsatellite instability (MSI) or tumor mutational burden (TMB). For non-small cell lung cancer, given its high incidence rate and poor prognosis, comprehensive NGS testing is crucial for a rapid and effective diagnosis.

Lung cancer accounts for the greatest loss of disability-adjusted life years of all malignancies and generates huge costs related to incapacity for work.

In Poland, the number of years of potential working life lost (YPWLL) due to premature death from lung cancer has decreased significantly by about 61% from 54,000 to 21,000 years between 2000 and 2021. In contrast, productivity losses due to lung cancer mortality decreased by 32%, from EUR 9.3 to 6.3 per capita (prices and exchange rates for 2021, unadjusted for purchasing power parity) [100]. However, they still remain very high.

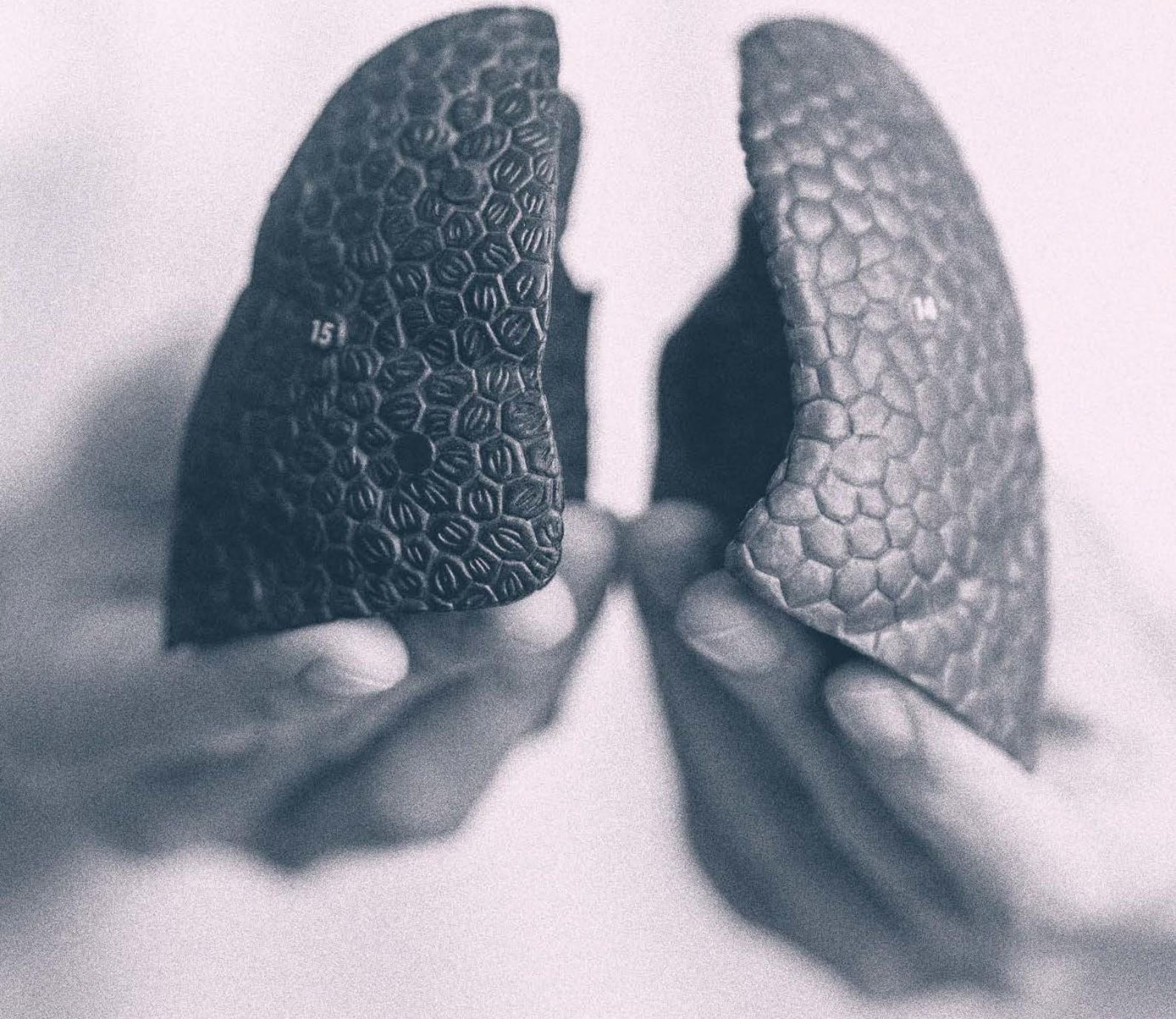
It is worth noting that the National Oncology Strategy assumes reimbursement in Poland of at least 90% of the anticancer drugs available in the EU by 2030. It should be emphasized that in terms of reimbursement availability, more than 50% of the drugs recommended by ESMO are currently reimbursed [101].

Comparison of average reimbursement per patient in drug programs in 2024 (B.4 – colorectal cancer, B.6 – lung cancer, B.9 – breast cancer; B.56 – prostate cancer) [102]

Program number	Name of the drug program	Scope code	Number of patients	Total payer expenditure on drug programs	Average payer expenditure per patient
B.4	Treatment of patients with advanced colorectal	03.0000.304.02	5,551	291,416,780	52,498
B.6	Treatment of non-small cell or small cell lung cancer	03.0000.306.02	12,200	1,294,870,414	106,137
B.9	Treatment of patients	03.0000.356.02	14,476	1,376,391,529	74,496
B.56	Treatment of patients with castration-resistant prostate cancer	03.0000.356.02	36,073	406,623,301	57,924

ELEMENTS OF EFFECTIVE PREVENTION AND LUNG CANCER PATIENT MANAGEMENT

05



5.1. Health education

In recent years, a holistic approach to human health has gained importance; it is based on comprehensive and personalized health care that is targeted to individual health needs. An important part of it is health education, which aims to: improve the ability to understand and use knowledge about health and individual risk factors, make health decisions, manage chronic diseases and disabilities [103].

The holistic model of health maintenance involves the following actions:

- preventing disease (prevention and education),
- increasing health potential (health promotion),
- regaining health (treatment and rehabilitation).

Health education is the conscious creation of learning opportunities, which involves various forms of communication to increase health literacy, health knowledge and developing life skills that promote individual and community health. Health education, in addition to providing information, is designed to strengthen motivation, skills and personal efficacy in taking action for health [104].

In 2024, the Ministry of Health and the Ministry of Education announced the start of works on a new school subject called health education. The subject will be taught in primary and secondary schools starting in September 2025. Health education will replace family education. The subject is intended for students in grades IV-VIII of elementary schools, as well as in grades I-III of secondary schools – general high schools, technical high schools, industry first degree schools. The health education program is to include, among others, elements related to addiction prevention, including tobacco smoking and the use of other nicotine products.

5.1.1. Scope and principles of health education

The main goal of health promotion is to share knowledge on how to control various determinants of health. It involves planning activities that empower people to learn about health to gain health skills and make a conscious decision to change their behavior for health benefits.

Health determinants [105]

OGÓLNE WARUNKI SPOŁECZNO-EKONOMICZNE I ŚRODOWISKOWE	GENERAL SOCIAL, ECONOMIC AND ENVIRONMENTAL CONDITIONS
WIĘZY I SIECI WSPARCIA W SPOŁECZNOŚCIACH	TIES AND SUPPORT NETWORKS IN COMMUNITIES
INDYWIDUALNY STYL ŻYCIA	INDIVIDUAL LIFESTYLE
WIEK, PŁEĆ I CECHY WRODZONE	AGE, GENDER AND CONGENITAL CHARACTERISTICS
ROLNICTWO I PRODUKCJA ŻYWNOŚCI	AGRICULTURE AND FOOD PRODUCTION
EDUKACJA	EDUCATION
ŚRODOWISKO PRACY	WORK ENVIRONMENT
WARUNKI ŻYCIA I PRACY	LIVING AND WORKING CONDITIONS
BEZROBOCIE	UNEMPLOYMENT
WARUNKI SANITARNE	SANITATION
SŁUŻBA ZDROWIA	HEALTH SERVICE
WARUNKI MIESZKANIOWE	HOUSING CONDITIONS

A person's health-related wellbeing depends on many factors, including lifestyle, which derives from choices and behaviors that are within our control. That is why it is so important to have the knowledge to make choices that promote lifelong health.

Health education in schools, addressed to children and adolescents, aims to teach the following skills [106]:

- Identify and solve health problems,
- Understand what health is, what it depends on, why and how to take care of it,
- Develop a sense of responsibility for their own health and health of other people,
- Strengthen self-esteem and confidence in one's abilities,
- Develop personal and social skills that promote wellbeing and positive adaptation to the tasks and challenges of daily life,

- Prepare to participate in health activities and create a healthy environment at home, school, workplace and in the community (health education is an important component of civic education).

The main goal of education is to prevent civilization diseases, including cancer, and therefore it includes issues concerning malignant neoplasms risk factors and factors that reduce the disease risk, included, among others, in the recommendations of the European Code Against Cancer [107], namely:

- activities to limit tobacco smoking and drawing attention to the problem of smoking-related cancers;
- promotion and implementation of activities to reduce the risk of cancer resulting from alcohol consumption;
- highlighting proper nutrition, physical activity and the need to maintain a healthy body weight as key factors in reducing the risk of developing cancer;
- activities to reduce exposure to carcinogens in the environment, place of residence and work, and drawing attention to environment care and preventing pollution;
- educational measures focusing on risk factors and early symptoms of malignant skin neoplasms, in particular malignant melanoma;
- education on the prevention of infection-related cancers;
- promotion of breastfeeding, among others, as a factor in reducing the risk of breast cancer.

5.1.2. Primary and secondary prevention

Primary prevention aims to prevent the onset of diseases (including cancer) through health education and health promotion (including, for example, preventive vaccinations).

Secondary prevention involves early detection of diseases and taking prompt corrective action to stop disease progression.

Most of the factors that increase cancer risk are influenced by individual personal lifestyle decisions, most notably by the following [108]:

- tobacco smoking - 30%
- diet - 30%
- hereditary factors - 15%
- infections - 5%
- occupational factors - 5%
- obesity and lack of physical inactivity - 5%
- alcohol - 3%
- UV radiation - 2%
- narcotics - 2%
- environmental contamination - 2%
- other - 1%

Early prevention

that is, elimination of social, economic and cultural life patterns that contribute to increasing the risk of neoplastic disease.

- in the context of lung cancer prevention: prevention of nicotine use (through legislative action, social campaigns and health education, counseling for smokers).

First phase (primary) prevention

means preventing the onset of disease by increasing individual resistance to disease (preventive vaccination, e.g., against HPV) or reducing exposure of susceptible individuals to harmful agents

- in the context of lung cancer prevention: reducing exposure to carcinogenic chemicals and some heavy metals at home and work (cadmium, lead, nickel, arsenic).

Second phase (secondary) prevention

counteracting the health consequences of the disease through early diagnosis and treatment (screening, periodic examinations, improving the effectiveness of treatment and rehabilitation).

- → in the context of lung cancer prevention: low dose computed tomography screening in high-risk groups [109].

Third phase prevention

carried out in advanced disease to counteract the symptoms severity, disability and premature death. These are measures aimed at stopping the progression or complications of an already developed disease [110].

- ☆ in the context of lung cancer prevention: recommendations for daily habits to reduce the adverse effects of treatment, follow-up tests (including predictive tests).

5.1.3. Education of medical personnel

Training medical professionals in health education is an essential component of comprehensive health care and has gained importance in recent years, which can be seen in the curricula of medical students and the emergence of new auxiliary professions (assistants, educators, coordinators).

According to the U.S. Joint Committee on Health Education and Promotion Terminology, a health educator is "a professionally prepared individual who serves in a variety of roles and is specifically trained to use appropriate educational strategies and methods to facilitate the development of procedures and interventions conducive to the health of individuals, groups, and communities".

In Poland, however, there is no official, legally defined educator profession like for example in the USA. Therefore, a degree, qualification or other credential is not required to work as a health educator.

However, training courses and postgraduate studies in this area are being offered, as part of the "health education" specialization in the public health faculty and the "health promotion and health education" specialization. Competencies and professional standards for health educators are often developed by employers/health care providers but are not derived from official standards of professional competence [111].

Nurses provide significant support in educating lung cancer patients in Poland's healthcare system. They help minimize the discomforts of the disease, educate on management during and after oncology treatment, provide psychological support to the patient and their family if the disease prognosis is unfavorable, or strengthen motivation to stop smoking. This translates into improved quality of life for patients and reduced treatment complications [112] [113].

The main goal of the nurse as an educator is to help the patient understand the disease and learn to live "anew" with cancer in order to take advantage of all opportunities and resources and feel satisfaction with life [114].

The nurse's obligation to provide health education services origins from the Act of 15 July 2011 on the professions of nurse and midwife (Polish Journal of Laws of 2011, No. 174, item 1039). The right to practice as a nurse involves providing health services, in particular:

- recognizing the patient's conditions and health needs;
- recognizing the patient's nursing problems;
- planning and providing nursing care for the patient;
- providing preventive, diagnostic, therapeutic and rehabilitation services and emergency medical activities independently within a certain scope;

- implementing physicians' recommendations in the process of diagnosis,treatment and rehabilitation;
- declaring the type and scope of care and nursing services;
- health education and health promotion.

Primary care physicians should and can play an important role in tobacco smoking prevention and patient education. As far as possible, primary care physicians should therefore use a minimal intervention with each smoking patient, based on the 5As principle: ask about smoking addiction, advise smoking cessation, assess motivation, assist the smoker to quit, arrange follow-up appointments or telephone contact to check if the smoking cessation plan is being implemented.

5.1.4. Patient education

A cancer diagnosis, including a lung cancer diagnosis, is one of the biggest challenges a patient has to face, causing anxiety, confusion and the need to change many daily habits – finding oneself in a new reality. Therefore, an integral part of fighting the disease is to properly prepare the patient for the treatment and recovery process.

Education of the oncology patient is aimed at increasing awareness of the disease itself, the diagnostic and therapeutic process and management at home, so that they can better understand their disease, its stages, treatment methods used, prognosis and possible adverse effects. This brings both clinical and social results, helps manage health problems and has a positive impact on wellbeing, recovery and satisfaction with health care.

It is important that the education of the oncology patient involves a team of experienced specialists who have the necessary knowledge and skills in the treatment and care of patients, in this case – with lung cancer.

The rapid development of cancer therapies – including immunotherapy, molecularly targeted treatments and minimally invasive techniques – has introduced a new quality in the treatment of lung cancer, but at the same time requires a change in the organization of patient care.

Immunotherapy, despite its efficacy, is characterized by a different toxicity profile that requires special surveillance and rapid response to adverse effects. In this context, **the role of oncology nurses as key members of treatment teams is growing in importance**.

Educating patients and their relatives about self-care, recognizing adverse symptoms and adhering to treatment recommendations is one of the pillars of successful oncology treatment. However, the current healthcare model in Poland **does not provide lung cancer patients with equal access to specialized nursing services**, despite the fact that oncology nurses are the ones qualified to continuously monitor patients, identify early adverse reactions and provide educational advice. Numerous studies confirm that **increasing the role of specialist nurses** in outpatient care can significantly improve patient outcomes and quality of life and reduce the risk of discontinuing therapy.

From an organizational perspective, it is crucial to **expand the scope of nursing advice in Secondary Outpatient Care (SOC)** to include oncology. Since 2020, it is possible to bill nursing advice in selected specialties (surgery, gynecology, cardiology, diabetology), but the lack of a similar solution for oncology patients is a significant system gap. **The introduction of oncology nursing counseling** would allow specialist nurses to carry out educational, preventive and treatment activities on their own, such as:

- preparing the patient for self-care and self-nursing during and after treatment,
- prevention and early recognition of side effects of therapy,

- skin care during radiation therapy,
- supporting patients taking oral cancer medications at home,
- safe disconnection of elastomer pumps,
- care and flushing of vascular ports.

Such a solution would reduce queues to oncologists, improve patient comfort and make more efficient use of staff resources and infrastructure. In addition, oncology nurses could support patients with remote contact and rapid response to health alerts.

The proposed changes are in line with the recommendations of **the Polish Association of Oncology Nurses** and the standards of the WHO and European nursing societies, which indicate that **strong oncology nursing is a prerequisite for effective, integrated care for cancer patients**.

The implementation of oncology nursing counseling within the SOC should be considered as a part of a comprehensive strategy to improve the quality of lung cancer care – for the benefit of both patients and the health care system.

Education of oncology patients takes place not only in the hospital or clinic, but also in the patients' living environment through various education and rehabilitation programs. An important role in the education of patients and their relatives is played by patient organizations, which provide educational meetings, support groups and help lines, implement counseling on the lung cancer patient pathway, provide psychological and dietary assistance and other services, such as the „Lung Cancer – You Can Treat It" ("Rak płuca – to się leczy") hotline [115].

5.1.5. Prevention of smoking tobacco and its substitutes among children, adolescents and adults

Cigarette smoke contains more than 7,000 chemicals, including more than 70 substances with carcinogenic effects, and their negative health effects influence not only cigarette smokers, but also those around them (passive smokers) [116].

Therefore, from a public health perspective, preventive measures should include at least these two groups.

WHO indicates that tobacco control plays an important role in global efforts to achieve the sustainable development goal of reducing premature deaths from non-infectious diseases by one-third by 2030 [117].

Smoking cessation, regardless of the presence of comorbidities and age, has been proven to be beneficial to health: it reduces the risk of many civilization diseases (including lung cancer), increases the effectiveness of radiation and cancer chemotherapy, improves the patient's wellbeing and overall health [118] [119].

Upbringing and the formation of appropriate health attitudes in society have a crucial role in the prevention of nicotine use, because measures taken from an early age with children, adolescents, young adults, as well as the elderly, are more effective. A child raised in a family or in a peer environment where smoking is not a habit, is more likely not to start smoking cigarettes or using other nicotine products.

The creation of a systemic model of primary prevention of nicotine dependence should assume (not only in the healthcare system) the existence of competent specialists who will shape the behavior of children, students and adolescents. What is important here is the role of the education system, teachers and educators, who should be involved in health prevention activities. Specialists with the right competence can be public health assistants, as well as health educators, school hygienists, people engaged in foundations and associations acting for health.

Their cooperation with the family doctor of the whole family, the primary care nurse or the dietician can have an important impact on the formation of appropriate health attitudes, including those related to active leisure, cardiovascular prevention or encouragement to do recreational sports. All of these measures, incorporated into a plan to eliminate nicotine from the patient's environment (child or adult), can help achieve this goal [120].

Scientific research proves that the chemical composition of the smoke produced by the tobacco burned in a cigarette is an extremely harmful mixture, and that exposure to it makes children and non-smokers into so-called passive smokers, which poses a serious danger to their health. Epidemiological data show common cases of respiratory cancers in people who never smoked cigarettes themselves, but for many years stayed around people who smoked.

Tobacco smoking prevention aims to reduce exposure to tobacco smoke (including both active and passive tobacco smoking) in the community by:

- ☆ preventing an increase in the number of people who start smoking;
- ☆ preventing an increase in exposure to tobacco smoke in public places;
- ☆ creating appropriate regulations to implement effective tobacco use control policies;
- ☆ increasing knowledge of the harmful effects of smoking tobacco products among children and adolescents;
- ☆ changing attitudes toward tobacco smoking, aiming to marginalize the phenomenon in society;
- ☆ increasing the number of people quitting smoking.

It is very important to tailor the message of anti-nicotine education and campaigns to the audience (children, adolescents, women, men, active smokers, passive smokers). Previous efforts to educate about the effects of smoking in schools have not been highly effective; moreover, nicotine initiation most often occurs in schools.

There is also a shift in habits from cigarette initiation toward e-cigarettes. Experts point out that it is worth building educational messages based on the voice of young people – what they would like to learn and what would convince them not to start using nicotine.

The key challenge of anti-tobacco prevention is to convince people (especially young people) that starting smoking is harmful, quitting has positive health effects and that they need to convince their own environment to change their cigarette smoking habits. Attention should also be paid to the new challenges of alternative nicotine products (heating tobacco, liquids). These products, due to the absence of tobacco smoke, do not expose bystanders to it, but they still contain nicotine, which is addictive and harmful to the human body.

Those particularly vulnerable to the consequences of tobacco smoking are the person already diagnosed with oncological or cardiological diseases. For example, the effectiveness of cancer treatment is reduced by about 15% if the patient continues to smoke. It also causes more side effects and adverse reactions, difficulties in wound healing, or increased radiation-induced reaction. In addition, studies of patients treated for early-stage lung cancer indicate that continued smoking increases the risk of cancer recurrence by 86%; in patients with advanced disease, active smoking increases the overall risk of death by 50%, and the risk of cancer-related death is increased by 60% [121]. In patients undergoing surgical treatment for lung cancer, cigarette smoking increases the risk of infectious complications, bronchopleural fistulas and chemotherapy failure due to drug resistance or fluctuations in drug concentrations. Therefore, smoking cessation education and support should also apply to oncology patients.

5.1.6. The role of patient organizations in educating patients and their relatives

Patient organizations are playing an increasingly important role in the oncology care system, complementing the efforts of public institutions and medical professionals to educate, communicate and support patients. They are a key component of civil society, involving patients, their families and experts in improving the quality of life and care of people with lung cancer.

Their activities include, among others, **health education, promotion of lung cancer prevention and early detection tests, emotional and psychological support** for patients and their relatives, as well as representing the voice of patients in dialogue with decision-makers.

Through public campaigns, webinars, educational publications, hotlines and support groups, patient organizations enable a better understanding of the disease, available treatments and patient rights. Such initiatives significantly empower patients, improve their orientation in the healthcare system and enable faster access to adequate help. Thus, in practice, the activities of patient organizations are becoming not only a supplement, but also **an important element of comprehensive oncological care in Poland**.

There are currently several organizations in Poland that bring together lung cancer patients and their relatives or carry out educational activities. Some of the most recognizable initiatives include, among others, Lung Cancer Section of the YOU CAN TREAT IT Foundation (Sekcja Raka Płuca Fundacji TO SIĘ LECZY), Lung Cancer Fighting Association (Stowarzyszenie Walki z Rakiem Płuca), Oncological Movement PARS (Ruch Onkologiczny PARS). The common denominator of their efforts is to improve communication between patients, doctors and health care institutions, and to strive for equal access to diagnostics and treatment throughout the country. These organizations also cooperate with scientific societies such as the Polish Lung Cancer Group (Polska Grupa Raka Płuca, PGRP), the Polish Society of Clinical Oncology (Polskie Towarzystwo Onkologii Klinicznej, PTOK), the Polish Oncology Society (Polskie Towarzystwo Onkologiczne) and the Polish Lung Disease Society (Polskie Towarzystwo Chorób Płuc, PTChP), so that their educational activities are in line with current medical knowledge, supporting the goals of the National Oncology Strategy.

At the European and global level, cooperation among patient organizations is already well established. Lung Cancer Europe (LuCE) brings together patient organizations from more than 20 countries, working for equal access to diagnostics and treatment, as well as breaking down the stigma of lung cancer patients. LuCE publications, such as the annual patient experience reports, are a valuable source of data used in shaping European Union health policies. At the international level, a similar mission is pursued by the Global Lung Cancer Coalition (GLCC), which integrates more than 40 patient organizations from around the world to promote global standards for lung cancer education, prevention and treatment. Polish organizations also cooperate with it.

The experiences of these networks shows that **the constant cooperation of public institutions, patient organizations and the scientific community** brings tangible results – increases the knowledge level of the public, speeds up diagnostics and improves compliance with therapeutic recommendations. Poland should continue to integrate patient organizations into the decision-making process, providing them with stable funding, access to epidemiological data and the opportunity to co-create health strategies. Patient organizations also act as **gatekeepers to quality of care** – they monitor patient experience, identify barriers to access to diagnostics and treatment, and make system recommendations to public authorities. Their voice is essential in shaping health policies based on the real needs of patients.

The inclusion of patient organizations in the implementation of the Lung Cancer Mission 2024–2034 is a prerequisite for effective patient education and support, as well as effective implementation of system recommendations. The patients and their experience constitute the most important benchmark for assessing the quality of oncology care in Poland.

5.2. Lung cancer prevention

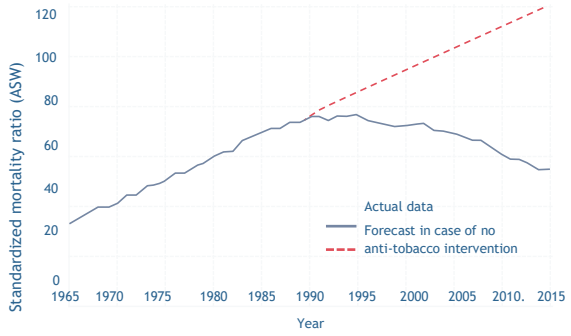
5.2.1. Population-based lung cancer screening in risk groups

The cancer strategy recommended by WHO is based on 3 main actions: primary prevention (disease prevention), secondary prevention (death prevention) and tertiary prevention (effective treatment). The least expensive prevention strategy is to reduce exposure to risk factors [122].

Lung cancer incidence shows an upward trend among women and a declining trend among men. This is primarily related to cigarette smoking trends. In Poland, the number of male smokers has more than halved since the early 1980s (63% in 1982 vs. 30% in 2014), while the number of female smokers has declined by 8 percentage points (29% vs. 21%). The decline in tobacco smoking prevalence among men has resulted in quickly noticeable mortality decline (first in younger age groups).

Previous scientific studies confirm that **lung cancer screening is most effective in people at high risk of developing lung cancer**, i.e. those who have been compulsive smokers for many years and/or have a family history of lung cancer or occupational exposure to carcinogens.

Actual and hypothetical mortality from lung cancer at the population level between 1992 and 2015 [123]



To date, the evaluation of the effects of lung cancer early detection tests is inconclusive whether the introduction of these programs affects lung cancer mortality in the general population. The main criterion for implementing screening for the entire population is the certainty that treating an earlier-detected disease yields better results at the population level, which will lower population mortality, as well as the cost-effectiveness of such treatment. The results of the Danish Lung Cancer Screening [124] and Italung [125] studies did not show a significant reduction in lung cancer mortality in the general population, while they did show such effectiveness for circulatory system diseases.

In addition, available data indicate that chest CT should be performed every 6 months for the first 2–3 years following cancer treatment, and annually thereafter. Many guidelines do not indicate after what time screening should be discontinued. Registry data from England suggest that lung cancer survivors remain at increased risk of developing a second primary cancer related to smoking for at least 10 years after initial diagnosis and in that their case routine follow-up for lung cancer should continue for 10 years [126].

A meta-analysis (including results from more than 20 clinical trials conducted between 1993 and 2023) involving 94,921 participants in 9 randomized clinical trials showed a 16% relative reduction in lung cancer mortality and a 3% relative reduction in mortality, from any cause, thanks to low-dose CT screening. A 2021 population-based prospective cohort study of 1,016,740 people in China showed that a single screening low-dose CT provides a 31% reduction in lung cancer mortality [127].

In Poland, a group of experts has prepared guidelines and recommendations for the early detection of lung cancer in the country.

They are in line with recommendations formulated for European Union countries [128]. In the Polish guidelines, great emphasis has been placed on the establishment of regional lung cancer screening centers, providing high-quality medical services that meet all quality requirements. The authors recommend forming multidisciplinary teams consisting of a radiologist, pathologist, pulmonologist, thoracic surgeon, clinical oncologist, radiation therapist, smoking cessation physician, nurse and coordinator.

The Polish screening program consists of conducting low-dose CT scans in a population at high risk for lung cancer [129]. Individuals eligible for testing are the ones who are identified for the study by screening center physicians or primary care physicians and are qualified for testing. Screening targets an asymptomatic subpopulation of a certain age (over 50–55 years) and an established minimum tobacco consumption (at least 20–30 pack-years, depending on recommendations). Additional risk factors (passive smoking, radon exposure, environmental and occupational exposure to carcinogens, non-cancerous lung diseases such as chronic obstructive pulmonary disease (COPD), idiopathic pulmonary fibrosis (IPF), history of lung cancer or cancer diagnosed in immediate family members according to some recommendations can also be considered when selecting the target group [130].

5.2.2. Oncological vigilance and the role of family doctors

Between 500,000 and nearly 1 million primary healthcare visits are made every day. Approximately 20,000–22,000 cases of lung cancer are diagnosed per year, but the number patients whose symptoms may suggest lung cancer is many times greater, so it is extremely important for the family physician to maintain oncological vigilance.

The family doctor has many important tasks in the diagnostic and treatment process.

First, prevention, including anti-nicotine intervention, or referring patients to preventive programs for low-dose CT scans, and oncological vigilance – paying attention to symptoms that may indicate cancer.

Primary care physicians should pay special attention to risk group patients:

- smokers – both active and passive,
- people suffering from chronic obstructive pulmonary disease (COPD),
- people occupationally exposed to asbestos, radon, chromium, nickel,
- patients with an atypical course of upper respiratory tract infections (e.g., recurrent, untreatable), recurrent pneumonia, and a history of long-term cough, especially if its quality has recently changed.

Other symptoms usually appear when the tumor is already quite extensive. These include, among others, shortness of breath, recurrent pulmonary infections, hoarseness, Horner's syndrome, superior vena cava syndrome or dysphagia. The first step should be a physical examination and an assessment of the symptoms reported by the patient. Symptoms, such as a change in cough nature, worse mood, and hemoptysis should always suggest the need to examine the patient and perform a chest X-ray [131].

Primary care physicians are also competent to carry out a basic diagnosis, issue a DiLO card in the case of suspected cancer, as well as the long-term management of the patient, including after the completed cancer treatment.

Importantly, for more than a year, a primary care physician can order a chest CT scan both with and without contrast, in addition to an X-ray. The patient's referral for a lung CT scan should be based on the description of changes revealed in the chest radiological scan. When referring a patient for in-depth diagnostics, the physician should be guided by the clinical picture and evaluation of previous radiological scans. Referral for a lung CT scan can be either elective or urgent [132].

When lesions suggestive of lung cancer are revealed in the tests, a DiLO card should be issued to the patient. If, on the other hand, the patient does not have symptoms, but is at risk, they should be referred for a low-dose CT scan (if they meet the eligibility criteria).

No more than seven weeks should pass between the time a patient reports with a DiLO card for diagnostics and received a diagnosis.

5.2.3. Environmental pollution and lung cancer

Research indicates that up to 99 percent of the world's population lives in places where levels of PM2.5 air pollution exceed annual WHO limits (one of the lung cancer factors).

According to the European Environment Agency (EEA), more than 10% of all cancer cases in Europe are due to exposure to environmental and occupational risks, including those associated with air pollution, passive smoking, exposure to radon, ultraviolet radiation, asbestos and other pollutants [133].

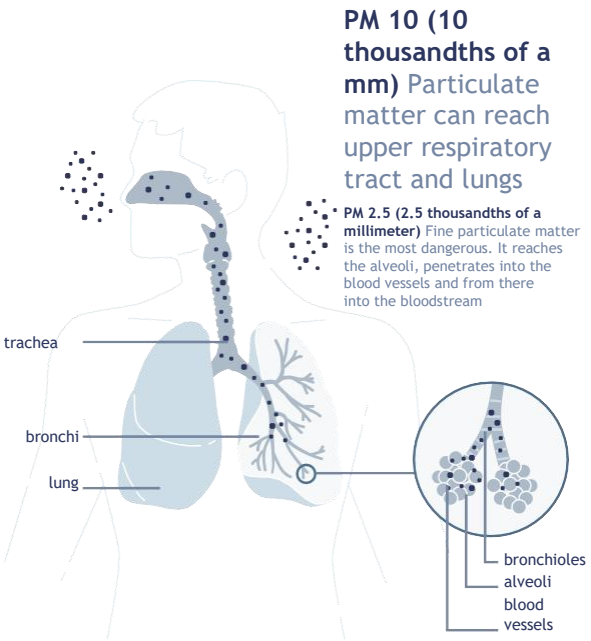
Air pollution alone accounts for about 1% of all cancer cases in Europe and causes about 2% of all cancer-related deaths. **For lung cancer, the percentage of deaths related to air pollution is much higher, estimated between 9% and 17%** [134]. In 2021, WHO updated its Air Quality Guidelines (AQG) – they recommend upper thresholds for long-term exposure to particulate matter: no more than 15 µg/m3 for PM10 and 5 µg/m3 for (PM2.5) [135].

Chronic exposure to air pollutants such as PM2.5 and nitrogen oxide has been linked to a higher incidence of not only lung cancer, but also colorectal cancer, prostate cancer and breast cancer. Researchers from University College London and the Francis Crick Institute looked at medical data collected from more than
400,000 people from the UK, South Korea and Taiwan.

Regardless of the part of the world, a higher incidence of cancer, including diseases linked to the EGFR gene mutation, particularly common in non-smoking patients, has been found among people living in areas with high concentrations of suspended particulate matter (PM2.5) in the air [136].

Researchers in the UK have recently discovered a mechanism for how air pollution causes neoplastic diseases in non-smokers. Suspended PM2.5 particles are responsible for harmful mutations, causing local inflammation in lung tissues.

Fine particulate matter in the air [137]



5.3. Lung cancer diagnostics

Efficient and comprehensive diagnosis of a lung cancer patient is key to achieving the best therapeutic effects. It is extremely important to order appropriate tests, control their quality (including collection and storage of tissue material) and conduct them in a timely manner. Otherwise, we will continue to observe a high percentage of tests that need to be repeated, which further increases diagnostic delays and limits the use of current combination treatment regimens and including patients in the drug program.

If lung cancer is suspected, the patient's examination should include a thorough history of the most common symptoms and a lung cancer risk assessment (including data on active and passive exposure to tobacco smoke, family history of cancer and exposure to harmful environmental factors). Any patient with suspected lung cancer should be interviewed and undergo a physical examination, chest scans (X-ray and CT; in justified cases – MRI and bronchofiberoscopy).

The physical examination should specifically include [138]:

- → symptoms associated with narrowing or closure of the bronchial lumen;
- → enlargement of peripheral lymph nodes (especially supraclavicular);
- → symptoms of the presence of fluid in the pleural cavity; → symptoms of the presence of fluid in the pericardial sac and myocardial infiltration;
- → symptoms of superior vena cava syndrome (swelling of the face, increased dyspnea, increased neck circumference, swelling of the upper extremities, widening of the veins in the neck and on the chest wall, bluish color of the face skin and mucous membranes);
- → hepatomegaly;
- ☆ pain on palpation of the skeletal system and chest wall;
- ☆ paraneoplastic symptoms;
- ☆ central and peripheral nervous system symptoms;
- ☆ body weight in context of normal weight.

An essential part of the lung cancer diagnostics is the assessment of performance status, which should be carried out according to the WHO/ECOG scale [139]. The occurrence of asymmetrical symptoms on physical examination of the respiratory system in a person at increased risk of lung cancer is an absolute indication for further diagnostics.

The lung specialist, after taking a history and the aforementioned tests, may abandon diagnostics or, in the case of a reasonable suspicion of lung cancer, initiate the diagnostic process (issue a DiLO card if not issued previously).

As part of the initial diagnostics, it is necessary to perform blood count with smear and check coagulation parameter, carry out biochemical tests (serum concentrations of glucose, creatinine, urea, sodium, potassium, calcium, bilirubin and the activity of transaminases, alkaline phosphatase and LDH), as well as a urinalysis. Other tests are carried out depending on individual indications.

In-depth diagnostics includes, among others, the collection of material for histological or cytopathological examination and molecular testing by bronchoscopy with biopsy or transthoracic lesion biopsy.

It is worth emphasizing that the diagnostic process should be planned and managed by setting dates and locations for subsequent services. Improving the quality of diagnostic tests constitutes a prerequisite for improving the efficiency and speed up diagnostics as well as increasing the ability of centers to provide more services. This includes imaging, endoscopic and biopsy tests, as well as pathomorphological and molecular diagnostics. Particularly important are measures to eliminate repeating examinations due to insufficient quality of previously conducted procedures or delays in their implementation.

The skills and experience of the team, as well as the quality and availability of endoscopic and biopsy equipment, are very important. We should aim that a single endoscopic procedure provides good-quality material for both microscopic diagnosis and molecular diagnostics, as well as pathomorphologic tumor staging [140].

5.3.1. Modern, fast and comprehensive

Lung cancer diagnostics comprises of multiple stages, is comprehensive and multidisciplinary, and includes:

- ☆ imaging: → chest radiological scans, chest CT scans, positron emission tomography, MRI (less frequently),
- → morphological testing: examination of material obtained by bronchoscopy, ultrasound-guided endoscopic biopsy (EBUS) and transthoracic biopsy, pleural cavity fluid examination, and, less frequently, sputum cytology,
- → laboratory tests,
- → molecular and immunohistochemical testing.

Lung cancer diagnosis is based on histological or cytological examination of material obtained from the tumor. Currently, a prerequisite for qualifying lung cancer patients for treatment is accurate tumor staging and molecular characterization (molecular testing performed for non-small cell lung cancer).

5.3.2. Imaging diagnostics

Imaging tests constitute the basis for lung cancer diagnosis. First, the physician refers the patient for a chest X-ray, which is a quick and easily accessible test.

Lung cancer is suspected when conventional chest X-ray in posterior-anterior and lateral projections shows [141]:

- → circular shadow (a fully solid lesion, partially solid lesion or the so-called ground-glass opacities);
- → changes in the cavity outline;
- → aeration disorders (asymmetry, atelectasis);
- → infiltrative lesion;
- → presence of fluid in the pleural cavity.

It should be noted that a normal conventional X-ray result does not rule out a tumor located in areas with restricted access (such as the apex of lung or mediastinum) or the presence of a small endobronchial lesion. Therefore, all patients with suspicious symptoms should have a chest CT scan with intravenous contrast administration (the scan should additionally include the upper abdomen with adrenal glands).

In special situations (such as a tumor of the superior thoracic aperture or a lesion in close proximity to the vessels), a chest MRI is also indicated. In some cases, a positron emission tomography (PET) scan is also indicated combined with CT (PET-CT), which plays an important role in differentiating between benign and malignant lesions and providing indications for other tests or further follow-up.

PET-CT is helpful in assessing the extent of the tumor before planned surgical treatment and radical irradiation (greatest diagnostic accuracy in evaluating the mediastinal lymphatic system and detecting distant metastases). PET-CT should be performed in all patients qualified for surgical treatment and radical radiotherapy or radiochemotherapy.

Brain scans are performed before planned radical treatment (grade II and III patients before parenchyma resection and grade III patients before combined radical radiochemotherapy). Other patients – only in case of suspicious symptoms. However, skeletal evaluation (scintigraphy or X-ray) is indicated in patients with symptoms suggestive of metastases.

Bronchofiberoscopy in patients with suspected lung cancer:

- → is essential to qualify for surgical treatment;
- → provides the opportunity to obtain cytological or histological material;
- → is helpful in assessing cancer staging.

Patients in the B.6. drug program undergo diagnostic imaging in accordance with the program's current recommendations [142].

5.3.3. Staging

The next step of lung cancer patient diagnostics is to determine the tumor's histology. A tumor fragment, depending on its location, can be taken during bronchoscopy. In the case of a tumor located near the chest wall, material for microscopic examination can be obtained by biopsy, that is a puncture through the chest wall (known as a transthoracic biopsy), usually under CT guidance.

If the diagnosis and/or tumor type cannot be confirmed using the methods described above, it is sometimes necessary to perform a surgery – opening the chest (thoracotomy) or inserting special instruments into the chest (video-assisted thoracoscopic surgery) to definitively confirm the cancer diagnosis and plan appropriate treatment. Taking a fragment of tumor tissue is also necessary for further testing, namely molecular testing.

Lung cancer staging includes TNM assessment of the primary tumor (T feature), regional lymph nodes (N feature) and organs where metastasis may occur (M feature).

In patients qualified for radical treatment, it is necessary to determine the size and location of the primary tumor and its relation to surrounding anatomical structures (chest wall, pleura, diaphragm, heart, large vessels and esophagus) and the status of regional lymph nodes.

The clinical severity of non-small cell lung cancer (NSCLC) is determined by a combined assessment of TNM features. At the time of NSCLC diagnosis, the percentage of patients assessed as grade I-II, III and IV is about 25%, 35% and 40%, respectively.

Until recently, a simplified classification was used in staging small cell lung cancer (SCLC) that distinguished between a limited disease (LD) and extensive disease (ED). Currently, both in SCLC and NSCLC, the TNM classification is recommended. At the time of cancer diagnosis, the incidence of grade I-III and IV SCLC according to TNM is about 35% and 65%, respectively.

In accordance to clinical guidelines, in patients with lesions visible in the bronchial lumen, at least 5 specimens should be taken. Brushing and collection of bronchial washings can increase the diagnostic value of the primary biopsy method, which is a forceps biopsy. The use of EBUS allows performing an efficient and safe needle biopsy of various mediastinal lymph node stations and central tumors located outside the bronchi.

In lung cancer patients undergoing parenchyma and lymph nodes resection, the final severity is determined by pathomorphological examination of the surgical material. The "pathological" stage determined in this way (pTNM) is more accurate and reflects the patients' prognosis better than the staged determined clinically.

Before planned surgical treatment and radical radiotherapy or radiochemotherapy, it is also necessary to assess the risk of cardiovascular complications and determine the ventilation and gas exchange efficiency of the lungs. History, physical examination, electrocardiography, and if indicated, echocardiography, exercise electrocardiography and coronarography play an important role in estimating the risk of cardiovascular complications. Spirometry is the test used to assess lung ventilation, and the most important indicator used in qualifying for surgery is forced expiratory volume in one second (FEV1). The tests should be performed on every patient before planned surgical treatment, as they are critical for planning further management [143].

5.3.4. Pathomorphological diagnostics

Modern personalized approach to lung cancer treatment requires the use of advanced, comprehensive pathomorphological and molecular diagnostics. Precise histological evaluation of the tumor and identification of genetic abnormalities, allows for individualized therapy planning and full use of the rapidly increasing effectiveness of available treatment options.

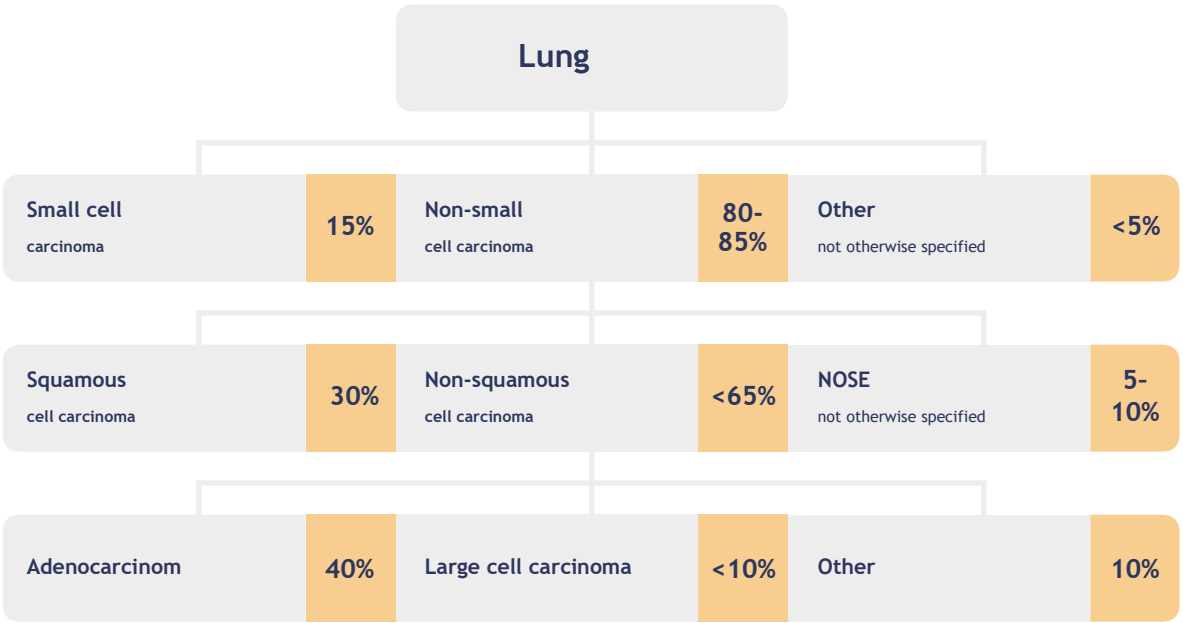
It should be noted that what is important in this process, is the proper organization, quality and coordination of diagnostic testing to ensure their timely performance. The smooth diagnostics is determined by, among others:

- ☆ adherence to recommendations for material (tissue) collection and fixation;
- ☆ access to comprehensive molecular diagnostics methods – adequate funding for necessary procedures (like next-generation profiling, blood tests);
- ☆ cooperation between specialists and centers that diagnose and treat a patient and the efficient information sharing;
- ☆ training and development of qualified medical staff;
- → appropriate procedures and equipment for pathomorphology/genetic diagnostics departments.

In lung cancer, the result of the pathomorphological examination should involve the determination of the histological tumor type and subtype, and in the case of post-operative examination should involve lung cancer diagnosis (histological type and subtype and malignancy grade), lymph node, blood vessels and lymphatic vessels status determination, surgical margin and tumor grade assessment in accordance with the current pathomorphological classification.

The pathomorphological diagnosis of lung cancer should be supplemented with the results of immunohistochemical and genetic tests to detect abnormalities that determine the type of systemic treatment.

Standardization and quality of pathomorphological diagnostics are one of the pillars of effective oncological treatment. Cancer diagnosis, the decision to use immunotherapy or targeted therapy, and qualification for the drug program are based on the result of the pathomorphological and molecular testing.



In Poland, the accreditation process for pathomorphology departments – which was supposed to ensure high quality standards, uniform procedures and reliability of results – **has not yet been fully implemented**.

A pilot program for accreditation of Pathology Diagnostic Units (Jednostki Diagnostyki Patomorfologicznej, JDP) by the **Center for Quality Monitoring in Health Care (Centrum Monitorowania Jakości, CMJ)** began in 2019. The goal of the program was to develop and test a model for assessing the quality of facility operations, including compliance with the requirements of PN-EN ISO 15189 and national quality standards. As part of the pilot program, 40 pathomorphology departments (both hospital and private) were certified, but the **program was not continued after the pilot phase**, and a formal accreditation system was not included in the current regulations.

As a result:

- → in many cases, certification by CMJ obtained under the pilot program **may expire** (usually 3 years after issuing),
- → new units **do not have the opportunity to obtain accreditation**, as there is currently no legal and organizational path to carry out the process,
- → the lack of accreditation **makes it difficult to standardize diagnostic procedures**, including quality control of specimen, equipment, reagents and processes for archiving biological material.

This situation has **direct consequences for patients and facilities**. According to the National Health Fund's guidelines, **funding for certain predictive tests – including PD-L1 expression assay – is only available to accredited pathomorphology departments**. In practice, this means that uncertified centers cannot bill this service under a contract with the National Health Fund, despite having adequate technical facilities and competent staff. This results in unequal access to diagnostics: some patients have to wait longer for the result, samples are sent to other centers, and the time needed to start treatment increases.

The lack of an up-to-date accreditation system also makes it difficult to **monitor the quality and efficiency** of pathomorphology diagnostics at the national level. The data reported by the laboratories is inconsistent, and the lack of external audits limits the ability to assess compliance of results with current standards. In the long term, this not only threatens the reliability of test results, but also hinders the implementation of modern diagnostic technologies such as comprehensive genomic profiling (NGS/CGP), which requires high quality control and validation. For several years, the expert community has been calling for the **reactivation and statutory authorization of a national accreditation system for Pathology Diagnostic Units**, covering both public and private facilities, with a central registry of certified units and a system of regular audits. The establishment of a permanent, mandatory accreditation mechanism is a necessary step toward improving the quality of oncology diagnostics, treatment efficiency and patient safety.

According to current information, the Ministry of Health has no plans for mandatory certification of Pathology Diagnostic Units. According to Article 26 (1) of the Act of 16 June 2023 on the Quality in Healthcare and Patient Safety (Polish Journal of Laws 2023, item 1692), an entity may apply for accreditation, which means that obtaining accreditation is voluntary. Any entity is entitled to voluntarily apply for accreditation and undergo an accreditation review to obtain an accreditation certificate. The Accreditation Council is currently working on developing accreditation standards for pathomorphology, based on the results of the pilot program implemented under the POWER project in 2022–2023. Currently, comments to the document are being implemented and after that it will be published in the form of a Minister of Health's notice. Then it will be possible to initiate the procedure for JDP reaccreditation.

5.3.5. Molecular and immunohistochemical diagnostics

Molecular diagnostics and **PD-L1 expression testing** are now **the standard of care for patients with non-small cell lung cancer (NSCLC)**. They are essential in qualifying for **personalized treatment**, i.e. selecting an appropriate therapy for the biological profile of a particular cancer. The results of these tests condition patient's eligibility for modern targeted therapies or immunotherapy/immunochemotherapy, which significantly improve the patient's prognosis and quality of life. Learning about the molecular biology of NSCLC, especially the discovery that pathogenic variants or other oncogene abnormalities occur in more than half of all adenocarcinomas, has revolutionized the diagnostics and, at the same time, the treatment of this cancer.

The main pathogenic variants found in NSCLC are:

- **EGFR** gene mutations (10–15%);
- **KRAS** gene mutations (25%);
- rearrangement of the **ALK** gene (2-4%);
- rearrangement of the **ROS1** gene (1–3%);
- **BRAF** gene mutations (1–5%);
- Neurotrophic tyrosine receptor kinase (**NTRK**) gene fusion (0.2–1%);
- **MET** gene mutation or amplification (2–5%); ☆ **RET** gene mutation or fusion (1–3%);
- ☆ human epidermal growth factor receptor 2 (**HER2**) mutation (2–5%) [144].

They are responsible for tumor development, which, however, can be **inhibited with precise molecularly targeted treatment**. It is much more effective than conventional chemotherapy and usually carries a lower risk of adverse effects.

PD-L1 testing by immunohistochemistry (IHC) allows determining whether a patient may benefit from immunotherapy in monotherapy or in combination with chemotherapy, either perioperatively or as the first and subsequent line of treatment, depending on tumor staging and the outcome of molecular diagnostics.

Importantly, the new algorithms for lung cancer management require a thorough analysis of each case, the **performance of comprehensive diagnostics** and the evaluation of results during treatment. Due to the complexity of genomic data (molecular testing), consultation with clinical experts, pathomorphologists and genetic diagnosticians is essential.

The qualification of grade II or III patients should now consider the possibility of perioperative treatment in multidisciplinary teams at the stage of preliminary diagnosis, i.e. before the start of causal treatment, based on the results of the following diagnostic tests:

02 **pathomorphological**
02 **evaluation, imaging,**
02 **molecular, immunological and**
02 **immunohistochemical testing.**

This allows for proper assessment of tumor type, stage, and the presence of pathogenic variants and to qualify the patient for the therapy from which they will gain most clinical benefit.

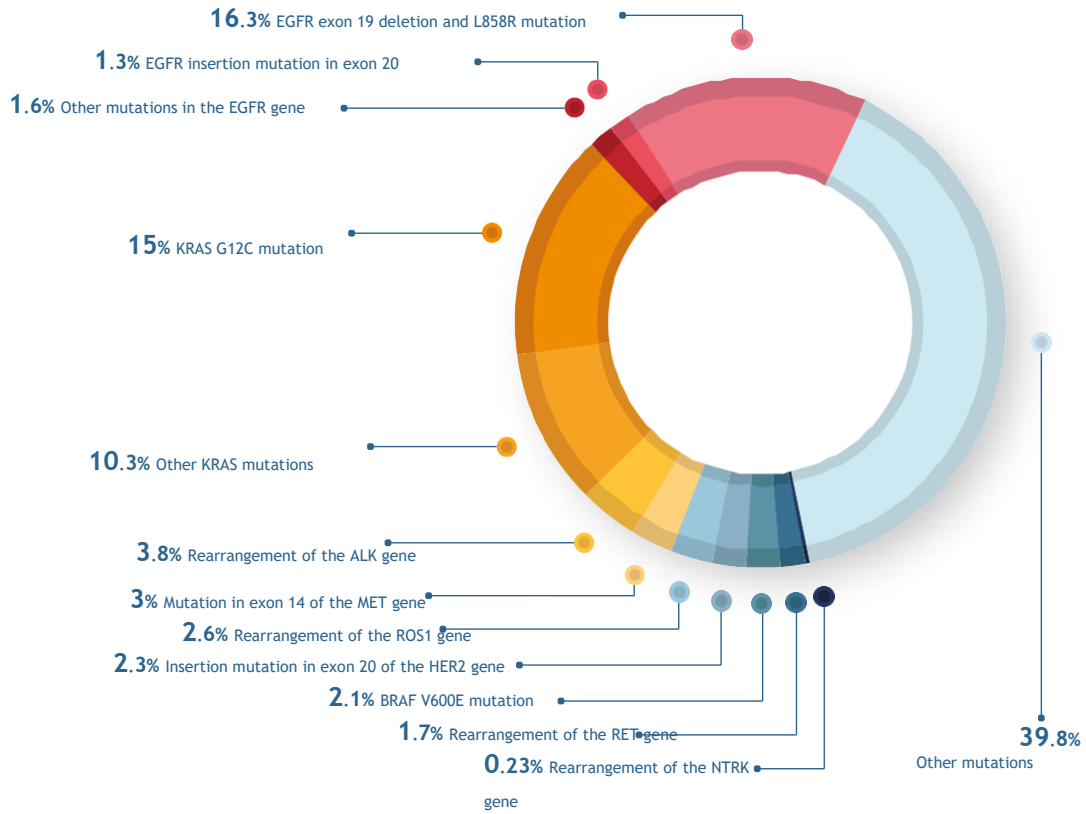
At present, the **NSCLC diagnosis, non-squamous subtype** (adenocarcinoma, large cell carcinoma, NOS) **requires at least testing** the following genes:

- ***EGFR*,**
- ***ALK*,**
- ***ROS1*,**
- ***NTRK1,2,3*,**
- ***KRAS* (G12C variant)** and
- **PD-L1** expression (immunohistochemistry assay)

However, the list of currently recommended variants also includes:

- *BRAF*,
- insertions in exon 20 of the EGFR gene,
- *RET*, *NTRK (1, 2, 3)*,
- *HER2*,
- *FGFR (1, 2, 3)*,
- *MET* (fusions or mutations involving exon 14 skipping).

Prevalence of pathogenic variants in NSCLC (2022 data) [145]



In almost all cases where abnormalities in the above genes are detected, effective treatments are already available or advanced clinical trials are being conducted for which the patient may qualify.

Molecular testing is divided into basic, complex and advanced, depending on the scope of analysis:

- → **basic** (e.g., analysis of a single gene or its fragment, allows detection of a known mutation in a specific gene, methods used: e.g., PCR – EGFR or KRAS gene analysis),
- → **complex** (e.g., a panel of multiple genes or cytogenetic analyses, simultaneously tests a group of genes that are associated with specific diseases or traits, such as FISH for 2–3 rearrangements or a panel of 6–40 amplicons/small NGS),
- → **advanced** (e.g., next-generation sequencing [NGS], which allows for testing of multiple genes and alterations in genetic material at the same time),
- ☆ **comprehensive genetic diagnostics** (e.g., the NGS CGP testing, which is not reimbursed in lung cancer; comprehensive genetic diagnostics in Poland is mainly used to assess germinal predisposition) – separately contracted services

Differences between the scopes of molecular (genetic) testing:

- ☆ **scope of analysis:** from a single gene to the entire genome;
- ☆ **information spectrum:** the more advanced the testing, the more information can be obtained about potential health problems;
- ☆ **application:** basic tests are targeted, complex NGS panels allow broader analysis, and advanced/complex NGS/CGP panels allow analysis of multiple genes and detection of different classes of changes (rearrangements/fusions, amplifications; signature analysis).

Predictive biomarkers in non-small cell lung cancer vs. type of therapy [146]

Biomarker	Medications
EGFR	TKI (1st, 2nd, 3rd generation)
ALK	TKI (1st, 2nd, 3rd generation)
ROS1	TKI
BRAF V600	BRAF serine-threonine kinase inhibitor
MET	TKI
RET	TKI
PD-L1	Monoclonal antibodies
NTRK	TKI
KRAS p.Gly12Cys (G12C)	KRAS GTPase inhibitor
EGFR insertions in exon 20	Monoclonal antibodies
Negative testing for EGFR, ALK	Monoclonal antibodies
Negative testing for EGFR, ALK, ROS1	Monoclonal antibodies

Currently, treatment effectiveness in patients with NSCLC receiving molecularly targeted therapy is monitored using:

- clinical evaluation (physical examination and history),
- imaging assessment (usually CT scan) and RECIST 1.1 response score.

The results of molecular testing should be obtained in the shortest possible time, which should not exceed from the time the material is received [147]:

- 10 working days for qPCR and Sanger sequencing,
- 20 working days for NGS,
- 10 working days for FISH.

Liquid ctDNA biopsy

Dynamic molecular monitoring – especially liquid biopsy (ctDNA) – is the direction of oncology care development, but its widespread use in Poland requires systemic solutions.

Importantly, **even in more than 30% of patients with NSCLC, there is no tissue for further molecular testing or the tissue from the paraffin block is non-diagnostic** [148, 149, 150, 151]. In these cases, liquid ctDNA biopsy is used.

It is a minimally invasive procedure, and research confirm that if the tumor is relatively large, it releases enough nucleic acids into the bloodstream to make the ctDNA test results reliable. The concordance of the two testing methods from tumor tissue and ctDNA testing now reaches 70–90% [152, 153]. In addition, ctDNA testing is currently the only minimally invasive molecular method that allows continuous monitoring of the treatment process and identification of molecular resistance mechanisms developed during therapy. This is clinically as well as pharmacoeconomically important (avoiding the administration of high-cost treatment when it is not ineffective).

Extensive monitoring of treatment efficacy and assessment of resistance mechanisms **using free circulating tumor cell DNA testing technology** is not yet a standard practice. In Poland, as in many other countries, such solutions are only being introduced in selected centers as part of clinical trials or pilot programs. Analysis of circulating DNA allows non-invasive assessment of the molecular tumor profile, and thus allows faster detection of emerging resistance mutations, monitoring of minimal residual disease, or early confirmation of disease progression before it becomes apparent on imaging studies.

An example of a molecular test used in monitoring resistance to lung cancer treatment, which can already be performed in Poland by liquid biopsy, is the evaluation of the EGFR p.Thr790Met (T790M) mutation, the so-called resistance mutation, which is the most common cause of progression during treatment with first- or second-generation tyrosine kinase inhibitors (TKIs). If detected, a third-generation inhibitor is used to break the mechanism of resistance to treatment, which significantly prolongs patients' life.

However, liquid biopsy is increasingly being used worldwide for a broader panel of tests – including mutations in other genes (e.g. KRAS, BRAF, MET, HER2), rearrangements (ALK, ROS1, RET)
or assessment of mutations in the context of immunotherapy (e.g. tumor mutational burden (TMB) indicators). In Poland, such tests are not systemically funded, which limits their use in daily practice.

The use of circulating tumor DNA testing can be considered in certain clinical circumstances [154]:

- → due to the patient's condition, which prevents invasive tissue sampling,
- → in the absence of sufficient tissue for molecular analysis,
- → for clinical trials – plasma ctDNA testing is a useful, minimally invasive test that can be used to identify many genes, including: *ALK*, *BRAF*, *EGFR*, *HER2*, *MET*, *RET*, *ROS1*
  and others that would not be identified in patients with metastatic NSCLC but may qualify for further therapy, including experimental therapies.

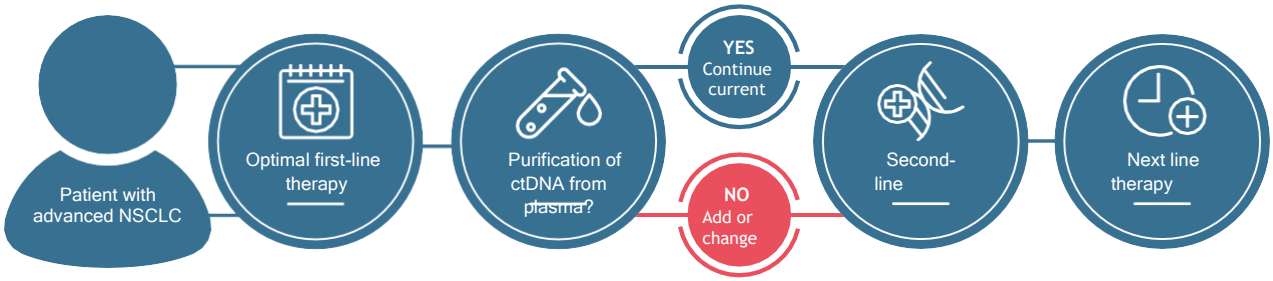
In Poland, **multigene NGS molecular testing using liquid biopsy** are still **not reimbursed** (single gene ctDNA tests are used on a very limited basis) in the case of missing or non-diagnostic tissue.

Comprehensive genomic profiling (CGP)

Comprehensive genomic profiling (CGP) based NGS technology as an advanced diagnostic technique enables the simultaneous evaluation of hundreds of genes with known links to cancer processes, and allows to detect:

- → substitution,
- ☆ insertions and deletions,
- ☆ gene copy number changes,
- → gene rearrangements (gene fusions), ☆
  genomic signatures: TMB, MSI, HRD.

The future of monitoring the effectiveness of molecularly targeted NSCLC therapies using liquid biopsy [155]



CGP is increasingly used in oncology, especially in lung cancer or ovarian cancer, due to the steady increase in the number of significantly clinical biomarkers.

As shown in a study comparing the use of CGP for EGFR, ALK, ROS1 cascade testing, CGP technology allowed to discover additional variants in up to 30% of patients [156]. Importantly, the use of CGP technology also translates into an increase in the median survival time of patients (median OS in the CGP cohort was: 15.7 months and in the cohort diagnosed with NGS panels: 7.0 months) [157].

The use of CGP NGS brings tangible benefits in clinical practice:

- allows to **test many more predictive** and prognostic **markers**,
- enables **more clinically effective therapeutic decisions** – quicker selection of effective treatment,
- **allows to increase the proportion of patients eligible for effective therapies** – data from registries (e.g. FoundationCORE, BFAST trials) show that **in an additional 10-20% of patients** CGP detects lesions that would not be identified in classical panels – these individuals can receive high performance treatment. In practice, this can mean better treatment outcomes, fewer hospitalizations, and lower costs of treating complications,
- **avoiding repeat biopsies and associated costs -** CGP (including the liquid biopsy version) minimizes the need to re-take tissue, which is associated with the risk of complications and additional costs (hospitalization, diagnostic imaging, post-procedure care),
- **saves material for further testing** (minimizes the risk of running out of tissue material for testing),
- provides **the opportunity to detect multiple somatic and germline variants in DNA**,
- allows to optimize the cost of treatment.

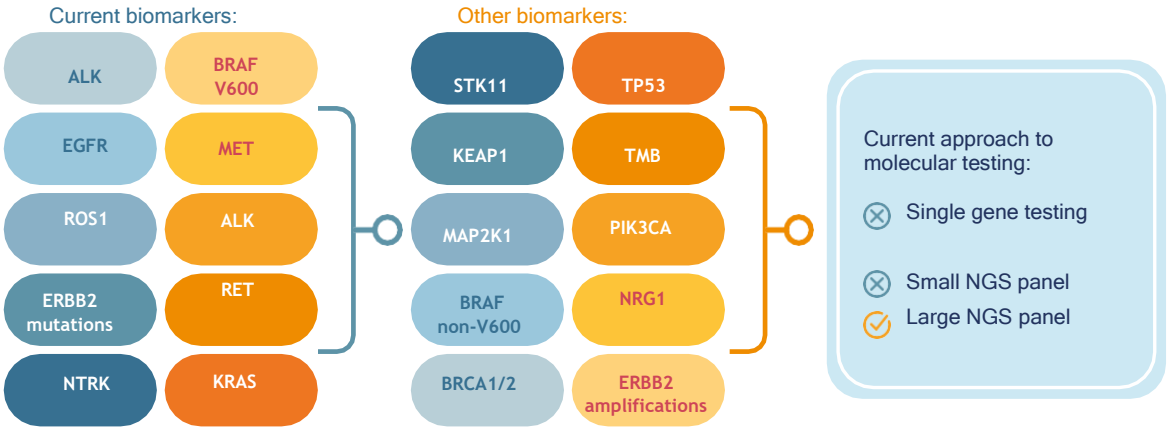
However, it should be noted that this test requires the molecular biology diagnostic team to have special skills in interpreting the results. All this affects the time needed to perform the test and submit the result, which is important in the treatment of oncology patients and should therefore be reflected in the form of **a new reimbursement product**. It seems reasonable that **this test should be performed in specialized centers, where patients will be provided with an optimal treatment plan** based on its results. Particularly important would be access to CGP NGS technology at the Centers of Excellence for Lung Cancer Diagnosis and Treatment, the so-called Lung Cancer Competence Centers (Lung Cancer Unit, LCU).

When is it reasonable to use CGP NGS?

- Already at **the stage of diagnosis of advanced unresectable NSCLC**,
- CGP technology is also recommended when **histologic material is limited** or when **single gene/gene panel testing shows no alteration**, in order to avoid repeated biopsy and effectively use available tissue material,
- In situations where tissue biopsy is difficult, risky or impossible, liquid biopsy (CGP using circulating tumor DNA, provides a valuable, less invasive method to supplement diagnostics.

The timing of molecular diagnostics is critical to the feasibility of targeted therapies for patients with NSCLC. As shown in the 2024 US study [158], more than 75% of patients received targeted therapy for a CGP test result obtained before first line of treatment, while in the case of prolonged genetic diagnostics – only 25%.

Directions for development in CGP genomic profiling [159]



It is worth recalling that on the initiative of the Polish Society of Oncology (Polskiego Towarzystwa Onkologicznego, PTO) in 2022, a **Healthcare Service Charter** (Karta Świadczenia Opieki Zdrowotnej) was established regarding ***comprehensive genomic profiling by high-throughput next-generation sequencing*** **(NGS)** in the molecular diagnosis of patients with malignant neoplasms. At the same time, the PTO has prepared guidelines for practicing physicians on how to order this test and how to bill for it. In September 2023, the Agency for Health Technology Assessment and Tarification (AOTMiT)
[160] issued a report analyzing the introduction of CGP in Poland, where it indicated the conditions for providing the service. The National Consultant for Clinical Oncology and several scientific societies, including the Polish Lung Cancer Group (Polska Grupa Raka Płuca) and the Polish Personalized Medicine Coalition (Polska Koalicja Medycyny Personalizowanej), supported this solution. Unfortunately, despite the announcement of the Ministry of Health, to date the service has not been added to the portfolio of guaranteed healthcare services.

In this context, it should be noted that the use of NGS and CGP multigene panels is not only clinically but also economically justified. For example, **the average cost of a CGP** in Europe amounts to a few thousand zlotys (about 9,000 PLN), while the **cost of targeted therapy** or immunotherapy can reach tens of thousands of zlotys per month, and treatment can last for months or years, ultimately generating a cost to the payer of hundreds of thousands to millions of zlotys per patient. According to the research, it is possible to achieve 21% savings in the unit cost of the test per patient [161].

Implementing treatment without full molecular knowledge can result in:

- → funding therapies that will not work,
- ☆ increased number of complications and hospitalizations,
- → the need for subsequent lines of treatment, which are more expensive and less effective,
- ☆ premature deaths that generate social and economic costs (loss of working years, pensions, benefits paid by the Social Insurance Institution).

In contrast, comprehensive and rapid diagnostics (NGS, CGP, PD-L1, liquid biopsy) allows personalized (targeted, immunocompetent) treatment to be selected right away - reducing hospitalizations, reducing therapy toxicity and prolonging patient survival.

It is an investment that pays off in both health and economic terms. Each month of delay in diagnosis incurs costs not only in the form of patient lives lost, but also millions to the system - because treatment in advanced stages of the disease is many times more expensive and less effective than radical therapies implemented early on.

Monitoring of patients with cancer progression

In the case of NSCLC progression in patients treated with targeted therapy, **repeat molecular testing by NGS** and, in justified cases, **CGP** is **crucial for further therapeutic management**.

Targeted therapies work only as long as the cancer depends on a specific molecular pathway. As treatment continues, the cancer may develop resistance to existing treatment, which causes **resistance to the drug used**. Without performing molecular testing after disease progression, it is **impossible to determine the resistance mechanism**, and thus to select the next effective therapy. Detection of a new mutation or activation of an alternative pathway (e.g., **MET amplification**, **HER2** mutation, **RET** or **NTRK** rearrangements) may make it possible to **change the patient's treatment with another available targeted therapy** - also under drug program B.6, B.144 or a clinical trial.

In this case, the recommended method for molecular diagnostics is NGS, which allows **simultaneous testing of multiple molecular markers** from a single sample, and FISH or IHC (e.g., to assess MET amplification). Optimization of predictive testing is extremely important in a frequent situation when biopsy material is limited.

Unlike single-gene tests, which use the material gradually and can finally use it up, **NGS** allows for **rapid, comprehensive molecular analysis**, increasing the chance of finding new pathogenic variants. It is also possible to do a NGS panel using ctDNA. In more complicated cases, especially after multiple lines of treatment, **comprehensive genomic profiling (CGP)** may now be considered – the analysis of up to several hundred or thousands of genes simultaneously (this test is not currently reimbursed).

This enables the identification of new therapeutic targets and qualification for clinical trials.

Simultaneous (conditional) referral for molecular (genetic) testing

A common practice to issue a simultaneous (conditional) referral for molecular testing together with a referral for pathomorphological testing would simplify and accelerate the diagnostic pathway for lung cancer patients – with the assumption that it will be used only if there are indications arising from the analysis of histopathological material.

Then, the pathomorphologist or clinician would use the molecular testing order based on the clinician's prior referral – without the need for additional visits and paperwork.

Such a model **significantly reduces the time between diagnosis and qualification for treatment and ensures diagnostic continuity**. At the same time, it does not lead to overuse of molecular testing, since it is performed only after a pathomorphological diagnosis is obtained, in clinically justified cases, in accordance with existing guidelines for specific types of cancer.

> Currently, in many centers, referral for molecular testing is issued only after the pathomorphological diagnosis is completed, which requires further consultations, takes up valuable time and leads to delays of up to weeks – and in some cases even to complete omission of this essential diagnostic step which constitutes a condition in qualification for targeted therapies and immunotherapy.

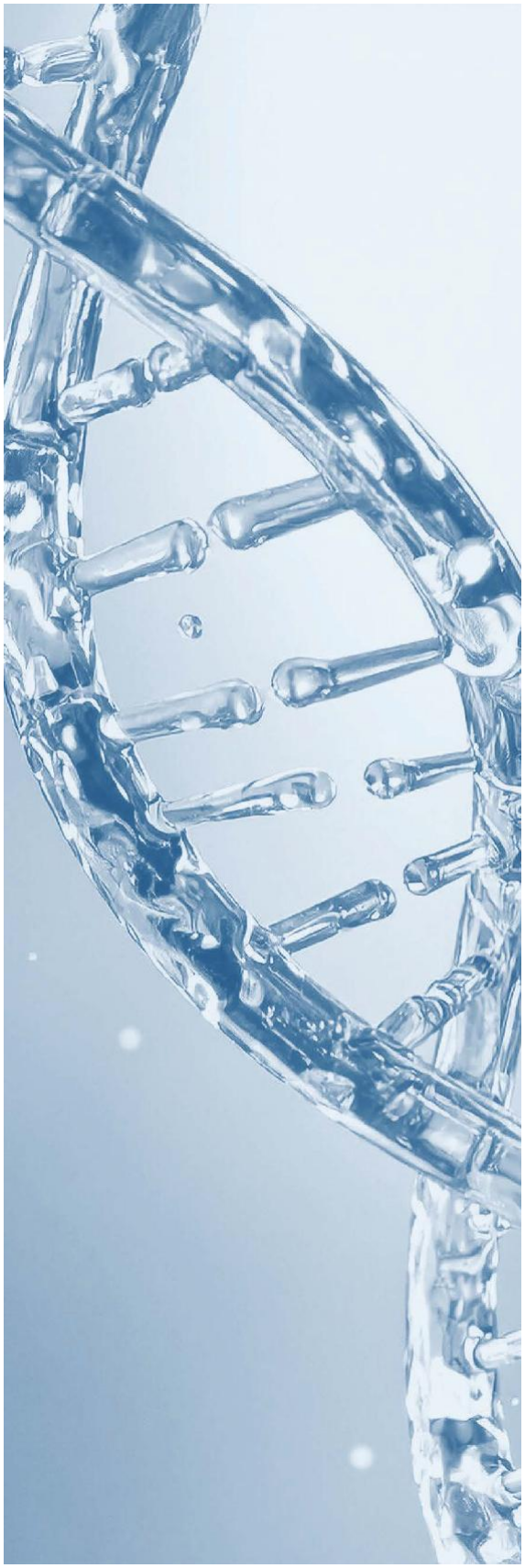
Currently, in the case of NSCLC, the treatment plan should be decided based on complete pathomorphological, molecular and immunological data – as there is no universal treatment regimen. Therapy is selected based on predictive factors, and most often it is combination therapy (as part of preoperative and postoperative treatment: chemotherapy, molecularly targeted therapy, immunotherapy, immunochemotherapy, surgical treatment and radiation therapy).

Qualification for the appropriate type of treatment is made by a Multidisciplinary Team (MDT) consisting of at least a clinical oncologist, a thoracic surgeon, and a radiation therapist. MDT meetings may also be attended by a pathomorphologist, radiologist, pneumonologist, molecular biologist, rehabilitation specialist or treatment coordinator.

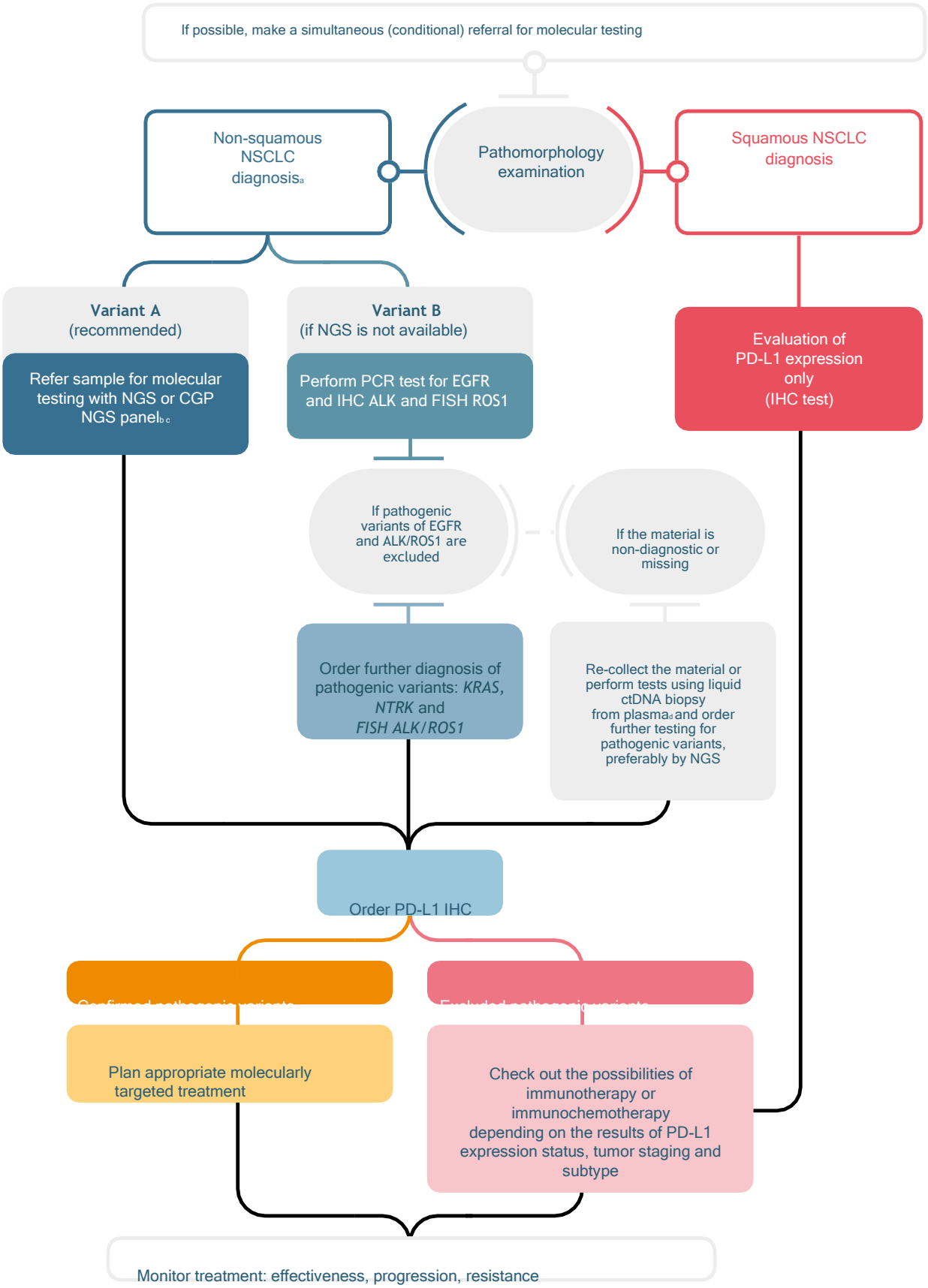
The simultaneous referral model has already been successfully implemented in some centers, and has worked well for several years at, among others, the National Oncology Institute – National Research Institute in Warsaw and the Institute of Tuberculosis and Lung Diseases in Warsaw (which initiated the idea).

In September 2025, experts engaged in the Lung Cancer Mission issued the ***Recommendations for a molecular diagnostic pathway and biomarker assessment in non-small cell lung cancer*** [162] with the aim of **standardizing the diagnostic process and increasing the effectiveness of treatment for NSCLC patients**.

Among others, it determines the optimal scope and sequence of molecular and immunohistochemical tests necessary for the effective qualification of patients with NSCLC for molecularly targeted therapy and immunotherapy, in accordance with current medical knowledge and the availability of drugs in Poland (both under the B.6, B144 drug program and early access under the RDTL Emergency Access to Treatment (Ratunkowy Dostęp do Technologii Lekowej, RDTL) procedure and clinical trials). Current standards for molecular diagnostics (including the use of single-gene assays, NGS and CGP panels, liquid biopsy with ctDNA NGS) for different clinical situations and patient groups were also indicated, taking into account the rationalization of biological material use and cost-effectiveness.



Procedure for molecular diagnostics and biomarker evaluation in NSCLC [163]



[a] Diagnosis of NSCLC of the following type: adenocarcinoma, large cell carcinoma, NOS or mixed type with predominant non-squamous cell nature [b] If available (especially important in case of limited tissue material) – recommended method [c] CGP NGS is currently not reimbursed [d] Indicated reimbursement of multigene NGS testing using ctDNA in inpatient and outpatient settings (SOC), reimbursement of NGS testing from liquid biopsy using ctDNA is justified in the first instance in patients who cannot have an NGS panel performed from tissue material due to its absence or insufficient quality.

Key challenges and barriers in predictive diagnostics in Poland

Molecular and immunohistochemical (IHC) diagnostics are the cornerstone of modern lung cancer treatment – it enables the selection of targeted therapy and immunotherapy tailored to the genetic profile of the tumor. Despite the dynamic development of therapeutic options and reimbursement of more drugs under the B.6 drug program, predictive diagnostics in Poland remains a weak link in the oncology patient's journey.

TOO FEW TESTS PERFORMED

In Poland, molecular testing is performed only in approx. 50% of patients with newly diagnosed non-small cell lung cancer (NSCLC), even though it is essential to verify eligibility for molecularly targeted therapy and immunotherapy. For comparison – in Western European countries the percentage exceeds 80%. Although an increase in the number of tests performed is being observed (more than 10,000 in 2024), this still does not meet the actual clinical needs.

INCOMPREHENSIVE TESTING

Diagnosis is often based on single-gene tests (e.g., PCR), performed sequentially. This approach causes:

- → Extended result waiting times increased consumption
- → of biological material,
- → risk of losing the ability to perform further tests.

Multi-gene/Advanced next-generation sequencing (NGS) is mainly performed at reference centers, while **comprehensive genomic profiling (CGP)**, which is the gold standard in many countries, **is not reimbursed in Poland**.

LACK OF REIMBURSEMENT FOR KEY TECHNOLOGIES

The Polish National Health Fund covers the costs of basic molecular testing and partly those of advanced testing, however, excluding:

- → comprehensive genomic profiling (CGP)
- → multi-gene testing using liquid biopsy (ctDNA) in the inpatient and outpatient lung cancer settings, testing using fresh material on an outpatient basis in lung cancer.
- →

The lack of reimbursement for liquid biopsy is especially problematic. In as many as 30% of patients it is not possible to obtain sufficient tissue material for testing, while ctDNA technology enables minimally invasive, reliable determination of genetic changes and monitoring of treatment.

LIMITED NUMBER OF ACCREDITED PATHOMORPHOLOGY LABORATORIES

Funding provided by the Polish National Health Fund for PD-L1 testing is only available at centers accredited as a pathomorphology diagnostic unit (PDU). After the accreditation pilot (2021–2023), **the certification process was put on hold**. As a result, some pathomorphology laboratories cannot have the costs of PD-L1 testing reimbursed, resulting in inequalities in access and the need to send samples to other voivodships. The lack of an up-to-date accreditation system also makes it impossible to monitor the quality of diagnostics and standardize procedures.

UNEVEN GEOGRAPHIC ACCESS

Advanced molecular diagnostics is mainly carried out by large academic centers and cancer institutes, as smaller hospitals lack the necessary laboratories, equipment and qualified personnel. Patients in peripheral regions are often waiting weeks for results, while sending material to external laboratories further prolongs the diagnostic process.

EXTENDED RESULT WAITING TIMES

Sequential single-gene testing and the need to send samples to other units mean that the waiting time for a full set of molecular testing results in Poland often exceeds 4–6 weeks. This significantly delays the initiation of treatment, which can lead to disease progression or prevent the patient from using targeted therapy.

PROBLEMS WITH THE AVAILABILITY OF BIOLOGICAL MATERIAL

Lung biopsies often provide a small amount of material, which is quickly depleted with sequential analysis. Without simultaneous testing of multiple markers (NGS), there is an increased risk of losing valuable diagnostic material and the need for repeating the biopsy, which constitutes an invasive procedure that puts an additional burden on the patient and does not always yield tissue material suitable for diagnostics.

INSUFFICIENT INTEGRATION OF THE DIAGNOSTIC SYSTEM

Poland lacks a coherent organizational and IT model that would combine data from pathomorphological, molecular and clinical examinations. The lack of a registry of laboratories and test results makes it impossible to analyze quality, turnaround times and plan health policy based on the data.

PROBLEMS WITH FUNDING THE PD-L1 PREDICTIVE FACTOR TESTING

Immunohistochemical testing, including *PD-L1* protein expression assays, is essential for confirming patient eligibility for treatment with immunotherapy under the drug program. Currently, the cost of a *PD-L1* assay can only be covered by centers with their own laboratory holding a pathological DRG certificate when a DiLO card is issued to a patient, exacerbating geographic inequalities in access to diagnosis and treatment. For example, the Podlaskie and Łódzkie voivodships do not have any such laboratory at all, the Zachodniopomorskie and Opolskie have one each, while both Warmińsko-Mazurskie and Pomorskie have two. This significantly limits the ability to choose appropriate therapy and exposes patients to ineffective or harmful treatment.

5.4. Treatment of patients with lung cancer

5.4.1. Surgical treatment

Surgical treatment of lung cancer remains the most effective treatment option, offering a chance for a full recovery. The standard of surgical treatment involves anatomical resection of the pulmonary parenchyma and systemic removal of the pulmonary and mediastinal lymph nodes on the operated side.

Eligible for surgery are patients with stage I, II and, in selected cases, stage III disease according to the TNM scale (current 9th edition – IASLC lung cancer guidelines) [164].

Over the past two decades, there has been tremendous development in minimally invasive thoracic surgery techniques, that significantly reduce surgical trauma and speed up patient recovery.

The goal of surgical treatment is the complete removal of the tumor. Unfortunately, only approximately 20% of all patients in Poland can receive radical treatment - because most patients are diagnosed already at the dissemination (distant metastasis) stages. However, the implementation of neoadjuvant treatments (systemic: in addition to chemotherapy and radiotherapy – immunotherapy/immunochemotherapy) may significantly increase the percentage of patients receiving surgical treatment in the future.

Anatomical resection involves removal of a single lobe of the lung (lobectomy), removal of two lobes of the right lung (bilobectomy) or removal of the entire lung (pneumonectomy). In the case of the right lung, an upper, middle or lower lobectomy is performed, depending on the location and size of the tumor, while an upper or lower bilobectomy is performed for lesions that exceed the boundaries of a single lobe. On the left side, an upper or lower lobectomy is performed.

Pneumonectomy (removal of the entire lung) is performed less and less frequently, in the case of tumors whose location is central, hilar or that involve all lobes of the lung, primarily because of the high number of postoperative complications and the significant impairment of respiratory capacity associated with the extent of the resection.

Therefore, whenever possible, the surgeon should consider sleeve resections, which involve segmental resection of a tumor-infiltrated portion of the main bronchus or main pulmonary artery, followed by anastomosis.

Segmentectomy, or resection of a single or several segments of the lung in the case of tumors up to 2 cm in diameter, is gaining importance. Long-term treatment results indicate that the effects of segmentectomy are comparable to those of entire lung removal [165, 166]. According to the guidelines of the European Association of Cardiothoracic Surgeons (EACTS), in such cases, proper assessment of eligibility for surgery and planning the extent of the resection are extremely important [167].

Any anatomical resection of lung cancer requires extensive **lymphadenectomy**, i.e. removal of lymph nodes of the lung and mediastinum. It allows for a more accurate assessment of the stage of the disease by detecting or excluding the presence of metastatic lesions in the lymph nodes and is the basis for establishing eligibility for postoperative, adjuvant chemotherapy, improving distant outcomes in patients with stage II or higher.

A traditional thoracotomy, where the thorax is opened and access is obtained the from the side, usually at the level of the fifth intercostal space, provides extensive access to the thorax, but in addition to incising the intercostal space all the way through and opening the ribs, it also requires cutting large muscle groups of the thorax. Due to the length of the intercostal incision and the need for a wide opening of the ribs, thoracotomy is the main reason for the high intensity of pain in the postoperative period.

The introduction of minimally invasive surgical access methods not only reduces surgical trauma but also brings many other benefits to the patient during the recovery and healing process.

Video-Assisted Thoracoscopic Surgery (VATS)

Minimally invasive techniques were initially used in abdominal surgery, later to be adopted for thoracic surgery in the first half of the 1990s as a sub-type of video-assisted thoracoscopic surgery (VATS, *Video-Assisted Thoracic Surgery*).

Over the past two decades, there has been tremendous development in minimally invasive thoracic surgery techniques, that significantly reduce surgical trauma and speed up patient recovery.

VATS was initially used to diagnose invasive diseases of the chest wall and organs, and as it improved, it began to be used for lung parenchymal resection procedures [168]. In Poland, the first VATS lobectomy in a lung cancer patient was performed in 1999 in Poznań. The consistent increase in the number of publications presenting the results obtained in lung cancer patients receiving VATS surgery observed in subsequent years has confirmed that it is a safe surgical method, and the distant results of treatment are comparable to those observed in patients operated on using classical thoracotomy.

The use of minimally invasive VATS surgical access is associated with several benefits for the surgical patients:

- ☆ reduction of pain in the postoperative period, ☆ reduction of the number of postoperative complications, ☆ a significant reduction in the risk of death after the procedure, ☆ reduction of the post-operative hospitalization duration, → a shorter period of postoperative rehabilitation,
- → a faster return to full fitness,
- → better tolerance of postoperative pharmacotherapy,
- → better cosmetic effect,
- → high acceptance of this method of surgery among patients [169].

VATS is carried out through a 4–5 cm long cut at the level of the 4th or 5th intercostal space without using any type of rib dilation, through between one and three additional ports. The number of ports depends on the surgical technique used [170].

In recent years, the VATS single-port technique, which uses only working access during the procedure, has become increasingly popular. However, regardless of the number of ports used, there were no significant clinical differences in the postoperative period between the single-port and multi-port methods.

A rapid increase in the number of VATS procedures worldwide is evident. At leading thoracic centers, this technique dominates as the primary method of surgical treatment of lung and other thoracic cancers. Currently in Europe, a minimum of 42% of lung resections for non-small cell lung cancer (NSCLC) are performed using VATS [171].

This changes the paradigm of assessment of lung cancer patients' eligibility for surgical treatment – the VATS method is currently the first-choice method in every case. Only local disease progression, the need for complex sleeve resections, or other local factors may require thoracotomy.

In Poland, almost half (more than 45%) of resections for lung cancer are performed using VATS, and in leading centers, most resections are already performed using minimally invasive VATS (65% to 85% of procedures). This places Poland among the top European countries [172].

When analyzing the availability of VATS thoracoscopic surgery in Poland compared to the rest of Europe, a few important trends can be seen:

- → Growing availability: Between 2012 and 2017, the number of VATS procedures increased at a rate of 50% per year, demonstrating rapid development of this method.
- → Stabilization at 40% – 45%: as of 2017, the percentage of surgeries performed using this method has stabilized at around 40–45% of all lung resections for cancer.

- Uneven geographic accessibility: approximately 80% of VATS procedures are performed at just eight thoracic centers, indicating that access to the technique varies widely between different regions of the country.

Robotic surgery

The introduction of surgical robots was another significant step in the development of minimally invasive thoracic surgery, further improving patient outcomes, increasing the safety of the procedure and expanding the range of minimally invasive procedures [173].

Technological advances in minimally invasive surgery have resulted in a very rapid increase in the number of VATS and robot-assisted video thoracoscopic surgery (RATS) procedures performed.

Robotic systems allow for even greater precision and control during surgery, which:

- eliminates the need for large incisions,
- reduces the risk of damage to tissues and organs,
- minimizes the risk of infection,
- shortens hospital stay and recovery time after surgery.

Surgical robots are currently used in thoracic surgeries, mostly in the following fields: surgical treatment of lung, mediastinal and esophageal tumors, urologic cancers (prostate, kidney, bladder), colorectal cancer, gynecologic cancers or in bariatrics and cardiac surgery.

Robotic thoracic surgeries are gaining importance by enabling precise manipulation in confined space or near large vessels and the heart.

The high level of minimally invasive surgery at thoracic centers in Poland opens opportunities for further development of robot-assisted procedures. However, barriers resulting from the high cost of these technologies and limited investment capacities at the local level (hospital, local government) remain. It should be stressed that medical facilities that strive to provide the highest quality of care have already invested or are planning to invest in robotic systems to enable precise surgical procedures and secure better outcomes for their patients. Consequently, there is a need for a national program to promote robotic surgery in treatment of lung and other thoracic cancers.

One of the main benefits of robotic surgery for thoracic cancers is the increased precision and safety of the procedures. Surgical robots are equipped with advanced tools such as micro-cameras and manipulators that allow surgeons to closely observe and manipulate organs inside the chest. This makes tissue preparation more precise, minimizing the risk of damage to adjacent structures and shortening the patient's recovery time. A significant advantage of this method is also the less invasive nature of the procedures. Traditional open thoracic surgeries require a large incision, which is associated with significant pain, long healing time and severe scarring. Surgical robots allow to perform surgery using small incisions; consequently, the patients experience less pain, have a shorter hospital stay and return to normal activity faster.

Another benefit of robotics in thoracic surgery is the ability to perform more complex and precise procedures than those available for traditional video-assisted thoracoscopic surgery. Accuracy is of key importance in thoracic surgery, especially in reconstructive procedures concerning the bronchial system or pulmonary artery (sleeve resections). Surgical robots give surgeons the ability to manipulate instruments ergonomically and with precision, making it significantly easier to perform complex surgeries.

This is especially important during lymph node dissection. As a result, robotic surgery allows more patients to access complex and minimally invasive procedures [174, 175].

It also supports medical education using surgical simulators (built into robots), allowing young clinicians to develop their skills in a safe, reproducible and controlled environment. This type of training allows to gain experience and confidence before performing surgery on patients. Before working independently, the robotic system operator must undergo an in-depth certification process, which translates into the quality and safety of treatments [176]. Certification includes training on simulators, theoretical tests, shadowing surgeries at other centers (often abroad), surgeries on cadavers, a practical exam, and performing the first procedures under the supervision of a proctor (a surgeon experienced in robotic surgery) [177].

Analyses comparing RATS to thoracotomy unequivocally confirmed benefits in terms of greater precision of the procedure, less intraoperative trauma, lower volume of evacuated pleural fluid and less risk of prolonged air leakage, which reduces the duration of drainage, surgery and patient hospitalization [178]. Similar effects were observed when comparing RATS to VATS. Drainage time was reduced from 74 hours in the VATS group to 31 hours in the RATS group, which translated into a reduced length of stay, from 4.19 days to 2.16 days [179]. A meta-analysis of 10 studies [180] showed comparable hospitalization and drainage times. In a study (Reddy RM, 2018), the authors have proven significantly longer surgery duration, but a lower rate of conversion to thoracotomy (4.8% vs. 8%) and fewer complications (33.4% vs. 39.2%), while 30-day mortality and the percentage of patients requiring transfusion were similar [181].

Importantly, the length of hospitalization for robotic surgery decreases as the center and surgeon gain experience [182]. Moreover, the length of stay at the intensive care unit, which is very costly, decreases [183].

US and Japanese studies comparing RATS to VATS have also confirmed the distant survival outcomes and oncologic efficacy of RATS treatments [184, 185].

Currently, 3 robotic systems are certified for thoracic surgery – DaVinci, Versius, Senhance [186, 187, 188]. Other manufacturers are launching technologies for this indication.

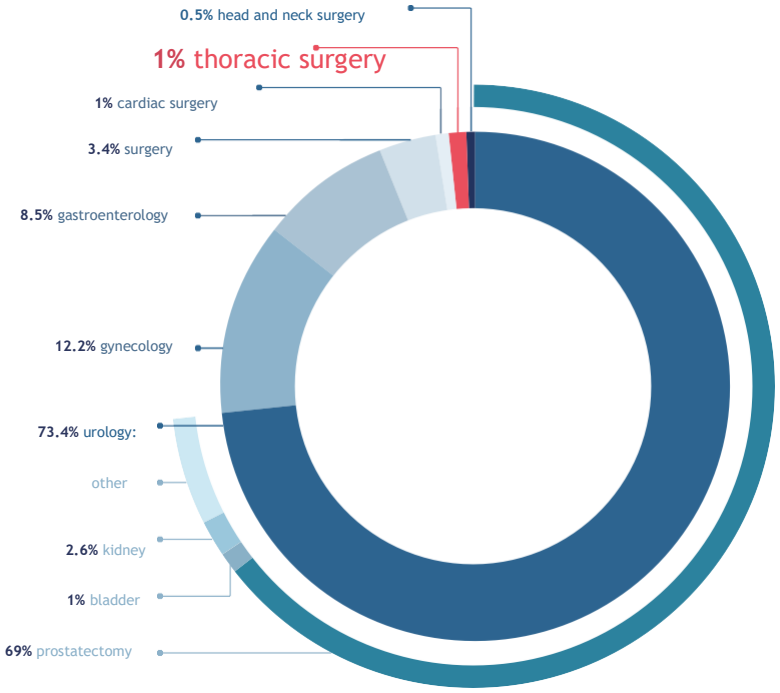
In Poland, the number of procedures performed with the assistance of robots is growing even more rapidly. The rate of increase in the number of procedures in 2023 was 100% compared to 2022. The greatest increase was seen for the following surgeries – 112%, urology – 100% and gynecology – 60%. Currently, more than 60 surgical robots are in use nationwide. In 2023, procedures assisted by the DaVinci robot were performed at 45 hospitals, the Versius system was used by 13 hospitals and the Senhance system by 1 hospital.

However, the use of robots in thoracic surgery remains low (approximately 1% of robotic surgery procedures in Poland).

In 2024, robotic thoracic surgery was being developed at 5 centers, which performed a total of 246 procedures. The leader in this area is the Military Institute of Medicine in Warsaw, where as many as 110 surgeries were performed. There were 78 of them at the Oncology Center in Bydgoszcz, 42 at the Świetokrzyskie Oncology Center, 9 surgeries at the University Clinical Center of the Gdańsk Medical University in Gdańsk and 7 robot-assisted lung cancer procedures (lobectomies) at the University Teaching Hospital No. 4 in Lublin [189].

The development of robotic procedures in Poland has recently been primarily influenced by changes in the reimbursement policy. In April 2022, dedicated pricing of healthcare services provided under the Polish National Health Fund was introduced for robot-assisted prostate cancer surgery, and in August 2023 for endometrial cancer (endometrial carcinoma) and colorectal cancer procedures.

Treatment areas in robotic surgery in Poland (as of 2023) [190]



Unfortunately, in the case of thoracic surgery, i.e. surgeries within the chest area, procedures using robotic systems are currently not separately reimbursed by the Polish National Health Fund (no separate pricing or a dedicated healthcare service). The payer refunds them up to the amount of another reimbursable lung resection method. It should be noted, however, that more centers in Poland, despite the lack of reimbursement, are investing in robotic thoracic surgery equipment, indicating a growing interest in this method and a significant need to expand the portfolio of services in this area.

In 2023 the Agency for Health Technology Assessment and Tariff System (ATMiT) analyzed robotic surgery, based on the order of the Minister of Health concerning justification for surgical treatment of neoplasms of the lung (C34 according to the ICD-10 classification), other thoracic cancers (including thymus - C37, heart, mediastinum and lung - C38, mesothelioma of pleura - C45, secondary neoplasms of the lung - C78.0, mediastinal - C78.1 and pleural - C78.2, and of other and ill-defined sites in the respiratory system and intrathoracic organs - C39). The Agency found it reasonable to consider minimally invasive methods using robotic surgery as one of the treatment options for patients eligible for surgical treatment of cancers from the following groups: C34, C37, C38, C39, C48 [191].

The Agency recommended reporting of robotic surgery procedures to be implemented as part of the clinical registry. The analysis was submitted to the Ministry of Health in early 2024.

Then in May 2025, based on an order issued by the Ministry of Health, the AOTMiT Transparency Council issued a position paper (No. 61/2025 [192]), which found it reasonable to classify the healthcare service *Robotic thoracic surgery (for lung and other thoracic cancers*) as a guaranteed healthcare service.

Despite these AOTMIT recommendations, a separate, higher pricing for robot-assisted thoracic surgery was not introduced. Autonomous surgical robotics has enormous potential to transform modern healthcare systems by offering safe, precise and minimally invasive surgical procedures. Unfortunately, the high cost of installing robotic systems, reimbursement barriers, and limited access to qualified personnel remain the main inhibitors to the expansion of these robotic procedures. The key to making robotic surgery generally available and implementing it into clinical practice is to prioritize it in reimbursement policies and public funding.

The length of hospital stay is one of the most important factors confirming fast recovery and convalescence, a lower rate of complications, as well as lower cost to the individual and the healthcare system. The greater precision of VATS and robotic surgery translates into increased safety and faster patient recovery after surgery. Therefore, further development of procedures using VATS as a standard in thoracic surgery and reimbursement of robot-assisted thoracic surgery healthcare services is necessary.

5.4.2. Radiotherapy

Radiotherapy is indicated in both non-small cell lung cancer (NSCLC) and small cell lung cancer (SCLC). It is most often used in combination with chemotherapy, known as concurrent radiochemotherapy, both in locally advanced stages and disseminated cancer, with metastases, for example, to the brain and bones. Particularly useful in the treatment of lung cancer is precision stereotactic radiotherapy and teleradiotherapy, which is used, among others, in patients with contraindications to radical lung parenchyma resection.

The treatment of choice for patients with locally advanced non-small cell lung cancer is radical radiochemotherapy (concurrent or sequential). The recommended treatment is single agent radiochemotherapy with adjuvant treatment with durvalumab. If chemotherapy is contraindicated, exclusive radiotherapy (dose of 60–66 Gy in both situations, covering the primary tumor and lymph nodes in the hilum and mediastinum on the tumor side).

In patients with generalized non-small cell lung cancer with chest discomfort or discomfort associated with metastases, palliative radiotherapy should always be considered.

In patients with malignant pleural mesothelioma, radiation therapy should be considered as part of a combination treatment with surgery and chemotherapy. Radiation therapy may also be considered for palliative treatment.

For patients who are ineligible for surgery, radiation therapy is being considered as a form of radical treatment (known as stereotactic radiation therapy, which involves very precise high-dose irradiation of the lesion(s)).

In recent years, there have been significant technological advances in radiation therapy. Modern linear accelerators are equipped with several solutions to increase the safety and precision of radiotherapy, such as multileaf collimators and imaging verification on the treatment table. High-tech modified versions of linear accelerators are opening new possibilities for radiation treatment, such as precise irradiation of small volumes using very high radiation doses or irradiation of large and well-defined volumes.

Modern radiotherapy is based on the simultaneous use of multiple diagnostic methods, including imaging such as: CT scan, magnetic resonance imaging or PET-CT. The use of these methods allows very precise selection of the area to be irradiated and precise delivery of the dose to the tumor, with as little irradiation of healthy tissue as possible. Each patient receives an individualized treatment plan, tailored to the severity of the disease.

Modern radiation therapy is precision image-guided radiation therapy (IGRT), providing the opportunity to monitor the location of the tumor. In addition to using conventional fractionated doses, it also uses high fractionated doses (>5 Gy), or hypofractionated doses, used in stereotactic radiotherapy.

Intracranial Stereotactic Radiosurgery (SRS) and Stereotactic Body Radiotherapy (SBRT) are methods of treating cancer and lesions involving administration of one or more (usually 1–5 fractions) high doses of radiation to the tumor area and a minimal volume of surrounding healthy tissue, e.g., irradiating cancerous lesions located in the deep structures of the central nervous system, lungs or liver. Stereotactic radiation therapy is used in radical, symptomatic and analgesic treatment (e.g. irradiation of metastases), providing high treatment efficacy with minimal adverse effects.

Radiochemotherapy and consolidation treatment

According to international and national recommendations (ESMO, NCCN, the Polish Society of Clinical Oncology (Polskie Towarzystwo Onkologii Klinicznej, PTOK), Polish Society of Oncological Surgery (Polskie Towarzystwo Chirurgii Onkologicznej, PTChO), Polish Lung Cancer Group (Polska Grupa Raka Płuca, PGRP)),
concurrent chemoradiotherapy (cCRT) is **the gold standard of treatment** in patients in a good general condition (ECOG 0–1) who cannot undergo radical resection.

Meta-analyses and randomized trials have shown that cCRT compared to sequential RCT (i.e. chemotherapy first, followed by radiotherapy) **extends median overall survival by approximately 20%** (from approx. 14 to 17–19 months) and increases 5-year survival by 4–5 percentage points [193].

Standard radiochemotherapy regimen:

- **radiotherapy** - dosing of 60 Gy in 30 fractions (2 Gy/fraction), using IMRT (intensity-modulated radiation therapy), VMAT (volumetric modulated arc therapy) or IGRT (Image-Guided Radiation Therapy) techniques, which limits pulmonary and esophageal toxicity,
- **chemotherapy** - most commonly using cisplatin with vinorelbine, etoposide or pemetrexed (depending on the histological type).

Consolidation treatment after radiochemotherapy is used in both immunotherapy and molecular targeted therapies.

The PACIFIC trial [194] showed that introducing immunotherapy (durvalumab) after successful radiochemotherapy (in progression-free patients) significantly prolongs overall and progression-free survival, making this regimen the current standard of care in stage III NSCLC. The 5-year survival rate in the durvalumab group is 43%, compared to 33% in the placebo group.

The phase 3 **LAURA** trial evaluated the efficacy of osimertinib as consolidation treatment after radical chemoradiotherapy in patients with inoperable, locally advanced (stage III), NSCLC with EGFR gene mutation. The study included adult patients with a confirmed EGFR mutation (deletion in exon 19 or L858R mutation in exon 21) who had no disease progression during or immediately after radical platinum-based chemoradiotherapy. The results of the trial showed a clear advantage of osimertinib over placebo: median PFS was 39.1 months vs. 5.6 months, representing a reduction in the risk of progression or death by approximately 84% in favor of consolidation treatment with osimertinib [195].

When it comes to small-cell lung cancer, the **ADRIATIC** trial evaluated the efficacy of durvalumab as consolidation treatment after radical chemoradiotherapy in patients with limited (stage I–III) small-cell lung cancer. Durvalumab significantly prolonged PFS and OS relative to placebo. The 3-year OS percentages were 56.5% vs 47.6%, with the difference in medians reaching more than 22 months in favor of durvalumab [196].

In selected cases (locally advanced operative stage, following eligibility confirmation in the thoracooncology team) radiochemotherapy can be used as:

- **neoadjuvant** treatment (pre-operatively) – to reduce tumor mass and improve resectability,
- **adjuvant** treatment – in patients after partial resection (R1) or in cases of microscopic infiltration of the margin.

In cases of limited small cell lung cancer, radiochemotherapy is the treatment of choice, usually initiated in the first 1–2 cycles of chemotherapy.

This treatment achieves a 5-year survival rate of 25–30%, a significant improvement over chemotherapy alone. In the disseminated form of SCLC, radiotherapy has a palliative and, in selected cases, a consolidative role.

The most common complications of radiochemotherapy are esophagitis and radiation pneumonitis, less commonly cardiotoxicity (especially with large RT fields). Delivery of sparing doses to the cardiac region significantly reduces the risk of cardiovascular events.

Using radiochemotherapy:

- improves patient survival rates,
- modern techniques (IMRT, VMAT, IGRT) and more accurate planning reduce toxicity.

IASLC stresses that adequate availability of radiochemotherapy at stage III determines population survival rates – countries with a high proportion of NSCLC patients receiving this treatment have 10–15% higher 5-year OS.

Modern radiotherapy techniques and safety:

- **IMRT/VMAT with IGRT** (with imaging) reduces doses delivered to the organs: lung, heart and esophagus, reducing the risk of interstitial pneumonia and esophagitis, with better dose conformation (in stage III NSCLC). Dose escalation beyond 60 Gy in radiochemotherapy does not improve outcomes and may cause harm [197];
- **SBRT/SABR** provides 85–90% 3-year local control in early NSCLC, with a low rate of adverse effects; in central tumors, softer fractionations and strict restrictions on critical organs are necessary [198];
- 02 **RT + immunotherapy** - after CRT in stage III NSCLC, the use of durvalumab significantly prolongs OS and PFS; the toxicity profile is acceptable, but requires vigilance [199];
- 02 **Adaptive RT** - these technologies allow to reduce safety margins, improving lung/heart protection by taking account of the respiratory motion (the direction of the standard's development) [200];
- 02 **Proton therapy** - significant physical benefits (lower out-of-field doses) have been well-documented with dosimetry; clinical benefit is sometimes dependent on patient selection and quality of planning [201].

Challenges in lung cancer radiotherapy in Poland:

- unequal access to concurrent radiochemotherapy and modern RT techniques (IMRT, IGRT, SBRT),
- lack of dedicated funding for advanced treatment planning and implementation techniques,
- insufficient integration of radiotherapy with systemic treatment (no formal coordination, no Lung Cancer Units),
- the time from eligibility confirmation to the start of therapy is too long – exceeding 4–6 weeks at some centers,
- shortages of personnel and equipment in some voivodships (especially outside large cancer centers).

5.4.3. Molecularly targeted treatment

Developments in medicine, including an understanding of the biology of cancer, the development of genetic and molecular testing, as well as innovative therapies for both early and advanced stages of cancer allow for an increasingly individualized approach to treating the cancer patient. Modern oncology is based on the paradigm of combination treatment, that is, combining several therapeutic methods simultaneously or sequentially to achieve the best possible results from anti-cancer therapy. The goal of this approach is to maximize the effectiveness of therapy, reduce the risk of recurrence and improve patients' quality of life.

In Poland, molecularly targeted therapies are currently registered for the treatment of NSCLC, for pathogenic variants in the *EGFR* and *KRAS gene (G12C)*, as well as *ALK* and *ROS1* and *NTRK1/2/3* gene rearrangements.

The use of molecularly targeted drugs under the drug program depends on molecular diagnostics being performed at a laboratory with an up-to-date quality control program certification for the specific test. In patients with generalized non-small cell lung cancer, the choice of treatment depends on clinical, pathomorphologic and molecular characteristics.

As part of their first-line treatment, non-small cell lung cancer patients at the generalized stage with the presence of a pathogenic variant in the *EGFR* gene should receive one of the *EGFR* tyrosine kinase inhibitors (osimertinib, afatinib, dacomitinib, gefitinib, erlotinib). Current guidelines recommend starting treatment with third-generation TKIs.

In subsequent lines of treatment, following failure of at least one previous line of systemic treatment (immunotherapy or immunochemotherapy or chemotherapy with platinum compounds), non-small cell lung cancer patients with the G12C pathogenic variant in the *KRAS* gene should receive a *KRAS G12C* kinase inhibitor (sotorasib).

Non-small cell lung cancer patients with a pathogenic variant in the NTRK gene in the 1st or subsequent lines of treatment should receive a TRK tyrosine kinase inhibitor (larotrectinib).

The second-line management of patients with generalized non-small cell lung cancer depends on the clinical and pathological features, the effects of prior systemic treatment and the molecular characteristics of the tumor. It is necessary to perform a repeated biopsy, because lung cancers can dynamically change their biological profile under the influence of previous treatment. Repeated biopsy reassesses the molecular profile of the tumor and detects mutations that determine treatment resistance – such as *EGFR T790M* or secondary lesions after immunotherapy. The following may be considered in this group: chemotherapy (docetaxel or pemetrexed), docetaxel in combination with nintedanib, *EGFR* inhibitors in patients who did not receive these drugs in the first line or osimertinib in patients previously treated with first- or second-generation *EGFR* inhibitors, *ALK* inhibitors in patients who did not receive these drugs in the first line or alectinib or brigatinib in patients previously treated with crizotinib or lorlatinib after failure of second-generation inhibitors, immunotherapy – only in the absence of pathogenic molecular variants (nivolumab or atezolizumab), palliative radiotherapy or symptomatic management.

Zoledronic acid is recommended for patients with generalized non-small cell lung cancer with bone metastases.

5.4.4. Immunotherapy

Consolidating immunotherapy with durvalumab (12 months) is recommended in patients with stage IIIA non-small cell lung cancer (patients ineligible for resection) and stage IIIB with response or stabilization after concurrent radiochemotherapy.

Patients with generalized NSCLC with PD-L1 protein expression in at least 50% of cells and without pathogenic variants of *EGFR, ALK* and *ROS1* genes should receive pembrolizumab or cemiplimab or atezolizumab as first-line treatment.

Non-small cell lung cancer patients at the generalized stage with *PD-L1* protein expression of less than 50%, without pathogenic variants in *EGFR*, *ALK* and *ROS1* genes should receive pembrolizumab in combination with chemotherapy in the first line of treatment (maximum 4 cycles of chemotherapy and maintenance treatment with pembrolizumab conducted until objective tumor progression or unacceptable toxicity) or nivolumab with ipilimumab in combination with chemotherapy (maximum 2 cycles of chemotherapy, followed by maintenance treatment with nivolumab and ipilimumab conducted until objective tumor progression or unacceptable toxicity) or durvalumab with tremelimumab (in patients who have not previously received immunotherapy or immunochemotherapy) or chemotherapy alone (two-drug regimens with cisplatin or in justified situations with carboplatin, while monotherapy may be considered only in selected clinical situations).

The second-line management of patients with generalized non-small cell lung cancer depends on the clinical and pathological features, the effects of prior systemic treatment and the molecular characteristics of the tumor. Chemotherapy (docetaxel or pemetrexed), docetaxel in combination with nintedanib, immunotherapy (nivolumab or atezolizumab) can be considered in this group.

Molecular testing is not performed for small cell lung cancer. Chemotherapy remains the primary treatment for SCLC patients, regardless of stage. The regimen of choice is the combination of cisplatin or carboplatin with etoposide (PE regimen). The optimal treatment for 1st line SCLC is a combination of two-drug chemotherapy with one of the immunocompetent drugs durvalumab or atezolizumab (maximum 4–6 cycles of chemotherapy, followed by maintenance treatment with durvalumab or atezolizumab given until objective tumor progression or unacceptable toxicity).

It is expected that reimbursement will be granted for the treatment regimen based on the ADRIATIC trial in patients with stage I–III small cell lung cancer; the trial showed significant improvements in treatment outcomes in this group of patients with poor prognosis and changed the therapeutic regimen. Durvalumab significantly prolonged progression-free survival and overall survival [202].

Patients with advanced pleural mesothelioma should be considered for immunotherapy with nivolumab and ipilimumab (treatment given until objective tumor progression or unacceptable toxicity) or chemotherapy (a regimen containing cisplatin and pemetrexed). In selected patients with advanced-stage pleural mesothelioma, second-line chemotherapy may be considered.

Repeat immunotherapy

The repeated use of immune checkpoint inhibitors (ICIs) is becoming an increasingly common practice in clinical oncology and is the subject of numerous observational studies and scientific publications.

Available data indicate **a growing medical need for the reintroduction of immunotherapy**, especially in patients with **kidney cancer** and **non-small cell lung cancer** (NSCLC). A growing number of reports from studies conducted in the real-world clinical settings confirm that **reintroduction of immunocompetent treatment** after previous exposure is becoming an established part of therapeutic practice.

The use of the so-called **ReT/ReC (*re-treatment/ re-challenge*)** strategy has its **theoretical, molecular and clinical** justification– immune mechanisms activated during primary treatment can be reactivated in certain patients, yielding therapeutic benefits. Although the efficacy of repeat immunotherapy is usually **lower than during initial treatment**, it has been observed that in some patients – especially those who have previously achieved long-term remission (e.g. in NSCLC) – ICI re-treatment can lead to repeated clinical response.

The decision to re-treat with immunotherapy should be **made on an individual** basis, taking into account the patient's overall condition, the course of previous treatment and the risk of severe adverse effects.

Results of several **systematic reviews** (Liu et al. 2024, Perdyian et al. 2023 and Feng et al. 2023, Gaii et al. 2022) indicate that **re-treatment with immunotherapy can reduce the risk of disease progression and prolong overall survival**, especially in patients with NSCLC, but also in other types of cancer, such as kidney cancer or melanoma.

The lack of clear therapeutic recommendations in international and Polish guidelines remains a problem; only the ESMO guidelines (2023) recommend considering repeat immunotherapy. Currently, the B.6 drug program does not allow the use of repeat immunotherapy in case of disease progression after previous immunocompetent treatment.

A review of clinical trials and clinical guidelines indicates the need:

- → to define groups of patients for whom re-treatment with immune checkpoint molecules may provide the greatest clinical benefit.
- → for unification of the definition related to repeated treatment with immunotherapy after immunotherapy. The most common definitions are: *Retreatment* (ReT) and *Rechallenge* (ReC) – both refer to the situation where immunotherapy is reapplied in patients who previously received it.

Oral and subcutaneous administration

There is a growing recognition of the need to allow cancer patients to receive treatment on an outpatient or home basis. Developments in cancer pharmacotherapy mean that many anticancer drugs are now available in oral or subcutaneous form, reducing the need for frequent hospitalizations.

Such solutions increase patients' independence and improve the comfort and quality of life for those undergoing long-term treatment [203].

Currently, under the drug program **B.6 (treatment of lung cancer and pleural mesothelioma)**, healthcare services cannot be provided in the home setting with reimbursement. Only the B.15 Program "*Prevention of Bleeding in Children with Hemophilia A and B*" provides such an option, with up to 88% of patients (363 of 413) opting for the home treatment option in 2023.

Administering the drug at home does not necessarily mean self-administration by the patients or their caregiver. It can be carried out by qualified medical personnel, such as a homecare visit nurse. A study conducted in the Opolskie voivodship [204] confirmed that patients receiving subcutaneous drugs at home experience a significant improvement in terms of quality of life. Most frequently, those patients reported time savings, greater flexibility in planning their day and a sense of security associated with the professional support of a nurse. The educational aspect of homecare visits also proved to be an added benefit, increasing the patient's confidence in their treatment and satisfaction with treatment.

Oral treatments include primarily **molecularly targeted drugs (targeted therapies)**, used in patients with detected predictive mutations, including in the genes ***EGFR***, ***ALK***, ***ROS1***, ***RET***, ***MET***, ***KRAS G12C***, ***BRAF*** or ***NTRK***. These drugs include tyrosine kinase inhibitors (TKIs), such as osimertinib, alectinib, lorlatinib, entrectinib and others. The use of these preparations at home is possible because they are taken orally and the patient only requires regular medical checks and tests to monitor treatment safety. The program has also recently included one **immunocompetent drug administered subcutaneously** (atezolizumab). Currently, most **immunotherapies** and **chemotherapies** still require **intravenous administration at the hospital or day care** oncology departments.

Additional drugs available in **oral or subcutaneous** form being included into the B.6 drug program, as well as the creation of a formal option for **reimbursing home treatment**, would go a long way toward improving patients' quality of life, increasing the efficiency of the system and relieving the burden on oncology departments.

5.4.5. Combination and perioperative treatment

Advances in lung cancer treatment over the past 10 years have been tremendous and defined by efficacy and development of new immunotherapies and molecularly targeted treatments. Treatment effectiveness is further enhanced by perioperative combination treatment.

Surgical treatment is still the primary method allowing to cure lung cancer, although the percentage of patients undergoing surgery does not exceed 20% in Poland.

In the population of patients who undergo surgery, the risk of both local recurrence and distant metastases is very high. Therefore, clinical management shifts in the direction of increasing the effectiveness of perioperative treatment (neoadjuvant or adjuvant), by supplementing surgery with radiochemotherapy, chemotherapy, immunotherapy, immunochemotherapy or molecularly targeted therapy.

The percentage of pathomorphologic responses is significantly higher in patients who receive treatment with a combination of chemotherapy and immunotherapy preceding surgical treatment. In such cases, confirming patient eligibility requires early pathomorphological diagnosis, assays of *PD-L1* protein expression status and molecular variants.

Currently available diagnostic and therapeutic options allow to select a group of patients in whom molecular abnormalities *(EGFR, ALK*) should be assayed after radical surgery, especially patients with adenocarcinoma.

This allows for implementation of molecularly targeted treatment using one of the third-generation tyrosine kinase inhibitors, which dramatically improves the effectiveness of treatment: a higher percentage of patients with long progression-free survival and overall survival, as well as a significant reduction in the risk of death for these patients. Similarly, the use of immune checkpoint inhibitors in patients with high *PD-L1* receptor expression as a supplement to radical surgery significantly improves distant outcomes.

Adjuvant treatment

Primary surgical treatment with a radical approach is only possible in approximately 20% of non-small cell lung cancer (NSCLC) patients. 30–50% of patients have recurrent disease and metastasis in distant organs after resection, justifying the use of adjuvant treatment [205]. Adjuvant systemic treatment includes the use of chemotherapy, molecularly targeted drugs and immunotherapy.

The main goal of adjuvant systemic treatment is to improve the survival rates of patients undergoing resection, which can be achieved by reducing the extent of the tumor and destroying potential micro-metastases.

Adjuvant treatment for lung cancer patients includes:

- → **chemotherapy** – the standard in patients with stage II-IIIA non-small cell lung cancer (cisplatin + vinorelbine). Administration of 2–4 cycles.
- → **molecularly targeted therapies** – in patients with stage IIB-IIIA non-small cell lung cancer, (sometimes IB with certain pathogenic variants) who have *EGFR* mutations (del19/ L858R) or *ALK* gene rearrangements.
- → **immunotherapy** – *PD-L1* inhibitors in stage IB and stage II-IIIB patients depending on TNM classification, *PD-L1* expression – a key biomarker that determines eligibility for adjuvant immunotherapy.

The rationale for **postoperative chemotherapy** has been confirmed in phase 3 trials and meta-analyses – it has been shown to increase 5-year survival rates by approximately 5% for cisplatin regimens [206]. The significant benefit of postoperative chemotherapy (2–4 cycles) applies to patients at stage II–IIIA and does not depend on the histological type of NSCLC or the age and sex of the patients. The use of preoperative chemotherapy provides similar benefits, as demonstrated in a systematic review of randomized trials (increasing 5-year survival rates by approximately 5%) [207]. Radiotherapy may be considered in assessing eligibility for adjuvant treatment – indications for adjuvant irradiation currently apply only to patients with the presence of tumor cells in the surgical incision line detected on postoperative pathomorphologic examination or with the absence of a reliable mediastinal lymph node status determination [208].

Molecularly targeted drugs (tyrosine kinase inhibitors) ***EGFR*** (osimertinib) and ***ALK*** (alectinib) are clinically proven to be effective **in the postoperative treatment of lung cancer patients** [209, 210]. The phase 3 ADAURA trial showed a significant 51% reduction in the risk of death after administration of osimertinib for 3 years following resection in non-squamous NSCLC patients with IB–IIIA postoperative stage and a deletion in exon 19 or a substitution in exon 21 of the *EGFR* gene. Grade ≥3 adverse effects were observed in 20% of patients treated with osimertinib and in 13% in the placebo group.

The phase III ALINA trial compared adjuvant treatment with alectinib administered for 2 years against chemotherapy in patients after resection for non-squamous NSCLC with IB–IIIA postoperative stage and *ALK* gene rearrangement. The results confirmed that administration of alectinib was associated with a 76% reduction in the relative risk of recurrence in patients at stage II–IIIA and in the general population (IB–IIIA). Grade ≥ 3 adverse effects during alectinib treatment occurred in 30% of patients (31% for chemotherapy) [211].

Both therapies are reimbursed under the B6 drug program.

Immune checkpoint inhibitors (atezolizumab, pembrolizumab) **have** proven efficacy in the **postoperative treatment of lung cancer patients**.

As part of the phase 3 **IMpower010 trial**, which included patients at stage IB–IIIA with NSCLC (squamous or non-squamous types) regardless of *PD-L1* protein status (no *EGFR*/*ALK* mutations), it was proven that atezolizumab as an adjuvant treatment significantly reduced the risk of death by 57% in postoperative stage II and IIIA patients with *PD-L1* expression ≥ 50% (unknown differences in other subgroups). Grade ≥ 3 adverse effects after atezolizumab treatment affected 12% of patients [212].

The **Keynote-091/PEARLS** trial [213] evaluated the postoperative administration of pembrolizumab to patients with stage IB (≥4 cm) – IIIA NSCLC (stage IIIA according to the TNM 7 classification. According to the European Medicines Agency's translation, this corresponds to stage IB (T2a tumors with a diameter of 4 cm) or stage II or IIIA or IIIB [(T3–4 (tumors with a diameter of >7 cm), N2 according to the 8th version of the TNM classification) after surgery and chemotherapy. Prolongation of disease-free survival (DFS) was demonstrated in the entire study population (regardless of *PD-L1* levels).

Both therapies are reimbursed under the B6 drug program.

Current guidelines for the use of postoperative adjuvant immunotherapy allow for chemotherapy administration if there are no contraindications. Patients eligible for adjuvant treatment should undergo *PD-L1* protein expression testing and *EGFR* and *ALK* gene status assessment (presence of abnormalities being an indication for adjuvant *anti-EGFR* or *anti-ALK* treatment) and *ROS1* testing in the case of non-squamous cell carcinomas.

Pre-operative treatment

The goal of preoperative treatment is to reduce tumor volume and/or eliminate micro-metastases before surgery to increase the R0 resection rate and prolong event-free time (EFS) and survival.

Stand-alone preoperative chemotherapy does not constitute standard of care. The indication is primarily for stage III NSCLC patients with borderline resectability, in whom the decision to use preoperative chemotherapy was made at a multidisciplinary meeting. Preoperative chemotherapy increases the risk of surgical complications and, in a group where it will not reduce tumor masses, poses the risk of postponing or abandoning surgical treatment or radiotherapy [214].

As part of the **CheckMate 816** trial, 3 cycles of **platinum-based** chemotherapy **in combination with nivolumab** were administered to patients with stage IB to IIIA according to the 7th edition of the TNM classification. Preoperative immunochemotherapy with nivolumab increased the percentage of pathologic complete responses (pCR) to 24% versus 2% in the standard chemotherapy group and increased the median event-free time (EFS) (the event being progression or death before the next line of treatment) to 32 months versus 21 months in the control group [215]. The toxicity of immunochemotherapy was not significantly higher than that of chemotherapy (43 cases of grade 3 or higher adverse effects of immunochemotherapy), but approximately 10% of patients discontinued treatment due to complications. Patients with a minimum of 1% *PD-L1* protein expression in tumor cells taken from a biopsy performed before surgery and patients at clinical stage III benefit most from preoperative immunochemotherapy.

> A preoperative treatment regimen using nivolumab is reimbursed and available through the B6 drug program.

Most often, preoperative treatment is combined with postoperative treatment in a perioperative (so-called "sandwich") regimen.

Perioperative (sandwich) treatment

Perioperative treatment of lung cancer, including neoadjuvant (preoperative) and adjuvant (postoperative) therapy, is currently a key component in the management of patients with operable non-small cell lung cancer. It involves adding systemic treatment before and/or after surgical treatment, which is why it is referred to as "sandwich" treatment. Its introduction and further development are driven by the need to increase treatment efficacy, reduce the risk of recurrence and improve overall survival, and is clinically justified.

The goals of perioperative treatment for lung cancer are:

- → Elimination of micro-metastases, which may already be present at the time of diagnosis, even if they are not detectable by imaging.
- → Optimization of surgical treatment – enables less extensive surgeries and increases the efficiency of resection.
- → Reducing the risk of recurrence, which is particularly important since more than 50% of patients experience disease progression after surgery.
- → Increasing the chance of radical tumor resection by reducing tumor volume with neoadjuvant therapy.
- → Improving overall survival (OS), as demonstrated in numerous clinical trials.

The introduction of perioperative treatment into clinical practice is a new challenge for thoracic surgeons and requires their active participation in the diagnosis and treatment pathway planning process for the patient in collaboration with clinical oncology specialists and diagnosticians.

Perioperative immunochemotherapy contributes to reducing the risk of recurrence and improving the survival of patients with locally advanced NSCLC.

Pembrolizumab, nivolumab and durvalumab have clinically proven efficacy in the perioperative treatment of lung cancer patients with immunochemotherapy. Trials with preoperative chemotherapy in combination with immunotherapy have been conducted in populations of patients at the early stages of NSCLC who were eligible for surgical treatment.

The **Checkmate 77T** trial [216] evaluated the **perioperative** use of **nivolumab** in combination **with 4 cycles of preoperative chemotherapy** with follow-up immunotherapy for one year after radical resection in stage IIA – IIIB cases. Compared to the group receiving chemotherapy alone preoperatively and placebo postoperatively, there was a significant improvement in the 18-month EFS rate to 70% and 47% pCR versus 50% 18-month EFS and 4.7% pCR rate in the control arm.

Perioperative treatment with nivolumab is not reimbursed
in the B6 drug program.

As part of the **Keynote-671** study [217], four cycles of preoperative **immunochemotherapy with pembrolizumab** were compared with four cycles of two-drug chemotherapy. In a group of patients in TNM grade II-IIIB according to the 8th TNM classification (with N2 features) eligible for surgery, the neoadjuvant use of pembrolizumab with chemotherapy, followed by surgery **and postoperative immunotherapy,** improved EFS at two-year follow-up (51% vs. 35%). A higher percentage of pCR was also observed (18% vs. 4%). Achieving pCR in both arms of the study was an independent prognostic factor. Differences in OS achieved statistical significance in the second interim analysis with a median follow-up of 36.6 months. [HR=0.72 [95% CI 0.56; 0.93], p=0.00517]. Median overall survival was not reached in the group of patients treated with pembrolizumab and was 52.4 months in the group of patients receiving placebo. (95% CI: 45.7; not reached) [218]. Grade 3 or higher adverse effects occurred in 45% of those receiving pembrolizumab and 37% of the placebo group.

Perioperative immunochemotherapy with pembrolizumab is reimbursed under the B6 drug program.

The Phase III **AEGEAN** trial evaluated the efficacy and safety of durvalumab in the perioperative treatment of patients with resectable stage II-IIIB non-small cell lung cancer. The addition of durvalumab to standard neoadjuvant chemotherapy and continuing postoperative therapy in patients with resectable stage II-IIIB NSCLC led to a significant improvement in event-free survival, with an acceptable safety profile. Although overall survival data is still immature, the observed trend suggests a potential benefit of durvalumab in this patient population.

Perioperative treatment with durvalumab is not yet reimbursed under the B6 drug program.

More clinical trials evaluating the perioperative use of various combinations of immunotherapy with chemotherapy and other immune checkpoint inhibitors are currently underway.

The results of clinical trials conducted in recent years in the field of perioperative immunotherapy, have shown that perioperative treatment with preoperative immunochemotherapy and postoperative immunotherapy has significant benefits in terms of the main goals: complete responses and event-free survival, for patients diagnosed with both histological types: squamous cell carcinoma and non-squamous cell carcinoma.

Patients with stage IIIA non-small cell lung cancer had the greatest benefit (the benefit in stage II was also significant). This is important because the effectiveness of surgical treatment in stage III has been most limited to date. In addition, reducing the risk of tumor recurrence should translate into a significant improvement in prognosis in the form of prolonged overall survival.

The first eligibility criterion for perioperative treatment is the determination of the histological type of non-small cell lung cancer including assessment of PDL-1 protein expression and exclusion of the presence of pathogenic variants of *EGFR*, *ALK* and *ROS1* genes, which requires obtaining tissue material of sufficient quality to allow pathomorphological, immunohistochemical and molecular evaluation. This continues to be a challenge for many centers in Poland due to the difficulty of collecting material and the long waiting time for biomarker evaluation.

The introduction of immunotherapy and molecularly targeted therapies into clinical practice has significantly changed the treatment strategy for patients with non-small cell lung cancer (NSCLC). This applies both to advanced-stage cancers that are ineligible for surgery and, increasingly, to primary resectable cases. At the same time, they involve numerous challenges. A key role in the qualification of patients for preoperative treatment is played by a precise assessment of the tumor stage, the possibility of radical resection, and pathomorphological and biomarker analysis. The safe use of modern perioperative treatment requires careful risk assessment and close monitoring of the course of treatment. Histopathological analysis of the post-operative material is no less important, as it can provide the basis for further complementary treatment.

To optimize the effectiveness of this approach, it is crucial to systematically collect clinical data, analyze experience, and report on treatment outcomes to regularly assess the services and challenges of perioperative treatment of non-small cell lung cancer. Improving access to perioperative lung cancer treatment in Poland requires multifaceted changes that include the organization and financing of the health care system, access to modern therapies and coordination of care based on multidisciplinary teams.

5.4.6. Role of multidisciplinary teams and Lung Cancer Units

New combination therapy options for lung cancer bring greater challenges in terms of detailed assessment of eligibility for treatment, evaluation of outcomes during treatment and decisions on optimal perioperative treatment. Given the increasing complexity of biomarker interpretation and the need for close collaboration with clinical, laboratory and research experts, this calls for a separate multidisciplinary team dedicated exclusively to lung cancer patients.

Multidisciplinary teams (MDTs) should include a team of specialists: clinical oncologist, thoracic surgeon, radiologist, patient coordinator, pulmonologist, radiation therapist, pathologist, genetic diagnostician, who will develop a treatment plan after consultation with the patient.

The multidisciplinary team should have full information from the diagnostic testing area: results of pathomorphological evaluation, imaging results, molecular and immunohistochemical test results. It is also important to assess the patient's general condition, e.g.: the presence of ischemic heart disease, chronic obstructive pulmonary disease, the patient's ability to withstand physical exertion. The MDT should also be able to decide which case should be discussed again. A prerequisite for the effectiveness and universality of consultations is their adequate pricing as an unlimited service and billing after meeting several administrative conditions, such as the quality of documentation [219].

In patients qualified for systemic treatment before or after surgery, it is crucial to assess the status of the tumor. This requires invasive mediastinal diagnostics in addition to imaging studies, so the cooperation of experienced specialists in thoracic surgery, pathology and clinical oncology is essential here.

An important aspect of treating patients with lung cancer is also to monitor the effects of treatment and maintain a registry of treated patients, which will allow periodic analysis of the benefits and difficulties of therapy [220].

Due to the increasing complexity of combined diagnostic and therapeutic management in lung cancer, it should ultimately be carried out in centers which have appropriate experience and provide multidisciplinary decision-making and comprehensive care. **The optimal model of care for lung cancer patients are the *Lung Cancer Units* competence centers**.

Combination treatment in lung cancer should be implemented in centers that have a full multidisciplinary team, including a thoracic surgeon, a clinical oncologist, a pulmonologist, a radiation oncologist, a pathomorphologist and a radiologist, together with a molecular diagnostician and diagnostic and therapeutic facilities. Only under such conditions can optimal therapeutic decisions be made and patients provided with the highest quality of care.

By creating an organizational structure with access to comprehensive diagnostics, modern therapies and the ability to provide coordinated care, it is possible to improve outcomes for lung cancer patients by ensuring appropriate evidence-based management and reducing unwarranted interventions. Specialists participating in multispecialty teams for combination treatment (including immunotherapy and molecularly targeted therapy) should be knowledgeable about all aspects of therapeutic management, including treatment resistance, incidence of adverse events and complications.

This requires careful monitoring and measures to prevent complications, crucial to the safety of immunotherapy and targeted treatment. An extremely important task of the multidisciplinary team is to evaluate the clinical benefits of therapy, assess pathological response to systemic treatment, predict treatment response and adjust treatment strategies on the basis of the data obtained.

According to the RECIST classification, criteria for evaluating response in solid tumors are based on pathologic response (pCR and MPR) and are primary and surrogate endpoints used instead of survival time indicators.

Patients undergoing immunotherapy may show a delayed but sustained response to treatment or exhibit pseudoprogression – pathomorphological evaluation after surgery may not correspond to radiological evaluation. Therefore, competence center specialists should have extensive and up-to-date knowledge of this important topic in order to make appropriate therapeutic decisions [221].

Multispecialty teams treating lung cancer patients, responsible for qualifying and monitoring systemic therapy, should keep their knowledge up-to-date based on the latest clinical trial results. The number of ongoing studies on systemic treatment is enormous, requiring constant adaptation of therapeutic strategies to the latest scientific developments.

The qualification of patients in early clinical stages (II-IIIB) for combination therapy should be done as early as the initial diagnosis, before any causal therapy is implemented.

Systematic monitoring of treatment results is also crucial. The team treating patients should keep a record of patients treated perioperatively, which allows for an analysis of the effectiveness and safety of the therapies used. The best solution in Poland would be integrating the databases with the National Cancer Registry (NCR), or the National Lung Cancer Registry, or the creation of a new registry, for example, by the health ministry. The maintenance of such a registry should ultimately be a prerequisite for the use of combination treatment involving immunotherapy and targeted therapies, which would allow better evaluation of the effects of therapy and further optimization of therapeutic management.

LCUs provide:

- **Access to advanced technologies and modern therapies**
  - → these centers have qualified medical staff, experience and modern diagnostic and therapeutic technologies, enabling personalized, innovative treatment, such as targeted therapies, immunotherapy and advanced surgical and radiotherapeutic procedures. This translates into better treatment results.
- **Better process management**
  - ☆ in *lung cancer unit* centers, the diagnostic process of treatment is carefully planned and monitored by the entire team of specialists. Through regular interdisciplinary meetings, every aspect of treatment – from diagnosis to rehabilitation – is discussed, minimizing the risk of errors and delays. An important support in this process is the function of the oncology patient coordinator.
- **Early diagnosis and rapid intervention**
  - ☆ specialized centers often have procedures that allow rapid diagnosis and implementation of treatment. Early and prompt treatment is crucial for lung cancer, as the rate of disease progression can be very high.
- **Psychological support and rehabilitation**
  - → lung cancer patients and their families receive not only medical but also psychological support. Specialized centers provide access to psychologists, physiotherapists and other rehabilitation specialists, which is important in improving the patient's condition and well-being and coping with the emotional burden of the disease.
- **Improving treatment methods**
  - → highly specialized centers participate in clinical trials, which contributes to the development of new therapies and treatments. Patients have access to innovative methods, often unavailable elsewhere.

Currently, Poland has LCUs based on international certification, not a model included in the legislation, as is the case with *Breast Cancer Units*. The Health Ministry is currently in the final stages of drafting the regulation implementing the LCU. The draft solution was prepared by a team of experts appointed by the National Cancer Council.

New design of ***Lung Cancer Units*** (LCU) in Poland, which was developed by, among others, the National Consultant in Clinical Oncology, numerous experts, including those from the Polish Lung Cancer Group, was created within the framework of the National Cancer Council and was submitted to the Ministry of Health for legislative work in mid-2024. Its implementation was planned for 2025.

In response to the need to provide comprehensive care for oncology patients, the Health Ministry has prepared draft regulations of the Minister of Health on guaranteed services in the field of:

- → specialist outpatient care – which introduces diagnostics and monitoring in the field of comprehensive oncology care for patients with lung cancer and other thoracic cancers,
- → hospital treatment – under which specific conditions are being introduced for the Center of Competence for lung cancer and other thoracic cancers and comprehensive oncological care for recipients with lung cancer and other thoracic cancers,
- → rehabilitation – under which comprehensive oncological care is introduced for recipients with lung cancer and other thoracic cancers – rehabilitation module.

Based on the before mentioned three draft regulations, the introduction of LCU model was planned to improve access to treatment for lung cancer as well as other selected thoracic cancers [222].

The clinical community has been waiting almost 15 years for the implementation of *Lung Cancer Units* in Poland.

5.5. *Standards and practice guidelines*

Key standards, recommendations and regulatory considerations for oncology care of lung cancer patients:

Poland

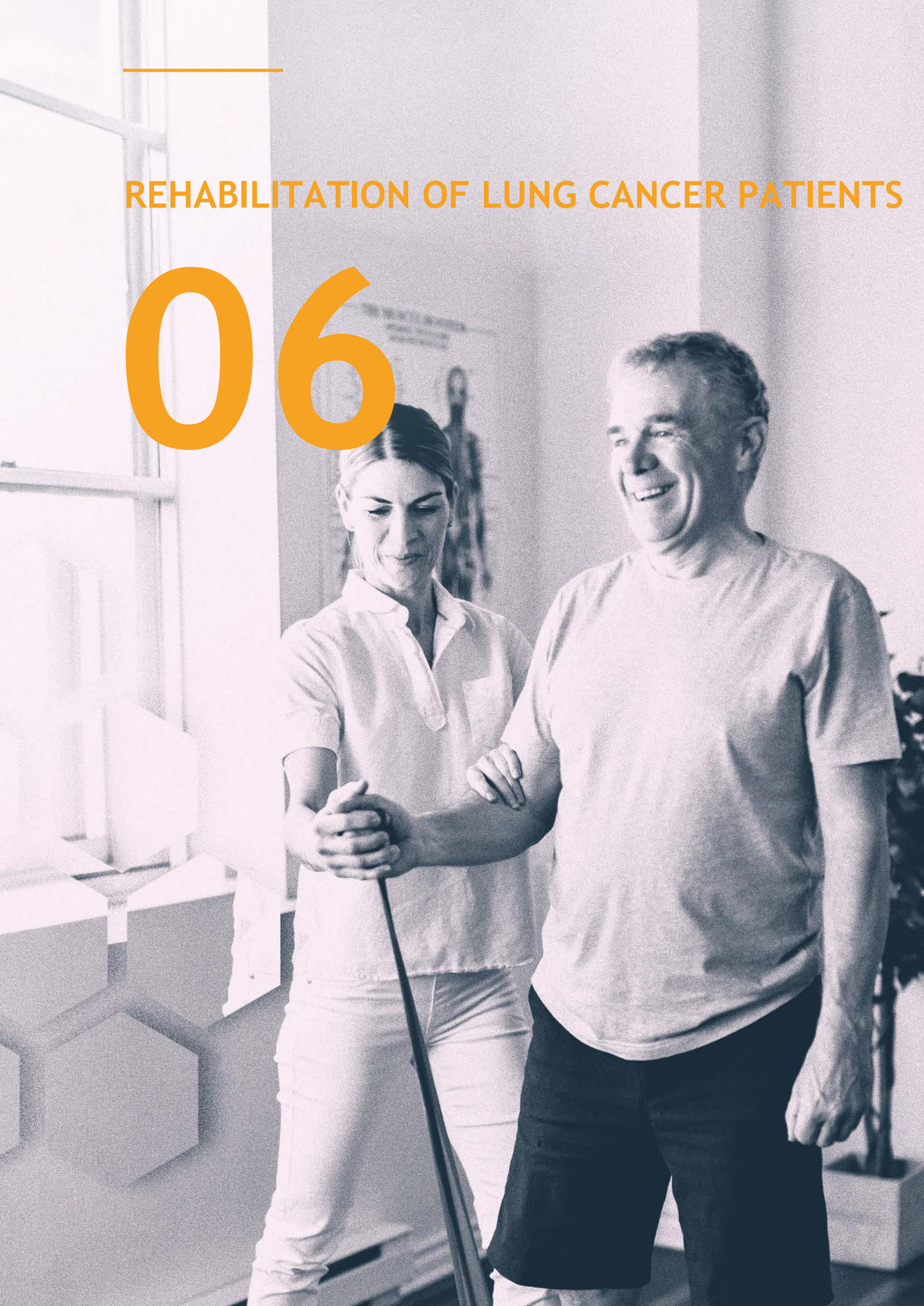
- Polish guideline 2022 entitled. "Thoracic Cancers" edited by prof. dr hab. Maciej Krzakowski [220]. Currently, the process of updating the guidelines for the National Oncology Strategy has begun, and publication is scheduled for the second half of 2024 (probably Q4). There are European (ESMO) and American (ASCO and NCCN) guidelines for the management of thoracic cancers.
- Pathomorphology: standards and examples of good practice and elements of differential diagnosis. Guidelines for pathomorphology departments/laboratories – The rules for collecting, sending for examination and processing tissue and cytological material used in the diagnosis of lung cancer are contained in the guidelines of the Polish Society of Pathologists, in textbooks [223].
- Organizational and procedural standards in pathomorphology. Guidelines for pathomorphology departments/laboratories (2020) [224].
- Regulation of the Minister of Health of 3 July 2024 on the detailed criteria determining the affiliation of a healthcare provider to the level of oncology care security of the National Oncology Network Specialized Oncology Treatment Center.
- Key oncology care recommendations for the organization and clinical management of thoracic cancers (2024) [225]
- Standards for genetic diagnostics – Somatic changes in solid tumors of children and adults, 2024 [226]
- Expert position on systemic perioperative treatment of patients with non-small cell lung cancer 2024 [227]

WORLD

- European and global guidelines on lung cancer issued by European and global scientific societies: ASCO, ESMO, NCCN, ASCO, RSNA, ACR, ASTRO, ESTRO, IASLC.
- *Lung Cancer Staging* TNM 9th Edition (2024) [228].
- Recommendations of the *Fleischner Society* 2024, an interdisciplinary scientific society whose main goal is to expand the study of thoracic pathologies through the use of thoracic imaging [229].
- ACR *(American College of Radiology*) Guidelines – Lung-RADS 2022 [230].
- International Society of Radiology guidelines [231].
- European Society of Radiology Recommendation 2024 [232].
- ASCO Guidelines for Surveillance of Patients Treated with Intent to Cure [233].
- Consensus on screening program for early detection of lung cancer in Poland [234].
- ESMO 2023 guidelines for NSCLC with oncogene dependency: Oncogene-addicted metastatic non-small-cell lung cancer:
  ESMO clinical practice guideline for diagnosis, treatment and follow-up. Ann, Oncol. 2023 [235]
- NCCN Guidelines 2022: NCCN Guidelines Committee. Clinical Practice, Guidelines in Oncology:
  Non-Small Cell Lung Cancer, version 5.2022 [236]
- CAP / IASLC / AMP 2018 Guidelines – College of American Pathologists (CAP), International Association for the Study of Lung Cancer (IASLC), Association for Molecular Pathology (AMP) guidelines for molecular testing to qualify patients with NSCLC for treatment with tyrosine kinase inhibitors [237]
- EACTS Guidelines [238]
- ERAS 2019 guidelines for faster recovery after thoracic surgery: recommendations from the Enhanced Recovery After Surgery Association and the European Society of Thoracic Surgeons (ESTS) [239]

REHABILITATION OF LUNG CANCER PATIENTS

06



Rehabilitation is an integral part of comprehensive care for lung cancer patients, both during and after treatment. Its goal is not only to restore physical fitness, but also to improve quality of life, reduce complications, and provide psychological and social support to the patient. In Western European or Scandinavian countries, oncology rehabilitation is the standard of care – it is included in the treatment plan from the moment of diagnosis.

In Poland, rehabilitation services are still fragmented, and their availability varies widely from region to region. Patients with lung cancer are still too rarely referred for prehabilitation, or pulmonary rehabilitation, despite the unequivocal health and clinical benefits. It is worth noting, however, that an increasing number of entities are implementing ERAS *(enhanced recovery after surgery*) guidelines for comprehensive perioperative patient care, aimedat improving not only patient function, but also the outcome of the entire treatment. Unfortunately, these procedures in Poland are not adequately priced and financed by the National Health Fund.

The primary goals of rehabilitation for lung cancer patients include:

- → increasing respiratory and circulatory fitness,
- → improving exercise tolerance,
- → prevention of muscle atrophy and sarcopenia, → restoring independence in daily functioning,
- → reducing shortness of breath, fatigue and anxiety,
- → improving overall well-being and quality of life.

Efficient rehabilitation has both physical and psychological dimensions, affecting the patient's motivation, cooperation in the treatment process and social readaptation.

6.1. Prehabilitation or ERAS in thoracic surgery

ERAS *(Enhanced Recovery After Surgery)* [240] is a standardized, multi-component perioperative care program aimed at **reducing surgical stress, accelerating recovery and limiting complications.**

In thoracic surgery – where the risk of respiratory complications, postoperative pain and loss of function is particularly high – implementation of ERAS translates into **shorter hospital stays, fewer complications, lower opioid use and lower overall costs.**

The ERAS protocol includes preoperative recommendations:

- → assessment and optimization of general condition (COPD, cardiovascular diseases, malnutrition, anemia);
- → **breathing and physical training** (training spirometry, fitness exercises, expiratory muscles exercises);
- ☆ **nutritional interventions** (screening malnutrition, immunomodulatory nutrition, protein supplementation);
- ☆ **smoking cessation** and anti-smoking support (≥4 weeks before surgery);
- → patient education (care pathway, daily goals, early verticalization, self-control of pain).

During the operation:

- ☆ minimizing surgical trauma **(VATS/single-port preference, VATS/robotics** with appropriate indications);
- → balanced anesthesia with **multimodal and regional analgesia** (e.g., muscle sheath blocks, paravertebral; opioid restriction);
- → targeted fluid therapy, normothermia, nausea/vomiting (PONV) and thrombosis (VTE) prevention;
- → strategy that spares the drain(s) and catheters.

Postoperative:

- → **early verticalization and mobilization** (on the day of surgery or the day after);
- → early nutrition, glycemic control;
- → standards for **removing drains** based on criteria (air leakage/volume), encouraging effective coughing and breathing exercises;

- → continuation of **multimodal analgesia** (preferentially opioid-free or opioid-sparing);
- → monitoring protocols and criteria for safe hospital discharge.

Benefits of implementing the ERAS protocol:

- → **a decrease in the rate of complications** (especially respiratory) and **a shorter hospital stay by** 1-3 days compared to conventional care;
- → **less opioid consumption**, better pain control and faster return to function;
- → **fewer rehospitalizations** due to education and standardization of discharge;
- → **reduction in total costs** (shorter hospitalization + fewer complications).

Prehabilitation and pulmonary rehabilitation in lung cancer patients reduce the incidence of postoperative complications and shorten the length of hospital stay [240, 242, 243, 244].

The prerequisite for successful implementation and maintenance of the ERAS program in thoracic surgery is, first and foremost, **close interdisciplinary cooperation of** the entire therapeutic team – thoracic surgeon, anesthesiologist, physiotherapist, dietician, nurse or ERAS coordinator and psychologist. It is also crucial to **standardize clinical pathways**, covering all stages of care
– preoperative, intraoperative and postoperative
– along with developed checklists and daily goals for the patient to monitor progress in recovery.

An indispensable part of the system is a **regular quality audit**, based on measurable indicators such as length of hospitalization, complication rate according to the Clavien-Dindo scale, number of readmissions to the hospital, postoperative pain levels, opioid consumption, time to first mobilization or the moment of drains removal.

What is equally important is **the continuity of patient care**, covering all stages of treatment – from the visit to the rehabilitation clinic and preparation for surgery, through the stay in the ward, to post-discharge follow-up, including forms of remote monitoring and follow-up consultations.

Such an organized system makes it possible not only to reduce recovery time, but also to achieve sustainable improvement of the quality of treatment and patient safety.

Many Polish thoracic surgery centers **are gradually implementing elements of ERAS**, and some are already running full pathways (especially for minimally invasive surgery). **A critical gap** remains the lack of funding for **ERAS/preoperative rehabilitation clinics** - a key stage of patient preparation that directly affects the risk of complications and length of hospitalization. Currently, prehabilitation is implemented piecemeal (as part of AOS or in-house projects), **without a dedicated service code and tariff**, which limits the availability and scale of the program.

Recommended directions for the development of prehabilitation in Poland:

- → **Including preoperative rehabilitation and ERAS clinics in the basket of guaranteed healthcare services** (a dedicated NHF product with a tariff that includes nutritional assessment, respiratory/physical training, anti-smoking support, education).
- → **Standardization of ERAS pathways** in thoracic surgery (minimum mandatory elements, quality measures, annual audit).
- → **Combining funding with quality** (e.g., bonus for achieving ERAS goals: POD0/1 mobilization, ≤X days to remove drains, LOS in benchmark).
- → **Integrating ERAS into the organizational models of LCUs** (Lung Cancer Units) and the National Oncology Network – with a coordinator responsible for patient flow between the ERAS clinic, the unit and post-discharge follow-up.
- → **Team training** (regional anesthesia, multimodal analgesia, respiratory protocols) and **patient tools** (ERAS goal log, educational apps).

6.2. Rehabilitation during and after systemic treatment and radiation therapy

Systemic treatments (chemotherapy, immunotherapy, targeted therapies) and radiation therapy can cause weakness, loss of muscle mass, shortness of breath and chronic fatigue. Rehabilitation programs aimed at improving exercise tolerance, respiratory function and muscle strength have measurable benefits in terms of quality of life, symptom reduction and social reintegration.

Post-treatment physical activity programs, including aerobic exercise, resistance training, Nordic walking, yoga or therapeutic dance, tailored to the patient's clinical condition, are increasingly common.

An important aspect of comprehensive patient care is the monitoring and management of adverse effects of systemic therapies.

Lung cancer treatment, which includes **chemotherapy, immunotherapy, targeted therapies** and radiation therapies, carries the risk of adverse effects that are inherent in intensive cancer therapy. Their presence does not always mean that treatment must be discontinued – in most cases, **effective prevention, early recognition and proper management** are possible, thus maintaining continuity of therapy and the patient's quality of life.

Chemotherapy is mainly associated with hematological toxicity (neutropenia, anemia, thrombocytopenia), gastrointestinal toxicity (nausea, vomiting, diarrhea), as well as mucosal damage, hair loss and fatigue. Depending on the cytostatic used, there may also be cardiotoxic, nephrotic or neurotoxic effects.

Immunotherapy (immune checkpoint inhibitors, ICI) has a different safety profile – **autoimmune-related adverse effects** are typical (***immune-related adverse events***), which can include:

- → pneumonia *(pneumonitis)*,
- → inflammatory bowel disease *(colitis)*,
- → inflammation of the thyroid, adrenal and pituitary glands (endocrinopathies),
- → dermatitis, → hepatitis,
- → in rarer cases – myocarditis or kidney inflammation.

Most of these complications are **mild to moderate** and resolve with appropriate treatment (such as corticosteroids), but they require early recognition and the experience of the treatment team.

Molecularly targeted therapies (inhibitors of *EGFR*, *ALK*, *ROS1*, *KRAS*, *MET* and others) can cause characteristic adverse effects due to the drug's mechanism of action, including skin rashes, dry skin, diarrhea, oral mucositis, liver dysfunction, and in some cases interstitial pneumonia. Effective management of these symptoms prevents treatment discontinuation and improves treatment tolerance.

Radiation therapy, on the other hand, can lead to local radiation reactions – inflammation of the skin, mucous membranes and esophagus – and radiation pneumonitis, which is one of the most serious complications of lung cancer treatment and can lead to pulmonary fibrosis. These actions depend on the dose, the volume of the irradiated field and individual patient risk factors.

Effective management of adverse effects requires **systematic patient monitoring**, education of the patient and their surrounding, and close interdisciplinary cooperation. In practice, this includes:

- ☆ **regular evaluation of laboratory parameters** (blood cell count, liver enzymes, renal parameters, thyroid hormones, inflammatory markers),
- ☆ **follow-up imaging tests** (X-ray, CT, ultrasound) to detect complications such as pneumonitis or myocarditis,
- ☆ **assessment of clinical condition and quality of life** (fatigue, appetite, pain, breathlessness),

- ☆ **prevention of complications** (e.g., neutropenia prophylaxis, infection prevention, nutrition support treatment),
- → **early response to** adverse effects according to guidelines (e.g., ESMO, NCCN, PTOK).

Modern oncology requires close cooperation between specialists from many disciplines – **clinical oncologists, radiation therapists, pulmonologists, cardiologists, endocrinologists, dermatologists, gastroenterologists and nephrologists** - both in monitoring complications and their treatment. Only such a model of care allows early detection and effective control of adverse effects, minimizing the risk of permanent sequelae. Of particular importance is the collaboration with **cardiologists (cardiooncology)** in the context of **cardiovascular** toxicity, **pulmonologists** in the diagnosis and treatment of **pulmonary** complications, **endocrinologists** in the care of immunotherapy-induced endocrine disorders, and **dermatologists** for skin complications.

Patient education about possible adverse effects, how to recognize them and how to report symptoms should be an integral part of the therapeutic process. Equally important is the **role of the oncology coordinator**, who monitors the course of treatment, transfers information between specialists and supports the patient in quickly accessing consultation.

Adverse effects of cancer therapy in lung cancer are **an inevitable but predictable part of treatment**. Their effective monitoring and management is made possible by modern prevention strategies, standards of practice and interdisciplinary cooperation. This approach not only improves patient safety but also increases the effectiveness of therapy and maintains its continuity, which directly translates into patient outcomes and quality of life.

6.3. *Psychological care – the role of psycho-oncology*

Rehabilitation is not just a physical process – it is also **emotional and mental support**. Anxiety and depressive disorders occur in up to 40% of lung cancer patients and require early intervention. Psycho-oncologist assistance, group therapy and active support groups help patients adapt to life with and after the disease.

Doctor-patient communication, supported by nursing staff and clinical psychologists, remains key.

Cancer causes severe stress, anxiety and lowered mood in patients and their families. An untreated mental crisis can **reduce motivation for treatment, worsen adherence and clinical outcomes**, and increase the number of emergency contacts with the system and the risk of premature termination of therapy. For this reason, leading scientific societies recommend **routine screening for distress and integration of psychosocial care** with cancer treatment [245, 246].

Psychological support includes psychoeducation, crisis interventions, individual and group therapy, anxiety and stress reduction techniques, symptom management training (e.g. sleeplessness, pain), coordination of social assistance and psychiatric consultations when necessary (pharmacotherapy for mood and anxiety disorders). Working with dyspnea and anxiety, smoking cessation interventions and caregiver support are particularly important in lung cancer care [247]. It is recommended that the assistance be continuous – from diagnosis, through treatment, post-treatment follow-up and palliative care.

According to the International Standard of Quality Cancer Care and NCCN/ESMO/ PTPO guidelines, **distress screening should be performed on every patient routinely**, at the beginning of the pathway and at key turning points (initiation/change of treatment, progression, end of therapy, entry into palliative care).

In practice, the **NCCN Distress Thermometer** [248] and short problem lists with a quick management algorithm (assessment, intervention, escalation to a psychologist/psychiatrist) are used.

The most common problems reported by patients:

- **Anxiety and depression**, sleeplessness, a sense of loss of control.
- **Existential distress**, concerns about family, work and finances.
- **Stigmatization** (especially in smokers/ex-smokers), guilt and shame.
- **Burden on family caregivers** - overload of duties, burnout, decision-making conflicts.

The goal of the intervention is to rapidly reduce distress, restore agency, improve communication with the team, **maintain adherence to treatment** and quality of life [249].

Forms of assistance:

- **Screening** - screening tools + rapid referral pathway.
- **Short-term interventions** (e.g., cognitive behavioral therapy, mindfulness, breathing techniques), support groups, family/guardian consultations.
- **Clinical psycho-oncology** - anxiety and depression disorder therapy, insomnia treatment, support in therapeutic decisions.
- **Psychoeducation/education** - working with information, patient rights, return to work, benefits,
- **Pharmacological treatment** - coordination of care with a psychiatrist.

Psychological care should be **integrated** with clinical oncology and palliative care - to respond to the effects of treatment (e.g., insomnia, anxiety due to shortness of breath, depressive symptoms after long-term therapy). ESMO and NCCN guidelines emphasize the importance of creating **multidisciplinary teams** and escalation of care pathways (from screening to specialized treatment).

Access to psycho-oncological counseling in Poland **remains inadequate and unequal**. In many centers, hospital psychologists help, but **psycho-oncology is not a separate, fully regulated NHF service**, and funding and staffing are limited - a topic that has already been described in national reviews and expert opinions (including the need to standardize the psycho-oncology profession and services [250]). Recent industry materials and reports highlight the shortage of rapid psychological help and long queues in the public mental health system

Recommended directions for the development of prehabilitation in Poland:

- **Introduce mandatory distress screening** at oncology centers with a defined intervention pathway.
- **Regulate the psycho-oncology profession, standardize definitions, and fund psycho-oncology services** in the guaranteed (National Health Fund) basket, including consultations for caregivers.
- **Strengthen the staff** (psycho-oncologists/clinical psychologists/psychiatrists) and integrate psychological care in the *Lung Cancer Units* model.
- **Develop forms of tele-support** and fast-tracking for patients in crisis (e.g., post-diagnosis/progression).

6.3. Nutritional care and nutrition treatment

Proper nutrition is one of the key factors determining the effectiveness of cancer treatment. In lung cancer patients, **malnutrition and cancer cachexia** are among the most common and debilitating complications. **Symptoms of malnutrition** are estimated to **occur in 50-60% of patients**, and in up to 20% they can be the direct cause of death.

The state of malnutrition is associated with **weakened immunity, poorer tolerance of systemic therapy and radiation therapy, slower wound healing after surgery,** and longer hospitalization.

Malnourished patients are more likely to require treatment interruptions, are more prone to infections and loss of muscle mass (sarcopenia), which significantly reduces quality of life and effectiveness of therapy.

Malnutrition affects up to 60% of lung cancer patients, and its consequences include weakened immunity, worse tolerance of therapy and longer recovery.

According to **ESPEN** (European Society for Clinical Nutrition and Metabolism) and **ESMO** (European Society for Medical Oncology) recommendations, nutritional assessment should be **a routine part of oncology care** [251, 252].

In clinical practice, it should include:
- → measurement of body weight and BMI,
- → body composition analysis (e.g., BIA, DXA, CT - muscle mass assessment),
- → blood chemistry (albumin, CRP, total protein, electrolyte parameters),
- → assessment of appetite, intake and gastrointestinal symptoms,
- → screening scales such as NRS-2002 (Nutritional Risk Screening) or PG-SGA (Patient Generated Subjective Global Assessment), among others.

Assessment should be performed **at the beginning of treatment, after each change in therapy and at times of deterioration in general condition,** in order to implement nutritional intervention as early as possible.

Nutritional management should be individualized and tailored to **the stage of treatment (surgical, systemic, radiotherapy or palliative)**, including:
- → **Oral nutritional supplements (ONS)** - high-protein, immunomodulatory and energy supplements used to supplement natural diets.
- ☆ **Enteral nutrition** - recommended when oral intake is insufficient (<60% of energy needs for >7 days). It can be delivered by probe or PEG.
- ☆ **Parenteral nutrition** - used when enteral nutrition is not possible (e.g., obstruction, severe dysphagia, postoperative complications).
- ☆ **Immuno-nutrition** (e.g. preparations containing arginine, omega-3 acids, nucleotides) - is particularly important in the perioperative period, affecting the reduction of the risk of infection and speeding up recovery.

Nutrition should be included **as early as possible** - already at the planning stage of cancer treatment - and **carried out in parallel with anti-cancer therapy**, and not only at the point of advanced cachexia.

Effective nutritional care requires **close collaboration between the oncologist, clinical dietitian, surgeon, nurse, physiotherapist and psychologist**. Such teams function in the Nutrition Support Team model, recommended by ESPEN and the Polish Dietetics Association. Regular exchange of information between specialists allows to:
- ☆ optimize therapy and adapt it to changes in the patient's condition,
- → integrate nutritional support with physiotherapy (maintain muscle mass and performance),
- → counteract appetite disorders, depression and apathy,
- → educate the patient and family on proper nutrition at home.

In Poland, nutrition care in oncology is still not standardized and **there are no comprehensive pathways funded by the National Health Fund**, including dietary counseling and outpatient nutrition treatment. Many centers lack full-time clinical dietitians, and patients receive support mainly through projects or internal initiatives.

Implementation of **an integrated nutrition care** model may include:
- → mandatory **nutritional screening** when a patient is admitted to an oncology center,
- → ensuring **access to a clinical nutritionist** at every stage of treatment.

- development and reimbursement of perioperative immuno-nutrition products,
- education of medical personnel on early identification of malnutrition risk,
- integrating nutritional care into standards ***Lung Cancer Units*** and the National Cancer Network.

Clinical nutrition is an integral part of cancer treatment, not an extra support. Early assessment of nutritional status and prompt implementation of nutritional intervention can increase the effectiveness of therapy, improve treatment tolerance and patient quality of life, and reduce healthcare costs by reducing complications and length of hospitalization.

6.4. Out-of-hospital care and telemedicine solutions

Lung cancer care does not end when a patient is discharged from the hospital. This is another important step in the therapeutic pathway, combining health monitoring, rehabilitation, nutritional support, psychological support and coordination of follow-up visits.

The goal of post-hospital care is to **maintain the effects of treatment, prevent complications, detect recurrences early and improve the patient's quality of life**. In practice, it is after hospital treatment that patients and their families often experience **a sense of confusion and lack of continuity of care**. Therefore, it is extremely important to ensure **coordination between the oncology center, primary care physician, AOS specialists and rehabilitation teams**.

The role of primary health care (PHC)

The primary care physician and community nurse play a key role in ensuring continuity of care for patients after cancer treatment. Their tasks include:

- **monitoring general condition,** vital parameters and possible adverse effects of therapy,
- **coordination of follow-up examinations and specialized consultations**,
- **prevention of comorbidities** (e.g., COPD, cardiovascular, metabolic),
- **health education and support in lifestyle modification** – smoking cessation, diet, physical activity,
- **early identification of signs of relapse or progression of the disease** and referral to an oncology center.

In the integrated care model, the PHC should have constant access to the patient's medical records from the oncology center, as well as the opportunity to consult with a team of specialists via telemedicine.

Outpatient rehabilitation and telerehabilitation

Rehabilitation after lung cancer treatment aims to restore the patient's physical fitness, respiratory capacity and independence, through:

- breathing exercises and training of respiratory muscles,
- increasing physical activity gradually,
- preventing thrombotic and respiratory complications,
- learning to breathe properly and cough effectively,
- support in dealing with chronic fatigue.

The use of **telerehabilitation for respiratory and physical** therapy is on the increase in modern care models – remote sessions with a physiotherapist, activity monitoring via apps and sensors (e.g., pulse oximeter, pedometer, Bluetooth spirometer). Such arrangements allow therapy continuation at home and a faster return to fitness without frequent visits to the facility.

After the end of treatment, many patients experience **a sense of emptiness, fear of relapse and difficulty returning to work or family life**.

Therefore, psychological care should **continue even after discharge**, including individual consultations, group therapy or online support.

Telemedicine solutions allow the implementation of remote psychological consultations and psychoeducation, which is especially important for people living outside large agglomerations. Online support groups and educational platforms run by patient organizations are also playing an increasingly important role, offering the opportunity to talk to a psychologist or other patients in a similar situation.

For post-hospital care to be effective, it must be **coordinated and integrated** within the National Cancer Network and the planned Lung Cancer Units model. In this model, a key role is played by an oncology coordinator and a long-term care nurse, who maintains contact with the patient after discharge, reminds about check-ups, provides support in contacting the PHC, AOS and rehabilitation team, and arranges telemedicine consultations.

Recommended directions for ensuring continuity of care for lung cancer patients:

- Ensuring **continuity of care after discharge** by coordinating care between the oncology center and PHC.
- Implementation of **remote monitoring tools** (telemonitoring, mobile apps, educational platforms).
- Establishment of **a post-hospital care clinic** within the LCU, including rehabilitation, dietetics, psychology and telecare support.
- Inclusion of **telerehabilitation and tele-psycho-oncology** in the NHF's catalog of guaranteed services.
- Development of **a standard for handover of a patient after cancer treatment** – with a control plan, dietary recommendations, rehabilitation program and contact path with the treatment team.

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