National Cancer Plan

Everyone has a role.

April 3, 2023

U.S. Department of Health & Human Services | National Institutes of Health | National Cancer Institute

THE NATIONAL CANCER PLAN

Overview

The National Cancer Act of 1971 recognized the need for a national commitment to making progress against cancer and dedicated the federal government to developing a large-scale, world-class cancer research enterprise.[i] The National Cancer Program requires three significant components: effective administration with clearly defined authority and responsibility, a comprehensive national plan, and necessary financial resources.

President Joe Biden and First Lady Jill Biden have long championed the goal of making progress for families facing cancer, leading the 2016 launch of the Cancer Moonshot[SM], and reaffirming this commitment in 2022 by calling for a national, whole-of-government initiative to "*end cancer as we know it today*"[1]. As part of the reignited Cancer Moonshot, they set goals to reduce cancer mortality by at least 50% over the next 25 years and improve the experience of people living with and surviving cancer, their families, and caregivers. This national charge challenges us to examine current efforts and to identify and address additional needs to dramatically reduce harm from cancer for all people.

With unprecedented scientific opportunities, passion, and commitment from diverse aspects of our society, the time is right to clarify the pressing needs and approaches essential to ending cancer as we know it. With the vision and charge of the Cancer Moonshot, we now present a new road map—a comprehensive National Cancer Plan—to advance the National Cancer Program, acknowledging that more than ever before, we have "a great opportunity … as a result of recent advances in the knowledge of this dread disease to conduct energetically a national program against cancer"[ii] and to demonstrate international leadership in this truly global challenge.

Today's National Cancer Program and a Plan for the Future

The National Cancer Act of 1971 gave broad authority to the director of the National Cancer Institute (NCI) to develop a National Cancer Program that included NCI, other components of the National Institutes of Health, and other federal and nonfederal cancer programs.

The focus of the National Cancer Plan is to achieve a society where every person with cancer lives a full and active life and to prevent most cancers so that few people need to face this diagnosis

Today's National Cancer Program represents a far more complex ecosystem than was imagined in 1971. Our progress against cancer is the direct result of advances made possible by investment from federal, state, and local governments in public health and basic, translational, and clinical research, and by the sustained efforts of researchers in academic and industry laboratories, professional societies, and nonprofit foundations, and

millions of patients, caregivers, and advocates. Most of all, progress is driven by the tireless optimism of many who believe that we can overcome the harm this disease brings to people.

The multitude of talents and resources represented across the National Cancer Program provides a unique opportunity to outline a plan of action that is broad, far-reaching, and impactful in delivering improved health outcomes for Americans. The National Cancer Program's success requires that every facet of our society and every person contribute to bringing about the changes needed to end cancer as we know it today.

To achieve its goals, the National Cancer Plan provides **a framework for collaboration** across the National Cancer Program that will provide the American people the full benefit of each partner's contribution.

The National Cancer Plan has three elements.

First, it establishes **goals** that we must achieve to prevent cancer, reduce mortality from cancer, and maximize quality of life for people living with cancer.

The second component of the National Cancer Plan is a **set of strategies** associated with each goal, describing essential research directions and implementation activities necessary to maximize benefits for everyone. There is still much we do not know about how cancer develops, how it progresses, and how to prevent and treat it. Research is the backbone of the National Cancer Plan, and NCI and the National Institutes of Health lead this component by supporting a comprehensive research portfolio to achieve each goal.

The third and perhaps most important component of the National Cancer Plan is a **call to action** that is at the center of the Cancer Moonshot: that everyone in our society, every organization and individual, do their part to end suffering from cancer. While the government agencies and other organizations that have traditionally comprised the "cancer community" will be essential to achieving the goals of the National Cancer Plan, commitment from many partners in the government, nonprofit, academic, and commercial sectors will speed our efforts. Indeed, every individual has a role to play—from helping friends and neighbors facing cancer to improving health literacy and addressing misinformation, from taking an active role in personal health to supporting programs that promote healthy communities.

GOALS OF THE NATIONAL CANCER PLAN

As President Biden has outlined, the goal of the Cancer Moonshot is to end cancer as we know it today. This bold, yet achievable charge requires us to understand the ways in which we know cancer today and to articulate a clear vision for how to make meaningful progress.

To get there, the National Cancer Plan focuses on eight primary goals. The goals are written as aspirational statements, describing an ideal future, and represent opportunities for everyone and every organization to contribute to our continued progress against cancer. Each goal includes a description of the current state and focused strategies to achieve progress—some within the purview of biomedical research and others for action through public health, health care delivery, financing, and public policy. We encourage everyone involved in our nation's fight against cancer to reflect upon these goals and strategies and to determine where their efforts might contribute.

Eight goals of the National Cancer Plan

1. **Prevent Cancer**
   All people and society adopt proven strategies that reduce the risk of cancer.

2. **Detect Cancers Early**
   Cancers are detected and treated at early stages, enabling more effective treatment and reducing morbidity and mortality.

3. **Develop Effective Treatments**
   Effective treatment, with minimal side effects, is accessible to all people with all cancers, including those with rare cancers, metastatic cancers, and treatment-resistant disease.

4. **Eliminate Inequities**
   Disparities in cancer risk factors, incidence, treatment side effects, and mortality are eliminated through equitable access to prevention, screening, treatment, and survivorship care.

5. **Deliver Optimal Care**
   The health care system delivers to all people evidence-based, patient-centered care that prioritizes prevention, reduces cancer morbidity and mortality, and improves the lives of cancer survivors, including people living with cancer.

6. **Engage Every Person**
   Every person with cancer or at risk for cancer has an opportunity to participate in research or otherwise contribute to the collective knowledge base, and barriers to their participation are eliminated.

7. **Maximize Data Utility**
   Secure sharing of privacy-protected health data is standard practice throughout research, and researchers share and use available data to achieve rapid progress against cancer.

8. **Optimize the Workforce**
   The cancer care and research workforce is diverse, reflects the communities served, and meets the needs of all people with cancer and those at risk for cancer, ensuring they live longer and healthier lives.

PREVENT CANCER

All people and society adopt proven strategies that reduce the risk of cancer.

Strategies

- Undertake fundamental and translational research to increase understanding of cancer etiology and the molecular nature of precancer and its relationship to genetic, behavioral, and environmental influences, and social determinants of health
- Identify methods and technologies to eliminate chronic infections that lead to cancer
- Pursue new vaccines to prevent cancers
- Understand and address toxic and environmental exposures that contribute to cancer
- Increase focus on cancer prevention clinical trials, including intervention and interception trials
- Develop, test, and evaluate interventions that incorporate individual, system, and societal-level approaches to promote cancer risk-reducing behaviors for people of all ages
- Conduct research to identify ways to prevent additional cancers among cancer survivors
- Develop and implement methods to eliminate tobacco exposure
- Address the obesity epidemic by developing and testing societal-level approaches to achieve optimal nutrition for all, with particular attention to early childhood
- Include measures to overcome health disparities at all levels and in all aspects of cancer prevention research

Current State

Scientists estimate that we could prevent more than half of all cancers by applying the knowledge that we have now. This knowledge includes altering behavior to reduce risk from modifiable factors, reducing cancer disparities by closing care gaps, reducing toxic and environmental exposures, receiving available vaccinations against infectious agents known to cause cancer, and implementing other preventive measures such as identifying and removing precancerous lesions.

The modifiable behavioral causes of cancer that remain common in society include tobacco use, alcohol use, obesity, a sedentary lifestyle, and excessive sun exposure. Safe and effective vaccines prevent cancers induced by HPV (human papillomavirus) and hepatitis B. Additionally, inherited genetic factors increase the risk for some cancers, and people with inherited risk syndromes require knowledge of this increased risk and increased monitoring and risk-reducing strategies. By identifying new ways to increase the uptake of proven prevention approaches, especially in medically underserved populations, more research in implementation science and targeted interventions could significantly reduce cancer incidence and death from cancer.

Although most approaches to cancer prevention involve avoidance of risk behaviors, advances in understanding how cancer develops now allow us to identify precancerous abnormalities in cells and tissues that indicate a high risk of transformation to invasive cancer. Cancer interception is the practice of actively treating these high-risk lesions, therefore "intercepting" the process of cancer formation before a malignancy can develop. Currently, effective prevention or interception approaches are unavailable for far too many cancers, particularly those often detected late, such as cancers of the brain, ovaries, and pancreas. There is a great need for more fundamental and clinical research to understand the biology of precancers in ways that lead to effective prevention or interception methods for all cancers.

Examples of NCI Research to Achieve this Goal

NCI supports a broad portfolio of research in cancer prevention, including studies to understand the causes of cancer, characterize the biology of precancerous lesions, and identify and test new prevention approaches, including tobacco cessation, multi-cancer vaccines, and novel prevention agents.

For example, a project supported through the Cancer Moonshot conducts comprehensive molecular analysis of precancerous lesions to identify new targets for prevention therapy. In addition, to better identify and care for individuals with inherited cancer syndromes, genomic research to quantify cancer risk has moved beyond single-gene forms of disease and now focuses on understanding polygenic risk in combination with other clinical and environmental risk factors.

NCI's commitment to funding cancer prevention research is essential because the private sector is hesitant to initiate such investigation due to many economic, logistical, regulatory, and legal considerations.

DETECT CANCERS EARLY

Cancers are detected and treated at early stages, enabling more effective treatment, and reducing morbidity and mortality.

Strategies

- Develop new methods to detect cancers, particularly for those cancers where no effective screening tests currently exist
- Develop novel imaging technologies for early cancer detection for use alone or in combination with other tests
- Develop methods to identify precancerous cells and eliminate them while minimizing side effects
- Conduct rigorous clinical trials to capture evidence about the benefits and harms of novel cancer detection tests
- Develop research partnerships that include primary care providers, researchers, and communities at increased risk for cancer to improve the testing and adoption of effective cancer screening
- Conduct research to identify and overcome barriers to the treatment of early-stage cancers in communities with disparities, including financial toxicity and policies that limit effective system-level and community-sourced patient navigation services

Current State

Finding cancer in its earliest stages, when it is most treatable, can reduce the number of people who die from cancer. Currently, however, only a handful of cancer screening tests are known to reduce the chance that people regularly receiving screening will die from the screened cancer and for which the benefits of screening outweigh the harms. They include:

- mammography for breast cancer
- HPV and Pap tests for cervical cancer
- colonoscopy, sigmoidoscopy, and stool-based tests for colorectal cancer
- low-dose CT scans for lung cancer

Unfortunately, screening rates for some of these successful tests are suboptimal. People's access to and use of screening can be affected by numerous social determinants of health, including where they live, whether they have health insurance, and whether they have

access to transportation, among others. In addition, there are no proven screening tests for nearly all other cancers, including those with high mortality, such as pancreatic, ovarian, and brain cancer. As a result, these cancers are often diagnosed based on symptoms, by which time they are often advanced and far more challenging to treat.

Once cancer is detected, it must be successfully treated. Although there have been tremendous advances in treatment, far too many cancers are diagnosed late when treatment is less likely to be effective. A better understanding of the reasons for disparities in rates of early detection of cancer across subpopulations is warranted. Also important is developing ways to screen for and effectively treat cancers for which mortality rates remain high.

New technologies under development can detect circulating tumor cells, tumor DNA, and other substances in the blood that indicate the presence of many types of cancer. Multi-cancer detection (MCD) assays developed using these technologies can improve early cancer detection, particularly for cancers without a current screening modality. These assays may also help identify patients at very high risk of being diagnosed with cancer in the future who can benefit from interception therapy. However, the research community must meet several challenges to ensure that these assays translate into decreased cancer mortality without overtreating conditions unlikely to cause harm.

Examples of NCI Research to Achieve this Goal

NCI supports studies and initiatives to develop new cancer screening tests and evaluate tests already far along the development continuum. For example, the Tomosynthesis Mammographic Imaging Screening Trial compares two types of Food and Drug Administration–approved digital mammograms to identify the best method for breast cancer screening. In collaboration with industry partners, NCI-funded researchers are also developing trials to understand the net benefit of MCD assays. NCI also fosters innovation in early-stage cancer detection by supporting technology development by U.S. small businesses.

Through the Cancer Moonshot and other programs, NCI drives efforts at the community level to improve how screening is performed, developing more acceptable and convenient ways of screening that increase screening rates in populations for which they have historically been low. These studies also include approaches to ensure that those who get screened receive the appropriate follow-up, including affordable treatment, if they have a positive result.

DEVELOP EFFECTIVE TREATMENTS

Effective treatment, with minimal side effects, is accessible to all people with all cancers, including those with rare cancers, metastatic cancers, and treatment-resistant disease.

Strategies

- Rigorously pursue a greater understanding of the fundamental mechanisms of cancer biology, from the earliest precancerous lesions to transition to cancer and metastatic disease, incorporating new computational methods to visualize, model, and predict tumor evolution
- Make the fullest possible use of available resources to identify biologically informed therapeutic targets
- Place particular emphasis on pursuing biological and technological approaches to treat rare cancers, treatment-resistant tumors, and childhood cancers
- Move aggressively and more equitably to transition promising new therapies from their initial discovery to clinical trials
- Inform treatment discovery and clinical development by collecting population-wide data on cancer recurrences and metastatic cancer development and linking these data to individual characteristics of patients and their tumors, treatments, and clinical outcomes
- Develop approaches that maximize equitable access to proven treatments
- Develop approaches that minimize toxicities from cancer treatment and that detect and ameliorate short- and long-term effects of treatment, including second malignancies in cancer survivors
- Develop effective methods for predicting if patients will respond to treatment and their likely long-term outcomes s

Current State

In 2023, roughly 1.9 million people in the United States will receive a new cancer diagnosis, almost all of whom will receive treatment. For some cancers, there are proven and highly effective treatment options. However, some treatments control cancer at the cost of harmful side effects and can even permanently affect a survivor's quality of life. For too

many others, including rare cancers, effective treatments that can meaningfully improve how long and well people live are limited or lacking altogether.

The concept of "precision oncology" captures the idea that each person's cancer is unique and that their treatment should reflect their individual characteristics, including the molecular makeup of their tumors. However, there are still significant gaps in our understanding of cancer biology, limiting the ability to develop precision therapies with limited side effects that work for all patients.

Even so, it is undeniable that there has been tremendous progress in cancer treatment, including precision oncology. Thanks to advances in immunotherapy, for example, the 5-year survival rate for people diagnosed with advanced melanoma has more than doubled. In addition, many have not had their disease recur following treatment, raising the possibility of a long-term cure. Lung cancer, the most common and, for many years, one of the most untreatable cancers, is also a testament to advances in precision oncology. Multiple drugs are now available that target specific genetic changes in lung cancer, helping many patients live much longer and with a better quality of life than was thought possible a decade ago. Immunotherapy has also made inroads in lung cancer, building on the progress achieved with targeted therapies.

New treatments would not be possible without clinical trials, which allow promising new treatments to be carefully tested in people with cancer. These studies provide evidence that a treatment works as intended and is safe for cancer care. Unfortunately, progress is hampered because the number of cancer patients participating in clinical trials remains low. This is particularly true for people from racial and ethnic minority groups, people from lower socioeconomic backgrounds, older people, and those with other serious health conditions.

Examples of NCI Research to Achieve this Goal

Tumor atlases describe the cellular, structural, and molecular characteristics of human cancers over time, from precancerous lesions to advanced cancer metastases, and reveal processes that drive malignancy. Created through the Cancer Moonshot, NCI supports the Human Tumor Atlas Network, a nationwide collaboration that draws upon expertise across disciplines and from new technological advances to make the comprehensive mapping of tumors possible.

The NCI Experimental Therapeutics Program and Small Business Innovation Research program help researchers in the academic and private sectors overcome financial and technical barriers to the development of new therapies—particularly high-risk treatments for rare cancers and pediatric cancers—and facilitate the movement of promising therapeutic agents from the research laboratory to patient care.

NCI supports clinical trials that test new cancer treatments, ranging from the earliest phases, where participants are the first to receive a new treatment, to large trials that determine whether new treatments achieve the improvements in outcome at acceptable toxicity that make them effective for routine use. These trials are available in hundreds of cancer centers across the country through the Experimental Therapeutics Clinical Trials Network, the National Clinical Trials Network, and the NCI Community Oncology Research Program.

Cancer Moonshot initiatives address many essential areas of new treatment development. These include clinical trials to advance promising immunotherapy regimens for adults and children with cancer and fundamental research to discover ways to overcome treatment resistance.

Cancer Moonshot programs also provide critical resources for collecting and storing patient data and biospecimens for use by researchers. They also directly engage people with cancer and long-term survivors to improve participation in clinical research. For example, the Cancer Moonshot supports NCI's Participant Engagement and Cancer Genome Sequencing Network, a program for cancer patients and posttreatment cancer survivors that uses rigorous cancer genome sequencing to address significant knowledge gaps in tumor biology. This program focuses on patients with rare cancers or rare cancer subsets, highly lethal cancers, cancers with an early age at onset, and those in understudied populations or with high disparities in incidence and mortality.

ELIMINATE INEQUITIES

Disparities in risk factors, cancer incidence, treatment side effects, and mortality are eliminated through equitable access to prevention, screening, treatment, and survivorship care.

Strategies

- Intensify study of the underlying molecular, societal, and health care delivery causes of disparities in cancer incidence and mortality
- Develop methods such as pragmatic trial designs to overcome inequities that prevent successful outcomes in underserved populations at each step of the cancer care continuum from prevention to survivorship
- Ensure that all areas of cancer research address population-specific diversity in biological and societal factors that impede successful cancer diagnosis, prevention, treatment, and survivorship
- Enhance cancer education-focused community engagement to promote structural changes that increase prevention and early detection measures
- Address the need for improving health literacy by developing culturally relevant education programs that increase community wellness
- Support deliberate and strategic efforts to increase the representation of all populations in cancer research and ensure that every person benefits equitably from cancer research and clinical advancements

Current State

Although we have made significant progress over the last several decades in reducing deaths due to cancer, not all people benefit equally. Certain populations, defined by demographic factors and social determinants of health, such as specific racial and ethnic groups and those who live in rural and economically deprived locations, continue to suffer disproportionately from cancer.

For example, in the United States, age-standardized overall death rates for cancer are highest for non-Hispanic Black people, followed by American Indian and Alaska Native people. Other populations, such as people with disabilities and sexual and gender minority individuals, also suffer disparities in cancer care and outcomes.

The reasons for disparities are complex and interrelated and include both biological and social determinants. Biological factors that contribute to disparities are poorly understood; however, increasing evidence suggests that they may play a role alone or in combination with social determinants of health. Social determinants that drive health disparities include inadequate access to transportation, crowded housing, environmental contamination, and poor access to healthy food. These factors are accompanied by inadequate access to cancer screening tests, preventive interventions, and high-quality cancer care.

To overcome disparities, we must do more by ensuring that research includes all populations to fully represent the diverse makeup of our society. Ending cancer as we know it for all people will require identifying and adopting ways to engage diverse populations as active participants in research while eliminating structural and contextual barriers to quality preventive care, screening, and cancer treatment.

Finally, while the National Cancer Program focuses primarily on addressing the needs of the U.S. population, it is abundantly clear that we are citizens of the world and that contributions and collaborations beyond our borders are essential.

Examples of NCI Research to Achieve this Goal

NCI is committed to ending cancer disparities and making health equity a reality. To these ends, NCI and the Cancer Moonshot support a robust research portfolio addressing health disparities across the cancer continuum from treatment discovery to delivery of preventive services to survivorship care. NCI supports research into biological, genetic, societal, and psychosocial causes of cancer health disparities. This work also fosters the growth of a nationwide cohort of researchers with expertise in cancer disparities and expands resources, such as biospecimens, patient-derived models, clinical and molecular data, and other methods necessary to conduct fundamental research addressing health disparities.

In addition, NCI-supported cancer control and health care delivery research programs are studying environmental and societal factors that increase cancer incidence, treatment side effects, and deaths in populations that experience disparities. These include populations based on race, ethnicity, sexual orientation, gender identity, health literacy, socioeconomic status, and geographical location in rural areas and areas of persistent poverty. Eliminating cancer disparities is woven throughout the Cancer Moonshot at all levels, with programs ranging from direct patient engagement and data sharing in genomic tumor characterization to initiatives that develop targeted prevention, screening, and treatment delivery models for underrepresented populations.

DELIVER OPTIMAL CARE

The health care system delivers evidence-based, patient-centered care to all people that prioritizes prevention, reduces cancer morbidity and mortality, and improves the lives of cancer survivors, including people living with cancer.

Strategies

- Advance and intensify research in cancer care delivery and implementation science, including research to inform improvements in cancer prevention, diagnosis, treatment, and survivorship and address inequities across this continuum

- Increase communication and collaboration between NCI and other government and private entities to capitalize on the data, expertise, resources, and relationships that inform and facilitate cancer research

- Through cross-agency collaboration and public–private partnerships, promote the widespread adoption and implementation of cancer research results and evidence-based methods that decrease cancer mortality and improve survivor well-being

- Identify and institute best practices for promoting public engagement, communication, and health literacy related to cancer risk, prevention, treatment, and survivorship that are tailored to the cultural, linguistic, financial, and educational needs of the relevant populations

Current State

Important advances in early cancer detection, treatment, and survivor care can meet resistance from the challenges of delivering high-quality cancer care. Ending cancer as we know it will require ongoing improvements across the health care system to ensure that high-quality cancer care is available to and affordable for all who need it.

Among the key challenges to ensuring the delivery of high-quality cancer care are the increasing complexity of cancer treatments, the increasing cost of treatment, and the disparities caused by persistent socioeconomic and cultural barriers that prevent too many people from getting timely access to culturally sensitive care. An issue that increasingly affects people with cancer is financial toxicity—that is, the personal and family stress and hardships created by the high cost of care. Financial toxicity can delay diagnosis, disrupt treatment, and cause other problems that lead to early mortality. These financial effects are not distributed evenly across populations, most commonly affecting those with low incomes, Black individuals, Hispanic and Latino individuals, and young adults.

Given these issues, research to improve health care delivery is extremely important. However, it is also challenging because it requires cooperation among clinicians and health systems that currently lack the time and resources necessary to conduct research. In addition, the data collections needed for health care delivery research are difficult to obtain because they are distributed throughout the health care system, in electronic medical records, insurance claims, cancer registries, and pharmacy databases, among others. Consequently, working with many different health care system components to gather, format, and analyze these data often meets resistance and is time-consuming and difficult.

Examples of NCI Research to Achieve this Goal

NCI is deeply committed to supporting health care delivery research and implementation science to ensure that health care practitioners and public health systems deliver evidence-based cancer care to all. Health care delivery research analyzes the impact that many factors—from reimbursement and other financial issues to organizational structures to technology—have on prevention, early detection, treatment, and survivorship care.

In addition, work in the field of implementation science develops methods and strategies to facilitate the uptake of evidence-based care into regular use by health systems. Cancer Care Delivery Research is one area of focus for the NCI Community Oncology Research Program, a network of researchers and community-based clinicians who conduct studies in settings where most people receive their care. The Cancer Care Delivery Research program addresses all aspects of cancer care delivery, including topics such as shared clinical decision-making and health services accessibility. In addition, the Cancer Moonshot supports programs to improve the management of symptoms during and after cancer treatment and to accelerate cancer screening and follow-up care.

Ultimately, although health care delivery research can uncover the “what to do” and “how to do it” of improving routine cancer care, it is up to the government, communities, industry, and individuals to use research knowledge to produce the changes necessary to end cancer as we know it. This is truly the work of the last mile, and success requires commitment from all aspects of our society.

ENGAGE EVERY PERSON

Every person with cancer or at risk for cancer has an opportunity to participate in research or otherwise contribute to the collective knowledge base, and barriers to their participation are eliminated.

Strategies

- Enable every patient to contribute their health data and biospecimens to research in a secure, privacy-protected manner that honors their wishes for the use of these resources to conduct cancer research
- Expand research infrastructure for all types of clinical and observational studies, developing and streamlining methods to increase access to participation for all
- Facilitate rapid referral, access, enrollment, accrual, and retention of diverse populations in clinical trials
- Integrate clinical research into routine clinical care using methods that avoid increasing provider or patient burden
- Ensure that opportunities to participate in and benefit from research are equitably distributed
- Develop and implement methods to return research results in meaningful ways to patients who participate in studies

Current State

Clinical trials are an essential component of cancer research. They provide evidence demonstrating that new treatments and ways to diagnose, prevent, and treat cancers are effective. Clinical trials also evaluate whether new therapies, devices, or protocols are associated with acceptable side effects when weighed against the potential benefits.

Clinical trials offer patients the opportunity to participate in cancer research and receive potentially promising treatments, and most patients indicate that they are willing to participate when a trial is offered to them. At present, however, only a small percentage of patients enroll in clinical research, and barriers to research participation exist at multiple levels. Multilevel barriers include many of the same features associated with overall access to quality care, such as lack of adequate health insurance, limited resources in rural locations, or inequities related to structural racism. Research participation is also hindered

by the limited availability of trials for specific types or stages of cancer and by overly restrictive study inclusion criteria.

Clinical trial access is increased by reaching potential participants in their communities and reducing the burden of participation. The COVID-19 pandemic accelerated the use of virtual interactions between health care providers and patients and showed us that more fully integrating telemedicine practices into clinical trials allows people to participate without the added time and costs of traveling to a clinical trial site. New investments in telemedicine infrastructure are needed to allow participants to sign consent forms online, receive medications in the mail or at health care facilities close to their homes, and undergo safety monitoring in their local community.

Clinical trials are not the only way individuals can contribute significantly to cancer research. For example, many participate in registries or observational studies that may not directly test specific approaches but observe behaviors, measure patient-reported outcomes, assess biomarkers, and record effects on morbidity and mortality without providing new interventions. For these studies, patients agree to share their medical information with researchers and can also donate blood or tissue samples.

New technologies are expanding our ability to conduct both clinical trials and observational studies. For example, with the nationwide adoption of an electronic health record and an increase in wearable technologies and apps that track information such as heart rate, physical activity, sleep, and stress, more people can contribute data to our collective body of knowledge about health and disease.

We must achieve a future where all people have equitable opportunities to participate in cancer research free of concerns and without burdens. Clinical trials and other clinical research studies need to be flexible, faster, simpler, less expensive, more equitable, and achieve higher impact on outcomes that are important to patients. Now more than ever, we have the potential to learn from every patient to improve results for everyone.

Examples of NCI Research to Achieve this Goal

NCI supports clinical trials at over 2,200 sites throughout the United States and worldwide through networks such as the National Clinical Trials Network and the NCI Community Oncology Research Program. These networks provide patients access to highly trained physicians and researchers who study how to better prevent and treat cancer through carefully designed trials. In addition to testing new cancer treatments, these studies include cancer prevention trials, trials testing behavioral interventions for cancer risk factors like smoking and obesity, de-escalation trials testing the effectiveness of using less treatment, and complex combination therapy trials using novel adaptive designs.

Through the Cancer Moonshot, NCI is updating its clinical trial infrastructure and developing new ways to allow more patients to participate in cancer research. This includes support for a wide range of clinical research, such as observational studies, biomarker development, and investigations using data from cancer registries and electronic health records. Other initiatives are building data collection, storage, and analysis infrastructure to maximize the use of patient data. In addition, programs funded through the Cancer Moonshot are studying ways to better engage patients in research and return research results to participants.

MAXIMIZE DATA UTILITY

Secure, privacy-protected sharing of health-related data is standard practice throughout research, and researchers share and use available data to achieve rapid progress against cancer.

Strategies

- Enable frictionless data sharing throughout all of cancer research and develop tools that optimize data use and analysis to achieve rapid progress
- Build and maintain a unified Cancer Research Data Ecosystem that enables the routine collection, integration, harmonization, distribution, and reuse of data from a broad range of research studies in a secure, patient privacy–protected environment
- Develop data quality standards, metrics, and acceptable methodologies to facilitate greater use of routine health care data as a research tool
- Support ongoing and new development of novel data visualization and analysis tools, and the infrastructure required to make them accessible to researchers
- Engage patients directly in data sharing, respecting their wishes for data use and implementing methods to return individual and study results to research participants
- Enable communities and health care organizations that face resource limitations or other disparities in access to research to engage with and benefit from data availability and related scientific advances

Current State

The multidisciplinary field of cancer research generates distinct and complex data sets, including data from classic cell and molecular biology experiments, large-scale "-omics" studies, analyses of clinical samples obtained from human participants, and patient-level data from clinical trials and large observational studies.

The electronic health record (EHR) also provides a resource to obtain data directly from routine clinical care, contributing "real-world data" to the pool of shared knowledge. Using the EHR, a wide range of patients can contribute research data, including healthy individuals, those at high risk for cancer, and those diagnosed with cancer. It is important to acknowledge that, currently, deficits exist in the collection and formatting of medical data in EHRs that limit their research potential, and these issues must be corrected to maximize the use of this data source.

In addition, patient privacy concerns for medical data must be carefully considered and addressed for all research, but especially for data obtained directly from EHRs. However, with the advent of the EHR to capture health information and additional advances in information technology, it is now possible to directly engage patients in data sharing, respecting their wishes for data use and implementing methods to return results to patients.

In addition to new data sources, new software tools are revolutionizing how we collect, organize, and use data for biomedical research. For example, machine learning algorithms can identify patterns in large, complex data sets that might escape human notice and evaluate the likely outcomes of different courses of treatment. Such tools can be a powerful aid to researchers and provide physicians with valuable information for clinical decision-making. However, machine learning tools are only as good as the data they are trained on, so they must be powered by accurate and reliable data, representing the diversity of all of society and eliminating sources of bias.

Creating a national data ecosystem to equitably and responsibly collect and share cancer data will enable all cancer research and clinical care participants to contribute, access, combine, and analyze diverse data related to cancer. This infrastructure will accelerate progress against cancer by providing researchers with resources required for knowledge generation and will be constructed and managed so that more patients can actively participate in clinical research.

Examples of NCI Research to Achieve this Goal

NCI provides infrastructure and tools and coordinates activities that enable data sharing and use across the cancer research community. For example, the Cancer Moonshot created the Cancer Research Data Commons and combined it with an existing Genomic Data Commons to provide platforms that make data generated through Cancer Moonshot initiatives and other NCI research programs available to the broadest possible research community. These data resources have expanded over the past decade and now provide a cloud-based data science infrastructure connecting data sets with analytical tools and services. The Cancer Research Data Commons and Genomic Data Commons currently contain genomic, proteomic, imaging, and clinical trials data and provide a cancer data service and data aggregator.

In addition, NCI continues its fifty-year commitment to the Surveillance, Epidemiology, and End Results Program, an initiative that collects and provides data on cancer incidence, mortality, and survivorship from across the United States and facilitates research to understand disparities in these outcomes. This unparalleled data resource also continues to evolve to improve cancer surveillance data collection and use. Collaborations with other government agencies, such as a Cancer Moonshot program with the Department of Energy,

are also advancing informatics, high-performance computing, and machine learning for cancer research.

OPTIMIZE THE WORKFORCE

The cancer care and research workforce is diverse, reflects the communities served, and meets the needs of all people with cancer and those at risk for cancer, ensuring they live longer and healthier lives.

Strategies

- Expand and extend the capacity for cancer research by engaging a diverse pool of talented learners in cancer research and supporting their pursuit of a career in cancer research

- Eliminate barriers and facilitate entry for individuals historically excluded from or underrepresented in the cancer research workforce

- Develop initiatives to address gaps and needs (e.g., more physician- and other clinician-scientists) and increase the number and competitiveness of cancer researchers from underrepresented and underserved backgrounds

- Conduct research to understand and address the unique needs and concerns of cancer researchers at all career stages and in all disciplines, including laboratory researchers, clinical care providers, data scientists, health economists, behavioral and social scientists, and all others who participate in cancer research

- Develop new strategies and mechanisms to support career development paths in the life sciences industries and non-research science sectors, such as education, health policy, or health journalism

Current State

Our efforts to end cancer as we know it will fail if we ignore our most important resource—the cancer care and research workforce. Early career cancer researchers must meet significant challenges as they embark upon and remain on this career path. These include completing initial training, finding mentors, obtaining research funding, and securing academic appointments. In addition, most research requires participation in scientific teams, making it difficult for early career researchers to gain the individual recognition required for professional advancement. Structural barriers along the way to becoming an early and midcareer cancer researcher reduce the diversity of the workforce and these barriers need to be addressed. Among the many challenges facing our cancer research workforce, the most significant is the uncertainty of a successful future in cancer research due to a lack of funding opportunities.

A mandate to develop a workforce that adequately reflects the populations it serves requires us to address long-standing societal factors that produce a cancer research and clinical care workforce lacking ethnic, racial, and gender diversity. A multifaceted approach to engage students at the earliest levels of schooling is needed to overcome persistent barriers to including scientists and physicians from underrepresented minority groups.

Our academic medical centers serve as hubs of scientific discovery and invention and train and support the next generation of researchers and clinicians. However, developing and maintaining a robust, stable, and diverse biomedical workforce requires collaboration across many other organizations, including research universities, professional societies, philanthropic foundations, private industry, and the federal government. All parties must invest in addressing 21st century issues related to training and supporting a diverse and robust cancer research and care workforce.

Examples of NCI Research to Achieve this Goal

Through its intramural research program and at academic institutions nationwide, NCI supports cancer researchers throughout their careers, from middle school to graduate school, postgraduate training, and independent researcher status. NCI funds training grants, fellowships, research career development awards, and education research grants for students and scientists at all career levels.

NCI-funded programs at all career levels address the advancement of cancer researchers from underrepresented groups. These programs foster the inclusion of underrepresented racial and ethnic groups as well as individuals with disabilities and from disadvantaged socioeconomic backgrounds. The newly launched Cancer Moonshot Scholars program advances cancer science while diversifying the pool of researchers and the approaches to cancer research that NCI supports. A prominent feature of this program is an increase in research awards supporting early-stage investigators from diverse backgrounds.

CALL TO ACTION

To succeed in ending cancer as we know it, we must apply the knowledge gained through research at many levels throughout our complex society. Because of this, the National Cancer Plan is not solely focused on research but is a framework that promotes collaboration among all stakeholders that is required to ensure that every person with cancer lives a full and active life and that most people never have to face the challenge of a cancer diagnosis. With the National Cancer Plan, we will accelerate progress through collaborations that leverage all available resources and sustain communication between all partners to share knowledge gained and continuously update goals as we achieve progress.

NCI stands ready to work with partners across the federal government and beyond to accomplish more together than we can separately. People with cancer are counting on us.

Visit the National Cancer Plan website at nationalcancerplan.cancer.gov for updates.

[i] https://www.cancer.gov/news-events/nca50/commemorate-national-cancer-act-50-years
[ii] The National Cancer Act of 1971. Public Law 92-218; 92nd Congress S. 1828; December 23, 1971.