RESEARCH *in* YOUR BACKYARD

Developing Cures, Creating Jobs

Pharmaceutical clinical trials in

NEBRASKA

Executive

This report shows how biopharmaceutical research companies continue to be vitally important to patient health and the economy in Nebraska.

Since 2004, **over 3,800 clinical trials** of new medicines have been conducted or are being conducted in collaboration with clinical research centers, hospitals, and local research institutions across Nebraska. These clinical trials investigate some of Nebraska's biggest health care challenges, including Alzheimer's disease, asthma, arthritis, cancer, cardiovascular disease and infectious diseases.

Summary

Clinical trials in
NEBRASKA

CLINICAL TRIALS IN NEBRASKA ARE A VITAL PART OF THE FDA DRUG APPROVAL PROCESS

In the development of new medicines, clinical trials are conducted to establish therapeutic effectiveness and safety and compile the evidence needed for the U.S. Food and Drug Administration (FDA) to approve new treatments.

Clinical trials of new medicines are typically conducted in three phases and, on average, account for nearly seven of the more than 10 years it takes to bring a new medicine from development to patients. Clinical trials are responsible for more than half of the $2.6 billion average cost of developing one new innovative medicine.

Institutional Review Boards (IRBs), independent committees of physicians, statisticians, local community advocates and others, review and approve clinical trials in advance to ensure trials are ethically conducted and patient rights are protected.

Clinical Trials in Nebraska since 2004 — Completed and Open	
All Clinical Trials	**Open Clinical Trials**
3,810	377

Source: www.clinicaltrials.gov. Search criteria: Nebraska, United States; Phase: early 1, 1, 2, 3; Industry only, first posted on or after 1/1/2004. Search performed 8/24/2023. Open clinical trials are recruiting, not yet recruiting, or expanded access available.

Executive Summary (cont.)

CLINICAL TRIALS MAY OFFER IMPORTANT THERAPEUTIC OPTIONS FOR PATIENTS

For patients, clinical trials may offer the potential for another therapeutic option or provide for a treatment where no FDA-approved treatments currently exist. Clinical trials may provide a new avenue of care for some chronic disease patients who are still searching for the medicines that are best for them.

Some clinical trials are conducted to compare existing treatments, and some are done to explore whether a medicine is appropriate for a different patient population, such as children or the elderly. Others are conducted to find ways to make existing approved treatments more effective and easier to use with fewer side effects.

ECONOMIC IMPACT OF THE BIOPHARMACEUTICAL SECTOR IN NEBRASKA

Biopharmaceutical research companies have been and continue to be a good source of jobs, tax revenue and research spending in Nebraska.

A study by TEConomy Partners[1] found that in 2020, the industry supported more than **18,000 jobs** throughout Nebraska. Wages and benefits for employees whose jobs were supported by the biopharmaceutical sector resulted in **$257.2 million in state and federal taxes paid**.

Biopharmaceutical research companies supported the generation of **$5.7 billion in economic activity** in the state, including the direct economic output of the sector itself, the output of the sector's vendors and suppliers and the output generated by the buying power of its workforce.

Company employees in Nebraska include life science researchers, management executives, office and administrative support workers, production workers, engineers, architects, computer and math experts, and sales representatives. Biopharmaceutical companies also supported the jobs of their vendors and suppliers, including construction and IT firms. And the employees of biopharmaceutical companies help to support local restaurants, day care centers and other community businesses.

ECONOMIC IMPACT OF CLINICAL TRIALS IN NEBRASKA

A separate study by TEConomy Partners[2] found that in 2017 alone, there were **403 active industry-sponsored clinical trials in Nebraska**, with an estimated enrollment of **8,403 Nebraska residents**. Infectious Diseases/Virology was the largest clinical trial disease area by total estimated enrollment in the state.

The investment at clinical trial sites was more than **$153.2 million** and the estimated total economic impact was more than **$394 million**.[2]

[1] *The Economic Impact of the U.S. Biopharmaceutical Industry: 2020 National and State Estimates, TEConomy Partners, https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/Economic-Impact-States-2022/US--Puerto-RicoEco-Impact-One-Pager-FINAL.pdf*

[2] *Biopharmaceutical Industry-Sponsored Clinical Trials: Growing State Economies, TEConomy Partners, https://www.phrma.org/-/media/TEConomy_PhRMA-Clinical-Trials-Impacts.pdf*

"In the pursuit of medical progress and improved patient care, clinical trials set the foundation for tomorrow's clinical breakthroughs. Our collaboration with the Nebraska Clinical Trials Network is a testament to our commitment to seek progressive treatments. Together, along with our community collaborators and study volunteers, we are discovering pathways towards a healthier future."

Mark Carlson, MD, Founder and Medical Director of Be Well Clinical Studies

Open Clinical Trials in Nebraska by Disease

Disease	Number of Trials
Alzheimer's Disease	5
Arthritis/Musculoskeletal Diseases	11
Autoimmune Disorders	6
Bladder Disorders	2
Blood Disorders	2
Cancer	177
Cardiovascular Diseases	24
Eye Disorders	2
Gastrointestinal Disorders	9
Genetic Diseases	6
Infectious Diseases	50
Kidney Diseases	4
Liver Diseases	5
Mental Illnesses	6
Neurologic Disorders	18
Respiratory Diseases	23
Skin Disorders	17
Other Diseases	10
Total	**377**

Source: www.clinicaltrials.gov. Search criteria: Nebraska, United States; Phase: early 1, 1, 2, 3; Industry only; first posted on or after 1/1/2004. Search performed 8/24/2023. Open clinical trials are recruiting, not yet recruiting, or are expanded access available.

Patient Resources & Directory

WHAT IS THE CLINICAL TRIAL EXPERIENCE?

Clinical trials are voluntary research studies conducted in people and designed to answer specific questions about the safety and effectiveness of drugs, vaccines, other therapies, or new ways of using existing treatments. Clinical trials can generate data to support FDA approval of a new medicine or a new indication for an existing medication. They may also grant participants early access to new medicines. By volunteering for a clinical trial, patients take an active role in their health care by helping researchers test new treatments. In Nebraska, **3,810** clinical trials since 2004 have targeted diseases and conditions including asthma, arthritis, cancer, cardiovascular disease, infectious diseases and Alzheimer's disease.

PHASES OF CLINICAL TRIALS

There are typically three phases of clinical trial testing used to evaluate potential new medicines:

PHASE I — Researchers test the medicine in a small group of people, usually between 20 and 100 healthy adult volunteers, to evaluate its initial safety and tolerability profile, determine a safe dosage range and identify potential side effects.

PHASE II — The medicine is given to volunteer patients, usually between 100 and 500 people, to study its efficacy, identify an optimal dose and to further evaluate its short-term safety.

PHASE III — The medicine is provided to a larger, more diverse patient population, often involving between 1,000 and 5,000 patients (but sometimes many more thousands), to generate statistically significant evidence to confirm its safety and effectiveness. They are the longest studies and usually take place in multiple sites around the world.

LEARNING ABOUT AND ACCESSING CLINICAL TRIALS

Patients can learn about clinical trials in several ways. Health care providers may be aware of clinical trials being conducted at hospitals, universities, and other leading health care facilities, and these institutions can be valuable sources of information for patients looking to participate. Patients can also use hospital and university websites to find the trials being conducted in their area.

For information on clinical trials being conducted at the University of Nebraska Medical Center visit https://www.unmc.edu/cctr/for-public/clinical-trials/index.html

For more information about clinical trials in Nebraska and how to participate in a clinical trial, visit www.centerwatch.com or www.clinicaltrials.gov.

WHAT TO EXPECT

Since clinical trials are often conducted in a doctor's office, patients may need to devote more time to physician visits and physical examinations. They may also have additional responsibilities, such as keeping a daily log of their health. Generally, prospective participants will receive information about the potential risks and benefits of participating in the trial and must sign an informed consent document saying, among other things, they understand that the clinical trial is research, and that they can leave the trial at any time. Patients can volunteer to participate, leading to a pre-screening interview. If they fit the criteria and requirements of the test, they may be enrolled.

PATIENT EXPENSES

As part of the informed consent process, clinical trial sponsors must disclose any additional costs to the subject that may result from participating in the research. During pre-screening discussions with the clinical trial investigator, the patient can also ask about associated costs to participate in the trial. Clinical trial sponsors usually pay for all research-related expenses and additional testing or physician visits required by the trial. Patients or their health insurance plan may be asked to pay for any routine treatments for their disease. However, it is important for the patient to know whether their health plans will pay for clinical trial participation or whether there will be out-of-pocket costs at the patient's expense.

Patients should inquire about whether they or their health insurance plan will be assessed any fees, and they should determine if their insurance will cover the expense of routine examinations. Patients who live a distance from the trial site should inquire whether the clinic has a policy for covering travel costs and living expenses. The National Cancer Institute, for example, makes patients cover their own travel costs for the initial screening visits. Once a patient is enrolled in the trial, the Institute pays for transportation costs for all subsequent trial-related visits. These patients may also receive a small per diem for food and lodging.

EXPANDED ACCESS

For patients with a serious or life-threatening disease who are ineligible or unable to participate in a clinical trial, use of an unapproved investigational medicine through an expanded access program may be an option. Expanded access is the use of an unapproved investigational medicine outside of a clinical trial to treat a patient with a serious or immediately life-threatening disease or condition when there are no other comparable or satisfactory alternative treatment options. Expanded access programs are part of many biopharmaceutical companies' commitment to patients.

"For patients, clinical trials may offer the potential for another therapeutic option or provide for a treatment where no FDA-approved treatments currently exist. Clinical trials may provide a new avenue of care for some chronic disease patients who are still searching for the medicines that are best for them. These treatments are often times 'cutting edge' and can potentially provide therapeutic treatment for patients that otherwise have not been able to find relief."

Greg Rugh, owner of Somnos Clinical Research

*For more information about **the drug development and approval process** in **the United States**, see page 17.*

LOCAL PATIENT ADVOCACY GROUPS

Patient advocacy groups in Nebraska serve as exceptional resources for patients, offering opportunities to connect and learn more about various health conditions and what treatment options are available locally. These groups also provide an important voice on behalf of patients to protect access to medicines and treatments.

The following are just some of the prominent groups that work on behalf of patients in Nebraska and may provide more information to patients with further questions.

Alzheimer's Association
Nebraska Chapter
8790 F Street, Suite 404
Omaha, NE 68127
(402) 502–4300

Alzheimer's Association
Lincoln Office
245 South 84th Street, Suite 215
Lincoln, NE 68510
(402) 502–4300

American Cancer Society
Nebraska Chapter
P.O. Box 24168
Omaha, NE 68124
(800) 227–2345

American Diabetes Association
Serving Iowa, Nebraska and South Dakota
P.O. Box 7023
Merrifield, VA 22116–7023
(317) 352–9226
adain@diabetes.org

American Heart Association
Lincoln Chapter
1540 South 70th Street, Suite 100
Lincoln, NE 68506
(402) 875–7382

American Heart Association
Omaha Chapter
900 Nicolas Street, Suite 200
Omaha, NE 68114
(402) 810–6870

American Liver Foundation
Nebraska State Resource Center
(800) 465–4837
info@liverfoundation.org

American Lung Association
Nebraska Chapter
11225 Davenport Street, Suite 101
Omaha, NE 68154
(402) 502–4950

Arthritis Foundation
Nebraska Office
16614 Vinton Circle
Omaha, NE 68130
(402) 262–0144

Brain Injury Alliance of Nebraska
P.O. Box 22147
Lincoln, NE 68542
(402) 423–2463
(888) 292–7415
info@biane.org

Epilepsy Foundation Nebraska
6001 Dodge Street, CEC288.7
Omaha, NE 68132
(402) 715-9422
nebraska@efa.org

NAMI Nebraska
National Alliance on Mental Illness
6001 Dodge Street, CEC219
Omaha, NE 68132–0305
(402) 345–8101

National Kidney Foundation
Serving Iowa and Nebraska
6165 Northwest 86th Street
Johnston, IA 50131
(515) 440–0402 ext. 463
(800) 596–7943
iana@kidney.org

OTHER PATIENT RESOURCES

MEDICINE ASSISTANCE TOOL (MAT): The Medicine Assistance Tool is a PhRMA-sponsored search engine designed to help patients, caregivers and health care providers learn more about the resources available through the various biopharmaceutical industry programs. MAT is not its own patient assistance program, but rather, a search engine for many of the support programs and resources that the biopharmaceutical industry has offered for decades. The online process takes about 15 minutes, and patients can find out instantly if they are eligible for assistance. Patients can visit *www.mat.org* for more information.

HEALTHCARE READY: Healthcare Ready is a tool activated to help keep emergency responders informed on the status of the biopharmaceutical supply chain in the event of a natural disaster or emergency. Healthcare Ready's Rx Open tool has been deployed in several states and the District of Columbia and helps victims and evacuees who needed to fill or re-fill their prescriptions find open pharmacies. Healthcare Ready also helps emergency responders with critical information on the challenges facing supply chain partners relating to electricity, fuel and transportation issues. Patients can visit *www.healthcareready.org* for more information.

Clinical Trial Policy Resources

THE BIOPHARMACEUTICAL SECTOR'S ROLE IN THE ECONOMY

America's biopharmaceutical research companies serve as the foundation for one of the country's most dynamic innovation and business ecosystems. The biopharmaceutical industry is among the most research and development (R&D) intensive industries in the United States. In fact, the sector accounts for the single largest share of all U.S. business R&D, accounting for approximately 17 percent of all R&D spending by U.S. businesses.[1] The industry and its large-scale research and manufacturing supply chain support high-quality jobs across the U.S. economy.

Biopharmaceutical companies invest 12 times more in R&D per employee than manufacturing industries overall.

The biopharmaceutical industry supported more than 4.4 million jobs across the U.S. economy in 2020, according to a study by TEConomy Partners.[1]

Over the last decade, biopharmaceutical companies that are members of the Pharmaceutical Research and Manufacturers of America (PhRMA) have more than doubled their annual investment in the search for new treatments and cures, including $101 billion in 2022 alone.

ECONOMIC IMPACT OF THE BIOPHARMACEUTICAL SECTOR IN NEBRASKA

Biopharmaceutical research companies have been and continue to be a source of quality jobs, tax revenue and research spending in Nebraska. A TEConomy Partners study[1] found that the biopharmaceutical sector:

- Supported more than 18,000 jobs throughout Nebraska in 2020.
- Supported the generation of $5.7 billion in economic activity in the state.
- Resulted in $257.2 million in federal and state taxes through jobs supported by the biopharmaceutical sector.

*For more information on the **economic impact of the biopharmaceutical industry in Nebraska**, see page 2.*

[1] *The Economic Impact of the U.S. Biopharmaceutical Industry: 2020 National and State Estimates, TEConomy Partners, https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/Economic-Impact-States-2022/US--Puerto-RicoEco-Impact-One-Pager-FINAL.pdf*

PUBLIC–PRIVATE PARTNERSHIPS AND LOCAL COLLABORATION

The following are just some of the prominent institutions that biopharmaceutical research companies are collaborating with on clinical trials for new medicines:

- **Advanced Dermatology of the Midlands**, Omaha
- **Alegent Health Bergan Mercy Medical Center**, Omaha
- **Alegent Health Immanuel Medical Center**, Omaha
- **Alegent Health Lakeside Hospital**, Omaha
- **Alivation Research**, Lincoln
- **Barrett Clinic**, La Vista
- **Be Well Clinical Studies**, Lincoln
- **Bryan Health**, Lincoln
- **Bryan Women's Care Physicians**, Lincoln
- **Celerion**, Lincoln
- **CHI Health Good Samaritan**, Kearney
- **CHI Health Research Center**, Omaha
- **CHI Health Saint Elizabeth**, Lincoln
- **CHI Health St. Francis**, Grand Island
- **Children's Hospital & Medical Center**, Omaha
- **Children's Physicians Clinic**, Omaha
- **Creighton University Medical Center**, Omaha
- **Faith Regional Health Services Carson Cancer Center**, Norfolk
- **Fred and Pamela Buffett Cancer Center**, Omaha
- **Great Plains Health Callahan Cancer Center**, North Platte
- **GU Research Network**, Omaha
- **Heartland Clinical Research**, Omaha
- **Heartland Hematology and Oncology**, Kearney
- **Meridian Clinical Research**, Norfolk, Omaha, Hastings
- **Methodist Physicians Clinic**, Fremont
- **Midlands Community Hospital**, Papillion
- **Midwest Children's Health Research Institute**, Lincoln
- **Missouri Valley Cancer Consortium**, Omaha
- **Nebraska Cancer Research Center**, Lincoln
- **Nebraska Cancer Specialists**, Omaha, Papillion
- **Nebraska Heart Institute**, Grand Island, Lincoln
- **Nebraska Methodist Hospital**, Omaha
- **Omaha OB-GYN Associates**, Omaha
- **Omaha VA Medical Center**, Omaha
- **Physician Research Collaboration**, Lincoln
- **Pioneer Clinical Research**, Bellevue
- **Prairie Fields Family Medicine**, Fremont
- **Quality Clinical Research**, Omaha
- **Regional West Medical Center**, Scottsbluff
- **Somnos Clinical Research**, Lincoln
- **Southeast Nebraska Cancer Center**, Lincoln
- **Synexus Clinical Research US**, Omaha
- **University of Nebraska Medical Center**, Omaha
- **Upstate Clinical Research Associates**, Omaha
- **VA Nebraska-Western Iowa Health Care System**, Omaha

NEBRASKA UNIVERSITIES PLAY A KEY ROLE IN RESEARCH

Collaborations between the biopharmaceutical research industry and universities play an important role in the development of new medicines. In the United States, there are more than 9,800 open clinical trials[1] being sponsored by the biopharmaceutical industry, universities, individuals, and organizations combined. These trials represent studies being funded by industry, research collaboration studies, and research undertaken by other groups on their own.

In Nebraska, of the 377 open clinical trials involving the biopharmaceutical research industry, the University of Nebraska Medical Center is collaborating on more than 84 of the clinical trials and Creighton University on more than 11 clinical trials.

[1] Data collected from www.clinicaltrials.gov. Search criteria: United States, Phase early 1, 1, 2, 3; Industry and Other, first received on or after 1/1/2004. Search performed 8/24/2023. Open clinical trials are recruiting, not yet recruiting, or are expanded access available.

"Improving people's lives through new treatments, tests, and preventatives requires the new knowledge created from clinical research and clinical trials. Our academic medical center is committed to serving as a leader globally in clinical research and innovation by engaging diverse communities in clinical research, forming strong, multidisciplinary research teams, and training the next generation of clinicians and scientists who will advance this critically important mission."

Russell J. McCulloh, MD, Vice President for Research, Nebraska Medicine, Associate Vice Chancellor for Clinical Research

THE STATE OF DISEASE IN NEBRASKA

More than 1.9 million people live in Nebraska[1], many of whom are dealing with disease and disability from asthma to cancer or from diabetes to heart disease.

Selected Disease Statistics in Nebraska	
Disease	**Health Statistic**
Alzheimer's Disease Deaths 2021[2]	687
Asthma Adults 2021[2]	122,491
Asthma Adult Deaths 2021[2]	25
Cancer New Cases 2023[3]	11,530
Cancer Deaths 2023[3]	3,540
Chronic Lower Respiratory Deaths 2021[2]	959
COVID-19 Deaths 2021[2]	1,594
Diabetes Deaths 2021[2]	583
Diabetes Adult Prevalence 2018[4]	141,491
Heart Disease Deaths 2021[2]	3,776
HIV-Number Living with a Diagnosis 2020	2,324
Hypertension Deaths 2021[2]	400
Chronic Liver Disease Deaths 2021[2]	308
Mental Illness—Adults 2018–2019[5]	290,000
Stroke Deaths 2021[2]	851

Source: 1. U.S. Census Bureau 2. Centers for Disease Control and Prevention (CDC) 3. American Cancer Society 4. American Diabetes Association 5. Kaiser Family Foundation, State Health Facts

NEBRASKA CLINICAL TRIALS AND SPECIAL POPULATIONS: CHILDREN, OLDER AMERICANS AND WOMEN

- Children under the age of 18 make up 24.2% of the population in Nebraska. Pediatric clinical trials are being conducted in the state for asthma, anemia, brain cancer, lymphoma and hemophilia, among others.

- Nebraskans aged 65 and older account for 16.9% of the states' population. In Nebraska, clinical trials are recruiting older people to study potential treatments for diseases such as Alzheimer's disease, breast cancer, osteoarthritis, prostate cancer and pulmonary arterial hypertension, among others.

- Women and girls make up 49.7% of the population in Nebraska. Clinical trials are recruiting women for studies on medicines for Alzheimer's disease, breast cancer, cytomegalovirus infections, endometrial cancer and rheumatoid arthritis, among others.

Open Clinical Trials in Nebraska for Special Populations

Population	Number of Trials
Children (birth–17)	78
Seniors (66 and older)	315
Women (only)	5

Source: www.clinicaltrials.gov. Search criteria: Nebraska, United States; Phase: early 1, 1, 2, 3; Industry only, first received on or after 1/1/2004. Search performed 8/24/2023. Open clinical trials are recruiting, not yet recruiting, or expanded access available.

10 Leading Causes of Death in Nebraska by Sex, 2016		
Disease	**Male**	**Female**
Cancer	1,799	1,675
Heart Disease	1,719	1,599
Chronic Lung Disease	524	508
Non-Motor Vehicle Accidents	332	225
Stroke	330	454
Diabetes	258	243
Suicide	202	
Alzheimer's Disease	194	440
Motor Vehicle Accidents	155	
Pneumonia	135	188
Essential Hypertension		158
Nephritis/Nephrosis		110

Source: Nebraska 2016 Vital Statistics Report, Nebraska Department of Health and Human Services

5 Leading Causes of Disease Death in Nebraska by Race/Ethnicity 2013–2017					
Disease	**American Indian**	**Asian**	**African American**	**Hispanic**	**White**
Cancer	90	135	594	344	16,592
Heart Disease	84	63	515	235	16,509
Chronic Lower Respiratory Diseases	25	20	135		5,490
Stroke		44	139	95	3,748
Alzheimer's Disease					2,913
Diabetes	37	24	160	93	
Liver Disease	39				
Perinatal Period				62	

Source: Nebraska Department of Health & Human Services, Division of Public Health, Office of Health Disparities & Health Equity, 2021

INDUSTRY COMMITMENT TO CLINICAL TRIAL DIVERSITY

As a nation, we are in a new era of medicine where breakthrough science is transforming patient care, but these innovations are meaningless if they don't reach all patients. It is critical that patients from traditionally underserved communities have access to innovative medicines. Achieving health equity is essential in creating a health care system that truly works.

Systemic racism that exacerbates health inequities has contributed to long-standing disparities in prevalence and severity of disease across racial and ethnic groups. These disparities can reflect in how often a disease occurs in a certain patient population, how serious the disease manifests itself in patients or how often a disease results in death.

Health disparities have many causes, including limited access to quality health care, health screenings, living and working conditions, experiences with the health care system/patient confidence, racism, bias in the treatment setting, underrepresentation of minority health care providers, and other social determinants of health, clinical trial participation, language barriers, and economics and insurance coverage.

The research-based biopharmaceutical industry recognizes the importance of including diverse patients in clinical trials for new medicines so that the clinical trial population reflects the intended treatment population. Addressing the systemic issues that deter Black and Hispanic communities from participating in clinical trials is critical to enhancing clinical trial diversity so that those who want to participate, can.

In an effort to address this long-standing mistrust and other issues, PhRMA and its member companies recently issued the first-ever industry-wide principles on clinical trials diversity, adding a new chapter to the already existing *Principles on Conduct Clinical Trials & Communication of Clinical Trial Results*. The new clinical trial diversity principles address:

Building Trust and Acknowledging Past Wrongs

- Reducing Barriers to Clinical Trial Access
- Using Real-World Data to Enhance Information on Diverse Populations Beyond Product Approval
- Enhancing Information About Diversity and Inclusion in Clinical Trial Participation

SCIENCE AND CLINICAL TRIALS[1]

Some of the medicines in clinical testing in Nebraska feature cutting-edge medical technologies. For example:

- An oral kappa opioid receptor (KOR) antagonist is in development as an adjunctive treatment for major depressive disorder. KOR antagonists play an important role in helping regulate stress and mood. Kappa opioid receptors are involved in anxiety-like, dysphoric, aversive and drug-seeking behavioral responses. KOR antagonists block kappa-opioid receptors and reduce these responses, producing antidepressant and anti-addictive effects. A clinical trial is being conducted at **Premier Psychiatric Research Institute** in **Lincoln**.

- A medicine in development to treat triple negative breast cancer binds to and inhibits AKT proteins. AKT helps to regulate cellular processes, such as cell division, cell death, and glucose and fatty acid metabolism. Mutations in the PI3K/AKT/mTOR signaling pathway can promote several types of cancer, including breast cancer, because normal cellular processes are disrupted. The medicine works by inhibiting AKT in cancer cells and is being tested in combination with paclitaxel, an approved chemotherapy treatment. Clinical trials are underway at **University of Nebraska Medical Center** in **Bellevue** and **Omaha, Crieghton University Medical Center** in **Omaha, Heartland Hematology & Oncology** in **Kearney, CHI Health Good Samaritan** in **Kearney, Saint Elizabeth Regional Medical Center** in **Lincoln, Alegent Health Immanuel Medical Center** in **Omaha, Alegent Health Bergen Mercy Medical Center** in **Omaha, Alegent Health Lakeside Hospital** in **Omaha**, and **Midlands Community Hospital** in **Papillion.**

- A once weekly fixed-dose combination medicine in development for type II diabetes is comprised of a long-acting basal insulin analog and an approved GLP-1 (glucagon-like peptide-1) agonist. The long-acting basal insulin has the potential to reduce the number of annual insulin injections from daily to weekly. Research has found that the GLP-1 agonist has the potential to lower blood glucose by stimulating the release of insulin and also lowers body weight. Clinical trials are ongoing in **Omaha**.

- A potential first-in class myeloperoxidase (MPO) inhibitor is in clinical trials for the treatment of heart failure with preserved ejection fraction — an advanced form of congestive heart failure — caused by microvascular inflammation. The investigational medicine inhibits MPO, which is known to cause the formation of hypochlorous acid and other free radicals that interfere with microvascular function (the tiny blood vessels in the heart). In preclinical models, MPO inhibitors have been found to reduce inflammation and fibrosis and improve microvascular function. Clinical trials are ongoing in **Lincoln**.

- A medicine approved to treat type II diabetes is in clinical trials for the treatment of obesity. The medicine binds to and activates the GIP (glucose-dependent insulinotropic polypeptide) and GLP-1 (glucagon-like peptide-1) receptors in the body. GIP and GLP-1 are hormones involved in blood sugar control. In preclinical models, GIP has been shown to decrease food intake and increase energy expenditure resulting in weight reductions. When combined with a GLP-1 receptor agonist, the treatment may result in greater effects on body weight, glucose and lipids. The medicine was recently approved in the U.S. as an adjunct to diet and exercise to improve glycemic control in adults with type II diabetes mellitus. In clinical trials, the medicine helped 63% of trial participants achieve at least a 20% reduction in body weight. Clinical trials are ongoing at the **VA Nebraska-Western Iowa Health Care System** in **Grand Isle, Omaha VA Medical Center** in **Omaha, University of Nebraska Medical Center** in **Omaha**, and **Quality Clinical Research** in **Omaha**.

- A disease-modifying treatment in development for relapsing multiple sclerosis is an inhibitor of Bruton's tyrosine kinase (BTK) and targets the source of multiple sclerosis damage in the brain (lesions). The BTK inhibitor not only inhibits the peripheral immune system, but also crosses the blood-brain barrier to suppress immune cells that have migrated into the brain, while also modulating microglia cells that are responsible for removing damaged neurons that have been implicated in multiple sclerosis progression. The medicine shows promise for reducing neuroinflammation and neurodegeneration, both implicated in disease progression. A clinical trial is underway at the **University of Nebraska Medical Center** in **Omaha**.

- A disease-modifying gene therapy is being tested as a single-dose treatment for patients with GBA1-mutated Parkinson's disease. The GBA gene contains instructions for making glucocerebrosidase (GCase), which is needed for the removal and recycling of the glycolipids. Glycolipids are a cellular component that accumulates with age, causing lysosomal dysfunction and aggregation of alpha synuclein in the cells, which is thought to lead to inflammation and neurodegeneration. The gene therapy delivers a non-mutated GBA1 gene to the brain. Another DMT being tested against Parkinson's disease is a monoclonal antibody that targets alpha-synuclein and is designed to block cell-to-cell transmission of aggregated alpha-synuclein found in Parkinson's. A clinical trial in ongoing at **Meridien Clinical Research** in **Omaha**.

- A CAR-T (genetically modified chimeric antigen receptor T-cell) therapy in development for leukemia and lymphoma in patients up to 17 years old. CAR-T therapy utilizes a patient's own T-cells to uniquely recognize and kill cancerous tumor cells. To make the therapy, a patient's blood is filtered to remove T-cells, which are then altered in the lab by inserting a gene that codes for a receptor that targets a protein unique to cancer cells. The T-cells are then returned to the patient intravenously, where they can then bind to and kill the cancer cells. Clinical trials are ongoing in **Omaha**.

- A novel bacterial topoisomerase II inhibitor is being developed to treat Neisseria gonorrhoeae infections and uncomplicated urinary tract infections. The drug has a dual mechanism of action and works by selectively inhibiting two bacterial enzymes – DNA gyrase and topoisomerase IV — that play a role in bacterial replication. The drug may have activity against most target pathogens resistant to established antibiotics. A clinical trial was conducted in **Lincoln**.

[1] *PhRMA Medicines in Development report, https://phrma.org/Scientific-Innovation/In-The-Pipeline/Medicines-in-Development*

Conclusion

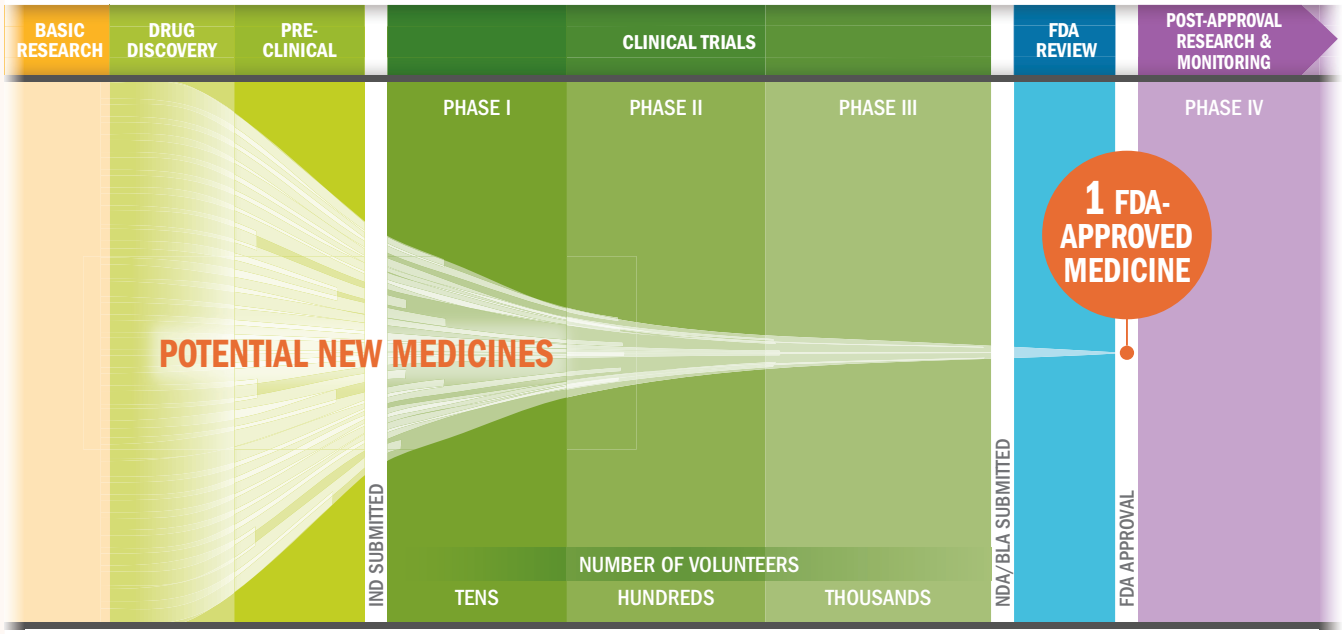
The Nebraska bioscience industry supports 18,000 jobs throughout Nebraska with wages and benefits supported by the sector, resulting in $257.2 million in state and federal taxes paid. The industry is also driving innovation and additional economic activity in the state. Biopharmaceutical research companies supported the generation of $5.7 billion in direct and indirect economic activity in Nebraska.

Nebraskans are also positively impacted by the presence of a strong biopharmaceutical sector and clinical trials in the state. Innovative treatments developed today are helping to expand the frontiers of science and could lead to more and better treatments for patients in the future. Additionally, Nebraska residents benefit from the pharmaceutical industry's commitment to clinical trial diversity and efforts to address health equity.

In Nebraska, this innovation is the result of a successful collaboration between biopharmaceutical companies and local research institutions. And the sector's growth and strength in Nebraska are driving our economy and communities forward.

THE BIOPHARMACEUTICAL RESEARCH AND DEVELOPMENT PROCESS

From drug discovery through FDA approval, developing a new medicine takes at least 10 years on average and costs an average of $2.6 billion.* Less than 12% of the candidate medicines that make it into Phase I clinical trials will be approved by the FDA.



Key: IND: Investigational New Drug Application, NDA: New Drug Application, BLA: Biologics License Application

* The average R&D cost required to bring a new, FDA-approved medicine to patients is estimated to be $2.6 billion over the past decade (in 2013 dollars), including the cost of the many potential medicines that do not make it through to FDA approval.

Source: PhRMA adaptation based on Tufts Center for the Study of Drug Development (CSDD) Briefing: "Cost of Developing a New Drug," Nov. 2014. Tufts CSDD & School of Medicine and US FDA Infographic, "Drug Approval Process," http://www.fda.gov/downloads/Drugs/ResourcesForYou/Consumers/UCM284393.pdf (accessed Jan. 20, 2015).

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