RESEARCH *in* YOUR BACKYARD

Developing Cures, Creating Jobs

Pharmaceutical clinical trials in
WISCONSIN

Executive

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

Since 2004, biopharmaceutical research companies have conducted or are conducting more than 3,700 clinical trials of new medicines in Wisconsin in collaboration with clinical research centers, hospitals and local research institutions. These clinical trials have investigated or are investigating some of Wisconsin's biggest health care challenges, including asthma, arthritis, cancer, diabetes, cardiovascular disease and gastrointestinal diseases.

"There are many perceived and practical barriers to getting patients enrolled in clinical trials. As a result, only 8% of cancer patients participate in clinical trials. It is essential for all stakeholders involved in this process to cooperate in reducing these structural, clinical and attitudinal barriers. This is the only way to advance the discovery of cures, accelerate improvements in treatment options and improve the quantity and quality of life for patients."

Paul Westrick,
Cancer survivor, volunteer and advocate

Summary

Clinical trials in
WISCONSIN

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

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

Clinical tests of new drugs are conducted in three phases and, on average, account for nearly seven of the more than 10 years it takes to bring a new drug 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.

All clinical trials must be reviewed and approved in advance by an Institutional Review Board (IRB), an independent committee of physicians, statisticians, local community advocates and others, to ensure a trial is ethically conducted and patient rights are protected.

Clinical Trials in Wisconsin since 2004—Completed and Open

All Clinical Trials	Open Clinical Trials
3,728	489

Source: www.clinicaltrials.gov. Search criteria: Wisconsin, United States; Phase: early 1, 1, 2, 3; Industry only, first posted on or after 1/1/2004. Search performed 4/26/2021. Open clinical trials are recruiting, not yet recruiting, or expanded access available.

Executive Summary (cont.)

CLINICAL TRIALS OFFER IMPORTANT THERAPEUTIC OPTIONS FOR PATIENTS

For patients, clinical trials offer the potential for another therapeutic option. Clinical trials may provide a new avenue of care for some chronic disease sufferers 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 drug is appropriate for a different patient population, such as children or the elderly. Still others are conducted to find ways to make existing approved drugs more effective and easier to use with fewer side effects.

ECONOMIC IMPACT OF THE BIOPHARMACEUTICAL SECTOR IN WISCONSIN

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

A study by TEConomy Partners found that in 2017, the industry supported more than 51,500 jobs throughout Wisconsin. Wages and benefits for employees whose jobs were supported by the biopharmaceutical sector resulted in $697 million in state and federal taxes paid.

Biopharmaceutical research companies supported the generation of $12 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 Wisconsin 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 WISCONSIN

A separate study by TEConomy Partners found that in 2017 alone, there were 409 active industry-sponsored clinical trials in Wisconsin, with an estimated enrollment of 6,811 Wisconsin residents. Cardiovascular and circulatory diseases were the largest clinical trial disease area by total estimated enrollment in the state.

The investment at clinical trial sites was more than $90 million and the estimated total economic impact was more than $273 million.

"The impact of clinical trials goes far beyond the healthcare industry. What is often overlooked is their stimulating effect on the economy. Each year, clinical trials invest millions of dollars in our communities and create well-paying jobs for various skill levels. There is no doubt that they benefit everyone, not just the participants."

— Kurt Bauer,
President of Wisconsin Manufacturers & Commerce

"Clinical trials are the bedrock of medical innovation. Every trial gets us one step closer to bringing effective tests and treatments to patients. Furthermore, they give patients access to the highest quality care that our healthcare system has to offer."

Laura Strong,
Clinical Trials Education Network — WI

Open Clinical Trials in Wisconsin by Disease	
Disease	**Number of Trials**
Alzheimer's Disease & Dementia	9
Arthritis/Musculoskeletal Disorders	5
Autoimmune Diseases	17
Blood Disorders	7
Cancer	260
Cardiovascular Diseases	29
Diabetes	6
Eye Disorders	17
Gastrointestinal/Esophageal Diseases	21
Genetic Disorders	7
Infectious Diseases	26
Kidney Diseases	13
Liver Diseases	3
Mental Disorders	3
Neurological Disorders	17
Respiratory Diseases	19
Skin Diseases	4
Transplantation	10
Other Diseases	16
Total	**489**

Source: www.clinicaltrials.gov. Search criteria: Wisconsin, United States; Phase: early 1, 1, 2, 3; Industry only; first posted on or after 1/1/2004. Search performed 4/26/2021. 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 research studies that generate data to support FDA approval of a new medicine or a new indication for an existing medication. They also grant participants early access to new medicines, which are being developed to help combat chronic and serious diseases. By volunteering for a clinical trial, patients take an active role in their health care by helping researchers test new treatments. In Wisconsin, 3,728 clinical trials since 2004 have targeted diseases and conditions like asthma, arthritis, cancer, diabetes, cardiovascular disease and Alzheimer's disease.

PHASES OF CLINICAL TRIALS

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

PHASE I—Researchers test the drug 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 drug 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 drug 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 are 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 Wisconsin's Carbone Cancer Center** visit *https://www.uwhealth.org/services/cancer*, for trials at the **University of Wisconsin-Madison** visit *https://ictr.wisc.edu/office-of-clinical-trials-oct/* and for **UW Health** visit, *https://clinicaltrials.uwhealth.org*. For clinical trials at the **Medical College of Wisconsin** visit *https://www.mcw.edu/departments/office-of-research/participants*.

More information about clinical trials in Wisconsin and how to volunteer for one can be found at *www.centerwatch.com*, as recommended by the Clinical Trials Education Network of Wisconsin.

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, like keeping a daily log of their health. All prospective participants must sign an informed consent document saying they understand that the clinical trial is research, and that they can leave the trial at any time. After consulting with their health care providers, patients can volunteer to participate, leading to a pre-screening interview. If they fit the criteria and requirements of the test, they can be enrolled.

PATIENT EXPENSES

Patients should ask during pre-screening interviews what it will cost them to participate in a clinical trial. Clinical trial sponsors usually pay for all research-related expenses and additional testing or physician visits required by the trial. Patients or their insurance companies may be asked to pay for any routine treatments of their disease. And it's important to know that some health plans do not pay for clinical trials.

Patients should make it a point to learn if they or their insurance company will be assessed any fees and should determine if their insurance company will cover the expense of routine examinations. Patients who live a distance from the trial site should learn the clinic's policy for covering travel costs and living expenses.

The National Cancer Institute, for example, makes patients responsible for their own travel costs for the initial screening visits. Once a patient is enrolled, the Institute will pay for transportation costs for all subsequent trial-related visits. These patients will receive a small per diem for food and lodging.

EXPANDED ACCESS

Successful completion of the clinical trials is required to demonstrate to the FDA that an investigational drug is safe and effective, so that it can be approved and made available to a broad patient population. Clinical trials are the primary route by which patients can participate in the drug development process, receive access to unapproved investigational drugs and contribute to the collection of safety and efficacy data necessary for FDA approval.

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 drug through an expanded access program may be an option. The current FDA process for a patient to gain access to an investigational drug through expanded access was established in 2009 in close consultation with patients, physicians and the biopharmaceutical industry. Expanded access programs are part of many biopharmaceutical companies' commitment to patients.

*For more information about **the drug development and approval process** in **the United States**, see page 13.*

LOCAL PATIENT ADVOCACY GROUPS

Patient advocacy groups in Wisconsin provide an exceptional resource for patients to connect and learn more about their condition and what treatment options are available in the state. These groups also provide an important voice on behalf of patients to protect their access to medicine and treatment.

The following are just a few major groups that work on behalf of patients in Wisconsin and may provide more information to patients with further questions.

Alzheimer's Association
Chippewa Valley Office
404 1/2 N. Bridge Street
Chippewa Falls, WI 54729
(715) 720-7611

Alzheimer's Association
Green Bay Office
(920) 469-2110

Alzheimer's Association
La Crosse Office
3817 Mormon Coulee Road,
Suite B
La Crosse, WI 44601
(800) 272-3900

Alzheimer's Association
Madison Office
2820 Walton Commons, Suite 132
Madison, WI 53718
(608) 203-8500

Alzheimer's Association
Milwaukee Office
620 S. 76th Street, Suite 160
Milwaukee, WI 53214
(414) 479-8800

Alzheimer's Association
Rhinelander Office
8A W. Davenport Street, Suite 224
Rhinelander, WI 54501
(715) 362-7779

Alzheimer's Association
Wausau Office
(715) 803-6779

Alzheimer's and Dementia Alliance of Wisconsin
3330 University Avenue, Suite 300
Madison, WI 53705
(608) 232-3400 or (888) 308-6251

American Cancer Society
Wisconsin Office
P.O Box 902
Pewaukee, WI 53072
(800) 227-2345

American Diabetes Association
Milwaukee Office
P.O. Box 7023
Merrifield, VA 22116-7023
(414) 778-5500
adawi@diabetes.org

American Heart Association
Milwaukee Office
1555 N. RiverCenter Drive,
Suite 211
Milwaukee, WI 53212
(414) 271-9999

American Heart Association
Madison Office
2850 Dairy Drive, Suite 300
Madison, WI 53718
(608) 709-4930

American Liver Foundation
Wisconsin Resource Center
1845 N. Farwell Avenue, Suite 312
Milwaukee, WI 53202
(414) 763-3435

American Lung Association
Wisconsin Chapter
13100 W. Lisbon Road, Suite 70
Brookfield, WI 53005
(262) 703-4200

Arthritis Foundation
Wisconsin Chapter
10427 W. Lincoln Avenue,
Suite 1300
West Allis, WI 53227
(414) 533-0453

Coalition of WI Aging & Health Groups
30 West Mifflin, Suite 406
Madison, WI 53703
(608) 224-0606

Epilepsy Foundation of Wisconsin
41 Park Ridge Drive, Suite C
Stevens Point, WI 54481
(608) 665-1848

NAMI Wisconsin
National Alliance on Mental Illness
4233 W. Beltline Hwy.
Madison, WI 53711
(608) 268-6000

CTEN-WI—MAKING PATIENTS AWARE OF CLINICAL TRIALS AND THEIR IMPORTANCE

The Clinical Trials Education Network of Wisconsin (CTEN) is focused on defining clinical research in terms that are easily understandable for the public, elected officials, and news media in a way that educates all about the instrumental role our industry plays in health care and the economy.

CTEN will continue to place the safety of our patients as the top priority of our profession. It is our mission to be acknowledged nationally and internationally as a leader in patient care, innovation and collaboration for the benefit of our patients.

Many of the partners in the CTEN are heavily involved in the clinical testing of new medicines in the state for a range of diseases, including infectious and respiratory conditions, cancer, asthma, migraine headaches, allergies, and others. We provide clinical research expertise and sophisticated equipment that enable biopharmaceutical companies and their local collaborators to conduct trials of new medicines.

More than a dozen organizations are partners of CTEN including: Anteco Pharma, Aurora Health Care, BioForward, Deltanoid Pharmaceuticals, DNASTAR, ENDECE, Exact Sciences, FluGen, Forte Research Systems, Hologic, Clinical Research Center at Marshfield Clinic Research Foundation, Quintessence Biosciences, Spaulding Clinical Research and VibeTech.

To learn about the companies that make up CTEN, visit *www.wiclinicaltrials.com*.

OTHER PATIENT RESOURCES

MEDICINE ASSISTANCE TOOL (MAT): The Medicine Assistance Tool, a PhRMA-sponsored web platform designed to help patients, caregivers and health care providers learn more about the resources available through the various biopharmaceutical industry programs offered to those who need financial support due to their lack of insurance or inadequate prescription medicine coverage. 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 been offering for decades. Patients should go to *www.mat.org* for more information. The on-line process takes about 15 minutes, and you'll find out instantly if you're likely to be eligible for help.

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 11 states and the District of Columbia and helped victims and evacuees who needed to fill or re-fill their prescriptions find open pharmacies. Healthcare Ready also helped emergency responders with critical information on the challenges facing supply chain partners relating to electricity, fuel and transportation issues. See more at *www.healthcareready.org*.

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. The industry and its large-scale research and manufacturing supply chain supports 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 million jobs across the U.S. economy in 2017, according to a study by TEConomy Partners.

Since 2000, biopharmaceutical companies that are members of the Pharmaceutical Research and Manufacturers of America have invested nearly $1 trillion in the search for new treatments and cures, including an estimated $83 billion in 2019 alone.

ECONOMIC IMPACT OF THE BIOPHARMACEUTICAL SECTOR IN WISCONSIN

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

- Supported more than 51,500 jobs throughout Wisconsin in 2017.
- Supported the generation of $12 billion in economic activity in the state.
- Resulted in $697 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 Wisconsin**, see page 2.*

PUBLIC-PRIVATE PARTNERSHIPS AND LOCAL COLLABORATION

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

All Saints Hospital, Racine

Aspirus Medford Hospital, Medford

Aspirus Research Institute, Wausau

Aspirus UW Cancer Center, Wisconsin Rapids

Bay Area Medical Center, Marinette

Bellin Memorial Hospital, Green Bay

Cancer Center of Western Wisconsin, New Richmond

Children's Wisconsin, Milwaukee

Columbia St. Mary's, Milwaukee

Covance Clinical Research, Madison

D.N. Greenwald Center, Mukwonago

Duluth Clinic Ashland, Ashland

Froedtert Hospital, Milwaukee

Gundersen Health System, La Crosse

Holy Family Memorial Medical Center, Manitowoc

Langlade Hospital and Cancer Center, Antigo

Marshfield Clinics, Chippewa Falls, Eau Claire, Minocqua, Rice Lake, Stevens Point, Wausau, Weston, Wisconsin Rapids

Medical College of Wisconsin, Milwaukee

Mercy Health System, Janesville

Oconomowoc Memorial Hospital, Oconomowoc

ProHealth Regional Care Center, Waukesha

Sacred Heart Hospital, Eau Claire

SSM Health, Madison

Spaulding Clinical Research, West Bend

St. Clare's Hospital, Weston

St. Francis Hospital, Milwaukee

St. Luke's Medical Center, Milwaukee

St. Mary's Hospital Medical Center, Green Bay

St. Mary's Hospital, Rhinelander

St. Michael's Hospital, Stevens Point

St. Nicholas Hospital, Sheboygan

St. Vincent Hospital, Green Bay, Oconto Falls, Sturgeon Bay

University of Wisconsin Hospitals & Clinics, Madison

University of Wisconsin Paul P. Carbone Comprehensive Cancer Center, Madison

Versiti, Milwaukee

Vince Lombardi Cancer Clinic, Oshkosh, Sheboygan, Two Rivers

Waukesha Memorial Hospital, Waukesha

William S. Middleton Memorial Veteran's Hospital, Madison

Wisconsin Center for Advanced Research, Milwaukee

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 8,500 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 the other groups are undertaking on their own.

In Wisconsin, of the 489 open clinical trials involving the biopharmaceutical research industry, the **Medical College of Wisconsin** is collaborating on more than 162 of the clinical trials and the **University of Wisconsin** on more than 139 clinical trials.

THE STATE OF DISEASE IN WISCONSIN

More than 5.8 million people live in Wisconsin[1], and many are dealing with disease and disability from asthma to cancer and from diabetes to heart disease.

Selected Disease Statistics in Nebraska	
Disease	**Health Statistic**
Alzheimer's Deaths 2018[2]	2,452
Anemia Deaths 2018[2]	105
Asthma Lifetime Prevalence Adults 2018[2]	12.0%
Asthma Lifetime Prevalence-Children 2018[2]	11.5%
Cancer New Cases 2021[3]	36,520
Cancer Deaths 2021[3]	11,700
Chronic Lower Respiratory Dis. Deaths 2018[2]	2,865
Diabetes Prevalence-Adults 2019[4]	9.0%
Diabetes Deaths 2018[2]	1,508
Heart Disease Deaths 2018[2]	12,053
Hepatitis, Viral Deaths 2018[2]	38
HIV Deaths 2018[2]	30
HIV-Number Living with a Diagnosis 2018[4]	6,331
Influenza/Pneumonia Deaths 2018[2]	1,074
Kidney Disease Deaths 2018[2]	929
Liver Disease Deaths 2018[2]	731
Mental Illness-Adults 2018-2019[4]	904,000
Parkinson's Death 2018[2]	691
Septicemia Deaths 2018[2]	579
Stroke Deaths 2018[2]	2,549

Source: 1. U.S. Census Bureau 2. Wisconsin Department of Health Services 3. American Cancer Society 4. Kaiser Family Foundation, State Health Facts

[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 4/26/2021.* Open clinical trials are recruiting, not yet recruiting, or are expanded access available.

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

- Children under the age of 18 make up 21.8% of the population in Wisconsin. Pediatric clinical trials are being conducted in the state for asthma, aplastic anemia, Crohn's disease, cystic fibrosis, hemophilia, Lennox-Gastaut Syndrome, leukemia, neuroblastoma, respiratory tract infections and sickle cell diseases, among others.

- Wisconsinites aged 65 and older account for 17.5% of the states' population. In Wisconsin, clinical trials are recruiting older people to study potential treatments for diseases such as breast cancer, chronic obstructive pulmonary disease, Crohn's disease, kidney disease, glaucoma, heart failure, leukemia, lymphoma, prostate cancer and rheumatoid arthritis, among others.

- Women and girls make up 50.2% of the population in Wisconsin. Clinical trials are recruiting women for studies on medicines for breast cancer, cervical cancer, endometrial cancer, ovarian cancer, respiratory tract infections, urinary incontinence and uterine cancer, among others.

Open Clinical Trials in Wisconsin for Special Populations

Population	Number of Trials
Children (birth-17)	93
Seniors (66 and older)	424
Women (only)	17

Source: www.clinicaltrials.gov. Search criteria: Wisconsin, United States; Phase: early 1, 1, 2, 3; Industry only, first received on or after 1/1/2004. Search performed 4/26/2021. Open clinical trials are recruiting, not yet recruiting, or expanded access available.

SCIENCE AND CLINICAL TRIALS

Some of the medicines in clinical testing in Wisconsin feature revolutionary medical technologies. For example:

- A therapeutic vaccine for non-small cell lung cancer (NSCLC) which uses messenger RNA (mRNA) to mobilize the patient's own immune system to fight the tumor(s). mRNA is the cell's blueprint to make proteins and subsequently send them to various parts of the body. mRNA medicines take advantage of the body's biological processes to create a desired therapeutic effect. The vaccine in development targets six specific tumor-associated antigens (substances produced in tumors that trigger an immune response) that are overexpressed in lung cancer. It is being studied in combination with cancer immunotherapy. A clinical trial is ongoing in **Milwaukee**.

- A second-generation CAR-T cell therapy comprised of genetically-modified T cells is designed to target B-cell maturation antigen (BCMA) and to redirect the T-cells to recognize and kill malignant myeloma cells. BCMA is a surface protein that is absent in most normal tissues but found in normal plasma cells and the majority of multiple myeloma cells. Clinical trials are being conducted at the **Froedtert Hospital and Medical College of Wisconsin** in **Milwaukee** and at the **University of Wisconsin Carbone Cancer Center** in **Madison**.

- A CD19-directed (a biomarker commonly found on leukemia and lymphoma B-cells) CAR-T cell therapy is in development for relapsed or refractory large B-cell lymphoma, including diffuse large B-cell lymphoma. CAR-T cell therapy is a type of immunotherapy where a patient's own T-cells are collected and engineered in the lab to recognize and kill cancer cells. The engineered T-cells are then returned to the patient to treat the cancer. The T-cells in this treatment are modified to recognize and kill malignant B-cells with the protein CD19 on the surface. A clinical trial is ongoing at the **Medical College of Wisconsin, Froedtert Hospital** in **Milwaukee**.

- A monoclonal antibody in development for the prevention of **migraine** binds to and inhibits the activity of a peptide expressed in the nervous system where it plays a role in controlling the widening of blood vessels and the transmission of nociceptive pain (pain arising from nerve cells) information. By inhibiting CGRP activity, anti-CGRP antibodies are thought to help inhibit the transmission of pain signals associated with migraines. Clinical trials are ongoing in **Marshfield**.

- A therapeutic recombinant pox virus vaccine that encodes the prostate-specific antigen (PSA) is being studied for the treatment of prostate cancer. Studies were conducted at Midwest Research Specialists and the Medical College of Wisconsin in **Milwaukee**.

- A long-acting version of an oral integrase inhibitor is in development for HIV pre-exposure prophylaxis (PrEP). PrEP is the use of antiviral medicines in uninfected people who have not been exposed to the virus to prevent infection. Long-acting, injectable medicines help with patient adherence to treatment for chronic illnesses.7 Integrase inhibitors block the action of integrase, a viral enzyme that inserts the viral genome into the DNA of the host cell. This is a vital step in retroviral replication and it's believed that blocking it can halt further spread of the virus. A clinical trial is being conducted in **Milwaukee**.

- A potential first-in-class medicine in development for asthma, blocks TSLP, an immune system messenger protein that is critical in the development and persistence of inflammation of the airways. It is believed that by blocking TSLP, the release of pro-inflammatory proteins by immune cells will be stopped, resulting in the prevention of asthma exacerbations and improved asthma control. Clinical trials were conducted in **Cudahy** and **Madison**.

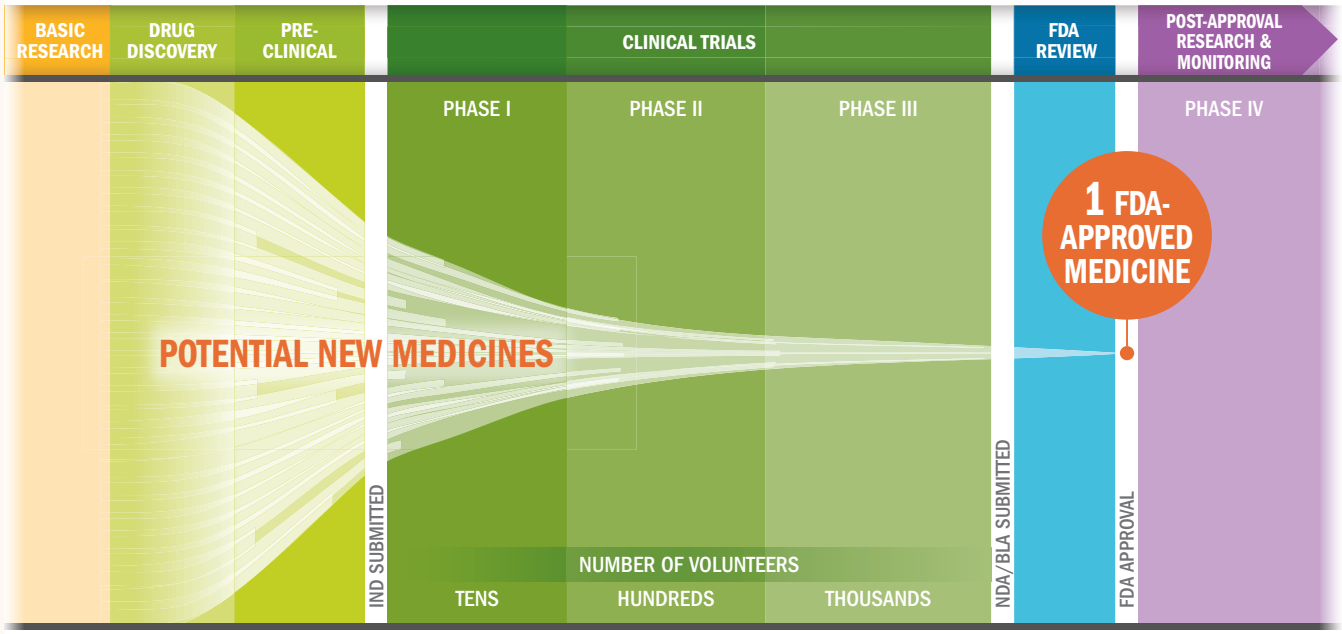
- A CAR-T (genetically modified chimeric antigen receptor T-cell) therapy in development for leukemia and lymphoma in patients up to 17 years old. CAR-T therapy utilizes a patient's own T-cells to uniquely recognize and kill cancerous tumor cells. To make the therapy, a patient's blood is filtered to 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 being conducted at **Medical College of Wisconsin, Froedtert Hospital** in **Milwaukee**.

- An oral fixed-dose combination of two therapeutics which target distinct receptors in the central nervous system is in development for the treatment of treatment-resistant major depressive disorder. The medicine offers a novel mechanism of action with one therapeutic increasing the therapeutic effect of the second, offering hope to the millions of patients who do not respond to standard antidepressant therapies. A clinical trial was conducted in **Waukesha**.
- A potential first-in-class oral medicine in development provides a new way to address type 1 and type 2 diabetes by acting on two different targets in the body. It is a dual inhibitor of both sodium-glucose co-transporter types 1 and 2 (SGLT1 and SGLT2), which are molecules that also help move glucose in and out of the body's cells independent of insulin. This movement is important for the absorption of glucose in the body both by the intestine (glucose absorption from food) and by the kidney (which determines how much glucose leaves the body via urine). A clinical trial was conducted in **Kenosha**.

The innovative treatments that are being developed today are helping to expand the frontiers of science and could lead to more and better treatments for patients in the future. In Wisconsin, this innovation is the result of a successful collaboration between biopharmaceutical companies and local research institutions.

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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