# Medicines are Transforming the Trajectory of Disease

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**Prescription medicines have yielded important progress against some of the most challenging diseases of our time. Today, new drugs are targeting the underlying causes of disease in ways never seen before, and diseases previously regarded as deadly are now manageable and even curable. In this new era of medicine, breakthrough science and personalized therapies are transforming the way we treat patients with a broad range of chronic and rare conditions. Looking forward, continued advances in biopharmaceutical innovation will be critical in addressing unmet need, improving public health and solving future health care challenges.**

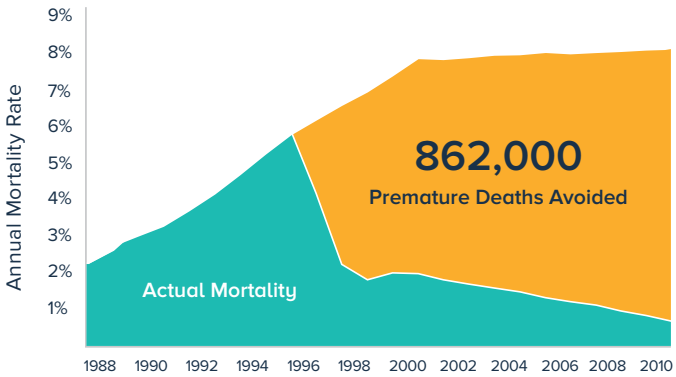
## PROGRESS AGAINST DISEASE

Medicines have played a central role in transforming the trajectory of many debilitating diseases, resulting in decreased death rates, improved health outcomes, and better quality of life for patients.

**CARDIOVASCULAR DISEASE** Tremendous strides have been made against cardiovascular disease over the past 40 years, due in large part to advances in treatment. Since 1980, the death rate from heart disease declined by about 60 percent.[1] And between 1980 and 2000, approximately two-thirds of the decline in coronary heart disease mortality, the most common type of heart disease, has been attributed to medical therapies.[2]

**HIV/AIDS** Once considered acutely fatal, HIV/AIDS is now a chronic and manageable disease. This dramatic change followed the introduction of highly active antiretroviral therapy in the mid-1990s, which transformed treatment and led to an 88% decline in death rates in the United States (See Figure 1).[3]

**Figure 1** Actual vs Projected Death Rates for HIV/AIDS in the United States




**HEPATITIS C** More recently, we've seen a remarkable transformation against another viral disease: hepatitis C. Just 6 years ago the only available treatment cured just half of patients and caused debilitating side effects. Today, a broad range of treatments with minimal side effects and cure rates approaching 100% are available for patients with all forms of the disease.[4,5] Looking forward, researchers project that with improved screening and today's cures, hepatitis C will be a rare disease by 2036.[6]

**CANCER** New medicines are also a driving force behind gains in the life expectancy of cancer patients. Since peaking in the early 1990s, the US has witnessed a 25% decline in cancer death rates.[7] Researchers attribute 73% of these gains to new treatments, including new medicines.[8] For some patients targeted therapies and immunotherapies, are often replacing traditional forms of cancer treatment—including chemotherapy, surgery and radiation—contributing greatly to improvements in treating many forms of cancer.[9]

## RECENT APPROVALS

Today, this progress continues as scientists explore new frontiers of biopharmaceutical research. In 2016, the US Food and Drug Administration (FDA) approved 27 new medicines, including 22 new medicines approved by the FDA Center for Drug Evaluation (CDER). Among CDER's approvals 36 percent were first-in-class medicines, representing entirely new ways of treating disease.[10,11]

Examples of novel therapies that became available to patients in 2016 include:

- The first medicine and only treatment for children and adults with spinal muscular atrophy (SMA). SMA is a rare and often fatal genetic condition characterized by loss of lower motor neurons controlling movement which results in progressive muscle weakness and wasting. The new medicine is an antisense oligonucleotide designed to treat mechanisms of the disease caused by mutations in the chromosome 5q, which leads to a key protein deficiency.[12,13]
- A first-in-class personalized medicine to treat chronic lymphocytic leukemia (CLL) patients with a specific chromosomal abnormality which is detected by a genetic test. The drug is an inhibitor of the BCL-2 protein, a protein that blocks "programmed cell death," including in cancer cells which can be overexpressed in some CLL patients.[14,15]

## THE FUTURE HAS NEVER BEEN BRIGHTER

Researchers are pursuing cutting-edge research and novel scientific strategies to continue to drive therapeutic advances for patients. There are currently about 7,000 medicines in clinical development globally with the potential to impact US patients.[16] And across the medicines in the pipeline 80% have the potential to be first-in-class treatments.[17]

**Medicines in development include:**[18]

**BLOOD CANCERS** Chimeric antigen receptor (CAR) T-cell immunotherapy is an emerging cellular approach demonstrating remarkable potential in clinical trials to help patients with blood cancers. CAR T-cell therapy involves removing immune-boosting T-cells from a patient, engineering them so they are able to recognize and kill cancer cells, and returning the engineered cells back to the patient. CAR T-cell therapy is an example of immuno-oncology. In total there are close to 250 medicines in the pipeline that fall into the most recognized classes of immuno-oncology medicines.[19]

**MIGRAINES** After decades of research into a signaling pathway that appears to play a central role in migraines, CGRP inhibitors are offering new hope for severe migraine sufferers. Experts in the field say these medicines, which inhibit the calcitonin gene-related peptide (CGRP) pathway to prevent migraine attacks, may lead to a "new era" of migraine treatment.

**CROHN'S DISEASE** A new approach in Crohn's disease—a severe inflammatory bowel disease—works by blocking production of a protein called SMAD7 which is present at high levels in Crohn's patients and blocks pathways that keep immune cells in check. In clinical trials more than half of patients achieved complete response within 2 weeks with SMAD7 blockers.

**ALZHEIMER'S DISEASE** Alzheimer's disease has proven a very challenging field of biopharmaceutical research. Despite many setbacks, researchers continue to actively pursue treatment. One promising approach in the pipeline involves blocking the BACE1 enzyme that is integral to creating amyloid-beta, which makes up the plaques that are involved in Alzheimer's disease progression.

The tremendous promise that is evident in today's biopharmaceutical pipeline represents a new frontier of research with the potential to transform the lives of patients. In this new era of medicine, science that was once considered unimaginable is now on the verge of producing a complete paradigm shift in the treatment of the most complex and challenging diseases of our time.

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1 Centers for Disease Control and Prevention (CDC), National Center for Health Statistics (NCHS), National Vital Statistics System. Age-adjusted death rates for 72 selected causes by race and sex using year 2000 standard population: United States, 1979-98. http://www.cdc.gov/nchs/data/mortab/aadr7998s.pdf. April 2016. J Xu, et al; US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System. Deaths: final data for 2014. Natl Vital Statistics Rep. 2017;65(4). https://www.cdc.gov/nchs/data/nvsr/nvsr65/nvsr65_04.pdf March 2017.

2 H Guo, D Cutler, T Graziano, M Weinstein, A Pandya. Why have we Been Dying Less from Coronary Heart Disease in the United States? Proceedings of the 22nd Annual International Meeting International Society of Pharmacoeconomics and Outcomes Research; May 2017; Boston, MA. Abstract available at: https://www.ispor.org/ScientificPresentationsDatabase/Presentation/71745?pdfid=48920

3 Centers for Disease Control and Prevention, National Center for Health Statistics. Health, United States, 2015: With Special Feature On Racial and Ethnic Health Disparities. https://www.cdc.gov/nchs/data/hus/hus15.pdf. Published May 2016. May 2017.

4 PhRMA. A Decade Of Innovation In Chronic Diseases: 2006-2016. http://phrma.org/sites/default/files/pdf/decade-of-innovation-chronic-disease.pdf. February 2016.

5 US FDA. Drugs@FDA: FDA approved drug products. http://www.accessdata.fda.gov/scripts/cder/drugsatfda. Accessed May 2017.

6 M Kabiri et al. The Changing Burden of Hepatitis C Virus Infection in the United States: Model Based Predictions. Ann Intern Med. 2014;161(3):170-180.

7 American Cancer Society. Cancer Facts & Figures: 2017. https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/annual-cancer-facts-and-figures/2017/cancer-facts-and-figures-2017.pdf.

8 S Seabury, "Quantifying Gains in the War on Cancer Due to Improved Treatment and Earlier Detection," Forum for Health Economics and Policy 2016; 19(1): 141–156.

9 American Association for Cancer Research. AACR Cancer Progress Report 2013. http://cancerprogressreport.org/2013/Documents/2013_AACR_CPR_FINAL.pdf

10 US FDA. 2016 Novel Drugs Summary. January 2017. https://www.fda.gov/downloads/Drugs/DevelopmentApprovalProcess/DrugInnovation/UCM536693.pdf

11 US FDA. 2016 biological license application approvals. February 2017. https://www.fda.gov/BiologicsBloodVaccines/DevelopmentApprovalProcess/BiologicalApprovalsbyYear/ucm482397.htm

12 FDA Press Release. FDA Approves First Drug for Spinal Muscular Atrophy. December 2016 https://www.fda.gov/newsevents/newsroom/pressannouncements/ucm534611.htm

13 Biogen Press Release. U.S. FDA Approves Biogen's SPINRAZA™ (nusinersen), The First Treatment for Spinal Muscular Atrophy. December 2016. http://media.biogen.com/press-release/neurodegenerative-diseases/us-fda-approves-biogens-spinraza-nusinersen-first-treatment

14 FDA Press Release. FDA Approves New Drug For Chronic Lymphocytic Leukemia in Patients With a Specific Chromosomal Abnormality. April 2016. https://www.fda.gov/newsevents/newsroom/pressannouncements/ucm495253.htm

15 Abbvie Press Release. AbbVie Receives FDA Accelerated Approval of Venclexta™ (venetoclax) Tablets, the First BCL-2 Inhibitor in Relapsed/Refractory Chronic Lymphocytic Leukemia Patients with 17p Deletion. April 2016. https://news.abbvie.com/news/abbvie-receives-fda-accelerated-approval-venclexta-venetoclax-tablets-first-bcl-2-inhibitor-in-relapsedrefractory-chronic-lymphocytic-leukemia-patients-with-17p-deletion.htm

16 Adis R&D Insight Database. Accessed June 2017.

17 Analysis Group, "The Biopharmaceutical Pipeline: Innovative Therapies in Clinical Development," July 2017.

18 Analysis Group, "The Biopharmaceutical Pipeline: Innovative Therapies in Clinical Development," July 2017.

19 PhRMA. Medicines in Development: Immuno-oncology. 2017. phrma-docs.phrma.org/files/dmfile/MID-Report-Immuno_Oncology-2017.PDF