National Institutes of Health
Technology Transfer

Public Health & Economic Impact Study

May 2023

Technology Transfer and Licensing at the U.S. National Institutes of Health

INNOVATION ECONOMY HEALTH

The technologies invented at the Intramural Research Program at the NIH generate benefits to public health, economic growth, and the biomedical innovation system. Linking IRP-licensed technologies to new datasets reveals the long-term impacts of technology transfer far beyond the short-term financial returns from royalty income.

Analysis conducted by RTI International

IMPACTS GENERATED BY TECHNOLOGY TRANSFER AT NIH

ACTIVITY
Technology patenting, marketing, and licensing negotiations by NIH

IMMEDIATE OUTPUTS
Licenses and Cooperative Research and Development Agreements to commercialize technologies invented at NIH

R&D	SALES	MEDICINE
1. Follow-on R&D efforts 2. Research tools enabling new approaches to R&D 3. Potential therapies submitted to FDA	New products or services introduced into the market	1. New therapies introduced 2. New vaccines administered
SAMPLE OUTCOMES	SAMPLE OUTCOMES	
1. Capital raised for R&D 2. Firms established or expanded 3. Clinical research to achieve FDA approval	1. Sales from products & services 2. Income from employment retained or created 3. Taxes on sales of new products & service	1. Improved disease management and treatment 2. Deaths/disability avoided
SAMPLE IMPACTS	SAMPLE IMPACTS	

INNOVATION

IRP-licensed technologies spur substantial follow-on research and development activity, including new inventions and clinical trials

1,700 patents
For technologies used in the 100 products with top sales, 58 licensees cited 148 NIH patents on over 1,700 subsequent patents.

The top 25 drugs were the subject of nearly
1,200 clinical trials.

ECONOMY

IRP technologies licensed from 1980 to 2021 contributed to products with over $130 billion in U.S. sales

57 products *commercialized by early-stage firms*
Among the 150 products with highest sales revenue from licenses.

Sales supported an average of
74,500 employment positions each year between 2001 and 2021.

HEALTH

Licensees develop therapies and vaccines that prevent lost productivity, extend lifetimes, and avert loss of life from key diseases

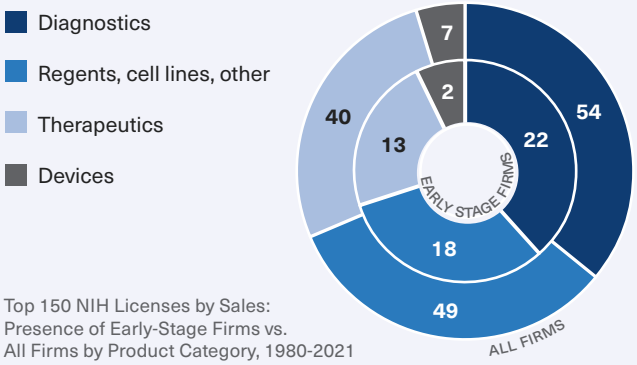
Patients with multiple myeloma gained **6 days/year *in productivity* and spent 3 fewer days/year *in the hospital*** from Velcade®, a treatment based on NIH-licensed technology.

Averted over
26,500 deaths
from cervical cancer in the U.S. between 2008 and 2019 from the development of Gardasil®, the HPV vaccine, preventing 557,640 future years of life lost.

NIH National Institutes of Health
Technology Transfer

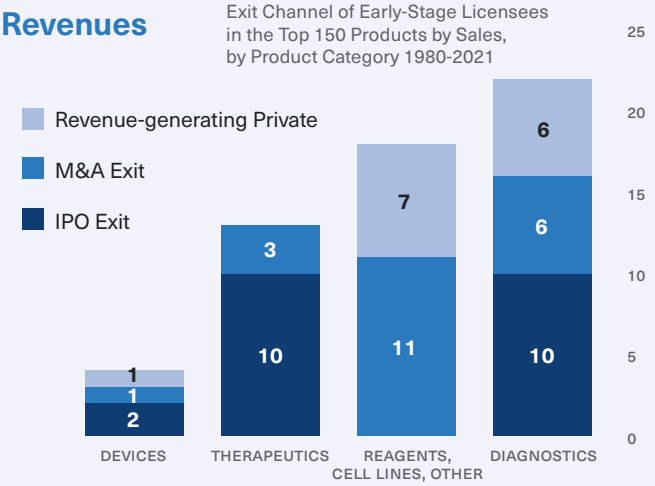
INNOVATION IMPACT

Early-Stage Firms Contribute to Commercialization Across All Product Categories, Generating Significant Revenues



Top 150 NIH Licenses by Sales: Presence of Early-Stage Firms vs. All Firms by Product Category, 1980-2021

Exit Channel of Early-Stage Licensees in the Top 150 Products by Sales, by Product Category 1980-2021



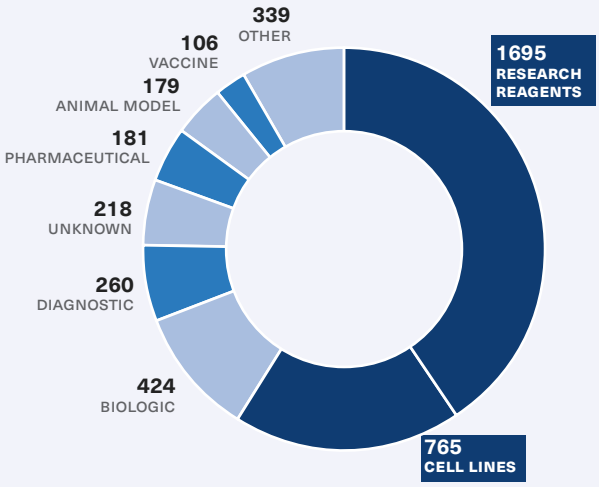
Licensing NIH Patents Leads to Downstream Technological Impact

Patent citation analysis shows that licensees frequently develop new inventions based on patents licensed from NIH.

Commercialized Drugs Spur Follow-on Clinical Research

- The top 25 drugs by sales based on licensed technologies were the subject of nearly **1,200** clinical trials.
  - In particular, **266** of the trials shown are post-market (Phase 4) trials.

Research Tools Are a Major Contribution by IRP to the Innovation Ecosystem

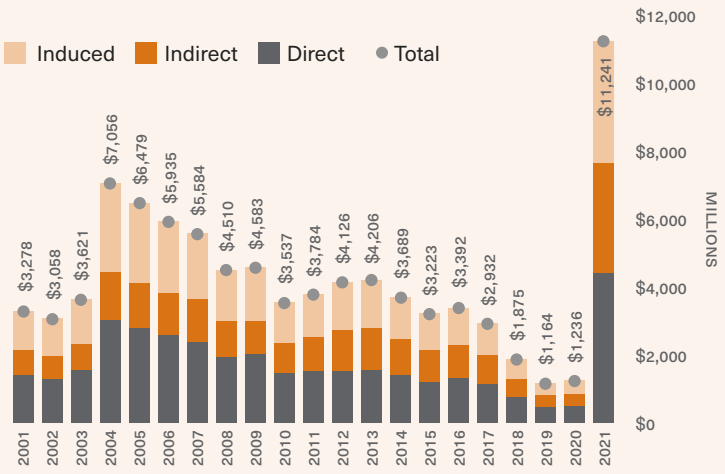


ECONOMIC IMPACT

U.S.-Based Sales Supported Significant Employment

- The number of positions funded by sales each year shows employment impact.
- Measurement includes direct, indirect, and induced employment.
- Employment impact translates to additional household income per year.

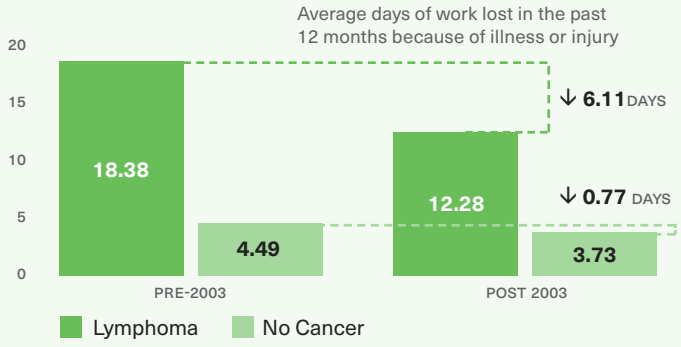
Note: 2021 result reflects sales of Comirnaty® COVID-19 vaccine

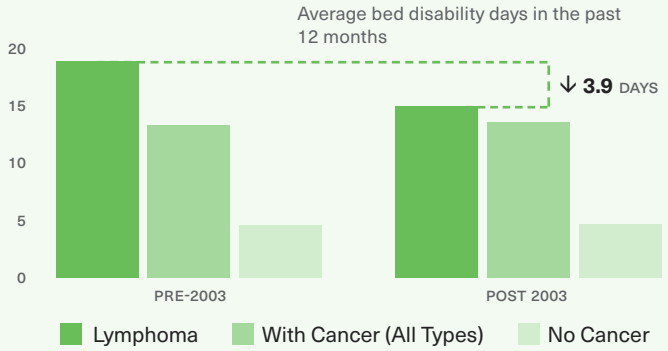


HEALTH IMPACT

Impact of Velcade® on Worker Absenteeism and Home Productivity

Velcade® is a targeted chemotherapy treatment approved in 2003 for multiple myeloma patients and patients with mantle cell lymphoma who had received at least 1 prior therapy. We examined the impact of its approval on productivity for people with lymphoma.

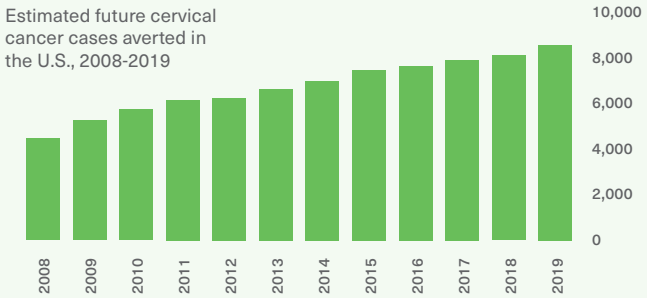




Impact of HPV Vaccines on Vaccination and Future Disease Burden

The first HPV vaccine, Gardasil®, received FDA approval in 2006 for female adolescents.

For the United States, we estimate that over **80,000** individuals would be likely to develop cervical cancer in the future if U.S. female adolescents had not been covered by at least 1 dose of Gardasil® and other HPV vaccines between 2008 and 2019.



Reducing the incidence of HPV among female adolescents vaccinated between 2008 and 2019 will potentially avert over **26,500** future deaths from cervical cancer, resulting in up to **557,640** future years of life loss prevented through HPV vaccination.

Examining global coverage of HPV vaccine, we find that over **18.4 million** future years of life loss could be averted through HPV vaccination that occurred between 2019 and 2021.

CONCLUSION

A comprehensive analysis of the impact of IRP technology licensing requires metrics across multiple domains

- Innovation ecosystem: contribution to US and global entrepreneurship in biomedical and other technologies, new R&D activity induced, new investments
- Economic: impact on employment, household income, tax revenues, economic output
- Health: gains in worker productivity, reduced disease burden that leads to higher worker participation, quality years of life, and deaths averted

Measurement depends on availability of high-quality data

- Additional curation of IRP licensing data could demonstrate enhanced impacts
- Data linking adds new detail and understanding but also requires more assumptions and caveats

New dashboards of technology licensing impact should go beyond short-term financial gains and focus on less tangible but highly significant contributions to social and economic well-being