

The impact of biopharmaceutical innovation on disability, Social Security reciprocity, and use of medical care of U.S. community residents, 1998-2015

Frank R. Lichtenberg

frank.lichtenberg@columbia.edu

Columbia University,

National Bureau of Economic Research, and CESifo

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Objective and approach

Objective

This study analyzes the overall impact that biopharmaceutical innovation had on disability, Social Security reciprocity, and the use of medical services of U.S. community residents during the period 1998-2015.

- Most of the data come from the [Medical Expenditure Panel Survey](#).

Approach

The effect of biopharmaceutical innovation is identified by differences across over 200 medical conditions in the growth in the lagged number of drug classes ever approved.

- 88% of private U.S. biomedical research funding comes from biopharmaceutical companies.
- The FDA believes that 70% of first-in-class drugs offer a “significant improvement” compared with products already on the market.

Research design

Pharmaceutical innovation

- Lagged number of drug classes ever approved for a medical condition

Controls

- Single year of age
- Single year of education
- No. of medical conditions
- Log of condition prevalence
- Medical condition fixed effects
- Year fixed effects



Person-level disability and Social Security reciprocity

- Person's Supplemental Security Income > 0?¹
- Person's Social Security Income > 0?²
- Unable to work because ill or disabled?
- Completely unable to do activity?
- Any IADL, ADL, functional, or activity limitations?
- Any limitation in work, housework, or school?
- Limitation in physical functioning?
- Cognitive limitations?
- Perceived health status fair or poor?
- Not working because retired?

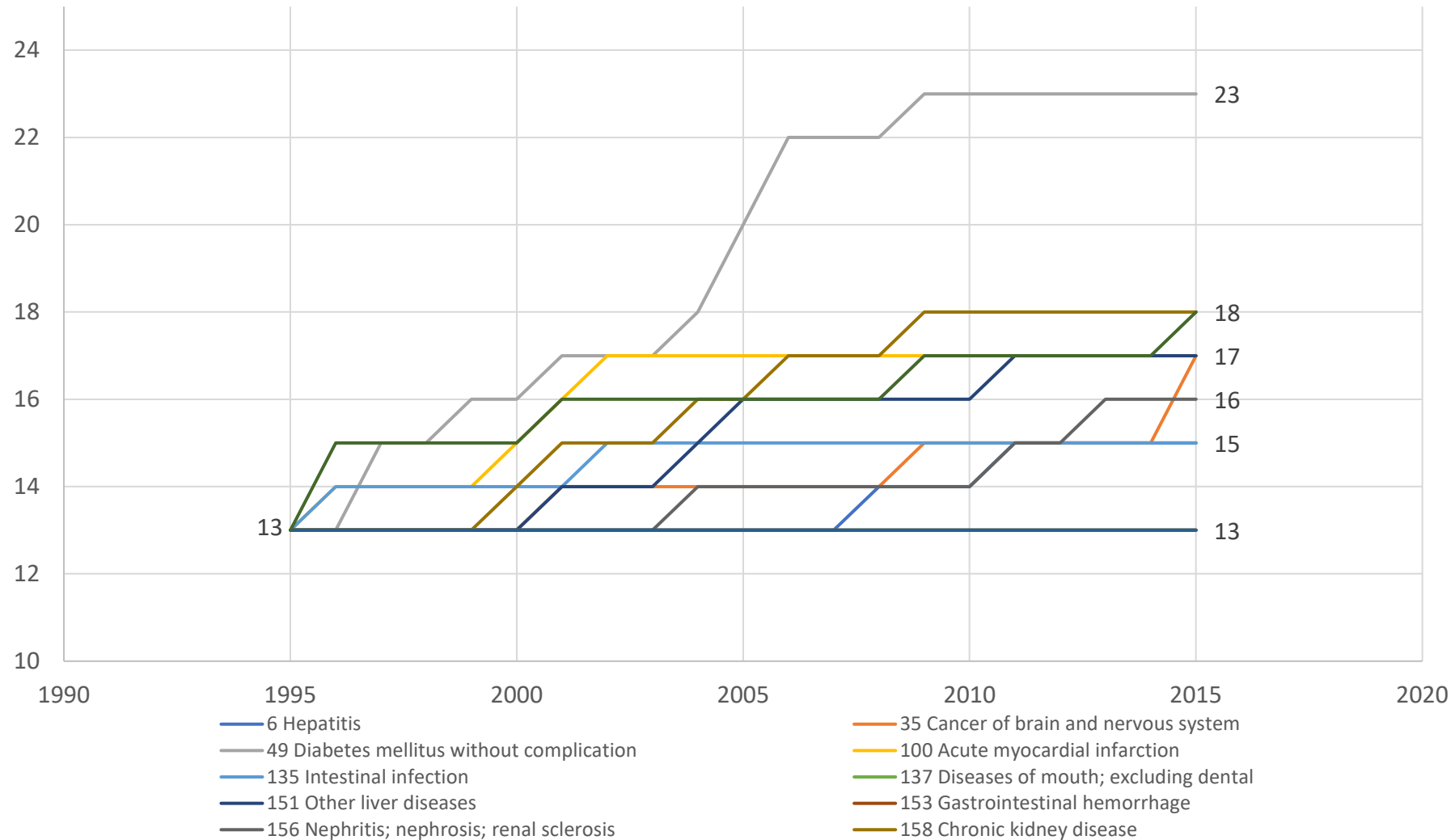
Condition-specific disability³

- Any bed days?
- Any missed work days?
- Any missed school days?

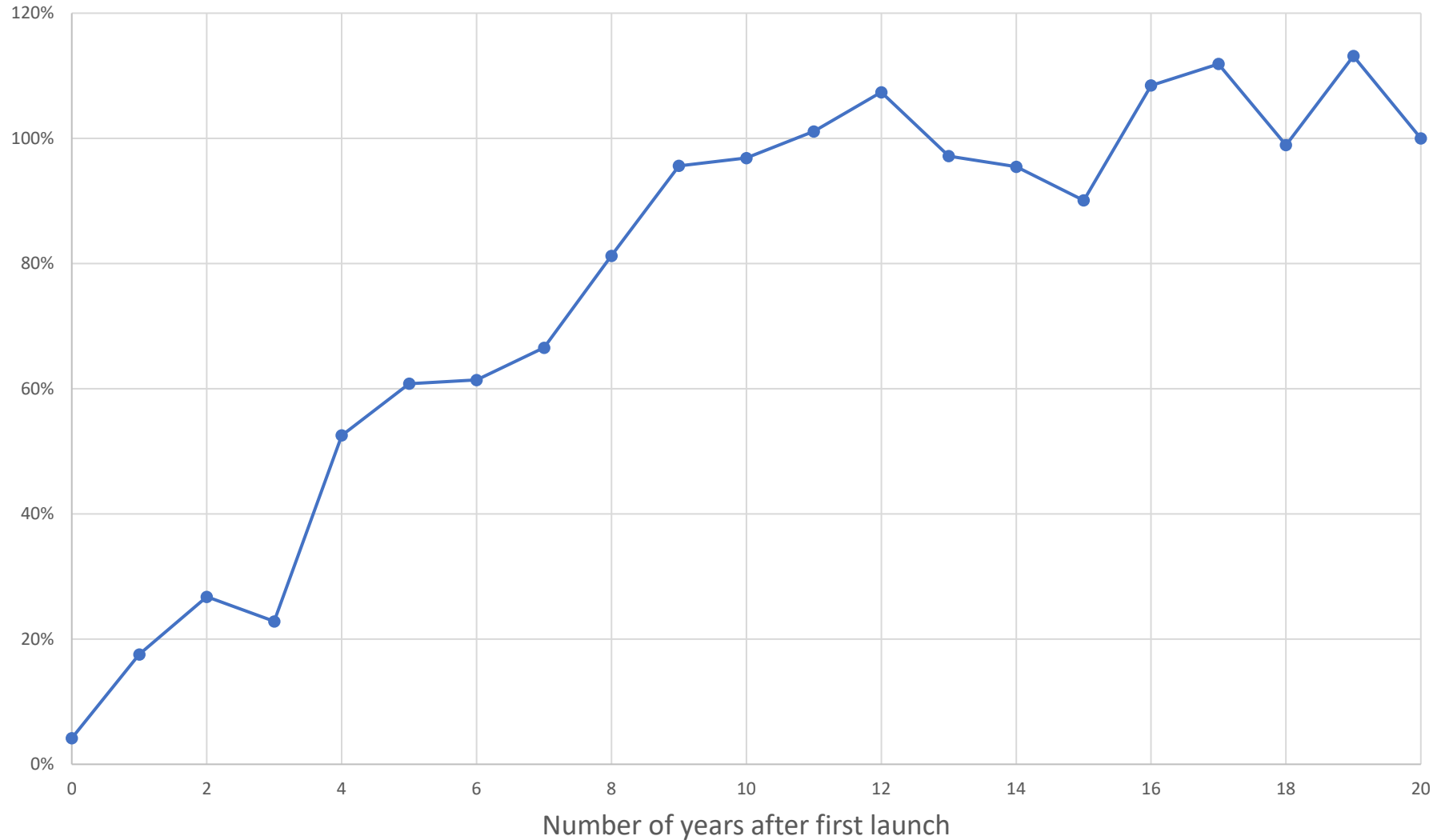
Condition-specific use of medical care: any of the following events associated with medical condition?

- Prescribed medicine events
- Inpatient events
- Emergency room events
- Office-based events
- Outpatient events
- Home health events

Number of WHO ATC4 chemical subgroups ever FDA-approved for 12 diseases, 1995-2015



Mean utilization of a drug class N years after first launch, relative to utilization of the drug class 20 years after first launch



Descriptive statistics

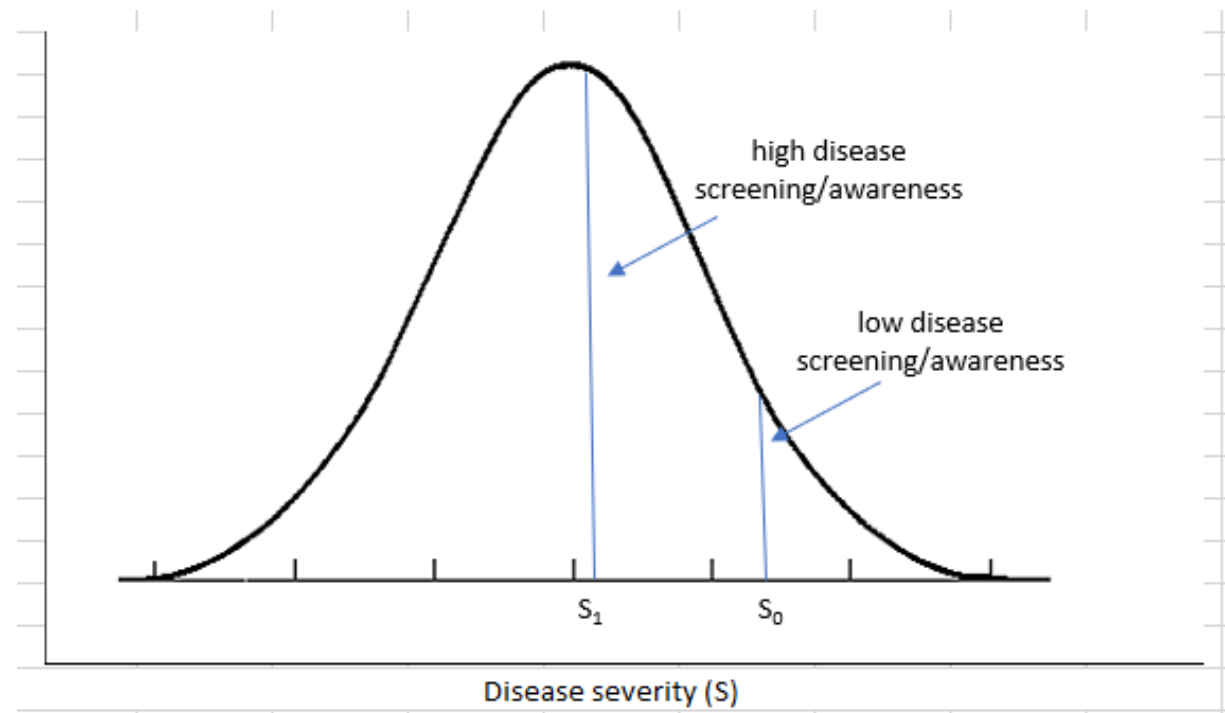
year	1997-2002	2003-2009	2010-2015
Person-level measures			
N	175,700	229,505	207,652
completed years of education	10.5	10.5	10.1
age	34.0	34.0	34.8
retired	8.0%	7.2%	6.8%
unable to work	3.7%	4.0%	3.9%
completely unable to do activity	4.1%	4.8%	4.5%
has any limitation	18.7%	20.0%	18.4%
has any limitation work/housework/school	6.8%	7.5%	7.0%
has limitation in physical functioning	8.6%	9.6%	8.7%
has cognitive limitations	3.0%	3.6%	3.7%
in fair or poor health	11.9%	12.9%	12.4%
receiving SSI	3.2%	3.0%	3.3%
receiving Social Security	13.2%	12.2%	12.2%

year	1997-2002	2003-2009	2010-2015
Condition-level measures			
N	467,820	665,993	640,420
any bed days assoc. w/ condition	13.3%	13.7%	12.2%
any missed school days assoc. w/ condition	8.2%	7.2%	6.6%
any missed work days assoc. w/ condition	12.5%	10.9%	9.9%
any inpatient events assoc. w/ condition	3.2%	3.0%	2.5%
any emergency room events assoc. w/ condition	5.3%	5.4%	5.2%
any home health events assoc. w/ condition	1.8%	1.9%	2.0%
any office-based events assoc. w/ condition	48.0%	46.9%	42.7%
any outpatient events assoc. w/ condition	5.2%	5.1%	4.5%
any prescribed medicines assoc. w/ condition	52.5%	53.6%	52.0%

20 most prevalent medical conditions, 2015

Clinical Classification Code	LABEL	UNWEIGHTED frequency	WEIGHTED frequency
98	ESSENTIAL HYPERTENSION	7,006	70,849,016
204	OTHER NON-TRAUMATIC JOINT DISORDERS	6,644	68,644,747
126	OTHER UPPER RESPIRATORY INFECTIONS	6,201	66,810,191
53	DISORDERS OF LIPID METABOLISM	5,264	56,623,122
205	SPONDYLOSIS, INTERVERTEBRAL DISC DIS	3,622	40,118,572
259	RESIDUAL CODES, UNCLASSIFIED	3,738	39,698,327
651	ANXIETY DISORDER	3,391	38,508,722
657	MOOD DISORDERS	3,158	33,769,084
211	OTHER CONNECTIVE TISSUE DISEASE	3,107	33,048,921
134	OTHER UPPER RESPIRATORY DISEASE	3,358	32,163,836
49	DIABETES MELLITUS WITHOUT COMPLICATIONS	3,228	29,160,284
200	OTHER SKIN DISORDERS	2,311	25,937,890
128	ASTHMA	2,422	22,238,337
48	THYROID DISORDERS	1,804	21,961,595
138	ESOPHAGEAL DISORDERS	1,880	21,107,407
244	OTHER INJURIES AND CONDITIONS DUE TO	2,017	20,309,261
255	ADMINISTRATIVE/SOCIAL ADMISSION	1,790	19,755,531
127	CHRONIC OBSTRUCTIVE PULMONARY DISEASE	1,723	19,188,873
133	OTHER LOWER RESPIRATORY DISEASE	1,983	18,572,466
136	DISORDERS OF TEETH AND JAW	1,764	18,200,494

Effect of disease screening/awareness on measured prevalence and mean severity



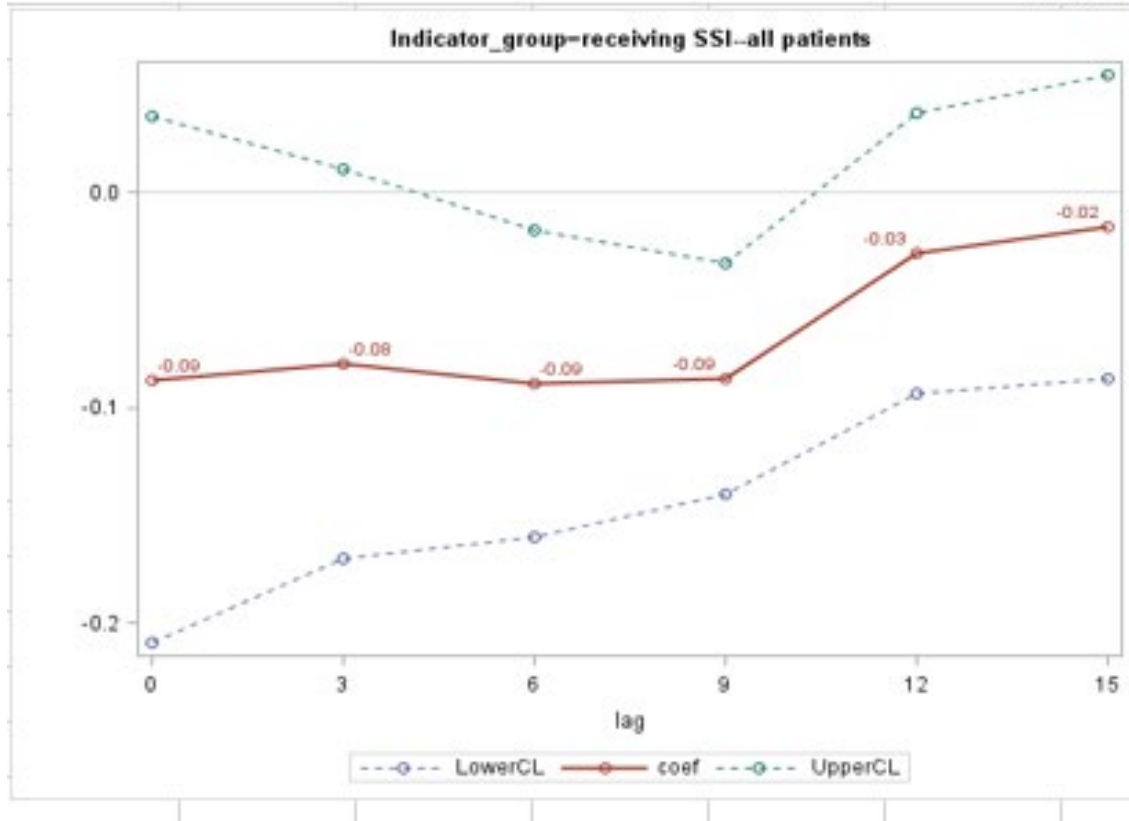
Comorbidities

- Suppose that person A has a single medical condition, e.g. diabetes, and that person B has diabetes and four other medical conditions.
- I hypothesize that diabetes-related pharmaceutical innovation will have a greater impact on the overall (person-level) health of person A than it will on person B.

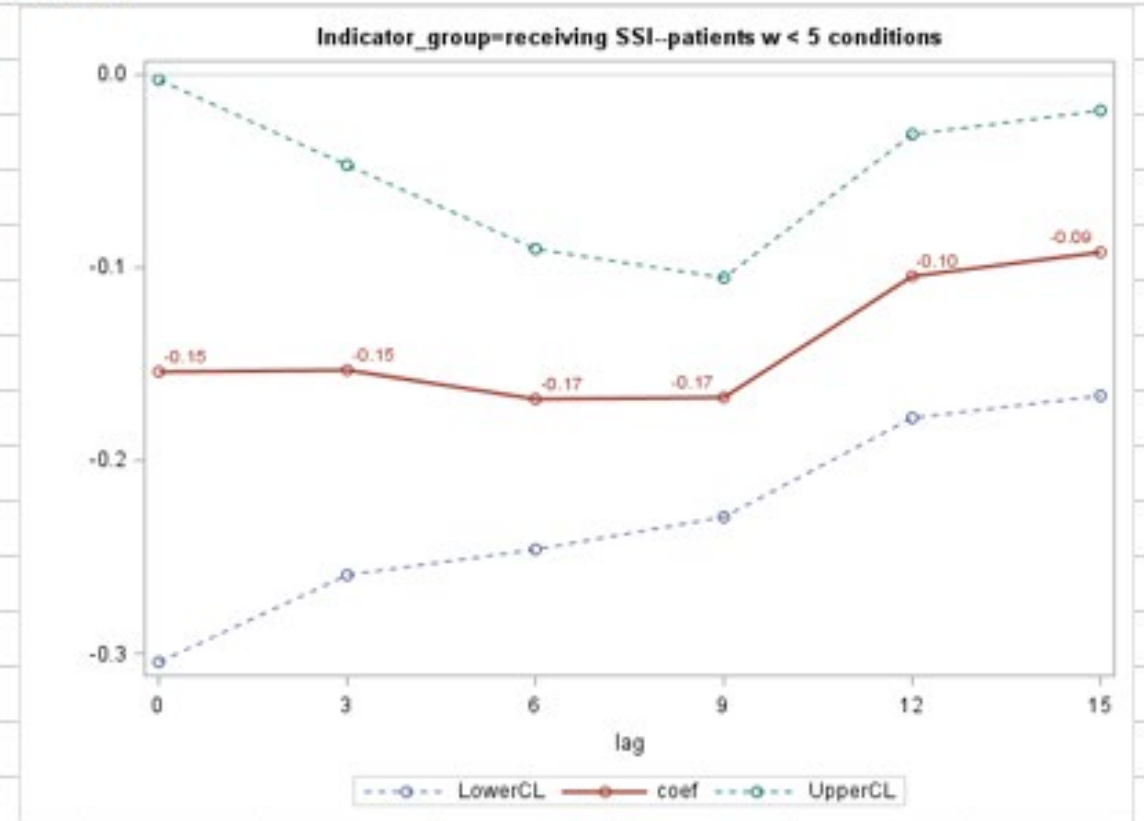
Findings

- The estimates indicate that **the probability of disability, Social Security reciprocity, and medical care utilization is inversely related to the number of drug classes previously approved.**
- The **length of the estimated lag is generally 6-9 years**, which is not surprising, due to the gradual diffusion of new drug classes.
 - Due to this lag, the number of current drug class approvals may be useful **predictors** of future disability, Social Security reciprocity, and medical care use.
- The effect of biopharmaceutical innovation related to a medical condition on the overall health of a person with that condition depends on the number of (other) medical conditions a person has: **the smaller the number of conditions, the larger the effect.**

Effect of number of drug classes ever approved by the end of year t-k on the probability of receiving SSI in year t

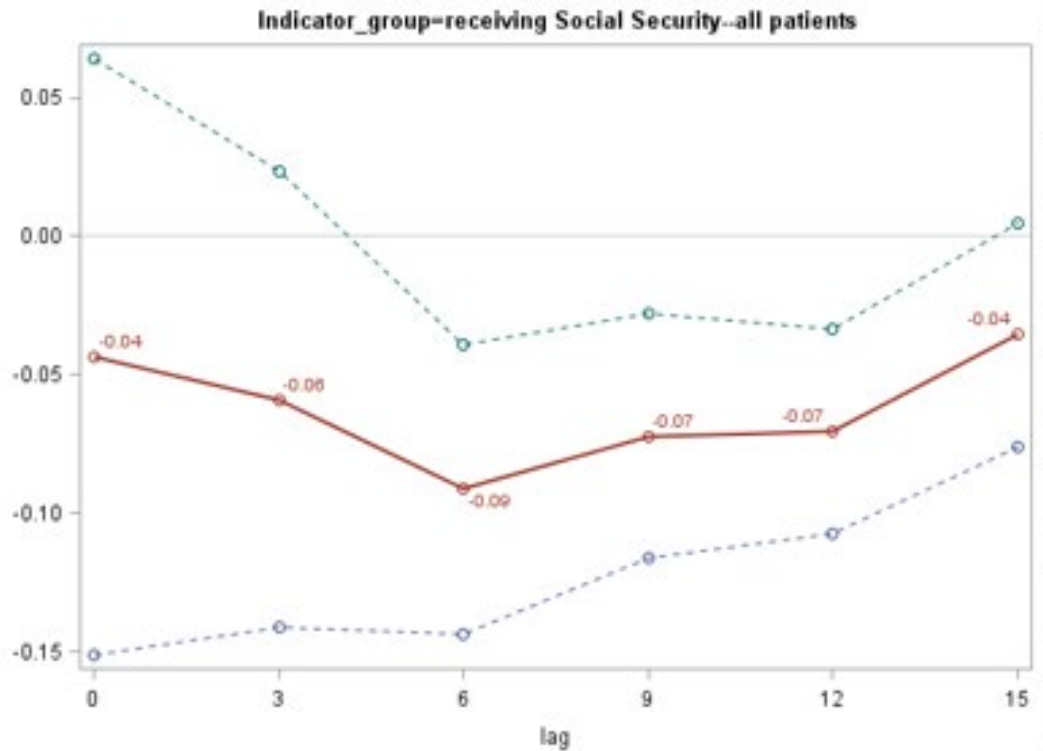


The probability that any person received SSI was significantly inversely related to the number of drug classes used to treat the person's medical condition launched 6-9 years earlier.

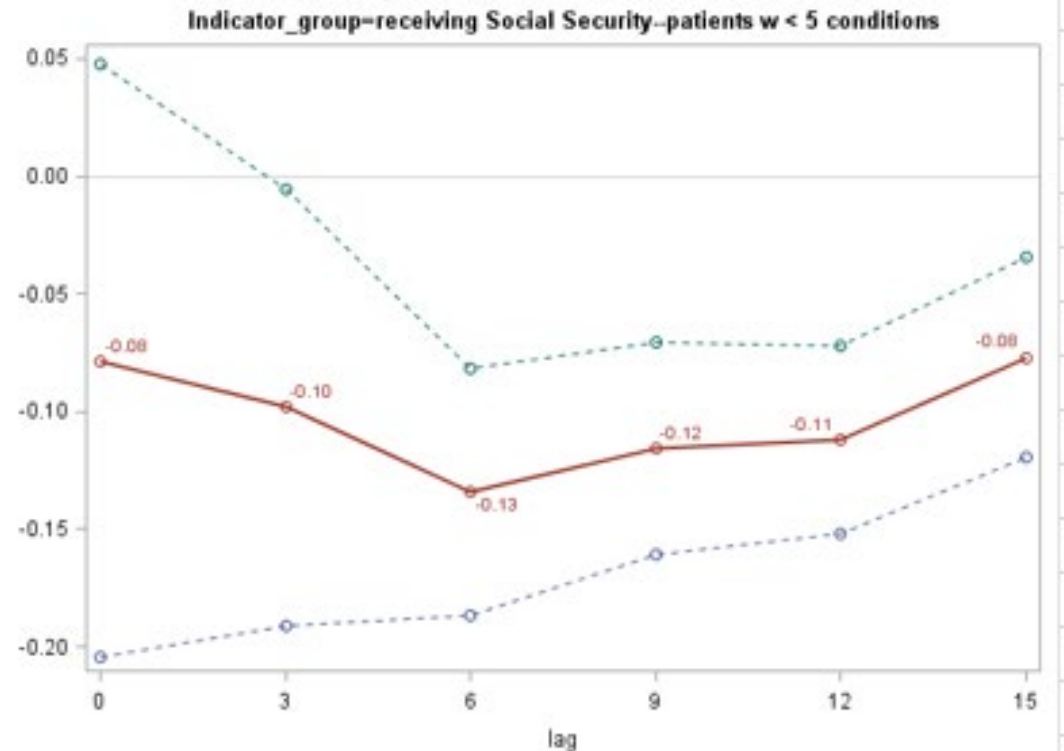


The probability that a person with less than 5 medical conditions received SSI was significantly inversely related to the number of drug classes used to treat the person's medical condition launched 0-15 years earlier; it was most strongly related to the number of drug classes used to treat the person's medical condition launched 12 years earlier. 11

Effect of number of drug classes ever approved by the end of year t-k on the **probability of receiving Social Security** in year t

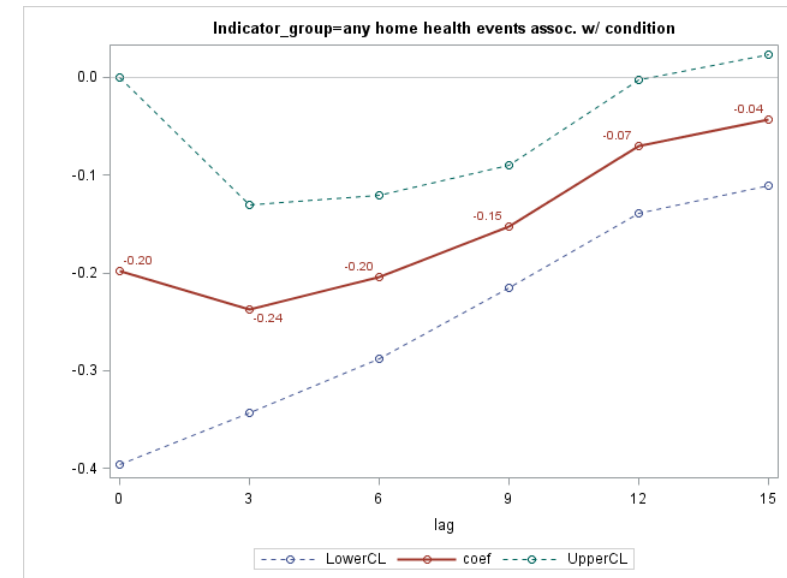
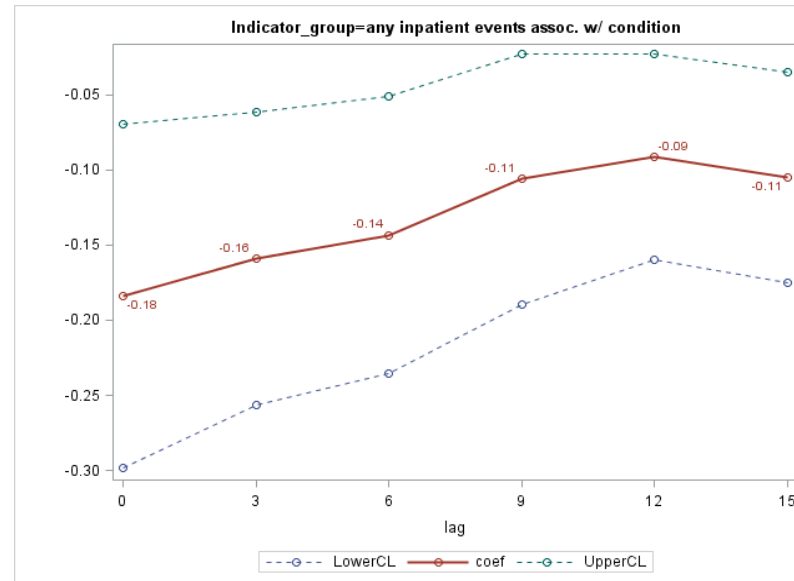
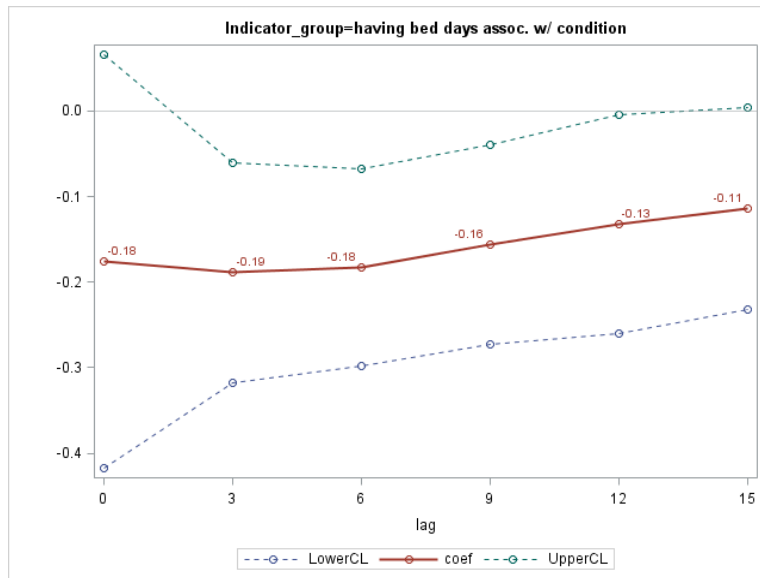


The probability that any person received Social Security income was significantly inversely related to the number of drug classes used to treat the person's medical condition launched 6-12 years earlier.



The probability that a person with less than 5 medical conditions received Social Security income was significantly inversely related to the number of drug classes used to treat the person's medical condition launched 3-15 years earlier; it was most strongly related to the number of drug classes used to treat the person's medical condition launched 12 years earlier.

Effect of number of drug classes ever approved by the end of year t-k on the probability of having any bed days, inpatient events, and home health events in year t



Estimated reductions in disability, Social Security reciprocity, and use of medical care

- Previous innovation is estimated to have reduced:
 - the number of people who were completely unable to work at a job, do housework, or go to school in 2015 by 4.5%
 - the number of people with cognitive limitations by 3.2%
 - the number of people receiving SSI in 2015 by 247 thousand (3.1%)
 - the number of people receiving Social Security by 984 thousand (2.0%)
 - the number of home health visits by 9.2%
 - the number of inpatient events by 5.7%

Estimated value in 2015 of some reductions in disability, Social Security reciprocity, and use of medical care attributable to previous pharmaceutical innovation

outcome	% reduction	estimated value (millions of dollars)
unable to work?	3.9%	\$27,124
receives SSI?	3.1%	\$2,287
receives Social Security?	2.0%	\$13,990
any emergency room visits?	2.3%	\$1,542
any inpatient events?	5.7%	\$56,136
any home health visits?	9.2%	\$8,234
any outpatient events?	4.1%	\$5,482
TOTAL		\$114,794

- The total value (\$115 billion) is fairly close to 2015 expenditure on drug classes that were first approved by the FDA during 1989-2006 (\$127 billion).
- However, for a number of reasons, the costs are likely to be lower, and the benefits are likely to be larger, than these figures.