

Has Using Newer Drugs Reduced Admissions to Hospitals and Nursing Homes?

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1. Introduction

In two previous studies (LICHTENBERG, 1996; 2001), I examined the effect of pharmaceutical innovation on utilization of hospital care. Both studies found that use of newer drugs was associated with lower utilization of hospital care, and that the reduction in hospital expenditure substantially exceeded the higher cost of newer drugs.

In this paper, I re-examine the effect of pharmaceutical innovation on utilization of hospital care by elderly Americans during a more recent period – 1997–2003 – using longitudinal state-level data on 12 states. The elderly account for about 45% of national hospital expenditures.¹ During the 1980s hospital discharges per person fell in both the 65–74 and 75 and over age groups, but since 1990 it has remained approximately constant in the 65–74 age group, and has increased about 8% in the 75 and over age group.

I also examine the effect of using newer drugs on admissions of elderly Americans to nursing homes. The elderly account for about 90% of national nursing home expenditures.² This implies that in recent years nursing home expenditures on the elderly have been almost half as large as hospital expenditures on the elderly.

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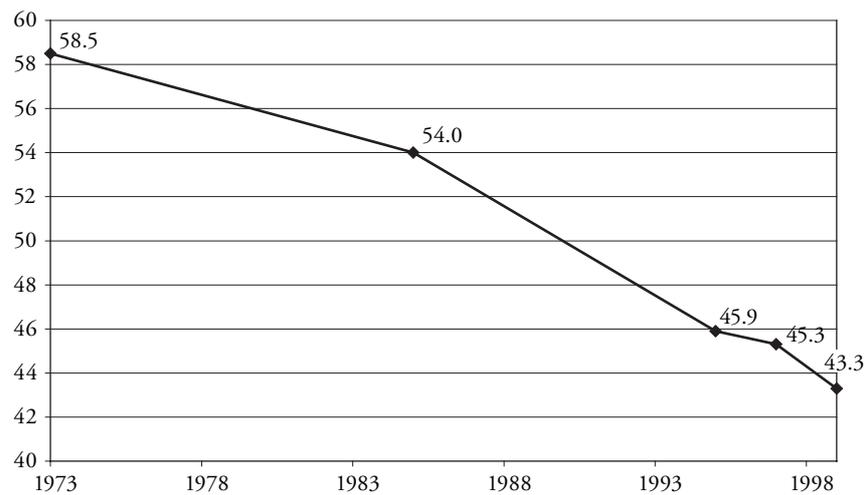
1 Source: author's calculations based on 1999 Health Care Utilization Project national statistics.

2 JONES (2002): 90 percent of nursing home residents in 1999 were elderly (65 years and over).

	hospital care	nursing home care
Aggregate expenditure in 1999 (billions) ³	\$393	\$91
Elderly share in aggregate expenditure	45%	90%
Elderly expenditure in 1999 (billions)	\$177	\$82

As Figure 1 shows, the age-adjusted ratio of elderly nursing home residents to elderly population has declined steadily since 1973, and the decline accelerated after 1985.⁴

Figure 1: Nursing Home Residents 65 Years or Over per 1,000 Population, Ages Adjusted



³ <http://www.cms.hhs.gov/statistics/nhe/historical/t2.asp>

⁴ Acceleration in the decline of nursing home utilization may have contributed to the halt in the decline in hospital admissions. A smaller nursing home population may contribute to more hospital admissions.

2. Key Hypothesis

My objective is to test the hypothesis that, *ceteris paribus*, people using newer, or later vintage,⁵ drugs will be in better health, and will therefore be less likely to be admitted to hospital and nursing homes. This hypothesis is predicated on the idea that pharmaceuticals, like other R&D intensive products, are characterized by *embodied technological progress*. According to the National Science Foundation, the R&D intensity of drugs and medicines manufacturing is 74% higher than the R&D intensity of machinery and equipment manufacturing.

3. Research Design Considerations

In principle, one could try to assess the effect of drug vintage on hospital and nursing home use in several different ways, i.e. with several types of data. One possibility is to use (cross-sectional or longitudinal) individual-level data. This approach is subject to several problems.

First, selection (non-random assignment of drugs to people) is likely to be an issue. People receiving newer drugs may be healthier (or sicker) than people using older drugs for other, unobserved reasons.⁶ The arguments (and evidence) go in both directions. In LICHTENBERG (2001), I tried to address this by using condition-by-person data, which allowed me to control for unobserved individual effects. However, if there are between-condition, within-person spillovers, this approach could lead to biased estimates. Such spillovers could be either negative or positive. For example, using a newer drug to treat arthritis might result in fewer nursing home admissions for musculoskeletal conditions, but more nursing home admissions for cardiovascular conditions (negative spillover). On the other hand, using a newer drug to treat depression and other mental disorders might lead to fewer nursing home admissions for both depression and diabetes (positive spillover).⁷

5 I define the vintage of a drug as the year in which the U.S. Food and Drug Administration (FDA) first approved the drug's active ingredient.

6 LLERAS-MUNEY and LICHTENBERG (2005) show that more educated people (who tend to be healthier) use newer drugs. However, DUGGAN and EVANS (2005) found that the sickest HIV/AIDS patients were most likely to receive new drugs, and that failure to account for this leads to severe underestimation of the effectiveness of these drugs. Also, a prominent physician at an academic medical center told me recently that private managed care plans often establish greater barriers to new drug use (e.g. prior authorization requirements) than Medicaid.

7 Improvements in mental health are likely to contribute to better management of chronic diseases like diabetes.

A second problem with analysis at the individual level is that no publicly-available dataset contains adequate information about an individual's utilization of both drugs and long-term care.⁸ The Medical Expenditure Panel Survey (MEPS) contains detailed individual-level information about prescription drug use, but it is a community survey: people residing in nursing homes are out of scope. The National Nursing Home Survey (NNHS) does not collect information about prescription drug use.

Both the selection problem and the missing-data problem can be addressed by using longitudinal state-level data. I was able to obtain unusually precise data, by state and year, on both (1) the number of elderly people discharged from hospitals (and the number discharged from hospitals to nursing homes), and (2) the vintage of drugs used in Medicaid program. I will use these data to estimate models of the form:

$$DISCH_{it}/POP_{it} = \beta \cdot VINTAGE_{it} + \gamma Z_{it} + \alpha_i + \delta_t + \varepsilon_{it} \quad (1)$$

where

$DISCH_{it}$ = the number of discharges of elderly people from hospitals in state i in year t ($t = 1997-2003$)

POP_{it} = the population of elderly people in state i in year t

$VINTAGE_{it}$ = the vintage of drugs used in the Medicaid program in state i in year t

Z_{it} = other characteristics of state i in year t (e.g., per capita income)

α_i = a fixed effect for state i

δ_t = a fixed effect for year t

ε_{it} = a disturbance

Due to the presence of fixed state and year effects, this is a difference in differences model of the hospital discharge rate ($DISCH/POP$). A negative and significant estimate of β would indicate that states with above-average increases in vintage had below-average increases in the hospital discharge rate, controlling for other changes in state characteristics.

If the vintage of drugs did not vary across states in a given year, estimation of eq. (1) wouldn't be feasible. But both the level and rate of increase of vintage varies across states. I will assume that this variation in drug vintage is exogenous

8 The Medicaid Analytic eXtract (MAX) data – formerly known as State Medicaid Research Files (SMRFs) – contain this information but are not publicly available.

with respect to admissions of the elderly to hospitals and long-term care. Three possible reasons for variation in drug vintage are access restrictions (Lichtenberg, 2005), prescription drug insurance coverage, and the frequency and likelihood of informational exchanges.

4. Data Construction

4.1 Hospital Discharge Data

The hospital discharge data are derived from the State Inpatient Databases (SID), one in a family of databases and software tools developed as part of the Healthcare Cost and Utilization Project (HCUP), a Federal-State-Industry partnership sponsored by the Agency for Healthcare Research and Quality. The SID currently has data on 22 states. For 12 of these states, the data extend back to 1997. Each inpatient discharge abstract reports the patient's age, as well as his or her discharge status: the disposition of the patient at discharge from the hospital, e.g., routine (home), to another short term hospital, to a nursing home or similar facility, to home health care, against medical advice, or discharged dead. Hence, we can determine the number of elderly patients discharged to nursing homes, and the number discharged dead. People may be admitted to a nursing home from someplace other than a hospital, but hospitals are the single largest living arrangement before admission, accounting for almost half (46%) of current residents.

4.2 Drug Vintage Data

The Center of Medicare and Medicaid Services (CMS) publishes detailed state-level drug utilization information for outpatient drugs purchased since 1991 by State Medicaid agencies. This information includes the number of prescriptions reimbursed to pharmacists by National Drug Code (NDC),⁹ state, and calendar quarter. The number of distinct products (NDCs) is large. On 08/09/05, CMS' Drug Product Data file, which contains the entire formulary of active drugs that are available under the Medicaid Drug Rebate program, included over 43,000

9 Each drug product listed under Section 510 of the Federal Food, Drug, and Cosmetic Act is assigned a unique 11-digit, 3-segment number. This number, known as the National Drug Code (NDC), identifies the labeler/vendor, product, and trade package size.

products. In March 2005, the Veterans' Administration (VA) National Drug File included over 96,000 products.

I used the VA National Drug File to determine the active ingredient(s) in each product. I used the Drugs@FDA database¹⁰ to determine the year in which the FDA first approved each of these ingredients. This enabled me to compute statistics characterizing the vintage distribution of Medicaid prescriptions in each state and year, e.g. the mean FDA approval year and the percent of prescriptions containing active ingredients first approved after 1980.

The Medicaid Drug Utilization data provide an unusually good opportunity to investigate embodied technological progress. In FY 2002, over 24 million Americans consumed prescription drugs under the Medicaid program.¹¹ Hence, we have very precise information about the vintage (FDA approval year) distribution of over 43,000 products utilized by 24 million people, by state and calendar quarter, from 1991 to the present. I show that changes in Medicaid drug utilization are a good indicator of changes in overall drug utilization.

4.3 Other Data

Eq. (1) includes the variable Z , which represents potential determinants of the hospital discharge rate other than drug vintage. I control for the following state characteristics:

<i>Variable</i>	<i>Source</i>
per capita disposable personal income	Bureau of Economic Analysis
% of residents below the poverty line	Census Bureau
educational attainment	Census Bureau
health insurance coverage	Census Bureau
mean Body Mass Index (BMI)	Centers for Disease Control

¹⁰ <http://www.fda.gov/cder/drugsatfda/datafiles/default.htm>.

¹¹ http://www.cms.hhs.gov/medicaid/msis/02_table10.pdf.

5. Results

States that had larger increases in drug vintage had smaller increases in the number of hospital discharges per elderly person. They also had smaller increases in the number of hospital discharges to nursing homes, in-hospital deaths, and nursing home residents, per elderly person.

We estimated the amount by which the 1997–2003 increase in drug vintage increased drug expenditure, and reduced hospital and nursing home expenditure, per elderly person in 2003, relative to what they would have been in the absence of the increase in vintage.

Even the upper-bound estimate of the increase in 2003 drug expenditure is lower than the sum of the lowest estimates of hospital and nursing home expenditure reductions. The upper-bound estimate of the increase in 2003 drug expenditure is much lower than the sum of the more reliable estimates of hospital and nursing home expenditure reductions – those that control for covariates and that are based on hospital discharge to nursing home data.

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