

# **Imperfect Information: Supplier Induced Demand and Small Area Variation**

One day, I went on rounds with Lester Dyke, a weather-beaten, ranch-owning fifty-three-year-old cardiac surgeon who grew up in Austin, did his surgical training with the Army all over the country, and settled into practice in Hidalgo County. He has not lacked for business: in the past twenty years, he has done some eight thousand heart operations, which exhausts me just thinking about it. I walked around with him as he checked in on ten or so of his patients who were recuperating at the three hospitals where he operates. It was easy to see what had landed them under his knife. They were nearly all obese or diabetic or both. Many had a family history of heart disease. Few were taking preventive measures, such as cholesterol-lowering drugs, which, studies indicate, would have obviated surgery for up to half of them.

Yet public-health statistics show that cardiovascular-disease rates in the county are actually lower than average, probably because its smoking rates are quite low. Rates of asthma, H.I.V., infant mortality, cancer, and injury are lower, too. El Paso County, eight hundred miles up the

border, has essentially the same demographics. Both counties have a population of roughly seven hundred thousand, similar public-health statistics, and similar percentages of non-English speakers, illegal immigrants, and the unemployed. Yet in 2006 Medicare expenditures (our best approximation of over-all spending patterns) in El Paso were \$7,504 per enrollee—half as much as in McAllen. An unhealthy population couldn't possibly be the reason that McAllen's health-care costs are so high. (Or the reason that America's are. We may be more obese than any other industrialized nation, but we have among the lowest rates of smoking and alcoholism, and we are in the middle of the range for cardiovascular disease and diabetes.)

And yet there's no evidence that the treatments and technologies available at McAllen are better than those found elsewhere in the country. The annual reports that hospitals file with Medicare show that those in McAllen and El Paso offer comparable technologies—neonatal intensive-care units, advanced cardiac services, PET scans, and so on. Public statistics show no difference in the supply of doctors. Hidalgo County actually has fewer specialists than the national average.

Nor does the care given in McAllen stand out for its quality. Medicare ranks hospitals on twenty-five metrics of care. On all but two of these, McAllen's five largest hospitals performed worse, on average, than El Paso's. McAllen costs Medicare seven thousand dollars more per person each year than does the average city in America. But not, so far as one can tell, because it's delivering better health care.



"Maybe the service is better here," the cardiologist suggested. People can be seen faster and get their tests more readily, he said.

Others were skeptical. "I don't think that explains the costs he's talking about," the general surgeon said.

"It's malpractice," a family physician who had practiced here for thirty-three years said.

"McAllen is legal hell," the cardiologist agreed. Doctors order unnecessary tests just to protect themselves, he said. Everyone thought the lawyers here were worse than elsewhere.

That explanation puzzled me. Several years ago, Texas passed a tough malpractice law that capped pain-and-suffering awards at two hundred and fifty thousand dollars. Didn't lawsuits go down?

"Practically to zero," the cardiologist admitted.

"Come on," the general surgeon finally said. "We all know these arguments are bullshit. There is overutilization here, pure and simple." Doctors, he said, were

racking up charges with extra tests, services, and procedures.

The surgeon came to McAllen in the mid-nineties, and since then, he said, "the way to practice medicine has changed completely. Before, it was about how to do a good job. Now it is about 'How much will you benefit?'"

Everyone agreed that something fundamental had changed since the days when health-care costs in McAllen were the same as those in El Paso and elsewhere. Yes, they had more technology. "But young doctors don't think anymore," the family physician said.

The surgeon gave me an example. General surgeons are often asked to see patients with pain from gallstones. If there aren't any complications—and there usually aren't—the pain goes away on its own or with pain medication. With instruction on eating a lower-fat diet, most patients experience no further difficulties. But some have recurrent episodes, and need surgery to remove their gallbladder.

Seeing a patient who has had uncomplicated, first-time gallstone pain requires some judgment. A surgeon has to provide reassurance (people are often scared and want to go straight to surgery), some education about gallstone disease and diet, perhaps a prescription

for pain; in a few weeks, the surgeon might follow up. But increasingly, I was told, McAllen surgeons simply operate. The patient wasn't going to moderate her diet, they tell themselves. The pain was just going to come back. And by operating they happen to make an extra seven hundred dollars.

I gave the doctors around the table a scenario. A forty-year-old woman comes in with chest pain after a fight with her husband. An EKG is normal. The chest pain goes away. She has no family history of heart disease. What did McAllen doctors do fifteen years ago?

Send her home, they said. Maybe get a stress test to confirm that there's no issue, but even that might be overkill.

And today? Today, the cardiologist said, she would get a stress test, an echocardiogram, a mobile Holter monitor, and maybe even a cardiac catheterization.

"Oh, she's *definitely* getting a cath," the internist said, laughing grimly.

To determine whether overuse of medical care was really the problem in McAllen, I turned to Jonathan Skinner, an economist at Dartmouth's Institute for Health Policy and Clinical Practice, which has three decades of expertise in examining regional

# Definitions

## **Supplier Induced Demand (SID):**

Occurs when physicians bill for extra services that they provide to generate extra revenues/income (an example of an agency problem)

## **Small Area Variation (SAV):**

Refers to variations in per-capita rates of surgery, physician visits and hospitalization among otherwise similar market areas (note: this can arise even if there is no agency problem)

- Supplier Induced Demand and Small Area Variation are competing arguments or explanations for difference in health care utilization.
- We'll consider both, starting with SID

# What is the agency problem?

- The principal delegates decision making to another party, the agent, who is supposed to act on their behalf and their best interests.
  - Principals recognize they are relatively uninformed and contract with someone who is more experienced and knowledgeable to act on their behalf
  - Examples might include shareholders (principals) in a company hiring executives (agents) to run a company

- In health care context, the principals would be the patients and their families, the agents would be physicians (and other health care providers)
  - Patients have imperfect information about their health problems so they contract with physicians who are supposed to be more knowledgeable to act on their behalf.



- The agency problem arises when the agent does not act in a way that promotes the best interests of the principal
  - The catalyst for this divergence in interests is usually related to the way the agent is paid
    - For example, the shareholders of a company hire an executive who collects a salary that is paid no matter how poorly the company does, so he/she/they/etc. might make different decisions than the shareholders who own shares and make losses when the share price falls.

# How are physicians paid?

- **Fee-For-Service**
  - physician receives a payment for each service he or she provides
  - some services are associated with higher payments, but others get a lower fee
  - the more services the physician provides the higher the payments/fees they receive
- **Capitation**
  - physician receives a payment per patient per unit of time (e.g., month)
  - payment will be made each period based on the number of patients a physician has and does not depend on whether the physician sees the patient
- **Salary**
  - a payment made for a period (e.g., monthly)
  - the payment does not depend on the volume of services provided or the number of patients a physician has

# Different payment systems create different incentives

Potential Incentives associated with physician payment systems

	Pay Individual		Pay Organization
	Fee For Service (FFS)	Salary	Capitation
<b>Purported Benefits and Shortcomings to Payers and Providers</b>			
Autonomy for providers	Yes	No	No
Remuneration closely related to effort	Yes	No	No
Compatible with solo practice	Yes	No	No (but can contract with solo practice physicians)
Productivity ("work hard")	Yes	No	No
Likelihood of waiting lists	No	Yes	Yes
Predictability of costs (to 3 <sup>rd</sup> part payer)	No	Yes	Yes
Predictability of income (to provider)	No	Yes	Yes
Cost containment	No	Yes	Yes
Encourages rostering	No	No	Yes
Encourages risk selection	No	No	Yes
Ability to ensure appropriateness	No	Maybe	Yes

# Different payment systems create different incentives

Implicit and Explicit Incentives and Disincentives for Providers			
Over-provide relatively lucrative services	Yes	No	No
Under-provide relatively less lucrative services	Yes	Maybe	Yes
Encourage referrals	Yes	Yes	No
Time per visit	No	Maybe	No
Encourage the use of alternate care providers	No	Yes	Yes
Encourage provision of necessary care	Yes	Maybe	No
Encourage provision of unnecessary care	Yes	Maybe	No
Encourage provision of preventive care	No	Maybe	Yes
Number of Hours Worked	Yes	No	Maybe
Encourage minimizing cost per service	Yes	No	Yes
Encourage providers to relocate to underserved areas	No	Maybe	Yes

# Disincentives of Salary Compensation

- Remuneration not closely tied to effort
- Low Productivity
- Long Wait Lists





- In a health care market, fee-for-service combined with imperfect information can lead to agency problems and supplier induced demand

**Fee-for-service payments  
+ Imperfect Information**

**=Supplier Induced Demand**



*Your income as a doctor is determined mainly by your business, not medical, prowess.*



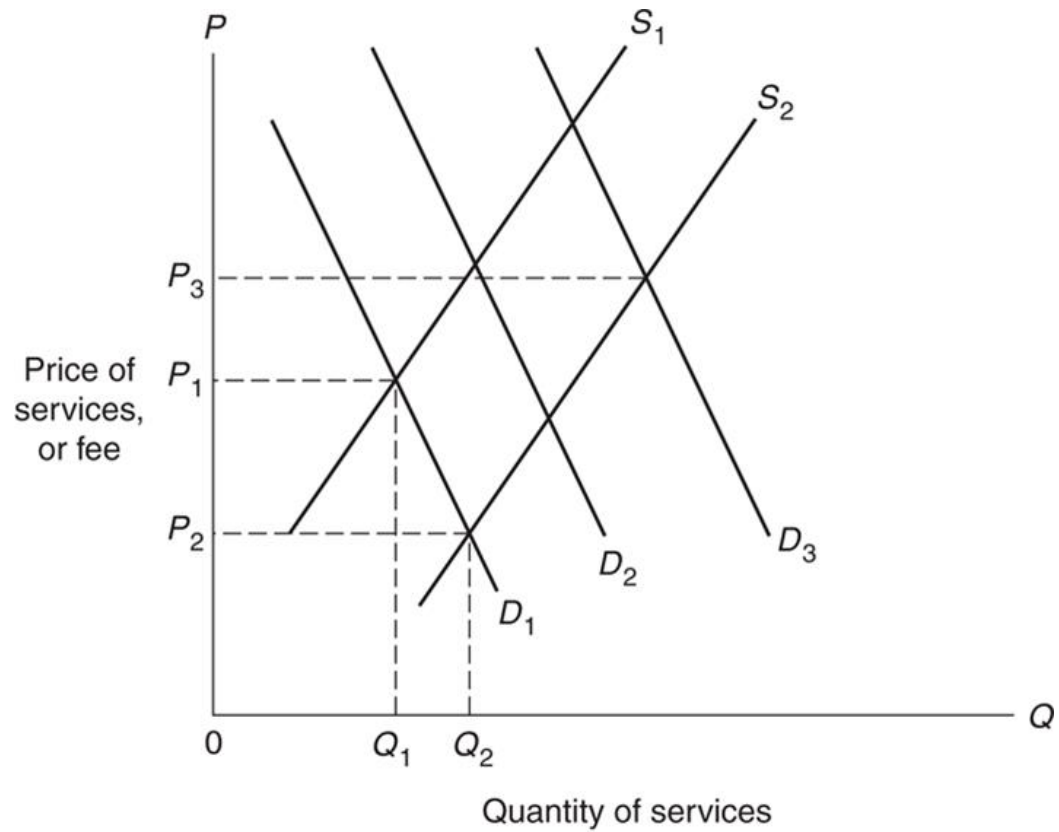
# PHYSICIAN AGENCY AND SUPPLIER-INDUCED DEMAND

## Overview

- Healthcare providers use their superior information about health problems to take advantage of the incentives created by a fee for service payment system.
  - If patients and physicians were equally well informed there wouldn't be a problem because the patient can just tell the physician that the service is not necessary
- We'll consider a five different models of SID

# 1. The Supply and Demand Model of SID

- Consider the following:
  - Suppose there is an increase in the supply of physicians (greater entry), shifts out supply
  - Physicians can respond by trying to induce more services (shift the demand curve out)
    - How much does the demand curve shift out?
      - It depends, time costs could matter as well as trust (the patient doesn't trust the physician)



The supply and demand model shows quantity increases resulting from a supply increase. The Reinhardt fee test argues that SID is identified when demand increases sufficiently to cause the price (fee) to rise.



## 2. Price Rigidities

- If prices are rigid, i.e., price doesn't adjust to changes in demand or supply, increase in supply could lead to some physicians inducing demand to get more services at the going price.

# 3. The Target Income Hypothesis

- This argues that physicians have desired incomes that they strive to achieve or to restore whenever actual income falls below the targets. This target income model is a special case of the benchmark model, though a relatively extreme one.
- This extreme focus on an income target, as well as the disinterest in further income in excess of the target, constitute features that have caused many health economists to question the target income idea.

## 4. Evans/Benchmark/Disutility of Inducements Model

- Let the physician's utility function be:

$$U = U(p, I)$$

where  $p$  is the net income from the practice; and  $I$  is the degree of inducement. Note that the inducements,  $I$ , are a bad. Physicians can induce demand for their services but they dislike doing so. This means that the utility curves will be backward bending, not like typical utility curves you see.

- The physician has a profit line which can be written as  $mQ_0 + ml$ , where  $m$  is the profit rate,  $l$  is the number of services the physician induces and  $Q_0$  is the level of medically necessary services without any inducement.
- Note that this is not a budget line, it is a profit line, which is increasing in inducements

# Utility Maximizing Solution

- The physicians problem is to

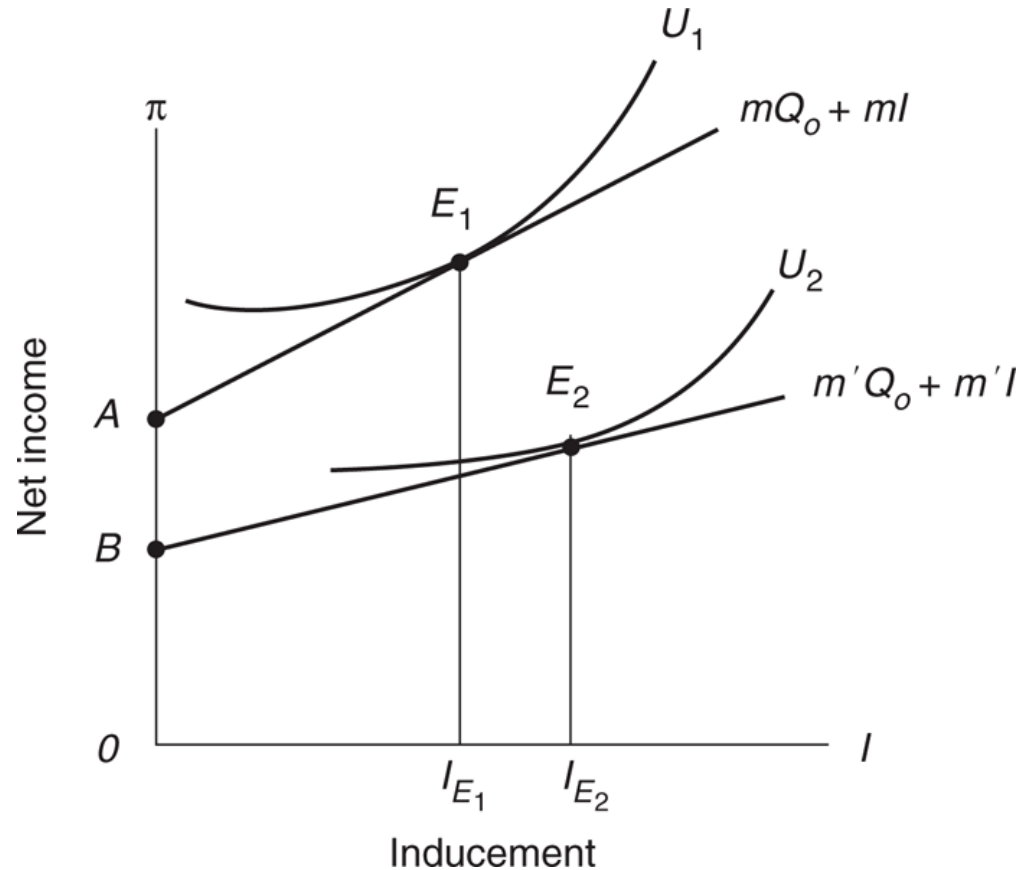
$$\max U = U(p, I)$$

*subject to*  $mQ_0 + mI$

The equilibrium will occur where the physicians marginal rate of substitution equals the profit rate; so where there is a tangency between the indifference curve and the profit line.



# Figure: Physician's Response to Reduced Rate Profit

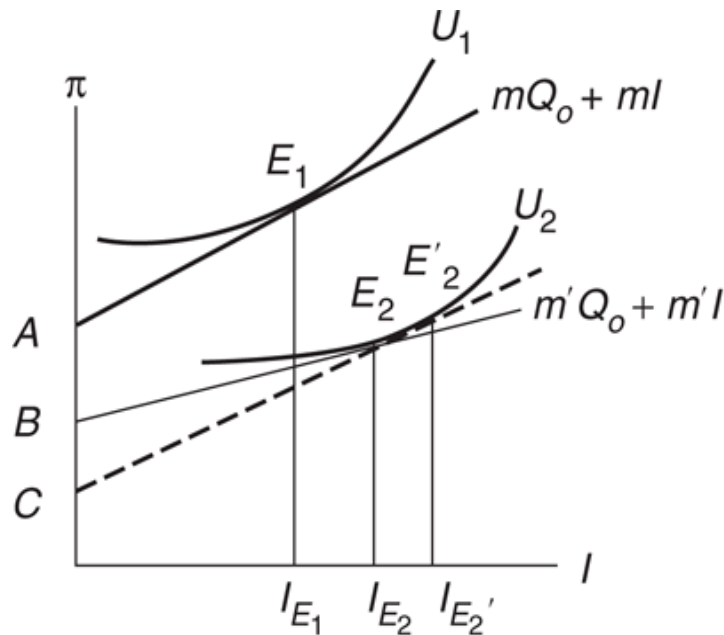


- In the previous diagram the profit rate for the physicians fell. Usually, this occurs because there was a fall in the market price for medical services (e.g., more entry of physicians).
  - A supply and demand diagram can be used to figure out what happens to the market price and the profit rate; unless there is explicit information about the profit rate provided.

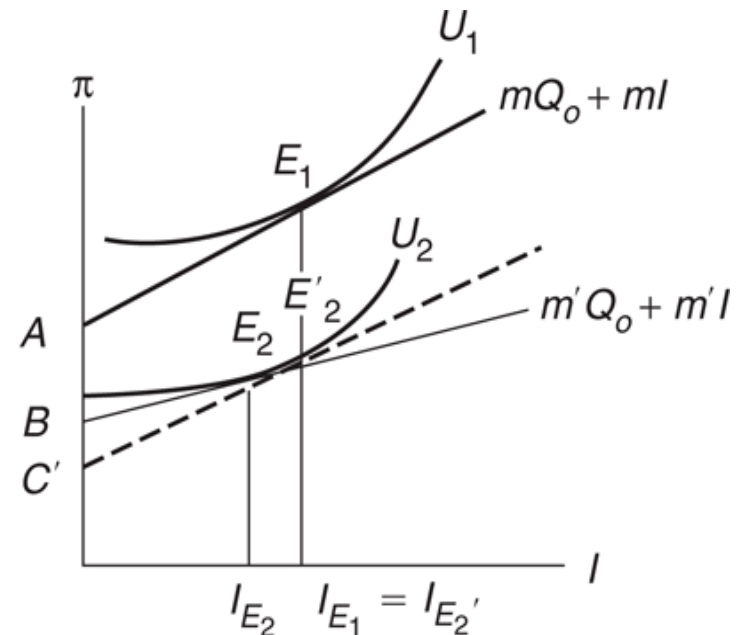
# Income and Substitution Effects

- The size of the income effect is critical to understanding and identifying SID behavior. A lower profit rate,  $m$ , has two offsetting effects on inducement:
  - *Substitution effect*: If inducement is less profitable (smaller  $m$ ), providers would do less inducement, that is, substitute away from it.
  - *Income effect*: Decreased income would make inducement more desirable.

# Income and Substitution Effects



A. Physician responds to lowered profit rate  $m'$  by increasing influence on patient demand.



B. When there is no income effect, as in profit-maximizing behavior, then the model predicts a decline in supplier influence will follow a decrease in the profit rate.

# 5. Profit Maximizing Model

- The physician has monopoly power and produces where  $MR=MC$ .
- With Imperfect information physicians can improve profits by inducing consumers to buy more healthcare services
  - Advertising and product promotion.
    - Increases MC
  - End up with new equilibrium where new MR equals new MC


# Some Examples of Physician Advertising



**McLean Gunderson**  
HARVARD MEDICAL SCHOOL AFFILIATE

**Highly specialized  
residential treatment  
for women with BPD**

[www.mcleanhospital.org/gunnyr](http://www.mcleanhospital.org/gunnyr)  
**888.657.5699** Boston, MA



**McLean Pavilion**  
HARVARD MEDICAL SCHOOL AFFILIATE

**Unparalleled psychiatric  
evaluation and treatment**

[www.mcleanhospital.org/pavnyr](http://www.mcleanhospital.org/pavnyr)  
**617.855.2874** Boston, MA

**SILVER HILL HOSPITAL**  
RESTORING MENTAL HEALTH SINCE 1931

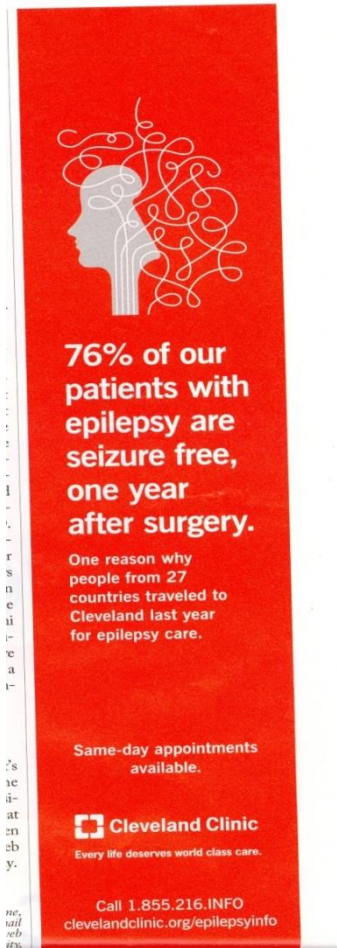
**Adolescent Dialectical  
Behavior Therapy Program**

Residential treatment for teens with  
mood disorders, impulsivity or self harm



New Canaan, CT  
(866) 548-4455 [www.silverhillhospital.org](http://www.silverhillhospital.org)


# Physician Advertising



**76% of our patients with epilepsy are seizure free, one year after surgery.**

One reason why people from 27 countries traveled to Cleveland last year for epilepsy care.

Same-day appointments available.

 **Cleveland Clinic**  
Every life deserves world class care.

Call 1.855.216.INFO  
clevelandclinic.org/epilepsyinfo



**PSYCHIATRIC HOSPITAL**

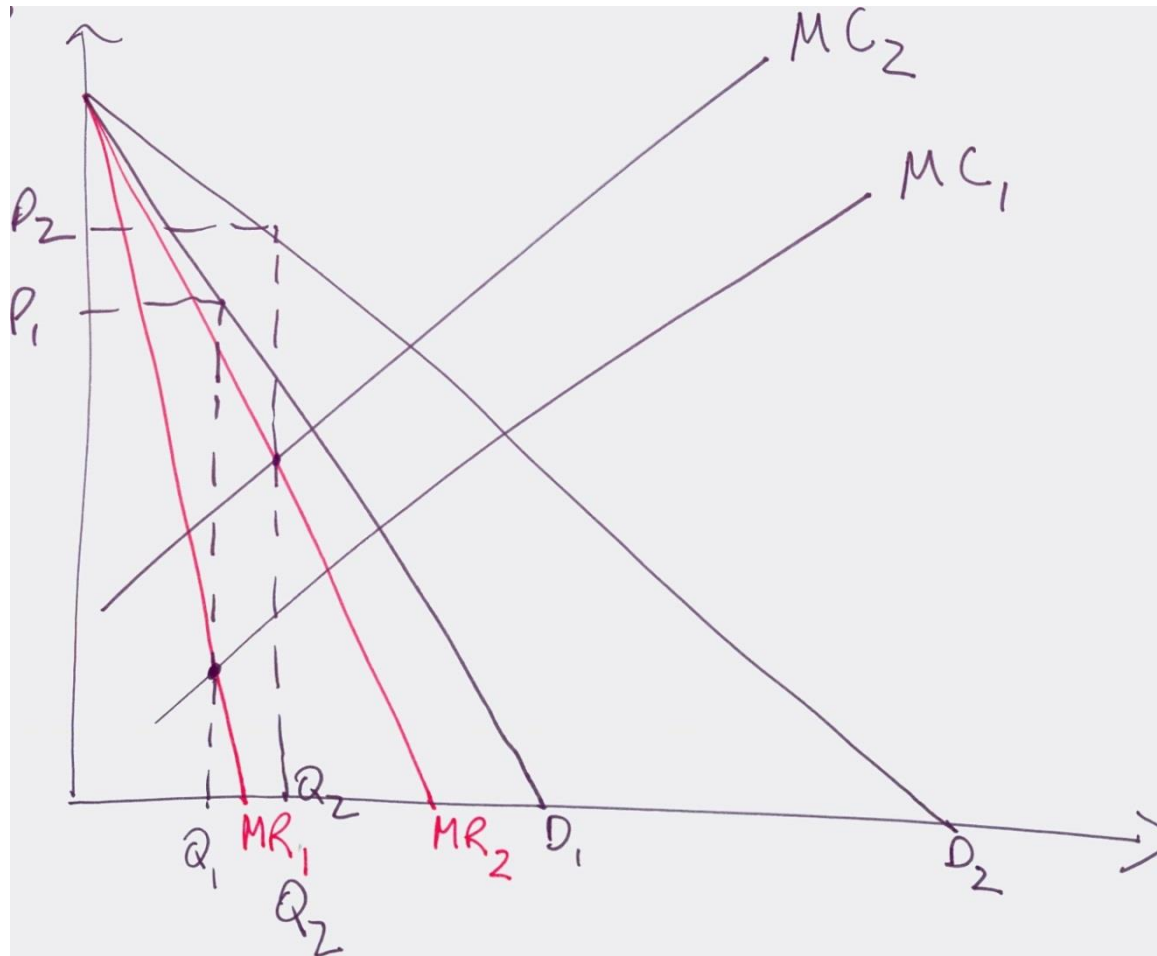
**MAYO CLINIC**

Depression  
Addiction  
Pain

507-266-5100  
M-F 8am-5pm CDT

mayoclinic.org/psychiatry-psychology

# Monopoly Model Profit Maximizing Point





# Description of monopoly model

- In the preceding diagram, the physician uses advertising and product promotion; this increases the marginal cost from  $MC_1$  to  $MC_2$ 
  - The extra advertising increases the demand for the physician's services from  $D_1$  to  $D_2$ ;
    - The new demand curve translates into a new marginal revenue curve  $MR_2$ 
      - The new marginal revenue curve and marginal cost curve mean that the physician has new production point, i.e. where  $MC_2 = MR_2$

# SMALL AREA VARIATIONS

## Overview

- Are the substantial variations in medical and surgical use rates per capita across small geographic areas caused by information problems?

# Top Surgical Procedures in Canada

## 18-64

1	Caesarean section delivery	112,344
2	Removal of appendix	26,251
3	Fractures	22,751
4	Hysterectomy	22,463
5	Removal of gallbladder	22,012

## 65 and older

1	Hip replacement surgery	37,704
2	Knee replacement surgery	34,254
3	Fractures	24,432
4	Coronary artery angioplasty	21,955
5	Pacemaker insertion	18,492

# Contributions to These Variations

- Much of the SAV work focuses on the contribution of socioeconomic characteristics of the population and the role of the availability of supplies of hospital and physician services
  - For example, if you have two areas and one has a much larger rate of hip and knee replacement, but that area also has a much older age structure (i.e., a large number of persons older than 65).
- For example, the incidence rate for hysterectomy procedures range from 311 per 100,000 in British Columbia to 512 per 100,000 in Prince Edward Island

# The Physician Practice Style Hypothesis

- Much of the observed variation is closely related to the degree of physician uncertainty with respect to diagnosis and treatment.
- Practice style probably varies among physicians due to an incomplete diffusion of information on medical technologies.

- This might be related to the way a physician was trained; for example, some physicians may be exposed to particular approach to treating a health problem while in medical school and not change their approach;

- The old view on treating back pain is that extensive physiotherapy would help; the new view is “take some time off and rest and if you have any pain take some advil”.
  - One is very intensive, the other is not;
    - Right now medical evidence suggests that the second approach is the best way to treat back pain.

# Formulation of Practice Style

- We assume throughout that physicians have a practice style and that it is created and altered by the irregular diffusion of information.
  - In english this means that things change in terms of how physicians understand how to best treat a health problem, that change is usually reported in papers published in medical journals and presented at conferences, but if a physician doesn't keep up with this he or she would not update their approach



# Education, Feedback, and Surveillance

- Studies show that information programs directed at physicians can alter their behaviors and thus presumably their practice styles.
- For example, the Canadian Medical Association (CMA) often issues practice guidelines to its members (so a physician might not read a journal, but they are more likely to read the newsletter from the association they belong to).

# CMA Treatment Guidelines

- <https://www.cma.ca/En/Pages/clinical-practice-guidelines.aspx>

# Machine Learning and Artificial Intelligence

- In machine learning literature there is a debate about expert decision making versus algorithmic decision making
  - Machine learning or algorithmic approaches use the data to categorize (diagnosis) individuals and use that information to proscribe treatment
  - Takes advantage of massive data that can be available in health care records of individuals (detailed health histories and demographic information, and maybe even genetic information in the future)
  - Algorithms generally do better than experts

# Machine Learning and Artificial Intelligence

- Can use algorithmic approach to supplement or complement diagnostic tools currently used by physicians and improve diagnosis rates
  - For example, with Caesarian section procedures high risk women tend to have less surgery, but low risk tend to have much more surgery
  - Using machine learning/artificial intelligence can improve diagnosis of women into these groups and reduce surgery rates in low risk women and increase surgery rates in high risk women and get for a more optimal level of service provisions

# SAV and the Social Cost of Inappropriate Utilization

- The most important issue in the SAV literature is the proposition that substantial variation in utilization rates is an indication of inappropriate care.
  - One U.S. estimate of the welfare loss due to variations from “true” practice in the nation total \$33 billion.

# The Inefficiency of Misinformation About the Marginal Benefits of Health Care

