L5: Supply of health care

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Health Economics
HSMP 6604
2021

Outline

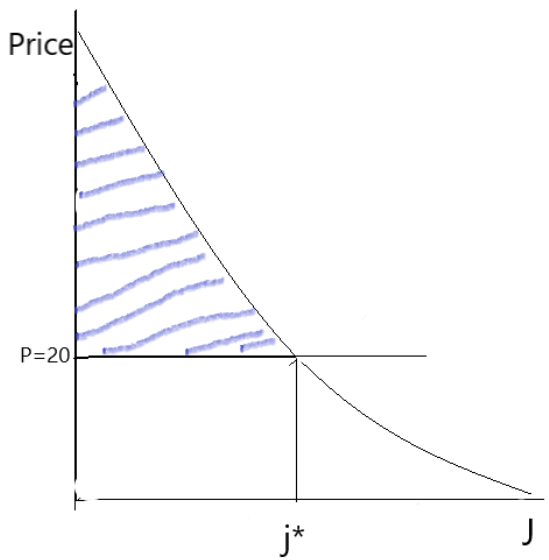
- Quick note on consumer surplus
- Big picture
- Barriers to entry
- Physician-induced demand
- Defensive medicine
- The hospital industry
- The nursing home industry
- Nursing homes versus home health

Consumer surplus, redux

- Since it's very important to understand the idea of "value," I wanted to discuss consumer surplus again
- Somebody used singing lessons as an example: Jerry buys 6 singing lessons for $20 each. This is what Jerry did
- Under the conditions of a perfectly competitive market, it means that for Jerry the consumer surplus of the 6th lesson was **zero**. If Jerry had been willing to pay, say, $40 for the 6th lesson, then he would have bought more lessons, not just 6th
- I know this is difficult, **please don't give up**
- It's easier if you think about the decision sequentially: the first lesson is also $20. Since Jerry bought 6, we know that he was willing/able to pay more than $20 for the first, and for the second, and the third and the fourth... all the way to the sixth. We know this because that's what he actually bought, six lessons. That's also what the demand curve tells us

Consumer surplus, redux

- The consumer surplus is the difference between what a consumer is willing to pay minus the market price
- To calculate the consumer surplus for Jerry, we would need to know his demand curve: $(WTP_1 - \$20) + (WTP_2 - \$20) + \cdots + (WTP_6 - \$20)$. We would need information WTP. We do know $(WTP_6 - \$20) = 0$
- Geometrically, the formula above is the area under the demand curve



Consumer surplus, redux

- This also shows the concept of marginal decreasing returns
- Let's do it Marcel Proust's style:

  "*I drank a second mouthful in which I find nothing more than in the first, then a third which gives me rather less than the second. It is time to stop; the potion is losing its magic.*"
- That's Marcel doing economic theory – implicitly there is a cost to drinking the fourth, which is more than the pleasure. Therefore, he stops. Implicitly, we also know that he got value (surplus) from the other drinks (I think it was actually tea)
- There are things we don't consume in quantities, but we could still apply the same concept: you have an accident, need to go to ER to save your life. You would have been willing/able to pay a lot for it. Your bill was $900 (plus the premium and other cost of insurance). Therefore, it had plenty of value to you
- We often don't need more than one car, but if they were cheap enough we could – one for the mountains, one for the city, one for show... But even with one car, we don't all buy luxury cars

Big picture

- For the next two weeks, we will discuss the other side of the health care market: "the producers" of health care, which we often call them **providers**
- Providers are physicians and their substitutes and complements: nurses, physician assistants, nurse aids, medical assistants
- But these providers work within a system that has great influence on them: medical practices, hospitals, physician groups, Health Maintenance Organizations (HMOs), nursing homes
- These providers are also "produced" in a fairly literal sense: medical schools, nursing schools, physician assistant programs...
- How is the supply of health care organized has important consequences for quality, costs, and outcomes – and value

Economic themes

- Remember perfectly competitive markets on the producer side
- We assume that there are no barriers to entry so if profits are positive, producers have an incentive to enter the market
- With more producers entering the market, the supply of products increases, which will then push prices lower
- This process would **continue until profits are zero**. Remember: **profits = revenue - costs**
- There is no extra "rents" or profits in perfectly competitive markets
- With a monopoly, the story is different. A monopoly is able to set prices, to an extent, so profit is not zero even in theory or the long run (this is called "**monopoly rents**")

Physicians

- People can't just don their coats and play doctor (I mean, you can, but if you do it outside your house to treat people, you could ended up in jail)
- Becoming a medical doctor is a long and time consuming process. In the US, there is college (4 years), then medical school (4 years), then residency (about 3 years), and then some obtain a specialty, say oncology (another 3 years) or cardiac surgery (over 10 extra years of training after med school, so 14 years counting college)
- Contrary to other countries, medical student is not heavily subsidized. Physicians have hefty student loans after graduation (average deb is about $220K)
- Physician salaries, understandably, are very high
- Adam Smith in 1776 observed that "wages vary with the cost of learning the business"
- (Smith made a lot of very clever observations, written in a persuasive style; that's why we still quote him, 244 years later)

Barriers to entry

- The length of training is a substantial barrier to entry, but it doesn't mean that is wrong
- All countries have extensive regulations to ensure that medical providers are properly trained
- Your textbook has a good discussion about the history of these regulations. It can be traced to the rise of the American Medical Association (AMA)
- The AMA was founded in 1847. The AMA focused on medical education so all physicians had proper training, and also created "licensure" requirements
- There is more. Together with the American Association of Medical colleges (AAMC), they both control the number of medical schools, the number of classes, the size of classes, and limit residency enrollment
- Just last week there was an article about too few residency programs: `https://www.nytimes.com/2021/02/19/health/medical-school-residency-doctors.html`

Does it pay off to go to med school?

- Some economists have argued for a long time that these policies result in large barriers to entry, and consequently, in **monopoly rents**
- A very vocal opponent of the AMA was Milton Friedman, an influential Nobel prize economist who was a (staunch) proponent of free markets
- If your're a person contemplating entering medical school or other professions and you want to maximize lifetime income, what would you do?
- By now I hope you see the pattern here: even if imperfectly, you'll compare the cost and benefits of different alternatives
- But you need to consider lifetime income, which means that we need to bring up discounting again. Medical school training takes a long time. Other alternatives require less training, so you can earn income faster
- The time issue is key, and it makes sense to compare professions that are similar – as in high paying

Returns over time?

- Say that you just graduated from college and need to decide between medical school or law school
- Your **flow** of income over time is going to be different between the two alternatives. So will be the cost per **year**, of course. To make things easier, let's say that we consider net income (income - the cost of investments). Let's call this I_t
- This would be something like: (10,000, 30,000, 40,000, 50000, ...) in the law alternative and (0, 0, 0 ,0, ... 30,000, 50,000, 10000) in the MD alternative (pear year)
- We want to bring all into the present (that is, calculate the present value), so we discount both flows and compare them:

  $\sum_{t=0}^{T} \frac{I_t^{LS}}{(1+r)}$ and $\sum_{t=0}^{T} \frac{I_t^{MD}}{(1+r)}$
- The issue is that even if both alternatives are high paying, the return to both have different timing because law school is just 3 years (really, just 2; the third year is mostly job hunting)

Internal rate of return

- Implicit in this discussion is patience, or delaying gratification as well
- MD money will arrive much, much later – in some cases 10 to 20 years later, after you pay students loans, which are substantial
- The discount rate is key here because the time difference is so large. For example at a discount rate of 7%, receiving $10,000 in tens years is worth about half today ($\frac{10000}{(1+0.07)^10} = 5083$). At 3%, it's 7440. The larger the discount rate, the more people value the present over the future – future income is worth a lot less in the present
- Another concept: the **internal rate of return** (IRR) is the discount rate that would leave people **indifferent between the two alternatives**. It's the discount rate in which the present value of an MD is the same as that of an law degree. Let's call this rate r^* ($\sum_{t=0}^{T} \frac{I_t^{MPH} - I_t^{MD}}{(1+r^*)} = 0$)
- If the IRR is higher than your personal discount rate (we called it ρ before), then **you should go to medical school because the wait is worth it**. **This works even if one career gains is a lot larger then the other**

Application

- If you are confused, focus on the bottom line: we could try to calculate the IRR for different careers or specialties. If some are high (in absolute terms or relative to other professions/specialties), it would suggests that more people should be entering the profession or the specialty
- It would also provide some evidence that there are barriers to entry. Friedman and Kuznets (1945) calculated IRR between physicians and lawyers
- It can also show different incentives regarding specialties. For example, Weeks and Wallance (2002) argued that "(hours-adjusted internal rate of return) declined for all specialty groups [between 1992 to 1998], especially for primary care specialties"
- It's an ongoing concern: we need more primary care specialists, but the money is somewhere else (but why doesn't salary increase?)

Application

- Here are some numbers IRR from Burstein and Cromwell (1985). They write: "...programs designed to reduce total medical expenditures by limiting physician incomes ca be enacted without serious impact on the financial attractiveness of this profession.

Table 3

Internal rates of return,[a] 1967–80.

Year	All physicians		General practitioners		Dentists		Lawyers[b]
	r_a	r_u	r_a	r_u	r_a	r_u	r_u
1980	12.1%	14.0%	14.2%	16.7%	—	—	7.2%
1979	11.6	13.7	14.5	17.2	—	—	7.2
1978	11.0	13.2	13.0	16.3	16.3%	14.9%	6.8
1977	10.2	12.6	13.3	17.0	—	—	6.8
1976	10.5	13.3	12.4	16.4	15.8	14.9	7.1
1975	11.6	14.2	12.3	16.7	—	—	7.1
1974	12.0	14.3	14.5	18.2	14.9	14.8	7.1
1973	10.8	13.8	12.5	17.4	—	—	6.7
1972	10.7	14.2	12.2	17.8	14.4	14.8	5.7
1971	11.6	15.1	13.2	18.9	—	—	6.6
1970	11.8	14.7	12.1	16.8	16.1	15.7	7.0
1969	11.3	14.3	12.5	17.2	—	—	4.7
1967	11.7	15.5	13.2	19.0	13.5	15.4	7.7

[a] r_a is the hours adjusted rate of return, and r_u is the unadjusted rate.
[b] No r_a was calculated for lawyers due to lack of data on hours of work for this group.

Big picture

- Law school is a good current example of how barriers to entry affect salaries: it's no longer a good investment, unless you can get into the top law schools. The glut of lawyers has lowered wages. Current hot area: computer science, anything medical sector, statistics ("big data")
- Barriers to entry are not all due to the AMA or AAMC of course. Some fields are harder than others, too – that by itself is a barrier to entry. A lot of people don't like the sight of blood
- So you feel much better about your decision to be in school: there is plenty of evidence showing that a lot of professions have IRRs that are higher than other investments and higher than other nonprofessional occupations
- In general, it pays off to get more education, although not always (a PhD in sociology for example)

Physician agency

- Arrow mentioned that one characteristic of the medical care market is uncertainty at many different levels, including the fact that we, as patients, do not know what is the best treatment
- We trust that our medical providers will have our best interest in mind when making decisions on our behalf
- So physicians have agency – over us
- In economics, **physician agency** refers to the "the theory and empirical literature on physician market power, behavior, and motives" (McGuire, 2000)
- With physician agency comes another concept: "physician-induced demand"

Physician induced demand

- **Physician-induced demand** is the **additional** demand for medical goods and services **induced** by a medical provider who is **considering factors other than the needs or goals of the patient**
- Note the words in bold: additional, induced, a provider considering goals other than the need of the patient
- The goals could be financial gain for the physician, but it's not the only one. It could be non-directly financial, like doing better in quality metrics, making a boss happy
- It's controversial because most of us believe that PID exists, but we do not the **extent** of it and it's very hard to estimate since we are limited by observational data

Physician induced demand

- On the other hand, it's not difficult to find evidence that physicians do respond to monetary incentives – the reasons could be subtle, so harder to establish intent
- For example, Hickson et al. (1987) randomly divided residents into two groups: one would be paid by a fixed salary; the other according to the number of services provider (fee-for-service, FFS)
- We kind of know the answer: the FFS group scheduled more visits than the other group
- As I said in another lecture: think of FFS medical providers as car mechanics who are supposed to follow an ethical code
- Another example: different behavior depending on who owns the practice. Physicians owning practices brings another layer of issues
- Example: you break your leg running...

Payment reforms

- We will discuss this during the second part of the semester when we'll cover health policy reform
- But most economists would agree that **payment reform** is an important component in any attempt to reduce costs, yet this is not without controversy – in part, this is the rationale behind managed care. Few people seem to like managed care...
- We probably can agree with the statement that FFS induces providers to perform too many unnecessary procedures
- What if we pay them as a bundle, based on a medical condition, not based on every little thing they do? Say, $\$10,000$ for a hip fracture
- Now we have another, also serious, problem: **they have an incentive to do too little.** They would make more money doing as little as possible since they still get $\$10,000$ for a hip fracture. Think about your mechanic getting paid by "a battery problem"
- Changing the payment model would need to come with another system that could also keep track of **quality** – and adjustments based on severity ("**patient mix**")

Defensive medicine

- One possible reason medical providers do too much is the fear of lawsuits – **medical malpractice lawsuits** or the fear of bad ratings or reviews
- **Defensive medicine** is defined as "deviations from optimal practice in order to reduce the risk of conflict with patients, especially in the form of malpractice lawsuits"
- Providers do buy malpractice insurance. Remember **moral hazard**? Malpractice insurance could create perverse incentives: instead of being cautions, a provider could take more risks with full insurance coverage (insurance companies know this, so they don't offer full insurance and also there is the issue of higher premiums after lawsuits)
- (We professors face something similar, let's call it "**defensive teaching**:" students get upset when a class is too hard. And we are supposed to entertain you on top of everything else... In schools (or departments) where teaching evaluations do not count as much, classes can be a lot harder.)

Hospitals

- When we think about health care providers the first thing that comes to mind are doctors
- The second is probably doctors in **hospitals**
- Hospitals in modern times is where people get care, either in the **inpatient** (overnight stay) or **outpatient** setting (ambulatory care, care in hospital with no overnight stay)
- Outpatient care also happens in **physician offices** or **practices**, although many are affiliate with hospitals
- A doctor providing care in a hospital could be hospital employee or not
- Many people seek care in the **emergency department** (ED or ER), which might become an overnight stay (inpatient)

Hospitals industry themes

- There has been a transition from hospital inpatient care to outpatient
- This transition reflects **technological** change and **economic incentives**. It's a good illustration of how powerful incentives are, and how one change here causes another change there
- How hospitals are organized matters a lot. In particular, relationships with physicians and relationships with other providers, say, nursing homes
- And relationships with payers...
- Hospitals are **monopolies** in some areas (rural) or **oligopolies** in most ("a small number of large firms have all or most of the sales in an industry")
- But there is also **product differentiation**: not all hospitals are perceived in the same way

From inpatient to outpatient

- For a historical perspective on medicine in the US, I recommend "The Social Transformation of American Medicine" by Paul Starr
- There is a chapter that traces the rise of hospitals. A key date is 1946, when the Hill-Burton act was passed amidst concerns that there were not enough hospitals
- Funds for new hospitals provider (especially in rural areas). In exchange, hospitals provide low-cost of free care for poor patients
- Both the number of hospitals and beds increased, until about 1974

From inpatient to outpatient

- The number of hospitals declined after 1974

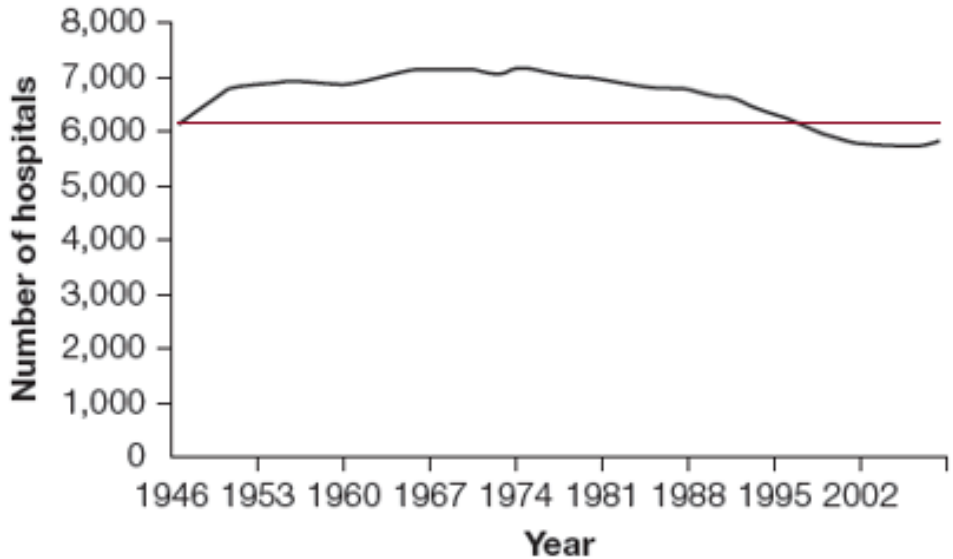


Figure: From BHT, Chapter 6

From inpatient to outpatient

- Why? In part **technology**, like laparoscopy surgery
- My dad (in Bolivia) stayed in the hospital for over a week after gallbladder surgery. I stayed 0 days (not having a gallbladder is a family tradition)
- In part, it's a good thing not to stay in the hospital for long
- The reason that shorter length of stay is uniquely American is money: **payments changed**
- In 1984, the Centers for Medicare and Medicaid services (CMS) changed the way hospitals are paid
- Rather than fee-for-service, they were paid using Diagnostic Related Group (DRG)

DRG

- In the FFS model, an elderly person who breaks a hip has to go to the hospital to get surgery
- The hospital will get paid for each day the person stays (like a hotel) and for each services the person receives
- But with DRGs, the hospital gets paid a fixed ("bundle") amount depending on diagnosis. The hip fracture bundle is made of 3 distinct DRGs: 480, 481, and 482
- So now the hospital has an incentive to ship patients out quickly because an extra day of stay means additional costs with not additional revenue. Remember marginal revenue equals marginal cost?
- More definitions: with bundled payment models, payments can be **prospective** or **retrospective**

But, but, but...

- ... how can it be that an elderly person who breaks a hip can go home in about 5 days? Well, they can't
- Hip fracture treatment involves either total hip arthroplasty or nails, screws
- So where do they go? To rehab centers in **nursing homes** (postacute care) or stand-alone rehab
- Not surprisingly, hospitals also have rehab centers or they integrate with nursing homes: get them out of inpatient care, put them in rehab, charge for both
- Although most people think of nursing homes as the place where the elderly goes when they can't take care of themselves, many, if not most, nursing homes also provide rehab services

Readmissions

- You might wonder: if hospitals discharge patients too early, aren't they at a higher risk of coming back? Yes they are
- Enter the Hospital Readmissions Reduction Program (HRRP), part of the ACA: "The Hospital Readmissions Reduction Program (HRRP) is a Medicare value-based purchasing program that **encourages** hospitals to improve communication and care coordination to better engage patients and caregivers in discharge plans and, in turn, reduce **avoidable readmissions**. The program supports the national goal of improving health care for Americans by **linking payment to the quality** of hospital care."
- More here: `https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/Readmissions-Reduction-Program`
- The "encouragement" is that hospitals with "excess readmissions" get reduced payments
- Think about incentives as either sticks or carrots. The HRRP is of the stick type
- Another common theme in health policy: **unintended consequences**

Competitive markets and the hospital market

- We saw there are barriers to entry for physicians. Well, there are **substantial barriers to entry for hospitals too**
- You already know the consequence: monopoly rents
- A new hospital requires very large investments. They also often need a Certificate or Need to even expand (so do nursing homes)
- Remember, for a monopoly to exist, the monopoly must be the only producer of the good or services. There many types of cell phones, but if people perceive that Apple's phones are not the same as any other phone, then product differentiation makes Apple phone like a monopoly
- Same with hospitals, but hospitals also have some competition, so hospitals are more like **oligopolies with differentiated products**. In a rural market, they could be monopolies
- Think implications: **a hospital has a strong incentive to differentiate** –usually via quality

Measure of competition

- With oligopolies, the few producers have an incentive to **collude** (cartels). Together, they have more market power
- But each one has an incentive to cheat, so cartels are hard to sustain. Also, they are not legal (same with hospitals or chicken producers)
- Economists use a simple (but clever) measure of market concentration: the **Herfindahl-Hirschman Index**:

  $HHI = s_1^2 + s_2^2 + \cdots + s_n^2 = \sum_i^n s_i^2$
- s is market share. If, say, there is just one firm, then $HHI = 1^2 = 1$. If two each with 50% share: $HHI = 0.5^2 + 0.5^2 = 0.5$. With four and equal share: $HHI = (0.25^2) * 4 = 0.25$. The more firms, the lower HHI
- The Federal Trade Commission uses a cutoff point of 0.25 for "highly concentrated" markets (caution: note that how you define "market" makes a huge difference)
- In metropolitan areas, the hospital industry HHI is about 0.33. Roughly, a metro area with 3 hospitals each with equal market share – HHI goes up if one of the 3 has more market share than the others

Prices

- We have seen the importance of prices in markets, but hospitals actually do not compete based on prices
- Would you go to Hospital A if they lowered their prices? Not really. The price to the patient is not the price the hospital charges – there is insurance in the middle
- Consumers don't do price shopping of hospitals
- Insurance companies can negotiate prices, and can steering patients to certain hospitals (in-network, out-of-network)
- It's an interesting market: **oligopolies interact with oligopsonies** (small number of buyers)
- In some cases, CMS can just set prices

Cost-sharing

- Consumers not doing price shopping is an example of **moral hazard**
- Again, there is nothing **moral** about this. Why would we do it? We have no incentives – it has nothing to do with our understanding of "right" and "wrong" (moral: "concerned with the principles of right and wrong behavior and the goodness or badness of human character.")
- It's an example of moral hazard because it reflect the fact that health insurance reduces incentives to "minimize the cost of loss." We don't lose anything by choosing the hospital that is more expensive because it's more convenient or because we think that it's of better quality
- One motivation behind **high-deductive plans** or plans with more cost-sharing for more expensive hospitals is to give more incentives to consumers
- Same with in-network or out-of-network

Quality

- To attract more patients, hospitals can negotiate prices with insurers, but **they can also appeal directly to consumers**
- One way is **quality**, either real of perceived
- To attract patients, hospitals could adopt technology, as in "our hospital has the latest robotic surgery machine and the latest [hyper-expensive] imagining technology"
- Read about **medical arms race** in textbook (Chapter 6)

Cost-shifting

- Hospitals are required to provide care regardless of ability to pay, and some hospitals provide a large portion of care that is not compensated
- This is called **uncompensated care**. Care that is not paid by out-of-pocket, insurance (public or private)
- A hospital, non-profit or for-profit, worries about sustainability. Given that uncompensated care is a reality, they could engage in cost-shifting or cross-subsidization
- It refers to the idea that **patients with health insurance pay more than patients without health insurance**
- Another form: some hospital units are more profitable than others (cardiac vs psychiatry), so one unit subsidizes the other units

Nursing homes

- We have covered issues regarding physicians and hospitals
- There are many aspects unique to nurses and physician assistants that we don't have time to cover: they are both complement and substitutes for physicians
- Another important provider of medical care is the **nursing home**
- You probably think of a nursing home as the place where our grandparents go when they can no longer take care of themselves, but there is much more to nursing homes
- The case of nursing homes illustrates the problems of access to care, profit motive, budget constraints, policy reforms aimed at improving quality

A very brief history

- Taking care of the sick and elderly used to be a family affair
- Women's and church groups established special homes for the elderly, often of the same ethnicity and/or religion
- It was an alternative to "almshouses" (aka poorhouses) where the poor and incapacitated received some sort of shelter of apparently dubious quality
- In the 1950s, the Medical Facilities Survey and Construction Act of 1954 allowed federal support for public and private nursing homes

Medicare and Medicaid in 1965

- It was the creation of Medicare and Medicaid in 1965 (Lyndon Johnson signed the Social Security Amendments of 1965 into law) that gave the final push for the growth of what we now know as nursing homes – and the demise of poorhouses
- The reason for the growth is economic: Medicare and Medicaid allowed the elderly to be **able to pay for care**
- Which attracted business: the growth in nursing homes was driven by the private industry, contrary to hospitals
- As of 2010, 70% of people receive care in a for-profit nursing home (in hospitals, about 30%)
- **Nursing homes are expensive**. You would need, on average, about $200 per day or $73,000 per year. The median home price is $320,000 or about 4.3 years in a nursing home

Words, words, words

- **Skilled nursing care**. Care provided by licensed health professionals (registered nurses, occupational therapists, physicians)
- **Home health care**. Skilled care that can be provided at home. Essentially a substitute for nursing homes for those who can still stay at home
- **Assisted Living Facilities**. For seniors who require more than care at home (activities of daily living) but not as much as in a skilled nursing facility
- **Nursing homes**. A place where elderly or disable can get skilled nursing care provided by licensed practical nurse (LPN), registered nurses (RN), and certified nurse's assistants (CNAs)
- Care in nursing homes can be **short term**: rehabilitation from an illness or injury or post-hospitalization or **long term** (e.g., dementia, inability to walk)
- **Skilled Nursing Facility** (SNF) and nursing homes are often understood to mean the same, but some **facilities** do not provide rehab services
- **Swing bed**: hospital beds used in both an acute care and Skilled Nursing Facility as needed

Themes

- The major themes regarding nursing homes are very nicely set up in Mor et al. (2004). From the abstract:

  "Nursing home care is currently a **two-tiered system**. The **lower tier consists of facilities housing mainly Medicaid** residents and, as a result, has very limited resources. The nearly 15 percent of U.S. nonhospital-based nursing homes that serve predominantly Medicaid residents have fewer nurses, lower occupancy rates, and more health-related deficiencies. They are more likely to be terminated from the Medicaid/Medicare program, are disproportionately located in the poorest counties, and are more likely to serve African-American residents than are other facilities. The **public reporting of quality indicators**, intended to improve quality through market mechanisms, **may result in driving poor homes out of business** and will disproportionately affect nonwhite residents living in poor communities. This article recommends a proactive policy stance to mitigate these consequences of quality competition."

- I highlighted some key words

Quality

- If there is a constant theme in nursing homes is this: **quality problems**
- Quality concerns have plagued the industry all the way back to its origin in poorhouses
- In 1972, reforms established requirements for nursing homes
- There have been other attempts since to try to increase the quality of care; we'll cover some

Profit

- Remember producer theory: profit = revenue - costs
- A producer who wants to maximize profits will produce up to the point in which marginal revenue equals marginal cost
- **Marginal revenue is in a nursing home is the revenue from a new admission**. But not all admissions are created equal
- There is a clear hierarchy in order of profitability:
  1. Private payers
  2. Medicare (rehab)
  3. Medicaid (long term)
- **Medicare and private payers are much more profitable**. 70 percent of nursing homes are for profit. You see the problem...
- This has exacerbated the sorting into quality tiers

Quality

- Quality varies by profit status, ownership type, size, payer, location

TABLE 1. Baseline characteristics by star, all nursing homes

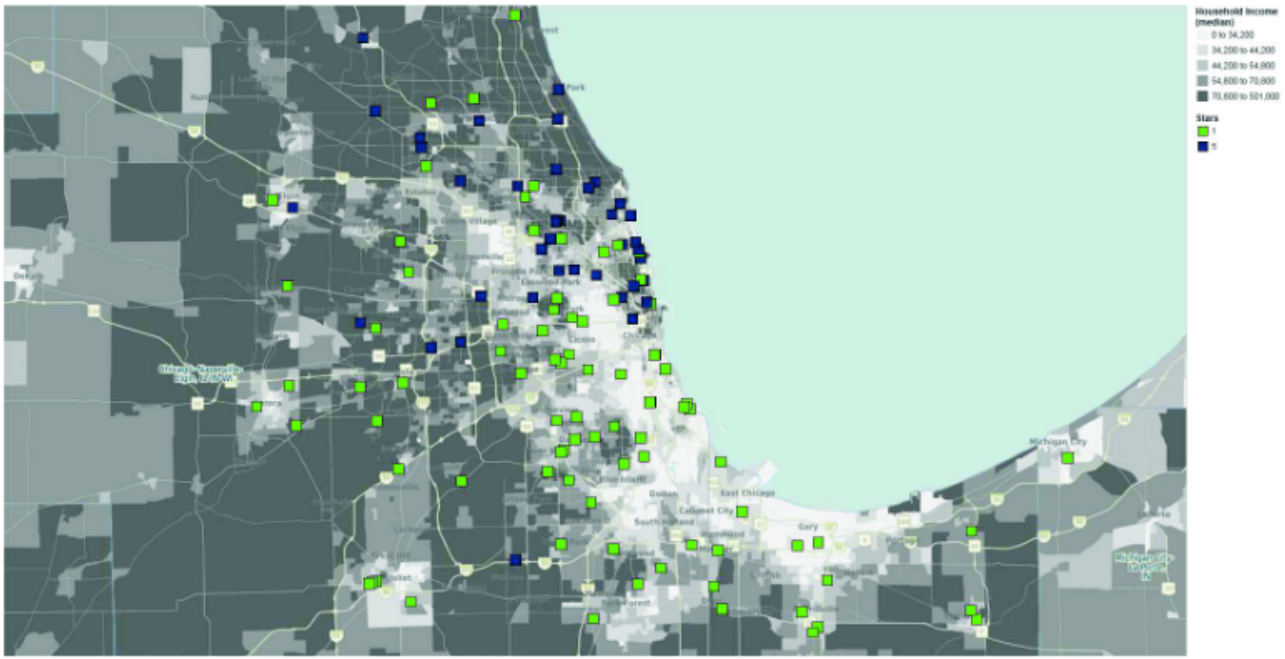
	Star rating									
	1		2		3		4		5	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
N	3,560		3,187		3,350		3,657		1,830	
Payer										
Medicaid	0.66	0.16	0.64	0.20	0.59	0.22	0.55	0.27	0.55	0.29
Medicare	0.14	0.10	0.14	0.12	0.16	0.17	0.18	0.22	0.16	0.22
Other	0.20	0.13	0.22	0.15	0.24	0.17	0.27	0.20	0.29	0.24
Residents	103.04	51.30	98.29	60.52	89.98	56.58	80.62	61.55	71.22	53.67
Beds	125.72	59.15	118.14	68.06	108.86	63.99	96.46	67.86	84.80	61.29
Occupancy	0.82	0.15	0.83	0.15	0.83	0.16	0.83	0.17	0.84	0.19
Occupancy > 0.95	0.17	0.37	0.21	0.40	0.22	0.41	0.23	0.42	0.31	0.46
HHI	0.20	0.23	0.20	0.24	0.21	0.24	0.22	0.25	0.19	0.22
HHI < 0.25	0.72	0.45	0.72	0.45	0.69	0.46	0.69	0.46	0.73	0.45
Special focus facility	0.69	0.46	0.67	0.47	0.64	0.48	0.62	0.49	0.64	0.48
Urban	0.03	0.16	0.01	0.10	0.00	0.06	—		—	
Area income	40.32	13.10	41.32	15.08	41.70	14.86	41.82	15.19	43.47	17.20
Chain	0.65	0.48	0.56	0.50	0.55	0.50	0.47	0.50	0.40	0.49
Hospital based	0.03	0.17	0.05	0.21	0.07	0.25	0.13	0.33	0.13	0.34
Ownership										
Profit	0.82	0.38	0.75	0.44	0.70	0.46	0.57	0.50	0.51	0.50
Nonprofit	0.16	0.36	0.22	0.41	0.26	0.44	0.37	0.48	0.42	0.49
Government	0.02	0.14	0.04	0.19	0.04	0.20	0.06	0.23	0.07	0.25

Figure: From Perraillon et al. (2019)

Segregation

- Not a lot of options if people live in a poor area. Chicago offers a stark example

Exhibit A4. Geographic distribution of one-star and five-star Nursing Homes in the Chicago area.



SOURCE: Authors' analysis from Nursing Home Compare December 2008 rating data.
Notes: Green squares are nursing homes with a 1-star rating. Dark blue squares are nursing homes with a 5-star rating. Shaded areas depict Census-tract level median household income from the 2010 US Census.

Figure: From Konetzka and Perraillon (2016)

Profit status matters

- It's a lot harder to establish if this correlation implies causality, but some research suggests it does

TABLE 2
Characteristics of Lower-Tier and Upper-Tier Facilities by Ownership, 2000

	For-Profit		Nonprofit	
Staffing and Case-Mix Characteristics	Lower Tier ($n = 1,578$)	Upper Tier ($n = 8,624$)	Lower Tier ($n = 382$)	Upper Tier ($n = 3,546$)
Registered nurses and full-time equivalents (FTEs)/residents	3.4[a]	5.5	5.4[a]	7.2
Licensed practical nurses and FTEs/residents	12.9	12.8	13.3	12.6
Certified nurse assistants and FTEs/residents	36.7[b]	37.6	43.6	42.5
Administrators and FTEs/residents	4.3[a]	4.9	5.8	6.2
Any physician extenders	16.8%[a]	20.7%	24.3%	21.4%
Occupancy rates	87.5[c]	88.3	91.9	92.9
% of residents with psychiatric diagnosis	22.3[a]	11.5	15.9[a]	9.3
% of residents with mental retardation	3.6[a]	1.7	3.1[a]	.9
Case-mix intensity index	.77[c]	.81	.82[a]	.80

[a]Kruskal-Wallis two-sample nonparametric test chi-square probability below .001.
[b]Kruskal-Wallis two-sample nonparametric test chi-square probability below .01.
[c]Kruskal-Wallis two-sample nonparametric test chi-square probability below .05.

Figure: From Mor et al. (2004)

Initiatives

- The creation of the Minimum Data Set (MDS) was an attempt to improve care in nursing homes
- In part a response to an Institute of Medicine report in 1987 detailing the problems in the industry
- Multiple goals: collect data that could be used for care planning, but also use to understand more about the nursing home population and create **quality indicators** – at the same time that data can also be used for payment
- Assessments are conducted at admission, discharge, and at other points
- Using that data, CMS published **quality indicators** for nursing homes around 2000

Public release of quality information

- Why is publishing quality indicators is supposed to be a good idea?
- In economics, this can be framed using the idea of **asymmetric information**
- Consumers often don't know the quality of providers. If they knew this information, they would choose providers of better quality
- So now the information is public, which means that providers know this too. This gives them an incentive to invest in quality since they don't want to lose consumers
- Or so the story goes...
- (Yet another example of a conceptual framework; it could be words, graphs, a mathematical model, both...)

Example: Quality indicators

- It could be things like "quality metrics"

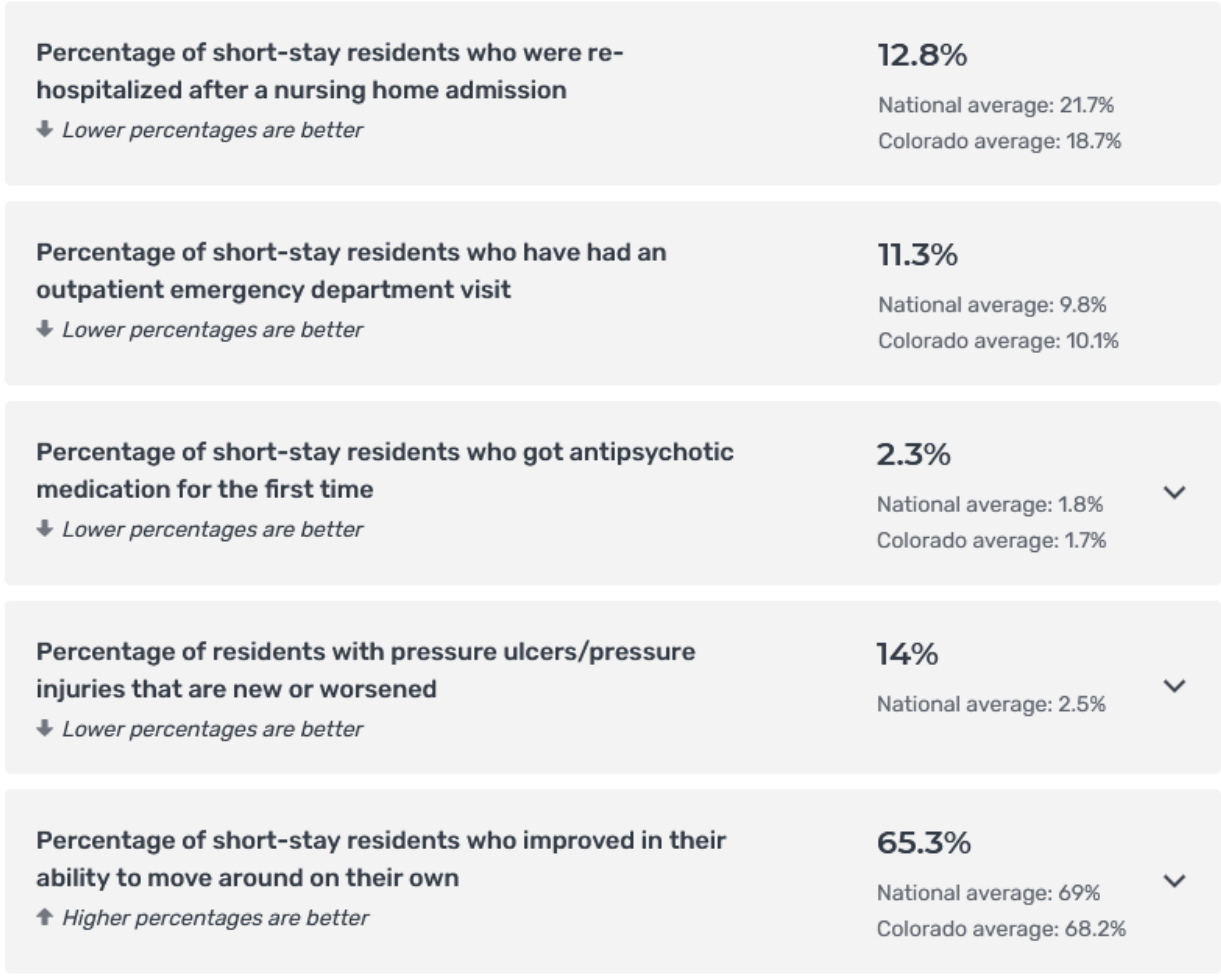


Figure: `https://www.medicare.gov/care-compare/?providerType=NursingHome`

Example: Ratings

- It could something simpler to understand, combining information and displaying stars

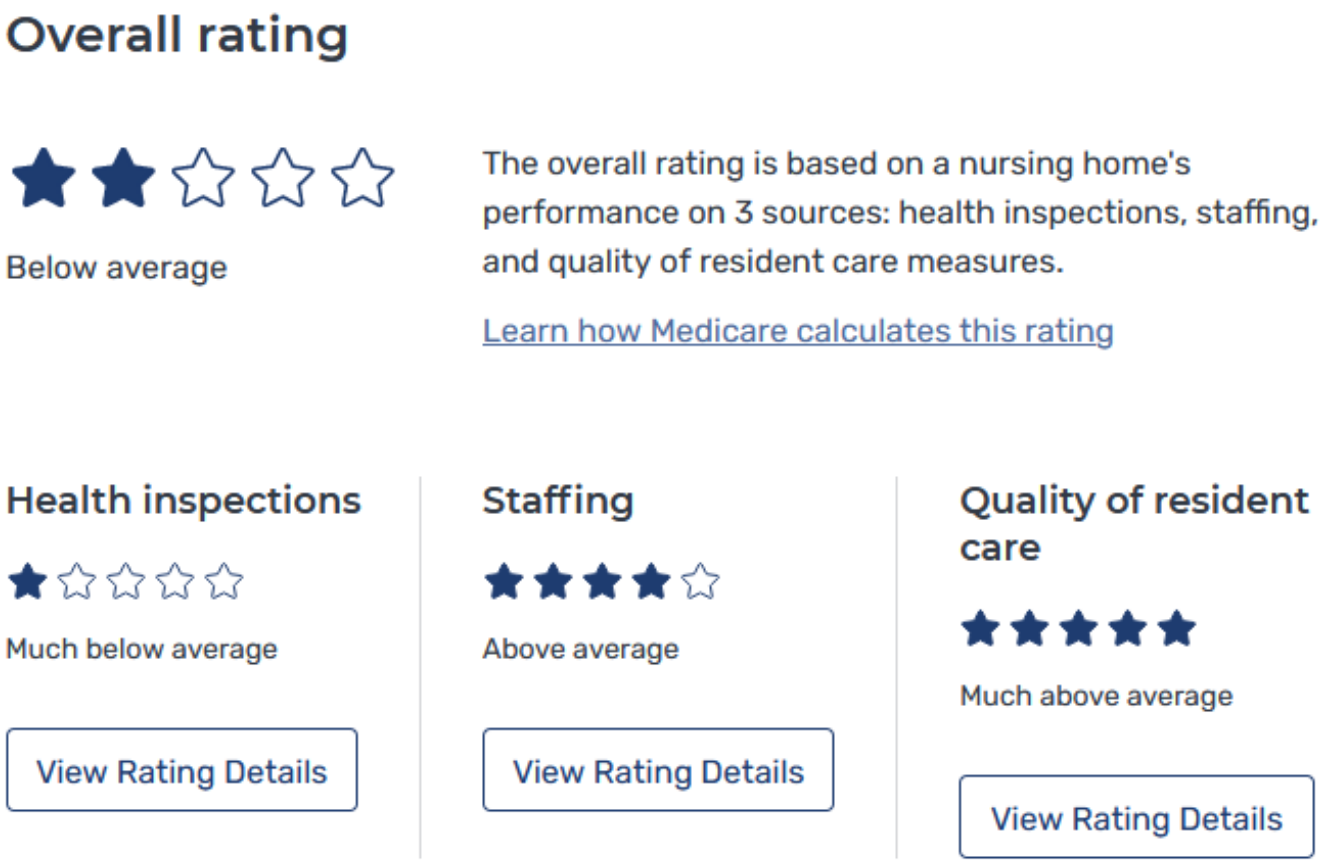


Figure: `https://www.medicare.gov/care-compare/?providerType=NursingHome`

Problems

- First, the obvious: do the metrics reflect quality of care? Maybe
- Several fair criticisms: little risk adjustment, based on old information, subjective inspections, doesn't reflect daily interactions with patients
- Any way you look at it, it's difficult to create come up with measures that truly reflect quality
- The information can be difficult to understand, that's why **simplified**, **composite** five-star ratings were created
- Second, do people actually use the ratings? Some yes, some no. It seems to depend on factors such as education, reasons for the stay. For some, that's an **unintended** consequence: **the information could be make the segregation worse, not better**

Do consumers respond?

- Mixed evidence. One way to measure response is checking if better nursing homes (according to the information made public) gain more residents after the publication of ratings
- The same causal inference problems we have discussed apply here. It's not an experiment: for example, better rated NHs have more rehab patients, those patients rotate more often, so better rating nursing homes have more admissions
- Some quasi-experimental designs show **small effects**

Do consumers respond?

- For example, one paper (mine):

  "... We use a regression discontinuity design to estimate changes in new admissions six months after the publication of the ratings. Our main results show that nursing **homes that obtained an additional star gained more admissions**, with heterogeneous effects depending on baseline number of stars. **We conclude that the form of quality reporting matters to consumers, and that the increased use of composite ratings is likely to increase consumer response**."
- Translation: better rated nursing homes seemed to have gained stars, but not low-quality nursing homes

Why not?

- Some possible mechanisms: the people who use the ratings are the ones who go to better nursing homes
- The two-tier system means that some people do not have much choice. Better nursing homes do not have a lot of Medicaid beds
- In a qualitative study, this is how an administrator of a nursing home with a large proportion of Medicaid patients explained it:

  "5 percent of consumers maybe [check ratings]. And of course, our first response is, pardon the French, "Screw the ratings!" Talk to the residents. I have a wait list. People want to be here. People want to come here . . . I'm full. What extra business do I want? I'm full. (Administrator)"

  Source: Perraillon, Brauner, Konetzka (2019)

Do nursing homes respond?

- Yes, clearly: they try to improve their ratings, but not all do it
- If they think ratings, matter, then yes, they have incentives
- This doesn't necessarily translate into better quality
- **Teaching to the test**: a term for any method of education whose curriculum is heavily focused on preparing students for a standardized test.
- There are cheap ways of improving ratings

So what are the lessons?

- Ironically, more ability to pay doesn't necessarily improve conditions – it does improve business opportunity (another form of moral hazard?)
- Every single initiative to improve quality of care changes incentives. Providers are quick to respond; consumer face barriers, but do respond in some way
- It doesn't mean trying to improve care is not worth it, but **it does require more than good intentions**

Now for something completely different: probability

- Next week we start covering demand for insurance. Insurance involves **uncertainty**
- Uncertainty involves **probability**. So I want to make sure we have time to cover the basics because:
  1. We tend to forget the basics
  2. Forgetting the basics comes back to haunt you
- Today serves as a reminder. Don't dismiss it

Probability

- Probability is a counting process or, more accurately, to calculate probability and to make sense of probability we need to **count**
- And we need repetition. **We need things happening many times**
- Consider for example a die with 7 faces. A die with 7 faces might not be a "fair" die
- How could we figure out what is the probability of observing any of the numbers in the new and esoteric die?
- (Die = singular, dice is plural)

Dice with 7 faces do exist

- Out of stock currently

Figure: https://www.mathartfun.com/d357.html

Counting

- To figure out if the die is fair – that is, if all numbers have equal chances of coming up – we could toss the die 1000 times
- If fair, we should see that **about** 142 times we observed a 1, 142 a 2, etc. That's because $1000/7 = 142.85$
- I wrote "**about**" because there is **randomness**: lack of certainty in an event
- Say we counted that we saw a 5 in 155 of the tosses. Therefore, the probability of a five is $P(D = 5) = \frac{150}{1000} = 0.155$ or 15.5% percent of time we should see a 5
- If we repeat this **experiment** 10,000 times or a million times, we will get closer and closer to exactly $P(D = 5) = 0.142857...$ (if our die is "fair")
- If repeat the experiment 10 times, anything could happen. Maybe we see 9 fives our of 10. Could happen

Department of BIG Ideas

- There is a lot packed in this silly example
- The notion of probability is about **counting** events happening or not
- The probability is defined as counting two things: the event of interest happening divided by the number of times the event could happen, or the "elements in the sample space"
- The notion of probability requires things **happening many times**
- No coincidence that the analysis of card games, dice and other games like that gave us **probability theory** – also, another example of economic incentives: there was money to be made if you figured these things out

Department of BIG Ideas

- Here are some brain twisting questions:
  1. What is the probability of seeing a 6 in the next toss of the die?
  2. What is going to happen in the next toss of a dice?
  3. What is going to happen if we toss the dice 100 times?
  4. What is the probability of another big bang happening? That is, another creation of the universe?
  5. Here is a fun one, both the wine place and the actual theorem: The Infinity Monkey Theorem
- This is **frequentist statistics**. For example, the proper interpretation of a 95% confidence interval $[a, b]$ for a statistic $\bar{x}$ is that if we repeated the experiment many times, 95 percent of the time the number would be between a and b
- In Bayesian statistics, you can give the statement a probabilistic meaning. With flat priors, we end up in similar places

Expected value

- The expected value is a measure of central tendency. Sometimes it means something, sometimes is a bit abstract
- In our 7-face die example, what is the expected face number? It's 4
- $E[D] = p(D = 1) * 1 + p(D = 2) * 2 + \cdots + p(D = 7) * 7 = 4$
- Or the middle number: 1, 2,3, **4**, 5, 6, 7
- If events have equal changes or equal probability, that's like our vanilla average: $\frac{a+b+c}{3} = \frac{1}{3}a + \frac{1}{3}b + \frac{1}{3}c$
- Expected value is more like a weighted average. What is your final grade in class if midterm 1 is worth 20%, midterm 2 is 35%, and the final is 45%?
- That would be $0.2 * grade1 + 0.35 * grade2 + 0.45 * final$

Gambling

- Suppose that you are given two choices:
  - A: You get \$1,000 with probability 0.5 or 0 with probability 0.5
  - B: You get \$500 for sure (that is, with probability 1)
- What would you do? (To make sense of this, we have to think frequentist)
- What is the expected value of both alternatives?

Gambling

- The previous question highlights the role of **preferences** and attitudes towards risk
- Risk tolerance is personal and situation-specific. We could gamble for fun in a casino with $100, but we might not gamble with our health or with our retirement money
- We ski and run in the mountains, but no way we will ride a motorcycle
- We could use the gamble in the previous question to define **risk averse**, **risk neutral**, **risk seeking** in **that particular situation**

Health insurance

- When it comes to health insurance, it makes sense to think about **risk aversion**
- We can think about health insurance as protection from **loss of income** and nothing else. We care about not losing our income and **we prefer more income to less income** – not a crazy assumption
- Health insurance can be thought of of a gamble we are willing to participate in because it protects us from uncertainty
- Let's think about the decision of buying insurance for next year

Health insurance

- If we get sick or have an accident or need to manage a chronic condition, our income would be I_s next year. Let's say $I_s = \$50,000$
- If we manage not to get sick, we would have $I_H = \$70,000$ next year (implicitly, this means the cost of health care is $\$20K$ if sick)
- The probability of getting sick is p. The probability of not being sick is $1 - p$
- Since you are all **spring chickens**, let's say $p = 0.05$
- So the **expected value** of your income next year is: $70K * (1 - 0.05) + 50K * 0.05 = \$69,000$
- I have an entrepreneurial spirit (not really) and good heart (mostly). I'll offer you an insurance contract: if you get sick, I'll give you $\$20K$ (payout) but will charge you a **premium** of $1,000$
- That's an **actuarially fair insurance**: Your **certain** income is now: $(70K - 1K) * 0.95 + (50K - 1K + 20K) * 0.05 = \$69K$
- I don't make any money... **Would you buy it**? Maybe... We need to **incorporate preferences and risk attitudes**

Hope you see where we are heading

- We can think of insurance as a product that allows us to **reduce uncertainty** and **maintain a level of income**. It's a way of reducing loss
- In a perfectly competitive market, all insurance would be fair as in the above example: profits would be zero. But perfectly competitive markets do not exist. They are pretty, imaginary theoretical unicorns
- We assumed **perfect information**. What about if I mistakenly thought you were spring chickens when in fact your risk of illness is higher? You have incentives to play spring chicken. Since I know this, I have incentives to try to figure out your true chicken status. **We will play games**
- Your incentives to buy insurance depend on **preferences**, and your **true chicken status** and the **cost of premium**
- Here is a summary: if you are in fact a spring chicken and the premium is higher than 1K, you are more likely to not buy it. But if you know you are in bad health, you have a lot of incentives to buy at that premium. That's **adverse selection**. **Moral hazard** is that with **full protection**, you could go to the ER when you have a hanging nail or start trying black runs at A-basin