Physicians and Credence Goods: Why are Patients Over-treated?

Don Wright
University of Sydney

Introduction

- A patient has limited information about what illness they have, the severity of the illness, or the appropriate treatment.

- A physician not only diagnoses the patient's illness and provides treatment, but also determines the severity of the illness and how much treatment is necessary.

- In some cases, even after the treatment has been delivered the patient does not know the extent of the treatment.

- Goods that have these characteristics are known as credence goods.

- The literature has taken two directions.

- The first assumes that the type or the extent of the treatment is observable and verifiable but the outcome is not and is concerned with whether there is under- or over-treatment, Dulleck and Kerschbamer (2006) and Emons (1997 and 2001).

- The second assumes that the outcome is observable or verifiable but that the extent of the treatment is not and is concerned with overcharging, Dulleck and Kerschbamer (2006), Fong (2005), and Liu (2011).

- This paper is concerned with the under- and over-treatment of patients by physicians,
- It is assumed throughout that treatment is observable and verifiable.
- The literature finds that the market solves the credence good problem in the sense that treatment is provided efficiently, that is, there is no under- or over-treatment.

- This is not consistent with the health economics literature, where over-treatment (supplier induced demand) is thought to be pervasive.

- This paper relaxes a number of assumptions and shows that in equilibrium under- and over-treatment are possible.

- Finally it is shown that efficiency can be restored if

- 1. The physician diagnoses the severity of the illness and treats the non-severe illness while other health providers (hospitals) treat the severe illness.

- 2. Some physicians diagnose honestly. Though at the cost of over-treatment by dishonest physicians.

- The Basic Model

- It is assumed that a patient has a non-severe or a severe illness.

- If the patient with the non-severe illness is treated at cost, $c_n = c$, then her benefit is $v_n = v$,

- Severe illness cost, $c_s = c + c_o$, benefit $v_s = v$,
- Non-severe illness cost, c_s, benefit $v_n = v$;

Severe illness cost c_n, benefit 0.

- The more costly treatment cures both illnesses while the less costly treatment only cures the non-severe illness.

- It is assumed that $v - c_s > 0$ so it is always efficient for the patient to be treated.

- The patient knows that with probability $\theta \in (0, 1)$ her illness is severe.

- A physician can diagnose the severity of the illness and treat it.

- It is assumed that (i) the patient can observe and verify which treatment she has received, (ii) the physician can provide either treatment for either illness, and (iii) once a patient receives a diagnosis from a physician they are committed to that physician for treatment.

- The physician posts take-it-or-leave prices p_n and p_s.

- After diagnosis the physician announces the severity of the illness and treats the patient.

- The physicain might announce the patient has the severe (non-severe) illness and treat then with cost c_s (c_n) even though the patient actually has the non-severe (severe) illness. That is, there is over (under) treatment.

- In equilibrium, patients are treated efficiently, that is, patients with the non-severe illness are treated at cost c_n and patients with the severe illness are treated at cost c_s.

- The physician optimally charges equal mark-ups of price above cost in equilibrium.

- In particular, $p_n - c_n = p_s - c_s$, where $p_n = v - \theta(c_s - c_n)$ and $p_s = v + (1 - \theta)(c_s - c_n)$.

- Given equal mark-ups, the physician has no incentive to under-treat or over-treat and has an expected payoff of $v - \theta c_s - (1 - \theta)c_n$.

Relaxing Commitment

- In the equal mark-ups equilibrium the price paid by the patient with the severe illness is greater than the benefit the patient receives from treatment. Therefore, the patient has an expost incentive to not be treated and renege on the contract. So relax commitment.

- Constrain prices to be less than the expected benefit of treatment given price mark-ups and the diagnosis.

Proposition 1: *Assume the basic model and in addition assume that* $p_s \leq Ev$ *and* $p_n \leq Ev$*. (1) If* $\theta \geq \frac{c_s - c_n}{v}$*, then the physician diagnoses honestly, charges prices so that* $p_s - c_s = p_n - c_n$*, and treats the patient efficiently or the physician diagnoses the severe illness, charges prices so that* $p_s - c_s > p_n - c_n$*, and over-treats the patient with the non-severe illness. (2) if* $\theta < \frac{c_s - c_n}{v}$*, then the physician diagnoses the non-severe illness, charges prices so that* $p_s - c_s < p_n - c_n$*, and under-treats the patient with the severe illness.*

- Intuition:

- Honest diagnosis: Physician payoff =

$P_1 = v - c_s$

- Diagnose Non-severe: Physician payoff =

$P_2 = (1 - \theta)v - c_n$

- Diagnose Severe: Physician payoff =

$P_3 = v - c_s$

Relaxing Commitment with $v_s - c_s > v_n - c_n$

- In health-care the problem is over-treatment not under-treatment.

- Assumed $v_s - c_s > v_n - c_n$ so the surplus created by appropriately treating the severe illness is greater than that from the non-severe illness.

Proposition 2: *Assume the basic model and in addition assume that* $p_s \leq Ev$, $p_n \leq Ev$, *and* $v_s - c_s > v_n - c_n$. *(1) if* $\theta \leq \frac{c_s - c_n}{v_s - v_n}$, *then the physician diagnoses honestly, charges prices so that* $p_s - c_s = p_n - c_n$ *and treats the patient efficiently. (2) if* $\theta > \frac{c_s - c_n}{v_s - v_n}$, *then the physician diagnoses the severe illness, charges prices so that* $p_s - c_s > p_n - c_n$ *and over-treats the patient with the non-severe illness.*

- Intuition:

- Under-treatment is never preferred by the physician because treating the severe illness appropriately generates more surplus than treating the non-severe illness appropriately.

- If θ is large, then it is very likely the patient has the severe illness. In this case, the expected payout to the physician of diagnosing the severe illness is large and close to $v_s - c_s$.

Two-Part Tariffs

- The use of two-part tariffs restores efficiency of treatment even if prices are constrained to ensure participation by the patient and the physician expost.

Relaxing Commitment and Observability of Costs with $v_s - c_s > v_n - c_n$

- The patient has no information about physician costs.

- If the patient is offered the non-severe treatment, then the expected benefit of this treatment is $Ev^n = (1-\theta)v_n$ while the expected benefit of being offered the severe treatment is $Ev^s = \theta v_s + (1-\theta)v_n$.

Proposition 3: *Assume the basic model and in addition assume that* $p_s \leq Ev^s$*,* $p_n \leq Ev^n$*,* $v_s > v_n$*,* $v_s - c_s > v_n - c_n$*, and physician costs are not known by the patient. Assume it is profitable to offer treatment for the non-severe illness,* $Ev^n - c_n \geq 0$*. (1) if* $\theta \geq \frac{c_s - c_n}{v_s}$*, then the physician diagnoses the severe illness, charges* $p_s = Ev^s$*, and over-treat the patient with the non-severe illness. (2) if* $\theta < \frac{c_s - c_n}{v_s}$*, then the physician diagnoses the non-severe illness, charges* $p_n = Ev^n$*, and under-treats the patient with the severe illness.*

Assume it is not profitable to offer treatment for the non-severe illness, $Ev^n - c_n < 0$. *(3) if* $Ev^s - c_s \geq 0$, *then the physician diagnoses the severe illness, charges* $p_s = Ev^s$, *and over-treats the patient with the non-severe illness. (4) if* $Ev^s - c_s < 0$ *then the physician offers no treatment to the patient.*

- Intuition:

- For small θ, diagnosing and treating the non-severe illness is the most profitable diagnosis and treatment and so under-treatment of the patient with the severe illness arises even though $v_s > v_n$ and $v_s - c_s > v_n - c_n$.

Other Health-care Providers

- For many illnesses, physicians and other health-care providers (OHP) jointly treat patients.

- If the patient has the non-severe illness, then cost $c_n = c$ and benefit v_n. If the patient has the severe illness, then joint treatment at cost $c_s = c + c_o$, where c_o is the cost of the services provided by the OHP, and benefit v_s.

- The additional expected surplus created by the physician diagnosing the severe illness and joint treatment is
$S = Ev^s - c - c_o - (Ev^n - c) = \theta v_s - c_o$

- Assume Nash bargaining over this surplus

- Expected net payoff of physician is
$EP^s = \phi(\theta v_s - c_o) + Ev^n - c$, where $0 \leq \phi \leq 1$ is the share of the expected surplus that goes to the physician.

Proposition 4a: *Assume the assumptions of Proposition 3 and in addition that the severe illness is jointly treated by the physician and an OHP. Assume* $\phi = 0$. *(1) if* $\theta v_s - c_o \geq 0$, *then the physician treats the patient efficiently. (2) if* $\theta v_s - c_o < 0$, *then the physician offers no treatment to the patient. Assume* $0 < \phi \leq 1$. *Proposition 3 applies with appropriate reinterpretation.*

- Intuition:

- If the physician has no bargaining power and receives none of the surplus created by diagnosing the severe illness, then the physician is indifferent about which diagnosis to offer and so diagnoses honestly. Therefore, the outcome is efficient with the patient with the non-severe illness treated solely by the physician and the patient with the severe illness jointly treated by the physician and the OHP.

- This stark result can be made less so if it is assumed that the physician has a preference for diagnosing honestly and treating accordingly.

- Let the cost to a physician of diagnosing dishonestly be k and let $\phi > 0$.

Proposition 4b: *Assume the assumptions of Proposition 4a and in addition that the cost of the physician diagnosing dishonestly is k. (1)If $\theta < \frac{c_o - \frac{k}{\phi}}{v_s}$, then the physician diagnoses the non-severe illness and under-treats the patient with the severe illness. (2) If $\frac{c_o - \frac{k}{\phi}}{v_s} \leq \theta \leq \frac{c_o + \frac{k}{\phi}}{v_s}$, then the physician diagnoses honestly and treats the patient efficiently. (3) If $\frac{c_o + \frac{k}{\phi}}{v_s} < \theta$, then the physician diagnoses the severe illness and over-treats the patent with the non-severe illness.*

- Intuition: See Diagram

- For a given ϕ, the greater is k the greater is the cost of diagnosing dishonestly and so the greater is the range of θ over which the physician diagnoses honestly.

- This suggests the further removed are the diagnosis and the treatment decisions (the smaller is ϕ), the greater is the range of parameters over which the patient is treated efficiently.

- In a recent paper, Afendulis and Kesler (2007) found that interventional cardiologists diagnosed and performed significantly more angioplasties than were diagnosed by cardiologists who only diagnose.

The Physician Cares about Treatment

- It is now assumed that the patient knows the probability, β, that the physician always diagnoses honestly and treats the patient appropriately.

• Let $p(i|j)$ be the probability that the patient has illness $i = n, s$ given diagnosis of illness $j = n, s$.

• Given the physician diagnoses the non-severe illness and offers the non-severe treatment, the probability that the patient has the non-severe illness is $p(n|n) = \beta + (1 - \beta)(1 - \theta)$.

• Similarly $p(s|n) = (1 - \beta)\theta$, $p(s|s) = \beta + (1 - \beta)\theta$ and $p(n|s) = (1 - \beta)(1 - \theta)$.

Proposition 5: *Assume the assumptions of Proposition 3 and in addition that the probability the physician always diagnoses honestly is* $0 < \beta \leq 1$. *(1) There are more parameter values for which either diagnosis and treatment is profitable than in Proposition 3. (2) There are more parameters values for which a physician, who only cares about income, diagnoses the severe illness and over-treats the patient with the non-severe illness than in Proposition 3.*

- Intuition:

- As the probability the physician diagnoses honestly increases, the probability $p(s|s)$ also increases, and given diagnosing the severe illness generates a greater surplus, a physician who only cares about income will diagnose the severe illness for more values of θ.

- Increasing β not only increases the probability that a patient is treated efficiently, but it also increases the range of θ over which over-treatment of the patient with the non-severe illness is preferred by the physician to under-treatment of the patient with the severe illness.

Conclusion

- Assumptions of the basic credence good model relaxed.

- It is shown that under- or over-treatment arise in equilibrium depending on the relationship between the probability the patient has the severe illness, the additional cost of the severe treatment, and the value of the severe treatment to the patient.

- Efficiency is restored for some parameter values when the physician only diagnoses and bears a cost of dishonesty.

- Introducing the possibility of altruistic behaviour into the framework trivially increases the probability of efficient treatment. But also increases the range of parameters over which a dishonest physician diagnoses the severe illness and over-treats the patient with the non-severe illness.

- These results suggest that the market mechanism only provides a partial solution to the credence good problem in the health care market.

- Future work will be aimed at adding patient insurance into the analysis.