A behavioral model on the decision of seeking care and adhering to treatment

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TO SEEK OR NOT TO SEEK

A Behavioral Model For The Demand For Health Care

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The Model

An individual experiencing some health condition has to decide if seeking health care services. the utility from seeking care is a function of predisposing characteristics, health care needs, and utility from other commodities

$$\underset{\{H,G\}}{Max}\ U_i(.) = \left[\left(x_0^p - \left(r^p + a\right)\cdot H_t\cdot\left(-\delta + B\cdot\alpha - \theta\cdot\pi\right) + PH_t - H_t\right) + u_G\right] + \left[\left(x_0^p - \left(r^p + a\right)\cdot H_t\cdot\left(-\delta + B\cdot\alpha - \theta\cdot\pi\right) + PH_t - H_t\right)\cdot u_G\right]$$

$$s.t\ \ x^e = P_H\cdot\left(1 - s(h)\right)\cdot H_t + P_G\cdot G_t$$

- H_t — *Health status*
- x_0^p — *Initial predisposing characteristics*
- r^p — *Charlson Index*
- a — *Weight of behavior over individual's health needs*
- δ — *Depreciation rate*
- B — *Indicator of health behavior*
- α — *Proportion of Ht restored through behavior*
- θ — *Co-occurring conditions indicator*
- PH_t — *Perfect Health*
- u_G — *Utility from other commodities*
- P_H — *Total cost (price) of health care*
- $s(h)$ — *Proportion of the cost of paid by third party (payer)*

Model Solutions. Scenario 1. Seeking care: We find that even if the individual is in need of seeking care, there are conditions that, if satisfied, the individual is going to decide not seeking care.

$$H_t^* = 0 \Leftrightarrow P_{H_t} = \frac{-\left(P_G + x^e\right)\cdot\left[-\left(r^p + a\right)\cdot\left(-\delta + B\cdot\alpha - \theta\cdot\pi\right) - 1\right]}{\left(1 - s(h)\right)\cdot\left(1 + PH_t\right)}$$

Rationality: $H_t^* = 0$ and $a = \frac{-1}{\left(-\delta + B\cdot\alpha - \theta\cdot\pi\right)} - r^p$

Irrationality: $H_t^* = 0$ and $a < \frac{-1}{\left(-\delta + B\cdot\alpha - \theta\cdot\pi\right)} - r^p$

Model Solutions – Scenario 2. Adherence. Adherence in t+1 occurs if:

$$H_{t+1}^* = 0 \Leftrightarrow \underbrace{\left(P_G + x^e\right)\cdot\left[-\left(r^p + a\right)\cdot\left(-\delta + B\cdot\alpha - \theta\cdot\pi\right) - 1\right]}_{-P_{H_t}\cdot\left(1 - s(h)\right)\cdot\left(1 + PH_t\right)} = \underbrace{\left(P_G + x^e\right)\cdot\left[-\left(r^p + a\right)\cdot\left(-\delta + B\cdot\alpha - \theta\cdot\pi\right) - 1\right]}_{-P_{H_{t+1}}\cdot\left(1 - s(h)\right)\cdot\left(1 + PH_{t+1}\right)}$$

i) The depreciation rate is lower than the marginal net effect of investment (through behavioral practices) minus the impact of co-occurring conditions

ii) The price of the treatment/service is the maximum price the individual is willing to pay

iii) The individual's decision in Scenario 1 was not to seek care

CONCLUSION. WE DEVELOPED A BEHAVIORAL MODEL FOR THE DECISION OF SEEKING HEALTH CARE AND TEST THE MODEL VALIDITY WITH A SAMPLE OF MENTAL HEALTH PATIENTS

Abstract

This paper aims to propose a general model to describe individuals' decision of seeking health care. The model assumes that the decision to seek care and adherence to treatment depends on the individuals' expectations about their current and future health status, socio-demographic characteristics and contextual factors, as well as the existence of co-occurring conditions. The main novelty of the model is the inclusion of behavior and contextual variables as predictors of the demand for health care services. We show how these two new arguments allow to predict more accurately individuals' behavior than previous behavioral models.

Aims and Contribution

We propose a parametric predictive model for seeking health care that combines the principles of behavioral economics and individuals' response to health expectations to predict seeking care behavior and compliance. Combining those theories with Andersen's behavioral model of utilization of health care services we designed a mathematical model. The aim of our model is to predict individual's decision towards seeking and using health care services along with changes in the barriers to access those services.

Data (for testing the model)

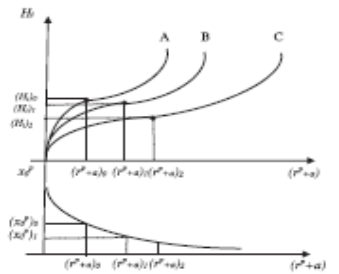
Data. Sample of patients seeking care in MA in 2009-2012, with a Mental Health diagnosis. Patients under 18, out of MA, with public insurance only were excluded. Providers out of MA or with missing ID were also excluded (N=821).

Methods. Random effects regression model including Xi control variables (age, gender, race, county of members & providers), other regressors (Zi): insurance type, Substance Abuse (SA) indicator, full insurance indicator, Charlson index, cost variables and Type of clinician. Dependent variable is a continuous variable: the maximum number of claims by patient. The analysis is done at the Medical Claim (Seeking Care Model) and Pharmaceutical Claim (Adherence) level.

$$Y_{it} = X\beta + Z\gamma + u_i + \varepsilon_{it}$$

Figure

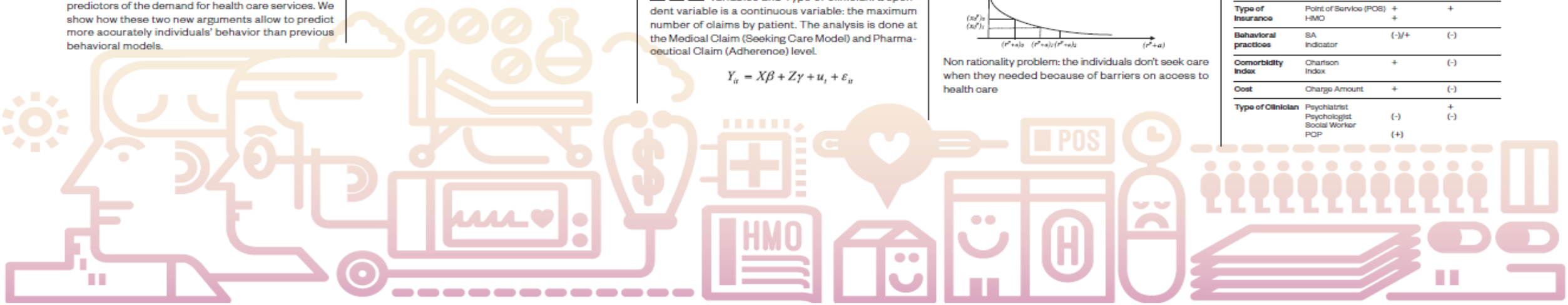
The demand of health care services as a function of predisposing characteristics



Non rationality problem: the individuals don't seek care when they needed because of barriers on access to health care

Preliminary Results

Dep Var: Number of Claims (by patient)	Category	SEEKING CARE MODEL	ADHERENCE MODEL
Gender	Male	+	(-)
Age	25-34		(-)
	35-44	+	
	45-54	(-)	(-)
	55-64	(-)	
County	Essex	+	
	Middlesex	(-)	+
Supply vs. Demand	City member provider equal	(-)	+
Type of Insurance	Point of Service (POS)	+	+
	HMO	+	
Behavioral practices	SA Indicator	(-)/+	(-)
Comorbidity Index	Charlson Index	+	(-)
Cost	Charge Amount	+	(-)
Type of Clinician	Psychiatrist		+
	Psychologist	(-)	(-)
	Social Worker		
	POP	(+)	



Outline

1. Introduction
2. Aims & Contribution
3. The Model
4. Model Results
5. Discussion

Introduction

Modeling the demand for health care and utilization of services remains of central importance

Grossman model (1972) has to be a reference but still there are many things to be analyzed that may matter when making decisions (Sepehri, 2015; Usher, 1975; Zweifel, 2012)

In modeling the usage of health care services studies often fail to account for contextual factors such as socio-demographic factors, predisposing and enabling characteristics, health insurance coverage and healthcare workforce composition potentially affecting the individual's decision of seeking care.

Introduction

More sophisticated versions of the Grossman's model assessed the relationship between uncertainty and the demand for medical care (Dardanoni and Wagstaff, 1990; Picone G et al., 1998; Pfeifer, 2012).

However, nor Andersen (1995) or Gelberg's models (2000) accounted for the determinants of adherence to care.

Introduction

Evidence shows that societal determinants may also influence the utilization of health care services (Andersen and Newman, 1973).

Not considering these contextual and societal determinants of medical care utilization may lead to inaccurate estimations of the utilization of health care services (Philips et al., 1998; Mechanic, 1980).

Aims and contribution

This paper aims to investigate why individuals decide not seeking care or not adhering to the prescribed treatment.

This model could be used to forecast the individual's decision of using health care services and to identify conditions that enable or preclude the usage of those services.

Two Stages/Scenarios

We propose an approach to model the individual's decision in a model where the two stages, seeking care and treatment adherence, are considered.

The Model

The proposed model builds on the original behavioral model by Andersen (1986, 1995) and the demand for health and health care model by Grossman (1972).

From Andersen:

(1) contextual variables which includes environmental factors and health care system characteristics, individual's characteristics or predisposing/enabling factors to use health care services (e.g., demographics, social structure, and present and future health expectations), factors that enable or impede such use of services (e.g., personal/family, and community resources) that ultimately define health care needs

(2) health behaviors

(3) health outcomes (e.g., patient's satisfaction)

The Model

The model incorporates uncertainty surrounding the incidence of illness, the effectiveness of medical care, and the depreciation of the stock of health.

The stock of health in our model decreases not only with time (Grossman's health depreciation factor), but also, because of individual health behaviors and the existence of co-occurring conditions.

What we offer is a theoretical approach trying to fill (at least in part) those gaps in previous models.

The Model (theoretical framework)

An individual *i* has a health condition and thus, should decide whether to seek care at any time *t*.

An individual seeks care with certain probability when the marginal utility of seeking care is equal or greater than its marginal cost. We assume that the individual's stock of health depreciates over time at a larger rate if she decides not to seek care when sick, has other co-occurring conditions or engages in unhealthy behaviors.

Glossary

H_t — *Health status*

x_0^p — *Initial predisposing characteristics*

r^p — *Charlson Index*

a — *Weight of behavior over individual's health needs*

δ — *Depreciation rate*

B — *Indicator of health behavior*

α — *Proportion of Ht restored through behavior*

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PH_t — *Perfect Health*

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P_H — *Total cost (price) of health care*

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The Model

We start by defining individual characteristics, X_i, as a vector of three components: predisposing characteristics (x^p), enabling resources (x^e), and health care needs (x^n).

(1) $$X_{it} = \left(x_{it}^{p}, x_{it}^{e}, x_{it}^{n}\right)$$

The Model

The predisposing characteristics are represented by the following function:

$$x_t^{\,p} = u\left(x_{t=0}^{p} - r^{p} \cdot \left(H_{t+1} - H_t \middle| \theta_t = 1\right)\right) \qquad \forall\left(H_{t+1} - H_t \middle| \theta_t = 1\right) \leq 0$$

We assume that the utility of seeking care based on the individual predisposing characteristics cannot be negative

The Model

Enabling characteristics are measured by the following expression:

$$x_t^{\,e} = P_t'\left(H_t\right)\cdot H_t + P_t\left(G_t\right)\cdot G_t$$

For: $P_t'\left(H_t\right) = P_{H_t}\cdot\left(1-s(h)\right)$

Let's assume that the cost of health care is a function of health insurance (*h*). We use prices to proxy health care cost. Thus, P_H is the total price of health care and $P_H(1\text{-}s(h))$ is the individual copay (i.e., out-of-pocket cost -OOP). Prices are assumed to be known and set up by the health care system. We also assume that copays vary depending on the type of health services and the individual copay depends on the type of health insurance.

The Model

Health care needs: initially, health needs are represented by the distance between health status an Perfect Health. This can be reduced by adding behavior

$$x^n = u\left(\left(PH_t - H_t\right) - a \cdot \left(H_{t+1} - H_t \middle| B = 1\right)\right)$$

$$\forall\left(H_{t+1} - H_t \middle| B = 1\right) \neq 0$$

$H_{t+1} > H_t \Leftrightarrow$ Health Investment

The Model

The equation for health investment is given by the expression:

$$I_t = B \cdot \alpha \cdot H_t \Rightarrow H_{i,t+1} = H_{it}(1-\delta_{it}) + B_{it} \cdot \alpha_{it} \cdot H_{it}$$

Where α represents changes in the health status due to (positive or negative) health behaviors. If the individual decides not to engage in any health behaviors (B=0), the health investment effect over the health care needs would be null and therefore $x^n = u((PH_t - H_t))$

The Model

Scenario 1: The decision of seeking care

The individual maximizes the following utility function:

$$Max \quad U_{it}(.) = u_H + u_G + (u_H \cdot u_G) \qquad \forall u_H = x^p + x^n \quad , \quad \forall u_G = u(G)$$

$$x^e = P_H \cdot (1 - s(h)) \cdot H_t + P_G \cdot G_t$$

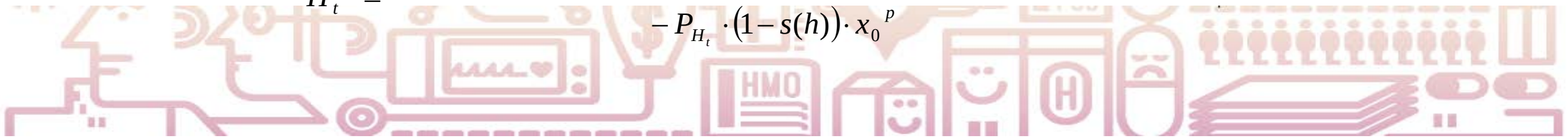
$$\underset{\{H,G\}}{Max} \quad U_{it}(.) = \left[\left(x_0^p - \left(r^p + a\right) \cdot \left(H_{t+1} - H_t \middle| \theta, B\right) + PH_t - H_t\right) + u_G\right] + \left[\left(x_0^p - \left(r^p + a\right) \cdot \left(H_{t+1} - H_t \middle| \theta, B\right) + PH_t - H_t\right) \cdot u_G\right]$$

The Model

Scenario 1 (SOLUTION)

Even if the individual needs seeking care, there is a condition that, if satisfied, the individual might decide not seeking care. We show how his condition is defined by the combination of risk aversion, the ability to restore health through behavior, health depreciation, and the impact of health investments.

$$H_t^* = \frac{\left(P_G + x^e\right)\cdot\left[-\left(r^p + a\right)\cdot\left(-\delta + B\cdot\alpha\right) - 1\right] + P_{H_t}\cdot\left(1 - s(h)\right)\cdot\left(1 + PH_t\right)}{-P_{H_t}\cdot\left(1 - s(h)\right)\cdot {x_0}^p}$$



The Model

Scenario 1 (SOLUTION)

Model Solutions. Scenario 1. Seeking care: We find that even if the individual is in need of seeking care, there are conditions that, if satisfied, the individual is going to decide not seeking care.

$$H_t^* = 0 \Leftrightarrow P_{H_t} = \frac{-\left(P_G + x^e\right)\cdot\left[-\left(r^p + a\right)\cdot\left(-\delta + B\cdot\alpha - \theta\cdot\pi\right) - 1\right]}{\left(1 - s(h)\right)\cdot\left(1 + PH_t\right)}$$

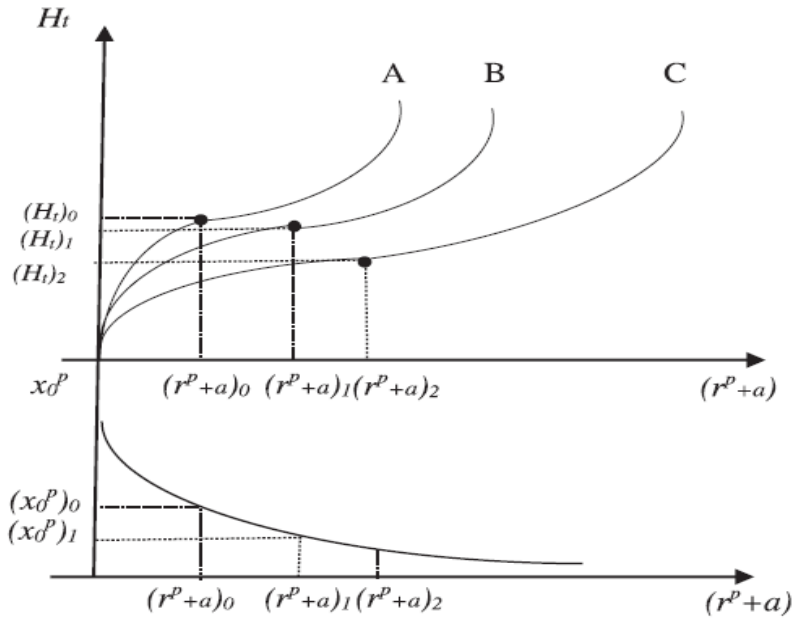
Rationality : $H_t^* = 0$ and $a = \frac{-1}{\left(-\delta + B\cdot\alpha - \theta\cdot\pi\right)} - r^p$

Irrationality : $H_t^* = 0$ and $a < \frac{-1}{\left(-\delta + B\cdot\alpha - \theta\cdot\pi\right)} - r^p$

Note that **α < α*** makes the marginal utility of seeking care positive

Figure

The demand of health care services as a function of pre-disposing characteristics



Non rationality problem: the individuals don't seek care when they needed because of barriers on access to health care

The Model

Scenario 2 : Treatment adherence

The individual decision concerning treatment adherence in future time periods is conditioned to have sought for care at *t=0.* Therefore, we can derive the optimal value for H_{t+1}^{*}.

$$H_{t+1}^{*} = (1 - \delta + B \cdot \alpha) \cdot \left[\frac{(P_G + x^e) \cdot [-(r^p + a) \cdot (-\delta + B \cdot \alpha) - 1] + P_{H_t} \cdot (1 - s(h)) \cdot (1 + PH_t)}{-P_{H_t} \cdot (1 - s(h)) \cdot x_0^{\,p}} \right]$$

The Model

Scenario 2 : Treatment adherence

Therefore, the possible reasons lead to the individual not to adhere to treatment in future periods are:

1. The health depreciation rate is higher than the net marginal effect of health investment ($\delta \geq 1 + B \cdot \alpha$)
2. Not having sought care at time *t* ($H_t^* = 0$ implies $H_{t+1}^* = 0$).
3. The price of health is the maximum price that the individual is willing to pay

If $u_G = G$, the price equals : $P_{H_t} = \frac{\left(P_G + x^e\right) \cdot \left[-\left(r^p + a\right) \cdot \left(-\delta + B \cdot \alpha\right) - 1\right]}{\left(1 - s(h)\right) \cdot \left(1 + PH_t\right)}$

Discussion

Model Implications for policy design

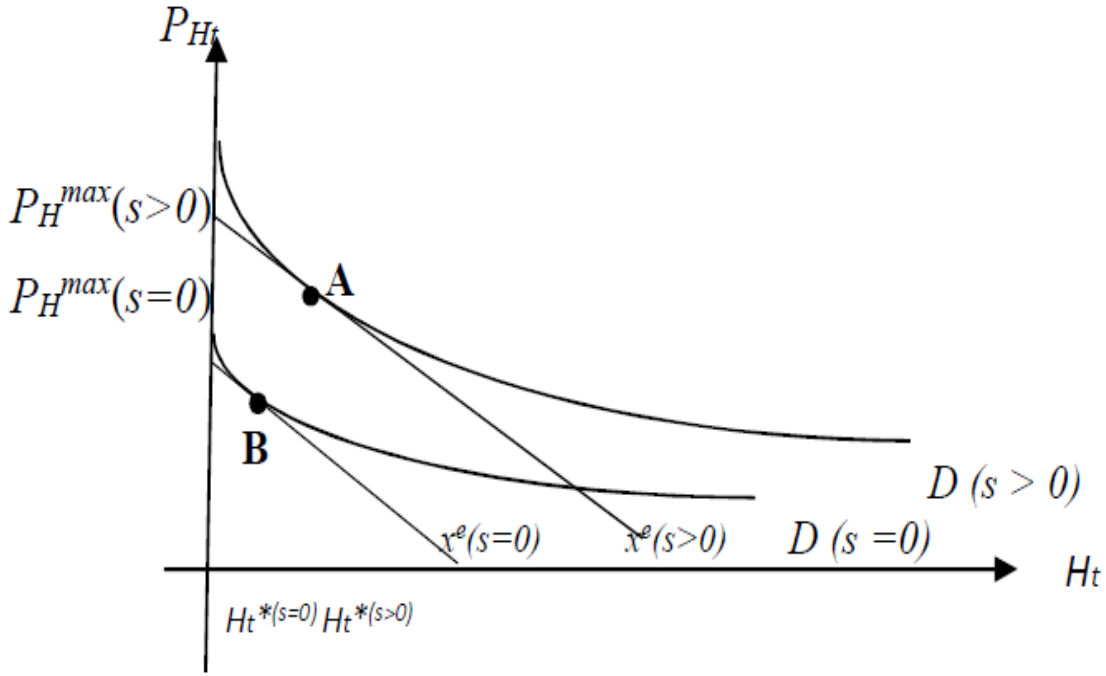
Barriers on demand

Barriers on Supply

Discussion

Model Implications for policy design

The demand curve for health care services with and without co-financing aid



We draw the demand of health care to look at how maximum prices that the individual would be willing to pay for health care services go down if the individual receives no co-financing aid to pay the cost of health care.

The maximum willingness to pay being higher than the maximum price the individual can pay (given the budgetary restriction). A and B represent optimal solutions.

Discussion

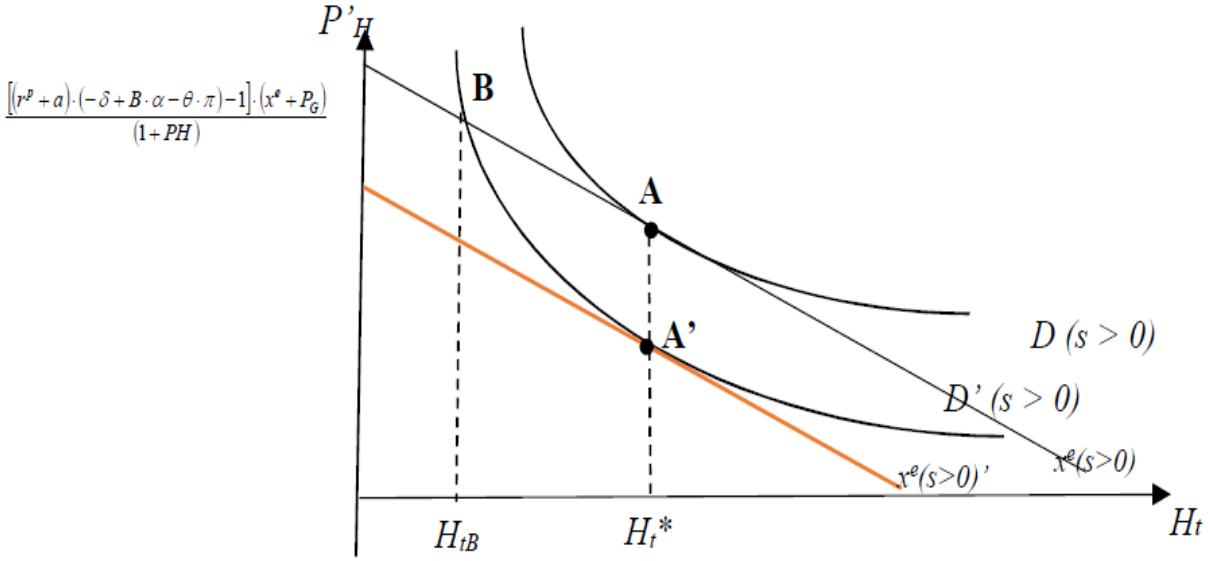
Model Implications for policy design

Barriers on Demand

They will affect the Marginal Utility of seeking health care. An individual may experience some change that makes less attractive to seek care. In the figure, an individual would decrease the demand from health care services from the quantity allocated in point A to H_t allocated in point B.

To return the demand for those individuals to the initially optimal (H_t^*) one possibility would be to give more aids to the individuals, reducing their OOP payments for health care services. That will move the budgetary restriction downwards until the new marginal utility equals the prices.

Fig 4. The demand curve for health care services when the individual engages in unhealthy behavior



Discussion

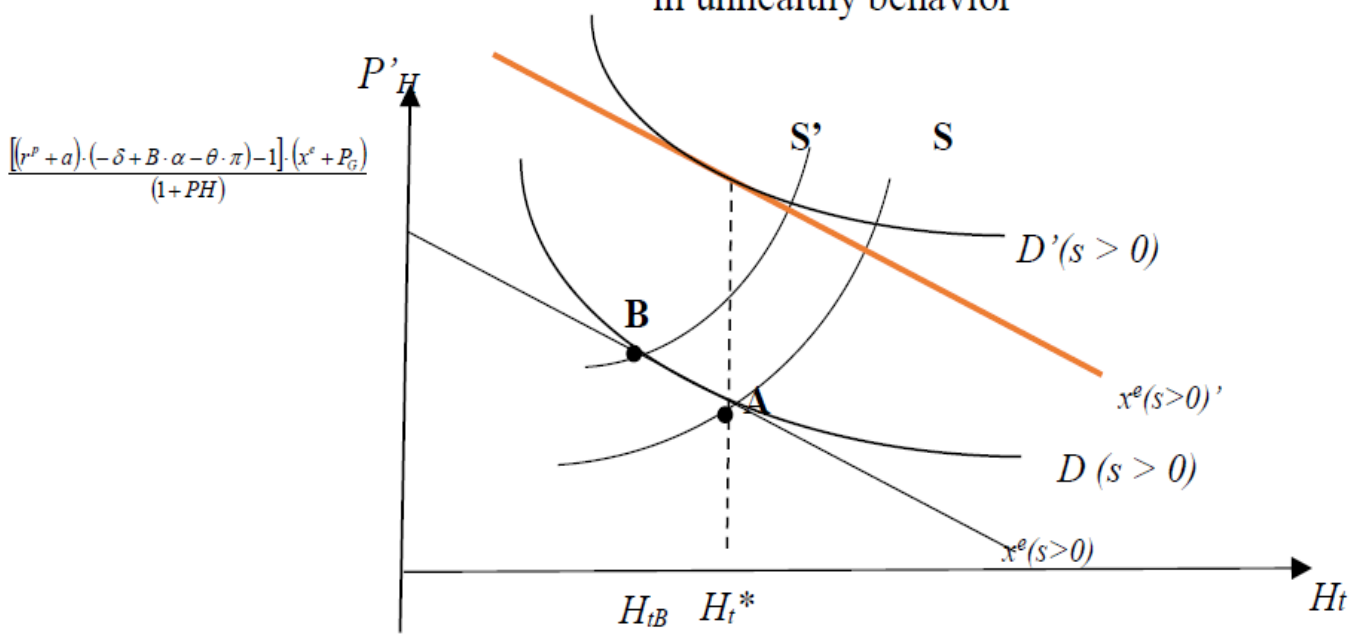
Model Implications for policy design

Barriers on the supply

In S' the individuals can access to less number of providers than in S. When that happens, there is in the short term a reduction in the demand for health care services. However, in the long term, to return the demand to its initially optimal level, policies should focus on increasing the marginal utility of seeking for health care.

As the prices rise due to the reduction of the number of providers in the health care market, increasing the utility from engaging in healthy behaviors we could ideally switch MgU to D'.

Fig 5. Representation of the demand curve for health care services when the individual engages in unhealthy behavior



Concluding remarks

The proposed model represents an adaptation of the Andersen (1986) behavioral model and Grossman (1972) health care demand model. The model accounts for variables significantly correlated with care-seeking behaviors in response to health problems/conditions.

The main contribution of this paper is our analysis of the impact of uncertainty and negative health investments on the decision of seeking care and adhering to treatment.

Concluding remarks

- The model is built on the principles of behavioral economics, Andersen's model for the decision of seeking care and Grossman model for the demand for health.
- In our model, we incorporate uncertainty through the possibility of suffering from co-occurring conditions, contextual variables and explore how supply and demand barriers affect to individual's decision of seeking care and adhere to treatment.
- The model seems to reflect real behavior on both scenarios, care seeking and treatment adherence, and could be useful for policy makers in the design of health promotion policies.

End

Thank you for your attention!

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