Average willingness to pay for disease prevention with personalized health information

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Subject

- The paper addresses the effect that personalized health information have on the average willingness to pay for disease prevention actions.
- The personalized information about the probability of disease **raises** the average willingness to pay for: 1) self-insurance actions if wealth and health are complementary and; 2) self-protection actions whatever the interaction between wealth and health.

Disease Prevention

- Disease prevention activities usually refer to the efforts made to reduce: 1) the probability of diseases (self-protection or primary prevention) and; 2) the severity of diseases (self-insurance or secondary prevention).
- The interaction between three instruments (insurance, self-protection and self-insurance)

Litterature Review

- The link between self-protection and prudence.
- The link between risk theory and health economics
- This paper complements these theoretical developments by examining **the effects that personalized health information** should have on the **willingness to pay** for disease prevention.
- The ever growing availability of health-related information **changes the way diseases are perceived by individuals and thus their propensity to prevent them**

Research problematic?

- An interesting question related to the development of

  personalized health information is whether the willingness to pay based on the average information (i.e. in the absence of personalized information) is higher than the average willingness to pay for prevention (i.e. with personalized information).
- Whether the relevance of prevention program is affected by the development of personalized health information?

Methodes and Results

- The consequences of the development of genetic testing?
- Mthode: The evaluation of the average willingness to pay of individuals differing in their baseline probability of disease
- **Results**: It is shown that the effects of personalized health information on the average willingness to pay for prevention actions **basically depend on the interaction between wealth and health in the utility function**, i.e. on whether individuals like or dislike the correlation between wealth-related and health-related harms.

Mathematical method

- Consider an expected utility maximizer who derives utility from wealth (w) and health (h), hence u(w, h)
- A given disease occurs with a probability p and lowers the individual's health status to h−m (where m denotes the severity of the disease). The individual expected utility is given by:
- EU = (1 − p)u(w, h) + pu(w, h −m)
- The willingness to pay (denoted Wp) for a reduction Δ in the probability of disease is defined by the following expression:
- (1 − p)u(w, h) + pu(w, h −m) = (1 − p + Δ)u(w −Wp, h) + (p − Δ)u(w −Wp, h −m)

- By approximate u(w −Wp, h) and u(w −Wp, h −m) through first-order Taylor expansions around u(w, h) and u(w, h −m) respectively: u(w −Wp, h) ~=u(w, h) −Wpu1(w, h)
- u(w −Wp, h −m) ~=u(w, h −m) −Wpu1(w, h −m)
- Inserting the third and fourth equations into second equation, we obtain after simplifications the following expression for:Wp
- ~= $\Delta[u(w, h) - u(w, h - m)]$
- $[(1 - p + \Delta)u1(w, h) + (p - \Delta)u1(w, h - m)] =$

$\Delta[u(w, h) - u(w, h - m)]$

EU1

- The last equation indicates that Wp is the ratio of the expected marginal benefit of self-protection (i.e.increasing by Δ the probability of experiencing the utility level associated to the healthy state instead of the utility level associated to the disease state) to the expected marginal cost of a monetary unit spent (i.e. a weighted average of the marginal utilities of wealth in the two states of the world).
- As for the change in the baseline of the diesease, another equation indicates how the willingness to pay for self-protection changes with the baseline probability

- of disease: $\frac{dWp}{}$

$$= \frac{\Delta[u(w, h) - u(w, h - m)]\,[u1(w, h) - u1(w, h - m)]}{[EU1]2}$$

- The sign of this equation is defined by $u1(w, h) - u1(w, h - m)$ i.e. the sign of $u12(w, h)$.
- The last inequalities can be explained as follows. If $u12(w, h) < 0$, the marginal utility of wealth is higher in the disease state.

- Reductions in the probability of disease, by changing the weight associated to the marginal utilities in the two states of the world, raise the expected marginal utility of wealth EU1 and thus lower the willingness to pay for self-protection. By the same reasoning, the willingness to pay for self-protection rises with the baseline probability of disease if u12(w, h) > 0.
- It is also mentioned that, no matter the sign of u12(w, h) the willingness to pay :

$\frac{d^2W}{dp^2}$

- Increases or decreases at an increasing rate (i.e. Wp is convex). The shape of the willingness to pay is defined by:
- $\frac{d2Wp}{dp2} > 0$
- The convexity of Wp with respect to the baseline probability of disease can be explained in the following way. Increases in p raise (resp. lower) Wp when u12(w, h) < 0 (resp. u12(w, h) > 0).
- These changes have the same impact (given by u1(w, h−m)−u1(w, h)) on the expected marginal utility of wealth. However, since they occur at different expected marginal utility levels, these
- (constant) variations in the denominator of (5) do not have the same impact on the ratio defining Wp.

- Suppose for instance that u12(w, h) > 0. In that case, the lower p, the higher the initial expected marginal utility of wealth and the lower the reduction of the marginal expected utility when p rises. If u12(w, h) < 0, the lower p, the lower the initial expected marginal utility of wealth and thus the lower the reduction in the expected marginal utility consecutive to an increase in p. In both cases, Wp is convex in p and, using the Jensen inequality, we conclude that the average willingness to pay is higher than the willingness to pay based on the average probability of disease.

- From this reasoning , we expect the development of genetic testing to raise the willingness to pay for self-protection actions.

- It is also seen by the authors that the information about the severity of the disease modifies the willingness to pay for reductions in the probability of disease.

  indicates that the willingness to pay for self-protection rises as the severity of the disease increases if u12(w, h) > 0. Increases in m raise the gap between being sick and being healthy and thus raises the marginal benefit of self-protection. Besides, when m rises, u1(w, h − m) falls if u12(w, h) > 0, lowering the expected marginal utility of wealth and thus the marginal cost of self-protection.

- Therefore, the severity of the disease raise the willingness

  to pay for self-protection if $u_{12}(w, h) \geq 0$ (sufficient condition) and has an undetermined effect if $u_{12}(w, h) < 0$. Let us assume that $u_{12}(w, h) \geq 0$. To assess the effect of the uncertainty about the severity of the disease on the average willingness to pay for self-protection actions, we must determine whether Wp is convex or concave in m.

- The conculsion is that when individuals become more informed about the severity of the diseases, the average willingness to pay for self-protection actions should increase.

- The willingness to pay (denoted byWm) for reductions
- Δ in the severity of disease is obtained from :
- $(1 - p)u(w, h) + pu(w, h - m) = (1 - p)u(w - Wm, h) + pu(w - Wm, h - m + \Delta)$

- Wm corresponds to the wealth variation which - when coupled with the reduction Δ (with Δ > 0) in the severity of disease - leaves individuals at the constant expected utility EU. The first order Taylor expansions of u(w −Wm, h) and u(w −Wm, h − m + Δ) around u(w, h) and

  u(w, h −m+Δ) respectively give:

  u(w −Wm, h) ~=u(w, h) −Wmu1(w, h)
- u(w −Wm, h −m+ Δ) ~= u(w, h −m+ Δ) −Wmu1(w, h −m+ Δ)

- The conclusion shows that:
- The willingness to pay for lower severities of disease is the ratio of the marginal benefit of self-protection (enjoying $u(w, h-m+\Delta)$ instead of $u(w, h-m)$ in case of disease) to the expected marginal cost of a monetary unit spent (i.e. the marginal utility of wealth in the two states of the world in which the money is spent). To ease the notation, let us denote the denominator of (13) by EU1 and $[u(w, h-m+\Delta) - u(w, h-m)]$ by Q.

- **As for the effect of the severity of the disease:**
- The equations indicate that $u12 \geq 0$ is a sufficient condition to obtain an increase in the willingness to pay for self-insurance actions when the severity of the disease rises. We now define the conditions under which Wm rises at an increasing rate with m (assuming again $u12 \geq 0$).

Research Plan(1)

- Average willingness to pay for self-protection
- Change in the baseline probability of disease , We expect the development of genetic testing to raise the willingness to pay for self-protection actions.
- Change in the severity of the disease, when individuals become more informed about the severity of the diseases, the average willingness to pay for self-protection actions should increase.

Research plan (2)

- Average willingness to pay for self-insurance
- **Change in the baseline probability of disease, the development of genetic testing should raise the average willingness to pay and thus increase the relevance of self-insurance programs if wealth and health are complementary (u12(w, h) > 0).**

Research plan (3)

- Effect of the severity of the disease, the average willingness to pay for self-insurance actions is expected to rise as individuals beco me better informed about the severity of diseases.

Conclusion

- The paper **evaluates** the way personalized information about the probability or about the severity of diseases **modify** the average willingness to pay for prevention actions. The conclusions obtained in the different cases considered are quite diversified and mostly depend on the interaction between wealth and health in individuals' utility functions.

What are the suggestions for future research?

- **Economic Perspectives on Personalized Health Care and Prevention** Kathryn A. Phillips[1] / Julie Ann Sakowski[2] / Su-Ying Liang[3] / Ninez A. Ponce[4],, Health Economics and Policy. Volume 16, Issue 2, Pages 57–86, ISSN (Online) 1558-9544, ISSN (Print) 2194-6191, DOI: 10.1515/fhep-2013-0010, July 2013
- **Identify Key Factors in Determining the Value of Prevention**
- **Use Real World Perspectives in Economic Analyses**
- **Consider Patient Heterogeneity and Diverse Populations in these kind of Economic Analyses**
- **Assessing Value of personalized information received from genetic tests and their role in disease prevention and increasing willingness to pay**
- **The role of Behavioral Economics in disease**

Other recent References and observations:

- **The Economics of Personalization in Prevention and Public Health,** Don S. Kenkel[1] / Hua Wang[1], Health Economics and Policy. Volume 16, Issue 2, Pages 87–105, ISSN (Online) 1558-9544, ISSN (Print) 2194-6191, DOI: 10.1515/fhep-2013-0011, July 2013,

As an example?

- General population respondents' average willingness to pay for a genetic test for colorectal cancer risk was US$150. Higher willingness to pay was significantly associated with being male, having higher income and education, having private health insurance and reporting a greater likelihood of getting colorectal cancer screening when due.

- Physicians' beliefs about patients were different than general population responses: physicians believed patients would be willing to pay more (US$212; $p < 0.001$), fewer believed patients would not pay (1 vs 17%; $p<0.001$), and if a genetic test indicated higher than average risk, physicians believed patients would be more likely to get screened (65 vs 46%; $p < 0.001$) and would choose alternative screening tests (62 vs 22%; $p < 0.001$). **(from :Valuing personalized medicine: willingness to pay for genetic testing for colorectal cancer risk)**
- Stephanie L Van Bebber[1†], Su-Ying Liang[1], Kathryn A Phillips[1], Deborah Marshall[2], Judith Walsh[3] & Nathalie Kulin[2]

Questions for authors

- **How do you evaluate the accessibility and availability of personalized information?**
- **Do you intend to add an observation in a selected population, using quantitative data?**

- **Do you intend to clarify the cross connection between internal varibles like:personal drivers:age, sex, education, culture, etc and public drivers the economic crisis in health care systems and their tendency to more privvate systems and non-reimbursement of genetic tests**

- **Thank you very much**