

Willingness to pay for risky lifestyles: results from the Pay for Others (PAY4O) study.

Eliminato: Ethics or money?

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Short title: Willingness to pay for risky lifestyles

Keywords Willingness to pay; health risks; lifestyles

Abstract

Introduction

We assess the individual willingness to pay for diseases arising from risky lifestyles and investigate the personal factors that influence such willingness.

Study Design

We conducted an online survey with 821 respondents in Italy. The questionnaire was distributed via Facebook© in July and August 2016. The questionnaire covered socio-demographic characteristics, health status, behaviour and psychological attitudes, economic status and opinion about covering the healthcare costs related to overeating, unhealthy diet, sedentary lifestyles, alcohol abuse, tobacco smoking, driving under the influence of alcohol, and illegal drug use by.

Methods

We performed:

- the study of the patterns in the dependent variables by Principal Component Analysis
- analysis of the determinants by Holdout Variable Importance measure (HOIT) obtained in Random Forest
- we used ordered Logit models

Results

Participants agreed with the idea that public health care should be provided for problems arising from bad eating habits and sedentary lifestyle (50.4%), while the healthcare consequences of the other risky behaviours should not be publicly financed by the Italian National Health Service

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(INHS).

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Conclusions

Our study gives an overview of the willingness to pay of a population living in a country where financing of the Health Service is based on general taxation. So, these results may be generalized, with due caution, to all the countries where the Health Service offers universal coverage and is operated by the government, but of course not to scenarios related to market-based or social health insurance systems.

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Introduction

The fight against non-communicable diseases is one of the main challenges of modern health care systems. Non-communicable diseases (NCD) are the main factor explaining mortality and health care expenditure in OECD Countries; in Italy 92% of death are amenable to NCDs as well as 10% of premature deaths (1,2).

Lifestyle is often one of the main determinants of these conditions, or its cause altogether. For example, physical inactivity alone is estimated to cost 9.2 billion € in the EU-28 countries (1.5 in Italy) (3-5).

Policy discussion around considering lifestyle in regulating finances and granting access to health care is not new. Many governments have tried to use affect lifestyle by indirect instruments such as taxes, subsidies, and information campaigns, often with controversial results (5-11).

This discussion has ethical as well as economic aspects. From an ethical point of view, it may seem unfair to deny treatment to an individual; on the other hand, individual responsibility requires everybody take the blame for his/her actions (12-14). From an economic point of view, priority and rationing in health care are necessary because of scarce resources, but there is no consensus on how to implement such rationing (15-21).

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The rationing measures proposed so far are usually related to appropriateness of care and expected effectiveness of the treatment; in the future, more severe measures such as rationing on lifestyle may become necessary to reduce the financial burden of non-communicable health diseases. The

use of these measures will depend on the value judgment that the public will make about their willingness to pay for treating the health damages caused by a risky lifestyle. The literature on this aspect is rather scant and usually relates to assessing the importance of the solidarity principle in public health care finance or the inclusion of a lifestyle risk in insurance premiums (1,22-27).

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Miraldo et al. used a convenience sample of 140 London residents to elicit attitudes to paying for health costs related to risky lifestyles (28). Le Clainche and Wittwer used a group of students to test alternative forms of payments for the health cost arising from different lifestyles (29).

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In this article, we present and discuss the results of the PAY4O (Pay for Others) study aimed to assess the individual willingness to pay for diseases caused by risky lifestyles and to investigate personal characteristics that could influence such willingness. The analysis was performed in Italy, a country where about 77% of health care expenditure is financed by general taxation (30). Hence, the increase in expenditure due to risky lifestyles is borne by the whole community.

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Methods

Data were collected by a self-administered web-based survey in July and August 2016, using the online survey software LymeSurvey (LymeSurvey GmbH, Hamburg, Germany). The questionnaire was distributed via the Facebook social network site. An *ad hoc* Facebook page was created. The post containing the link to the survey was planned to reach more than 30,000 persons aged 18 or older, with a distribution in all Italian regions. **The link to reach and to fill our questionnaire was sent to all the contacts of the authors and in this way a snow ball effects was started.**

The questionnaire included forty-nine questions divided into five main sections: Socio-Demographic, Health Status, Behaviour and Psychological Attitudes, Economic and Target. An English translation of the Italian questionnaire and the complete list of variables are presented in Appendix A and B, respectively. The questions are essentially in line with a similar questionnaire published by Miraldo et al. in 2014 (28).

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Ethical approval and informed consent

Before accessing the online questionnaire, all respondents were provided with information about the study and were asked to give their consent to participate. The participation was totally anonymous and voluntary, and the respondents received no remuneration. The study involved no risk or harm to any respondents, and data collected were processed only statistically for scientific purpose. The study was reviewed by and received ethics clearance from the Ethics Committee of the University of Milano (opinion No. 28/15 03.06.2015).

Data analysis

The analysis of data was conducted in several steps:

1. Data preparation: questionnaires that were not completely filled in were excluded. We also ran some consistency checks to exclude questionnaires that were clearly not genuine. These checks have included: age, height, weight, BMI and gender-specific consultations.
2. Analysis of the dependent variables: this step describes opinions on which health care cost caused by risky behaviours should be paid by the **Italian National Health Service (INHS)** and the strength of these opinions.
3. Study of the patterns in the dependent variables: by Principal Component Analysis (PCA). PCA is a data reduction technique, which can show how variables cluster together according to the amount of information they share. In our case, it allows to determine whether an individual (not) willing to pay for a specific risky lifestyle is also (not) willing to pay for another one. For each question, we have excluded the 'Do not Know' answers, leaving the original categorization otherwise unchanged
4. Analysis of the determinants. We select variables relevant to willingness to pay by extending the testing approach of Janitza et al. published in 2016 to datasets with a small number of covariates (31). Such method is based on the Holdout Variable Importance measure (HOIT) obtained in Random Forest. Random Forest is a well-established machine-learning tool that can be particularly attractive when there are no prior assumptions on the relationship among

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variables; it allows covariates to be of any kind without the need of pre-processing or filtering: variables can be numeric, categorical (ordered or nominal), and binary, as in the problem at hand. Analyses were performed with the ranger package in R, while the code to implement the HOIT was written in R by the authors. For each question, we excluded the ‘Do Not Know’ answers.

5. Ordered Logit models: the variables found to be significant in the previous step were used to estimate ordered logit model.

Ordered logit models are frequently motivated by a latent variable model. Let y denote a random variable taking one of the J possible values. There is an unobserved latent variable Y that is determined by

$$Y = \alpha + \beta X + \sigma \varepsilon$$

where Y is a variable that measures willingness to pay for risky behaviour, X is the vector of influential variables detected by the Random Forest, and ε is a mean zero random error term and σ is a parameter that allows the variance of the error to be shifted up or down.

The observed random variable y is determined as follows:

$$y = 0 \text{ if } Y \leq \alpha_1$$

$$y = 1 \text{ if } \alpha < Y \leq \alpha_2$$

⋮

$$y = J - 1 \text{ if } Y > \alpha_{J-1}$$

Where $\alpha_1 < \alpha_2 < \dots < \alpha_{J-1}$ are threshold parameters that determine the observed outcome.

The results of the model have been used to compute marginal effects obtained with the package OGLMX in R.

Results.

Characteristics of the sample

1435 individuals started the questionnaire, but only 821 completed it. The analysis was carried out on these complete answers. The internal checks have suggested the exclusion of 4 questionnaires. Complete descriptive statistics of all variables are shown in Appendix B.

Willingness to pay

Table 1 presents the distribution of the responses regarding willingness to pay for the seven risky behaviours proposed.

Table 1. Description of the willingness to pay in the sample.

	Definitely yes %	More yes than no %	More no than yes %	Definitely No %	Do not know %	Overall Yes %	Overall No %
Illicit drug use	16.2	23.9	26.2	29.8	3.9	40.1	56.0
Tobacco smoking	15.7	23.5	29.7	28.2	2.9	39.2	57.9
Overeating	19.3	31.8	30.2	15.4	3.2	51.1	45.6
Unhealthy diet	18.2	34.2	30.8	13.7	3.1	52.4	44.5
Alcohol abuse	16.3	26.9	27.7	26.9	2.2	43.2	54.6
Drink and drive	12.0	14.4	18.4	51.8	2.9	26.4	70.2
Sedentary lifestyle	18.1	32.3	27.1	17.3	5.1	50.4	44.4

Overall yes=Definitely yes+More yes than no
Overall no=Definitely no+More no than yes

For six of the seven lifestyle behaviors, opinion on whether health care costs should be paid for by the **NHS** is divided, with three behaviors (tobacco smoking, illicit drug use and alcohol abuse) drawing majorities somewhat over 50% in favour of public financing, while the other three behaviors (unhealthy diet, overeating and sedentary lifestyle) had majorities a little above 50% against it. The former three behaviors describe substance (ab)use, the latter three the field of nutrition and exercise. Public financing of the health consequences of the seventh behaviour, drinking and driving, is rejected by a large majority.

The share of respondents choosing a 'definitely' answer ('definitely yes' plus 'definitely no') can be interpreted as an indicator of opinion strength. For the substance use/abuse behaviours, opinion strength is higher than for the the diet- and activity-related risks That means the public is more firm

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in rejecting the idea of covering the cost for health care caused by substance-use behaviours than it is in accepting to cover the cost for nutrition and activity risks. There seems to be some uncertainty in the sample with regard to the latter risks, which might also explain the highest percentage (5.1%) of 'I don't know' answers for covering the cost for the health consequences of a sedentary lifestyle.

Patterns in the dependent variable

For PCA, the variance explained by the first two components is 78.9%, hence only two factors will be considered. The original variables seem to cluster into two groups as shown in Table 2.

Table 2. Factors loads for the PCA

	1 st Principal Component	2 nd Principal Component
Illicit drug use	0.9*	0.18
Alcohol abuse	0.87*	0.32
Tobacco smoking	0.79*	0.39
Drink and drive	0.74*	0.36
Sedentary lifestyle	0.2	0.87**
Unhealthy diet	0.36	0.84**
Over-eating	0.56	0.67**

The PCA thus yields the same typology of behaviors that the analysis of the frequency counts above, but it also groups the drinking and driving behaviour with the substance use items (first principal component, where it belongs in terms of substance).

The higher the loading the higher a variable is correlated with the component. It is interesting to note the pattern in the answers. Component 2 contains the eating and exercise behaviours whose health consequences a majority wants to be covered, while Component 1 collects the substance use items where a majority disagreed with public financing. The components mean that, on average, if one agrees (does not agree) to financing a risky behaviour belonging to a component, the same person is also likely to agree (disagree) to financing other behaviours that are part of the same component. This is true for both components, but the internal consistency is higher for the substance use behaviours.

The other interesting result is that respondents differentiate among behaviours and do not uniformly agree that the **NHS** should (not) pay for risky behaviours. Individuals seemed to attach a stigma to

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risky behaviours associated with substance use/abuse, where majorities hold that health risks should be borne by the individual. On the other hand, for the dieting and activity behaviours, the respondents seemed to be more prone to think that individual responsibility plays a less important role, hence the **NHS** should pay for the cost deriving from these risks. This intuition has been further tested using Random Forest on a count variable, summing up the positive values (Definitely Yes, More Yes than No=1) of the dummies used to estimate the association between the characteristics of the respondents and their willingness to pay for each unhealthy behaviour (see Appendix C). The results show that there is no association between the count variables (that can be interpreted as an average willingness to pay) and individual characteristics.

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Random Forest Estimations

Illicit drug use: 56% of those responding to the questionnaire disagreed with the idea that the **NHS** should pay for care deriving from illicit drug use. The Random Forest estimation (Appendix C) showed an association with age, religion and number of cigarettes, which have been used to estimate the logit model. The marginal effects of the relevant variables are presented in Table 3.

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Table 3. Marginal effects on the willingness to pay for health risk of illicit drug use.

	Marginal Effect	Marginal Effect 95%		P Value
		-		
Age	0.0033	-0.0026	0.0092	0.2717
Religion Others	-0.3337	-0.7864	0.1190	0.1485
Religion Catholic	-0.2942	-0.4791	-0.1094	0.0018
Religion Not Available	0.0579	-0.2644	0.3802	0.7246
Number of cigarettes	0.0199	0.0094	0.0304	0.0002

Mc Fadden R2=0.01627

Religious beliefs seem to be significant in this case. Being Catholic significantly reduces, by 29%, the probability of agreeing with the idea that the **NHS** should pay compared to being atheist

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(baseline). Age seems to have a positive effect on the probability of agreeing as well as the number of cigarettes smoked. Both effects are however very small (0.03 % and 0.2%, respectively).

Tobacco smoking. 58% of those responding to the questionnaire disagreed with the idea that the

NHS should pay for health care deriving from tobacco smoking. The Random Forest estimation (Appendix C) showed an association with religion, BMI and smoking habits (being a present smoker, past smoker, number of cigarettes smoked at present or in the past), which have been used to estimate the logit model. In this case, the estimation with all the influential variables detected by the Random Forest was not feasible due to perfect multicollinearity between the dummy variable: never smoked and the number of cigarette smoked (individuals who never smoked correctly declared zero cigarettes). The relationship between smoking habits and their importance (measured by the number of cigarettes smoked) could be non-linear. For this reason, we have estimated a logit model where the dummies for smoking habits have been interacted with the number of cigarettes smoked. In this way, we can capture the fixed effect (being a smoker –past or present) and the variable effect (how bad the habit is/was). However, these interaction variables have proved to be non-significant. A closer inspection of the variable number of cigarettes (see Appendix B) showed that present and past smoking habit were quite similar. For these reasons, we have deleted the number of cigarettes from the analysis.

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As in the previous estimation being Catholic reduced the probability of agreeing with paying by 28% while other religions were not statistically significant. A strong and significant positive relationship was found with smoking behaviour. The effect of the latter is quite interesting: past smokers are likely to be more willing than present smokers to agree with the idea that the NHS should pay for cost deriving from tobacco smoking (52% vs 26%, respectively).

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Alcohol abuse. 55% of those responding to the questionnaire disagree with the idea that the NHS should pay for diseases due to alcohol abuse. The Random Forest estimation (Appendix C) showed an association with religion and smoking habits (dummy for being a present smoker, dummy for being a past smoker, number of cigarettes smoked at present or in the past). For the same reasons as

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presented above, the number of cigarettes have not been considered in the estimation of the logit model). The marginal effects of the relevant variables are presented in Table 4.

Table 4. Marginal effects on the willingness to pay for alcohol abuse.

	Marginal Effect	Marginal Effect 95%		P Value	Sign
Religion Others	-0.2623	-0.7119	0.1873	0.2529	
Religion Catholic	-0.3745	-0.5579	-0.1911	0.0001	***
Religion Available Not	-0.0378	-0.3503	0.2746	0.8125	
Cigarette smoker	0.2236	0.0438	0.4035	0.0148	*
Ex Cigarette smoker	0.2832	0.0760	0.4904	0.0074	**

Note: Standard error in parenthesis. *: significant at 90%; ** significant at 95% ; ***: significant at 99% ; Mc Fadden R2=0.15 logit

The results for alcohol abuse were quite similar to those for tobacco smoking. In this case, there was not a one-to-one association between agreeing with paying and the risky behaviour, but a sort of indirect relationship through smoking.

Other risky behaviours

The Random Forest estimation (Appendix C) showed that the participant's characteristics were not associated with the willingness to pay for overeating, unhealthy diet, drink and drive and sedentary lifestyles.

Discussion

In public health care systems, the growing cost of health care requires the assessment of the willingness to pay for treatments offered by the public sector. As lifestyle is emerging as one of the most important determinants of health care costs, in this analysis, we have tried to measure the willingness to pay of a convenience sample of Italian individuals (2,32).

In our sample, individuals seemed not simply to be 'in favour' or 'against' paying for risky lifestyles; they rather differentiated between different risky behaviours. In general, there seems to be more willingness to pay for risks deriving from eating and sedentary lifestyle. On the other hand, overall rejection of paying was more frequent for alcohol abuse, illicit drug use and tobacco smoking. The least willingness to pay was found for behaviours that may harm other people (70.2%

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disagreed with paying for the risk of drink and drive). Several explanations can be given for these results. Several campaigns were launched through the years to warn people about risks deriving from smoking and drinking, and since 2003, in Italy, tobacco smoking has been banned from public places. Illicit drug use is a criminal offence, and the punishment for driving under the influence of alcohol has been stiffened recently. These communication and legislative activities could be responsible for the unwillingness to pay for health care costs deriving from these types of risky behaviours.

In contrast, the emphasis on healthy diet in public communication is more recent and the messages are somehow 'controversial', due to the massive presence of misleading advertising. Also, the risks related to a sedentary lifestyle seemed not to be well perceived, causing the highest level of 'I don't know' replies (5.1%), maybe due to a possible misperception of the level of physical activity that is necessary to be active. These results are more interesting taking into account the high level of education of the population included in the sample (52.8% graduated/post-graduated) and the well-known association between risk awareness in health and level of education. (33). This in spite of

recent studies showing that the direct cost to the NHS of physical inactivity is of about 1.6 billion €⁴ while about 10% of total disease-adjusted life years lost depend on dietary risks (33). We found

an association between willingness to pay for the health damages caused by illicit drug use, tobacco smoking and alcohol consumption on the one hand and two main individual factors on the other: personal beliefs (religious creed) and indulging (or having indulged) in risky behaviours. This result is partially in line with Miraldo et al., but it is somehow stronger since in our case no economic variables were significant (28). Moreover, our findings are in line with Le Clainche and Wittwer who, in a different context, showed that there should be a link between payment for health and lifestyle, but the link should be made on the ground of equity and justice rather than economic considerations (29).

No association was instead found between willingness to pay for the other risky behaviours examined and participant characteristics. For drink and drive, the result was probably justified by

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the high number of respondents who were against the payment (70.2%). This work used a unique dataset and an innovative estimation technique. The innovative procedure presented in this paper allowed to use machine learning tools such as Random Forest also for smaller datasets (see Appendix C). These techniques are particularly suitable for studies with no prior assumptions on the influential variables, a case that applies rather often to public health studies.

A main limitation must be considered in interpreting the results of this study. We examined a convenience sample of Italian citizens recruited on a voluntary basis using a social network platform.

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The level of education was slightly higher than for the Italian population (52.8% vs 34% graduated/post graduated), and women were overrepresented (72% vs 51%).⁴⁰ The unemployment rate was rather low (4.2% against the national average of 11.7% according to the latest ISTAT data), which is in line with the higher level of education of the sample. Income distribution was similar to the national one, although our sample average income was higher (34).

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Although being a convenience sample, our dataset reflects very well the characteristics of the group of individuals that contributes mostly to financing health in the Italian NHS. In fact, the majority of respondents were individuals in their working age (mean age 42.4 years), usually employed (66.9%): in a public health care system, as the NHS is, this is exactly the group who contributes most to financing health care.

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Furthermore, willingness to pay was investigated in relationship with many population characteristics not only in the socio-demographic area but also regarding personal health status, behaviour and psychological attitudes, and economic indicators. All this information allowed us to account for the main factors that could influence the agreement that NHS should pay (not) for health care costs deriving from risky behaviours.

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Differently from Miraldo et al., we investigated the willingness offering an 'I don't know' option alongside scaled responses (definitely yes, more yes than no, more no than yes, definitely no), in order to capture respondents' indecision and not to force them to take a clear-cut position (28). In

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fact, indecision was quite present in some specific risky behaviours. Our study is also significantly different from Borges et Al., where the authors studied the willingness to pay for other individuals' health out of pocket, in an altruistic manner (35).

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Our study gives an overview of the willingness to pay of a population living in a country where financing of the NHS is based on general taxation. So, these results may be generalized, with due caution, to all the countries where the Health Service offers universal coverage and is operated by the government, but of course not to scenarios related to market-based or social health insurance systems.

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From a Public Health point of view, there are health risks where the population does not seem to hold strong opinions on whether the NHS should or should not pay for the consequences. These include some very important risk factors for chronic diseases, such as unhealthy diet and sedentary lifestyle. On the other hand, for those areas where the respondents gave more definitive answers, ethics rather than economic considerations seemed to influence willingness to pay. These include behaviours that are either illegal (drug abuse), highly stigmatised (smoking and alcohol abuse) or dangerous for other people (drink and drive). All these behaviours are probably perceived as a signal of antisocial attitudes, whose consequences should be borne by the individuals adopting such lifestyle rather than by the whole community.

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