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Examining Willingness-to-Pay and Zero Valuations for a Health Improvement with Logistic Regression

Afentoula G. Mavrodi, PhD[1], Stavros A. Chatzopoulos, PhD[2], and Vassilis H. Aletras, PhD[1]

Abstract

Study aim was to elicit the Greek general population's willingness-to-pay (WTP) for a health improvement (recovery to perfect health), examine attitudinal differences between willing- and unwilling-to-pay individuals regarding healthcare services provision, and investigate —using a logistic regression model—demographic/socioeconomic factors impact on their intention to pay for a health improvement. A research tool was developed to conduct a cross-sectional stated-preference telephone-based survey (January-February 2019) and a representative sample (n = 1342) of the Greek general population was queried. The computer-assisted telephone-interview (CATI) method was used to ensure random sampling. WTP was elicited using the iterative bidding technique. Participants' attitudes toward healthcare services provision were assessed through pre-defined statements. Test-retest reliability of these statements was assessed using intraclass correlation coefficients (ICC). Logistic regression was employed to identify sociodemographic factors' effect on WTP intention. Differences among individuals' attitudes were assessed using the chi-square test. All analyses were conducted using the IBM SPSS Software v.25.0. Analysis showed acceptable reliability for WTP estimates (ICC = .67) and good reliability for healthcare services assessment statements (ICC = .83-.94). Mean WTP was estimated at €439.8. Respondents with higher educational level and higher household income were more likely to be willing to pay for a health improvement. On the contrary, older participants were less likely to be willing to pay. Most participants who considered public healthcare services to be of high quality were unwilling to pay. Logistic regression analysis led to the development of an effective predictive model regarding factors affecting individuals' WTP intention for a health improvement. Further classification of unwilling-to-pay individuals into protest responders and "true" zero valuators showed that protest responders are unlikely to be representative of the population. Hence, study results can be used for debiasing WTP responses, leading to a more accurate use of WTP estimates by policy makers, exploiting WTP values in medical interventions cost-benefit analysis within reimbursement decisions framework.

Keywords

contingent valuation, logistic regression, health economics, stated-preference study, protest responses, zero valuations, Greece

What do we already know about this topic?

Although contingent valuation has been widely used in healthcare, employment of logistic regression to assess willingness-to-pay (WTP) and zero valuations within the healthcare environment is rather limited.

How does your research contribute to the field?

The present research adds to the economic evaluation literature by examining WTP and zero valuations for a health improvement through logistic regression and offering insights on the impact of sociodemographic factors on individuals' likelihood to be willing to pay for an improvement in their health achieved through a general treatment offering recovery from their current health state to perfect health. Moreover, it adds to the Greek economic evaluation literature by eliciting a WTP estimate for a health improvement, employing for the first time a large representative sample of the Greek general population.

What are your research's implications toward theory, practice, or policy?

Most prior contingent valuation studies have focused on the effect of sociodemographic determinants on WTP estimates. The logistic regression approach adopted in the present cross-sectional stated-preference survey aims at classifying individuals into 2 discrete classes (those willing and those not willing-to-pay for a health improvement) and assessing the impact of sociodemographic characteristics on their intention to pay for a health improvement achieved through a general treatment offering recovery to perfect health. Moreover, this study offers insight with respect to potential differences in socioeconomic factors impacting WTP intention when protest responses and "true" zero valuations are distinguished and considered in the analysis. Therefore, this study separates willing and unwilling individuals based on their sociodemographic characteristics and further examines how these characteristics affect protest responses and zero valuations. Consequently, study results can be potentially used for debiasing WTP responses. The latter could lead to a more accurate use of WTP estimates by policy makers, who intent to exploit WTP values in cost-benefit analysis of medical interventions within the framework of reimbursement decisions. With respect to the private sector, the logistic regression model developed in the present study could constitute a supportive tool in the decision-making process in order to identify individuals willing to pay out-of-pocket for a health improvement, and therefore, target potential clients and promote specific insurance programs accordingly.

Introduction

Economic evaluation constitutes a health economics tool adopted by policymakers to facilitate informed decisions in healthcare budget allocation and reimbursement of medical interventions.[1-3] Within the economic evaluation framework, the Contingent Valuation (CV) Method constitutes a widely used technique to elicit a monetary estimate for the perceived value of a medical treatment with no market value. Specifically, respondents in CV studies are asked to consider a scenario for a hypothetical treatment and state their maximum willingness-to-pay (WTP) to ensure the health improvement offered by this treatment.[3-9]

Many CV studies have found that individuals' demographic and socioeconomic characteristics[4,5,8-16] have an impact on WTP values. Nevertheless, research on the impact of the above factors on the likelihood of an individual having a positive (non-zero) WTP for a treatment is rather limited. Only 2 recent studies held in Malaysia[17,18] have explored the impact of demographics on the probability of a person's intention to pay for Hepatitis B and dengue vaccines, which target people suffering from the respective diseases.

Unwilling to pay participants constitute a great concern in CV studies since it is deemed important to assess whether these participants constitute "true" zero valuations or protest responses. Respondents who report zero valuations in CV studies may genuinely value a treatment at zero ("true" zero valuation), due to inability to pay[19] or if they consider this treatment to be of no value for them.[20-22] However, zero valuations could also be protest responses,[19] which suggest a protest against payment, primarily due to the fact that participants consider paying for a treatment someone else's responsibility, such as the government's.[20-22] Protest responses may account for 50% to 73% of overall zero valuations in CV studies depending on the goods/services being valued.[19]

There is no consensus regarding the appropriate handling of protest responses in CV studies. Sociodemographic characteristics of protestors are likely to vary from non-protestors that give "true" zero valuations.[19] Some researchers[23,24] support that protest responses should be eliminated from the analysis. Others[20,22,25] claim that this is not an appropriate approach from a statistical perspective, since it might lead to sample bias due to protestors' different sociodemographic characteristics. It is suggested that the removal of protest responses can be sustained only if the characteristics of such respondents do not significantly differ from those with positive valuations.[19] Moreover, if protest responses are included when considering WTP values, estimates might be inaccurate and lower with respect to the true economic value of the treatment under consideration.[19] Hence, classification of protest and "true" zero valuations is important in order to reach accurate WTP estimates and also uncover any sociodemographic variables associated with protest responses. It is unlikely that protest responders are representative of the entire population, hence, removing protests will lead to unrepresentative samples.[19]

[1]University of Macedonia, Thessaloniki, Greece
[2]Aristotle University of Thessaloniki, Thessaloniki, Greece

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Corresponding Author:
Afentoula G. Mavrodi, Department of Business Administration, University of Macedonia, 156 Egnatia Street, Thessaloniki 546 36, Greece.
Email: amavrodi@uom.edu.gr

The logistic regression approach adopted in the present study aims to shed light into individuals' classification between those willing and those not willing to pay for a health improvement, based on a range of sociodemographic characteristics. Sociodemographic differences between the 2 groups might indicate the need for further classification of unwilling to pay individuals into "true" zero valuations and protest responses.

The popularity of logistic regression models (LRMs) may be attributed to the straightforward interpretability of model parameters and ease of use. LRMs provide high flexibility, potentially resulting in model overfitting, thus reducing model accuracy on previously unseen cases. However, given the low complexity of the LRMs, overfitting is less of an issue.[26,27] Moreover, logistic regression allows incremental building of models and has low generalization error.[26] All the above render LRMs ideal for our research.

To date, CV studies conducted within the Greek healthcare setting focus solely on providing WTP estimates for disease-specific interventions.[9,28] Therefore, to the best of our knowledge, no previous empirical research has estimated the Greek general population's WTP for a general treatment offering recovery to perfect health.

The aims of this study were to elicit the Greek general population's WTP for a health improvement and to explore sociodemographic differences between willing to pay and not willing to pay individuals, offering insight on how to treat protest and "true" zero valuations.

Methods

Study Design and Sample

A cross-sectional stated-preference survey was conducted from January to February 2019. A representative, with regards to age, gender, and region of residence, sample of 1342 adults from the general Greek population, was randomly selected. Respondents' recruitment was performed by the University Research Institute of the University of Macedonia, Thessaloniki, Greece, through stratified random sampling. Based on the population of each of the 9 geographical regions in Greece, a percentage distribution was allotted to the sample (strata). This ensured that the sample was representative of the Greek general population with regards to region of residence. Then, within each geographical stratum, random sampling was applied, to improve sample precision by mitigating coverage error.[6] Last, the sample was adjusted for non-responses by post-stratification weighting to mitigate non-response rate.[29] Respondents completed the survey via telephone interviews, adopting the Computer-Assisted Telephone Interview (CATI) method. This allowed, through random-digit dialing, an equal chance of selecting a person to participate in the survey. Use of the CATI method ensured random sampling within strata.[6]

Survey Tool

The survey tool developed for this research followed the design of the questionnaire described in a previous study[11] and consisted of 4 parts: (i) assessment of current health state using EuroQoL-5D-3L[5,12,30]; (ii) WTP elicitation; (iii) assessment of healthcare services provision; and (iv) demographic/socioeconomic characteristics.

The Greek version of the Euro-QoL-5D-3L has been validated for the Greek general population[31] and EQ-5D responses were transformed into utilities using the UK TTO-based value set.

For WTP elicitation, the individual perspective was adopted and participants assessed a new available treatment, with no adverse effects or risk, which during administration, would relieve them of all health problems/symptoms allowing recovery to perfect health. This treatment was set not to be reimbursed either by the National Health System or private insurance; monthly payments were out-of-pocket (OOP) from respondents' total net disposable income. Willing to pay participants were distinguished from those not willing to pay (protest responders) through a filter yes/no question.[32] Respondents offering a negative answer to the filter question, were asked to identify the reason for their attitude through a follow up question, in order to detect protest responses.[6]

WTP was elicited using the iterative closed-ended bidding technique, where the lower and maximum bids offered were €1 and €8192, respectively. Starting from the minimum (maximum) bid, if respondents replied positively (negatively), the payment was doubled (halved) until they were unwilling (willing) to pay the specified amount.[9,11,33-36] The maximum bid offered was set at 10 times the monthly net national disposable income of the year of study (€13 991), without though exceeding it;[37] an approach followed by researchers in similar studies.[9,11,34,35] Finally, participants had to respond to a 0 to 10 certainty scale (0 referring to no certainty and 10 to extreme certainty) with respect to the WTP amount they provided.[4,10]

Respondents' overall satisfaction from healthcare services provision was examined through a 0 to 10 satisfaction scale (0 referring to extremely dissatisfied and 10 to extremely satisfied).[7] Individuals' attitudes toward equity in access and quality of healthcare services were assessed through 3 pre-defined statements.[38] Specifically, participants had to respond to the following assessment statements (AS): "All Greek citizens have equal access to public healthcare services" (AS1), "Public hospitals and health centers offer healthcare services of high quality" (AS2) and "Doctors in public hospitals and health centers are respectful" (AS3). Respondents were asked to state the extent to which they agree with each statement (to a great/moderate/little extent/not at all).

Finally, respondents had to report their age, gender, educational level, professional status, marital status, household

size, number of household members holding either a part- or full-time job and net monthly disposable household income.

Pilot Testing, Validity, and Reliability Assessment

Survey tool development was based on literature review, cognitive interviews assessing questions' clarity and understanding, and a pilot study examining questionnaire validity and reliability. Through an extensive literature review a first version of the questionnaire was developed. This version was assessed through 15 semi-structured interviews. The 15 respondents who participated had different sociodemographic characteristics in terms of gender, age, and educational level and were requested to comment on questions' relevance, clarity, and comprehensibility. Through these interviews, questionnaire content validity was verified.

In the pilot study conducted (n = 103) no difficulties in understanding and completing the questionnaire were observed. About 97 out of these 103 participants completed, via telephone interviews, the questionnaire twice, under the same conditions, over a period of 2 weeks. Questionnaire construct validity was assessed through known-groups validity. Specifically, we examined, through 2 hypotheses, whether the WTP estimate is sensitive toward participants' ability to pay for a health improvement (H1: Income level is positively correlated with WTP; and H2: The WTP estimate for the overall sample differs significantly from the respective WTP estimate for participants stating a WTP value equal to or less than their net monthly disposable household income). These hypotheses were tested through a Kruskal-Wallis *H* Test and a Mann-Whitney *U* Test, respectively. Non-parametric analysis did not reject the validity hypotheses tested, verifying known-groups validity and showed that indeed the WTP estimate is as expected sensitive to participants' income level ($P = .000 < .001$).

The reliability of the survey tool was examined through the test-retest approach using the intraclass correlation coefficient (ICC) (2-way mixed-effects model, absolute agreement), where a value of .6 and .8 refers to acceptable and good reliability, respectively.[39] Analysis showed acceptable reliability for WTP estimates (ICC = .67, 95% CI: 0.51-0.78) and good reliability for healthcare services assessment statements (ICC values ranging from .83 (95% CI: 0.76-0.89) to .94 (95% CI: 0.91-0.96)).

Data Analysis

WTP was calculated for: (a) all willing to pay participants, (b) participants stating a WTP value equal to or less than their net monthly disposable household income (WTP_{income}), (c) participants being less or very certain for their stated WTP value ($WTP_{low\_certainty}$, $WTP_{certainty}$), and (d) participants stating a WTP value equal to or less than their net monthly disposable income and being very certain for the stated WTP value ($WTP_{income\_certainty}$). Participants were classified as less or very certain by setting the value "7" as the cut-off point on the certainty scale employed.[40,41] Differences between those estimates and the main WTP outcome were assessed using a Mann-Whitney *U* Test.

Descriptive statistics regarding demographic/socioeconomic characteristics and assessment statements are presented both for respondents willing and not willing to pay for the hypothetical treatment. A chi-square of homogeneity test was employed to assess differences among the proportions of the 4 responses in each assessment statement. This test was followed by post-hoc analysis that involved pairwise comparisons using the *z*-test of 2 proportions with a Bonferroni correction. Statistical significance for post-hoc analysis was inferred at $P < .0083$.

Logistic regression was conducted to explore the impact of socioeconomic and demographic factors on participants' probability to be willing to pay a positive amount for the hypothetical treatment. Regarding the predictor variables of the LRM, we retained as independent variables those factors that showed significance in the univariate analyses (Mann-Whitney and Chi-square tests). For the "marital status" variable, we merged the "divorced" and "widowed" categories into 1 ("divorced/widowed") in order to increase the reliability of statistical inference given the limited observations of these categories. The LRM took the form:

$$\begin{aligned} logit(p) = ln\left(\frac{p}{1-p}\right) &= \beta_0 + \beta_1 x_{Age} \\ &+ \beta_2 x_{Utility} + \beta_3 x_{No\,education/Elementary} + \beta_4 x_{High\,School} \\ &+ \beta_5 x_{Private\,College} + \beta_6 x_{Employed\,for\,Wages} + \beta_7 x_{Freelancer} \\ &+ \beta_8 x_{Pensioner} + \beta_9 x_{Student} + \beta_{10} x_{Household\,Size} \\ &+ \beta_{11} x_{Number\,of\,Household\,Members\,Holding\,a\,Job} \\ &+ \beta_{12} x_{Unmarried} + \beta_{13} x_{Married} + \beta_{14} x_{Divorced/Widowed} \\ &+ \beta_{15} x_{Household\,income\,less\,than\,€\,500} \\ &+ \beta_{16} x_{Household\,income\,€\,500-€1,000} \\ &+ \beta_{17} x_{Household\,income\,€1,001-€1,500} \\ &+ \beta_{18} x_{Household\,income\,€1,501-€2,000} \end{aligned} \quad (1)$$

where p is the probability of an individual to be willing to pay and $1-p$, the probability of not to be willing to pay, β_0 is the constant, $\beta_1 \ldots \beta_k$ are the logistic regression coefficients of the predictor variables.

Nagelkerke R^2, Hosmer-Lemeshow chi-square[42] and predictive ability were computed to evaluate model fit. A predictive ability of over 50% is considered acceptable for a good model.[43] For model validation, we adopted the 75%/25% cross-validation approach, where the cases are randomly divided into 2 subsets; a training sample containing 75% of the cases and a holdout sample containing the remaining 25% of the cases.

Since our aim was to investigate the factors that have an impact on individuals' probability to be willing to pay for a

Table 1. Demographic and Socioeconomic Characteristics of Study Participants Willing (n = 528) and not Willing (n = 395) to Pay for an Improvement in Their Health Condition.

	Willing to pay	Not willing to pay	*P*-value
Gender: female [N (%)]	281 (53.2)	227 (57.5)	.133[a]
Age (years) [mean (SD)]	46.2 (16.6)	53.9 (17.7)	.000[b*]
Householdsize [mean (SD)]	3.0 (1.3)	2.8 (1.3)	.018[b*]
Number of household members holding a full-time or part-time job [mean (SD)]	1.4 (1.0)	1.1 (1.0)	.000[b*]
Education [N (%)]			
No/elementary	19 (3.6)	56 (14.2)	.000[a*]
High school	179 (33.9)	161 (40.8)	
Private college (IEK)	55 (10.4)	40 (10.1)	
Higher education (university)	274 (52.0)	138 (34.9)	
Professional status [N (%)]			
Employed for wages	175 (33.1)	109 (27.6)	.000[a*]
Freelancer	122 (23.1)	58 (14.7)	
Pensioner	106 (20.1)	125 (31.6)	
Student	40 (7.6)	19 (4.8)	
Unemployed	79 (15.0)	76 (19.2)	
Marital status [N (%)]			
Unmarried	184 (35.1)	81 (20.8)	.000[a*]
Married	304 (57.8)	246 (63.0)	
Divorced	16 (3.0)	22 (5.7)	
Widowed	22 (4.1)	41 (10.5)	
Net monthly disposable household income [N (%)]			
Less than €500	59 (11.6)	62 (16.7)	.000[a*]
€500-€1000	160 (31.6)	169 (45.7)	
€1001-€1500	148 (29.1)	80 (21.6)	
€1501-€2000	75 (14.9)	41 (11.2)	
More than €2000	65 (12.9)	18 (4.8)	
EQ5D utility value [mean (SD)]	0.695 (0.224)	0.647 (0.260)	.003[b*]

[a]Chi-square test, $a = .05$.
[b]Mann-Whitney *U* Test, $a = .05$.
*P-values that are statistically significant at $P < .05$. Percentages do not round up due to missing values that are not presented here.

health improvement, participants reporting utility values equal to 1 were not considered in the analysis. This was because these participants were in perfect health and therefore, in no position to identify willingness to pay for a treatment offering recovery to perfect health, as they were already in this perfect health state.

Statistical significance was set at 5%. All analyses were conducted using SPSS version 25.0.

Results

Demographic and Socioeconomic Characteristics

The survey was completed by 1342 subjects. Out of these, 410 (30.6%) reported a utility value equal to 1 and were excluded from subsequent analysis. Out of the remaining subjects, 528 (39.3%) were willing to pay for the hypothetical treatment, whereas 395 (29.4%) were not willing to pay and 9 (0.7%) did not respond to the WTP screening question. Demographic and socioeconomic characteristics of those willing to pay for the hypothetical treatment and those not willing to pay (participants giving zero valuations) are given in Table 1. All sociodemographic characteristics, apart from gender, differed significantly between 2 participant groups ($p < .05$). Out of those not willing to pay for the hypothetical treatment, 301 (76%) identified governments or sick funds' responsibility to cover the cost of such a treatment, as the primary reason for their attitude. The remaining 94 unwilling to pay participants were motivated by inability to pay or indifference toward the hypothetical treatment offering recovery to perfect health.

WTP Estimate

As shown in Table 2 the main WTP estimate differs from the respective estimates elicited for specific participants' groups. The mean WTP when considering all participants (main estimate) was €439.8. On the contrary, the mean WTP_{income} and

Table 2. Willingness-to-Pay for a General Treatment Offering Recovery to Perfect Health.

Variable	Mean (SD)	Median (IQR)	Minimum-Maximum	95% CI
WTP (n = 528)	439.8 (1217.4)	64.0 (240.0)	1.0-8192.0	335.7-543.9
WTP_{income} (n = 476)	189.0 (519.4)	64.0 (240.0)	1.0-8192.0	142.2-235.7
$WTP_{low\_certainty}$(n = 231)	417.7 (1298.2)	64.0 (204.0)	1.0-8192.0	269.6-565.7
$WTP_{certainty}$(n = 302)	447.9 (1025.3)	128.0 (196.0)	1.0-8192.0	314.0-581.8
$WTP_{income\_certainty}$ (n = 280)	190.9 (640.7)	32.0 (112.0)	1.0-8192.0	115.6-266.3

Note. WTP = WTP estimate when considering all study participants; WTP_{income} = WTP estimate considering only those participants stating a WTP value equal to or less than their net monthly disposable household income; $WTP_{low\_certainty}$ = WTP estimate for those participants that are less certain for their WTP response (reporting 0-6 on the certainty scale); $WTP_{certainty}$ = WTP estimate for those participants that are very certain for their WTP response (reporting 7-10 on certainty scale); $WTP_{income\_certainty}$ = WTP estimate for those participants stating a WTP value equal to or less than their net monthly disposable income and being very certain for their WTP response; SD = standard deviation; IQR = interquartile range; CI = confidence interval.

$WTP_{income\_certainty}$ were significantly lower. Mean $WTP_{low\_certainty}$ and $WTP_{certainty}$ were €417.7 and €447.9, respectively; these did not differ from each other or the main estimate ($P > .05$). Lastly, we estimated the trimmed mean WTP at €265.2, by excluding 5% of the estimates.

Healthcare Services Provision Assessment

Descriptive statistics of the factors assessing healthcare services provision of both participants' groups are given in Table 3. Both groups reported, in absolute numbers, a mean overall satisfaction score slightly below 5 (on a 10-point scale). In fact, the satisfaction rate did not differ significantly between the 2 groups ($P = .270$).

Chi-square results revealed that only for assessment statements AS2 and AS3, the 4 independent proportions differed significantly between the 2 participant groups ($\chi^2(3) = 19.802$, $P = .000$ and $\chi^2(3) = 12.671$, $P = .005$, respectively). Post hoc analysis showed that with respect to AS2, there was a statistically significant difference in the proportion of willing and unwilling to pay participants who agreed to a great extent with the fact that public healthcare structures offer high quality services (n = 40, 7.7% vs n = 58, 15%, $\chi^2(1) = 12.251$, $P = .000-<.0083$). No other pairwise comparisons for AS2 were statistically significant. Regarding AS3, there was a statistically significant difference in the proportion of willing and unwilling to pay participants who did not agree at all with the fact that public doctors are respectful (n = 61, 11.6% vs n = 26, 6.8%, $\chi^2(1) = 6.260$, $P = .002-<.0083$). No other pairwise comparisons for AS3 were statistically significant.

Logistic Regression Results

Logistic regression results are presented in Table 4. Only estimated coefficients for statistically significant independent variables are presented. The 883 cases that were available for the analysis of the LRM satisfied both the minimum and the preferred sample sizes. To evaluate the impact of outliers on the model we run 2 models: the baseline model including all cases and a revised model excluding outliers whose studentized residual was greater than 2.0 or less than −2.0 and compared their classification accuracy rates. The classification accuracy rates of the baseline and revised models were the same (64.7% and 64.6%, respectively). Since the 2 models were equally accurate, we interpreted the results of the baseline model. In this model, there was no multicollinearity since none of the independent variables had a standard error larger than 2.0. Moreover, the existence of a relationship between the independent variables and the dependent variable was supported since the probability of the model chi-square (112.781) was significant ($P = .000$). The chi-square of Hosmer-Lemenshow Test (10.802) was not statistically significant ($P = .213$), suggesting a good fit of the model. The LRM classified correctly 64.7% of cases (79.6% and 44.1% for those willing and not willing to pay, respectively).

In the LRM only 6 predictors associated with age, education, and household income showed statistical significance. Based on the regression results, increasing age was associated with a decrease in the likelihood of an individual to be willing to pay for the hypothetical treatment ($P = .031$). Individuals with no or elementary education had .28 ($\text{Exp}(B) = 0.280$, $P = .000$) times lower odds of being willing to pay compared to a higher education graduate. Similarly, individuals with high school education had 0.69 times lower odds of being willing to pay compared to a higher education graduate ($P = .040$). Last but not least, individuals with household income less than €500, €500 to €1000, or €1500 to €2000 had 0.31-, 0.29-, and 0.51-times lower odds, respectively, of being willing to pay compared to an individual with household income more than €2000 ($P = .002$, .000, and .049, respectively).

For the LRM proportional by chance accuracy was 64.1%, a value slightly lower than the classification accuracy, which was computed at 64.7%. In the cross-validation analysis of the model, the overall relationship between independent variables and the dependent variable was statistically significant ($P = .000$). The significance of the overall relationship between independent variables and the dependent variable supports the interpretation of the model using the full data set, since the probability of the model chi-square (73.781)

Table 3. National Healthcare Services Overall Satisfaction Rate and Assessment of Individuals' Attitudes Toward Healthcare Services Provision for Those Willing (n = 528) and not Willing (n = 395) to Pay for an Improvement in Their Health Condition.

	Willing to pay	Not willing to pay	*P*-value*
National healthcare services overall satisfaction rate** [mean (SD)]	4.4 (2.4)	4.6 (2.7)	.270[a]
Pre-defined statements assessing healthcare services provision: *To what extent do you agree with the following statements . . .*			
AS1. All Greek citizens have equal access*** to public health care services [N (%)]			
Agree to a great extent	122 (23.3)	74 (19.3)	.094[b]
Agree to a moderate extent	192 (36.7)	140 (36.5)	
Agree to a little extent	91 (17.4)	57 (14.9)	
Not agree at all	118 (22.6)	112 (29.3)	
AS2. Public hospitals and health centers offer healthcare services of high quality [N (%)]			
Agree to a great extent	40 (7.7)	58 (15.0)	.000[b*]
Agree to a moderate extent	220 (42.3)	167 (43.1)	
Agree to a little extent	131 (25.1)	63 (16.0)	
Not agree at all	130 (24.9)	100 (25.9)	
AS3. Doctors in public hospitals and health centers are respectful [N (%)]			
Agree to a great extent	165 (31.5)	144 (37.0)	.005[b*]
Agree to a moderate extent	232 (44.2)	186 (47.9)	
Agree to a little extent	67 (12.8)	32 (8.3)	
Not agree at all	61 (11.6)	26 (6.8)	

[a]Mann-Whitney *U* Test, $a = 0.05$.
[b]Chi-square test, $a = 0.05$.
*P-values that are statistically significant at $P < .05$; **Satisfaction rate is measured on a 0 to 10 scale, where 0 is extremely dissatisfied and 10 extremely satisfied; ***"Access" refers to the distance from the closest specialized doctor and/or the distance from the closest tertiary hospital and/or the waiting time from appointment setting till visiting a hospital doctor or a sickness fund doctor.

Table 4. Logistic Regression Results.

	Dependent binary variable "willing/not willing to pay"						
Independent variables	Coeff *B*	SE	Wald	df	Exp(*B*)	95% CI	*P*-value
Constant	1.884	0.708	7.007	1	6.581	N.G.	.008
Age	−0.017	0.008	4.661	1	0.983	0.968-0.998	.031
No/elementary education[a]	−1.273	0.338	14.227	1	0.280	0.144-0.542	.000
High school	−0.378	0.184	4.224	1	0.685	0.478-0.983	.040
Household income less than €500[b]	−1.157	0.366	9.988	1	0.314	0.153-0.644	.002
Household income €500-€1000	−1.225	0.315	15.084	1	0.294	0.158-0.545	.000
Household income €1501-€2000	−0.672	0.341	3.884	1	0.510	0.262-0.996	.049
Nagelkerke R^2 0.163							
Hosmer-Lemeshow Test chi-square 10.802 *P*=.213							
Model prediction ability 64.7% (79.6% for those willing to pay and 44.1% for those not willing to pay)							

Note. CI = confidence interval; Coeff *B* = regression coefficient *B*; df = degree of freedom; Exp(*B*) = exponential of regression coefficient *B*; SE = standard error.
[a]"Higher Education (University)" was set as the reference category.
[b]"Household income more than €2000" was set as the reference category.

testing overall relationship was $P = .000$. The pattern of significance for the individual relationships between the dependent variable and the independent variables was the same when using the full data set and the 75% training sample. The classification accuracy rate for the model using the validation sample was 64.8%, which although only 0.5% higher than that for the training sample (64.3%), it implied a better fit than that obtained for the training sample.

Discussion

Logistic regression analysis showed that Greeks unwilling to pay for a general hypothetical treatment offering recovery to perfect health were, on average, older, had lower educational level, and were less affluent compared to those willing to pay. Hence, in our study, participants might be unwilling to pay for the treatment due to their inability to afford it because

of increased household financial needs and/or limited disposable household income. Since the beginning of the government-debt crisis, out-of-pocket health payments exceed 30% to 40% of household's capacity to pay[44] and cover 34.8% of healthcare expenses.[45] This is so, despite the presence of a National Health System and social insurance funds. It is, thus, evident that Greeks are already bearing a substantial part of the economic burden in healthcare, which has shrunk their household income and, therefore, might explain their inability to pay for the hypothetical treatment. Regarding the impact of the level of education on WTP, respondents with higher educational level were more likely to be willing to pay for a health improvement. It is more likely for highly educated individuals to acknowledge the treatment as essential for perfect health recovery and be able to fully appreciate the value of the benefits offered. Lastly, as mentioned above, older participants were less likely to be willing to pay for a health improvement. The elderly tend to accept more readily deteriorating health[5] and have a lower life expectancy; 2 aspects that might explain this finding. The impact of education and income on WTP likelihood is in accordance with other studies' findings[17,18] where the same regression approach was adopted and WTP likelihood for the Hepatitis B and dengue vaccines was examined.

Most prior literature[4,5,8-16] has focused on the effect of demographic and socioeconomic determinants on WTP values reported solely by those that are willing to pay for a health improvement. Nevertheless, even in those studies, similar findings are encountered in terms of the most common determinants impacting WTP being income,[4,5,8,10,12-14,16] age,[4,5,8,10,13-16] and education.[4,8,10,12,14,16]

We further examined whether inclusion of protest responses in the "unwilling to pay" group influences the effect of sociodemographic variables on the likelihood of WTP for perfect health recovery. Using insights from the follow-up question, unwilling to pay participants were distinguished between "true" zero valuators and protest responders. In this subsequent analysis only protest responders (those unwilling to pay due to their belief that government or sick funds should cover treatment cost) were included in the "unwilling to pay group." Inclusion of protest responders seems to impact—to an extent—the effect of sociodemographic variables on the likelihood of a positive WTP. Hence, removing protest bids from the calculation of WTP values might lead to unrepresentative samples as it was suggested in other studies.[19,20,22,25] Therefore, econometric techniques allowing valuation estimates of WTP to be "debiased" after allowing for unrepresentativeness of protestors should be utilized in future research to overcome this issue.[19]

Our study also showed that the general Greek population is willing to pay on average a monthly amount of €439.8 for a health improvement obtained through a general treatment offering recovery to perfect health. This estimate differs from that of other studies (comparison of mean values in 2019 Euros).[5,12-18] This could be due to different demographic/socioeconomic characteristics of the sample populations and employment of different WTP elicitation techniques.[5,12-18] In 2 studies focusing on the general population and eliciting WTP for health improvements using, though, the payment card technique, WTP estimates were much lower.[5,12] Similarly, for health improvements deriving from disease-specific treatments WTP estimates were much smaller compared to our main outcome.[17,18]

The WTP estimate when considering the responses of only those participants that were indeed able to cover treatment costs (ie, those that stated a monthly WTP amount that was lower than or equal to their net disposable monthly household income) and were very certain with respect to their response (ie, those that reported a certainty level of 7 and above on the 0-10 certainty scale) was €190.9. This value was significantly lower than the main outcome and one could argue that given the characteristics of the subgroup based on which it was estimated, it is a more accurate measure. Bearing in mind the economic difficulties that Greek households have been facing during the last decade due to the government-debt crisis, it could be considered closer to the actual amount an individual would be able to pay for recovery to perfect health.

Considering overall satisfaction with healthcare services, our analysis showed that, on average, both willing and unwilling to pay participants are slightly dissatisfied regarding the services of the Greek NHS. During the past decade Greece has faced a severe debt crisis that has indisputably affected the Greek NHS. The latter has to financially cope with an increased demand for public services through a rather shrunk budget. Understaffing, fewer resources, deterioration of access to and provision of healthcare services are only few of the problems the Greek NHS faces, affecting undoubtedly the quality of healthcare provision[46] and thus, individuals' satisfaction.

Logistic regression analysis showed that the independent variables considered in the respective model constitute useful predictors to distinguish individuals willing to pay for a health improvement from individuals not willing to pay (classification accuracy $>$ by chance accuracy). Moreover, the model itself would be effective in predicting scores for cases other than those included in the sample (validation sample accuracy rate $>$ training sample accuracy rate), thus, supporting the generalization of the analysis.

Our study is subject to the following limitations. Participants might tend to respond positively to the screening question, as a result of the "yea-saying phenomenon" that characterizes CV studies,[6] irrespective of their actual desire to pay for the hypothetical treatment. Therefore, our initial classification of the respondents into the 2 groups might be biased to some extent. Moreover, individuals' attitudes toward NHS services provision were assessed through predefined statements. Despite the fact that the design of these statements was the outcome of an extensive literature review, they might not cover all parameters that might affect views

toward healthcare services provision. Therefore, future research is essential in order to investigate additional variables that might affect the probability of willingness to pay for a health improvement and consider them as inputs in the model.

Conclusions

Our study showed that younger individuals and individuals with higher educational level and/or higher income level were more likely to be willing to pay for a health improvement (perfect health recovery). Distinguishing between protest responses and "true" valuations of those unwilling to pay indicated some similarities but also some differences regarding the effect of sociodemographic factors on the likelihood of being willing to pay for a health improvement. All this information is necessary for modelling responses and deriving debiased and representative estimates of WTP.[19]

The general Greek population was willing to pay on average a monthly amount of €439.8 for a health improvement obtained through a general treatment offering recovery to perfect health. A significantly lower estimate (€190.9) was, also, calculated based on the responses of certain participants that were indeed able to cover treatment costs. Given the economic difficulties that Greek households have been facing during the last decade, this latter estimate could be considered more accurate since it appears to be a more realistic and affordable amount.

The model developed for this study was built on explicit sociodemographic characteristics; therefore, it was specific to these predictors. Even so, our analysis showed that these independent variables could constitute useful predictors in classifying individuals regarding WTP for a health improvement. Moreover, the model is effective in predicting scores for cases other than those included in the sample and thus, analysis could be generalized. On that ground, it could be considered a supportive tool in informed decision-making since it helps classify, based on their demographics, individuals willing and not willing to pay out-of-pocket for a health improvement. This classification could be supportive for private insurance companies when targeting potential clients.

This cross-sectional stated-preference study added 4 important elements in the CV literature. First, it assessed, using a LRM, the effect of sociodemographic factors on individuals' willingness-to-pay intention for a health improvement that is obtained through a general—and not disease-specific—treatment. Therefore, this study constitutes one of the first investigations where logistic regression is applied in the CV literature, exploiting all sample responses (both those WTP and those not WTP). Second, it is the first study adopting logistic regression in order to classify individuals with respect to their WTP using a scenario based on a general treatment and one of the first studies that tries to offer insights on the sociodemographic characteristics of protest responders and "truly" unwilling to pay individuals. Third, it elicited a WTP value for a health improvement using a representative sample of the general Greek adult population. Last, it examined the impact of Greek individuals' attitudes toward equity in access and quality of healthcare services/personnel on willingness-to-pay likelihood.

Zero valuations and protest responses represent a serious problem to the integrity of data collected in CV studies and dealing with them inappropriately may result in biased estimates and inaccurate conclusions, especially when these studies are conducted in countries with national health care systems in place,[19] as is the case in Greece. Therefore, further research is essential in order to focus on alternative econometric techniques, such as the double-hurdle model,[22] the Type II Tobit model,[25] or the Heckman selection model,[19] which will allow "debiasing" and will further explore how WTP is affected by sociodemographic characteristics of protest responders and "true" zero valuators. Furthermore, future research could examine hypothetical scenarios describing alternative payment vehicles (ie, payments through taxation), as it is expected that protest respondents' behavior might be affected by the payment vehicle and the nature (private/public) of treatment admission.[19,47]

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Author Contributions

AGM, PhD, conceived the original idea for the study, designed and conducted the study, performed data analysis and results interpretation, and drafted the manuscript. SAC, PhD, contributed to all statistical analysis performed, revised, and approved the final manuscript. VHA, PhD, contributed to the design and coordination of the study, and provided critical review and approval of the final manuscript.

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ORCID iD

Afentoula G. Mavrodi https://orcid.org/0000-0002-8415-2196

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