Do Utility Values and Willingness to Pay Suitably Reflect Health Outcome in Hip and Knee Osteoarthritis? A Comparative Analysis with the WOMAC Index

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ABSTRACT. ***Objective***. To establish whether health utility (time trade-off, TTO) and willingness to pay (WTP) values reflect clinical health outcome as evaluated by the Western Ontario McMaster Universities Osteoarthritis Index (WOMAC) in hip and knee osteoarthritis (OA).

Methods. One hundred twenty-eight patients with OA attending a specialized arthritis clinic were interviewed about their socioeconomic characteristics and administered the TTO technique and the WOMAC. Their WTP for 2 hypothetical anti-osteoarthritic drugs was also investigated: the first drug was said to provide a significant improvement in WOMAC dimensions and the second a complete cure of the disease. WTP was elicited by both discrete-choice and bidding game methods.

Results. Answer rates were 89.1% for TTO, 98.4% for discrete-choice WTP for both scenarios, and 89.8% and 85.2% for bidding game WTP in the relief and the cure scenario, respectively. The mean TTO utility value was 0.84 (standard deviation 0.20). In discrete-choice, those accepting the bid had higher monthly income (€ 1536.5 vs € 1060.1, $p < 0.001$, for the relief scenario and € 1449.3 vs € 1071.6, $p < 0.001$, for the cure scenario). With the bidding game format, WTP was positively correlated with income in both scenarios ($r = 0.56$, $r = 0.55$, $p < 0.001$). WTP measures differed equally between education and socioeconomic groups with those in favored groups consistently reporting higher WTP (Kruskal-Wallis tests statistics ranging from $p < 0.01$ to $p < 0.001$). Except for stiffness, WOMAC dimensions were correlated in the expected direction with TTO values ($r = –0.27$, $p < 0.01$ for pain and $r = –0.36$, $r = –0.34$, $p < 0.001$ for physical function and total score, respectively).

Conclusion. Whereas they showed good feasibility, WTP measures poorly reflected clinical condition and were mainly related to economic status and ability to pay. TTO was correlated with the WOMAC dimensions and may be considered closer to clinical situations than WTP. However, concern arises regarding the homogeneity of the study sample in terms of clinical severity, which may have precluded the identification of a relationship between WTP and clinical status. (J Rheumatol 2003;30:2452–9)

Key Indexing Terms:
TIME TRADE-OFF WILLINGNESS TO PAY WOMAC OSTEOARTHRITIS

Arthritis affects millions of individuals worldwide[1-3]. Age is the strongest predictor of arthritis[4,5] and as the population ages, a trend toward increasing prevalence is projected[3,6]. Osteoarthritis (OA) is the most common form of arthritis and a major cause of disability leading to impaired quality of life and substantial economic burden for society[2,7-9].

Given expanding prevalence of chronic disorders and the increasing gap between health care expenditures and available resources, a growing interest in health care evaluation has emerged. Health status measures have become common evaluation tools in health care[10]. In addition to radiological and biologic standards, effectiveness is being assessed through instruments to determine self-perception of several health dimensions.

The Western Ontario McMaster Universities Osteoarthritis Index (WOMAC) was specifically developed to measure OA-related disability in the hip and knee[11]. It assesses 3 OA-relevant concepts: pain, stiffness, and physical function and is now one of the most commonly used instruments for the evaluation of new agents[12-14] or total hip/knee arthroplasty in OA[15-17].

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However, efficacy is no longer the only criterion on which decisions are based. Optimizing health care expenditures is a major issue for health authorities as well, and economic evaluations are thus recommended in addition to effectiveness appraisal. Economic evaluations compare alternative strategies in terms of costs and outcomes, the goal being to maximize health benefits for a given amount of resources[18]. Several approaches have been proposed to assess cost effectiveness of new strategies. The key difference between them relates to outcome. In many instances, however, there is general agreement on the need to take into account the effect on quality of life in outcome measures[19,20]. This is particularly true in chronic disorders such as OA, where survival is not directly threatened but where the deleterious effect on quality of life is considerable.

In economic evaluation, 2 major approaches can be used to measure changes in health status. One implements quality adjusted life years (QALY) to incorporate changes in both quality and quantity of life. QALY are calculated by multiplying each expected life-year by a quality weight ranging from 0, illustrating indifference between life and death (worst health state), and 1 representing equivalence to perfect health. This weight represents a global and unidimensional evaluation of quality of life on a single cardinal scale. Several methods can be used to derive quality weight: visual analog scale (VAS), standard gamble (SG) stemming from the theory of decision making under uncertainty[21], and time trade-off (TTO) specifically developed for the health care field[22]. Whereas VAS is an empirical and readable method, SG and TTO are grounded in utility theory and may appear more cognitively challenging in that patients are faced with risky treatment (SG) or temporal choice (TTO) involving death.

The second approach is the willingness to pay (WTP) technique. Survey methods are applied to elicit how much individuals would be willing to pay for a specified health change[23,24]. There are 2 ways of applying such surveys. One is to directly ask patients with a particular disease what they would pay for a specific health improvement. The second is to ask the general population what they would be willing to pay to cure a particular disease. This method, known as the contingent valuation method, was originally developed in environmental economics to value environmental benefits[25]. It has been applied to valuing the benefits of health care strategies for about 20 years[26,27].

The first approach is referred to as health utility and is directly related to quality of life. The second is referred to as a benefit, that is, a monetary value attributed to a specific health state or change. Cost assessments are then combined with such outcome through cost-utility or cost-benefit analysis to provide ratios that reflect the efficiency of health care strategies[18]. Health utilities and WTP help answer questions about crucial resource allocation. However, health utilities provide crude evaluation of quality of life, and the WTP approach, although related to quality of life, does not directly measure quality of life[28]. Moreover, they may appear cumbersome and cognitively demanding for patients and may not provide relevant information for daily individual care. In contrast, despite their inadequacy for economic evaluation, comprehensive health status instruments are readily and practically applicable in routine clinical practice. They supply straightforward relevant information to patients and health professionals.

Because OA is increasingly considered as a major public health problem, economic evaluations are nowadays of prime importance. Whereas health utilities and WTP are essential components of such evaluations, they may be viewed as clinically meaningless insofar as they insufficiently capture quality of life of patients. To be as trustworthy as possible, economic evaluation should be based on outcome measures that suitably reflect clinical states. The purpose of our study was to investigate how health utilities and WTP are interrelated with the widely established and well-validated WOMAC in hip and knee OA.

MATERIALS AND METHODS

Patients. Subjects were recruited among patients with hip and knee OA attending the outpatient physical rehabilitation and rheumatology clinic of the University Hospital of Liège, Liège, Belgium. OA diagnosis was based on the American College of Rheumatology clinical and radiographic criteria for hip or knee OA[29,30]. Patients were approached at the time of their visit and were invited to participate in an OA outcomes study by answering a face-to-face administered survey at the clinic. Patients were presented with the aim and scope of the study and reassured about the confidentiality and anonymity of their answers. They were told that the interview would last 15 to 20 minutes. Except for oral consent to participate and reporting hip or knee OA as defined above, there were no selection criteria for inclusion in the study.

Interviews. During the structured interview, patients' principal demographic characteristics were recorded: age, gender, marital status, the number of individuals in the household, education, whether they were retired or had preferential status. In the Belgian health insurance system, individuals are eligible for preferential status if they are widowed, disabled, retired, or orphaned and have insufficient economic means. The focus of the interview then moved to health and economic outcome appraisal.

WOMAC. Evaluation consisted of the 24 items of the WOMAC (5 items for pain, 2 for stiffness, and 17 for physical function) as experienced during the 48 hours before assessment[11]. The 5-point Likert scale version was used, with a separate score for each concept: 0–20 for pain, 0–8 for stiffness, and 0–68 for physical function. A lower score indicates less dysfunction. In this study, a total score was also computed. The WOMAC has shown reliability and validity in different settings[31-33] and has been widely used in OA[12-17].

Comorbidity. A 26-item list of symptoms/conditions encompassing major illnesses was presented to patients, who reported any conditions they had over the past 6 months. Height, weight, and disease duration were also documented.

Time trade-off. In the outcome appraisal, patients were asked to choose between realizing their life expectancy (they were advised of their life expectancy based on age) in their current health state and living in perfect health for a shorter period of time. When patients said they preferred to live a shorter time, the number of years of perfect health was varied repeatedly (ping-pong technique) until absolute indifference between both alternatives

was reached. The situation of indifference determined the TTO quality of life score, which was obtained by the ratio of years in perfect health to patient's life expectancy. Life expectancy data were retrieved from the Health Ministry of the Belgian French Community[34].

Willingness to pay. WTP amounts for a monthly treatment for OA were elicited by both discrete-choice and bidding game format. In discrete-choice questions, patients are presented a single price for a treatment that would yield a specified health change. The patients either accept or reject the price. By randomly varying the price across a number of different subsamples, the mean WTP can be estimated[35]. In a bidding game, a first price (bid) is proposed to patients and the bid is then raised or lowered according to the patients' answer until the maximum individual WTP is reached.

The treatment consisted of one pill daily for one month that would change the health status of patients for one month. Patients were guaranteed no side effects would occur but were advised that their health insurance would not cover the treatment; thus patients had to realistically consider their monthly ability to pay. Two distinct scenarios were envisaged to appraise consistency of WTP answers. The first was a relief scenario and the second was a total cure scenario. Relief was presented as a health state where the patient would experience "slight" pain, stiffness, and physical disability for each of the 24 items of the WOMAC.

Evaluation began for the relief scenario by the discrete-choice approach. The price was randomly varied in 10 subsamples from BEF 500 (€ 12.4) to BEF 5000 (€ 124) at BEF 500 increments. The discrete-choice answers were ordered as follows: "yes, definitively," "yes probably," "no probably," and "no definitely". The discrete-choice question was then followed by a bidding game process using the price from the discrete-choice question as starting bid. The evaluation was repeated for the cure scenario with, for each patient, the same starting price as the relief scenario.

Socioeconomic status. Socioeconomic status was rated through a single question about whether their household financial resources were sufficient to cover their needs. A gradual 4-choice scale was proposed for the responses with lower grade representing higher degree of difficulty. Patients were also asked to report their monthly available household income on a 24-point scale with a BEF 5000 (€ 124) increment, from "less than BEF 20,000" (€ 496) up to "more than BEF 130,000" (€ 3223).

Feasibility. At the end of the interview, comprehensiveness and acceptability of the questionnaire were evaluated through 2 simple questions with 4 graded answers: "How did these questions seem to you?" with lower grade answers meaning greater feeling of ease and, "Did the questions make you feel uncomfortable, notably those related to financial aspects?" with lower grades indicating greater annoyance.

Statistical analysis. Spearman's correlation coefficients were computed to examine the relationship between continuous variables. For categorical variables, Kruskal-Wallis analyses of variance were performed to make group comparisons and independence was checked by chi-square test. All statistical tests were performed at the 5% level. Bonferroni correction was applied for multiple comparisons.

From discrete-choice questions, answers were dichotomized as "accept/reject," and logistic regressions were used to compute for each scenario the mean WTP according to the formulation of Johansson[36].

Multivariable regression analyses were used to evaluate associations in combinations of characteristic variables and WOMAC scores on TTO, WTP bidding game (linear regression), and WTP discrete choice (logistic regression). Household income, education level, and socioeconomic status represented the same concept (significantly dependent). Education level may appear as a key variable in the understanding of a complex question such as WTP scenario. However, in the regression equations, we only retained income, which is more likely to reflect the individual ability to pay. Each WOMAC score was modeled separately (models I, II, III, and IV) and control regressions (model V) were performed to portray the variance explained by the WOMAC scores. To provide information on the relative importance of the association of each independent variable with TTO and WTP, we standardized all variables and presented results as standardized regression coefficients (ß).

RESULTS

Study sample. In all, 129 patients were invited to take part in the study and 128 were investigated. One refused to participate due to a lack of time to stay 15 minutes more at the clinic. Interviews lasted a mean of 16.5 min (standard deviation, SD, 7.8). Table 1 shows demographics and clinical characteristics of participants. The average household income was € 1390.3 monthly versus the national average household income of € 1062.4, as assessed by a nationwide representative health and socioeconomic survey[37]. Hypertension (29.7%), osteoporosis (28.9%), back pain (27.3%), hypercholesterolemia (16.4%), and gastrointestinal ulcers (11.7%) were the most reported comorbid conditions.

Answer rates. Answer rates were quite satisfactory. For the TTO question, the answer rate was 89.1%. In WTP, whereas

Table 1. Characteristics of the study population (n = 128).

Characteristics	Mean (± SD)
Demographic	
Age	64.1 (± 9.9)
Women, %	87.5
Marital status, %	
Married	60.9
Divorced	10.2
Widowed	22.7
Single	6.3
Household size, %	
1	30.5
2	50.8
≥ 3	18.8
Years at school, %	
< 12	27.3
12–15	31.3
15–18	18.0
> 18	23.4
Retired, %	68.0
Preferential status beneficiaries, %	26.6
Socioeconomic status, %:	
Major difficulty	11.7
Difficult	32.0
Good	30.5
Advantageous	25.8
Monthly household income, €, n = 122	1390.3 (± 642.6)
Clinical	
BMI, kg/m^2	27.5 (± 4.6)
Disease duration, yrs	12.3 (± 9.2)
Hip	16.4
Knee	60.2
Hip & knee	23.4
WOMAC	
Pain, range: 0–20	7.1 (± 4.2)
Stiffness, range: 0–8	2.8 (± 2.2)
Function, range: 0–68	23.9 (± 13.2)
Total, range: 0–96	33.8 (± 17.9)
Number of comorbidities	2.3 (± 1.5)

98.4% responded with the discrete-choice question for both scenarios, the answer rates were somewhat lower for the bidding game approach, with 89.8% responding for the relief scenario and 85.2% responding for the cure scenario. Among those having declined the bidding game format, the main reasons of refusal were: (a) affirmation that no monetary value could be placed on health (30.8% in relief scenario and 23.0% in cure scenario) and (b) more time was needed to think about the "sacrifice" that would have to be made in order to be able to afford the treatment proposed (23% in relief scenario and 22.3% in cure scenario). A patient reported a value of BEF 100,000 (€ 2478.9) as his/her willingness to pay for a cure. This value was judged aberrant and was not further considered in the analysis involving this variable. Regarding household income, 95.3% responded to the question. All other measurements were completed by the participants. Comprehensiveness and acceptance of the interview were rated high as well. Overall, 57.0% found the questions easy, 34.4% found them very easy, and 88.2% felt totally comfortable with the interview.

Time trade-off. The mean utility value as measured by TTO was 0.84 (SD 0.20, range 0.18–1.0). Tables 2 and 3 report correlation and regression analysis for TTO. Except for stiffness, WOMAC dimensions correlated in the expected direction with the TTO ($r = –0.27$, $p < 0.01$ for pain and $r = –0.36$ and –0.34, $p < 0.001$ for physical function and total score, respectively). Regression analysis confirmed these results (ß = –0.37, $p < 0.001$ for pain, ß = –0.40, $p < 0.001$ for physical function and ß = –0.39, $p < 0.001$ for total score). R^2 were substantially increased and disease duration had a positive effect on TTO when WOMAC pain, function, or total scores were introduced in the regression equation. Other variables were not associated with TTO value.

Willingness to pay bidding game. The bidding game results were a mean WTP of € 81.9 (SD 75.1, range 5.0–371.8) for relief and € 114.9 (SD 101.7, range 0–619.7) for a cure.

Table 2. Spearman's correlation coefficient for willingness to pay (WTP), bidding game amount, and time trade-off (TTO) values with variables.

Characteristics	WTP Bidding Game Relief	WTP Bidding Game Cure	Utility TTO
Age	–0.12	–0.09	–0.01
Disease duration	–0.01	–0.08	0.05
BMI	0.03	–0.09	–0.06
Comorbidity	–0.17	–0.24*	–0.07
WOMAC			
Pain	–0.10	–0.14	–0.27**
Stiffness	0.01	–0.05	–0.09
Function	–0.05	–0.08	–0.36***
Total	–0.06	–0.10	–0.34***
Proposed bid	0.23*	0.20*	NR
Income	0.56***	0.55***	–0.01

Coefficients significant at: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$. NR: not relevant.

Table 3. Standardized ß-coefficients from multivariable regression analysis for the effect of variables and WOMAC scores on time trade-off.

Models	I	II	III	IV	V
Age	–0.17	–0.12	–0.14	–0.15	–0.11
Gender	–0.04	–0.02	–0.02	–0.02	–0.03
Disease duration	0.22*	0.16	0.21*	0.22*	0.16
BMI	–0.02	–0.04	0.02	0.01	–0.04
Comorbidity	–0.12	–0.11	–0.09	–0.10	–0.11
Household size					
2	–0.11	–0.09	–0.07	–0.08	–0.09
≥ 3	–0.17	0.14	–0.13	–0.14	0.13
Income	–0.07	0.00	–0.04	–0.05	0.00
WOMAC					
Pain	–0.37***				
Stiffness		–0.06			
Function			–0.40***		
Total				–0.39***	
R^2	0.16	0.05	0.19	0.18	0.05

Coefficients significant at: *** $p < 0.001$, * $p < 0.05$. I: variables and WOMAC pain score. II: variables and WOMAC stiffness score. III: variables and WOMAC function score. IV: variables and WOMAC total score. V: variables only.

With this method, WTP was positively correlated with the proposed bid ($r = 0.23$ and 0.20, $p < 0.05$) and with income in both scenarios (Table 2), stronger correlation being found for income ($r = 0.56$ and 0.55, $p < 0.001$). Comorbidity was negatively correlated with maximum individual WTP in the cure scenario (r –0.24, $p < 0.05$). Multivariable regression analyses (see Table 4) showed the constant association of household income and the proposed bid with WTP. Income played a more important role in the relief scenario (ß = 0.59, $p < 0.001$) than in the cure scenario (ß = 0.18, $p < 0.001$). No WOMAC dimensions increased the variance explained by the models. Figure 1 details the effect of socioeconomic status by reporting differences in WTP mean value across different groups: the higher the socioeconomic status, the higher the WTP. The most educated reported significantly higher WTP than the 3 other groups for both scenarios ($p \leq 0.007$). Those without preferential status were willing to pay more than their counterparts in both scenarios ($p < 0.001$). Those living in a household of 3 or more were willing to pay more for a cure than those living alone ($p = 0.009$). For socioeconomic status, all WTP differed significantly across groups ($p \leq 0.003$) except for a cure between those experiencing difficulty and those in major difficulty ($p = 0.02$).

WTP discrete-choice. WTP as measured by the discrete choice question was € 64.2 (standard error, SE, 13.4) for a relief and € 101.6 (SE 20.1) for a cure. Table 5 displays Kruskal-Wallis analysis for this WTP approach. Those having accepted the bid reported significantly fewer comorbid conditions than those having refused it (2.1 vs 2.6, $p < 0.05$ for the relief scenario and 2.1 vs 2.8, $p < 0.05$ for

Table 4. Standardized ß-coefficients from multivariable regression analysis for the effect of variables and WOMAC scores on willingness to pay bidding game.

Model	I		II		III		IV		V	
Scenario	Relief	Cure	Relief	Cure	Relief	Cure	Relief	Cure	Relief	Cure
Age	0.03	0.17	0.03	0.17	0.02	0.17	0.02	0.17	0.02	0.17
Gender	0.08	–0.12	0.07	–0.12	0.08	–0.12	0.08	–0.12	0.08	–0.12
Disease duration	0.04	0.01	0.04	0.01	0.04	0.01	0.04	0.01	0.04	0.01
BMI	–0.01	–0.09	–0.01	–0.09	–0.01	–0.09	–0.01	–0.09	–0.01	–0.09
Comorbidity	–0.09	–0.09	–0.10	–0.09	–0.09	–0.09	–0.09	–0.09	–0.09	–0.09
Household size										
2	–0.04	0.01	–0.05	0.01	–0.05	0.01	–0.05	0.01	–0.05	0.01
≥ 3	–0.07	0.10	–0.08	0.10	–0.09	0.10	–0.08	0.10	–0.09	0.10
Income	0.60***	0.38***	0.59***	0.38***	0.59***	0.38***	0.59***	0.38***	0.59***	0.38***
Proposed bid	0.19**	0.18**	0.18**	0.18**	0.19**	0.18**	0.19**	0.18**	0.20**	0.18**
WOMAC										
Pain	0.07	0.00								
Stiffness			0.08	–0.02						
Function					0.00	–0.01				
Total							0.03	–0.01		
R^2	0.37	0.27	0.36	0.27	0.35	0.27	0.35	0.27	0.35	0.27

Coefficients significant at: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$. I: variables and WOMAC pain score. II: variables and WOMAC stiffness score. III: variables and WOMAC function score. IV: variables and WOMAC total score. V: variables only.

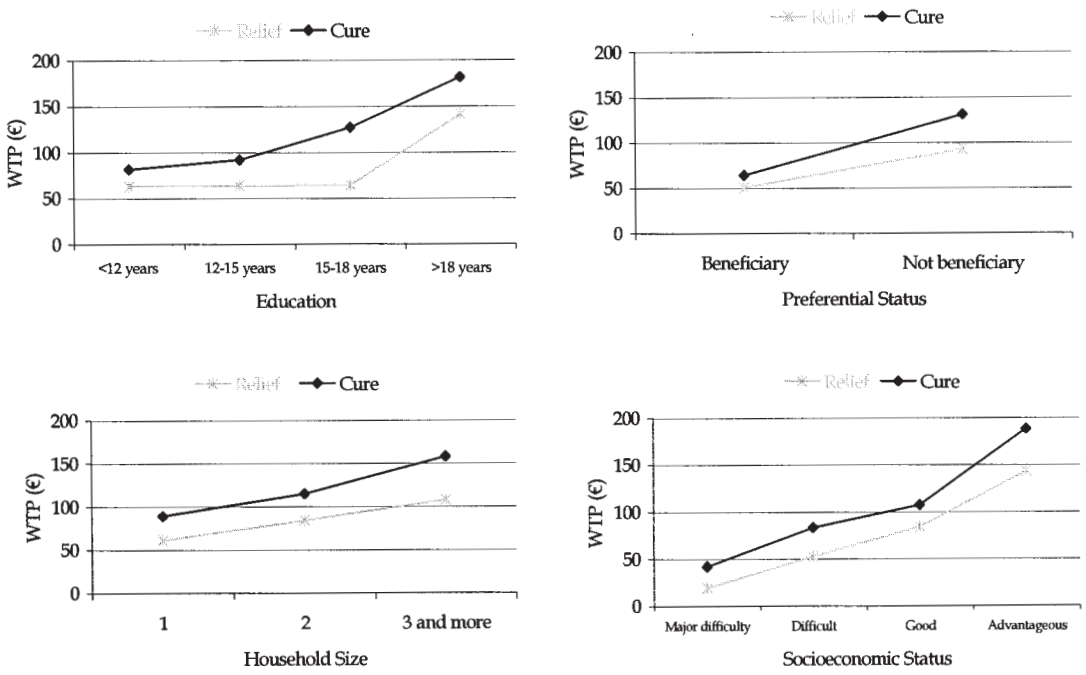

Figure 1. Maximum mean willingness to pay as elicited by bidding game method for each education, household size, preferential and socioeconomic status categories.

the cure scenario). Those having accepted also had higher monthly income (€ 1536.5 vs € 1060.1, $p < 0.001$, for the relief scenario and € 1449.3 vs € 1071.6, $p < 0.001$ for the cure scenario). A difference was additionally noted in the bid proposed; those having accepted the bid were actually presented with a lower bid (€ 59.7 vs € 87.7, $p < 0.001$ for the relief scenario and € 62.0 vs € 97.2, $p < 0.001$ for the cure scenario). Regression analysis corroborated these findings (data not shown).

Time trade-off and willingness to pay values. The 2 WTP methods correlated well ($r = 0.51$ and $r = 0.57$, $p < 0.001$) for the relief and cure scenario, respectively. No significant correlation was found between TTO values and any of the WTP measurements.

Table 5. Kruskal-Wallis analysis of variance for willingness to pay (WTP) discrete choice with variables.

	WTP Discrete Choice			
	Relief		Cure	
Characteristics	Accept	Refuse	Accept	Refuse
Age	63.4	65.5	63.8	65.6
Disease duration	11.6	13.8	12.3	13.1
BMI	27.5	27.7	27.5	27.7
Comorbidity	2.1*	2.6*	2.1*	2.8*
WOMAC				
Pain	6.9	7.5	7.1	7.4
Stiffness	22.9	25.7	23.6	25.8
Function	2.8	2.6	2.9	2.6
Total	32.6	35.9	33.5	35.7
Proposed bid, €	59.7*	87.7*	62.3***	97.2***
Income, €	1536.5***	1060.1***	1449.3***	1071.6***

Means differ at : *** $p < 0.001$, * $p < 0.05$. BMI: body mass index.

DISCUSSION

Our study investigates how TTO and WTP are related to the WOMAC in OA patients attending a specialized arthritis clinic. WTP was elicited by 2 commonly employed methods. WTP questions were about expected health outcomes as previously argued[38]. The results show that TTO was correlated with the WOMAC pain, physical function, and total scores. No correlations were found between WTP and any of the WOMAC dimensions.

The reasons WTP was not correlated with the WOMAC in our sample may be multiple. First, mean WOMAC scores corresponded to one-third of the maximum score so we may consider that in our sample, OA was not as disabling as it could be. Additionally, OA is very often considered as a normal and irremediable consequence of aging. Individuals probably deem expensive therapeutics as futile expenses. Further, patients were unfamiliar with WTP questions concerning their health. Finally, in the Belgian national social security system, based on universality and solidarity, individuals do not pay directly for health care. The system is tax-financed, and social security pays for individual care or reimburses patients for a large part of their expenses. For all these reasons, participants would have been unprepared to trade money for health. As a result, they would have answered according to their ability to pay rather than their real health state.

The substantial heterogeneity of OA patients should also be kept in mind. It is likely that the sample size was too small to take into account such heterogeneity. It might be that the study population was too homogeneous in terms of health status and disease severity to detect a significant relationship between WTP and WOMAC scores. This would also explain the lack of correlation between TTO and WTP values. Future studies should be based on a larger population including more heterogeneous groups of patients. As a example, in addition to patients routinely followed by a specialist such as those included in this report, we could recruit patients failing to consult on a regular basis because of mild OA or patients waiting for joint arthroplasty because of unbearable pain and overwhelming disability.

The SG and VAS approaches were not employed to value health utility. WTP questions are likely to be cognitively demanding, and respondents may misunderstand or object to the concept of probability[39]. In our study, we included only patients fulfilling American College of Rheumatology criteria for OA. Age, education, or other sociodemographic data were not retained as selection criteria to get a sample as representative as possible of our OA population. Our study was a first attempt to investigate WTP in this population. We consequently postulated that the patients were not familiar with WTP and preferred to minimize offense and objection among participants by excluding cognitively demanding probability questions. The VAS approach was not employed because it may appear inaccurate and imprecise and has too weak a theoretic foundation for valuation of utility[40,41]. It should be noted that SG techniques would have led to different conclusions concerning a correlation between WOMAC, WTP, and health utility.

Comorbidity was inversely related to WTP amount and those refusing the bid reported more comorbid conditions. However, group comparisons between those affected and those not affected by each comorbid condition failed to show any significant differences. It seems that it was rather the number of comorbidities that affected WTP values. Such a number may be viewed as an indicator of the health burden on patients in addition to their OA. Those with other major chronic illnesses are certainly less willing to pay for an additional therapeutic agent because they already have to pay for other care. This may have important implications when using WTP as a measure of health benefit. Those reporting more chronic disease also have poorer quality of life. They may actually report lower WTP values and show reluctance to pay for a new therapeutic strategy. Consequently, they could be accredited with lower benefit even though their health state offers greater room for improvement.

Our findings can be compared to those from Cross, *et al*, who investigated WTP in OA for hip and knee joint replacement[42]. They reported that improvement in the operated joint before surgery versus after, as measured by the WOMAC, was not significantly associated with WTP. It was the postoperative joint state that determined WTP: those willing to pay something reported better postoperative scores for WOMAC pain, stiffness, and physical function than those unwilling to pay. As stated above, this suggests that we should study the association between WTP and specific health instruments on more heterogeneous groups of patients.

Few studies addressing the relationship between WTP,

health utilities, and health status instruments were retrieved. In asthma, psoriasis, and atopic eczema, TTO was found to correlate in the expected direction with specific health status instruments: the Asthma TyPE[43] and the Dermatology Life Quality Index (DLQI)[44]. These 2 studies report similar results with the SG and the generic Medical Outcome Study SF-36 health profile. In intermittent claudication, TTO was noted to correlate with 6 dimensions of the SF-36[45]. O'Brien, *et al*[46] also described a strong association between SG values and the 8 SF-36 dimensions in chronic lung diseases. Regarding WTP, when elicited by bidding game, it correlated with 2 dimensions of the Asthma TyPE[43] and one dimension of the DLQI[44]. When ascertained by discrete-choice, WTP correlated with one dimension of the Asthma TyPE[43] and 4 dimensions of the DLQI[44]. O'Brien, *et al* concluded that correlation between WTP and SF-36 dimensions were small and ambiguous[46].

Correlation between health utilities and WTP is problematic. No agreement was found across studies. As in this report, no significant association was observed between health utilities and WTP in asthma[43]. Lunberg, *et al* reported a significant correlation only between TTO and WTP as measured by discrete-choice question[44]. Results from Bala, *et al* in shingles confirm this statement: they report no significant correlation between QALY and WTP[47]. Conversely, O'Brien, *et al*[46] as well as Cunningham, *et al*[48] revealed a strong association between utility values and WTP.

In addition to household income, we introduced a question likely to reflect the self-perception of ability to pay. Our study clearly shows that ability to pay drives the WTP amount in this OA population. Whereas some authors warned against the influence of income on WTP in other populations[42,44,46], others minimize the importance of the level of income[47,49]. Nevertheless, few studies on WTP clearly show data on ability to pay.

Although the costs of OA and rheumatic diseases in general have been well documented, greater efforts are needed in the area of economic evaluation[50,51]. It has recently been argued that there is a dearth of full economic evaluations of acceptable quality as well as an under-implementation of cost-benefit analysis in rheumatic diseases[52]. Cost-benefit analysis is attractive for economists and policy makers. It deals with monetary value only, and WTP is based on relatively few weak assumptions compared to QALY computation and is theoretically sound in a welfare economy[53].

Our study of OA is the first to assess the relationship between WTP with TTO, WOMAC, and ability to pay. Whereas WTP measures showed good feasibility, our data failed to show that WTP suitably reflects clinical status. WTP was mainly related to economic status and ability to pay. On the other hand, TTO was correlated with the WOMAC dimensions and may be considered closer to the clinical situation than WTP. This finding extends and stimulates the intense debate on WTP application in health care[46,47,54-56]. In view of the dearth of published literature on this important issue, it seems premature and inopportune to conclusively reject WTP as a measure of health benefit. It should be kept in mind that in this study, a relationship between clinical status and WTP may not have been identified because of the limited range of clinical severity represented in the sample. Further analysis based on a broader and more heterogeneous OA population will be useful and is strongly advocated.

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