A Comparison of Willingness to Pay for Substance Use Disorder Treatment in Methadone Maintenance Clinics and Residential Facilities: The Role of Cost Payers' Income and Patients' Addiction Severity

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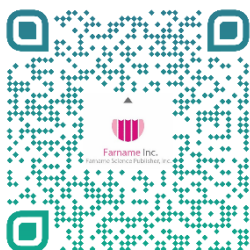
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ABSTRACT

Background & Objective: Traditional economic studies on substance use disorder treatment have generally focused on the standard evaluation of the costs and benefits of treatment programs. Meanwhile, willingness to pay (WTP) as a subjective economic indicator uncovers the intangible benefits of treatment that are not gauged by traditional measurements. This study aimed to examine the effect of cost payers' income and substance use disorder severity on WTP for treatment.

Materials & Methods: In an applied descriptive-correlational study, the Addiction Severity Index was used for patients with substance use disorder in two treatment settings: methadone maintenance treatment (MMT) and abstinence-based residential facilities (RFs). The cost payers' WTP was measured by the contingency valuation method. The cost payers' income and the patients' addiction severity indexes were analyzed in relation to WTP in a regression model. We also used Kruskal-Wallis and Mann-Whitney U statistical tests to examine the differences in the two treatment settings.

Results: In MMT clinics, WTP increased with higher income and a higher substance use index, respectively. WTP decreased with the worse grades in the patients' legal and medical status. In RFs, however, changes in WTP for treatment were solely dependent on the cost payers' income.

Conclusion: When clients and their families bear the full cost of treatment, cost payers' income plays a key role in preparedness for purchasing treatment services. The severity of substance use disorder is the second factor determining WTP for treatment.

Keywords: Willingness to Pay, Addiction Severity, Substance Use Disorder Treatment, Methadone Maintenance Therapy, Residential Facility

Introduction

In economics, benefit-cost methods estimate the financial advantages of an intervention against its costs. These methods have already been extended to the economic evaluation of substance use disorder (SUD) treatment programs (1, 2). Drug Abuse Treatment Cost Analysis Program (DATCAP) and Client DATCAP are known tools for standardizing cost estimates of interventions from the perspective of a community and clients, respectively (3, 4). To evaluate the financial benefits of SUD treatment programs, standard frameworks have also been developed which consider the monetary benefits of treatment as prevented tangible costs of SUD following treatment interventions (5-8), such as saving health-related costs, alleviating the burden on the judicial system, and averting productivity reductions. Furthermore, reductions in clinical severity of SUD, as measured by the Addiction Severity Index (ASI),

calculated in monetary values, have been applied to measure the benefits of treatment intervention (1, 2). French (9) classified the costs of addiction treatment into three groups: 1) cost of illness, emphasizing the costs of SUD as an illness such as reduced productivity of patients and the costs of their mortality and morbidity; 2) cost of averting behavior, focusing on costs of behaviors attempting to minimize the consequences of drug use, such as changing the place of residence or purchasing personal defense devices in high-prevalence areas; and 3) intangible costs of drug use, such as bystanders' pain and suffering, family disruption, and reduced public security and social welfare. These external costs can be measured by the utility valuation method. Evidently, the measurement of the benefits of SUD treatment must not be limited to avoided tangible costs but should be extended to intangible costs (10).

By definition, willingness to pay (WTP) is the maximum price that a person is willing to pay for an additional unit of applied product or service (11). Measurement of WTP, which was initially restricted to classical economic studies, has gradually expanded to public health (12) and drug use (13) policy studies. Nowadays, WTP is an appropriate method for measuring SUD treatment benefits (14-16). It measures the intangible outcomes of treatments such as improved social safety and individual well-being (12). Most WTP studies have focused on taxpayers' characteristics (15, 16) or family viewpoints (17-19), whereas Cartwright (5) points out the need for considering treatment value from consumers' point of view. Moreover, while most WTP studies have focused on demographic factors, the association between addiction severity and WTP has rarely been measured (20, 21).

In 2017, the number of drug users in Iran was estimated at 2,800,000, among whom 1,300,000 were registered clients on methadone maintenance therapy (MMT) or in abstinence-based residential services (RFs) (22). Contrary to MMT as a self-referral and voluntary service, residential services in Iran are often sought under the force of the family or by court referral (23). The six-month relapse rate for RFs has been reported to be as high as 85% (24); for the MMT service, it is between 20 and 69%, with an average of 30% (25-28). In Iran, treatment costs in both programs are either paid by clients themselves or by their families with no public funding or support. In our 2017 study (29), we examined WTP from cost payers' point of view and showed that attitudes towards different aspects

$$\text{Recent Use Index (RUI)} = \sum_{i \in S} \alpha_i \beta_i \gamma_i$$

$$\text{Long - Term Use Index (LTUI)} = \sum_{i \in S \times F} \alpha_i \beta_i \delta_i$$

of drug use and its treatment are important when deciding on paying for addiction treatment. In this research as the secondary analysis from the same study, we assessed the relationship of cost payers' income and SUD severity with their tendency to pay for treatment. Since economic studies on SUD treatment in Iran are limited (30, 31), we aimed to better understand the economics of drug use treatment in an Iranian sample by measuring WTP for addiction treatment.

Materials and Methods

Study Design

This was an applied descriptive-correlational study on WTP for SUD treatment in Iran conducted in 2017. We employed convenience sampling from two types of treatment programs of outpatient MMT and RFs in Tehran.

Ethics approval and consent to participate

The researchers pledged the confidentiality of information. The respondents filled out and signed a written consent form. The ethics standards of the study were approved by the Tehran University of Medical Sciences IRB (Code # 9121457002).

Participants

A total of 28 patients from three MMT clinics and 31 patients from four RFs participated. With the ASI, all the participants were interviewed for their addiction severity scores. If the patients paid for their treatments, then the WTP question was posed, but if another person paid the fee, we recruited the cost payers to present their WTP for treatment. Most MMT respondents for WTP were clients, while most RF respondents were family members. The inclusion criteria were the availability of the patient and the person in charge of paying the treatment fees (if different from the patient), and agreement to provide written consent (the confidentiality of the information provided by respondents was guaranteed by the researchers).

Instruments

We measured two important factors that influenced SUD treatment, including drug use severity and WTP.

A. To measure drug use severity, a modified and validated Persian-translated version (32) of ASI (33) was used. The Persian version of ASI had 114 questions covering six domains of medical condition, legal status, employment support status, family and social status, psychiatric condition, and drug use status. With an innovative approach, we included the number of different types of substances used, each weighted by both the harm index (30) and the frequency of use, to develop a table of adjusted indexes for recent use (in the month before treatment) and long-term use of drugs (See Table 1). Using the above conventional harm coefficients, we developed two equations to measure recent and long-term drug use status Recent Use Index (RUI) vs. Long-Term Use Index (LTUI). An increase in these indexes showed a more severe addiction status.

B. i: Index drug

S: Set of drug types

F: Set of frequency types of consumption (regular use vs. irregular use) (29, 34)

α: Conventional harm coefficient of index drug (according to Table 1)

β: Consumption frequency multiplier effect of index drug (regular use vs. irregular use index of each drug according to Table

γ: Identifier of recent use for index drug

δ: Consumption duration of index drug (year)

For example, the recent use index (RUI) for a patient with a history of regular heroin smoking and irregular

methamphetamine smoking one month before the treatment was calculated as:

9*11=99 for heroin

7.1*9=63.9 for methamphetamine

99+63.9=162.5 total RUI

Moreover, the long-term use index for a patient with a history of regular heroin smoking for two years and irregular methamphetamine smoking for the same time until 1 month before the treatment was calculated as:

9*11*2=198 for heroin

7.1*9*2=127.8 for methamphetamine

198+127.8=325.8 total LTUI

Since the patients did not remember the precise values of the responses in successful abstinence attempts and their longest abstinence period, we created an index relative to the extreme values reported in the sample. We formulated a relapse index (RI) according to the following equation:

$$\text{Relapse Index} = \frac{\left(\dfrac{\text{Successful Abstinence Attempts}}{\text{Highest Abstinence Attempt of the Sample}}\right) + \left(\dfrac{1 - \text{Longest Period of Abstinence (Month)}}{\text{Longest Abstinence of the Sample (Month)}}\right)}{2}$$

Evidently, an increase in this index reveals a higher rate of relapse and, therefore, a more severe process of drug use.

C. Based on the contingency valuation (CV) method **(15)**, we first presented the respondents with a variety of fixed payment ceilings (cost per day) for MMT clinics and RFs to select from. Then, we asked them whether the price of the service differed from the current one and what price would be the maximum they would pay above which they would give up their treatment. Next, the respondents were directly asked an open question regarding their maximum WTP to double-check their declared WTP. As noted before, in most cases, the actual person who paid for the treatment in RFs was a close family member, while it was the patients themselves in MMT clinics.

Data Collection

The questionnaires were completed and graded by a trained interviewer during a face-to-face interview.

Statistical Analysis

The two samples of MMT clinics and RFs could not be analyzed together because services in the two facilities were different in nature, i.e., outpatient pharmacological intervention vs. residential non-pharmacological service, respectively. Furthermore, in most cases, the actual person who paid for the treatment in RFs was a family member, while in outpatient clinics, it was the patients themselves. Therefore, considering different services and different supply and demand markets in the two samples, we recruited two separate regression models. For the non-parametric data, we also used Kruskal-Wallis and Mann-Whitney U statistical tests to examine differences between the opposing groups. To analyze the predictors of WTP, we used cost payers' income and the addiction severity scales as predictor variables. After checking the absence of collinearity in the variables, by using a backward regression equation, we calculated the best model specification.

Results

The average age of the patients was 41.2 (± 11) and that of the cost payers was 43 (± 11) years. The most frequent level of education for the patients in MMT clinics was below high-school diploma (70.5 %), while more than half (50.4 %) of the patients in RFs had a high-school diploma or higher degrees. The average monthly income of the cost payers in the three months before the treatment was $371 (± 315). The cost payers' demographic characteristics were presented in detail in our previous study **(29)**. The comparative demographic characteristics of the respondents in MMT clinics and RFs are given in Table 2. The clients at RFs were significantly younger and more educated than those in the MMT clinics, lived in larger houses, and had a lower income in the three months prior to their admission for treatment. Assuming that the respondents might not be willing to disclose their income, we also used the average surface area of the respondents' houses as an index of their socioeconomic status. Table 3 lists the results of the Mann-Whitney U test comparing economic indexes and WTP among the treatment cost payers. The respondents from MMT clinics were willing to pay up to $1.91 (± 0.58) per day (equal to 18% of their daily income), while the respondents from RFs reported that they were willing to pay up to $5.24 (± 1.73) per day (equal to 30% of their daily income). Therefore, WTP was significantly higher in RFs clients. Similarly, the cost payers' economic indexes in RFs were significantly higher than those of the respondents from MMT clinics.

Table 1. Grading of drugs' harms according to conventional harm coefficient and consumption frequency.

Drug	Method of Use				Frequency	
	Smoking	Oral Ingestion	IV Injection	Sniffing	Regular	Irregular
Cannabis	2	-	-	-	3	2.1
Methamphetamine	9	-	-	-	8	7.1
Opium	4	5	-	-	5	4.1
Opium Extract (Shireh)	6	7	-	-	6	5.1
Heroin	11	-	12	10	9	8.1
Crack Heroine	14	-	15	13	10	9.1
Methadone	-	1	-	-	2	1.1
Alcohol	-	8	-	-	7	6.1
Benzodiazepines	-	3	-	-	4	3.1

Table 2. Comparative demographic statistics of patients under treatment in MMT clinics and RFs. (Mann-Whitney U Test).

Variable	Center Type	Mean (SD)/Percent	Significance Level
Clients' age (year)	MMT	44.0(±10.9)	0.000
	RF	29.1 (±8.9)	
Education level (high-school graduate and above)	MMT	29.5%	0.009
	RF	54.8%	
Average monthly income in three months leading to treatment ($)	MMT	312.5 (±43.1)	0.000
	RF	203(±33.7)	

Table 3. Comparative economic indexes and WTP of cost payers in MMT clinics and RFs. (Mann-Whitney U Test).

Variable	Center Type	Mean (SD)	Significance Level
Average cost payer' monthly income in the three months leading to treatment ($)	MM	313.41(±220.9)	0.046
	RF	520.51(±220.9)	
Average residence surface area of the cost payer (m²)	MMT	51.81(±21.2)	0.000
	RF	72.55(±30.05)	
Daily willingness to pay ($)	MMT	1.91(±0.58)	0.000
	RF	5.24(±1.73)	

The recent use index (RUI) (see Table 4) was significantly higher in the clients from RFs than those from MMT clinics. On the other hand, the long-term use index (LTUI) did not significantly differ between the two settings. However, the relapse status index was significantly higher in the clients from RFs.

Table 4. Comparison of drug use status between clients in MMT clinics and RFs (Mann-Whitney U Test).

Variable	Center Type	Mean (SD)	Significance Level
Recent Use Index (RUI)	MMT	83.31(±60.8)	0.005
	RF	121.8(±64.6)	
Long-Term Use Index (LTUI)	MMT	1331.7(±1035.1)	0.258
	RF	1554.3(±1062.2)	

Information regarding the clients' source of income is presented in Table 5. In MMT clinics, the most common source of income was the client's employment, while in RFs, close relatives (mainly the family) were the main source of income. Table 5, Part B demonstrates the distribution of the two types of cost payers for treatment in RFs and clinics. In MMT clinics, often the clients themselves paid for their treatment, whereas in RFs, the patients' families paid the costs.

Table 5. Comparison of the frequency of the main source of income of clients (Kruskal-Wallis Test) and the actual cost payer's (Mann-Whitney U Test) in MMT clinics and RFs.

Variable	Frequency (%)		Significance Level
	MMT	RF	
Clients' main source of income			
Employment	73.1	29	0.000
Pension	6.4	3.2	0.000
Family	14.1	45.2	0.000
Illegal Activities	5.1	9.7	0.000
Other (Charity, etc.)	1.3	9.7	0.000
The actual cost payer			
Client	94.9	16.1	0.000
Other than the client (Family or else)	5.1	83.8	0.000

Exploring the bivariate correlation between variables of interest showed significant correlations between LTUI and the clients' lower economic status, reflected by their houses' average surface area in MMT clients (Table 6). Interestingly, no significant correlation was observed between WTP and drug use severity in MMT clients. However, RUI and LTUI in RF clients were significantly correlated with the cost payers' WTP.

Table 6. Correlations of variables of interest in MMT clinics and RFs.

Setting	Variable	Variable	Correlation coefficient	Significance Level
MMT	Long-term use index (LTUI)	Patient mean surface area of residence	-0.406	0.023
	Long-term use index (LTUI)	WTP	-0.071	0.538
	Recent use index (RUI)	WTP	-0.025	0.828
RF	Long-term use index (LTUI)	WTP	0.362	0.045
	Recent use index (RUI)	WTP	0.426	0.017

Based on the coefficient regression model (Table 7), in MMT clinics, the cost payer's income and long-term drug use index showed a positive association with WTP by 31.8% (p = 0.005) and 28% (p = 0.024), respectively. Moreover, a negative association was found between WTP and the clients' two sub-scales of *legal status* (-22.2%, P = 0.046) and *medical status* (27.5%, P = 0.022).

On the other hand, in RFs, the cost payers' income (43.6%, P = 0.028) was the sole determinant associated with WTP. It means that in MMT clients, WTP increased with higher income and a higher substance use index by 31.8% and 28%, respectively. Besides, WTP decreased with the worse grades in the clients' legal (22.2%) and medical status (27.5%). Nevertheless, in RFs, changes in WTP for treatment were solely dependent on the cost payers' income (43.6%).

Table 7. Regression model for WTP based on cost payers' income and the patients' addiction severity indexes in MMT clinics and RFs.

Variable(s)	Non-standard coefficients		Beta Standardized Coefficients	t	Significance Level
	B	Standard Error			
Setting: MMT clinics					
Model			Adjusted R Square: 0.276		0.000
Constant	12691.225	2663.854		4.764	0.000
Long-term use index (LTUI)	0.485	0.209	0.280	2.316	0.024
Legal status	-799.982	393.874	-0.222	-2.031	0.046
Medical status	-591.295	252.533	-0.275	-2.341	0.022
Positive history of discharge from treatment on financial grounds	-27.795	14.438	-0.205	-1.925	0.059
Cost payers' average monthly income in the three months leading to treatment	0.001	0.000	0.318	2.895	0.005
Setting: RFs					
Model			Adjusted R Square: 0.520		0.001
Constant	17983.894	4724.522		3.807	0.001
Long-term use index (LTUI)	-0.001	0.001	-0.216	-1.242	0.228
Relapse status index (RSI)	1001.932	1040.124	0.220	0.963	0.346
Employment support	2108.258	1140.182	0.392	1.849	0.079
Client's main source of income	0.829	0.909	0.150	0.912	0.372
Clients' average monthly income in the three months leading to treatment	-15645.033	8133.344	-0.274	-1.924	0.068
Cost payers' average monthly income in the three months leading to treatment	0.002	0.001	0.436	2.360	0.028

Discussion

We designed a study based on the contingency valuation approach to apply WTP for addiction treatment as a practical method in the evaluation of intangible costs of drug use and addiction treatment monetary benefits (18). In a previous study (29), we showed that cost payers' attitudes towards different aspects of drug use and its treatment play an important role in WTP for addiction treatment. In this research, as a secondary analysis from the same study, we considered patients' addiction severity and cost payers' economic status as other deciding factors.

This study showed that compared to the MMT clinics, WTP was higher in residential programs. Compared to MMT clients, those admitted to RFs were significantly younger, more educated, and had a higher RUI. In terms of financial status, RF clients were often dependent on their families who paid for the treatment. However, at MMT clinics, while the average client had

an employment-based income, the household family income was lower. Therefore, the significantly higher WTP for drug use treatment in RFs, compared to MMT clinics, might simply be regarded as a function of income. In other words, families with higher incomes prefer to send their addicted members to RFs to ease their own minds, even for a short time (23).

Given the nature of single payment upon admission to RFs, compared to the monthly payment in MMT clinics, it appears that families preferred the more expensive single-shot strategy of detoxification as a magic solution to drug use despite the higher relapse rate in this model. This preference for short-term detoxification treatment is similar to previous findings of a recent Iranian study on RFs (23).

Despite the reasonable expectation that LTUI should follow the same pattern as RUI, the lack of a significant difference in LTUI between the two groups may be attributed to the lower age of clients in RFs. The higher RUI in RFs clients may reflect poly-drug use with more high-risk use in RFs patients that results in more serious harm in a shorter period. However, as this harmful pattern lasted shorter in generally younger RFs clients, when compared to long-term traditional use of opioids with a less risky pattern in MMT clients, the harm-related difference became insignificant (represented in the non-significant difference of LTUI) between the two groups. Based on the average age of the MMT clients which was higher than that of the other group, one could add the possibility that individuals with a high-risk pattern of drug use have failed to survive to more advanced ages and, therefore, MMT clients should naturally have a low-risk pattern of drug use and lower LTUI.

As revealed by our regression model for MMT clinics, average monthly income had a significant association with WTP, followed by LTUI. Furthermore, a negative significant association between clients' LTUI and their houses' surface area was observed in MMT clients. In other words, the longer the clients' history of drug use, the worse their economic status. Evidently, in this study, we used the average surface area of the house as a representative of economic indexes; however, the use of *overcrowding*—the ratio of persons to floor space in square feet (35)—could also have been applied as a better representative. Our data showed that in MMT clinics, when the clients are paying for the treatment themselves and not through a third party, WTP is much more dependent on economic status. This conclusion is in line with former studies (36, 37) which found affordability to be a key determinant of retention in MMT. As shown in Table 3, the average monthly income of the MMT clients was $312.50—almost equal to the official monthly minimum wage for the same year ($282.50). Besides, according to the Statistical Center of Iran, the average nominal cost of Iranian households in 2017 was $686.50 compared to the $764.47 nominal income (38). One can, therefore,

conclude that since there is almost no margin left for treatment costs ($32 per month or 14% of the minimum wage) in the case of MMT patients, this could be a reasonable explanation for the cardinal role of economic status in the WTP of this group of patients.

Regarding items measured in ASI, drug use status, legal status, and medical status sub-scales have been shown to be key elements for calculating the financial benefits of drug use treatment (2). We found that intangible costs such as deteriorated legal and medical status were associated with a lower WTP for treatment. Our findings are consistent with those of previous studies in the United States (20) and Vietnam (39) on the association between clients' health conditions and WTP for methadone treatment.

Our findings revealed that in RFs, WTP is mainly associated with the cost payers' average income, which is consistent with a previous argument (16), justifying the role of income with more maneuverability in paying for drug use treatment costs. In a previous study (40) in Norway, after excluding two groups of respondents (those not believing in the efficacy of treatment and *protest zeroe*s who believed the government is responsible for paying for addiction treatment), the income elasticity of WTP was calculated as 0.75; this means that for every percent of increase in income, the WTP for the addiction treatment was raised by 0.75 %. Moreover, it has been shown (23) that desperate families who pay for treatment might use RFs as a solution to improve their own mental health. In fact, if they can afford the costs, they use RFs as a means of secluding the drug user from the community and the family. Therefore, WTP in RFs appears to be a factor of short-term drug use severity with no attention to the effectiveness of the program. Although there was no correlation between drug use severity and WTP in our sample from MMT clinics, both RUI and LTUI were correlated with WTP in RFs. We believe that the homogeneity of the drug use index in MMT clinics obscured such a correlation, while a wide variety of drug types and poly-drug use in RFs was a factor that led to such a correlation. Furthermore, the absence of such an association in our regression model might be due to the effect of other factors not measured in our study. Since we reported the first estimation of WTP for SUD in Iran, we believe our findings should be re-examined by future studies.

Assuming that only 15% of individuals with SUD undergo treatment each year, it is of policy-making importance to measure WTP for the priority assessment of subsidization or insurance coverage of different treatment programs. Using the price elasticity of demand for MMT and WTP for the service, Bishai (20) provided a model for allocating optimal subsidization of MMT and suggested the necessity of higher subsidy allocation for clients with lower WTP. According to our findings where WTP was lower in MMT settings, MMT should be prioritized over detoxification treatments whenever an incentive policy

for addiction treatment is considered (such as subsidization or insurance premium). Other factors such as patients' drug use status, legal status, and health status, as well as cost payers' economic status, should also be taken into account. The other point to consider is that according to this study, WTP was higher in residential programs, yet residential treatment is typically shorter. It would be advised to look not at WTP/day at a specific time point, but at WTP over a longer period or a lifetime WTP.

Limitation

Our sample was recruited from the Tehran metropolitan area; therefore, the results should be generalized with caution. Because of the payment system for drug use treatment in Iran in which patients and their families pay for treatment, we regarded WTP by people in treatment and third-party payers to be of the same value, an approach that needs further research.

Conclusion

WTP is a practical tool for evaluating SUD treatment programs. As long as addiction treatment programs follow conventional market rules where payment is out-of-pocket, cost payers' economic status plays a key role in preparedness for purchasing treatment services. Patients' severity of SUD could be another key factor determining the WTP for treatment. To understand the nature of the illegal drug market and its supply and demand for addiction treatment programs, the WTP for treatment could be applied in drug policy-making (20, 41) as a recommended research direction.

Authors' Contributions

Samaneh Ahmadian_Moghadam: Writing - Original Draft. Formal analysis, Investigation, Resources, Data Curation, Project administration, Software, Validation.

Emran M Razaghi: Writing - Review & Editing, Visualization, Supervision, Project administration, Conceptualization, Methodology, Funding acquisition.

Ali Mazyaki: Conceptualization, Methodology, Software.

Ethics approval and consent to participate

The researchers pledged the confidentiality of information. The respondents filled out and signed a written consent form. The ethics standards of the study were approved by the Tehran University of Medical Sciences IRB (Code # 9121457002). The authors declare that they have no conflicting interests regarding this study.

Availability of data and materials

The datasets used and/or analyzed in the current study are available from the corresponding author on reasonable request

Conflict of Interest

The authors declare that they have no competing interests.

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