

Modeling and Estimating Preferences Over Treatment Programs for Depression

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Abstract

Choice question data and discrete choice random-utility models are used to estimate preferences over treatment programs for depression. Preferences are allowed to vary with treatment and individual characteristics. The findings include: (1) The value of consuming market goods is less when one is depressed. This is a type of income effect and drives a wedge between willingness-to-pay to eliminate one's depression and willingness-to-accept it. Traditional income effects are also important. (2) The probability of choosing no treatment varies as a function of individual characteristics, costs, and side effects. (3) Willingness-to-pay to avoid sexual and weight gain side effects can be high but varies extensively across individuals.

Key words: Choice questions, depression, treatment preferences, WTP, income effects. *JEL classification:* I190, Q510

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In the United States, Major Depressive Disorder (MDD) is a widespread and chronic problem. Over their lifetime, 10 to 25% of women and 5 to 12% of men will suffer from depression. More than half of individuals who experience one episode of depression also experience a second (American Psychiatric Association, 1994).

Depressed individuals are less productive at work than non-depressed individuals. (Berndt et al., 1998). Experts predict that over the next decade depression will become the second leading cause of disability (Murray and Lopez, 1996). In 1990 the direct costs of depression, such as medical services, medication, and therapy, totaled approximately \$12.4 billion, accounting for more than two percent of all direct expenditures on health. Indirect costs from lost labor productivity and mortality were even larger at \$22.3 billion, approximately 0.5% of GDP.¹ These costs are similar to the costs associated with cancer, AIDS, and coronary heart disease (Greenburg et al., 1993).² But, most importantly, living with clinical depression greatly reduces one's quality of life. Up to 15% of those suffering from MDD commit suicide (American Psychiatric Association, 1994).

position across articles. We thank Kaiser Permanente for allowing us to conduct the study and Arne Beck, Cathy Bartsch, and Carolee Nimmer for sponsoring the project. Special thanks to the patients who participated in the study and the clinicians who recruited them. Thanks to Nick Flores, Luke Rodgers, and Don Waldman for valuable comments and suggestions.

¹ These numbers represent the costs of treating depression; they do not include willingness to pay to eliminate depression.

² Indirect costs are based on MDD and bipolar disorder. Direct costs are based on MDD, bipolar disorder, and dysthemia.

Somewhat surprisingly, a significant share of individuals with MDD discontinue treatment prematurely (McCombs et al., 1990; Thompson et al., 1996; Simon et al., 1996). For example, Lin et al. (1995) found that 28% of primary care patients stopped taking anti-depressants within one month of beginning treatment; 44% had stopped within three months. One explanation is that the treatment method, often chosen by the health care provider, does not match patient preferences. Another possibility is that how individuals feel about the side effects and costs changes as the level of depression wanes.

This study examines the treatment preferences of patients with MDD. We use a discrete choice random-utility framework to model and estimate treatment preferences as a function of the treatment program and patient characteristics. Treatment attributes include effectiveness, money and time costs, type of treatment, and sexual and weight gain side effects. We model how depressed individuals trade off treatment attributes as a function of depression severity, income, age, gender, and previous experience with side effects. We estimate: (1) the extent that perceived depression level affects the value of market goods; (2) other income effects; (3) the probability of choosing no treatment; (4) willingness-to pay to eliminate or reduce depression versus willingness-to-accept it; and (5) willingness-to-pay to avoid side effects.

The data come from a choice question survey administered to patients diagnosed with MDD at a HMO mental health facility.³ For each choice question,

³ The terms *choice questions* and *choice experiments* are used interchangeably in the literature. There is an extensive literature on the theory and application of choice questions in marketing, transportation, and economics. For survey articles see Louviere (1988); J. (1992); Wittink and Cattin (1989); Green and Srinivasan (1990); Batsell and Louviere (1991); Adamowicz et al. (1998). To name a few exam-

respondents chose their preferred treatment from two alternative depression treatment programs. One reason to use a choice question survey is that the patient's actual treatment program (the observed "choice") does not necessarily reflect the patient's preferences. The observed choice is the outcome of a dance between the patient, the clinician, and the insurance company and does not just reflect patient preferences.⁴

Figure 1 shows an example choice question from the survey. Each question describes treatment by its effectiveness, cost, hours of psychotherapy, use of anti-depressants, and possible side effects. We allowed for three side effects: loss of sex drive, becoming non-orgasmic, and extent of weight gain. For example, this question asks the respondent to choose between eliminating her depression but experiencing a 15% weight gain and no interest in sex and reducing her depression but experiencing the no-orgasm side effect. An additional question followed each choice pair and asked the individual to choose between the

ples, choice experiments have been used to examine patient treatment preferences over: asthma symptoms McKenzie et al. (2001); miscarriage management Ryan and Hughes (1997); the diagnosis and treatment of severe knee injuries Bryan et al. (1998, 2000); health states involving respiratory and cardiovascular illnesses Johnson et al. (2000); wait time for treatment Propper (1990); cervical cancer screening Ryan and Wordsworth (2000); health state preferences Hakim and Pathak (1999); the location of surgery facilities Ryan et al. (2000); rheumatology care Ryan and Bate (2001); and treatment of menorrhagia San Miguel et al. (2000).

⁴ See Mortimer (1997) for a study that for a study that uses observed treatment program to examine the demand for anti-depressants. Choice questions are easily designed so that there is independent variation in each attribute of a treatment program and can include treatment options not currently available. These are advantages over an observed choice method.

previously chosen treatment plan and no treatment. Each survey contained five pairs of choice questions. In making these choices, individuals are choosing over three emotional states: their current level of depression, some depressive symptoms, and no depression.⁵ These states are associated with varying time and money costs and side effects.

Our results show that preferences over the side effects vary significantly as a function of patient characteristics such as age and gender. This has important implications for tailoring the treatment to the patient. In addition, the results indicate significant willingness-to-pay (*WTP*) to eliminate or reduce depression.

To our knowledge, this is the first study that estimates how the value of market goods varies with one's level of depression. Our empirical results suggest that depressed individuals place less value on market goods/money than individuals who are not depressed. This reflects the fact that depressed individuals have diminished ability to enjoy the things that money can buy. While we are not the first to use choice questions to estimate treatment preferences for illnesses, we are the first to use choice question data to value in dollars, treatment programs for MDD.

Previous studies have used standard gamble (Revicki and Wood, 1998), contingent valuation (O'Brien et al., 1995), and a limited choice format (Dwight-Johnson et al., 2000) to learn about preferences over MDD treatment pro-

⁵ "Some Depressive Symptoms" was defined as a reduction in MDD where the individual still experiences a few symptoms of depressions. Respondents were told that the symptoms were not as severe as full depression but were more intense than the normal feelings of sadness experienced by non-depressed individuals.

grams.⁶ The outpatient populations in these studies ranged from primary-care patients screened with depression to patients currently being treated for depression.

Results vary across the three studies. Revicki and Wood (1998) found that treatment preferences varied with current depression severity but not with demographic characteristics. Severe depression was ranked as the worst of all possible depression and remission states, with 25% of the sample considering this state as worse or equivalent to death. Imipramine was typically considered less preferred than the other medications studied, nefazodone and fluoxetine, because of the resultant side-effects.

Dwight-Johnson et al. (2000) found that the majority of primary care patients preferred active treatment of depression to a wait-and-see approach; patients were fairly evenly divided on the preferred treatment method (antidepressants, individual counseling, group counseling). Treatment preferences varied by ethnicity, gender, income, and knowledge about treatment options. For example, wealthier individuals or those with more knowledge about antidepressants were more likely to prefer active treatment.

O'Brien et al. (1995) did not find significant differences by income, gender, age, or education, in WTP to avoid certain side effects. Average WTP to avoid each side effect are not significantly different from each other at the

⁶ In the study by Dwight-Johnson et al. (2000), patients chose over treatment programs that varied by cost, number of months spent in treatment, probability of cure, type of treatment, and presence of nausea or headache. The number of people choosing a specific option rather than a random utility model was used to calculate the probabilities of treatment choice.

5% level. However, O'Brien et al. (1995) does find significant differences in WTP to avoid the most disliked and least disliked side effects, blurred vision (WTP=\$Can11 per month) and dry mouth (WTP=\$Can11 per month).

1 Survey and Sample

The population of interest is depressed adults seeking treatment for a new episode of MDD. The sample includes both individuals seeking treatment for the first time and those with previous treatment experience who are seeking treatment for a new episode of depression. The study was conducted for 11 months at a Kaiser Permanente mental health facility in Colorado. The sample includes individuals age 22 and older. Patients as young as 18 were asked to participate if they were financially independent from their parents.⁷

All intake patients, prior to meeting with a clinician, received a note informing them of the study. Clinicians conducted a semi-structured mental health evaluation with each intake patient. Patients diagnosed with MDD were asked to participate in the study.⁸ If the patient was unable to participate because of time constraints, the clinician provided a take-home survey.

⁷ We excluded individuals who in addition to MDD had other major mental disorders (bipolar disorder, schizophrenia, psychotic features, etc.) or who possessed substance abuse problems. We also excluded patients assessed as suicidal, requiring inpatient care or intensive outpatient group care, depressed because of physical illness, or deemed not mentally capable. For patients older than 73, the clinicians used their own discretion as to the physical and mental capabilities of the patient to participate.

⁸ Many intake appointments at the clinic were for mental disorders other than MDD or for MDD combined with other co-morbidities. Each clinician had a list of

Surveys were administered in person to patients by a survey administrator (Jennifer Thacher) who explained the first choice question to all respondents and was available to answer questions. With the exception of the pretest, we did not pay participants.⁹ The survey instrument underwent extensive testing and revisions and was pre-tested on populations at both the University of Colorado and Kaiser Permanente.

The survey consisted of 37 questions and took approximately 15 minutes to complete. The overall readability level was grade six, as assessed by the Flesch-Kincaid Grade Level score. The survey had four sections. Section 1 provided background information about psychotherapy, anti-depressants, and side effects. It included questions on perceptions and attitudes about treatment. Section 2 consisted of the five pair-wise choice and follow-up questions and a question on the importance of each treatment characteristic in answering the choice questions. Respondents were told to assume that each treatment plan would last one year and permanently eliminate or reduce the depression. Section 3 collected demographic information and elicited information about any previous depression treatment. Section 4 asked a series of questions about

the eligibility criteria. Only a small proportion of the intake appointments qualified for the study, many fewer than we anticipated. It is not possible to calculate an accurate response rate. The clinicians did not always inform the survey administrator of eligible patient that they did not recruit, either because the patient did not want to participate or because the clinician did not have time to recruit. It is our sense that the clinicians made serious efforts to recruit eligible participants and that most of these participated.

⁹ The take-home surveys included a thank-you note and a nominal gift of \$2. Previous research has shown that nominal gifts increase the probability that the survey will be completed. Kaiser did not allow us to pay participants.

the patient's experience at the clinic.¹⁰ The appendix shows the levels of the seven attributes in the choice questions.

The design of the survey allowed for positive correlation between the cost and the number of hours spent in therapy. Side effects only occurred in combination with taking anti-depressants. We generated all reasonable alternatives, selected 16 choice sets for the final design, and divided it into four different survey versions (Johnson et al., 1998).¹¹ We assigned choice pairs to survey versions so as to ensure that there were no implausible comparisons across choice pairs.

2 The Data

One hundred seven individuals took the survey. Women comprised 75% of the sample. Eighty-one percent of respondents were White, Non-Hispanic. The average age of participants was 40 (s.d.=11); the youngest was 18 and the oldest was 74. The most common response to highest completed level of education was "some college". The average household income, based on the midpoint of income ranges, was \$53,738 (s.d.=30,516).

Table 1 shows the depression level and previous treatment experience of patients at the time of the survey. All individuals in the study were diagnosed as clinically depressed. Of those whom the clinicians diagnosed a level of de-

¹⁰ An example survey can be seen at www.unm.edu/~jthacher/DepressionSurvey.pdf.

¹¹ The choice sets were selected using the SAS `%choicseff` macro (Kuhfeld, 2000). D-optimality was chosen as the measure of a design's efficiency. See Huber and Zwerina (1996) and Zwerina et al. (1996) for a discussion of this method. An additional simple first choice question was created by hand and added to each survey.

pression, 27% were diagnosed with mild MDD, 61% with moderate MDD, and 10% with severe MDD. Forty-five percent of the sample were receiving their first ever treatment for depression.

Forty-five percent of respondents reported that they would need to take time off work in order to attend therapy sessions; 31% would need to arrange for child care. The most common descriptions of therapy, chosen from a list, were: helpful, chance to deal with things, self-exploration, and problem-solving. The most common descriptions of anti-depressants were: helpful, embarrassing, and common method.

When choosing between treatment programs, respondents chose the least-cost alternative only 35% of the time. They chose not depressed over some depressive symptoms only 61% of the time. In 89% of the follow-up choices, respondents chose treatment.

3 Model

A discrete choice random-utility model is assumed with K treatment alternatives, including no treatment. A logit specification is assumed. The individual is assumed to choose the preferred alternative given her current depression and her projection of what life would be like with either some depressive symptoms or no depression but additional costs and side effects. Each individual answered five sets of A , B choice pairs, each followed by a followup choice between the chosen alternative and no treatment (NT). One hundred and two individuals provided usable survey data. Denote the utility to individual i of

¹² Individuals could experience multiple side effects.

choosing treatment k from the j^{th} choice set

$$U_{ijk} = V_{ijk} + \varepsilon_{ijk}, \quad i = 1 \dots 102, \quad j = 1, \dots, 5, \quad k \in [A, B, \text{ and } NT] \quad (1)$$

where

$$V_{ik} = f(Y_i - P_k) + h(T_i - H_k) + g(\mathbf{X}_k). \quad (2)$$

Y_i is income, P_k is the cost of alternative k , T_i is free time, H_k is the number of therapy hours, and \mathbf{X}_k is a vector of the characteristics of treatment k . Income not spent on treatment, $(Y_i - P_k)$, is spent on the numeraire and time not spent on therapy, $(T_i - H_k)$, is spent in other activities. The probability individual i chooses alternative k from the j^{th} choice pair is:

$$\Pr_{ijk} = \frac{e^{V_{ijk}}}{e^{V_{ijA}} + e^{V_{ijB}}}, \quad k = A, B. \quad (3)$$

The probability that individual i chooses no treatment, NT , over the preferred treatment alternative in the j^{th} choice pair is:

$$\Pr_{ijNT} = \frac{e^{V_{ijNT}}}{e^{V_{ijA}} + e^{V_{ijB}} + e^{V_{ijNT}}} \quad (4)$$

The likelihood function takes the following form:

$$L = \prod_{i=1}^{102} \prod_{j=1}^5 (\Pr_{ijA})^{r_{ijA}} (1 - \Pr_{ijA})^{1-r_{ijA}} (\Pr_{ijNT})^{r_{ijNT}} (1 - \Pr_{ijNT})^{1-r_{ijNT}}. \quad (5)$$

r_{ijA} takes a value of 1 when alternative A is chosen and 0 otherwise. r_{ijNT} is defined similarly. See the appendix for a derivation of Equations 4 and 5. Maximum likelihood estimation is on the basis of 486 choices.

This estimated form of V_{ik} is specified in two steps. First utility is assumed a function of emotional state, both directly and indirectly through its effect

on the marginal utility of money (Model 1). After this specification is discussed, the model is generalized to include extensive preference heterogeneity in terms of observable characteristics of the individual such as age and gender (Model 2). The probability of selecting no treatment and WTP estimates are presented for Model 2.

3.1 Model 1: Allowing Utility to Depend on Emotional State

We allow emotional state to affect utility in two ways. First, we model utility as being directly influenced by emotional state. We also allow utility to be indirectly influenced by emotional state by allowing emotional state to affect how much an individual values goods. The variation in income across individuals allows us to separately identify the direct and indirect effects of emotional state on utility. A question of interest is whether individuals feel the same way about market goods regardless of their depression level. It seems reasonable that individuals obtain less pleasure from consuming goods when depressed.

Assume the utility from choosing a particular treatment alternative is:¹³

$$\begin{aligned}
 U_i = & (\alpha_y + \alpha_{yd}D + \alpha_{yds}DS)(Y_i - P) \\
 & + \beta_{ndc}NDC + \beta_{nda}NDA + \beta_{ndb}NDB \\
 & + \beta_oO + \beta_{sx}SX + \beta_wW \\
 & + \varepsilon_i
 \end{aligned} \tag{6}$$

¹³ The j subscript is suppressed.

This equation represents the result of specification testing by the authors. For example, number of hours spent in therapy was not a significant variable.

where,

D = Emotional state is depressed (1=Yes, 0=No)

DS = Emotional state is some depressive symptoms (1=Yes, 0=No)

Y_i = Individual i 's monthly household income (in thousands of dollars)

P = Monthly price of treatment (in thousands of dollars)

NDC = No depressive symptoms due solely to counseling(1=Yes, 0=No)

NDA = Not depressed from use of anti-depressants alone (1= Yes, 0=No)

NDB = Not depressed from both anti-depressants and counseling (1=Yes, 0=No)

O = Experiences no-orgasm side effect (1=Yes, 0=No)

SX = Experiences reduced sex-drive side effect (1=Yes, 0=No)

W = Experiences weight gain side effect (1=Yes, 0=No).

Denote α_y as the marginal utility of income for an individual when not depressed; $\alpha_y + \alpha_{yd}$ is the marginal utility of income when depressed and $\alpha_y + \alpha_{yds}$ is the marginal utility of income when the individual has depressive symptoms. Note that this specification assumes that depressed individuals can predict how much enjoyment they would receive from goods when not depressed.

The presence of the dummy variables NDA , NDB , and NDC allows individuals to have preferences over the method by which they treat their depression as well as preferences over the emotional states themselves. For example, all else held constant, β_{nda} represents the increase in utility from using anti-depressants alone to end depression. Three possible side effects, inability to orgasm (O), reduced sex-drive (SX), and weight gain (W), can affect an individual's utility. For example, the term β_o enters utility if the treatment

involves anti-depressants and results in the no-orgasm side effect.¹⁴

Table 2 shows the parameter estimates. All parameters are highly significant and of the expected sign. Model 2 correctly predicts 70% of the AB choices, 88% of the follow-up choices, and 63% of both choices. A likelihood ratio test rejects the hypothesis that $\alpha_{yds} = \alpha_{yd} = 0$. Thus we can reject the hypothesis that current emotional state does not affect the marginal utility of money. As would be expected, the marginal utility of income is highest when not depressed, followed by some depressive symptoms, and depression. When an individual is depressed, consumption is estimated to lose 22% of its value; with depressive symptoms, consumption loses 4% of its value.

Income effects exist because our model allows the the value people place on market goods to be affected by emotional state. Thus, WTP does not equal WTA . Consider an individual's WTP to eliminate her MDD through the use of therapy alone. Assuming zero cost for treatment, an individual would be willing to pay an amount such that her utilities are the same in both states¹⁵:

$$\alpha_y(Y_i - WTP_i) + \beta_{ndc}NDC = (\alpha_y + \alpha_{yd})Y_i \quad (7)$$

Solving for WTP_i , one obtains:

$$WTP_i = \frac{\beta_{ndc}}{\alpha_y} - \frac{\alpha_{yd}}{\alpha_y}Y_i. \quad (8)$$

The first term, $\frac{\beta_{ndc}}{\alpha_y}$, is the direct effect on utility of a change in emotional state. It is the strict improvement in utility from eliminating depression and is essen-

¹⁴ Equation 6 assumes that individuals feel the same way about side effects, regardless of treatment effectiveness.

¹⁵ Note the typical assumption that the random component is not state specific, so drops out of the WTP calculation.

tially the marginal rate of substitution between emotional state and income.¹⁶ The second term, $-\frac{\alpha_{yd}}{\alpha_y}Y_i$, is the indirect effect on utility from a change in emotional state. If $\alpha_{yd} < 0$, depressed individuals value the numeraire less and the income effect is positive and increasing in income. Eliminating MDD increases an individual's utility level both because she prefers being not depressed and because an individual values goods more when she is not depressed. If $\alpha_{md} = 0$ the income effect disappears. The calculation of WTP is based on the marginal utility of money that applies in the improved state. For the same scenario,

$$WTA_i = \frac{\beta_{ndc}}{\alpha_y + \alpha_{yd}} - \left(\frac{\alpha_{yd}}{\alpha_y + \alpha_{yd}} \right) Y_i. \quad (9)$$

A similar interpretation holds for this formula, except that now things are valued on the basis of marginal utility of income when depressed.

Comparison of Equations 8 and 9 shows that in absolute terms, $WTA > WTP$. You must pay an individual more to remain depressed than she is willing to pay to eliminate her depression. A depressed individual values each dollar of income (or unit of numeraire good) less if depressed than if not depressed, so depressed individuals must be paid significantly more to accept continuing MDD. An individual's current emotional state affects her marginal rates of substitution between income and emotional state. WTA and WTP estimates are presented below for Model 2, the model with heterogeneity.

3.2 Model 2: Preference Heterogeneity

Model 1 illustrates how marginal utility of income varies with emotional states and drives a wedge between WTA and WTP . This model assumes that ev-

¹⁶Note that the value of income varies with emotional state.

everyone has the same preferences, which is a restrictive assumption. Model 2 generalizes Model 1 by allowing treatment preferences to vary as a function of observable characteristics of the individual. We include the impact of the following characteristics in the final specification: gender, education level, the individual's current level of MDD, race/ethnicity, age, previous experience with the side effect, previous treatment experience, and Body Mass Index (BMI). In addition, Model 2 generalizes Model 1 to allow for two types of income effects: the emotional type of income effect introduced in the previous model and traditional income effects. We examined a number of other types of heterogeneity but did not find them to be significant. Specify utility as:¹⁷

$$\begin{aligned}
U_i = & (\alpha_y + \alpha_{yd}D + \alpha_{yds}DS)(Y_i - P)^{0.5} & (10) \\
& + \beta_{ndc}NDC + \beta_{ndb}NDB \\
& + (\beta_{ap1}P1_i)NDA \\
& + (\beta_{nde}E_i + \beta_{ndl}Li)ND \\
& + (\beta_{oyg}YG_i)O \\
& + (\beta_{sx} + \beta_{sxf}F_i)SX \\
& + (\beta_w + \beta_{wf}F_i + \beta_{wps}PS_i)W \\
& + \varepsilon_i,
\end{aligned}$$

¹⁷ The model was first fit estimating the exponent on income. A likelihood estimate test showed that the estimated exponent model was not significantly different from a model where the exponent was assumed to be 0.5.

where

F_i = Female (1=Yes, 0=No)

$P1_i$ = First treatment for MDD or previously treated with anti-depressants
(1=Yes, 0=No)

E_i = Has less than a college degree (1=Yes, 0=No)

L_i = Current MDD rated as moderate or severe by clinician (1=Yes, 0=No)

YG_i = Individual is less than 41 years of age (1=Yes, 0=No)

PS_i = Previously experienced weight gain side effect from anti-depressants or
underweight according to BMI score(1=Yes, 0=No).

Equation 10 differs from Equation 6 in a number of ways. (1) The marginal utility of income varies with household income. Model 2 allows for traditional continuous income effects through the term $(Y_i - P)^{0.5}$. (2) The term $(\beta_{ap1}P1_i)$ models it so that the only people for whom anti-depressant use affects their utility are those with previous treatment experience.¹⁸ (3) The term $(\beta_{nde}E_i + \beta_{ndl}L_i)$ allows education level and current depression severity to affect feelings about eliminating depression. (4) The no orgasm side effect $(\beta_{oyg}YG_i)$ only affects younger individuals.¹⁹ (5) The impact of the reduced sex-drive side effect $(\beta_{sx} + \beta_{sxf}F_i)$ varies with gender. And, (6) The

¹⁸ Use of anti-depressants did not significantly affect the utility of those individuals who had no previous experience with anti-depressants.

¹⁹ There was no significant effect for individuals older than age 40. There were no significant difference between current moderate and severe depression severity or between feelings about anti-depressant treatment alone if the individual was receiving her first treatment for depression or had previously been treated with anti-depressants.

term $(\beta_w + \beta_{wf}F_i + \beta_{wps}PS_i)$ allows the impact of the weight gain side effect to vary with gender, previous experience with this side effect, and the individual's Body Mass Index.

Table 3 reports the parameter estimates. Model 2 correctly predicts 74% of the AB choices, 89% of the follow-up choices, and 66% of both choices. On the basis of a likelihood ratio test, Model 2 explains the choices significantly better than Model 1.

The parameter estimates in Table 3 show, as expected, that holding outcome constant, individuals prefer treatments that require less money. Individuals without a college degree value eliminating their depression less than individuals with a college degree. Dwight Johnson et al. (2000) found a somewhat similar result; individuals with less knowledge about anti-depressant treatment are less likely to choose treatment.²⁰

Not surprisingly, moderately and severely depressed individuals value eliminating MDD more than mildly depressed individuals. Revicki and Wood (1998) also found statistically significant differences between utility scores based on current MDD severity.

We find different opinions among individuals about using anti-depressants as the sole treatment method. Individuals receiving their first treatment for MDD or previously treated with anti-depressants view it more favorably than individuals previously treated only with therapy.

²⁰ Our finding raises important ethical issues for the health care provider. Should patient preferences for non-treatment be respected when they are the result of education level? Or should health care providers spend more time on educating certain patients about depression treatment?

Individuals age 18 to 40 are negatively impacted by the the no-orgasm side effect; for individuals age 41 or older, the presence of the no-orgasm side effect does not significantly affect treatment decisions. We do not find significant gender differences in preferences over the no-orgasm side effect. The reduced sex-drive side effect makes males significantly worse off. It does not significantly affect women.

The weight gain side effect makes most individuals worse off; women are made worse off than men. Underweight women or individuals with previous experience with the side effect are less negatively impacted than other individuals. In fact, underweight males view the weight gain side effect as a marginally significant positive benefit. All women view the side effect negatively.

Note that the ranking of the side effects varies across individuals as a function of their characteristics. For example, consider two young people without previous experience with the weight gain side effect and who are not underweight. The female ranks the side effects from worst to least bothersome as: weight gain, no orgasm, reduced sex-drive. The male ranks the side effects from worst to least bothersome as: no-orgasm, reduced sex-drive, and weight gain.

Table 4 shows that for costless treatment, the probability of choosing no treatment increases as income falls. When not depressed, each dollar of income is enjoyed more. Because they consume more, higher income individuals obtain more value from treating their depression. Most individuals, except for the very poorest, would choose to eliminate or reduce MDD with therapy alone if treatment is free. The same is generally true for treatment that includes anti-depressants but has no side effects.

²¹ Calculated for individuals who are mildly depressed and have less than a college

Table 4 also shows that certain groups of individuals are likely to choose no treatment, even if the treatment was free. Therapies that include multiple side effects can cancel the impact of reducing one's level of MDD. In contrast, a model with no preference heterogeneity would predict that most individuals would choose treatment. A model that did not account for preference heterogeneity would significantly underestimate the probability of choosing no treatment for certain populations. For example, Model 2 predicts that a young, mildly depressed, male without a college degree is two times more likely to choose no treatment than Model 1 predicts.

Consider how a clinician might use these results. Assume there are four treatment plans available, those listed in Table 5. Column one of Table 5 reports the average choice probability associated with each option. The probability of choosing each treatment alternative was calculated for each individual in the sample; this probability was then averaged over the sample. Column one shows that therapy alone at \$600 per month is the alternative most likely to be chosen. The model predicts that on average, 30% of individuals would choose this treatment plan while only 7% would choose no treatment. Treatment *A* is twice as likely to be chosen, on average, as option *C*, a combined antidepressant and therapy treatment. This suggests that individuals feel there are attributes associated with treatment method beyond the cost or effectiveness. Most individuals have only a very small probability of choosing no treatment.

Column two indicates how much individuals deviate from these averages depending on their characteristics. The most noticeable aspect of this column is that the No Treatment alternative has a very high probability of being chosen

degree.

for some individuals in the sample. Some individuals have a 75% probability of choosing no treatment. The very poor are most likely to choose no treatment. For example, the individual predicted to be most likely to choose no treatment is female, young, does not have a college degree, is mildly depressed and earns less than \$10,000 per year. Lower income women getting their first treatment are more likely to choose anti-depressants alone with sexual side effects. Men are more likely to choose combined therapy and anti-depressants. In this simulation, income appears to be the most important determinant of which treatment a patient chooses.

Next we present *WTP* estimates to eliminate depression. Other studies have found that individuals reliably rank MDD as worse than other chronic diseases (such as, Wells and Sherbourne, 1999; Lenert et al., 2000) and in some cases view severe MDD as equivalently bad as or worse than death (Revicki and Wood, 1998). The survey indicated that the treatment plans would last for one year and permanently eliminate or reduce the depression. The implication of this is that treatment for less than a year would eliminate or reduce the depression while the treatment was taking place, but that depression would return if treatment were stopped prematurely. Borrowing and taking out loans for treatment is not an unreasonable response; one should not be surprised if individuals have *WTP* for a cure that is more than their income for the year. Finally, another issue to consider when interpreting *WTP* is that individuals may account for the associated labor effects of treating their MDD; individuals may believe that an improved emotional state will allow them to earn a higher wage (Graves, 2002). We do not have data that would allow us to test for this last possibility.

Tables 6 and 7 shows descriptive statistics for *WTP* and *WTA* to eliminate

or reduce MDD. In Table 6, treatment is through therapy alone and estimates vary across the individuals in the sample as a function of current MDD level, income, and education level. In Table 7 treatment is through anti-depressants alone. We examine the cases of no side effects and experiencing all three side effects. In the second part of 7, *WTP* and *WTA* also vary by characteristics that affect side-effects, such as age and gender.

As expected, income effects cause a wedge between *WTP* and *WTA* and the estimates are of a large magnitude. Tables 6 and 7 also show that there is significant heterogeneity in the amount people are willing to pay to eliminate their depression. Table 7 shows, as would be expected, that both *WTP* and *WTA* measures are significantly lower in the presence of side-effects. The fact that these measures are lower for treatment with anti-depressants than for treatment with therapy alone reflects the fact that individuals perceived a difference between eliminating and reducing their depression when the treatment was with therapy but did not perceive a difference when treatment was with anti-depressants alone. This seems to indicate that individuals do not fully believe that anti-depressants can completely eliminate their depression.

Table 8 expands on the relationship in Table 6 by showing how *WTP/WTA* to eliminate depression by therapy alone varies by income level and current depression severity for individuals without a college degree. It reports the estimated *WTP* and *WTA* for these measures, which comes from the choice question data. In addition, Table 8 reports the simulated median and confidence intervals for these measures.²² Ceteris paribus, households with the

²² As can be observed from the confidence intervals, the distribution is quite asymmetric. For this reason, we report the simulated median rather than the simulated average *WTP* and *WTA*.

lowest incomes possess the highest marginal utility of money. Higher-income individuals are willing to pay more to eliminate MDD and side effects.

4 Conclusions

This study examines the treatment preferences of MDD patients at a HMO mental health clinic. We analyze choice question data using two random utility discrete-choice models. The study demonstrates the feasibility of using choice question data to study treatment preferences for mental illnesses. Not surprisingly, individuals preferred treatment programs with lower costs, greater effectiveness, and fewer side effects. We found significant preference heterogeneity for depression treatment among individuals. Individual characteristics such as gender, age, current depression severity, income, and previous treatment experience affect treatment preferences. Allowing preference heterogeneity shows that certain groups have a fairly high probability of choosing no treatment, even if the treatment is free. In addition to traditional income effects, we found that the value of market goods varies with emotional state: an individual values consumption less when depressed. This drives a wedge between *WTA* and *WTP*. Because depressed individuals value money less, they must be paid more to remain depressed than they would be willing to pay to eliminate their depression.

All depressed individuals have experience with not being depressed. An issue is how accurately they can recall not being depressed. Research suggests that individuals might make mistakes with respect to judging what alternate emo-

²³ Distribution is based on 10,000 draws.

tional states would be like. It is not clear in which direction these mistakes would be. For example, would an individual be more likely to overestimate how wonderful life would be without depression or more likely to take the gloomy perspective that life wouldn't be that much better without depression? Future work needs to more explicitly address this issue.

Future research needs to monitor compliance and collect data from those who do and do not continue treatment. More data is needed on how individuals tradeoffs between effectiveness and costs might or might not change as treatment progresses.

A Attribute Levels

B Derivation of Equations 4 and 5

The probability that individual i chooses treatment A over treatment B and then chooses treatment over no treatment is:

$$\Pr_{ijA\cap T} = \frac{e^{V_A}}{e^{V_A} + e^{V_B} + e^{V_{NT}}}. \quad (\text{B.1})$$

Equation 4 follows from the fact that $\Pr_{ijNT} = 1 - \Pr_{ijA\cap T} - \Pr_{ijB\cap T}$.

In the case of the logit model, it can easily be shown that the more general form of the likelihood function,

$$L = \prod_{i=1}^{102} \prod_{j=1}^5 (\Pr_{ijA\cap T})^{r_{ijA\cap T}} (\Pr_{ijB\cap T})^{r_{ijB\cap T}} (\Pr_{ijA\cap NT})^{r_{ijA\cap NT}} (\Pr_{ijB\cap NT})^{r_{ijB\cap NT}}, \quad (\text{B.2})$$

simplifies to Equation 5.

²³ Kaiser limited the dollar amounts that could be used in the survey.

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Fig. 1. Example choice question

10 If you had to choose, would you prefer Alternative A or Alternative B?

	Alternative A	Alternative B
Effectiveness	Not Depressed	Some Depressive Symptoms
Hours of psychotherapy per month	6 hours	6 hours
Use of anti-depressants	Yes	Yes
Your monthly cost for treatment	\$350	\$350
Weight gain from treatment	15% weight gain	None
Little or no interest in sex	Side effect occurs	No side effect
Inability to achieve an orgasm	No side effect	Side effect occurs
<i>Check the box of the alternative you prefer</i>	<input type="checkbox"/>	<input type="checkbox"/>
	I prefer Alternative A	I prefer Alternative B

11 If you had to choose, would you prefer the alternative you chose in question 10 or would you prefer to receive no treatment and stay at your current level of depression? *Check the appropriate box.*

1 I prefer the alternative that I chose in question 10, including the costs and side effects, to my current condition

2 I prefer to receive no treatment and stay at my current level of depression

Table 1

Current Depression and Previous Treatment Experience

	Number	Percent
Clinician's Assessment of Depression Level		
Mild	22	27%
Mild-Moderate	1	1%
Moderate	50	60%
Moderate-Severe	1	1%
Severe	8	10%
Treatment Experience		
First treatment for depression	48	45%
Side Effect Experience if Previously Used Anti Depressants¹²		
Weight Gain Side Effect	19	42%
Diarrhea Side Effect	5	11%
Inability-to-Orgasm Side Effect	16	36%
Reduced Sex-Drive Side Effect	22	56%
Other Side Effect	11	24%

Table 2

Model 1 Maximum Likelihood Parameter Estimates

Parameter	Estimate	Est/s.e.	Prob
MU of Income (α_y)	1.88	2.48	0.01
MU of Income Change if Depressed (α_{yd})	-0.41	-6.13	0.00
MU of Income Change of Depressive Symptoms (α_{yds})	-0.06	-1.60	0.05
MU: Eliminate Depression with Therapy Only (β_{ndc})	1.13	4.02	0.00
MU: Eliminate/Reduce Depression with Anti-Depressants Only (β_{nda})	0.68	2.27	0.01
MU: Eliminate/Reduce Depression with Both (β_{ndb})	1.09	4.27	0.00
MU: No Orgasm Side Effect (β_o)	-0.57	-3.21	0.00
MU: No Sex-Drive Side Effect (β_{sx})	-0.30	-1.88	0.03
MU: Weight Gain Side Effect (β_w)	-1.03	-7.13	0.00

Table 3

Model 2 Maximum Likelihood Parameter Estimates

Parameter	Est.	Est/s.e.	Prob
Income Parameter if Not Depressed (α_y)	6.05	3.24	0.00
MU of Income Change if Depressed (α_{yd})	-0.99	-5.78	0.00
MU of Income Change if Depressive Symptoms (α_{yds})	-0.22	-1.57	0.06
MU: Eliminate Depression with Therapy Only (β_{ndc})	1.29	4.30	0.00
MU: Anti-Depressants Only; 1st Treatment or Previous Anti-Depressants (β_{ap1})	0.78	2.60	0.00
MU: Eliminate/Reduce Depression with Both (β_{ac})	1.10	4.04	0.00
MU Change: Eliminate Depression; No College Degree (β_{nde})	-1.11	-3.64	0.00
MU Change: Eliminate Depression; Severely or Moderately Depressed (β_{ndl})	0.94	3.25	0.00
MU: No Orgasm; Young (β_{oyg})	-1.02	-4.24	0.00
MU: No Sex-Drive (β_{sx})	-0.77	-2.66	0.00
MU Change: No Sex-Drive; Female (β_{sxf})	0.64	1.92	0.03
MU: Weight Gain Side Effect (β_w)	-0.44	-1.81	0.04
MU Change: Weight Gain; Female (β_{wf})	-1.21	-4.26	0.00
MU Change: Weight Gain; Previously Experienced or Underweight (β_{wps})	0.94	3.28	0.00

Table 4

Probability of No Treatment Varies with Treatment and Personal Characteristics

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Treatment	Probability of Choosing No Treatment at Zero Cost		
	Income	Income	Income
	=20K	=55K	=90K
Therapy Only	19%	9%	5%
Anti-Depressants and Weight-Gain Side Effect for Female with Moderate/Severe Depression	44%	25%	16%
Anti-Depressants with Weight-Gain Side Effect for Female Receiving First Treatment	67%	46%	32%
Anti-Depressants with No-Sex-Drive Side Effect for Male Receiving First Treatment	45%	26%	16%
Anti-Depressants with No-Orgasm Side Effect for Age 18 – 40 Receiving First Treatment	52%	31%	20%
Anti-Depressants with Both Sexual Side Effects for Male, Age 18 – 40 Receiving First Treatment	70%	50%	35%

Table 5

Heterogeneity Causes Differences in Preferred Treatment

Treatment Option	Probability Choose		
	Avg	Min	Max
A: Therapy Only (6 hours per month; \$600)	30%	2%	56%
B: Anti-depressants Only (Sexual side effects; \$50)	20%	5%	40%
C: Anti-depressants & Therapy (2 hours; Weight gain; \$250)	17%	5%	51%
D: Anti-depressants Only (No side effect; \$350)	25%	4%	34%
E: No Treatment	7%	0%	75%

Table 6

Descriptive Statistics for Monthly *WTP* and *WTA* to Eliminate Depression by Therapy Alone

	Average	Median	Min	Max
WTP	\$1,642	\$1,532	\$134	\$4,309
WTA	\$2,628	\$2,349	\$203	\$7,086

Table 7

Descriptive Statistics for Monthly *WTP* and *WTA* to Eliminate/Reduce Depression
by Anti-Depressants Alone

Experience All 3 Side-Effects

	Average	Median	Min	Max
WTP	\$258	\$232	-\$1,374	\$2,429
WTA	\$423	\$293	-\$1,242	\$3,433

Experience No Side-Effects

	Average	Median	Min	Max
WTP	\$1,347	\$1,234	-\$109	\$3,689
WTA	\$2,050	\$1,884	-\$111	\$5,475

Table 8

Comparison by Income Level and Current Depression Level of *WTP* and *WTA* to

Eliminate Depression with Therapy Alone for Individual without a College Degree

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	Current Mild Depression		Current Moderate Or Severe Depression	
	Monthly WTP (Median) (C.I.)	Monthly WTA (Median) (C.I.)	Monthly WTP (Median) (C.I.)	Monthly WTA (Median) (C.I.)
\$20,000	\$570 (\$571) (\$346 – \$1,006)	\$839 (\$840) (\$447 – \$2,268)	\$872 (\$864) (\$584 – \$1,339)	\$1,463 (\$1,453) (\$838 – \$4,310)
\$55,000	\$1,496 (\$1,487) (\$982 – \$2,608)	\$2,179 (\$2,156) (\$1,245 – \$5,776)	\$2,017 (\$2,012) (\$1,393 – \$3,293)	\$3,181 (\$3,182) (\$1,883 – \$8,394)
\$90,000	\$2,409 (\$2,388) (\$1,610 – \$4,278)	\$3,498 (\$3,453) (\$2,033 – \$9,531)	\$3,086 (\$3,090) (\$2,141 – \$5,241)	\$4,766 (\$4,789) (\$2,850 – \$14,181)

Table A.1

Current Depression and Previous Treatment Experience

Attribute	Levels
Effectiveness	Not Depressed, Some Depressive Symptoms, Current Level of Depression
Hours of psychotherapy per month	0, 2, 4, 6
Monthly cost for treatment ²⁴	\$0, \$15, \$30, \$45, \$50, \$60, \$75, \$90, \$100, \$105, \$150, \$200, \$300, \$350
Use of anti-depressants	Yes, No
Reduced sex-drive side effect	Occurs, Doesn't Occur
Inability-to-orgasm side effect	Occurs, Doesn't Occur
Weight gain side effect	0%, 5%, 10%, 15% of current weight