Measuring the Willingness-to-pay for a Horticulture Therapy Site Using a Contingent Valuation Method

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Abstract. Previous research has shown horticultural therapy (HT) provides both physical and mental benefits to those engaged in the gardening activities. Individuals' willingness-to-pay (WTP) for these benefits, however, is unknown because of the lack of well-defined markets for HT. As such, this study estimates individuals' mean WTP for a HT site in Busan, South Korea. Mean WTP is ≈$170/month U.S. per individual. WTP, however, shows a wide dispersion; the standard deviation of the estimated WTP is ≈$60 U.S. This study provides additional information to the policymakers of Busan concerning the issue of developing a horticultural site for its citizens. This information must be weighed against the costs of developing the site.

Horticultural therapy (HT) is the use of gardening-related activities to help achieve treatment and rehabilitation goals (American Horticultural Therapy Association, n.d.). Gardening benefits include improved physical and psychosocial health outcomes such as lower cholesterol levels, lower blood pressure, improved psychological well-being, and increased social integration (Armstrong, 2000; Waliczek et al., 2005; Walsh et al., 2001). One potential avenue for achieving these benefits is the exercise gardening provides. The American College of Sports Medicine and the Centers for Disease Control and Prevention recommend at least 30 min of moderate intensity physical activity 5 d or more per week (Nelson et al., 2007; Pate et al., 1995). Gardening offers such physical activity (Ainsworth et al., 2000; Gunn et al., 2005; Withers et al., 2006).

Furthermore, gardening activities include weightbearing motions such as pushing a mower, digging holes, pulling weeds, and moving soil, which work most muscle groups leading to improved muscle strength and bone mineral density (Restuccio, 1992; Turner et al., 2002). Another potential physical benefit of gardening activities is the possibility of improved muscle coordination and the training of unused muscles (Relf, 1973). Gardening activities provide proper motions to practice grasp and release and flexion of the thumb and forefinger (Relf, 1973). Such activities may improve grip strength of participants in gardening programs (Reynolds, 1999). Particularly for older adults, gardening activities are suitable because they can be adapted to a variety of physical abilities (Relf, 1981; Riordan, 1983; Shoemaker and Lauer, 1979).

Since Kaplan (1973) suggested humans have a basic psychological need for plants in the environment, studies have demonstrated that gardening has positive effects on psychological aspects, including improved psychological well-being (Kaplan, 1973; Reynolds,

2002; Ulrich, 1981) and social well-being (Sommer et al., 1994). Through gardening, older adults may experience a sense of achievement, satisfaction, and aesthetic pleasure (Milligan et al., 2004). Moreover, seeing greenery and being in nature reduce stress and pain and improve attention capacity and mood (Diette et al., 2003; Lohr and Pearson-Mims, 2000; Ulrich, 1981). Despite growing interest in HT, few studies have addressed people's willingness-to-pay (WTP) for HT in terms of rehabilitation and recreation activities.

The metropolitan city of Busan (population 3.6 million), the second largest city in South Korea, is interested in developing a HT site for its citizens. This site would be designed for its citizens to enjoy activities such as walking, physical therapy and other medical treatments, recreation, and experiential activities. Busan government officials are concerned with the economic value of the HT site as they evaluate the costs and benefits from establishing the site. This study's objective is to estimate the WTP for the use of the HT site by the citizens of Busan.

Because of the current lack of well-defined markets for HT sites, relevant market data on individuals' WTP are not available; therefore, this study uses a contingent valuation approach. The contingent valuation method (CVM) is often used to obtain individuals' WTP for hypothetical changes in situations in which there is a lack of market data. CVM has gained broad acceptance (Walsh, 1986). It has been used to estimate WTP for a variety of nonmarket situations, including endangered species and wildlife (Solomon et al., 2004), clean water (Carson and Mitchell, 1993), landscape preservation (Drake, 1992), parks and rivers (Lee, 1997), and cultural heritage (Dutta et al., 2007).

Materials and Methods

CVM estimations of WTP begin empirically with defining a change within a contingent or hypothetical market. Here, the change is providing the HT site versus the current situation of no HT site. The contingent market is usually represented by the use of a survey questionnaire, which explains the situation and then asks the respondents if they are willing to pay a given bid amount provided there is an appropriate payment vehicle. After statistical estimation of the WTP function, a mean WTP is obtained through mathematical manipulation of the estimated function. WTP is the monetary amount that makes a person indifferent between the two scenarios, with and without the HT site.

A dichotomous choice (DC) question is used to measure individual's WTP. Respondents in the DC approach are asked only to accept or reject a suggested bid under the hypothetical market situation. In other words, they need answer only "yes" or "no" to a given bid. It may be easier for respondents to make a decision in the DC question because they are familiar with discrete choices in real market transactions (Hanemann, 1994).

Model specification and procedures. The theoretical starting point for CVM studies is the random utility model. In this model, the utility that individual i receives from alternative k is:

$$u_{ik} = v_{ik} + \varepsilon_{ik} \qquad [1]$$

where v_{ik} is the indirect, deterministic utility individual i receives on choosing alternative k, and ε_{ik} is an unobservable or random component of the utility function. The random component is assumed to be identically, independently distributed with mean zero.

Let A be a specific fee associated with the use of the HT site. An individual will choose the HT site (alternative j) over not having the HT site (alternative k) if the utility associated with the HT site and paying the fee is larger than the utility associated with not having the site (Hanemann, 1984):

$$u_{ij}(Y_i - A_i, x_i) + \varepsilon_{ij} > u_{ik}(Y_i, x_i) + \varepsilon_{ik} \quad [2]$$

where Y is income, A is the fee or bid, and x_i represents a vector of individual socioeconomic characteristics of individual i. If the utility associated with not having the site is larger than the utility with the site and paying the fee, the individual chooses to not pay the fee for the site.

It is often assumed that u_{ij} takes on a linear form (Haab and McConnell, 2003). Under this assumption, the difference in utility between having the HT site and not having the site can be written as:

$$\begin{aligned} \Delta u_i = u_{ij} - u_{ik} &= \alpha_1 + \beta_1(Y - A_i) + \gamma_1 x_i \\ &\quad - (\alpha_0 + \beta_0 Y_i + \gamma_0 x_i + \varepsilon_{ij}) \\ &= (\alpha_1 - \alpha_0) - \beta_1 A_i + (\beta_1 - \beta_0) Y_i \\ &\quad + (\gamma_1 - \gamma_0) x_i + \varepsilon_{ik} > 0 \\ &= \alpha - \beta_1 A + \beta Y_i + \gamma x_i > 0 \qquad [3] \end{aligned}$$

where $\alpha = (\alpha_1 - \alpha_0)$, $\beta = (\beta_1 - \beta_0)$, and $\gamma = (\gamma_1 - \gamma_0)$; the α's are the intercepts, and β' and γ's are the coefficients associated with the bid amount, income, and other socioeconomic factors. Inclusion of income depends on assumptions on the marginal utility. For example, under the assumption of constant marginal utility of income between the two alternatives, the coefficients associated with income are equal, $\beta_1 = \beta_0$. Under this assumption, income drops from the utility difference equation (Haab and McConnell, 2003). Socioeconomic characteristics are often included in cross-sectional empirical analyses to shed light on the importance of particular factors (Shaw et al., 2005). Models including and excluding income and other socioeconomic factors are estimated to determine the effect of these assumptions on WTP.

The DC format of the CVM question has a binary choice dependent variable, which requires a qualitative choice model. The most commonly used model is the logit model. In the logit model, the probability (P_i) that the individual will accept a bid (A) can be expressed as (Hanemann, 1989):

$$\begin{aligned} P_i = F_i(\Delta u) &= \frac{1}{1 + \exp(-\Delta u)} \\ &= \frac{1}{1 + \exp\{-(\alpha - \beta_1 A + \beta Y + \gamma x)\}} \end{aligned} \qquad [4]$$

where $F_i(\Delta u)$ is the cumulative distribution function, β_1 is the coefficient associated with the negative of the bid amount, and α, β, and γ are the coefficients (previously defined) to be estimated. The model is estimated using NLOGIT version 3.0.10. Following Haab and McConnell (2003), expected WTP can be calculated as:

$$E(\text{WTP}) = [\hat{\alpha} + \hat{\beta}\bar{Y} + \hat{\lambda}\bar{x}]/\hat{\beta}_1 \qquad [5]$$

where the hats ($\hat{}$) represent the estimated coefficients from the logit model and the bars ($\bar{}$) indicate the means of the independent variables. In other words, mean WTP equals the sum of the mean of the independent variables multiplied by their estimated coefficients for all variables except bid divided by the estimated coefficient associated with the bid amount.

Hypothetical market scenario and survey design. The contingent valuation questionnaire was designed to provide respondents with adequate information, making them aware of the hypothetical market situation. Before the hypothetical situation was presented, the activities and goals of the HT site were outlined. The following information was provided to the respondents. The Busan metropolitan city government is planning to operate an experiential HT site with the goal of improving the physical and mental health of the community. This program will allow people to cultivate flowers and vegetables. Furthermore, people can enjoy walks, other recreational activities, experiential activities in the proposed HT garden, and other mental and physical therapy activities. Experiential activities include cultivating plants in flower pots and growing vegetables and flowers outdoors. The HT also provides activities for making a variety of garden-oriented art crafts such as dwarf trees and mosaics of flowers. Furthermore, participants will enjoy taking a walk in the garden, medical examinations, physical (medical) treatments, recreation, baths, and meals. Experiential activities run Monday through Friday 9 AM to 5 PM.

The CVM scenario (translated from Korean) was:

> *"If a HT site is provided for physical rehabilitation and mental health, where activities such as walking, treatment of physical therapy and medical conditions, recreation, and experiential activities would take place, would you be willing to pay _____Won as an admission fee for one month per person?"*

In the blank, only one fee amount was placed, which was randomly selected from a predetermined range of offers. Each respon-

dent received only one contingent valuation scenario. Respondents provided a single yes/no answer to this contingent scenario. A set of eight different offers were selected on the basis of pretest results, which asked participants to provide their maximum WTP for month per person for activities at the HT site using an open-ended question. The results of the pretest survey indicate that WTP ranged from a low of 50,000 to a high of 2,000,000 Won (Korean currency). Based on the pretest, the predetermined fees were 50,000, 100,000, 150,000, 200,000, 300,000, 500,000, 1,000,000, and 2,000,000 Won. At the time of the survey, $1 U.S. equaled $\approx$950 Won giving approximate values of $53, 105, 158, 211, 316, 526, 1053, and 2105 U.S.. The pretest involved testing the entire questionnaire, including explanations on the questionnaire, directions, and WTP questions, by conducting a small sample survey.

An on-site survey of Busan metropolitan citizens was conducted between 8 and 16 Aug. 2006. This study used a personal interview method, which is more likely to elicit reliable estimates of use value of HT because of its strength in achieving higher response rates than mail surveys (Lee and Han, 2002). The survey was conducted in busy areas of public offices, universities, bus and railroad stations, department stores, and markets. Field researchers approached residents, outlined the purpose of the research project, and invited them to participate in the survey. On obtaining consent, a self-administered questionnaire was presented to each respondent to complete. A total of 422 usable questionnaires were collected.

Results and Discussion

Demographic profile of respondents. The proportion of male respondents (49.8%) is similar to female respondents (50.2%), which mirrors the population of Busan (Table 1). Age groups in the sample are also relatively evenly distributed, except for people aged 60 years and older. When compared with Busan age groups, the sample underrepresents older respondents (60+ years of age) and overrepresents respondents in the 40- to 49-year-old age group. The remaining age groups' percentages are similar between the sample and Busan citizens. Respondents that have attended colleges or universities represent 53.6% of respondents, whereas 46.4% of the respondents had a high school education or less. Corresponding numbers for education for Busan are not available. Respondents with monthly household income between $3000 and $3900 U.S. (incomes converted to U.S. dollars using an exchange rate of 950 Won/U.S. dollar) comprise 35.8% of the sample followed by respondents with incomes greater than $4000 (29.4%), less than $1900 (19.4%), and $2000 to $2900 (15.4%). Using the midpoints of the income ranges and probabilities associated with each range, mean monthly income of the sample is $3297. Again, comparable breakdown of monthly incomes is not available for Busan.

Mean per capita gross domestic product (GDP) for all Busan population, however, is $1188. A more comparable figure would be to convert this per capita figure to per capita for the population older than age 20 years. In this case, mean per capita GDP is $1530. Overall, the sample is slightly younger and has a higher income level than the population of Busan. Given the locations where the survey was conducted, these over- and under-representations are expected. As such, care should be taken in interpreting the results beyond the sample.

Before responding to the contingent question on the WTP for a HT site, respondents were asked to answer 5-point Likert scale questions concerning their knowledge of HT. Scale points 1, 3, and 5 were labeled as not knowledgeable, neutral, and very knowledgeable, respectively. Scale points 2 and 4 were unlabeled. Approximately 20% of the respondents answered they are not knowledgeable about HT. Forty-two percent of the respondents indicated their knowledge lies between not knowledgeable and neutral (response 2). On the other extreme, less than 5% of the respondents indicated they are knowledgeable of HT beyond neutral—responses 4 (less than 4%) and 5 (less than 1%). The remaining 34% of respondents indicated a neutral response.

Estimated logit model. Estimated logit models including and excluding income and other socioeconomic factors are presented in Table 2. In the models, bid and age are continuous variables. Education and income ranges are entered as qualitative 0 to 1 variables. The percentage of respondents' answers correctly classified by the model ranges between 65% and 70%. Both the Akaike and Schwarz loss functions are similar between the models but tend to favor model 3 (minimize the loss functions). The McFadden R^2's are similar between the models, but this measure slightly favors model 1.

Bid (admission fee) to the HT site is significant at $P < 0.001$ in all three models with an inverse relationship between the fee amount and the probability of accepting the fee. As the price of the fee increases (decreases), the probability of paying the bid (a "yes" response) decreases (increases) in the hypothetical market (fee is entered as a negative amount in the model). The higher two income categories are significant at $P < 0.1$ in model 1. Both coefficients are positive with the higher income category having the larger coefficient. These results indicate that higher income earners are more likely to respond "yes" to a given bid amount. The other demographic variables of age, sex, and education are insignificant.

Willingness-to-pay for horticultural therapy site. Using Eq. [5], mean WTP ranges between $165 and $172 U.S. per month among the three models. These dollar amounts are equivalent to ≈$5.50 U.S. per day. The inclusion or exclusion of socioeconomic variables has only a minor effect on the mean WTP, indicating the assumption of constant or nonconstant marginal utility is of little importance in the calculation of WTP. To get an indication of variability in WTP, the delta method (Greene, 2002) is used to obtain approximate standard errors for WTP. For the three models, approximate standard errors are $60, $60, and $62 U.S.

Table 1. Percentage of respondents and citizens of the metropolitan city of Busan in different demographic categories.

Demographic characteristic		Sample	Busan[z]
Gender	Male	49.8	49.8
	Female	50.2	50.2
Age (years)	20 to 29	23.5	21.0
	30 to 39	22.5	21.0
	40 to 49	31.0	23.0
	50 to 59	19.4	18.0
	60 or older	3.6	17.4
Education[y]	Elementary school or less	1.7	
	Middle school	4.7	
	High school	40.0	
	College/University	53.6	
Monthly household income (U.S. $)[x]	Less than $1,000	2.6	Average GDP[w] = $1,530
	$1,000–1,900	16.8	
	$2,000–2,900	15.4	
	$3,000–3,900	35.8	
	$4,000–4,900	22.3	
	$5,000 or higher	7.1	

[z]Source: survey (N = 422) and Korea National Statistical Office (2008).
[y]Education level and monthly income not available by category as asked on the questionnaire.
[x]As a percentage of the population over 20 years to an age to make the sample and Busan numbers comparable.
[w]Average gross domestic product of over age 20 Busan population (calculated value and Busan Metropolitan City, 2008).

Table 2. Estimated coefficients of three willingness-to-pay (WTP) models for garden therapy based on differing assumptions on constant marginal utility (SEs in parentheses).

Variable	Model 1	Model 2	Model 3
Constant	−0.6294	−0.368	0.308
	(0.755)	(0.733)	(0.145)*
Bid[z] (U.S. $)	0.00020	0.00019	0.00018
	(0.0003)*	(0.0003)*	(0.0003)*
Male	0.315	0.302	
	(0.225)	(0.221)	
Age (years)	0.0148	0.015	
	(0.012)	(0.011)	
Income (2,000–2,900)[y]	0.127		
	(0.36)		
Income (3,000–3,900)	0.483		
	(0.283)**		
Income (>4,000)	0.852		
	(0.318)*		
High school education[x]	−0.290	−0.218	
	(0.470)	(0.465)	
College/university education	−0.091	0.045	
	(0.501)	(0.494)	
McFadden R^2	0.14	0.12	0.11
Correct predicted	70%	68%	65%
Akaike information criteria	1.193	1.198	1.192
Schwarz information criteria	539.655	530.000	511.035
Observations	422	422	422
WTP U.S. $	171.29	171.03	164.75
WTP SD	59.74	60.23	62.30

[z]Coefficient associated with negative bid amount; estimation assumes an exchange rate of 950 Korean Won per US dollar.
[y]Base is income less than $1900 U.S./mo.
[x]Base is education of middle school or less.
*, **Significant at a $P < 0.05$ or 0.10.

Discussion

As previously discussed, horticulture and gardening activities provide both physical and mental health benefits to the people engaging in these activities. Based on the health benefit evidence of gardening and garden environments, policymakers in Busan, South

Korea, are considering developing a HT site. In grappling with this issue, one concern is the economic value of the HT site to the citizens of the city. The value of HT, however, is difficult to estimate because no well-defined market exists in Korea for HT sites.

In this respect, CVM was used to estimate use value of a HT site. Estimated mean WTP for use of a HT site is ≈$170 U.S. per month per individual represented in the sample. This estimated value indicates the WTP for a HT site is considerable. Individuals' WTP is highly variable as indicated by the SE of the estimated WTP being ≈$60 U.S. This wide dispersion may partially contribute to the fact that most respondents were not aware of the benefits of HT sites. Care must be used in extrapolating the estimated values beyond the sample, because the sample underrepresents older and lower-income citizens of Busan. Although insignificant in the estimated logit model, the coefficient associated with age may indicate older people value a HT site more than younger people. Gardening tends to be an activity of older people; as such, older individuals may value a HT site more. The estimated logit model suggests the smaller a person's monthly income is, the less they value a HT site. These competing factors suggest caution in interpreting beyond the sample.

One reason that the WTP for a HT is relatively high may be explained by the fact that Korean people are health-conscious. Monthly membership fees to fitness clubs in South Korea, for example, range from ≈$50 U.S. to $240 U.S. Low-cost membership clubs simply provide health equipment, whereas high-end clubs provide a variety of facilities. These membership fees indicate Koreans are willing to pay for health benefits. Another potential reason for a relatively high WTP might be the experimental design used in eliciting WTP. Lee and Mjelde (2007) estimated the preservation value of the Korean DMZ based on two experimental designs: hypothetical (just provide a yes/no answer) and real (respondents provided an address that an environmental group could contact them). Their results indicate the WTP associated with the hypothetical setting is likely to be larger than the value obtained from the WTP in the real setting. As such, the payment setting of the current study may have biased WTP upward. Another potential reason for a high WTP is, given the majority of respondents were not aware of the benefits of HT, respondents may have overestimated their WTP based on hearing of the benefits for the first time on the questionnaire.

Even considering these cautions, it appears an HT site has considerable value to the citizens of Busan. This economic value is only part of the equation for determining the benefits relative to the costs of development of a HT site. Besides determining if the benefits outweigh the costs, other issues must be considered. Local government officials need to grapple with the issue of whether the HT site should be provided by the public sector or by private sector. A HT site could be provided by the private sector, but such a provision may exclude lower-income citizens. Another option is a two-sector method of investment in which the public sector provides land and infrastructure, and the private sector operates the garden and facilities. Another important issue is education of the citizens of Busan concerning the benefits of a HT site. Most respondents answered they are unaware of the mental and physical benefits. For a site to be successful, such education is vital. People being aware of the benefits will increase the use of the site.

Finally, the assumption of constant or nonconstant marginal utility of income and the inclusion of socioeconomic factors has little effect on the estimated WTP. Within the economic literature, there is no consensus as to the inclusion of variables other than fee in the WTP logit model. Obviously, this study is only one data set, but it appears within the linear utility assumption, inclusion or exclusion of socioeconomic variables is dependent on the researchers' preferences and questions being answered.

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