Going Once, Going Twice: Using Willingness-to-Accept Auctions to Promote Smoking Cessation

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ABSTRACT

Introduction: Incentive-based smoking cessation interventions increase quit rates. The optimal incentive, however, is unknown. We used a willingness-to-accept (WTA) auction where smokers submitted bids indicating the incentive they would need to receive for one week of smoking cessation.

Methods: Smokers ready to quit (n=35) participated in a WTA auction, naming the amount they needed to be paid to quit for one week. Auction winners received an incentive if they successfully quit. All smokers received nicotine replacement therapy and self-help cessation materials. Carbon monoxide concentrations were monitored remotely 3 times during the week and in person at the final session.

Results: Participants who smoked their first cigarette within 5 minutes of waking demanded a significantly larger incentive in exchange for quitting than those who waited (p<.05). 45% of auction winners quit smoking compared to 20% of nonwinners (p<.05). The cost per quit was $466 among auction winners compared to $894 among nonwinners.

Conclusions: WTA auctions may be an effective way to determine the amount smokers need to be paid to quit, which would allow researchers to estimate the most cost-effective payment to offer as part of incentive-based smoking cessation programs. Replication evaluating longer-term cessation outcomes with larger samples is warranted.
IMPLICATIONS

Incentive-based smoking cessation interventions increase quit rates. However, the optimal incentive is unknown. We found that a willingness-to-accept (WTA) auction is a feasible technique for estimating the amount smokers need to be paid to quit. Incentives are a surprisingly cost-effective way to facilitate smoking cessation because they are only paid to those who successfully quit. WTA auctions are a promising tool for determining the incentive that strikes the optimal balance between being large enough to motivate cessation, but small enough that it can be offered to the largest possible population of smokers for a given program budget.
INTRODUCTION

Incentive-based smoking cessation interventions increase quit rates. Most study designs to date include incentive amounts that are selected by the investigator; however, allowing the smoker to identify the incentive amount that would offset their value of continued smoking provides a more precise estimate of the incentive that would motivate an individual smoker to quit. Experimental economics, specifically experimental auctions, offers an approach for determining a personalized incentive level.

Experimental auction participants bid in a market-like environment designed so that they do not benefit from overstating or understating what they feel they need to be paid to give up a good or perform a task. Because of the real and immediate financial consequences, auction participants are more likely to respond truthfully than if they were taking part in a hypothetical market or responding to a survey. Since each participant names their own bid, researchers learn more about the incentive an individual smoker requires to quit than if all participants were offered the same dollar amount. Participants in willingness-to-pay (WTP) auctions name the price they would pay for a good or service. Researchers have used WTP auctions to estimate smokers’ demand for cigarettes with graphic warning labels and plain packaging, smokeless tobacco, and e-cigarettes. Participants in willingness-to-accept (WTA) auctions name the price they would need to be paid in exchange for a good they own or for performing some task. Researchers have used WTA auctions to estimate the value of products and services such as willingness to complete unpleasant tasks like listening to an annoying noise or tasting a bitter liquid, and WTA for pens, chocolate bars, cash lotteries, battery life in smartphones, and to give up access to social media websites. The feasibility of using a WTA auction for smoking cessation has not been evaluated.

After conducting individual interviews with a small sample of smokers (n=10) to determine if the WTA auction instructions were understandable, we asked 35 smokers who were interested in quitting sometime in the future to complete the WTA auction and then abstain from all tobacco product use for one week, using nicotine replacement therapy (NRT) should they choose. The aims of this study were to: 1) determine the feasibility of using a WTA auction with smokers; 2) describe the characteristics associated with WTA bid amounts; and 3) determine the efficiency of using a WTA auction as a smoking cessation intervention. We hypothesized that the WTA would be an efficient intervention demonstrated by greater smoking quit rates among smokers who won the WTA auction.
METHODS

Participants

Participants were recruited through frequent postings on Craigslist. Individuals ages 21 or older, who smoked five or more cigarettes a day, and who were interested in quitting smoking in the future were eligible to participate. Interested females were required to provide a negative pregnancy test prior to participation.

Procedures

All procedures were approved by The Ohio State University’s Institutional Review Board.

At the baseline session, each participant individually met with a member of the research team and, after consenting to the study, completed an assessment, engaged in the WTA auction, and received NRT with self-help quitting educational materials. The educational materials were reviewed with one of the researchers. Participants received $50 for completing the baseline session.

In the WTA auction, participants wrote down an amount between $0 and $100, which indicated how much they would need to be paid to quit smoking cigarettes for one week. The research assistant then randomly drew a dollar amount between $0 and $100 printed on a slip of paper from a jar. The participant’s written value was compared to this randomly selected price. If their bid was less than the randomly selected price, the participant “won” the auction and would be paid the randomly selected price for biochemically confirming one-week abstinence from smoking. Participants whose bids were higher than the randomly drawn price “lost” the auction and therefore would not receive a financial incentive for abstinence. By separating the price participants were paid if they won the auction from the bid they submitted, this Becker-DeGroot-Marshak mechanism eliminates the incentive for participants to overstate their WTA in the hope of receiving a larger incentive. Overstating WTA reduces the probability that a participant wins the auction but does not increase the incentive the participant receives if s/he wins since the incentive is determined by the random draw.

Each participant was given a micro Smokerlyzer© carbon monoxide (CO) monitor and a Samsung Tablet with a front-facing camera, allowing the research team to follow their expired CO concentrations. Participants were shown how to use the Smokerlyzer© and were instructed on how to create videos of themselves breathing into the device and then displaying the result to the camera. Participants recorded a video of themselves completing the CO reading between 6:00 PM and 8:00 PM on days 2, 4, and 6 (day 1 began the day following the baseline assessment). They then uploaded the videos to a secure website at our university where the research team could view the readings. At the day 7 follow-up session, CO concentration was again measured. Abstinence was defined as having a CO < 7 ppm on days 2, 4, 6, and 7.
A reminder text was sent to each participant on required CO measurement days to ensure that they would remember to submit the video. When CO was < 7 PPM, the study team sent a congratulatory message to participants.

Participants were provided with self-help materials based on recommendations in the Clinical Practice Guideline, *Treating Tobacco Use and Dependence.* For example, different behavioral and cognitive strategies to aid in quitting and symptoms of withdrawal were discussed with each participant. Participants were given one week of NRT in the form of patch (21 mg) and gum (4 mg). Participants were instructed to apply a new patch each morning, beginning on their quit day and continuing every day for one week, and that they may chew NRT gum daily to reduce cravings.

At the follow-up session, participants completed an assessment, returned the study equipment, provided a CO sample, and received compensation. All participants received $3 compensation for each submitted video. In addition, participants who “won” the auction and were confirmed abstinent on days 2, 4, 6, and 7 received the randomly drawn auction payment. All participants who completed the follow-up session received $35 in compensation.

**Measures**

*Smoking-related measures:* At the baseline assessment, participants were assessed on smoking behavior, nicotine dependence (*Fagerstrom Test for Nicotine Dependence [FTND]*)[^13], decisional balance[^14], previous quit attempts, other tobacco use, quitting self-efficacy, and motivation to quit in the next 30 days and 6 months. At follow-up, if the participant quit smoking, they were asked questions about the type and amount of NRT used, additional resources potentially used to quit, and withdrawal symptoms experienced (*Minnesota Nicotine Withdrawal Scale*)[^15]. If the participant did not quit, they were asked again about their smoking behavior, nicotine dependence, type and amount of NRT potentially used, and motivation to quit smoking.

*Other measures:* At baseline, participants answered questions about sociodemographics (race/ethnicity, age, gender, education, income) and health status. They then completed a one-minute adjusting delay discounting task.[^16]

**Statistical Analysis**

Descriptive statistics were calculated for the sample who consented to the study. T-tests were used to compare the average bid by participant characteristics. Chi-square tests were used to test the association between auction outcome and confirmed abstinence, as well as to test the association between auction outcome and participant characteristics.
RESULTS

Participants

Participants were 45.7% female, 57.1% white, and an average age of 41.9 years (Table 1). All participants were interested in quitting smoking in the next 30 days.

Feasibility

A total of 59 people called, texted, emailed about the study. To assess feasibility, our goal was to recruit 35 participants. Of the 35 who consented to the study, 31 completed all study procedures. Among completers, 87% used the study-provided NRT. More variability was seen in the submission of study videos confirming CO concentration. Eighteen participants submitted all three videos, four submitted two videos, three participants submitted one, and 10 participants submitted none. There were no differences between participants who submitted all three videos (n=18) vs. those who submitted fewer (n=17) with respect to age, race/ethnicity, income, time to first cigarette in the morning, and confidence in quitting tobacco.

Participants overwhelmingly described the program as somewhat to very helpful (100% for overall program), 88.9% reported the NRT was helpful, and 77.4% reported that the CO readings were helpful. Of the 28 participants who answered, 20 reported the equipment was not difficult at all to use. When asked for recommendations to improve the program, participants suggested a longer quit period, varied text message formats for congratulatory messages, checking CO concentration more often, using smartphones instead of tablets, and providing better tasting nicotine gum.

Characteristics associated with bids

Figure 1 presents cumulative distribution functions for auction winners and nonwinners. Winners bid lower (M=$20.80) than nonwinners (M=$51.90). As indicated in Table 1, demographic and smoking-related characteristics were not significantly different between the two groups with one exception: those who smoked their first cigarette within five minutes of waking bid higher (M=$46.30) than those who waited more than five minutes (M=$27.70; p < .05).

Cessation

The cessation rate was significantly higher among smokers who won the auction (45% vs. 13.2%, p = 0.046). A greater proportion of white participants quit smoking compared to nonwhite participants (45% vs. 13.3%, p <.05; Table 1). No other significant differences were found for cessation rates between demographic or smoking-related variables (Table 1).

Cost per quit

Taking into account participation fees, payments for uploading videos, incentives paid to auction winners who successfully quit, the cost of NRT and pregnancy tests, and research assistants’ wages, the cost per quit was $466 for auction winners and $894 for nonwinners.
DISCUSSION

This study determined that a WTA auction is a feasible technique for estimating the amount smokers need to be paid to quit. Incentives are a surprisingly cost-effective way to facilitate smoking cessation because they are only paid to those who successfully quit. WTA auctions are a promising tool for determining the incentive that strikes the optimal balance between being large enough to motivate cessation, but small enough that it can be offered to the largest possible population of smokers for a given program budget. Studies designed to determine the most effective incentive level for smokers to quit and maintain abstinence should consider this robust and feasible approach.

Consistent with our expectations, smokers who won the auction had a higher one-week quit rate compared to nonwinners. The average bid among winners was lower than the average bid among nonwinners. This was as expected. Because winning required bidding less than the randomly drawn price, smokers who submitted low bids were more likely to win the auction.

Higher bids among participants who smoke their first cigarette within 5 minutes of waking was also consistent with our expectations. Participants who think quitting will be more difficult should demand greater compensation for quitting, and should therefore submit a higher bid. Participants who smoke their first cigarette within 5 minutes of waking are more dependent on nicotine, making quitting more difficult.

This preliminary study evaluated one-week smoking cessation outcomes in a small sample. However, seven-day point prevalence is significantly correlated with 30-day smoking cessation outcomes. Nonetheless, these procedures require replication with longer cessation periods and a larger, more diverse sample. This would allow researchers to generalize the results to the population at large and to compare cost-per-quit estimates with those from the rest of the cessation literature. Improved ease of remote CO monitoring with greater automation could also improve scalability of the intervention for use by employers. The current study was limited to smokers interested in quitting. Future studies should 1) examine whether auctions could be used to determine an effective incentive level for the minority of smokers not interested in quitting and 2) include a control group that does not participate in an auction and does not receive an incentive. The latter would allow researchers to empirically test the effect losing a WTA auction on smoking cessation outcomes.
FUNDING

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DECLARATION OF INTERESTS

The content is solely the responsibility of the authors and does not necessarily represent the official views of the Ohio State University Comprehensive Cancer Center.

ACKNOWLEDGMENTS

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REFERENCES


Table 1. Demographic and Tobacco-related characteristics of the Phase 2 sample (n=35), average bids and % quit by sample characteristics

<table>
<thead>
<tr>
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<th>% or Mean +/- SD (n)</th>
<th>Average Bid</th>
<th>% Confirmed Quit</th>
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</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Female</td>
<td>45.7% (16)</td>
<td>$36.0</td>
<td>37.5%</td>
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<tr>
<td>Male</td>
<td>54.3% (19)</td>
<td>$32.5</td>
<td>26.3%</td>
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<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
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<tr>
<td>22-41 years</td>
<td>41.9 ± 12.7</td>
<td>$39.2</td>
<td>22.2%</td>
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<tr>
<td>42 years and older</td>
<td>51.4%</td>
<td>$28.7</td>
<td>41.2%</td>
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<tr>
<td><strong>Race</strong></td>
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<td></td>
<td></td>
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<tr>
<td>White</td>
<td>57.1%</td>
<td>$27.0</td>
<td>45.0%*</td>
</tr>
<tr>
<td>Other</td>
<td>42.9%</td>
<td>$43.6</td>
<td>13.3%</td>
</tr>
<tr>
<td><strong>Income (n=34)</strong></td>
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<td></td>
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<tr>
<td>&lt; $25,000</td>
<td>32.4%</td>
<td>$36.5</td>
<td>27.3%</td>
</tr>
<tr>
<td>&gt; $25,000</td>
<td>67.6%</td>
<td>$32.0</td>
<td>34.8%</td>
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<td><strong>First Cigarette</strong></td>
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<tr>
<td>Within 5 minutes</td>
<td>34.3%</td>
<td>$46.3*</td>
<td>25.0%</td>
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<tr>
<td>After 5 minutes</td>
<td>65.7%</td>
<td>$27.7</td>
<td>34.8%</td>
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<td><strong>Confidence in Quitting</strong></td>
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<tr>
<td>1-5</td>
<td>6.5 ± 2.2</td>
<td>$41.6</td>
<td>28.6%</td>
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<td>6-10</td>
<td>40.0%</td>
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*p < .05
Figure 1. Cumulative distribution functions of bids for auction winners and nonwinners