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**A Choice Experiment of Traveler Willingness to Pay for  
Proactive Protection against Bed Bugs in Hotels**

Jerrod Penn

Department of Agricultural Economics  
University of Kentucky  
[Jerrod.penn@uky.edu](mailto:Jerrod.penn@uky.edu)

Wuyang Hu

Department of Agricultural Economics  
University of Kentucky  
[wuyang.hu@uky.edu](mailto:wuyang.hu@uky.edu)

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## **A Choice Experiment of Traveler Willingness to Pay for Proactive Protection against Bed Bugs in Hotels**

### **Abstract:**

In recent years, the global rate of bed bug infestations has increased dramatically as well as the corresponding costs. One subtle cost that is important to the hospitality industry is travelers' anxiety and risk of getting bed bugs. In this analysis, we use a Choice Experiment to investigate travelers' WTP for proactive protection against bed bugs when booking a hotel. For travelers' reaction to proactive protection against bed bugs, nearly 60% of travelers have a favorable opinion, while less than 10% rejected such efforts. Travelers have positive and significant Willingness to Pay for all four protective services considered, with the greatest value placed on the use of mattress encasements and the least value associated with weekly inspections from hotel staff. While hotels may be hesitant to openly advertise protective services, our results demonstrate that many travelers may be receptive.

## Introduction

Since their global resurgence, bed bugs continue to persist both in the United States (Potter, et al., 2015) as well as many other parts of the world (Potter, et al., 2010). Bed bugs are not known to transmit diseases, so response from public health or other government agencies has been relatively limited. On the other hand, bed bugs still cause real physical harm to people such as allergic skin reactions and irritation (Doggett, et al., 2012, Potter, et al., 2010).

More importantly, bed bugs cause mental and emotional anxiety much more severe than their physical harm. Doggett, et al. (2012) and Goddard and de Shazo (2012) document that symptoms include nightmares, flashbacks of the infestation, insomnia, emotional distress, extreme and excessive avoidance behaviors, and personal dysfunction. Goddard and de Shazo (2012) suggest that these symptoms may lead to Posttraumatic stress disorder (PTSD) in susceptible individuals. As such, bed bugs can truly damage the well-being of people in the many types of locations and industries at risk infestation. The issue has become so severe, state and local government are beginning to add bed bug ordinances to codify the rights and responsibilities of landlords and tenants (California Assembly, 2016, New York City Administrative Code, 2010).

While researchers continue to pursue methods of eradication and detection to help pest control operators (Koganemaru and Miller, 2013, Szyndler, et al., 2013), the economic aspects of bed bugs remains elusive. To date, only one study has considered consumer effects of bed bugs with respect to the hotel industry by Penn, et al. (2014). They identified traveler Willingness to Pay to avoid hotels with reported cases of bed bugs. More importantly, their results also suggest that the value of avoiding bed bugs is greater than other crucial hotel features such as Wi-Fi.

Given this previous evidence of a significant and positive WTP to avoid the risk of bed bugs, then it may follow that there may be a price premium from protection against bed bugs in hotels. This is similar to a number of other studies that consider consumer purchases and preferences in order to

mitigate risk of illness from food-borne illness (Hammit and Haninger, 2007). The purpose of this study is to establish traveler WTP for protective measures against bed bugs in hotels.

### **Experimental Design and Methods**

To understand how consumers might perceive proactive protection against bed bugs in hotels, an online survey was conducted in May 2015 using the Qualtrics platform. To avoid biasing participants, the survey was advertised as being on general hotel preferences. Respondents must have reported staying in a hotel at least once in the past year in order to be included in the sample.

The survey itself contained two Choice Experiments related to general features of hotels such as the average rating, price, and additional hotel amenities. Respondents were instructed to think about their choices in the CE as if it were a leisure/personal trip so as to guard against purchasing behavior from a sponsored business trip. After the first CE, survey respondents answered an initial bed bug question on how they might react to a sign announcing a hotel's proactive protection against bed bugs. After this question, they saw representative images of some of the potential protective services before participating in the second CE, as in Figure 1. The protective services included as attributes in the CE were: weekly room inspections by staff, bed bug-proof mattress encasements, biannual canine inspection twice, and biannual professional inspection services. These attributes of bed bug protection were selected based on their ease of comprehension among leisure and business travelers in focus groups as well as their real-world applicability from industry experts. Focus group feedback showed that using these four representative images of the protective services helped respondents quickly comprehend and recognize the features in the CE.

To provide context and realism to the CE, we include five additional hotel-related attributes, the price per night, the average guest rating, the number of reviews, and whether complimentary

Wi-Fi or breakfast are provided by the hotel. Each of these attributes was also included in the first CE, so quickly understood by respondents in this CE. A description of the attributes and their levels appears in Table 1. An example choice set appears in Figure 2.

Lastly, we exclude respondents who failed to pass multiple red herring-style questions or took fewer than six minutes to complete the survey, treating them as inattentive respondents that compromise analysis quality as in Jones, et al. (2015).

### **Model Framework**

In order to model our data of consumer preferences for proactive bed bug protection, we rely on Random Utility Theory. In this context, utility can be specified as in equation 1, for person  $n$  choosing hotel room  $j$  in choice set  $t$ , which is a function of price,  $p_{njt}$ , and other non-price characteristics of the hotel room:

$$U_{njt} = \alpha_n p_{njt} + \beta_n' x_{njt} + e_{njt} \quad (1)$$

If we assume an extreme value distribution for the random component, it becomes estimable, and is known as a parameter-space model. The conventional approach to generate an estimate of Willingness to Pay (WTP) after model estimation is to calculate negative one multiplied by the ratio of the attribute coefficient over the price coefficient. Some potential shortcomings are associated with parameter-space models and WTP derived from them. For example, if all attribute coefficients are assumed to be heterogeneous across respondents, including price (as specified above), the corresponding WTP can have undefined moments and can produce unreasonably large values. As well, assuming independence across the parameter-space attributes inherently means that the corresponding WTP estimates are correlated. To overcome some of these issues, we use a Willingness to Pay Space

model (Train and Weeks, 2005), as in equation 2, which is a re-expression of parameter-space models, except that attribute coefficient estimates,  $w_n$ , from the model, directly reflect WTP for each attribute.

$$U_{njt} = -\lambda_n p_{njt} + (\lambda_n w_n)' x_{njt} + e_{njt} \quad (2)$$

## Results

In total, 2068 respondents completed the survey who passed attention-check and minimum time requirements. The sample contains some socioeconomic differences compared to the population (US Census Bureau, 2015). Because travelers and hotel-users are the central population of interest in this study (rather the entire US population), some of these differences are expected. For instance, business travelers, defined as those who stayed hotels at least 7 nights for business/work-related reasons, have similar characteristics to industry figures (AHLA, 2016). In fact, from the entire sample 13.6% of respondents reported staying in hotels for business/work-related reasons at least 25 nights per year. For example, our sample has a greater proportion of males than the population, which reflects a similar trend of business travelers. In general, our sample is above-average in terms of levels of education, household income, and age.

Prior to beginning the CE, respondents received the following prompt: “Suppose at a hotel, you saw the following sign posted at the front desk: ‘We strive to provide a good night’s rest to our guests with a hygienic sleep environment. We take proactive steps to assure your wellness with weekly room inspections, use of bed bug proof mattress encasements, canine inspections twice per year, and professional pest control inspections twice per year.’” Respondents could provide six different responses ranging from rejection, “I wouldn’t stay at the hotel. Protecting against bed bugs means they’ve had bed bugs,” to affirmation, “I would probably stay at the hotel. I feel better knowing they’re taking proactive steps against bed bugs.” Proactive protection was largely viewed positively, with results appearing in Figure 3. About 9.3% rejected proactive protection, a segment that shares some similarity

to conventional protest respondents. The largest cohort of respondents (46.3%) had strong affirmation for proactive protection against bed bugs, whereas at 24.0%, the second largest group chose “I’d prefer they were doing these things and did not tell me about it.” The implication is that many travelers understood the risk of bed bugs and appreciated such protective services, which may assuage hotel operators’ fear that respondents simply learning of such services may harm the reputation of the brand and their specific hotel.

### **Model Results**

Model results from the mixed-logit WTP-space specification appear in Table 3. The results show that the conventional aspects of hotel quality are significant and follow convention. For example, we would expect and observe that WTP for a hotel increases as the average guest review increases from poor to excellent. Additionally, we see that WTP Wi-Fi is especially large, more so than breakfast or the proactive protection features. This preference for Wi-Fi matches previous industry literature (Greif, 2010).

Our examination of the proactive protection against bed bugs shows that all four features are significant and relevant to travelers. Based on the point estimate of WTP, the most important feature is the mattress encasement (\$27.70), followed closely by the biannual pest professional inspection (\$26.36). The biannual canine inspection is in a close third, valued at \$22 per night. While significant, the value travelers place on a weekly staff inspection of the hotel room is markedly lower than the other proactive protection attributes (\$12.80). Post-estimation tests reveal that WTP for weekly inspection is significantly lower than the three other attributes. Consideration of the standard deviations for each of the non-degenerate attributes is also important. For example, we would expect that the value of a “good” (3 out of 5 average) or “excellent” (5 out of 5 average) rating from previous guests may be interpreted and valued differently across guests.



With respect to the proactive protection measures, we see significant heterogeneity in the WTP for weekly inspections, mattress encasements, and canine inspections. For these three attributes, their standard deviations are roughly twice as large as WTP, meaning that for some, there is clearly negative WTP/disutility with the presence of the attribute, and for others, extremely large positive WTP. One measure, biannual professional inspections, was not significant, meaning that respondents generally had an equal value for providing this service.

As a robustness check, we also consider WTP among respondents who could be characterized as protestors, namely those who answered “I wouldn’t stay at the hotel. Protecting against bed bugs means they’ve had bed bugs.” Results in this analysis are qualitatively similar in terms of statistical significance and magnitude of the coefficients both in the WTP point estimates as well as in their standard deviations. A noteworthy difference is the increased and significantly different ( $p=.028$ ) WTP for mattress encasement and WTP for professional inspections. This means that the mattress encasement provides the most value among those who do not reject protective measures. The standard deviation of the professional inspection is now significant, suggesting heterogeneous value among consumers, though to a lesser extent compared to the other proactive measures.

While all proactive protection attributes against bed bugs are significant, many hotel operators may be hesitant to immediately employ and advertise such efforts. The WTP results can support adding incremental methods of proactive protection. Operators may choose to adopt mattress encasements as a method of reducing bed bug infestation rates in their rooms and have biannual professional inspections. In this case, if an acutely aware hotel guest voices concern over bed bugs, the operator can share their about the proactive measures in place, and based on our results, create the greatest additional value/utility to the guest. Furthermore, these two features can mitigate the risk of bed bug infestations such as number of rooms affected or duration of being compromised.

### **Implications/Conclusions**

Even as bed bugs continue to cause problems for consumers and businesses in the hospitality industry, proactive protection may be an opportunity to reduce the real and perceived risk of them among consumers, creating greater guest satisfaction in hotels. This study investigates consumer WTP for proactive protection against bed bugs in the context of staying in a hotel.

We find that travelers have positive WTP for all four bed bug protection attributes. Travelers consider mattress encasements as the most valuable protective measure against bed bugs, with WTP of roughly \$28 per night. Adding mattress encasement has the added benefit of being a one-time expense while creating value for hotel guests indefinitely. This is followed closely by a biannual inspection from pest control professionals and an equivalent service using canines. Their near identical WTP is sensible in that the service rendered is the same for both attributes, but it is simply how the service is performed. Travelers may not know dogs are employed to detect bed bugs, nor know they are typically seen as a more accurate and efficient way of inspection.

The information is important to the industry as it continues to update its policies towards the pest, both in back-of-house strategies as well as front-of-house if hotel guests encounter bed bugs during their stay. Further, hotels must be cautious about actively advertising such information and its implication on their brand's value and reputation to *their* clientele. While perception and WTP for proactive protection may vary greatly across respondents, some hotels may have better information on whether advertising such information is more likely help or hurt their reputation among their hotel guests.

While our evidence indicates that consumer preferences for proactive protection are heterogeneous, one future investigation should consider their personal familiarity. For example, residents from certain cities or those who have recently lived in apartments may be more receptive to protection.

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Figure 1:





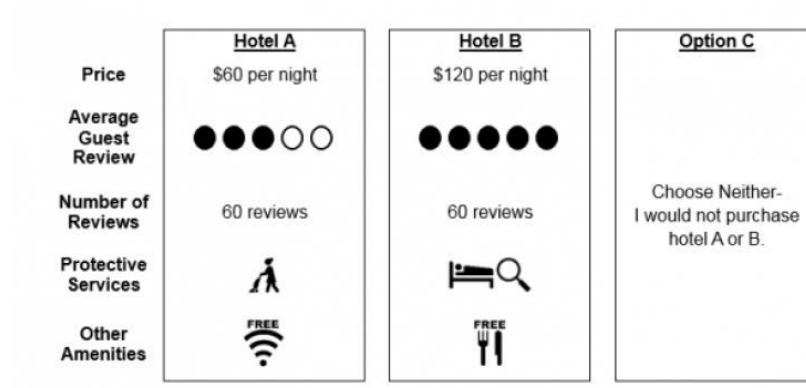
<b><u>Protective Service</u></b>	<b><u>Icon</u></b>
Room inspection by housekeeping staff once per week	
Bed bug-proof mattress encasements	
Canine detection twice per year	
Room inspection by professional pest control company twice per year	

Figure 2:



For a **leisure/personal** trip, I would likely choose:

Hotel A

Hotel B

Option C

Figure 3:

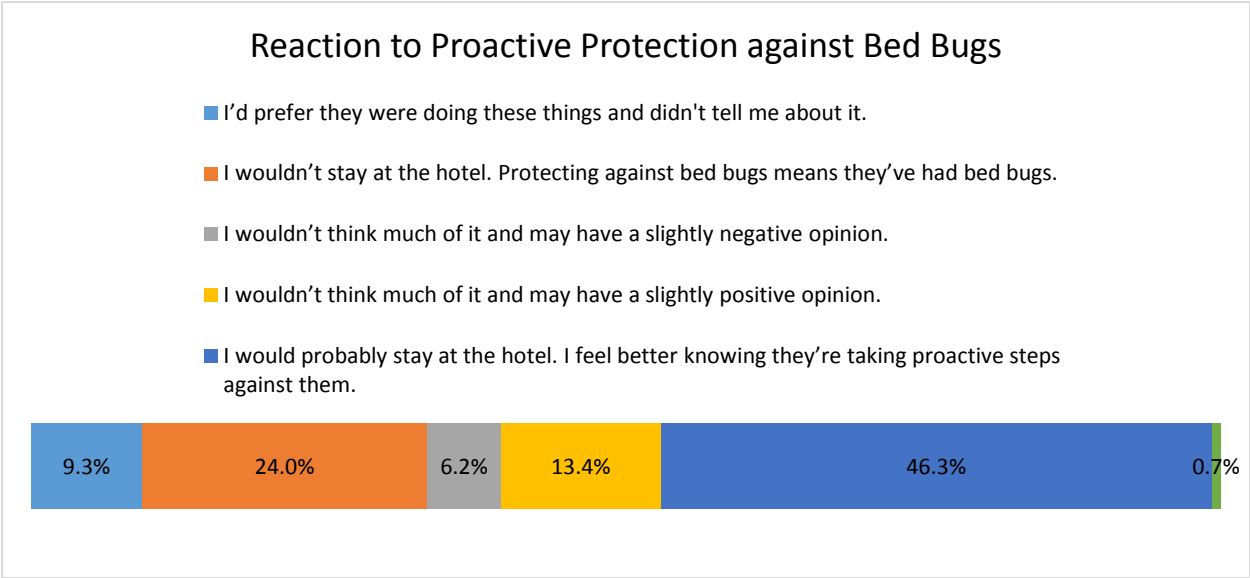


Table 1:

<b>Attribute (# of levels)</b>	<b>Description</b>
<b>Price (6)</b>	\$60, \$90, \$120, \$150, \$180, and \$210 per evening
<b>Guest Review (4)</b>	The average online review is 2 (Poor), 3 (Average), 4 (Good) or 5 (Excellent) on a 5 point scale
<b>Number of Reviews (2)</b>	15 reviews, 60 reviews
<b>Breakfast (2)</b>	Free breakfast
<b>Wi-Fi (2)</b>	Free in-room Wi-Fi
<b>Staff Inspection (2)</b>	Room inspection by housekeeping staff once per week
<b>Mattress Encasement (2)</b>	Bed bug-proof mattress encasement
<b>Canine Inspection (2)</b>	Canine detection twice per year
<b>Professional Inspection (2)</b>	Room inspection by professional pest control company twice per year

Table 2: Descriptive Statistics of Sample

	<b>Sample</b>	<b>US Population<sup>1</sup></b>
<b>n</b>	2068	
<b>Age<sup>2</sup></b>	48.6	37.8
<b>Household Income<sup>2</sup> (\$thousands)</b>	\$84.0	\$55,775
<b>% Female</b>	47.8	50.8
<b>% Married</b>	62.6	47.5
<b>% Minor Children</b>	29.9	31.4
<b>% White</b>	80.6	73.1
<b>% Business traveler<sup>3</sup></b>	37.7	
<b><u>Education</u></b>		
<b>% High School</b>	12.1	27.6
<b>% Some College</b>	31.0	29.0
<b>% Bachelor's</b>	33.4	19.0
<b>% Advanced</b>	22.6	11.6
<b>% Full Time</b>	45.5	49.1

<sup>1</sup>Based on the 2015 American Community Survey 1-year estimates.

<sup>2</sup>Based on the midpoint of responses.

<sup>3</sup>Defined as at least 7 nights in hotels for business/work-related purposes in the past year.



Table 3: Model Results in Mixed Logit-WTP Space

<b>Hotel Attribute</b>	<b>All Respondents N=2068</b>		<b>Exclude Protest Respondents N=1875</b>	
	WTP Estimate	Std. Error	WTP Estimate	Std. Error
<b>Ln(-Hotel Price)</b>	-3.65***	(0.06)	-3.65***	(0.06)
<b>Opt-Out</b>	-27.82***	(4.34)	-31.46***	(4.52)
<b>Average Review</b>	37.43***	(6.52)	32.63***	(3.66)
<b>Good Review</b>	68.27***	(5.53)	64.98***	(3.46)
<b>Excellent Review</b>	78.65***	(5.00)	69.67***	(3.79)
<b>Number of Reviews</b>	0.04	(0.05)	0.05	(0.05)
<b>Breakfast</b>	30.60***	(2.81)	29.19***	(2.31)
<b>Wi-Fi</b>	44.38***	(2.69)	42.26***	(2.5)
<b>Weekly Staff Check</b>	12.80***	(2.32)	12.29***	(2.26)
<b>Mattress Encasement</b>	27.70***	(2.90)	31.31***	(2.42)
<b>Biannual Canine Check</b>	21.98***	(2.75)	22.01***	(2.24)
<b>Biannual Professional Check</b>	26.36***	(2.70)	24.63***	(2.08)
<b>Standard Deviations</b>				
<b>Ln(-Hotel Price)</b>	0.95***	(0.09)	0.96***	(0.09)
<b>Average Review</b>	53.77***	(3.39)	54.22***	(2.72)
<b>Good Review</b>	27.44***	(3.93)	1.39	(3.26)
<b>Excellent Review</b>	36.70***	(5.09)	53.13***	(5.04)
<b>Breakfast</b>	37.92***	(2.98)	34.47***	(2.55)
<b>Wi-Fi</b>	40.74***	(5.11)	29.45***	(3.62)
<b>Weekly Staff Check</b>	28.95***	(6.88)	17.96***	(3.08)
<b>Mattress Encasement</b>	67.44***	(4.91)	59.80***	(3.14)
<b>Biannual Canine Check</b>	37.76***	(7.20)	28.43***	(2.68)
<b>Biannual Professional Check</b>	1.37	(4.39)	16.37***	(2.90)

