



BED BUGS AND HOTELS

Traveler Insights and Implications for the Industry

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The resurgence of the bed bug, *Cimex lectularius* L., has been well documented in the United States and throughout the world (Boase 2001, Doggett et al. 2004, Potter et al. 2010). While various studies have examined impacts of bed bugs in residential settings (Cooper et al. 2015, Wang et al. 2010), less is known about their effects on commerce. Historically, bed bugs have been found wherever there is human activity. While infestations are most common in homes and apartments, three fourths (75%) of pest management professionals in the United States also report finding bed bugs in hotels and motels (Potter et al. 2015), which raises questions about the impact of this pest on travel and tourism.

Considering that 4.8 million people stay in hotels and

motels nightly (60% for leisure, 40% for business), understanding traveler attitudes with respect to bed bugs is important (AHLA 2015). Of course, lodging accommodations are an important part of the world's economy (Fig. 1). In the U.S., industry statistics indicate that there are about 53,000 properties and almost 5 million guest rooms, producing \$176 billion in annual revenue (AHLA 2015). Almost two thirds (64%) of available rooms are occupied each night. As part of the broader \$1.4 trillion travel and tourism industry, hotels and motels also influence many interrelated businesses (airlines, cruise ships,

ABOVE: Fig. 1. People depend on hotels when traveling for both business and leisure. They are an important part of our nation's travel and tourism industry.

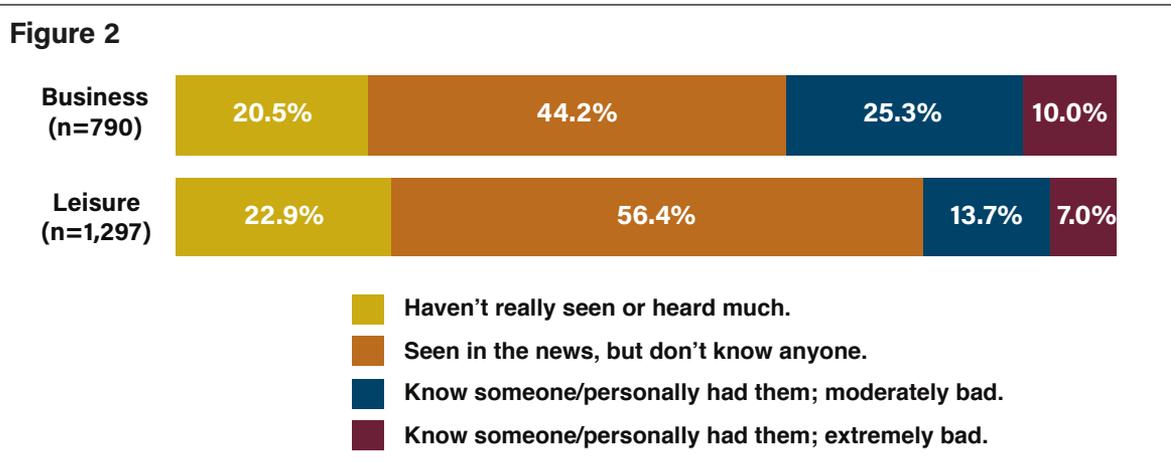


Fig. 2. Reported prior knowledge of and experience with bed bugs by business and leisure travelers.

restaurants, car rental firms, travel agents, tour operators, etc.). To investigate how much the public knows and cares about bed bugs while traveling, we implemented a national survey of hotel patrons.

Survey Design and Implementation

The survey was conducted in May 2015 via an online survey with market research firm Qualtrics (Provo, Utah, U.S.A.), following six rounds of refinement with focus groups before deployment. We used a 64-item questionnaire, of which 15 questions pertained directly to traveler awareness, experience, and attitudes toward bed bugs. Additional questions surveyed respondent habits when booking and staying in hotels (e.g., frequency, price, desired amenities) and demographics (gender, age, education, etc.). To encourage broad participation and minimize bias related to bed bugs, the survey was presented as a general questionnaire on attitudes and preferences for hotels and associated amenities, and bed bug-related questions were presented toward the end of the survey.

To relate respondent socioeconomic and travel-related information to our questions of interest, we used logit models (Cameron and Trivedi 2005) in STATA 13 (StataCorp LP 2014) and included demographics, hotel

preferences, the frequency of business and leisure travel, use of social media, and whether or not participants were related to a hotel employee as explanatory factors (independent variables). For statistically significant variables, we calculated the marginal effects of each coefficient, interpreted as the percentage change in the probability that a respondent's answer to a particular survey changes given a change in an independent variable. In the reported figures, we partitioned respondents into two groups: business travelers, defined as at least seven or more nights in a hotel in the past year for business or work-related purposes; and leisure travelers, which includes all other travelers. When results of the two groups were virtually identical, we combined data for the presented figures, though the regressions still controlled for these variables separately.

Results and Discussion

Respondent Demographics. Respondents (n=2,088) represented all 50 states and the District of Columbia: 1,298 leisure travelers and 790 business travelers. The number of usable respondents in the regression is 1,956 travelers, or 1,251 and 705 of leisure and business travelers, respectively (Table 1). The sample exhibited some differences relative to the general U.S. population, but this was expected given the sample's focus on frequenters of hotels (AHLA 2014). Interestingly, very few of the demographic categories were both significant and had a large marginal effect; this suggests that the hotel industry will largely be unable to find out whether travelers will choose a particular hotel based on demographic information.

Prior Experience and Concerns with Bed Bugs. We wanted to know if and to what extent respondents thought about bed bugs and how this might influence future hotel-booking decisions. First, respondents were asked their level of prior experience with the pests (Fig. 2). In general, most respondents said they knew about bed bugs via news outlets, but had no personal experience (44% for business, 56%, for leisure). However, business travelers were more likely than the leisure travelers ($P = 0.04$) to have had personal experience or know someone having personal experience with bed bugs (35% and 21%

Table 1: Sample descriptive statistics for respondents in the study.

Characteristics	Leisure Travelers	Business Travelers ¹
Female	60%	28%
Bachelor's Degree	28%	42%
Graduate Degree	17%	31%
Age 18-34	22%	32%
Age 35-54	26%	40%
Age 55 or Older	52%	28%
Children in home	23%	41%
White	84%	75%
Number of Responses	1298	790

¹Those who travel for business-related reasons at least 7 nights in the past year.

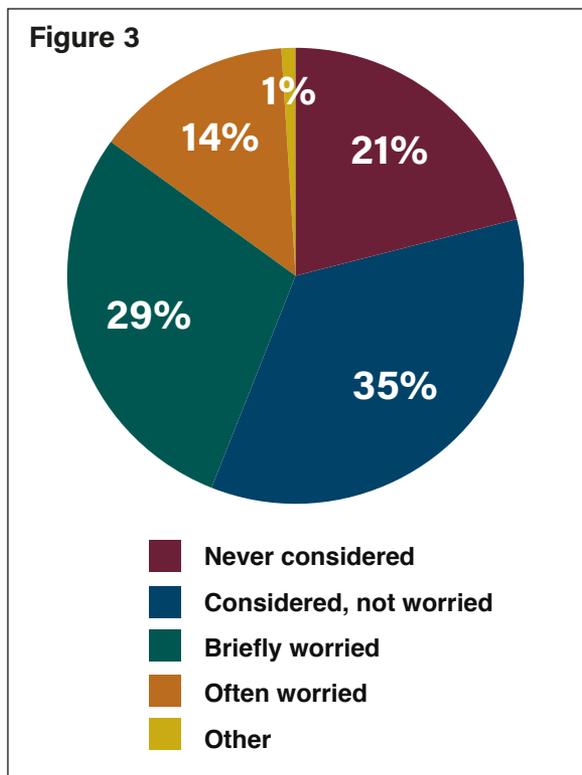


Fig. 3. The overall reported cognizance or “worry” about bed bugs and hotels (business and leisure travelers combined).

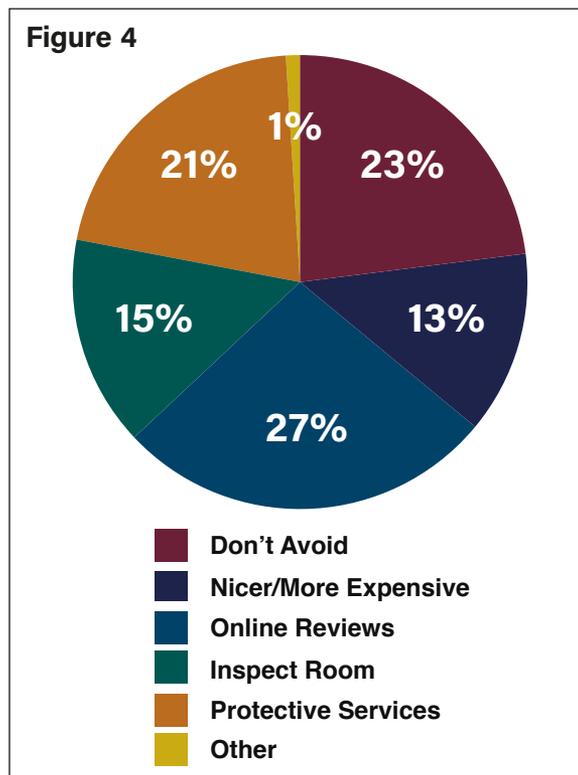


Fig. 4. Respondents' opinions of the best way to avoid bed bugs in hotels.

respectively). Respondents that reported posting online hotel reviews ($P = 0.01$), including those that contained mention of bed bugs ($P < 0.01$), also reported having more personal experience with bed bugs than those who did not report posting online reviews. Roughly one in five respondents (both business and leisure) mentioned they “haven’t really seen or heard much” about bed bugs, suggesting a further need for public education.

We then asked respondents to rate how much they worry about bed bugs while staying in hotels (Fig. 3). The majority of respondents said they thought about bed bugs while staying in hotels, but were not worried (35%), or only briefly worried about them (29%). About one in five respondents (21%) never thought about bed bugs or considered them a concern while traveling, while 14% worried about them often. Not surprisingly, those who reported finding bed bugs in a publicly posted hotel review or on social media (12% and 2% of business and leisure respondents, respectively) were significantly more likely to have a greater level of worry, as were those who reported more prior personal experience with bed bugs ($P < 0.01$). Based on the average marginal effects, each additional level of bed bug experience increased the likelihood of choosing “often worried” about bed bug by 10%. For example, compared to those who didn’t consider or worry at all, those with extremely bad bed bug experiences were 30% more likely to worry more about bed bugs while traveling. In general, leisure travelers appeared more worried about bed bugs than business travelers, despite business travelers spending more nights and money in a hotel. This indicates that on the whole,

business travelers might be more familiar and therefore less frightened of hotels with bed bug issues, real or unsubstantiated. Women were 5% more likely to often worry about bed bugs than men. Additionally, married women with children have an 11.8% higher chance of reporting greater levels of bed bug worry while traveling than single and childless women. While women are 48.4% of the combined sample of business and leisure travelers, 65.1% say they are primarily responsible for choosing and booking hotels for leisure purposes; therefore, hotels should be mindful of their potential vulnerability to women who generally worry more about bed bugs and who often make the booking decisions.

Respondents were largely divided on best ways to avoid bed bugs while staying in hotels (Fig. 4). A surprising number believed that bed bugs were not an issue in hotels (23%), while 13% stated that staying at nicer/more expensive hotels was the best means of avoidance, despite reports of hotels of all stature being impacted (Ceglowski 2016, Greene 2016). Over a quarter of participants (27%) believed that checking online reviews was the most useful way to avoid bed bug issues (pitfalls of this approach are discussed in the next section). Other respondents felt that prevention by the hotel itself or via personal room inspection would be best ways to avoid bed bugs, although reliance upon these (see below) is problematic also.

Ability to Identify a Bed Bug. Beyond personal experience, a separate but related question asked respondents if they could correctly identify a bed bug from a lineup of other common arthropods (Fig. 5). When respondents

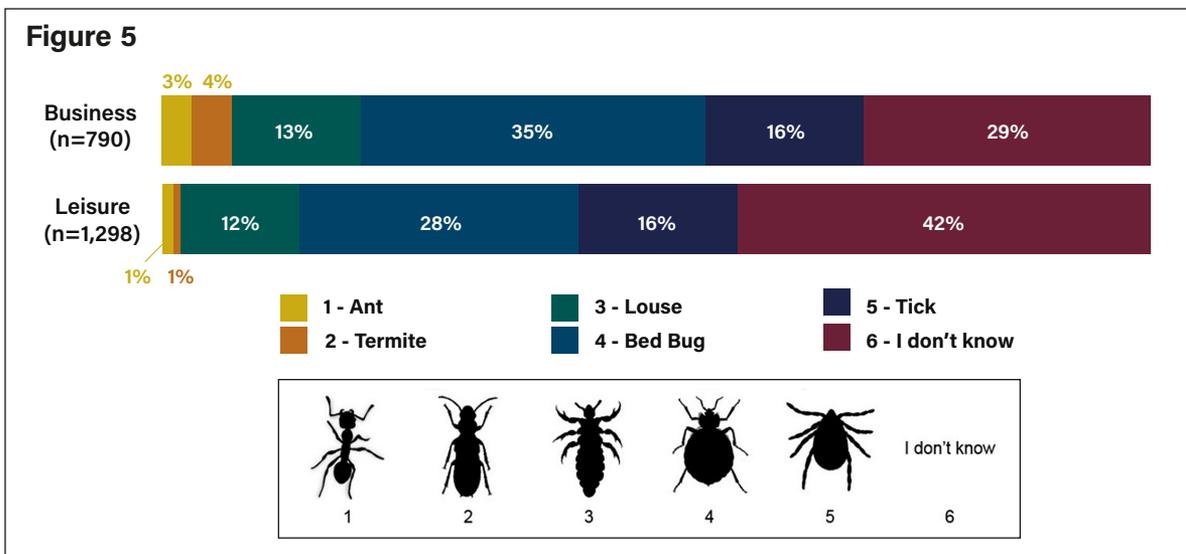


Fig. 5. The percentage of respondents (by business and leisure travelers) who identified various arthropod outlines as those of bed bugs.

were shown a lineup of enlarged black silhouettes of an ant, termite, louse, bed bug, and tick, only 35% of business travelers and 28% of leisure travelers correctly identified the bed bug. Additionally, a substantial proportion of business (29%) and leisure (42%) travelers admitted not knowing (i.e., did not even guess). This has important ramifications for hotels, because a person's stated encounter with bed bugs might be erroneous, as has been the case in recent news stories where allegations of bed bugs have been made on social media (Fox 5 News 2016). The posted image of a "bed bug infestation" in that case was subsequently determined to be a deceased spider, but the story gained enough notoriety online to appear in the Snopes.com database (Mikkelson 2016). Based on our findings, people are likely to have difficulty distinguishing bed bugs from other household arthropods (Fig. 6). Similarly, only 13% of people surveyed in Germany (Seidel and Reinhardt 2013) and 10% in Great

Britain (Reinhardt et al. 2008) were able to distinguish a bed bug when shown a live adult specimen in a vial. The prospect of misreporting a bed bug infestation is a concern not just for hotels, but in apartments, hospitals, schools, offices, theaters, and other public spaces. Ramifications of a false report can be costly to the proprietor, who often must respond with a professional pest control service and compensation of the complainant. Moreover, the hotel's reputation can be harmed if the guest decides to post an online review, even if it is later confirmed that what they found was not a bed bug. Not being able to recognize a bed bug is also precarious for travelers because it increases the odds of inadvertently transporting them home from a trip.

As might be predicted, respondents who stated they had prior experience with bed bugs were more likely than others to correctly identify the bed bug ($P < 0.01$). Moreover, those who reported "briefly worrying about them" were 9% more likely to correctly identify a bed bug compared someone who "has thought about them, but is not worried." If a respondent stated that someone else usually books the hotel room, that individual was 12% less likely to correctly identify the bed bug ($P = 0.04$). Few demographic variables affected bed bug identification ability, with race being the only significant factor. Asian and Black/African-American respondents were 10% and 8% more likely, respectively, to correctly identify a bed bug compared to white, non-Hispanic respondents.

Prevention and Disclosure of Infestations. Vigilance and prevention have long been considered important to managing bed bugs (Pinto et al. 2007, Potter 2011). We wanted to determine if travelers wanted to know that hotels were taking steps to prevent bed bugs, and whether they thought hotels had a duty to disclose infestations. Respondents were asked how they would react to seeing the following statement posted on a sign near the front desk of a hotel they regularly frequent: "We strive to provide a good night's rest to our guests with a



Fig. 6. Many things can be mistaken for bed bugs, including this shed skin of a dermestid found on a hotel mattress.

Figure 7

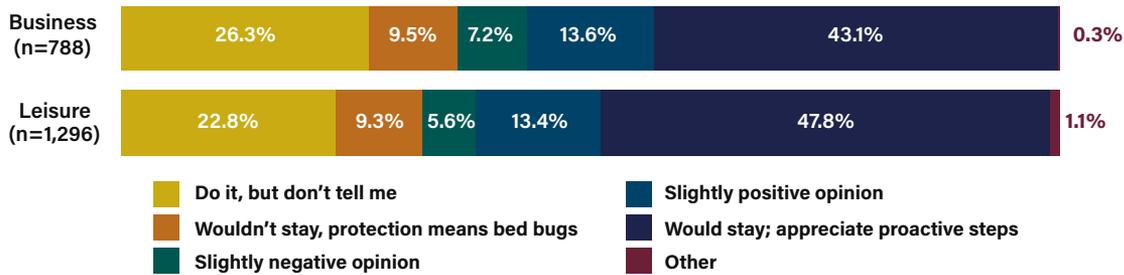


Fig. 7. How respondents reacted to a hypothetical scenario in which a hotel posted information at the front desk about their bed bug prevention methods.

hygienic sleep environment. We take proactive steps to assure your wellness with weekly room inspections, use of bed bug-proof mattress encasements, bed bug-sniffing dogs, and professional pest control inspections twice per year.” They could respond that 1) they preferred that the hotel takes those steps, but do not want to be told about it; 2) they wouldn’t stay at the hotel because the sign insinuates they’ve had bed bugs; 3) they wouldn’t think much of it, but might have a slightly negative opinion; 4) they wouldn’t think much of it with a slightly positive opinion; or 5) they would probably stay and appreciate the hotel taking proactive steps. (Respondents could also provide some other response of their choosing, but less than 0.75% chose that option, so we ignored those responses.) The largest number of respondents (both business and leisure) said they would stay and felt better knowing proactive measures against bed bugs were being taken (Fig. 7). The second largest response appreciated that the hotel was taking precautions, but did not wish to be told. The cumulative response of both groups shows that most travelers want to stay in hotels with bed bug protective services—the key difference being whether they want to be informed or not.

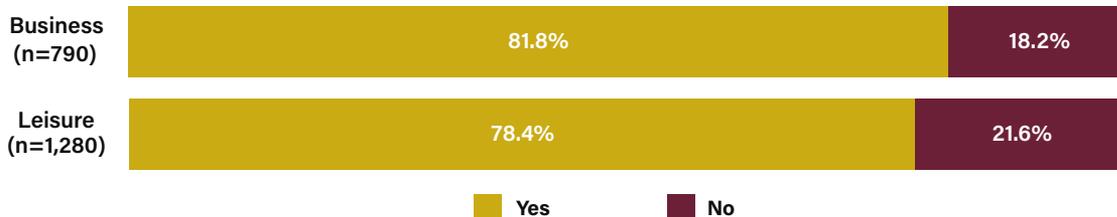
The largest marginal effect in this question was among respondents who let others make their hotel arrangements; they were 11.6% more likely to select “do it, but don’t tell me.” Travelers with more bed bug experience were consistently more likely to select the positive proactive protection response, and less likely to select any other response. Surprisingly, those who had previously posted and mentioned bed bugs in a hotel review had a pessimistic assessment of the sign and were more likely to choose not to know about such measures, reject it, or have a slightly negative opinion of it. The remaining

variables were not significant for any of the responses. For instance, the number of nights stayed in hotels during the past year, the hotel category or average price per night, and traveling as a family (three or more) had no apparent relationship with how travelers reacted to the proactive protection sign. This means that no single demographic factor overwhelmingly affects how people respond to proactive bed bug protection. The mixed results suggest that hotels may want to have information about their bed bug protective measures available upon request (instead of for all to see) so as not to worry tentative customers.

When asked, “Do you think hotels should be required to tell guests if their assigned hotel room has ever had a prior problem with bed bugs?” the vast majority of respondents agreed (Fig. 8). Among the respondents who wanted mandatory disclosure of previous bed bug issues, we also asked them how far back in time (i.e., length of time) they would want to know of such incidences (Fig. 9). Strikingly, about two-thirds of leisure travelers wanted to know if there had been bed bugs in the room at some point in the past year, and the remaining third wanted to know if there had *ever* been an occurrence. Leisure respondents were more likely to want longer lengths of disclosure, with 32% wanting “any occurrence ever” disclosed, compared to 21% of business travelers. Business travelers tended to be more lenient ($P = 0.02$), with 48% wanting to know of any occurrences in the past three months or less, versus 38% of leisure travelers. Furthermore, respondents who have publicly posted a hotel review ($P = 0.03$) or posted a review specifically mentioning bed bugs ($P < 0.01$) were much less likely to want longer disclosure periods. More frequent social media users also wanted less disclosure time ($P = 0.03$),

Fig. 8. Respondents’ opinion of whether hotels should be required to disclose previous bed bug issues.

Figure 8



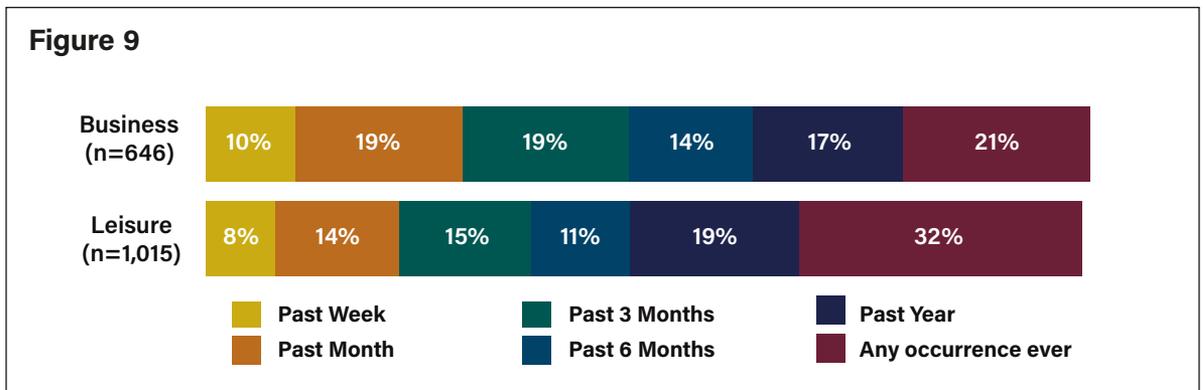


Fig. 9. Respondent preference for the required length of time to know when bed bugs were a problem in their hotel room.

possibly as those who have had prior knowledge of bed bugs are much more critical/skeptical of previous bed bug incidences and proactive protection.

Mandated disclosure of a property's bed bug history is becoming an important and contentious issue in the rental of apartments, with some cities requiring disclosure to prospective tenants (California Assembly 2016, New York City Administrative Code 2010). If similar legislation was passed requiring bed bug disclosure in hotels, the consequences could be far-reaching. Such a ruling could potentially take rooms out of service for prolonged periods, possibly long after the threat to guests has diminished. It could also necessitate maintaining and sharing infestation records with some customers, a troubling prospect for the hotel industry. While informing guests about past infestations may seem unnecessary to hoteliers, there is presently no way to be certain that a formerly infested room is now bed bug-free.

Reaction to Bed Bugs in Online Reviews. The majority of travelers today consider online reviews when booking hotel accommodations. In one survey of global respondents, TripAdvisor found that 80% of travelers read at least six to 12 online reviews before selecting a hotel on their site (PhoCusWright 2013). Other studies concluded that customer reviews are the most important factor

in hotel-booking decisions and that online reviews and reputation management are the most important issues of the industry (Ady and Quadri-Felitti 2014, Deloitte 2015, PhoCusWright 2013).

Given the importance of online reviews for hotels, we wanted to know how booking decisions would be influenced by reports of bed bugs (Fig. 10). Respondents were presented with the following scenario: "You're about to make a reservation for a certain hotel, but you read an online review posted in the last month that says they found bed bugs in their hotel room." Travelers then ranked four responses in terms of most to least likely to pursue each: 1) choose the hotel, but be careful to inspect the room; 2) avoid that particular hotel; 3) avoid that entire brand of hotel; or 4) reduce the number of hotel nights and overnight trips taken (Fig. 11). Tellingly, more than half of all respondents (60% traveling for leisure, 51% for business) said they would be very unlikely to choose a hotel with a single online report of bed bugs. The finding should be especially concerning to hoteliers, given that such online reports can be inaccurate. Interestingly, some respondents (25%) were still willing to select a hotel with a report of bed bugs as their first course of action, suggesting some travelers are less concerned about such online posts, or perhaps doubt their accuracy. The most frequently chosen second course of action (33% of respondents) was to not select that brand of hotel, suggesting loyalty to an entire brand can be harmed by reviews posted about a single property. Few travelers chose to stay fewer nights in hotels as either their first (7%) or second (21%) most likely response to reading online reviews about bed bugs.

Reaction to Finding Bed Bugs in Hotel Rooms. We also wanted to assess how travelers would respond to finding bed bugs, as compared to other problematic issues in hotel rooms. Respondents were first asked if they normally check for abnormalities such as an unclean bathroom, odor, linen stains, or signs of bed bugs before settling into their room. Only 11% said they do nothing to check the room, while a majority of respondents indicated they check for cleanliness of the bathroom (80%), the absence of room odor (72%), and clean sheets and towels (62%). Conversely, only 34% reported searching



Fig. 10. Online reviews and reports mentioning bed bugs cause most travelers to choose a different hotel.

Figure 11

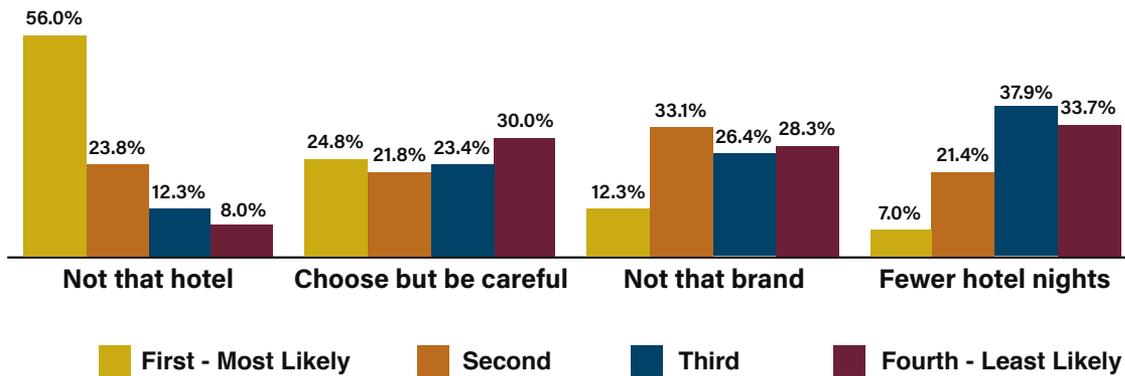


Fig. 11. Respondents' reaction to reading an online report of bed bugs, and how it would influence their choice of accommodations.

for signs of bed bugs (Fig. 12). Travelers were then asked how they would respond to finding such issues during their stay. For each room issue, they were asked to choose their most likely response from the following options: 1) do nothing; 2) report it to the front desk; 3) request a new room; or 4) switch hotels entirely with a full refund (Fig. 13). In most scenarios, traveler responses were relatively restrained and mainly involved contacting the front desk and/or requesting a new room. Finding signs of bed bugs, however, elicited a more extreme response, with 60% of travelers stating they would leave the hotel and demand a refund. Business travelers showed slightly more leniency toward finding bed bugs than leisure travelers, with 55% indicating they would change hotels versus 63% of leisure travelers. Leisure and business travelers' reactions to other hotel room issues tended to be more similar. Clearly, consumers are more intolerant of bed bugs than other room deficiencies. Hotels should

be cognizant of this fact when responding to complaints, real or perceived.

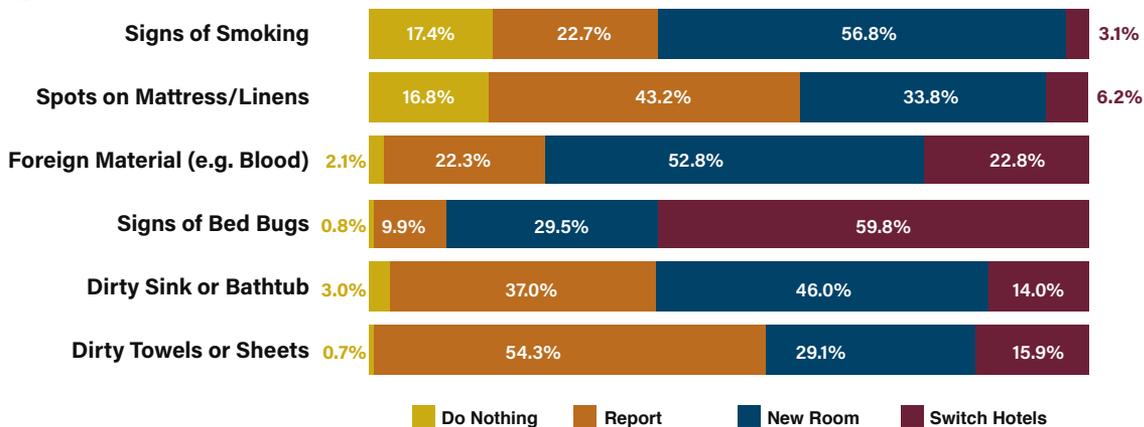
Finally, travelers were asked specifically how they would

Fig. 12. Despite their concerns, only about a third of travelers check their hotel room for bed bugs before settling in.



Fig. 13. Response to hotel room issues: how respondents said they would deal with hotel room issues, including those associated with bed bugs.

Figure 13



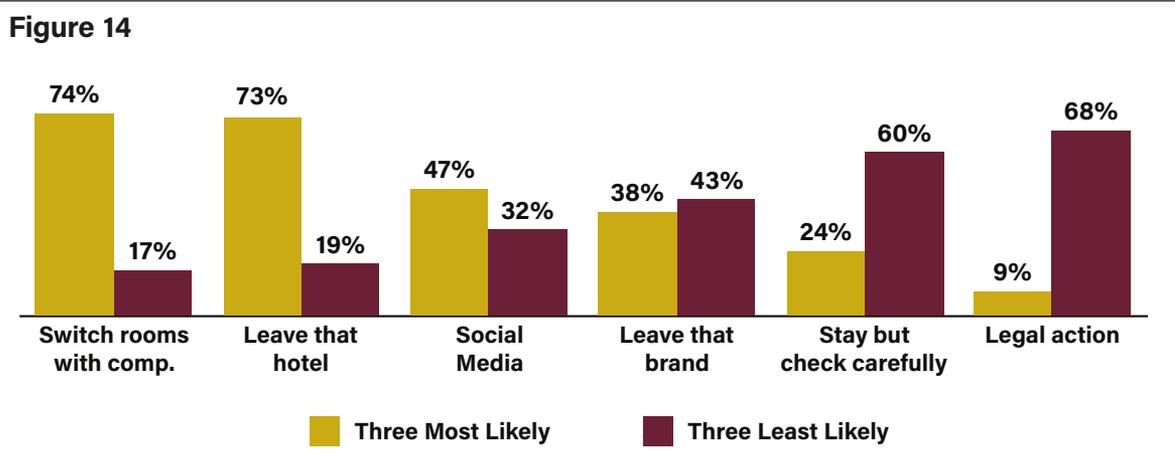


Fig. 14. Response to finding a bed bug in your room: respondents' three most likely and three least likely actions.

respond to finding a live bed bug in a hotel room during their stay. Respondents were given the option to select the three most and least likely outcomes they would pursue (Fig. 14). Most respondents chose “switching rooms with compensation” (74%) or “leaving the hotel” (73%) as their top two picks (Fig. 15). Fewer travelers (38%) said that they would leave and avoid future bookings with that hotel brand entirely. Relative to online reviews, 47% of respondents said that if they found a bed bug in their hotel room they would “report it and post about the experience on social media.” Taking legal action against the hotel was the least likely option chosen (9%), suggesting that if hotels offered some form of modest compensation (e.g., one or two nights’ stay) many guests would be content.

Conclusions and Future Directions

This is the first nationwide study to survey attitudes of travelers with respect to bed bugs. The findings should be especially useful to the hotel and lodging industry, and will help them better understand people’s apprehensions about bed bugs when staying in their establishments. While the majority of consumers have limited understanding of or experience with bed bugs,

the pests evoke fervent responses by both business and leisure travelers. Compared to other hotel room issues, such as odor or lack of cleanliness, evidence of bed bugs is far more likely to cause guests to switch hotels, seek compensation, or even switch to a different hotel brand. When booking accommodations online, the majority of business and leisure travelers stated that a single report of bed bugs would cause them to choose another hotel. More than half of all respondents wanted to know if their assigned room had a previous bed bug issue, even if it occurred long ago. Demographic and travel-related characteristics of respondents generally provided little indication of which segments of the population are particularly attuned to bed bugs. Rather, attitudes and awareness appeared to be more determined by individual factors.

When it comes to bed bugs, the hotel and lodging industry is caught “between a rock and a hard place.” With the continual turnover of guests, periodic introductions of the bugs are inevitable, just as they are in apartments, college dormitories, patient care facilities, etc. (Fig. 16). Widespread reliance on social media and online reviews when booking accommodations makes hotels especially vulnerable to reports of infestation. Our findings indicate that a single online report of bed bugs adversely impacts future bookings, irrespective of whether the review is accurate. Hotels and others in the hospitality sector should develop a reputation management plan to prudently respond to such comments. Hotels should also train their housekeeping and engineering staffs to recognize and report bed bugs in the earliest possible stages, when infestations are more manageable. Similarly important is training front desk/customer service employees to respond promptly and empathetically when incidents arise within the hotel. Most travelers favor hotels with a bed bug protective service plan in place. While some properties are already engaged in early detection and prevention of bed bugs, others react only when problems arise. Fifteen years into



Fig. 15. Finding bed bugs in a hotel room elicits an extreme response from most guests.



Fig. 16. Bed bug incidents in hotels are inevitable, given the perpetual turnover of guests and their belongings.

their resurgence, bed bugs remain a serious pest issue. Sub-optimal treatment tools, less tolerant consumers, and ubiquitous reporting of incidents via social media have made bed bugs especially challenging for hotels. The pests are a reminder to those in this country that it is not a birthright to live free of parasitic vermin.

Acknowledgements

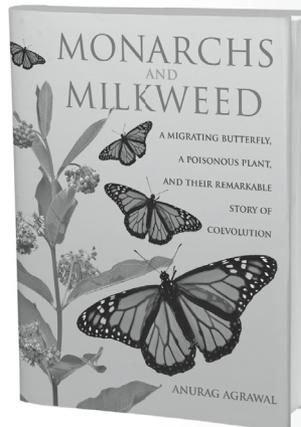
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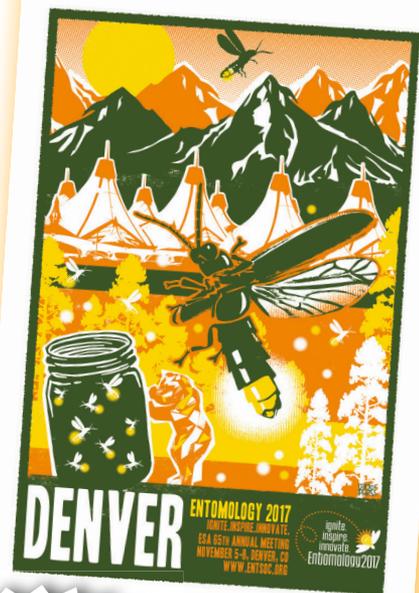
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