


When Hotel Guests Complain About Tobacco, Electronic Cigarettes, and Cannabis: Lessons for Implementing Smoking Bans

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ABSTRACT

We analyzed reviews on [tripadvisor.com](https://www.tripadvisor.com) from a random sample of $N = 477$ hotels in ten large cities in the US to examine how well existing policies protect guests from exposure to tobacco, electronic cigarette, and cannabis (TEC) smoke. We examined the association between complaints per 100 reviews with hotel smoking policies, star rating, cost, brand, and location. Of all TEC complaints, 80% were associated with thirdhand smoke residue lingering in hotels from previous guests. Compared to the hotel brands with the best records, the two worst-performing brands had 3.4- and 3.6-times higher complaint rates ($P < .001$). Hotels with ≤ 2 -star ratings had twice the complaints as higher-rated hotels ($P < .001$). Compared to 100% smokefree hotels, those offering designated smoking rooms had a 35% higher rate of complaints ($P < .05$). The success of some hotel brands demonstrates it is feasible to protect guests by fully committing to, implementing, and enforcing 100% smokefree building policies.

KEYWORDS: secondhand smoke, thirdhand smoke, environmental tobacco smoke, consumer complaints, information asymmetry, hospitality, hotels, cannabis, electronic cigarettes

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Introduction

2021 was the fifteenth anniversary of Westin Hotels and Resorts becoming the first hotel chain in 2006 to ban smoking in all their properties in the USA, Canada, and the Caribbean.¹ Later that same year, Marriott International followed suit, and by 2011 several other prominent hotel chains (eg, Sheraton, Wyndham Hotels and Resorts, and Comfort Suites) had announced similar policies.² By 2013, four states in the US (ie, Indiana, Michigan, North Dakota, and Wisconsin) had adopted policies to ban smoking in all hotel and motel rooms.³ Since then, however, progress towards adopting comprehensive state-level smoking bans has been slow. As of July 1, 2021, only three additional states had adopted state-wide smoking bans (Colorado, Connecticut, Vermont), while other states continued to pursue policies permitting smoking in designated smoking rooms.⁴ Based on decades of research on secondhand smoke (SHS) intrusion in multiunit buildings and the persistent legacy of thirdhand smoke (THS) residue, reluctance to implement comprehensive smoking bans in many hotels continues to create significant exposure risks for guests and employees in hotels without such policies.^{5,6}

While few states have been willing to pass smokefree legislation for hotels over the past decade, there are now 270 cities throughout the US that have passed smokefree laws at the local level. Similar progress is reflected in the biannual surveys

conducted by the American Hotel & Lodging Association (AHLA).⁷ Their findings indicate that an increasing proportion of hotels have adopted voluntary smoking bans and have reduced the number of designated smoking guest rooms. While 38% of hotels reported being “100% non-smoking” in 2008, this percentage increased to 56% in 2010, 63% in 2014, and 85% in 2016. However, when the AHLA in 2018 redefined “100% non-smoking” as “100% non-smoking building”, only 63% of hotels reported having a 100% non-smoking building, suggesting there was some ambiguity in previous surveys about the definition of “100% non-smoking”, and previous surveys provided an overly optimistic view. Even more sobering is the fact that only 28% of budget hotels and 42% of hotels at interstate locations had a 100% smokefree building in 2018, suggesting that a majority of budget travelers are at risk of exposure to toxic secondhand and thirdhand smoke pollutants.^{5,8,9}

The existing patchwork of policies across different state and local jurisdictions and hotel brands and chains represents an ambiguous environment for tobacco policies and their implementation. Further complicating this inconsistent policy field is that hotels serve a large and diverse national and international clientele who bring varying expectations about smoking bans and restrictions from their home locations to their travel destinations. Smokers visiting from regions with high smoking prevalence and lax policies may be unfamiliar with and



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may find it challenging to comply with restrictive smoking policies. Nonsmokers visiting from regions with strict policies and low prevalence may have less tolerance for other hotel guests' smoking behavior. The recent legalization of recreational cannabis in some jurisdictions and the increase in electronic vaping devices contribute to additional complexity and uncertainty about the interpretation of smoking bans and their implementation. Finally, the economic success of a hotel is driven by high occupancy and turnover rate, virtually guaranteeing that over the course of a year, any particular room may have housed multiple smokers. For instance, with a smoking prevalence of just 15% and an average of 200 different guests per year in a hotel room, the binomial probability that 20 or more smokers occupied a particular room is 98.5%. Such a policy setting creates significant challenges for hotels for informing guests and implementing smoking bans that consistently protect hotel guests and employees.

Violations of hotel smoking bans do not only affect other hotel guests who are exposed to intruding secondhand smoke (SHS) in nearby rooms. They also create exposure risks to future guests because tobacco, electronic cigarettes, and cannabis (TEC) smoke and aerosols leave behind thirdhand smoke (THS) residue that accumulates over time and can linger for years.¹⁰⁻¹⁴ Previous research has shown that compared to hotels with complete smoking bans, nonsmoking and smoking rooms in hotels that allowed smoking were polluted with THS, and nonsmoking guests staying in a designated smoking room were exposed to tobacco smoke toxicants.³ SHS and THS exposure not only create health risks for guests and staff, but hotels also incur high costs for cleaning and repairs after guests have smoked in a room (eg, shampooing carpets, keeping rooms vacant). Not surprisingly, a survey of hotel managers in California found that 80.5% of nonsmoking hotels charged a fee or fine if guests smoked in a nonsmoking room, ranging from \$20-\$1600 (Mean = \$168).¹⁵ A mixed-methods study of hotel management and media coverage of smokefree hotels showed that business considerations, such as cost savings, guest preferences, and competitor actions, were primary factors for implementing smokefree policies.¹⁶

To better understand how hotel guests experience smoking policies in hotels, we examined guest reviews for information about exposure to SHS or THS smoke from tobacco, electronic cigarettes, and cannabis (TEC). We borrowed the concept of information asymmetry from behavioral economics, considering TEC complaints as a possible result of a disparity between what a hotel claims to offer in terms of protection from exposure to SHS and THS and what guests experience in a hotel. We scrutinized reviews on the independent travel website TripAdvisor, focusing on complaints by nonsmokers who had made reservations in a 100% nonsmoking hotel or for a nonsmoking room in a hotel that also had smoking rooms. We hypothesized TEC-related complaints would be nearly universal and that a majority of complaints would be associated with tobacco rather than cannabis and electronic cigarettes and

with THS residue rather than SHS intrusion. Moreover, we hypothesized that hotels offering designated smoking rooms, lower-priced, and lower-star hotels would have more TEC complaints and that early adopters of smoking bans and hotels in communities with lower smoking prevalence would have fewer TEC complaints.

Methods

Sample

The study population of interest was hotels listed by TripAdvisor in the US, the most popular travel-related website featuring user-generated content with little evidence for false content.¹⁷⁻²⁰ To equally represent states across the range of smoking prevalence in the US, we selected two states in each of the five smoking prevalence categories designated by the Centers for Disease Control and Prevention.²¹ The prevalence categories and selected states were: 9% to < 12.24%, California and Utah; 12.24% to < 15.48%, Texas and New York; 15.48% to < 18.72%, Oregon and Nebraska; 18.72% to < 21.96%, Michigan and Alabama; and 21.96% to 25.2%, Arkansas and Kentucky. Within each state, we then selected the largest city by population: Los Angeles, CA, Salt Lake City, UT, Houston, TX, New York City, NY, Portland, OR, Omaha, NE, Detroit, MI, Birmingham, AL, Little Rock City, AR, and Louisville, KY. For each of the ten cities, a list of all hotels represented on [TripAdvisor.com](https://www.tripadvisor.com) was generated and organized by traveler ranking. We then randomly selected from each city's list 50 hotels with at least 50 reviews for a total sample size of N = 500 hotels. Although all hotels had ≥50 review ratings, six hotels did not have written comments and were excluded from analyses of TEC complaints. In addition, room cost per night was unavailable for 16 hotels, and no star ratings were given for seven hotels, resulting in a total sample size of 477 hotels with complete data sets.

Data Collection

Hotel websites and TripAdvisor comments were reviewed from November 2018 to February 2019 using the web scraper ParseHub.²⁰ Altogether, hotel guests left 332,277 comments.

Measures

Current hotel-reported smoking status. The website of each hotel was reviewed for information about smoking policies and coded '0' non-smoking or 100% smokefree, '1' allows smoking in some or all its rooms, and '2' no information was provided about smoking status.

Current TripAdvisor-reported smoking status. The TripAdvisor hotel smoking status was recorded '0' for a hotel listed as non-smoking, '1' as smoking, and '2' as 'non-smoking rooms available.'

Hotel Star Level. Hotel star level can range from 1 to 5 and was collected from the hotel overview page on [TripAdvisor.com](https://www.tripadvisor.com).

Hotel Brand. Hotel brand was determined by accessing the world list of chain branded hotels on [wikipedia.com](https://en.wikipedia.org/wiki/List_of_hotels) and then cross-referenced with information on the hotel's own website.²² All hotels without a brand were grouped into an 'independent' category. For statistical analyses, brands represented by ≤ 30 hotels were grouped in "other brands."

Hotel Room Price per Night. Price per night was recorded from the TripAdvisor website for a standard price (excluding specials) of the lowest level room.

Review interval. This variable describes the number of years over which guest reviews were available.

Tobacco, Electronic, or Cannabis Related Complaints. Each guest review was content-analyzed in NVivo 12 using a common set of specific keywords and the stemmed words from these roots.²³ See [Table S1](#) of the online supplement for a listing of search terms and [Table S2](#) for examples of guest reviews. Any duplicate keyword identifications were excluded. Complaints were only counted from guests indicating that they stayed in completely smokefree hotels or a smokefree room or a smokefree public hotel areas. Complaints from guests about adjacent areas where smoking was allowed (ie, an attached casino) were discarded. For each TEC complaint, we coded whether it mentioned tobacco, electronic cigarettes, or cannabis. Finally, we coded whether the complaint referred to the intrusion of tobacco or cannabis smoke from nearby guests (ie, SHS) or the THS residue left behind from previous guests (eg, stale tobacco smoke odor). Based on these coding rules, we counted (1) the total number of all TEC-related complaints, (2) the number of tobacco-related complaints, (3) the number of electronic-cigarette-related complaints, (4) the number of cannabis-related complaints, (5) the number of SHS complaints, and (6) the number of THS complaints.

Adjusted number of TEC-related complaints. To control for differences between hotels in the number of reviews, we created adjusted TEC indices describing the number of complaints per 100 reviews.

Noise and Dirtiness Complaints. Noise and dirtiness are 2 of the most common consumer complaints in hotels and were coded for a subsample of 149 (Birmingham, Detroit, and Los Angeles) and 99 hotels (Birmingham and Los Angeles), respectively, to serve as referents to evaluate the frequency of SHS and THS complaints.²⁴⁻²⁷ Similar to TEC complaints, hotel reviews were analyzed using Nvivo 12 based on a set of search terms for dirtiness and noise (see [Table S3](#) of the online supplement).

Adjusted number of noise and dirtiness complaints. To control for differences between hotels in the number of reviews, we created adjusted-noise and cleanliness indices describing the number of complaints per 100 reviews.

Statistical Analyses

Descriptive analyses were conducted to report major characteristics of the hotels and their TripAdvisor reviews, identify influential data points, and scrutinize variable distributions. We report the mean numbers of adjusted complaints per 100 reviews, their 95% confidence intervals, as well Tukey's five-number summary (Minimum, 1st Quartile, Median, 3rd Quartile, Maximum).²⁸ Hypotheses about predictors of adjusted TEC complaints were tested based on a multivariable negative binomial regression model with hotel location, hotel star rating, hotel brand, hotel capacity, number of hotel rooms, hotel room cost, and hotel smoking policy as covariates. The negative binomial regression models initially included an adjustment for the clustering of hotels within cities, but this was found to be unnecessary due to an intraclass correlation of 0. Categorical variables were dummy-coded. All analyses were conducted using Stata version 17.²⁹ The Type I error rate was set at an alpha = .05.

Results

Hotel Characteristics

[Table 1](#) shows the locations and major characteristics of hotels. According to their own websites accessed between November 2018 and February 2019, 63% of hotels were 100% smokefree; according to TripAdvisor, 96% were smokefree. Of the 465 hotels identified by TripAdvisor as smokefree, 298 hotels (64%) provided information on their website confirming the smoke-free designation, 36 (8%) indicated that nonsmoking guest rooms are available, and 131 (28%) hotels provided no information about their smoking policy. Hotel capacity ranged from 11 to 1705 (Mdn = 115) guest rooms, and the cost for a standard room ranged from \$41 to \$650 (Mdn = \$95).

Hotel Guest Reviews

[Table 2](#) shows the median total number of reviews was 374 (Interquartile Range - IQR: 164 to 818). This translates to a median of 43 reviews per year (IQR: 19 to 102) or a median of 34 reviews per 100 guest rooms per year (IQR: 19 to 71). TripAdvisor reviews covered periods ranging from .6 to 16.7 years before our assessment.

TEC, Noise, and Dirtiness Complaints

The analysis of guest reviews for TEC-related complaints (see [Table 2](#)) showed an average of 9.6 complaints per hotel

Table 1. Hotel characteristics and locations.

HOTEL CHARACTERISTICS	
Locations (N = 494)	
Birmingham, AL	10.1% (50)
Detroit, MI	10.1% (50)
Houston, TX	9.5% (47)
Little Rock City, AR	10.1% (50)
Los Angeles, CA	9.9% (49)
Louisville, KY	10.1% (50)
New York City, NY	9.9% (49)
Omaha, NE	10.1% (50)
Portland, OR	10.1% (50)
Salt Lake City, UT	9.9% (49)
Hotel Star rating (N = 493)	
2	12.0% (59)
2.5	31.4% (155)
3	29.0% (143)
3.5	11.6% (57)
4	10.8% (53)
5	5.3% (26)
Hotel Brands (N = 493)	
Independent	20.9% (103)
Hilton	16.6% (82)
Marriott	16.8% (83)
Wyndham	10.3% (51)
Choice	10.3% (51)
InterContinental	11.0% (54)
Others	14.0% (69)
Hotel Capacity (number of rooms, N = 494)	
Mean (95% Confidence Interval)	163 (148;179)
Min-Q1-Mdn-Q3-Max	11-84-115-175-1705
Hotel Room Cost (\$, N = 482)	
Mean (95% Confidence Interval)	117 (110;123)
Min-Q1-Mdn-Q3-Max	41-76-95-130-650
Hotel Smoking Status	
Hotel-reported (N = 480)	
Nonsmoking or 100% smokefree	63.8% (306)
Allows smoking in some or all rooms	8.5% (41)
No information provided	27.7% (133)
TripAdvisor-reported (N = 494)	
Nonsmoking	96.4% (476)
Smoking	2.8% (14)
Non-smoking rooms available	.9 (4)

Note. Min-Q1-Mdn-Q3-Max: Tukey five-number summary; Min: smallest observed value, Q1: 1st quartile, Mdn: median, Q3: 3rd quartile, Max: largest observed value.

(95% Confidence Interval: [6.9, 10.1]). Per 100 guest reviews, the mean number of TEC-related complaints was 2.3 (95% CI: [2.2;2.9]). Closer inspection showed the distribution of complaints was heavily skewed, with a median of .9

and an IQR of .2 to 3.4 complaints per 100 reviewed. The largest proportion of TEC-related complaints concerned THS residue (M = 2.08; 95% CI: [1.78;2.38]), and only a small fraction was attributable to SHS (M = .23; 95% CI: [.14;0.32]). Table S2 in the supplemental material gives examples of SHS and THS-related reviews. None of the guests registered a complaint specifically about electronic cigarettes. Cannabis-related complaints were reported at an average of .24 per 100 reviews (95% CI: .19;0.30). For comparison, Table 2 also shows dirtiness and noise complaints based on a subsample of N = 99 and N = 149 hotels, respectively. For every TEC-related complaint, hotels received, on average, four noise and four dirtiness complaints. TEC-related complaints were weakly and positively correlated with noise (Spearman rho = .271, $P < .01$) and dirtiness complaints (Spearman rho = .273, $P < .01$).

Figure 1 shows the rank-ordered distribution of TEC-related complaints per 100 reviews showing that 17.6% had no TEC-related complaints, and 54.3% of hotels had ≤ 1 TEC complaint per 100 reviews. In contrast, about 1 in 4 hotels (24.5%) had three or more TEC-related complaints, with a maximum of 26.5 TEC-related complaints per 100 reviews.

Predictors of TEC-Related Complaints

Negative binomial regression models (see Table 3) showed that hotel smoking status as reported on the hotel website, guest review rate, hotel star rating, room cost, hotel brand, and hotel location were independently and significantly associated with TEC complaints (overall model fit statistics $\chi^2(24) = 288.38$, $P < .001$). In contrast, hotel smoking policy as reported by TripAdvisor ($P = .605$), hotel capacity ($P = .767$), review interval ($P = .691$), and state's smoking prevalence ($P = .142$) were not associated with TEC complaints (Table S4 in online supplement for additional model information). Tables S5 to S8 in the online supplement provide the estimated marginal means and 95% confidence intervals based on the model presented in Table 3.

Controlling for all other variables, lower-star hotels (≤ 2 star ratings) had significantly more TEC complaints (Mean = 3.4) than higher-star hotels (2.5 to 4 star ratings; Means: 1.3-2.1; $\chi^2(1) = 15.58$, $P < .001$). Hotels with 2.5 to 5 star ratings did not differ from each other. Figure 1 illustrates this association showing that hotels with ≥ 2.5 stars (blue) tended to have fewer TEC complaints than hotels with ≤ 2 stars. Hotels with higher-price standard rooms had fewer complaints. For a \$20 increase in room cost per night, TEC complaints were reduced by 13% ($z = -3.56$, $P < .001$). Hotels with more guest reviews per 100 rooms had fewer TEC complaints. A 10-point increase in the number of guest reviews per 100 rooms was associated with an 11% reduction in TEC complaints independent of other variables ($z = 6.65$, $P < .001$). Compared to nonsmoking hotels (Mean = 1.91), those offering designated smoking rooms (Mean = 2.57) and those providing no information about their status (Mean = 2.44) had 35% ($P = .046$) and 27% ($P = .039$)

Table 2. Descriptive statistics for total number hotel guest reviews and for complaints about tobacco, electronic cigarettes, cannabis, noise, and dirtiness (N = 494 hotels).

CHARACTERISTICS	MEAN [95% CI]	MIN-Q1-MDN-Q3-MAX
Review Interval (Years)	10.2 [9.8;10.7]	.6-6.3-11.6-14.5-16.7
Number of Hotel Reviews (N)		
Total	672.5 [590;754]	50-164-374-818-9644
Per Year	85.7 [74.3;97.1]	4-19-43-102-1326
Per 100 guest rooms per year	55.7 [50.5;61.0]	2-19-34-71-440
Number of TEC-Related Complaints	8.5 [6.9; 10.1]	0-1-4-10-348
Number of TEC-related Complaints per 100 Reviews		
Tobacco-Related	2.3 [2.0;2.6]	0-.2-.8-3.0-26.5
SHS-Related	.28 [.23;0.32]	0-0-0-.32-3.2
THS-Related	2.08 [1.78;2.38]	0-.1-.6-2.6-29.6
Electronic Cigarette-Related	0	0
Cannabis Related-Related	.24 [.19;0.30]	0-0-0-.1-5.1
Hotels without TEC-Related Complaints (%)	17.6 [14.4;21.3]	
Number of Dirtiness Complaints (N = 99)	10.8 [8.9;12.6]	.9-4.1-7.5-15.0-50.0
Number of Noise Complaints per 100 reviews (N = 149)	10.2 [9.3;11.2]	.8-5.7-9.3-13.1-34.7

Note. TEC: Tobacco, Electronic Cigarettes, Cannabis. 95% CI: 95% confidence interval.

Min-Q1-Mdn-Q3-Max: Tukey five-number summary, Min: smallest observed value, Q1: 1st quartile, Mdn : median, Q3: 3rd quartile, Max: largest observed value.

higher TEC complaints, respectively. Among the hotel brands, Marriott and Hilton had the overall lowest mean TEC complaints (.94 and .98, respectively). This is in contrast to Wyndham (3.36), Choice (3.14), other brands (Mean = 2.34), and independent hotels (Mean = 2.25). That is, Wyndham and

Choice hotels had more than three times as many TEC complaints per 100 reviews than Marriott and Hilton. Among the ten different locations, Salt Lake City, UT, and Omaha, NE, had the lowest mean TEC complaints, with 1.64 and 1.71, respectively. In contrast, Los Angeles, CA, Detroit, MI, and

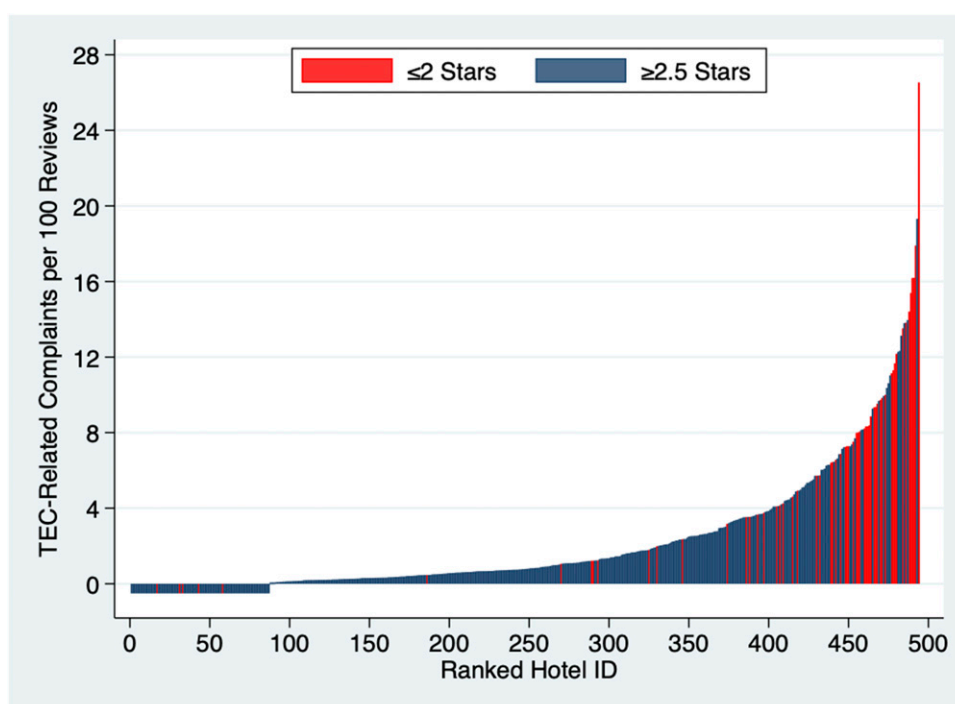
**Figure 1.** Rank-ordered distribution of the number of complaints about tobacco, electronic cigarettes, and cannabis by hotel guests per 100 reviews.

Table 3. Incident rate ratios of negative binomial regression model for TEC-related complaints in hotels per 100 reviews (Overall model fit: $\chi^2(24) = 396.09$, $P < .001$; Pseudo $R^2 = .21$; $N = 477$).

TEC-RELATED COMPLAINTS PER 100 REVIEWS	IRR	STANDARD ERROR	P-VALUE	95% CI	
				LB	UB
Hotel Star Rating (Referent: ≤ 2 Stars)					
2.5	.595	.079	.000	.458	.772
3.0	.426	.069	.000	.311	.585
3.5	.551	.121	.006	.358	.846
4.0	.384	.108	.001	.221	.668
5.0	.623	.235	.210	.298	1.305
Hotel Room Cost (\$)	.993	.002	.000	.989	.997
Guest Reviews Per Year per 100 Rooms	.988	.002	.000	.985	.992
Smoking Policy Hotel Website (Referent: Nonsmoking)					
Smoking	1.345	.200	.046	1.005	1.801
No information	1.272	.148	.039	1.013	1.599
Hotel Brand (Referent: Marriott)					
Independent	2.408	.490	.000	1.616	3.590
Hilton	1.046	.249	.851	.656	1.667
Wyndham	3.594	.799	.000	2.324	5.557
Choice	3.358	.697	.000	2.235	5.045
InterContinental	1.463	.319	.081	.954	2.245
Other	2.503	.523	.000	1.662	3.768
Location (Referent: Salt Lake City, UT)					
Birmingham, AL	1.544	.306	.028	1.048	2.277
Detroit, MI	1.730	.351	.007	1.163	2.574
Houston, TX	1.111	.232	.615	.738	1.673
Little Rock, AK	1.167	.233	.438	.790	1.726
Los Angeles, CA	1.892	.471	.010	1.162	3.081
Louisville, KY	1.463	.296	.060	.984	2.175
New York, NY	1.712	.593	.120	.869	3.375
Omaha, NE	1.043	.217	.839	.694	1.567
Portland, OR	1.331	.263	.149	.903	1.961

Note. TEC: Tobacco, Electronic Cigarettes, Cannabis. IRR: Incident Rate Ratio, showing the multiplicative change in predicted complaints for a 1 unit increase in a quantitative explanatory variable or for a comparison to the reference group of a dummy-coded explanatory variable. 95% CI: 95 percent confidence interval of the incident rate ratio. LB: Lower Boundary; UB: Upper Boundary

Birmingham, AL, had the highest means with 3.11 ($P = .01$), 2.84 ($P = .007$), and 2.54 (.028), respectively, controlling for other variables.

Discussion

This is the first study to examine hotel guest reviews for tobacco, electronic cigarettes, and cannabis complaints. We specifically focused on TEC-related complaints by guests who deliberately tried to protect themselves from SHS or THS exposure by making reservations for nonsmoking rooms or in 100% smokefree hotels. Our findings show that the patchwork of different state and hotel policies fails to consistently protect nonsmokers from being exposed to SHS smoke intrusion and THS residue. Of all TEC-related complaints, 80% were

associated with thirdhand smoke residue lingering in hotels from previous guests, 10% with secondhand tobacco smoke intrusion, and 10% with cannabis. Not a single guest review specifically mentioned electronic cigarettes or vaping. It should be noted, however, that it is difficult to attribute SHS and THS odor, discoloration, or burn marks to a specific product or a combination of products, and some of the complaints attributed to tobacco smoke may have been caused by electronic cigarettes or cannabis.

Our findings provide insights into some of the factors affecting TEC complaints in hotels and hotel rooms where TEC use is presumably banned. As hypothesized, budget, low star, low-price hotels had more complaints about TEC than the other hotels. That is, guests who stayed in the lowest-star and

lower-priced hotels found themselves at a higher risk of exposure to TEC pollutants even if they made reservations for a smokefree room or in a smokefree hotel. This suggests that current hotel smoking policies disproportionately affect guests staying in the lowest-star hotels. It should be noted that the increased rate of TEC complaints applied to ≤ 2 star hotels and that 2.5 and higher star-rated hotels did not differ from each other. In addition to room cost and star ratings, hotel policies and practices play a significant role in protecting guests from TEC exposure. Hotels that have adopted a 100% smokefree policy showed, on average, 26% fewer complaints than hotels that allow smoking in some hotel rooms. Second, hotel brands had an unexpectedly strong association with TEC complaints independent of smoking status, star rating, and room price. As hypothesized, two early adopters of 100% smokefree hotels had the fewest TEC-related complaints (Marriott with .93 and Hilton with .97 complaints per 100 reviews). In stark contrast, however, two other early adopters showed the worst record among branded hotels with complaints at a three-times higher rate (Choice Hotels: 3.14, Wyndham: 3.36) than Marriot or Hilton. These findings suggest that hotels' failure to protect nonsmokers from TEC exposure is influenced by how they implement and enforce their smoking policies.

Different from our expectation, there was no association between state overall smoking rates and TEC complaints. However, TEC complaints differed significantly between locations. Hotels in Los Angeles, CA, located in a state with low smoking prevalence, had the highest rate of TEC complaints controlling for other variables (3.11). In contrast, Little Rock, AK, the capital of a state with one of the highest smoking prevalences, had one of the lowest rates of complaints (1.92). Similarly, Michigan is one of the few states that ban smoking in hotels, but Detroit had the second-highest rate of TEC complaint among the ten cities (2.84). While we cannot give a definitive answer to why rates of TEC complaints differed between locations, these destinations may attract different groups of guests (eg, international travelers from countries with higher smoking rates) who systematically differ concerning expectations about smoking in hotel rooms. These expectations may affect the behavior of smokers as well the likelihood of nonsmokers to notice THS and register TEC-related complaints.

Implications

Based on the existing scientific evidence on SHS and THS in multiunit buildings and findings about guest complaints from the present study, restricting smoking to particular guest rooms or areas within the hotel is an ineffective policy and fails to protect guests staying in nonsmoking rooms of the same building from SHS and THS exposure.^{5,9} Fifteen years after the first hotel chains adopted 100% smokefree policies, it is misleading for hotels to suggest nonsmoking rooms offer a smokefree environment when in the same building smoking is allowed in other rooms. When deciding which hotel to stay in,

hotel guests rely on accurate information provided on a hotel website to make reservations for nonsmoking rooms expecting protection from SHS and THS exposure. Our findings suggest that many hotels claim to offer a hotel stay free of SHS and THS when in fact, their policies cannot assure this level of protection to their guests. To remove this information asymmetry, hotels offering dedicated smoking rooms should present themselves as smoker hotels and caution their guests that they cannot protect nonsmokers from SHS and THS exposure in nonsmoking rooms. Not only will this allow guests to make informed decisions, but it will also reward hotels that do provide a 100% smokefree-building hotel.

Our findings show, however, that declaring a 100% smokefree building policy or a state-wide hotel smoking ban itself does not automatically protect nonsmokers from exposure to SHS and THS. The substantial differences between hotel brands in TEC-related guest complaints independent of their smoking policies demonstrate that the implementation of such policies matters. Implementation starts with disclosing on their website and other public relations material that a hotel follows and enforces strict 100% smokefree building policies. Effective implementation also requires hotel staff training, signage, and reminders at check-in, hallways, balconies, conference rooms, staircases, elevators, and guest rooms. In addition, implementation includes consistent enforcement of policies and practices. Finally, implementation requires listening and responding to guest feedback, such as online reviews to identify and remedy discrepancies between how a hotel presents and how guests experience a hotel's smoking policy.

With 80% of TEC complaints attributable to THS residue left behind by previous guests, hotels must pay attention to two separate issues. Hotels have to be deliberate and persistent in implementing smoking bans to avoid the new accumulation of THS. In addition, hotels have to address existing THS reservoirs left behind from years of permissive smoking policies. THS is highly persistent and will not disappear by itself, so a single THS-polluted room will cause repeated complaints. Even though guests may complain about the offensive odor, the underlying THS reservoir will not be reduced by using fragrances or other chemical approaches to cover up or remove the odor (eg, ozonation). Instead., hotels must identify, clean, and remove the reservoirs where THS pollutants are stored, such as carpets, beds, mattresses, furniture, and wallboard, to prevent future odor complaints caused by re-emission from THS reservoirs.

Limitations

Hotel guest complaints about tobacco, electronic cigarettes, and cannabis should be interpreted with caution. The number of TEC-related complaints we recorded is likely to be an undercount of the actual number of TEC-related incidences experienced by hotel guests because only a fraction of such incidences is likely to be reported, and only a fraction of those are provided in writing as guest reviews on TripAdvisor. It is also possible that guests may have misinterpreted odors as

coming from tobacco, cannabis, and e-cigarette products or failed to attribute unpleasant odors to tobacco and cannabis products. Irrespective of a potential undercount, the number of TEC complaints per 100 reviews provides a valuable metric describing the relative frequency of TEC complaints compared to the total number of guest reviews and sheds light on differences between hotels and the factors affecting such complaints. While our study relies on a random sample of hotels in the largest cities of 10 states with 50 or more guest reviews, our findings cannot be generalized to hotels in smaller cities, rural areas, or hotels generating fewer than 50 guest reviews. The distinct differences in TEC complaints between locations suggest location-specific factors that affect TEC complaints, but these factors remain unknown and should be further explored. This study could not examine changes in TEC complaints over time as hotels may have transitioned to smokefree policies. Hotel and TripAdvisor smoking status used in this study was based on hotel policies from November 2018 to February 2019. The official hotel policies at the time guests made reservations could not be confirmed except for hotels that had publicly declared smokefree policies since 2006 or 2011. However, this does not alter our conclusions as all TEC complaints came from guests reporting reservations for smokefree rooms or in smokefree hotels, that is, hotels offering smokefree accommodations at the time of a hotel stay.

From a consumer's perspective, hotels share many characteristics with other indoor environments for which comprehensive smoking bans already exist. Like restaurants, bars, airplanes, and public transportation, hotels have a high occupancy turnover and are used by a broad cross-section of the population. While at first it seemed impossible, 100% smokefree policies for these indoor environments are now widely implemented and enjoy high compliance. A uniform, comprehensive building-wide smoking ban for hotels would remove ambiguity and facilitate the implementation of consistent policies across different hotel brands to protect the vast majority of guests seeking a sanctuary from secondhand and thirdhand smoke pollution caused by tobacco, cannabis, and electronic cigarette use. Until such uniform bans are in place, individual hotels should give up the illusion that designated smoking rooms can protect nonsmokers and fully commit to implementing and enforcing a 100% smokefree-building policy.

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Author Contributions

E. Weigel and G. Matt, contributed to conception or design, acquisition, analysis, or interpretation, drafted the manuscript, critically revised the manuscript, and gave final approval for this manuscript.

REFERENCES

1. CBS News. *Westin Hotels Go Smoke Free*; 2005. 12/5/2005 [cited 2021 8/21/21]; Available from: <https://www.cbsnews.com/news/marriott-hotels-to-go-smoke-free/>.
2. CBS News. *Marriott Hotels to Go Smoke-Free*; 2006. 7/20/2006 [cited 2021 8/21/21]; Available from: <https://www.cbsnews.com/news/marriott-hotels-to-go-smoke-free/>.
3. Matt GE, Quintana PJE, Fortmann AL, et al. Thirdhand smoke and exposure in California hotels: non-smoking rooms fail to protect non-smoking hotel guests from tobacco smoke exposure. *Tob Control*. 2014;23:264-272.
4. American Nonsmokers' Rights Foundation. *State and Local 100% Smokefree Hotel and Motel Guest Room Laws*. American Nonsmokers' Rights Foundation; 2021.
5. Jacob P 3rd, Benowitz NL, Destailats H, et al. Thirdhand smoke: new evidence, challenges, and future directions. *Chem Res Toxicol*. 2017;30:270-294.
6. Matt G.E., Quintana PJE, Destailats H, et al. Thirdhand tobacco smoke: emerging evidence and arguments for a multidisciplinary research agenda. *Environ Health Perspect*. 2011;119:1218-1226.
7. American Hotel & Lodging Association. *2018 Lodging Survey*. Washington, DC: American Hotel & Lodging Association; 2019. 1250 Eye Street, NW, Suite 1100, Washington, D.C. 20005. www.AHLA.com.
8. Office of the Surgeon General. *The health consequences of smoking—50 years of progress: a report of the surgeon general*. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, Office of the Surgeon General; 2014. 2 volumes.
9. U.S. Surgeon General. *The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2006.
10. Shahab L., Goniewicz ML, Blount BC, et al. Nicotine, carcinogen, and toxin exposure in long-term e-cigarette and nicotine replacement therapy users: a cross-sectional study. *Ann Intern Med*. 2017;166:390-400.
11. Goniewicz ML, Lee L. Electronic cigarettes are a source of thirdhand exposure to nicotine. *Nicotine Tob Res*. 2015;17:256-258.
12. Wylie ADL, Abbott JPD. Heterogeneous ozonolysis of tetrahydrocannabinol: implications for thirdhand cannabis smoke. *Environ Sci Technol*. 2020;54:14215-14223.
13. Sempio C, Lindley E, Klawitter J, et al. Surface detection of THC attributable to vaporizer use in the indoor environment. *Scientific Reports*. 2019;9:18587.
14. Matt G.E., Quintana PJE, Hoh E, et al. Remediating thirdhand smoke pollution in multiunit housing: temporary reductions and the challenges of persistent reservoirs. *Nicotine Tob Res*. 2021;23:364-372.
15. Zakarian JM., Quintana PJE, Winston CH, Matt GE. Hotel smoking policies and their implementation: a survey of California hotel managers. *Tob Induc Dis*. 2017;15:40.
16. McDaniel PA, Malone RE. "You Want Your Guests to Be Happy in This Business": Hoteliers' Decisions to Adopt Voluntary Smoke-Free Guest-Room Policies. *Am J Health Promot*. 2018;32:1740-1746.
17. Ayeh JK, Au N, Law R. "Do we believe in TripAdvisor?" Examining credibility perceptions and online travelers' attitude toward using user-generated content. *J Travel Res*. 2013;52:437-452.
18. O'Connor P. *User-Generated Content and Travel: A Case Study on TripAdvisor.com*. Vienna: Springer Vienna; 2008.
19. O'Connor P. Managing a hotel's image on tripadvisor. *Journal of Hospitality Marketing & Management*. 2010;19:754-772.
20. ParseHub. *A free web scraper that is easy to use, Version 54.0.1 (64-bit)*; 2018. [cited 2021 8/26/21]; Available from: <https://www.parsehub.com/>.
21. Centers for Disease Control and Prevention. *State Tobacco Activities Tracking and Evaluation (STATE) System*. Map of Current Cigarette Use Among Adults; 2017. December 19, 2018 [cited 2019 3/2/19]; Available from: <https://www.cdc.gov/statesystem/cigaretteuseadult.html>.
22. Wikipedia. *List of chained-brand hotels*; 2021. 7/20/21 [cited 2021 8/20/21]; Available from: https://en.wikipedia.org/wiki/List_of_chained-brand_hotels.
23. QSR International Pty Ltd. *NVivo (released in March 2020)*; 2020. [cited 2021 8/20/21]; Available from: <https://www.qsrinternational.com/nvivo-qualitative-data-analysis-software/home>.
24. Levy SE, Duan W, Boo S. An analysis of one-star online reviews and responses in the Washington, D.C., Lodging Market. *Cornell Hospitality Quarterly*. 2013;54:49-63.
25. Statista. *Most common complaints of hotel guests from the United States as of March 2015*; 2018. [cited 2021 8/26/21]; Available from: <https://www.statista.com/statistics/427822/most-common-hotel-guest-complaints-us/>.
26. Bender A. *Americans' Biggest Complaints About Hotels*; 2012. [cited 2021 8/26/21]; Available from: <https://www.forbes.com/sites/andrewbender/2012/07/27/americans-biggest-complaints-about-hotels/#711975202c8f>.
27. Zaldivar G. *Hotel Guests' Most Common Complaints*. 2017. [cited 2021 8/26/21]; Available from: <https://www.travelpulse.com/news/hotels-and-resorts/hotel-guests-most-common-complaints.html>.
28. Hoaglin DC, Mosteller F, Tukey JW. *Understanding robust and exploratory data analysis*. Wiley; 1983.
29. StataCorp. *Stata statistical software: Release 17*. College Station, TX: Stata Corporation; 2021.