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The following publication Yang, Y., Lin, M.S. and Magnini, V.P. (2024), "Do guests care more about hotel cleanliness during COVID-19? Understanding factors associated with cleanliness importance of hotel guests", *International Journal of Contemporary Hospitality Management*, Vol. 36 No. 1, pp. 239-258 is published by Emerald and is available at <https://dx.doi.org/10.1108/IJCHM-08-2022-0956>.

Do guests care more about hotel cleanliness during COVID-19? Understanding factors associated with cleanliness importance of hotel guests

Abstract

Purpose: Growing health concerns amid the COVID-19 pandemic have led guests to focus on various aspects of hotel cleanliness. This study investigates whether customers' perceived importance of hotel cleanliness during their stay depends on local pandemic severity and moderators of the pandemic–cleanliness relationship.

Design/methodology/approach: Based on TripAdvisor data from 26,519 reviews in 2020 for 2,024 hotels across the United States, we evaluated the importance of hotel cleanliness using the estimated coefficient of the cleanliness score in a regression of overall hotel rating scores.

Findings: Results of a multi-level ordered logit model confirmed that a more difficult local pandemic situation rendered cleanliness more important during hotel stays. Additionally, the effect of the pandemic was more pronounced among specific groups: men and travelers with more expertise; and guests staying in hotels without COVID-19 protocols for linen cleaning, with a lower average rating, with a larger size, and in a more urbanized location.

Originality: This study represents a pioneering effort to assess how pandemics shape people's (perceived) importance of cleanliness during hotel stays based on revealed data. Despite potential managerial relevance, a number of the moderating variables included in this study, such as traveler expertise and hotel location, have never been studied within the context of cleanliness perceptions during a pandemic.

Keywords: hotel experience; hotel cleanliness importance; COVID-19; pandemic severity

Introduction

Cleanliness is a key driver of guests' hotel satisfaction and was even in pre-pandemic times (Vos *et al.*, 2019). Tragically, the COVID-19 pandemic resulted in an estimated 5.8M deaths worldwide as of February 2022 (Ritchie *et al.*, 2022). Cleanliness perceptions in hotels have become increasingly important throughout the pandemic (Del Chiappa *et al.*, 2022). For example, because COVID-19 can be transmitted via surfaces touched by hand (WHO, 2020), hotel guests have paid close attention to the cleanliness and sanitation of such touchpoints (Del Chiappa *et al.*, 2022).

Since the start of the COVID-19 pandemic, a number of researchers have brought forward meaningful studies related to hotel cleanliness within the context of a pandemic. Pillai *et al.* (2021), for example, focus primarily upon the potential roles of technology in hotel cleanliness efforts. Magnini and Zehrer (2021) synthesize research from disparate bodies of literature to explicate how various subconscious cues can influence guests' cleanliness perceptions. In a qualitative study, Awan *et al.* (2020) conduct in-depth interviews with 17 tourists in an effort to explore how the pandemic has influenced their perceptions of hotel cleanliness. Furthermore, Jiang and Wen (2020) examine how various hotel marketing and management practices should be adapted due to the pandemic.

While the above studies offer both practical and research implications, it is germane to note that all are conceptual or qualitative in design. Therefore, they are useful in serving as a springboard for empirical inquiry that further extends our understanding of hotel cleanliness in pandemic conditions. Hence, this current study makes an incremental contribution to this stream of research by using empirical data to examine how the pandemic, along with a number of contextual variables, shapes hotel cleanliness perceptions of guests. Stated differently, this current study extends existing hotel cleanliness studies during the pandemic by employing empirical data and by analyzing contextual variables not yet examined in this context.

The contribution of this current study is needed because despite the marked significance of hotel cleanliness, it remains to be seen whether and how situational, property-level, or guest-centric variables influence today's pandemic-induced focus on hygiene. We endeavor to examine such potentially intervening factors. More specifically, using consumers' online hotel ratings, this study explores whether the importance of cleanliness (i.e., in its influence on overall hotel experience ratings) is affected by relative pandemic severity in the property's local area. Moreover, do guest-centric factors such as gender or travel expertise attenuate or magnify the importance of cleanliness? In addition, do property-specific factors such as hotel size, location centrality, publicized cleaning protocols, and/or status moderate the effects of cleanliness perceptions on overall guest satisfaction?

This study yields several potentially meaningful contributions. First, it represents an empirical effort to assess how pandemics shape people's (perceived) importance of cleanliness during hotel stays. Second, this study sheds light on the heterogeneity of the pandemic–cleanliness relationship by unveiling a series of moderators. Third, this study provides actionable insights on hoteliers for cleanliness management. From a practical perspective, for instance, if frequent (more knowledgeable) travelers are found to have a heightened importance of cleanliness relative

to less knowledgeable travelers, then the hotel's and/or industry's marketing messaging can be tailored accordingly. Customized messaging is particularly important because views on hotel cleanliness manifest through the confluence of conscious and subconscious cues (Magnini and Zehrer, 2021).

To achieve the above-described purpose, the next section of this paper synthesizes relevant literature and theories to anchor a set of research hypotheses. Second, our study methods, including data characteristics, construct operationalization, and modeling parameters, are detailed. Next, hypothesis testing results are presented. Lastly, theoretical and practical implications are described along with potential avenues for subsequent work.

Literature Review and Hypothesis Development

Theoretical foundation for cleanliness in hotels

Cleanliness (e.g., of the lobby, amenities, and guest rooms) is fundamental to hotels' reputation and performance (Gu and Ryan, 2008). Lockyer (2003) defined hotel cleanliness as comprising cleanliness in guest rooms and public areas, including the building's exterior and lobby, and found that it affected travelers' hotel choices in New Zealand. Research has since focused on hotel hygiene as a principal determinant of guests' hotel selection, satisfaction, and loyalty (e.g., Barber and Scarcelli, 2010; Park, H. *et al.*, 2019). The COVID-19 pandemic has underlined the importance of hotel hygiene standards (Chan *et al.*, 2021), as the virus can spread easily via surfaces (WHO, 2020). Higher microbial counts on surfaces present potential sources of disease transmission (Park, H. *et al.*, 2019). Therefore, a more holistic understanding of hotel cleanliness can help hoteliers meet guests' stringent expectations.

Studies have addressed the impact of hotel cleanliness on guests' hotel selection. Unsurprisingly, cleanliness has consistently ranked as a top factor in guests' hotel choice and satisfaction—ranking #1 (e.g., Weaver and Oh, 1993) and #3 (e.g., Hart, 1993) among several elements. Yet the importance of cleanliness varies with guests' cultural and demographic backgrounds (Hart, 1993; Lockyer, 2003). Lockyer (2003) laid a solid foundation on hotel cleanliness by administering a survey containing open- and closed-ended questions. He compared importance and performance differences for hotel cleanliness in six areas: outside, room, kitchen, bedroom, bathroom and toilet, and reception. Later, Zemke *et al.* (2015) used a questionnaire to evaluate perceived cleanliness and its association with hotel guests' accommodation-related willingness to pay. Women and younger travelers were more willing to pay a higher price for a guest room that had been disinfected more intensively. Park, H. *et al.* (2019) conducted a survey and an adenosine triphosphate test to examine the relationship between guest contact and surface cleanliness. Their findings generated practical suggestions encouraging hoteliers to focus on high-touch and unsensitized areas when cleaning. Furthermore, based on online review data from TripAdvisor, Pacheco (2017) found cleanliness to have a positive and significant impact on guests' overall experiences in two- to four-star hotels; this effect was insignificant for five-star hotels.

Given the influence of COVID-19, researchers have identified growing concerns about cleanliness across consumer segments (e.g., Awan *et al.*, 2020; Shin and Kang, 2020). Guests may care more about cleanliness because the hotel experience involves extensive human interaction and contact with various physical surfaces (e.g., Gaur *et al.*, 2021). Awan *et al.*

(2020) conducted a qualitative study on hotel guests' expectations around the so-called "new normal" amid the pandemic. Results indicated that both guests and hotel management should pay additional attention to cleanliness. In another conceptual paper, Magnini and Zehrer (2021) focused on perceived cleanliness in hospitality settings and developed a framework of subconscious influences. They identified the degree of lighting, presence of plants/greenery, shininess of surfaces, ambient scents, solid-color (all-white) bedding, and the presence of cleaning staff as vital atmospheric cleanliness cues. Moreover, they recommended that "...it would be prudent to empirically examine a host of potential moderating and mediating variables" (p. 5) in the future. Given the theoretical foundations, the following sections will discuss this study's hypothesis development.

Hotel cleanliness and ratings

During the pandemic, guests are likely to stay at hotels that adhere to strict hygiene standards to minimize the possibility of infection (Jiang and Wen, 2020). Many hotels have therefore modified their usual hygiene standards by enhancing manual cleaning and developing automated non-contact procedures. Different hotel departments may opt to adapt their hygiene protocols in response to changing consumer demand. We adopt protection motivation theory and expectancy disconfirmation theory to clarify consumers' evaluations of cleanliness. Protection motivation theory explains how individuals alter their behavior to reduce their perceived risks as a response to a crisis or threat (Rogers, 1975). After a crisis or threat appears, individuals aim to identify and evaluate the negative impact of such a change, and later cope with new strategies to alleviate the negative impact. During the COVID-19 pandemic, many hotel guests have paid extra attention to hotel cleanliness because of the uncertainty and health related concerns (Shin and Kang, 2020). Therefore, their overall evaluation of hotel performance hinges on whether they perceive the hotel's new cleanliness policies can mitigate the negative impact of the COVID-19 pandemic.

In addition, expectancy disconfirmation theory suggests that guests' satisfaction is contingent upon whether perceived product performance matches – or does not match - expectations (e.g., hotel cleanliness) (Oliver, 1980). According to this framework, expectations serve as a comparative referent or benchmark for the development of a satisfaction judgment (Zehrer *et al.*, 2011). It is germane to note that incongruence between expectations and actual performance can be positive or negative. In this context, guests are likely to express satisfaction if a hotel's cleanliness performs better than their expectation; when cleanliness fails to meet expectations, guests will be dissatisfied. Guests' satisfaction with hotel cleanliness has come to play an increasingly pertinent role in hotel selection (Jiang and Wen, 2020). Hotel online review ratings are typically used to assess consumer satisfaction (e.g., Li *et al.*, 2013; Zhou *et al.*, 2014). Hotel cleanliness has even been recognized as the most unsatisfactory aspect of hotel stays, despite this factor having been ranked as the most important in hotel choice (Dolnicar, 2002). We thus argue that hotel cleanliness can influence guests' overall perceptions of and satisfaction with a hotel as evidenced by overall hotel ratings online. The following hypothesis is proposed accordingly:

H1: Hotel cleanliness rating has a significant positive impact on overall hotel ratings.

COVID-19 severity and hotel cleanliness

The importance of hotel cleanliness continues to intensify among guests due to anxiety about COVID-19. However, the pandemic's effects have varied geographically (Napierala *et al.*, 2020). Many U.S. counties maintain their own COVID-19–related statistics, which can affect regional hotel businesses (Cronin and Evans, 2020). Hotel guests are more likely to raise concerns about destinations with evolving COVID-19 situations. As indicated in expectation confirmation theory (ECT), a destination's pandemic situation is likely to play a key part in guests' expectations about hotel stays: guests who anticipate a higher number of local cases will presumably be more worried about the consequences of COVID-19.

The theory of perceived risk, which captures how consumers react to uncertainty and perceive risk when making decisions, can partly explain pandemic-related concerns alongside ECT. Perceived risk is born from possible adverse outcomes of product or service consumption (Rehman *et al.*, 2020). Perceived risk and uncertainty are intertwined such that uncertainty amplifies perceived risk (Shimp and Bearden, 1982). In this study, a higher level of pandemic severity (as reflected by higher perceived uncertainty) is thought to be associated with greater perceived risk. That is, greater perceived risk will likely compel people to engage in self-protective behavior, such as paying more attention to hotel cleanliness. We take the number of local COVID-19 cases as a proxy of concern: if hotel guests are more concerned about COVID-19, they may be more attuned to hotel cleanliness in order to minimize the risk of infection.

Disconfirmation and concern are thus assumed to moderate the relationship between guests' hotel cleanliness ratings and overall hotel ratings. Given equal hotel cleanliness, guests with higher cleanliness expectations due to local COVID-19 case rates will be less satisfied as shown in their overall hotel ratings. Stated formally:

H2: Local pandemic severity strengthens cleanliness importance, as measured by the impact of hotel cleanliness on overall hotel ratings.

Heterogeneity of the pandemic's impact on cleanliness importance

We examine a set of factors influencing the pandemic's impact on cleanliness importance as revealed in online ratings. These aspects include guests' personal traits (e.g., gender and knowledge), hotel characteristics (e.g., COVID-19–related action, hotel rating, and hotel size), and location attributes.

Gender

Scholars have long focused on the demographic factor of gender to classify individuals' perceptions of hotel cleanliness (e.g., Barber and Scarcelli, 2010; dell'Olio *et al.* 2011; Zemke *et al.*, 2015). Yet whether men and women in fact perceive cleanliness differently remains inconclusive. Whereas researchers such as Barber and Scarcelli (2010) and Vos *et al.* (2019) observed no significant variation in perceived cleanliness between men and women, dell'Olio *et al.* (2011) and Mortimer and Clarke (2011) identified cleanliness as more important for women than for men when assessing service quality. Still others (e.g., Lockyer, 2003; Zemke *et al.*, 2015) noted no significant differences in perceived cleanliness between women and men although women expressed greater concerns about it. Perceptions of cleanliness have placed greater pressure on hotel management amid COVID-19 (Jiang and Wen, 2020). Given

inconsistent findings regarding cleanliness-related gender discrepancies and the current pandemic context, it seems worthwhile to test the role of gender on cleanliness under these circumstances. The following hypothesis is thus proposed:

H3: The pandemic's impact on cleanliness importance is more pronounced for female guests than for male guests.

Knowledge

Consumers' experience with and knowledge about a product or service can inform their search, processing, and purchase behaviors (Alba and Hutchinson, 1987). Consumer knowledge can be broadly categorized into three types: subjective knowledge, objective knowledge, and user experience (Raju *et al.*, 1995). Subjective knowledge refers to a consumer's perceived knowledge about the value and quality of a product or service. Objective knowledge can be determined using objective tests of a consumer's knowledge level. Usage experience is generally evaluated on the basis of a consumer's personal experience with a product or service regardless of how information is obtained. Cleanliness is a relatively subjective topic and requires situational understanding; as such, we refer to consumers' usage experiences to assess hotel guests' perceived cleanliness.

Researchers have examined how different degrees of knowledge can influence consumers' behavior (e.g., Lee and Ro, 2016; Park and Kim, 2008). Knowledgeable consumers are more likely to quickly assess information quality and to rely more on their own judgment and experience (LaTour *et al.*, 2011). In particular, Xiang *et al.* (2015) examined the guest experience and knowledge in big data and text analytics by using hotel review data. Their results indicated that hotel guests could express their knowledge and share their experience in their reviews, which are found to have a strong correlation with their satisfaction. During the pandemic, perceived cleanliness is considered a core of the overall hotel experience (Shin and Kang, 2020). Therefore, knowledgeable hotel guests who possess richer user experience can probably discern overall hotel quality and perceived cleanliness more effectively. More knowledgeable consumers are also likely to seek additional information to evaluate a situation when procuring services. They are therefore more apt to attend to COVID-19's impact on cleanliness. The following hypothesis is proposed as a result:

H4: The pandemic's impact on cleanliness importance is more pronounced for more knowledgeable guests.

COVID-19-related action

The concept of hotel cleanliness extends beyond a conventional understanding of hygiene and sanitation during the pandemic. Hotel guests are likely to be highly aware of COVID-19, including in terms of local case statistics and medical support. Guests should be similarly inclined to prioritize their health over potential viral exposure. As concerns about hotel hygiene continue to rise, many hotels have promoted more stringent sanitation procedures to attract guests (Jiang and Wen, 2020). For example, many major hotel groups have launched corporate cleaning policies that outline new safety precautions, physical barriers between guests and staff, and enhanced public high-touch area cleaning (Cross, 2020).

Even so, hotel cleanliness is not readily observable by guests (Park, H. *et al.*, 2019). Research has shown that consumers' perceptions of hotel cleanliness depend on subconscious cues such as lighting, scents, and the presence of cleaning staff (Magnini and Zehrer, 2021). Godovykh *et al.* (2022) conducted an online scenario-based experiment to examine the impact of cleaning information sources on consumer trust. Hotel guests have different perceptions on cleanliness due to the perceived trust from multiple sources. However, the need for policy-related communication between corporations and guests during crises (e.g., the COVID-19 pandemic) has yet to be empirically emphasized. Hsieh *et al.* (2021) applied protection motivation theory to determine whether social trust mediates the effects of threat perceptions on individuals' intentions to stay at a hotel. Related policy statements can bridge the information gap between hotels and guests, bolstering guests' trust in a hotel's cleaning procedures. Trust and confidence can in turn alleviate guests' perceived risk. When a hotel publicizes COVID-19-related action, consumers will likely express more trust in its cleaning processes and lower anxiety levels, leading to higher overall hotel ratings:

H5: The pandemic's impact on cleanliness importance is less pronounced for hotels implementing additional cleanliness procedures which are disclosed online.

Hotel rating

Hospitality and tourism researchers have recognized word-of-mouth (WOM) and electronic WOM (eWOM) as integral to consumers' expectations. Decades ago, Grönroos (1982) pointed to WOM as a key antecedent of consumers' anticipated quality through the impacts of business image, reputation, and communication. Perceived quality manifests as the difference between consumers' expected and experienced quality (Parasuraman *et al.*, 1985). In the digital era, eWOM has begun to further influence consumers' perceptions of quality and value (Cheng *et al.*, 2023; Davari *et al.*, 2022). Individuals can easily search for information from other consumers via online reviews before actual consumption (Cheng *et al.*, 2023). A major metric of hotel quality is the average hotel rating on websites (Ye *et al.*, 2009). Such ratings and feedback can further influence hotel guests' expectations of hotel quality. Hotel management is especially willing to devote time and energy to maintaining a high level of perceived quality and to monitoring eWOM (Xie *et al.*, 2016). General concerns about hotel cleanliness during the pandemic have required managers to allocate more resources to hotel hygiene. Hotels with higher average ratings may also implement more rigorous cleaning practices to safeguard their reputation. These practices can be documented through eWOM and transmitted among consumers, enhancing prospective guests' confidence in and expectations about hotel quality. Conversely, hotels with lower average ratings may have neither the motivation nor the resources necessary to excel at cleanliness. Guests might in turn be particularly concerned about their hotel experience as postulated below:

H6: The pandemic's impact on cleanliness importance is more pronounced for hotels with lower average ratings.

Hotel size

The literature on business operations has highlighted firm size as essential to performance so that hotel scholars have used the number of rooms as a proxy for hotel size to measure the effects of economies of scale (Lee *et al.*, 2014; Orser *et al.*, 2000). However, the role of hotel size is

inconsistent from a firm governance perspective (DeFranco *et al.*, 2017): larger hotels tend to have more standardized practices to cover key aspects of hotel guest service encounters—yet smaller hotels can react promptly to changes and target niche markets that larger hotels do not cover (DeFranco *et al.*, 2017). The impact of hotel size remains unclear during the COVID-19 pandemic, with larger hotels possessing more resources but smaller hotels enjoying flexibility. We consider hotel guests' viewpoints in contending that hotel size can trigger perceived risk (Wang *et al.*, 2021). Larger hotels serve more guests within their properties, which can generate a sense of crowdedness. Crowdedness can be represented by the density of population, which is the number of guests within the hotel property in this context (Wang *et al.*, 2021). Specifically, larger hotels may feature greater risk (e.g., due to hosting a denser population within a restrained indoor area) than smaller hotels, as consumers are more sensitive to crowdedness during the pandemic (Wang *et al.*, 2021). Hotel guests may thus be more concerned about incidental interactions with other guests, sparking additional worry about hotel cleanliness and the avoidance of infection:

H7: The pandemic's impact on cleanliness importance is more pronounced for larger hotels.

Location popularity

Researchers and practitioners have both deemed location a main asset and competitive advantage in firm performance (Sainaghi, 2011; Yang *et al.*, 2014). Many hotel guests prefer to stay in popular locations (Yang *et al.*, 2018). Desirable hotels typically offer various facilities, such as tourist attractions, restaurants, and transportation outlets, in the immediate vicinity to accommodate guests' needs while saving time (Shoval *et al.*, 2011). With these additional entertainment and recreation options available nearby, hotel guests can maximize their enjoyment during their hotel stay given space-time limitations. Yang *et al.* (2018) identified three location-related factors, surrounding environment, transport convenience, and accessibility to points of interest, that could impact hotel guest rating. They found that a hotel property's accessibility to nearby key attractions, transportation facilities (e.g., airports and public transportation), resources (e.g., green space and water coverage) and local businesses could have positive influences on hotel guest satisfaction. However, under the risks associated with the COVID-19 pandemic, such effect may not convey the same message to hotel guests. In specific, a popular location can suffer from excessive traffic (e.g., residents and tourists) at nearby facilities. Similar to the argument for hotel size, hotel guests could be sensitive to crowdedness in nearby locations that may suggest higher risks. More popular attractions nearby could imply a denser population in the nearby regions. The pandemic could pose obstacles to social distancing in highly populated communities, increasing the risk of viral exposure (WHO, 2020). Hotel guests may perceive hotels in popular locations as being higher-risk and hence hold greater expectations for hotel cleanliness. The following hypothesis is therefore put forth:

H8: The pandemic's impact on cleanliness importance is more pronounced for hotels in popular locations.

Research Method

Data collection

In October 2021, we collected a comprehensive dataset of TripAdvisor reviews to test our research hypotheses. A JAVA scrawler was programmed to collect hotel reviews and hotel profiles from the TripAdvisor page of each hotel, and the data obtained were further manually checked to guarantee accuracy. TripAdvisor, as the largest online hotel review platform, enables users to evaluate their hotel experiences with an overall rating as well as a set of sub-ratings, such as on the establishment's cleanliness, location, service, rooms, value, and sleep quality (Liu *et al.*, 2013). We obtained TripAdvisor hotel reviews in the United States via https://www.tripadvisor.com/Hotels-g191-United_States-Hotels.html. This link does not list all hotels in the United States but includes a representative sample of hotels across different states. We gathered hotel-specific information, review-specific information, and reviewer-specific information. Regarding hotel-specific information, we collected hotel names, addresses, overall displayed rating, number of reviews, travel safety measures during COVID-19, property amenities, room features, room types, and location information (e.g., hotel address). Review-specific information included each review's title and content, overall rating and sub-ratings, date of stay, review posting date, and trip type (see Figure 1). Typical sub-ratings include ratings on cleanliness, room, sleep quality, service, value, and location. Although every review included an overall review rating, only part of each review involved the cleanliness sub-rating, which was the focus of this study. Lastly, for reviewer-specific information, we documented the time when the reviewer joined TripAdvisor, their number of contributions, and their total points amassed in TripCollective based on past contributions (<https://www.tripadvisor.com/TripCollective>). Some reviewers disclosed their gender and age group in their reviewer profile, and these demographic characteristics were noted when available.

(Please insert Figure 1 about here)

After removing reviews without a cleanliness sub-rating, our sample comprised 26,519 reviews for hotel stays in 2020 from 2,024 hotels across the country. Data also cover the pre-pandemic period in 2020 to better highlight the impact of pandemics. Data were geographically representative of hotels in the contiguous United States, covering all 50 states and the District of Columbia (Figure 2).

(Please insert Figure 2 about here)

Empirical model

In this research, we were particularly interested in the importance of cleanliness in hotel experiences. Inspired by Pacheco's (2017) study that regressed the overall experience score on the cleanliness sub-rating score, we gauged cleanliness importance by the magnitude and significance of the estimated coefficient of the cleanliness score in the overall score regression. We employed a multi-level ordered logit model in place of simple linear regression. A multi-level model can capture the nested structure of data, where review information is nested within each hotel property (Park, S. *et al.*, 2019). Moreover, as the overall experience score lies on an interval ranging from 1 to 5, the ordered logit model can capture this ordinal response by estimating the cumulative probability of each score (Grilli and Rampichini, 2014). Our specific model is written as follows:

$$y_{ijt}^* = \mathbf{x}_{ijt}\beta + \omega_t + \mu_j + \varepsilon_{ijt}$$

$$y_{ijt} = m \text{ if } \tau_{m-1} \leq y_{ijt}^* \leq \tau_m \text{ for } m = 1, 2, \dots, 5 \quad (1)$$

where i represents each review, j represents each hotel property in the sample, and t indicates the specific month of a reviewer's hotel stay. y_{ijt} is the observed overall rating from each review, and y_{ijt}^* is the latent outcome, based on which y_{ijt} is observed. Moreover, x_{ijt} is a row vector of independent variables; ω_t is the year-month-specific effect capturing the time-specific effect in each month of observation. μ_j denotes the hotel-specific effect of hotel j that captures unobserved characteristics, drawn from a multivariate normal distribution with mean 0 and variance matrix Σ ; ε_{ij} is an error distributed as a logistic distribution that is independent of μ_j . Lastly, four cut-off points τ_1 through τ_4 were estimated after assuming $\tau_0 = -\infty$ and $\tau_5 = +\infty$ to classify y_{ijt} from y_{ijt}^* . We used the mean-variance adaptive Gauss-Hermite quadrature to approximate the likelihood function (Skrondal and Rabe-Hesketh, 2004) in the model's maximum likelihood estimation.

Variable operationalization

The dependent variable in our model was *rating* (i.e., the overall rating score listed on TripAdvisor, with 1 = terrible, 2 = poor, 3 = average, 4 = very good, and 5 = excellent). Regarding our major variables of interest, *r_clean* indicates the cleanliness sub-rating score on TripAdvisor (from 1 to 5), and *Incases* is the log of average daily confirmed COVID-19 cases per capita in the county where the hotel was located in the previous month of the reviewer's stay. By doing so, we are able to better capture the casual effects of pandemics. Data on daily confirmed cases for each U.S. county were obtained from the Johns Hopkins Coronavirus Resource Center (<https://coronavirus.jhu.edu/>). The estimated coefficient of *r_clean* in the model was used to test H1, with the coefficient predicted to be positive and significant. We referred to the estimated coefficient of the interaction term between *r_clean* and *Incases* to test H2. According to H2, the coefficient should be positive and significant, conveying a larger impact of the cleanliness score on the overall rating when the local pandemic situation is more severe. Therefore, the coefficient of the interaction term between *r_clean* and *Incases* reflects the pandemic's effect on cleanliness importance.

To understand the heterogeneity of this impact and to test H3–H8, we introduced a series of three-way interaction terms with *r_clean* and *Incases*. The variable *gender* captures the reviewer's gender as disclosed on TripAdvisor, with H3 forecasting a positive and significant coefficient of the interaction term *r_clean* * *Incases* * *gender = female*. Another variable, *Incontributions*, represents the log of the reviewer's contribution points on TripAdvisor based on past activities such as posting reviews or uploading photos and videos. This variable proxies the reviewer's expertise (Park, S. *et al.*, 2019). TripAdvisor assigns reviewers to different levels based on TripCollective points. Per H4, the coefficient of the interaction term *r_clean* * *Incases* * *Incontributions* should be negative and significant. We used *COVID_action* to capture a specific hotel cleaning action during the pandemic (i.e., high-temperature washing of linens), equal to 1 if the hotel reported using a high-temperature wash as a COVID-19 response on TripAdvisor during the month of the reviewer's check-in and 0 otherwise. H5 predicted a negative and significant coefficient of the interaction term *r_clean* * *Incases* * *COVID_action*. Additionally, *average_rating* indicates the average rating score of the hotel on TripAdvisor, and the interaction term of *r_clean* * *Incases* * *average_rating* was used to test H6. A negative and significant coefficient of this interaction term would lend support to H6. To test H7, we included

the interaction term $r_clean * Incases * lnrooms$, where $lnrooms$ is the log of hotel rooms disclosed on the TripAdvisor hotel page. If H7 were to hold, then its estimated coefficient would be positive and significant. Lastly, the interaction term $r_clean * Incases * lnrestaurants$ was applied to test H8, where $lnrestaurants$ measures the log number of 1+restaurants within 0.3 miles from the hotel property based on information provided on TripAdvisor. H8 forecasted a positive and significant coefficient.

The model also included a set of control variables:

- *lnmonth_dif*: log of 1+months taken to post a review after the reviewer's stay. As Yang *et al.* (2018) explained, this measure reflects the temporal distance between a guest's actual stay and the time at which their review was posted; a greater temporal distance may be susceptible to recall biases in the overall hotel rating.
- *COVID_actions*: a dummy variable indicating if the hotel disclosed high-temperature washing of linens. Actions in response to COVID-19 may reduce infection risk during the pandemic and are expected to improve hotel guests' overall experiences.
- *lncontribution*: log of the reviewer's contribution points on TripAdvisor based on past activities. As indicated in prior studies, more experienced guests who reach a higher contribution level on TripAdvisor tend to be more demanding and more likely to post a lower overall experience rating (Park, S. *et al.*, 2019).
- *traveler_type*: the travel type disclosed on TripAdvisor for each review: 1 = business (reference group), 2 = couples, 3 = family, 4 = friends, 5 = none, and 6 = solo. Research has shown that guests traveling for different purposes hold disparate expectations about their hotel experiences, leading to distinct overall ratings of their actual stays (Liu *et al.*, 2013).

Data description

Table 1 presents descriptive statistics for the variables used in our econometric analysis. The dependent variable, *rating*, had a mean value of 4.709 out of 5, while the independent variable, r_clean , had a mean of 4.786. In terms of categorical variables, only a portion of reviewers disclosed their travel type, with business trips being most frequent. Among reviewers who identified their gender, women were more common than men. Half (52.40%) of reviews pertained to hotels that disclosed their linen sanitation protocol in response to the pandemic.

(Please insert Table 1 about here)

Empirical Results

Results for basic models

Based on the empirical strategy discussed, we first estimated basic models. Specifically in the model, the estimated coefficient of r_clean in the model was used to test H1, while the estimated coefficient of the interaction term between r_clean and $lncases$ to test H2. Table 2 displays the estimation results of our basic models to test H1 and H2 without three-way interaction terms. Models 1 and 2 did not include control variables, whereas Models 3 and 4 contained additional control variables. In Models 1 and 3, the estimated coefficient of r_clean was positive and significant, implying that a higher hotel cleanliness rating corresponded with a higher overall rating of the hotel experience. Therefore, H1 was empirically supported. Models 2 and 4 contained the two-way interaction term, $r_clean * lncases$, and the estimated coefficient of this

term was positive and significant. The estimated coefficients for each of these two models were similar, suggesting high robustness: the impact of hotel cleanliness rating appeared more salient for hotels in counties facing a more severe pandemic situation. As such, H2 was empirically supported.

(Please insert Table 2 about here)

Regarding other control variables, the estimated coefficient of *lnmonth_dif* was insignificant, indicating that the temporal distance between the date of a guest's stay and when their review was posted did not influence the overall rating. Furthermore, the estimated coefficient of *COVID_action* was positive and significant, highlighting that hotels' implementation and disclosure of COVID-19 response actions could enhance guests' overall experiences. No strong evidence emerged for the role of traveler type on hotels' overall ratings.

Results for models with three-way interactions

Table 3 lists the estimation results of models with three-way interactions. As depicted in Table 2, the models with and without control variables generated largely similar results during hypothesis testing, and additional control variables improved the models' goodness of fit. We then estimated these models using the control variables in Table 3. Results without control variables were quite similar during hypothesis testing and are available upon request. Additionally, to reduce unnecessary complexity when interpreting our findings, each model included only one three-way interaction term to test the corresponding hypothesis.

(Please insert Table 3 about here)

Model 5 contained the interaction term $r_clean * Incases * gender = female$ to test H3. Because only a small proportion of TripAdvisor users disclosed their gender, this model was estimated based on a sample size ($N = 2,846$) substantially smaller than that employed with other models. The estimated coefficient of the three-way interaction was negative and significant ($\beta = -0.00494, p < 0.01$). Women seemed to be less sensitive to pandemic severity when evaluating the importance of cleanliness during a hotel stay versus their male counterparts. H3 was hence rejected.

Model 6 examined the interaction effect of traveler knowledge level measured by *Incontributions* to test H4. Specifically, the three-way interaction $r_clean * Incases * Incontributions$ was estimated to be positive and significant ($\beta = 0.00216, p < 0.01$). Hotel guests with more knowledge were more sensitive to local pandemic severity when assessing the importance of cleanliness. H4 was accordingly supported.

Model 7 addressed the interaction effect of hotels' COVID-19 response (as reflected by linen-washing procedures) to test H5. The interaction term $r_clean * Incases * COVID_action$ had a significant and negative estimated coefficient ($\beta = -0.0057, p < 0.05$); in other words, reviewers trusted hotels that reported clear COVID-19 action (i.e., high-temperature linen washing), and evaluations of cleanliness importance were less contingent on local pandemic severity. H5 was supported.

In Model 8, we included the interaction term $r_clean * Incases * average_rating$ to test H6. The estimated coefficient was negative and significant ($\beta = -0.0273, p < 0.01$): guests staying at

highly rated hotels were less sensitive to local pandemic conditions when considering cleanliness importance. This empirical result aligned with H6.

Model 9 included hotel size as a moderator with a three-way interaction $r_clean * Incases * Inrooms$ to test H7. Its estimated coefficient was positive and significant ($\beta = 0.00589, p < 0.01$), such that guests who stayed at larger hotels were more sensitive to the local pandemic situation when evaluating cleanliness importance. H7 was therefore supported.

Lastly, in Model 10, we incorporated the three-way interaction term $r_clean * Incases * Inrestaurants$ to test H8. The term was estimated to be positive and statistically significant ($\beta = 0.000706, p < 0.05$). That is, guests staying at hotels in popular locations were more concerned with local pandemic severity when pondering the importance of cleanliness. H8 was consequently supported.

Robustness checks

We next performed a series of robustness checks using alternative regression models: (1) the same multi-level ordered logit model with the COVID-19 cases of the same month of hotel stays; (2) a linear regression model without considering the ordinal scale and multi-level structure of data; (3) a linear multi-level model considering the multi-level structure of data but disregarding the ordinal scale of the dependent variable; and (4) an ordered logit model considering the ordinal scale of the dependent variable but overlooking the multi-level data structure. Findings returned generally similar conclusions as hypothesis testing. Specific results are available upon request.

Discussion and Implications

Conclusion

In this study, we empirically confirmed cleanliness rating as a vital aspect of guests' overall evaluations of their hotel stays. Its importance was found to depend on local COVID-19 severity. We also unveiled several factors moderating the impact of pandemic severity on cleanliness importance, namely gender, guests' expertise, hotel's COVID-19 response, hotel's average rating, hotel size, and hotel location. Findings demonstrated that pandemic severity exerted a larger impact on the perceived cleanliness importance for two groups: men and more experienced guests. Local pandemic conditions were also more impactful for hotels that disclosed a linen-cleaning protocol in response to COVID-19, had a lower average TripAdvisor rating, were of a larger scale, and were in more popular and urbanized locations.

Theoretical implications

With respect to theory development, this study represents a pioneering effort to empirically investigate hotel cleanliness and elucidate the dynamics of customers' attitudinal changes during the pandemic based on situational factors. Del Chiappa *et al.* (2022) pointed out the increased importance of cleanliness perceptions during the pandemic. The moderators identified and tested in our study, which influenced individuals' cleanliness judgments and overall experience evaluations, add novel insight to this research stream. Specifically with regard to the gender finding, future research is warranted to examine whether the heightened cleanliness perceptions

by males found in this study is an artifact of travel during pandemic conditions. Stated differently, past studies that found no gender differences (Barber and Scarcelli, 2010; Vos et al. 2019), or elevated attention by females (dell’Olio et al. 2011; Mortimer and Clarke, 2011), were not conducted with pandemic-era data.

Also from a theory-building perspective, our work has extended Oliver’s (1980) expectancy disconfirmation theory to cleanliness perceptions. Findings revealed various main effects. More specifically, cause and effect relationships between cleanliness and outcome variables can be framed within Oliver’s (1980) expectancy disconfirmation theory: when expectations are exceeded satisfaction is the result. Likewise, the converse also occurs in terms of dissatisfaction. Regarding moderating effects, whereas Hsieh *et al.* (2021) applied protection motivation theory to explore aspects of pandemic recovery, we employed this theory to consider the impacts of cleanliness perceptions on overall hotel ratings.

Crotts *et al.* (2012) text-mined travel blogs and discovered that people traveling outside their home countries emphasized cleanliness perceptions more strongly than during domestic trips. The current study’s findings expand related knowledge based on user-generated content (UGC): we illuminated a host of moderators in the relationship between cleanliness and hotel guests’ overall satisfaction. When combined with other sources of big data, such as county-level COVID-19 case statistics, our results illustrate that UGC data can enhance the understanding of cleanliness perceptions as well as the relationships between such perceptions and contextual variables (e.g., traveler expertise and hotel size).

Practical implicaitons

Along with enriching theoretical knowledge of guests’ perceptions of the hotel servicescape, our results hold practical value for hotel firms. Several strategies are recommended to promote hotels’ performance during the COVID-19 pandemic and similar crises. First, managers should ensure timely disclosure of sanitation practices. Second, extensive support should be provided for hygiene-sensitive guests, especially in large hotels and hotels in urban areas. Third, lower-end hotels would benefit from guidance to improve their sanitation-related efforts during the pandemic. Lastly, local pandemic severity should be closely monitored so hotel managers can tailor their risk mitigation strategies.

Also with regard to practical implications, because actual and perceived cleanliness often vary (Magnini and Zerhrer, 2021), hotel marketers can infuse cleanliness messaging into communication efforts and do so conscientiously as this study’s moderators suggest. For example, a hotel that is objectively clean may not be perceived as such by potential guests in the absence of appropriate messaging: such messaging is especially important for larger hotel properties, especially those in highly transient locations. Additionally, because the effect of the pandemic is found in this study to be more pronounced among specific groups [for example: men and travelers with more expertise; those staying in large hotels] flexible cancellation policies can be accented in marketing messaging. Research conducted by Volgger *et al.* (2021) indicates that highlighting flexible cancellation policies can aid in placating the concern of covid-worried customer segments. Accenting a company’s / brand’s authenticity can also help mitigate such concerns (Shoenberger *et al.* 2021).

Limitations and future research

Some limitations may temper the generalizability of our results. First, some subsample analysis (i.e., Model 5 on gender effect) covers a small sample size, which may lead to a less generalizable result. Second, our data covered specific parts of the pandemic cycle. It would be interesting to observe how customers' perceived importance of cleanliness changes throughout the pandemic. Similarly, even though certain activities (e.g., outdoor recreation) (Landry *et al.*, 2021) and perceptions (e.g., cleanliness) (Del Chiappa *et al.*, 2021) have intensified during the pandemic, it remains unclear how long this increased focus will persist thereafter. Might cleanliness perceptions be heightened for years to come as people remember the loss of life caused by the pandemic and/or learn to live with novel variants? Shedding light on these questions would provide pragmatic insight for hospitality firms.

Third, initial evidence implies that cultural factors, particularly uncertainty avoidance, can shape customers' cleanliness perceptions (Zhang *et al.*, 2020). Data for this study were obtained in a single country, and reviewers' nationalities were unknown. The influence of culture thus remains ambiguous. Further research can evaluate how cultural traits might explain cleanliness importance among individuals.

Fourth, the TripAdvisor cleanliness score did not include sub-scores for different aspects of cleanliness (e.g., room cleanliness, cleanliness of public areas). Scales are available to measure separate dimensions of cleanliness (e.g., Barber and Scarcelli, 2010; Vos *et al.*, 2019). This research can therefore be extended to investigate whether and how identified moderators affect cleanliness dimensions. For instance, would the intensified effect at large hotels hold more for public areas in comparison to guest rooms? Questions such as these are ripe for investigation as they are replete with practical implications.

References

- Alba, J.W. and Hutchinson, J.W., 1987. Dimensions of consumer expertise. *Journal of Consumer Research*, 13(4), pp.411-454.
- Awan, M.I., Shamim, A. and Ahn, J., 2020. Implementing 'cleanliness is half of faith' in re-designing tourists, experiences and salvaging the hotel industry in Malaysia during COVID-19 pandemic. *Journal of Islamic Marketing*, 12(2) pp. 543-557.
- Barber, N. and Scarcelli, J.M., 2010. Enhancing the assessment of tangible service quality through the creation of a cleanliness measurement scale. *Managing Service Quality: An International Journal*, 20(1), pp. 70-88.
- Chan, J., Gao, Y.L. and McGinley, S., 2021. Updates in service standards in hotels: how COVID-19 changed operations. *International Journal of Contemporary Hospitality Management*, 33(5), pp.1668-1687.
- Cheng, X., Xue, T., Yang, B. and Ma, B., 2023. A digital transformation approach in hospitality and tourism research. *International Journal of Contemporary Hospitality Management*, (ahead-of-print).
- Cronin, C.J. and Evans, W.N., 2020. *Private precaution and public restrictions: what drives social distancing and industry foot traffic in the COVID-19 era?* (No. w27531). National Bureau of Economic Research.
- Cross, C., 2020. Hotel Cleanliness Policies in the Time of COVID-19. HVS, viewed 4 August 2022, <https://www.hvs.com/article/8888-Hotel-Cleanliness-Policies-in-the-Time-of-COVID-19>.
- Davari, D., Vayghan, S., Jang, S. and Erdem, M., 2022. Hotel experiences during the COVID-19 pandemic: high-touch versus high-tech. *International Journal of Contemporary Hospitality Management*, 34(4), pp.1312-1330.
- DeFranco, A.L., Morosan, C. and Hua, N., 2017. Moderating the impact of e-commerce expenses on financial performance in US upper upscale hotels: The role of property size. *Tourism Economics*, 23(2), pp.429-447.
- Del Chiappa, G., Pung, J.M. and Atzeni, M., 2022. Factors influencing choice of accommodation during Covid-19: A mixed-methods study of Italian consumers. *Journal of Quality Assurance in Hospitality & Tourism*, 23(4), pp.1037-1063.
- Dell'Olio, L., Ibeas, A. and Cecin, P., 2011. The quality of service desired by public transport users. *Transport Policy*, 18(1), pp.217-227.
- Dolnicar, S., 2002. Business travellers' hotel expectations and disappointments: A different perspective to hotel attribute importance investigation. *Asia Pacific Journal of Tourism Research*, 7(1), pp.29-35.
- Gaur, L., Afaq, A., Singh, G. and Dwivedi, Y.K., 2021. Role of artificial intelligence and robotics to foster the touchless travel during a pandemic: a review and research agenda. *International Journal of Contemporary Hospitality Management*, 33(11), pp.4079-4098.
- Godovykh, M., Back, R.M., Bufquin, D., Baker, C. and Park, J.Y., 2022. Peer-to-peer accommodation amid COVID-19: the effects of Airbnb cleanliness information on guests' trust and behavioral intentions. *International Journal of Contemporary Hospitality Management*, (ahead-of-print).
- Grilli, L., and Rampichini, C., 2014. 'Ordered logit model' in A.C. Michalos (Ed.), *Encyclopedia of Quality of Life and Well-Being Research*, Springer, Dordrecht, Netherlands (2014), pp. 4510-4513

- Grönroos, C., 1982. An applied service marketing theory. *European journal of marketing*, 16(7), pp.30-41.
- Gu, H. and Ryan, C., 2008. Chinese clientele at Chinese hotels—Preferences and satisfaction. *International Journal of Hospitality Management*, 27(3), pp.337-345.
- Hart, W., 1993. What women want. *Cornell Hotel & Restaurant Administration Quarterly*, 34(5), pp.10-11.
- Hsieh, Y.J., Chen, Y.L. and Wang, Y.C., 2021. Government and social trust vs. hotel response efficacy: A protection motivation perspective on hotel stay intention during the COVID-19 pandemic. *International Journal of Hospitality Management*, 97, p.102991.
- Jiang, Y. and Wen, J., 2020. Effects of COVID-19 on hotel marketing and management: a perspective article. *International Journal of Contemporary Hospitality Management*.
- Landry, C.E., Bergstrom, J., Salazar, J. and Turner, D., 2021. How has the COVID-19 pandemic affected outdoor recreation in the US? A revealed preference approach. *Applied Economic Perspectives and Policy*, 43(1), pp.443-457.
- Latour, K.A., Latour, M.S. and Feinstein, A.H., 2011. The effects of perceptual and conceptual training on novice wine drinkers' development. *Cornell Hospitality Quarterly*, 52(4), pp.445-457.
- Lee, S. and Ro, H., 2016. The impact of online reviews on attitude changes: The differential effects of review attributes and consumer knowledge. *International Journal of Hospitality Management*, 56, pp.1-9.
- Lee, S., Upneja, A., Özdemir, Ö. and Sun, K.A., 2014. A synergy effect of internationalization and firm size on performance: US hotel industry. *International Journal of Contemporary Hospitality Management*.
- Li, H., Ye, Q. and Law, R., 2013. Determinants of customer satisfaction in the hotel industry: An application of online review analysis. *Asia Pacific Journal of Tourism Research*, 18(7), pp.784-802.
- Liu, S., Law, R., Rong, J., Li, G. and Hall, J., 2013. Analyzing changes in hotel customers' expectations by trip mode. *International Journal of Hospitality Management*, 34, pp.359-371.
- Lockyer, T., 2003. Hotel cleanliness—how do guests view it? Let us get specific. A New Zealand study. *International Journal of Hospitality Management*, 22(3), pp.297-305.
- Magnini, V.P. and Zehrer, A., 2021. Subconscious influences on perceived cleanliness in hospitality settings. *International Journal of Hospitality Management*, 94, p.102761.
- Mortimer, G. and Clarke, P., 2011. Supermarket consumers and gender differences relating to their perceived importance levels of store characteristics. *Journal of retailing and consumer services*, 18(6), pp.575-585.
- Napierała, T., Leśniewska-Napierała, K. and Burski, R., 2020. Impact of geographic distribution of COVID-19 cases on hotels' performances: Case of Polish cities. *Sustainability*, 12(11), p.4697.
- Oliver, R.L., 1980. A cognitive model of the antecedents and consequences of satisfaction decisions. *Journal of Marketing Research*, 17(4), pp.460-469.
- Orser, B.J., Hogarth-Scott, S. and Riding, A.L., 2000. Performance, firm size, and management problem solving. *Journal of Small Business Management*, 38(4), p.42.
- Pacheco, L., 2017. Customer satisfaction in Portuguese hotels: Evidence for different regions and hotel segments. *Tourism Analysis*, 22(3), pp.337-347.
- Parasuraman, A., Zeithaml, V.A. and Berry, L.L., 1985. A conceptual model of service quality and its implications for future research. *Journal of marketing*, 49(4), pp.41-50.

- Park, D.H. and Kim, S., 2008. The effects of consumer knowledge on message processing of electronic word-of-mouth via online consumer reviews. *Electronic Commerce Research and Applications*, 7(4), pp.399-410.
- Park, H., Kline, S.F., Kim, J., Almanza, B. and Ma, J., 2019. Does hotel cleanliness correlate with surfaces guests contact?. *International Journal of Contemporary Hospitality Management*.
- Park, S., Yang, Y., and Wang, M., 2019. Travel distance and hotel service satisfaction: An inverted U-shaped relationship. *International Journal of Hospitality Management*, 76, pp.261-270.
- Pillai, S. G., Haldorai, K., Seo, W. S., and Kim, W. G. 2021. COVID-19 and hospitality 5.0: Redefining hospitality operations. *International Journal of Hospitality Management*, 94, 102869.
- Raju, J.S., Sethuraman, R. and Dhar, S.K., 1995. The introduction and performance of store brands. *Management Science*, 41(6), pp.957-978.
- Rehman, Z.U., Baharun, R. and Salleh, N.Z.M., 2020. Antecedents, consequences, and reducers of perceived risk in social media: A systematic literature review and directions for further research. *Psychology & Marketing*, 37(1), pp.74-86.
- Ritchie, H., Edouard Mathieu, Lucas Rodés-Guirao, Cameron Appel, Charlie Giattino, Esteban Ortiz-Ospina, Joe Hasell, Bobbie Macdonald, Diana Beltekian and Max Roser., 2020, 'Coronavirus Pandemic (COVID-19)'. *Published online at OurWorldInData.org*. viewed 7 February 2022, <https://ourworldindata.org/coronavirus> [Online Resource]
- Rogers, R.W., 1975. A protection motivation theory of fear appeals and attitude change. *The Journal of Psychology*, 91(1), pp.93-114.
- Sainaghi, R., 2011. RevPAR determinants of individual hotels: evidences from Milan. *International Journal of Contemporary Hospitality Management*.
- Shimp, T.A. and Bearden, W.O., 1982. Warranty and other extrinsic cue effects on consumers' risk perceptions. *Journal of Consumer research*, 9(1), pp.38-46.
- Shin, H. and Kang, J., 2020. Reducing perceived health risk to attract hotel customers in the COVID-19 pandemic era: Focused on technology innovation for social distancing and cleanliness. *International Journal of Hospitality Management*, 91, p.102664.
- Shoenberger, H., Kim, E., and Sun, Y. 2021. Advertising during COVID-19: Exploring perceived brand message authenticity and potential psychological reactance. *Journal of Advertising*, 50(3), pp. 253-261.
- Shoval, N., McKercher, B., Ng, E. and Birenboim, A., 2011. Hotel location and tourist activity in cities. *Annals of tourism research*, 38(4), pp.1594-1612.
- Skrondal, A. and Rabe-Hesketh, S., 2004. *Generalized latent variable modeling: Multilevel, longitudinal, and structural equation models*. Chapman and Hall/CRC.
- Volgger, M., Taplin, R., and Aebli, A. 2021. Recovery of domestic tourism during the COVID-19 pandemic: An experimental comparison of interventions. *Journal of Hospitality and Tourism Management*, 48, pp. 428-440.
- Vos, M.C., Galetzka, M., Mobach, M.P., van Hagen, M. and Pruyn, A.T., 2019. Measuring perceived cleanliness in service environments: Scale development and validation. *International Journal of Hospitality Management*, 83, pp.11-18.
- Wang, D., Yao, J. and Martin, B.A., 2021. The effects of crowdedness and safety measures on restaurant patronage choices and perceptions in the COVID-19 pandemic. *International Journal of Hospitality Management*, 95, p.102910.

- Weaver, P.A. and Oh, H.C., 1993. Do American business travellers have different hotel service requirements?. *International Journal of Contemporary Hospitality Management*, 5(3), pp.16-21.
- WHO., 2020. The COVID-19 risk communication package for healthcare facilities. viewed 4 August 2022, <https://apps.who.int/iris/handle/10665/331140>.
- Xiang, Z., Schwartz, Z., Gerdes Jr, J.H. and Uysal, M., 2015. What can big data and text analytics tell us about hotel guest experience and satisfaction?. *International Journal of Hospitality Management*, 44, pp.120-130.
- Xie, K.L., Zhang, Z., Zhang, Z., Singh, A. and Lee, S.K., 2016. Effects of managerial response on consumer eWOM and hotel performance: Evidence from TripAdvisor. *International Journal of Contemporary Hospitality Management*, 28(9), pp.2013-2034.
- Yang, Y., Luo, H. and Law, R., 2014. Theoretical, empirical, and operational models in hotel location research. *International Journal of Hospitality Management*, 36, pp.209-220.
- Yang, Y., Mao, Z. and Tang, J., 2018. Understanding guest satisfaction with urban hotel location. *Journal of Travel Research*, 57(2), pp.243-259.
- Yang, Y., Wu, L. and Yang, W., 2018. Does time dull the pain? The impact of temporal contiguity on review extremity in the hotel context. *International Journal of Hospitality Management*, 75, pp.119-130.
- Ye, Q., Law, R. and Gu, B., 2009. The impact of online user reviews on hotel room sales. *International Journal of Hospitality Management*, 28(1), pp.180-182.
- Zehrer, A., Crotts, J.C. and Magnini, V.P., 2011. The perceived usefulness of blog postings: An extension of the expectancy-disconfirmation paradigm. *Tourism management*, 32(1), pp.106-113.
- Zemke, D.M.V., Neal, J., Shoemaker, S. and Kirsch, K., 2015. Hotel cleanliness: will guests pay for enhanced disinfection?. *International Journal of Contemporary Hospitality Management*, 27(4), pp.690-710.
- Zhang, P., Gerdes Jr, J.H. and Meng, F., 2020. The impact of national culture on hotel guest evaluation—A big data approach. *International Journal of Tourism Research*, 22(5), pp.582-592.
- Zhou, L., Ye, S., Pearce, P.L. and Wu, M.Y., 2014. Refreshing hotel satisfaction studies by reconfiguring customer review data. *International Journal of Hospitality Management*, 38, pp.1-10.

Table 1. Descriptive statistics of variables in the empirical model

Variable	Definition	Obs	Mean	Std. Dev.
rating	overall rating score listed on TripAdvisor	26,519	4.709	0.779
r_clean	cleanliness sub-rating score on TripAdvisor	26,519	4.786	0.675
lncases	log of average daily confirmed COVID-19 cases per capita in the county where the hotel was located in the month of the reviewer's stay	26,514	-11.530	3.555
lnmonth_dif	log of 1+months taken to post a review after the reviewer's stay	26,519	0.168	0.347
lncontributions	log of the reviewer's contribution points on TripAdvisor based on past activities	26,519	1.137	1.493
average_rating	average rating score of the hotel on TripAdvisor	26,519	4.669	0.279
lnrestaurants	log number of 1+restaurants within 0.3 miles from the hotel property based on information provided on TripAdvisor	26,519	3.116	1.661
lnrooms	log of number of hotel rooms	26,491	4.498	1.564
		Freq.	Percent	Cum.
traveler_type = 1	travel type disclosed on TripAdvisor for each review, 1= business travelers	2,670	10.07	10.07
traveler_type = 2	2 = couples	636	2.40	12.47
traveler_type = 3	3 = family	573	2.16	14.63
traveler_type = 4	4 = friends	149	0.56	15.19
traveler_type = 5	5 = none	22,407	84.49	99.68
traveler_type = 6	6 = solo	84	0.32	100.00
gender = male	reviewer's gender as disclosed on TripAdvisor	1,331	46.77	46.77
gender = female		1,515	53.23	100.00
COVID_action = 0	a dummy variable indicating if the hotel disclosed high-temperature washing of linens; 0 = without high-temperature washing of linens	12,622	47.60	47.60
COVID_action = 1	1 = presence of high-temperature washing of linens	13,897	52.40	100.00

Table 2. Estimation results of basic empirical models on overall hotel rating.

	Model 1	Model 2	Model 3	Model 4
	All	All	All	All
r_clean	2.038*** (0.028)	2.174*** (0.077)	2.041*** (0.028)	2.180*** (0.077)
Incases	0.0745*** (0.017)	0.0248 (0.031)	0.0709*** (0.017)	0.0201 (0.031)
r_clean*Incases		0.0112* (0.006)		0.0114* (0.006)
Inmonth_dif			0.0328 (0.057)	0.0320 (0.057)
COVID_action			0.117* (0.060)	0.116* (0.060)
Incontributions			-0.117*** (0.012)	-0.117*** (0.012)
traveler_type = 2			0.196 (0.138)	0.190 (0.138)
traveler_type = 3			0.218 (0.146)	0.208 (0.145)
traveler_type = 4			0.203 (0.248)	0.198 (0.247)
traveler_type = 5			0.112 (0.070)	0.111 (0.070)
traveler_type = 6			0.428 (0.343)	0.419 (0.341)
Cut off 1	2.092*** (0.300)	2.684*** (0.436)	2.136*** (0.311)	2.737*** (0.442)
Cut off 2	3.425*** (0.301)	4.020*** (0.437)	3.456*** (0.312)	4.059*** (0.443)
Cut off 3	4.932*** (0.304)	5.528*** (0.440)	4.955*** (0.315)	5.559*** (0.446)
Cut off 4	6.520*** (0.307)	7.115*** (0.442)	6.549*** (0.319)	7.153*** (0.448)
var(hotel effects)	0.368*** (0.048)	0.369*** (0.048)	0.375*** (0.047)	0.376*** (0.047)
Year-month effect	Yes	Yes	Yes	Yes
N (reviews)	26519	26519	26519	26519
N (hotels)	2024	2024	2024	2024
AIC	24789.5	24788.0	24709.9	24708.2
BIC	24936.9	24943.5	24922.7	24929.2


Notes: (1) *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively. (2) Standard errors are presented in parentheses.

Table 3. Estimation results of empirical models with a three-way interaction on overall hotel rating.

	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
r_clean	2.481*** (0.234)	2.163*** (0.078)	2.183*** (0.078)	2.136*** (0.076)	2.098*** (0.076)	2.167*** (0.078)
Incases	-0.0192 (0.087)	0.0217 (0.031)	0.0190 (0.031)	0.0128 (0.031)	0.0225 (0.031)	0.0183 (0.031)
r_clean*Incases	0.0287* (0.017)	0.00714 (0.006)	0.0114* (0.006)	0.135*** (0.009)	-0.0232*** (0.006)	0.00814 (0.006)
r_clean*Incases*gender=female	-0.00494*** (0.002)					
r_clean*Incases*Incontributions		0.00261*** (0.001)				
r_clean*Incases*COVID_action			-0.0057** (0.002)			
r_clean*Incases*average_rating				-0.0273*** (0.002)		
r_clean*Incases*Inrooms					0.00589*** (0.000)	
r_clean*Incases*Inrestaurants						0.000706** (0.000)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year-month effects	Yes	Yes	Yes	Yes	Yes	Yes
Cut off 1	2.984** (1.227)	2.888*** (0.444)	2.777*** (0.460)	2.981*** (0.435)	2.812*** (0.439)	2.779*** (0.443)
Cut off 2	4.865*** (1.221)	4.219*** (0.445)	4.098*** (0.461)	4.283*** (0.436)	4.119*** (0.440)	4.100*** (0.444)
Cut off 3	6.632*** (1.223)	5.724*** (0.448)	5.598*** (0.464)	5.767*** (0.438)	5.608*** (0.443)	5.600*** (0.447)
Cut off 4	8.626*** (1.233)	7.317*** (0.450)	7.192*** (0.466)	7.362*** (0.441)	7.203*** (0.445)	7.194*** (0.449)
var(hotel effects)	0.0592 (0.093)	0.374*** (0.047)	0.376*** (0.047)	0.206*** (0.033)	0.246*** (0.034)	0.377*** (0.047)
N (reviews)	2846	26519	26519	26519	26491	26519
N (hotels)	1215	2024	2024	2024	2019	2024

AIC	3129.3	24692.0	24710.1	24437.9	24399.4	24703.8
BIC	3296.0	24921.2	24939.3	24667.1	24628.6	24933.0

Notes: (1) *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively. (2) Standard errors are presented in parentheses.

 wrote a review **May 2021** *Review date*
Farmingdale, New York • 1 contribution • 1 helpful vote

★★★★★ *Overall rating*

Excellent stay *Review title*

"Our stay was excellent- front desk experience was efficient and we were able to get dining reservations immediately with our concierge Christopher. The room was fresh, clean, very comfortable, we were on a high floor and had an excellent view of the city. Great room and fast elevators. Great location - central to many sights- felt very safe." *Review content*

[Read less](#) ▲

Date of stay: May 2021 *Date of stay*

★★★★★ Value	★★★★★ Rooms
★★★★★ Location	★★★★★ Cleanliness
★★★★★ Service	★★★★★ Sleep Quality

Sub-ratings

Review collected in partnership with DoubleTree by Hilton ©

This review is the subjective opinion of a Tripadvisor member and not of Tripadvisor LLC. Tripadvisor performs checks on reviews.

1 Helpful vote



 **Helpful**  **Share**

Figure 1. Typical TripAdvisor hotel reviews

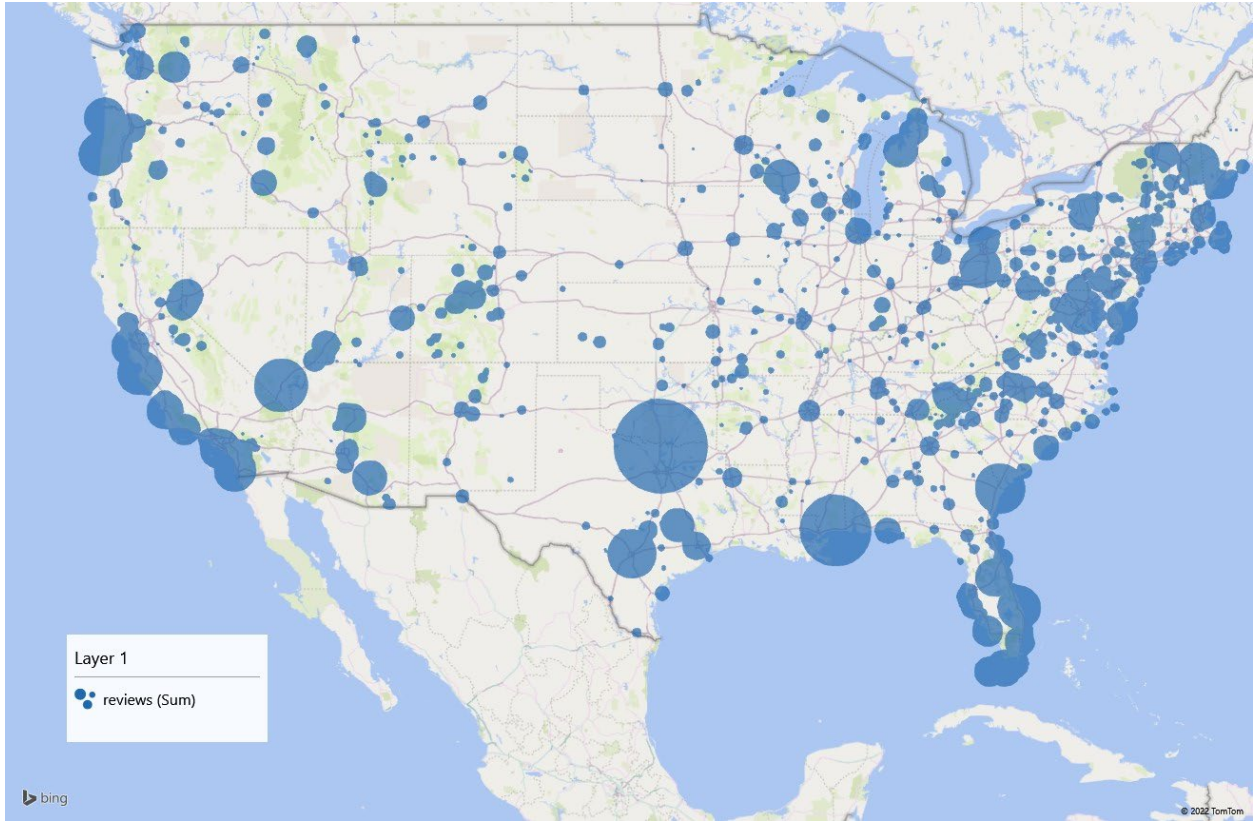


Figure 2. Geographic distribution of sampled hotels