



Article

Signals of Hotel Effort on Enhancing IAQ and Booking Intention: Effect of Customer's Body Mass Index Associated with Sustainable Marketing in Tourism

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Abstract: Since outdoor air pollutants may penetrate into hotels, indoor air quality (IAQ) has recently developed as an important criterion for tourists' decision to choose traveling destinations and for business travelers to select accommodation. Thus, some hoteliers have raised concerns about the negative effects of emerging air quality issues on guests' experience and are willing to invest in improving the IAQ. Unlike the hotel's currently offered services and products which are observable, the improved IAQ is almost invisible and the mitigation technology of air pollutants is new to hoteliers, consumers and researchers in tourism. Hence, the search and understanding of the relationship of signals communicating hotel's effort on air quality enhancement and booking intention plus the mediating and moderating factors become the main objective of the research and can fill the knowledge gap plus meet the practical need. The study found that the more reinforced IAQ effort included in the website presentation, the higher the travelers' booking intention. The travelers' trust in the hotel partially mediated the relationship between travelers' perception of reinforced IAQ effort input by hoteliers and their booking intention. Further, the study finds that the enhancement of online booking intention does exist in a segment of travelers who are high health-conscious. Additionally, the influence of health-conscious traveler's perception of hotel IAQ enhancement effort via the portal on the dependent variable—hotel booking intention was statistically significant. The findings enable hotel managers to have a deeper understanding of the relationship between the potential customers' booking intention on hotel rooms and the online marketing communication signals mediated by their trust in the hotel's cleaning air effort. The results can serve as a reference for designing more effective marketing communication programs and channels for hotels' endeavor to improve indoor air quality, especially sustaining the tourism development in the post-epidemic era. Additionally, the study unveils some applied measures in improving hotel air quality not being documented in hospitality and tourism journals.



Citation: Sun, B.; Liu, L.Y.; Chan, W.W.; Zhang, C.X.; Chen, X. Signals of Hotel Effort on Enhancing IAQ and Booking Intention: Effect of Customer's Body Mass Index Associated with Sustainable Marketing in Tourism. *Sustainability* **2021**, *13*, 1279. <https://doi.org/10.3390/su13031279>

Received: 6 November 2020

Accepted: 11 January 2021

Published: 26 January 2021

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Keywords: sustainable marketing; sustainability; communication; booking intention; BMI; IAQ; signaling theory

1. Introduction

Air pollution due to economic expansion, population growth, forest fires and sandstorms has been one of the major sustainable development issues in Asian countries as evidenced by the experience in India and China. In the latest years, the increased frequency

of coverage about air pollution has been observed in India and study finds air pollution impacts are not confined merely to the capital city [1]. Another research study reviewed 58 relevant studies and noted that particulate matter is the major factor causing respiratory health problems including deficit lung function, asthma, heart attack, cardiovascular mortality and premature mortality in the long term [2].

In China, dozens of provinces and major metropolises were also smothered and shrouded in severe smog and haze for several months every year after the 2008 Beijing Olympic Games [3]. Only 3 out of 74 major cities in China meet air quality standards. For example, the areas of Beijing-Tianjin-Hebei suffered from air pollution for more than 60 percent of days in 2013 [4]. Beijing issued its “red alert” about heavy air pollution in 2015 and 2016 [5]. This severe environmental issue is a threat to the tourism and hospitality industry as every 1 percent growth in air pollution can lower tourist arrivals by 1.24 percent [6]. Scholars also find that tourists are willing to incur higher departure tax to fund host governments to improve on air quality measures [7].

The study cautioned that air pollution is more harmful than water pollution or soil pollution as the inhalable particles can move freely with airflow and permeate all of the lower parts of the atmosphere in local areas [8]. Exposure to outdoor air pollution can cause short-term respiratory symptoms such as coughing, throat irritation, chest tightness, wheezing, and shortness of breath. Air pollution can also result in long-term diseases such as lung cancer, bladder cancer, cardiovascular disease and asthma [9].

Air pollution can affect hotel guest experience negatively since ventilation systems draw poorer outdoor air into buildings as fresh air supply and hotel guests consequently breathe in low-quality air [10]. In addition, other types of indoor air pollutants originating from smoking, renovation, poorly maintained ventilation systems and duct designs that are difficult to clean further aggravate indoor air quality problems. Accompanying these emerging environmental issues and their profound harm to human beings is the published United Nation 2030 agenda for sustainable development “to end poverty, protect the planet and ensure prosperity”. Against this background, attention on hotel IAQ and its improvement measures implemented by hoteliers have thus been further raised.

Individual hotels have begun to adopt some IAQ enhancement measures such as installing fresh air purification devices, cleaning the fancoil dust, ceiling dust regularly, setting up some green indoor plants in public areas, placing portable air purifiers in certain hotel rooms, etc. Ctrip, the largest online travel agent in China, launched a special column named “Hotel Room with Clean Air” [11]. Various kinds of hotel rooms with IAQ enhancement measures were also collected and presented in this special column page [12]. Such recognition for the need to implement more measures to clean indoor air will enhance the popularity of strengthening IAQ management in the hotel industry in the near future.

However, both consumers and hoteliers in this region are unfamiliar with measures for IAQ enhancement. Thus, Chan [13] suggests more studies to investigate and comprehend the measures for IAQ enhancement actions as findings can contribute to the industry and academic literature. Nevertheless, existing studies have been confined to investigation about the removal efficiency of air pollutants by air purifiers in hotels [14–16], there is a paucity of information about the marketing communication specific to invisible air cleanup and associated cleaning efforts committed by hotels plus the relationship with hotel booking intention. It is expected that the study can fill the knowledge gap and offer some references to improve the communication of green efforts committed by hoteliers.

In light of the development, the need appears for hoteliers to understand more about the effective and efficient ways to communicate the offering of invisibly improved IAQ and the associated effort undertaken to the potential customers. The study thus deliberately selected specifically hotel that has equipped with clean air facilities and demonstrated commitment for investigation. Three-hundred and twenty in-house or departing hotel guests were invited to rate on the booking- and trust-related attributes after viewing screen captures of additional air-cleaning actions. The study also further analyzed the relationship and ratings on these attributes by using the structural equation modeling technique.

Specifically, the research aims to investigate the relationship of the impact of hotel's online signals about improved IAQ on consumers' room booking intention and test if travelers' trust belief on hotel's cleaning air effort can affect their booking propensity. In addition, the study further tests if a customer's health-conscious level can serve as mediating variables on the above testing relationships. It is expected that the findings will provide hoteliers with reference to plan their sustainable marketing mix by designing effective communication of their cleaning air effort with potential and targeted customer segments.

2. Literature Review

2.1. Sustainability Marketing

Sustainable development has been extensively discussed across the globe and has been conceptualized as a matrix containing sustainable areas: nature, life support, community and areas to be developed including people's life expectancy and economic growth [17]. In tourism, sustainable development has been interpreted as development that can meet the needs of tourists, cater opportunities to propel economic growth, protect the physical environment, and improve residents' quality of life while raising opportunities for the future through the coexistence of tourism development and environmental quality [18].

In the sustainable development process, environmental balance (which has been defined as "sustainability" in recent years) is subject to the influence of demographic phenomena, the development of technology and organizational innovations, a set of values shared by enterprises, consumers, employees plus the policy of government [19,20].

In order to accelerate sustainable development and sustainability, sustainable marketing has been considered as a proper device that could be achieved through the contribution of marketing sub-disciplines including green marketing and social marketing [21]. Green marketing assists the development by marketing more sustainable products and services while adding sustainability efforts into the marketing process and business practice. Social marketing refers to the use-power of marketing to encourage sustainable behavior among all stakeholders—individuals, businesses and decision-makers.

On the other hand, sustainability marketing strategies do not only consider adding value to the customer but also building long-term relationships with customers. Such a strategic orientation creates benefits for business, society and ecology. Against the background, a study put forward the concept to transform traditional 4P's (Product, Price, Place and Promotion) into 4C's (Customer solution, Customer cost, Convenience and Communication) as sustainability criteria into marketing strategy [22]. More recently, another conceptualized sustainability of services marketing mix which is an extension of traditional 4Ps by adding another four Ps including Participants, Process, Physical Evidence and Partnership, has been brought up [23]. These eight elements of the framework cross-reference with the triple bottom line to describe the marketing task in terms of a matrix rather than a mix. However, the mainstream study about sustainability marketing information has been confined to the observable service and product.

On the other hand, Garay et al. [24] suggested that sustainability approaches might be more useful in achieving behavioral change when the approaches are adapted to the absorptive capacity and learning styles of their targeted segment. Segmentation has long been employed by marketers and scholars to understand the various categories of customers and their behavior so as to help identify their orientation toward sustainability and the style of their sustainable actions [25]. When consumers are informed about social, ethical and environmental issues, they are subject to the influence of marketing information to consume products in a manner that compliments those views [26].

In the lodging business, researchers analyzed travelers' decision-making processes when choosing accommodation and identified the key attributes, including cleanliness, comfortable bedding, staff service, value for the money, price, design, bathroom privacy, in-room air temperature control, sprinkler systems, brand and reputation [27–31]. It is noted that cleanliness in hotel selection has been confined to visible cleanliness, especially bathroom cleanliness [32]. There is a paucity of research information about hotel

indoor air quality, an attribute related to invisible cleanliness for hotel selection, and its associated marketing.

Numerous studies agree that modern travelers increasingly rely on peers' opinions and online ratings when booking accommodation [33–35]. Online travelers' are eager to find trustworthy information to minimize potential risks that might emerge through online booking [36]. In particular, there has been a lack of understanding of how indoor air quality measures online could affect the consumers' hotel booking intention online.

Also, when prior research studied hotel booking intention, many theories were used such as the utility theory, prospect theory, regret theory, satisfying theory plus the theory of reasoned action and derivative theory. On the other hand, there is no single unifying theory has emerged to explain decision-making on booking hotel [37]. However, information economics has utilized signals as a mechanism or theory to tackle problems that arise under asymmetric information. Kirmani and Rao are amongst the early batch of scholars focusing on the ways that a business may signal the unobservable quality of its products [38–40].

2.2. Signaling Theory and Hypothetical Development

Information plays an important role in influencing consumers' hotel online booking intention [41–43]. While information asymmetries might occur when different people acquire different understandings, early studies often assume both consumers and producers have perfect knowledge in terms of price, utility, quality, and production methods [44]. Increasingly, the effects of imperfect information and their influence on an individual's decision-making become significantly important [13].

Accordingly, information asymmetries can be divided into two stages: information scarcity in the pre-purchasing period and information clarity in the post-purchasing period [38]. Pre-purchase information scarcity occurs when a consumer cannot access or interpret a product's quality attributes prior to making a purchase. Post-purchase information clarity occurs when a consumer can readily assess the quality of a product immediately after purchase or use. Information asymmetries are common to all industries and markets tend to use counteracting institutions to cancel out the effects by signaling. Signaling theory helps to explain the behavior of two parties when they have access to different information [45], the theory also posits a notion that a rational consumer anticipates a firm to honor the implicit commitment through a signal [46].

Signaling theory has been discussed extensively in numerous disciplines to describe market interactions in which buyers and sellers have asymmetric information in pre-purchase contexts [47,48]. In the online context, signaling occurs via displaying website features that deliver information from sellers to buyers [49]. There are three dimensions of website signals; pre-purchase signals, purchasing signals, and post-purchase signals. To some extent, online signals are more significant since information asymmetries accompany technology-mediated channels [50,51].

Managers focused on achieving high profitability, desirable service standards and product quality. Logically, managers should also tailor the product content as an information signal and communicate to consumers effectively [52]. Information signals can influence the perceptions and behaviors of receivers (customers). More importantly, consumers may make inferences based on these signals received [53]. With limited product knowledge due to imperfect information, consumers are more likely to view products or services with higher perceived risk and ambiguity. As consumers find it impractical to expend a great deal of effort in searching and evaluating products and services, they are more likely to rely on information signals received to infer product quality and perceived risk level [54].

According to signaling theory, online travelers often make inferences using signals such as peer to peer opinion, online ratings and other relevant information for decision-making [55]. Signaling is particularly important for online hotel booking mainly because consumers can not access the hospitality service before they consume it. This inherent information asymmetry calls for bridging information gaps between producers and con-

sumers [56]. Especially, a larger number of cleaning indoor air measures are carried out before guests' check-in, air purification facilities are concealed in interior design plus cleaned air is mostly unobservable. However, IAQ management has not yet been considered cleaning air effort as core signals for hotel operators to enhance their credibility and motivate booking intention online [57]. Also, there is a paucity of hotel that makes claims for better IAQ management such as by cleaning the internal parts of the air conditioning system and air ducts, regularly setting up IAQ monitoring system, installing additional air purifiers, training up staff with relevant knowledge, and obtaining certification.

Studies even suggest that generalized suspicion still exists and are not easily counteracted [58,59]. Some hotel guests are doubtful of the cleaned air certificate, as the nature of IAQ is unobservable and a limited number of independent certifying agents are available. Thus, the study tested the relationship between the perceived effects of IAQ enhancement effort on hotel booking intention. It is thus hypothesized that:

Hypothesis 1 (H1). *Travelers' online booking intentions tend to have a positive relationship toward a hotel that claim to make signals about having reinforced air quality improvement effort than one that does not make such a claim.*

2.3. Trust Theory and Hypothetical Development

Signals are fashionably presented online. As such, trust in signaled information has been receiving more attention, including a focus on its mediating effect on purchasing decisions, than before.

The term "Trust" is defined as a generalized expectancy held by an individual that the word, promise or statement of another individual can be relied on and it has been widely applied in different disciplines such as psychology, sociology and marketing [60]. Researchers have conceptualized trust both as a trait, such as "interpersonal trust" [61] and as a state [62]. Building trust has become important in the virtual environment as online stores have faced challenges to convince people to purchase untouchable and inexperienced products [63]. Researchers suggest that trust can be a key mediating variable between relationship constructs and behavioral outcomes [64,65].

Studies identified the four key types of trust drivers namely, website characteristics (navigation, privacy policies, third-party endorsements and absence of errors), retailer characteristics (brand strength, merchandise value, order fulfillment), consumer attitudes toward e-commerce, and consumer personality. Researchers indicated that retail characteristics such as brand cues and advertising are critical drivers of building strong trustworthiness on online transactions [66–69]. The study further classified the trust of a brand in two dimensions: the reliability dimension and the intention dimension [70]. Reliability dimension or ability belief refers to the consumer perception that the brand fulfills its promise and satisfaction consumers' need. The intention dimension indicates the consumers' willingness to depend on the brand.

In the hotel industry, brands have been used not just as a proxy of luxury but also as an indication of hotel groups' service management level. However, brands are not sufficient to denote the hotel's ability to improve IAQ because of the invisible, intangible and undetectable nature of air plus managers' limited knowledge of IAQ. Hotel brand may not be a critical driver of trust in online booking for rooms with IAQ improvement measures. Alternatively, the factors—reliability dimension and intention dimension—of trust about the hotel's collaborated, dedicated and innovative measures on enhancing IAQ may serve as trust drivers in influencing hotel bookings.

The primary reason to adopt any forms of online signaling in IAQ enhancement is to raise the credibility of hotel or customers' trust belief to motivate booking intention. Furthermore, prior mainstream studies had already shown that online purchasing behavior is generally affected by information [56,71]. It is thus reasonable to examine customers' trust beliefs mediate the relationship between perception of hotel IAQ enhancements and online booking intention. Thus, we propose the following:

Hypothesis 2 (H2). *Customers' trust belief in hotel mediates the relationship between their perception to signaled measures of hotel IAQ enhancement and booking intention online.*

2.4. Health Consciousness and Hypothesis Development

Health-consciousness is the degree to which health concerns are integrated into a person's daily activities; it is often evaluated in terms of personal health-management characteristics [72]. The health-consciousness is increasingly regarded as one of the important influencing factors on consumers' behavior, especially to health-related products or services.

The health-consciousness construct aims to assess an individual's readiness to take health actions that are hinged on three components: health motivations, perceived threats posed by conditions, and the perceived probability that compliant behavior will reduce the threat [73]. Thus, health-consciousness refers to whether individuals are aware of the influence of lifestyle on health or not [74]. Generally, health-conscious individuals are more concerned about their state of well-being. These types of customers are more likely to be interested in improving the quality of life and maintaining their health; this leads to their engagement in health actions [75,76].

Hotel management may deploy marketing resources to deliver the hotel's signal about better IAQ to the customer segment that has a higher level of health-consciousness. The study thus proposes health-consciousness as another important construct to affect the relationship between perception of IAQ enhancement effort online and booking intention.

Health-consciousness can be a major determinant of healthy behaviors as it is independently associated with less exercise or low fruit and vegetable intake [77]. The effect of health-consciousness on attitude toward healthcare activities are exemplified by individuals who have high levels of health-consciousness tend to have favorable attitudes toward obtaining regular medical check-ups, and maintaining a healthy diet to prevent heart disease and cancer [78]. In terms of food consumption, some studies reported that highly health-conscious consumers have a more favorable attitude toward organic foods [79,80]. For buying decisions, individuals with high levels of health concern had greater intentions to buy and pay more for foods with health benefits [81] and to use nutrition labels when buying food products [82]. It is thus appropriate to use varying health-consciousness-related instruments to measure booking intention (i.e., a kind of health action) of rooms with almost unobservable IAQ improvement. Body mass index (BMI) is a fundamental and reference indicator of people's health condition. As this indicator carries the signals hinting at the health risk potential of a person, BMI has been commonly used in the healthcare field as a key reference for classifying people into different groups for further health analysis [83,84]. It is generally expected that people with a higher level of health-consciousness usually have better BMI. Thus, it is thought that desirable normal BMI may produce a reinforcing effect on the booking intention of the hotel which communicates its cleaning indoor air signals to the market. Thus, this study investigates the moderating role of health-consciousness on the relationship between the online signals of IAQ management and traveler's booking intention. Therefore, the hypothesis reads:

Hypothesis 3a (H3a). *Customers' healthy body mass indices enhance online booking intention by reinforcing the effect of perceived cleaning air effort signals on their trust belief about a hotel.*

On the contrary, the study is curious about the impact of customers possessing undesirable health indices on the booking intention for the same hotel. Against this background, the study proposes the following hypothesis:

Hypothesis 3b (H3b). *Customers' undesirable healthy body mass indices enhance online booking intention by reinforcing the effect of perceived cleaning air effort on their trust belief about a hotel.*

The conceptual framework of this study is shown as below (Figure 1).

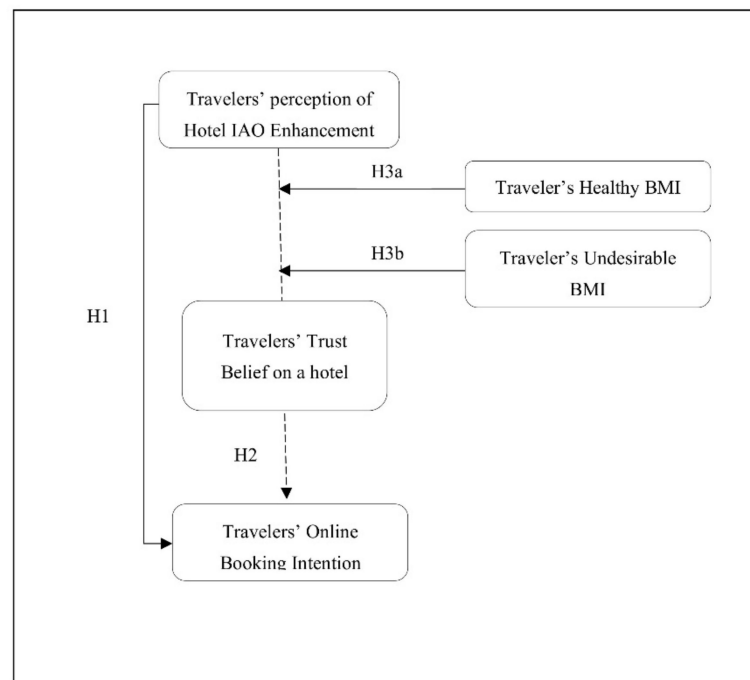


Figure 1. Conceptual Framework of this Study.

3. Method

The chosen hotel for the experiment adopted a trial and test approach to detect the market response to its initiatives and initial investment (only for two floors of hotel guest rooms) in enhancing IAQ. Since the air cleaning activities are mostly undertaken before guest check-in and the air purification devices are concealed by partitions in the corridor or ceiling in the room, guests are mostly unaware of the air cleaning endeavor performed by the hotel. Thus, the hotel favored the conduct of research to examine the booking intentions of internal customers first before the full investment in air purification facilities and associated marketing communication.

The study used multi-disciplinary approaches and involved knowledge including mainstream marketing, hospitality management, information technology and environmental engineering. The quantitative research method was adopted.

The participants viewed the web page of a hypothetical hotel (Hotel H) with IAQ enhancement measures. An instruction booklet was provided in advance. Participants were asked to imagine that they are searching this web site for a hotel that has additional air-cleaning measures. The search was limited to the page presented and pages related to air cleaning actions. Since photos are seen as trustworthy and highly credible signals, photography are used in this experiment [85]. Captures the photos from the hotel website screen are related to basic indoor cleaning measures, such as regular fan coil dust cleaning, carpet cleaning, ceiling dust cleaning, floor air purifier, portable room air purifier, room ceiling air purifier, green plants and masks provision. These measures become the construct of perceived signals of cleaning air effort for testing. In addition, the text description was as follows:

“Hotel H has always been committed to providing every guest the most comfortable and neat environment for rest with good air quality and proper temperature indoors. Hotel IAQ improvement measures adopted by Hotel H are shown below”

Participants viewed the screen capture for five minutes and then completed the surveyed items related to their online booking intentions and trust beliefs in improving hotel IAQ.

The key pieces of literature provide the basis for the design of the questionnaire in this study as described in the above hypothesis development. Regarding customers’ perception

of hotel IAQ enhancement effort, a seven-point rating scale was applied to range from a scale of 1 = “Strongly disagree” to 7 = “Strongly agree”. For online booking intention, the design of questionnaire adopted a one-item scale of online booking intention as being used in a prior study [86]. Respondents were asked to indicate how likely it is they would book the hypothetical hotel (H hotel) on a seven-point scale rating from a scale of 1 = “Strongly disagree” to 7 = “Strongly agree”.

An eight-item measure was adopted to form the construct of customers’ trust belief in the hotel [87]. To better match the project related to hotel IAQ, several refinements and supplements were made according to the Brand Trust Scale [70], which were shown in Appendix A. Participants were asked to indicate their trust belief of the hotel’s commitment based on a 5-point scale ranging from 1 (completely disagree) to 5 (completely agree).

The final part of the questionnaire is designed to record *personal information of respondent*—demographic data on respondents’ gender, weight and height. Data on weight and height were used to calculate Body Mass Index (BMI) using the formula: weight (kg)/height (m). Standards utilized to classify BMI were as follows: healthy or desirable BMI (BMI = 20–24.9), underweight (BMI < 20), and overweight (BMI ≥ 25) [88].

Based on the measurement items generated by the literature review, the initial questionnaires were designed in English and then translated into Chinese by doctoral translators independently to ensure the translation quality.

After the questionnaire was designed, a pre-test was undertaken to reduce any likely confusion caused by the questionnaire and ensure all the items can be understood [89]. The pilot questionnaires were given to a convenience sample of 20 people of different ages and varying occupations. Customers’ online booking intention measurement was then changed to a single item as underneath.

“After reading website of H Hotel it is very likely that I would book a room at this hotel if it was in a location I was travelling to” (with a response scale of 1 = Strongly disagree to 7 = Strongly agree).

Sampling

The survey instrument was distributed and collected through field distribution of a semi-structured questionnaire to guests in a five-star hotel that has 328 luxurious guestrooms and has been leading the enhancement of hotel IAQ in Shanghai [90]. The selected hotel is also a famous property with its 65 newly remodeled rooms with different kinds of IAQ enhancement measures and active involvement in creating the IAQ standards for the industry [91].

The total number of the collected questionnaire is 320. Due to some guests being in a hurry to leave the hotel, some questionnaires were partially completed. The convenience sampling method was adopted and a total of 306 valid questionnaires were collected. The chosen participants are college-educated and use the internet every day. Data were collected in both lobby and executive lounge of the studied hotel. A hotel restaurant coupon was provided to participants as an incentive. The data were collected in the two-year period before the pandemic era. Hotel staff from both the front office and executive lounge department in the hotel were trained to introduce the background and logistics of participating in the survey to visiting customers or in-hotel guests.

Research subjects’ profiles reveal that 44.4% of the respondents were male and 55.6% were female. For the nationality of the participants, the majority of the respondents were from Mainland China; only a quarter of the respondents were from countries non-China. Regarding their Body Mass Index (BMI), over half of the respondents had a healthy or desirable BMI, 28.28% of the respondents were underweight and 16% of the respondents were overweight according to BMI standard.

4. Data Analysis and Results

The study employed Partial Least Square–Structural Equation Modeling (PLS-SEM) to analyze the data using the software SmartPls 3 (3.2.6). The iterative algorithm of PLS

path modeling firstly evaluates the measurement model by checking internal consistency and convergent validity. The following steps are to evaluate the structural model, test the collinearity among constructs, process factor loading and assess the significance of the relationships. The path-weighting scheme of PLS was used to provide the highest R^2 value of endogenous latent variables.

4.1. Measurement Findings

Table 1 displays the ascertained correlation of constructs with a range of 0.26 to 0.97. It can also be seen from Table 2 that all factor loadings were greater than the suggested norm 0.7 by Dijkstra and Henseler [92]. For the value of the factor loading on the single item measures (BI, BMIs), the study fixed it to 1 as being carried out by previous research [93,94]. Thus, the study accepted these loadings and proceeded to analysis.

Table 1. Correlations among Variables, Means, Standard Deviations.

Variables	1	2	3	4	5
1. Booking intention	0.97	0.56 **	0.31 **	0.37 **	0.26
2. Perceived effort		0.84	0.55 *	0.47 **	0.33 *
3. BMI—Healthy level			0.97	0.38	0.34
4. BMI—Undesirable level				0.78	0.28
5. Trust belief					
Means (SD)	3.86(0.52)	3.540(.61)	4.06(0.81)	3.82(0.54)	2.7(1.68)

Note: BMI = Body Mass Index; * $p < 0.05$, ** $p < 0.01$.

Table 2. Validity and Reliability of Constructs and Items.

Construct	Overall Segment		Healthy Segment		Undesirable Segment	
	Indicator	Factor Loadings	Indicator	Factor Loadings	Indicator	Factor Loadings
Perceived cleaning air effort (PE)	PE1	0.81	PEH1	0.75	PEU1	0.73
	PE2	0.85	PEH2	0.73	PEU2	0.74
	PE3	0.72	PEH3	0.88	PEU3	0.79
	PE4	0.73	PEH4	0.82	PEU4	0.74
	PE5	0.72	PEH5	0.72	PEU5	0.77
	PE6	0.74	PEH6	0.84	PEU6	0.73
	PE7	0.79	PEH7	0.85	PEU7	0.75
		AVE = 0.62 CR = 0.85 $\alpha = 0.75$		AVE = 0.71 CR = 0.83 $\alpha = 0.81$		AVE = 0.74 CR = 0.77 $\alpha = 0.63$
Trust belief (T)	T1	0.71	TH1	0.72	TU1	0.81
	T2	0.77	TH2	0.71	TU2	0.85
	T3	0.85	TH3	0.76	TU3	0.72
	T4	0.72	TH4	0.68	TU4	0.73
	T5	0.78	TH5	0.77	TU5	0.78
	T6	0.76	TH6	0.71	TU6	0.69
	T7	0.81	TH7	0.75	TU7	0.79
		AVE = 0.68 CRH = 0.75 $\alpha = 0.85$		AVE = 0.64 CR = 0.81 $\alpha = 0.77$		AVE = 0.73 CR = 0.76 $\alpha = 0.82$
Body Mass Index—Healthy (BMIH)	BMIH1	1		1		1
Body Mass Index—Undesirable (BMIU)	BMIU1	1		1		1
Booking Intention (BI)	BI1	1		1		1

Note: Suffix H = Healthy segment; Suffix U = Undesirable segment.

Two items (mask provision and compensation by IAQ related problems) separately in PE and T constructs were excluded due to low average variances extracted (AVE). The remaining AVE were also above the suggested threshold 0.5 [95], except TH4 and TU6 which were slightly below the threshold. For composite reliability (CR), the values were greater than the acceptable standard 0.7 as suggested by Nunnally et al., and [96,97] and reflected the internal consistency of scaled items.

Since the independent variable or construct is more than one for estimating a dependent variable, a collinearity assessment using variance inflation factor (VIF) was performed. As it can be shown in Table 3, all VIF were found to be within the range from 1.12 to 2.11. The result is not less than 1 and greater than 5, indicating the absence of collinearity among variables [97,98]. Moreover, all three model's fit statistics exhibit the fitness of the models.

Table 3. Variance Inflation Factors.

Equation (3) (Dependent variable BI)		Equation (4) (Dependent variable BIH)		Equation (5) (Dependent variable TH)		Equation (6) (Dependent variable BIH)	
Predictor variable	VIF	Predictor variable	VIF	Predictor variable	VIF	Predictor variable	VIF
PE	1.38						
		PEH	1.62	PEH	1.61	PEH	1.98
		BMIH	1.82	BMIH	1.52	BMIH	1.75
		PEH * BMIH	1.36	PEH * BMIH	1.12	PEH * BMIH	1.68
						TH	1.72
						TH * BMIH	1.48
Equation (7) (Dependent variable BIU)		Equation (8) (Dependent variable TU)		Equation (9) (Dependent variable BIU)			
Predictor variable	VIF	Predictor variable	VIF	Predictor variable	VIF		
PEU	2.11	PEU	1.78	PEU	1.63		
BMIU	1.45	BMIU	1.96	BMIU	1.65		
PEU * BMIU	1.88	PEU * BMIU	2.54	PEU * BMIU	1.52		
				TU	1.78		
				T * BMIU	1.54		

Note: BMI = Body Mass Index, Suffix H = Healthy segment; Suffix U = Undesirable segment; BI = Booking intention; PE = Perceived effort of cleaning air; T = Trust belief. VIF = Variance inflation factor.

Although the majority of marketing studies in the academic field adopt an approach using multiple-item measures, there are still some studies using single-measure for investigation with justifications. For instance, scholars demonstrate that adding additional items to a measure does not lead to more information captured [99]. Another one acknowledges, in the conclusion, that the choice of measurement items should also be taken into the preference of the client [100]. Research also shows that the predictive validity of single-item measures is comparable to that of multiple-item measures and encourages the use of single-item measures where appropriate [101]. Some other studies argue some redundancies and potential disadvantages of using multiple-item measures [102–104].

More recently, another study has also found evidence for the nomological validity of net promoter index (NPI) and recommends the inclusion of NPI in the set of customer voice matrix [105]. The present study's BMI possesses the same characteristics as NPI which is an index and appears in form of a single-item measure.

It is also important to note that data of the above NPI and vast majority of variables employed in service marketing studies are on perception scale, the requirement for internal reliability test is deemed to be necessary and reasonable. Nevertheless, the data of BMI in this study is physical, hard and not sensitive, by nature. So the need for respective reliability indicators is not very necessary.

On the other hand, if the object and attribute of the construct can be conceptualized as concrete and singular, there is no need to use a multiple-item scale to operationalize the construct [102,106]. In this study, the dependent variable—booking intention BI is quite straightforward, unambiguous and concrete to respondents; thus the use of single-item is thus adopted in this study.

4.2. Structural Modeling Test

A four-step process for testing the mediation effect was followed [107,108]. Every step embraces a specific equation and subsequently, multiple regression analysis was conducted to ascertain the following equations (1 to 3/9) where BI refers to booking intention, PE refers to perceived air cleaning effort and T stands for trust belief.

$$BI = \beta_{1i} + \beta_{1ii} (PE) + \epsilon_1 \quad (1)$$

$$T = \beta_{2i} + \beta_{2ii} (PE) + \epsilon_2 \quad (2)$$

$$BI = \beta_{3i} + \beta_{3ii} (PE) + \beta_{3iii} (T) + \epsilon_3 \quad (3)$$

Muller further suggested that the fulfillment of the following conditions as a requirement of variable functions as mediator. The process involves the below steps (i) demonstrating a significant relationship between the independent and dependent variable in the absence of mediator as in Equation (1). (ii) exhibiting a relationship between the independent variable and mediator. In other words, the predictor (PE) must significantly impact the mediator (T). (iii) The third is that controlling for the influence of the predictor (PE), the mediator must significantly affect the dependent variable. In other terms, the mediator is related to the dependent variable while controlling for the independent variable.

Table 4 displays the summarized statistics of the estimated structural PLS-SEM analysis and the results basically meet the above three conditions. As shown, the perceived signals communicating the hotel's effort on cleaning indoor air (PE) was positively related to booking intention (BI) ($B = 0.58$, $p < 0.01$, $R^2 = 0.85$), thus supporting Hypothesis H1.

Table 4. Partial Least Square (PLS) Regression Results for Mediation Model.

	Equation (1) (DV: BI)		Equation (2) (DV: PE)		Equation (3) (DV: BI)	
<i>Direct Effect</i>						
Predicting variable	B	t-value	B	t-value	B	t-value
PE	0.58	8.86 **	0.52	8.55 **	0.38	6.62 **
Trust belief					0.42	7.58 **
<i>Indirect Effect</i>						
Indirect Path	PE- > T- > BI		B	t-value		
			0.22	3.62 **		

Note: DV = Dependent Variable; BI = Booking intention; PE = Perceived effort of cleaning air; ** $p < 0.01$.

Besides, after the inclusion of a mediator in the PLS path model, the indirect influence via the mediator (the whole path from PE to BI) must be significant. The bootstrapping of an indirect path generated the results about the indirect effect in the lower part of Table 4 that shows the significant relationship ($\beta = 0.22$, $t = 3.62$, $p < 0.01$).

The fourth step (iv) is to show that the relationship between the independent and dependent variable is absent during the presence of the mediator; that is, the relationship between these two variables must be significant. Steps three and four are accomplished in one step. The flow starts with the proposed mediator regressed on the independent variable. Next, the dependent was regressed on the independent.

The fourth condition is that, in the presence of mediator (T), the prior significant path coefficient between independent and dependent variables (PE to BI) has to significantly alter its value or magnitude. In analyzing our case, the investigation ascertained that the

estimated path coefficient had significantly been reduced from 0.58 to 0.38, close to 27%. The considerable drop in the magnitude of the path coefficient in Equation 3 suggests the existence of partial mediation. In addition, the variance accounted for (VAF) ratio was computed to assess the strength of the mediation effect. VAF compares the size of the indirect effect (0.22) with the total effect (.38 + 0.22 = 0.60) that is the sum of direct effect and direct effect). The calculated VAF value 0.36 (0.22/0.60) which lies within the range (0.20–0.80) being reckoned as partial mediation [98]. Additionally, it is observed that the significant relationship between PE and BI in Equation 1 (t-value = 8.86) remains in the presence of the mediator in Equation 3 (t-value = 6.62).

4.3. Moderated Mediation Tests (Hypothesis H2 and H3)

To assess the moderated mediation effect in the presence of the moderator referring to body mass index, the study adopted Muller et al.'s three-step process [108]. Other separate sets of multiple regression Equations (4)–(9) were estimated using the three variables in prior testing on the above plus the moderating variable—body mass index (BMI). The * process indicates the interaction or multiplication of the two variables that is the interaction term of testing the moderating effect. The study estimated the equation 4–6 and 7–9 by applying a standardized (product) indicator approach in the PLS path model [109]. The former set of equations represents the characteristics derived from the data pool of the respondents who meet the desirable healthy range of BMI and the latter stands for the response from the respondents who are not up to the desirable normal standard of BMI.

$$BI = \beta_{4i} + \beta_{4ii} (PEH) + \beta_{4iii} (BMIH) + \beta_{4iv} (PEH \times BMIH) + \epsilon_4 \quad (4)$$

$$T = \beta_{5i} + \beta_{5ii} (PEH) + \beta_{5iii} (BMIH) + \beta_{5iv} (PEH \times BMIH) + \epsilon_5 \quad (5)$$

$$BI = \beta_{6i} + \beta_{6ii} (PEH) + \beta_{6iii} (BMIH) + \beta_{6iv} (PEH \times BMIH) + \beta_{6v} (T) + \beta_{6vi} (T \times BMIH) + \epsilon_6 \quad (6)$$

To determine the existence of moderated mediation effect, Muller et al. again suggested the first condition that β_{4ii} of Equation 4 must be significant while β_{4iv} is not. As shown the Table 5, the study found that the group with desirable normal BMI met this requirement. Then a further check on the beta coefficients of Equations 5 and 6 is performed to detect the existence of the underneath patterns—either both β_{5iv} and β_{6v} are significant or both β_{5ii} and β_{6vi} are significant. The testing showed that the former estimates—both β_{5iv} and β_{6v} are significant, while only β_{5ii} is significant in the latter estimates of β_{5ii} and β_{6vi} . The last condition requires the moderating effect of residual PE on BI, that is β_{6iv} be significant. Such a condition was satisfied in testing the significance of β_{6iv} in our study.

Table 5. PLS Regression Results for the Moderated Mediation Model (Healthy BMI Travelers' Pool).

Predicting variable	Equation (4) (DV:BIH)			Equation (5) (DV:TH)			Equation (6) (DV:BIH)		
	B		t-value	B		t-value	B		t-value
<i>Direct Effect</i>									
PEH	0.24	(β_{4ii})	3.55 **	0.38	(β_{5ii})	6.92 **	0.08	(β_{6ii})	5.48 **
BMIH	0.72	(β_{4iii})	12.13 **	0.35	(β_{5iii})	5.21 **	0.69	(β_{6iii})	8.67 **
PEH * BMIH	0.09	(β_{4iv})	4.58	0.32	(β_{5iv})	5.56	0.23	(β_{6iv})	4.26
TH							0.25	(β_{6v})	4.58 *
TH × BMIH							0.03	(β_{6vi})	0.01
<i>Indirect Effect</i>									
Indirect Path				B		t-value			
PE × BMI(H)->T-> BI				0.05		2.55			
PE * -> T-> BI				0.06		3.36			
BMI(H)-> T-> BI				0.08		3.78			

Note: BMI stands for Body Mass Index, H in the suffix stands Healthy BMI segment; DV = Dependent Variable; BI = Booking intention; PE = Perceived effort of cleaning air; T = Trust belief; ** $p < 0.01$; * $p < 0.01$.

The above testing results indicate that a moderated mediation pattern exists in the proposed model endorsing the hypothesis 3a that desirable BMI enhances booking intention by reinforcing the effect on the perceived signals of hotel's effort on cleaning indoor air.

The model testing generated the coefficients of determination (R^2) for TBH, PEH and BMIH (0.26, 0.07 and 0.32 respectively). The results revealed that about 26% of the variance of TBH could be explained by PEH while 32% variance of BI could be explained by TBH, PEH and BMIH).

For the determination of the moderated mediation effect exerted by a traveler with undesirable body mass index, the study the sample principle suggested by Muller et al. and being adopted on the above healthy BMI segment. Respective equations are stated underneath.

$$BIU = \beta_{7i} + \beta_{7ii} (PEU) + \beta_{7iii} (BMIU) + \beta_{7iv} (PEU \times BMIU) + \epsilon_7 \quad (7)$$

$$TU = \beta_{8i} + \beta_{8ii} (PEU) + \beta_{8iii} (BMIU) + \beta_{8iv} (PEU \times BMIU) + \epsilon_8 \quad (8)$$

$$BIU = \beta_{9i} + \beta_{9ii} (PEU) + \beta_{9iii} (BMIU) + \beta_{9iv} (PEU * BMIU) + \beta_{9v} (TU) + \beta_{9vi} (TU \times BMIU) + \epsilon_9 \quad (9)$$

Accordingly, the first condition that β_{7ii} of the equation must be significant while β_{7iv} is not. Whereas the study finds the former is not significant and the latter is significant as shown in Table 6. For the beta coefficients of Equations 8 and 9, the required conditions either both β_{8iv} and β_{9v} are significant or both β_{8ii} and β_{9vi} are significant are also not ascertained. Instead, observation shows β_{8iv} , in our case, is not significant and β_{9v} is significant. For the case of β_{8ii} and β_{9vi} , only β_{8ii} is significant. The last condition requires the moderating effect of residual PE on BI, that is β_{9iv} be significant. Such a condition was not ascertained in β_{9iv} in the study. Thus, the test on the significance of coefficients based on the data of undesirable BMI segment does not support H3b.

Table 6. PLS Regression Results for the Moderated Mediation Model (Undesirable BMI Travelers' Pool).

	Equation (7) (DV:BIU)			Equation (8) (DV: TU)			Equation (9) (DV:BIU)		
	<i>Direct Effect</i>								
Predicting variable	B		t-value	B		t-value	B		t-value
PEU	0.19	(β_{7ii})	0.98	0.33	(β_{8ii})	5.82 **	0.58	(β_{9ii})	2.33 **
BMIU	0.66	(β_{7iii})	9.30 *	0.42	(β_{8iii})	6.91	0.71	(β_{9iii})	8.62
PEU × BMIU	0.05	(β_{7iv})	5.62 *	0.28	(β_{9iv})	3.11	0.32	(β_{9iv})	9.55
TU							0.34	(β_{9v})	2.26*
T × BMIU							0.08	(β_{9vi})	0.001
	<i>Indirect Effect</i>								
Indirect Path	B			t-value					
PE × BMI(U)-> T-> BI	0.06			2.55					
PE × ->T->BI	0.03			3.36					
BMI(U)->T->BI	0.05			3.78					

Note: BMI stands for Body Mass Index, U in the suffix stands Undesirable BMI segment; DV = Dependent Variable; BI = Booking intention; PE = Perceived effort of cleaning air; T = Trust belief; ** $p < 0.01$; * $p < 0.01$.

4.4. Discussion

Based on the assertion about the existence of information asymmetries between a business firm and customers derived from signal theory, the study initiated the idea that perceived signals of hotel effort on cleaning indoor air increase booking intention by positively influence the trust belief of hotel. Additionally referencing the insight on the market shared by hotel managers and review on research about indoor air quality studies and healthy product, the study further developed a theoretical concept—desirable normal body mass index of customer raises booking intention of the hotel with a commitment on IAQ improvement by strengthening the effect about perceived signals of hotel's cleaning air effort on trust in the hotel. Table 7 shows the result of the four tested hypotheses. Based on

the data analysis procedure above, Hypothesis H1, H2 and H3a were supported. However, hypothesis H3b was rejected.

Table 7. Hypothesis Summary.

Hypothesis	Result
<i>H1: Perception to signals of hotel IAQ enhancement measures positively impacts on travelers' online booking intentions</i>	Supported
<i>H2: Customers' trust belief on hotel mediates the relationship between their perception to signaled measures of hotel IAQ enhancement and booking intention online</i>	Supported
<i>H3a: Customers' healthy body mass indices enhance online booking intention by reinforcing the effect of perceived cleaning air effort on their trust belief about a hotel.</i>	Supported
<i>H3b: Customers' undesirable healthy body mass indices enhance online booking intention by reinforcing the effect of perceived cleaning air effort on their trust belief about a hotel.</i>	Rejected

As shown in Table 7, H1 is supported. While IAQ management has not yet considered expressing cleaning air effort as core signals for hoteliers [57], the current study argues that having signals of hotel IAQ enhancement is perceived positively by travelers. These signals will certainly enhance travelers' online booking intentions. To make this happen, we need to aware that building trust has always been important in a virtual environment, including online hotel booking [63–65]. Our H2 shared similar thoughts, here, customers' trust belief on hotel mediates the relationship between their perception to the signaled measure of hotel IAQ enhancement and booking intention online. Customers' trust in a hotel and their willingness to believe information online of a hotel is fundamental for IAQ management, which could consider as a type of information. The importance of IAQ management for individual travelers lies in individuals' health-consciousness as indicated in H3a. If people are more aware of the influence of lifestyle (including hotel booking) on health, they will more likely to pay attention to IAQ management [75,76]. Here, booking a hotel with IAQ signals would consider as part of their lifestyle of engaging in health actions. It also explains why H3b was not supported. As those who are less health-conscious will not aware of the potential influence of lifestyle on health. Further information about theoretical and practical implications of these discussions is introduced in the conclusion.

5. Conclusions

Since consumers could not access the hospitality service before they consume it online, travelers often make inferences using signals for decision-making. The main purpose of the signals is to provide extra information in enhancing the credibility of the products or services. The study thus proposed and tested the hypotheses about the relationships among items and constructs—perceived online signals of hotel's effort on enhancing IAQ, trust belief of hotel, BMI and booking intention. The results reveal that the more reinforced IAQ effort included in the website presentation, the higher the travelers' booking intention. In particular, the study reveals the customers' trust belief as a mediator to the relationship between perceptions of IAQ enhancement and hotel online booking intention. In addition, the study found that a stronger mediating effect of trust belief between travelers' perception of hotel's communicated online signals about reinforced IAQ effort and online booking intention.

5.1. Theoretical Implications

This paper has two major theoretical contributions to the literature of travelers' decision-making process of accommodation selection. First, unlike previous studies, the current study shows that IAQ enhancement is an important signal for the hotel to enhance its credibility and motivate booking intention online. As discussed above, the signaling theory has previously been discussed extensively in the domain of hotel booking [41–43]. However, rarely have these studies considered IAQ management as one of the core signals for travelers' decision-making and behavior. The current study, therefore, enriches the past

literature of online hotel booking that hotel IAQ enhancement could be a salient determinant for tourists' booking intention of hotel rooms. Second, by analyzing the impact of trust within the signaling theory framework, this study confirmed that the enhancement of hotel IAQ could enable more trust of the hotel and thereby a higher online booking intention. Such finding echoed the findings of previous studies that trust is one of the most crucial antecedents for online decision-makings where uncertainty exists [34,35]. In the online context, attributes of hotel rooms are credence attributes, which means that they cannot be verified by the consumer before actual patronage. As most travelers do not have the expertise and resources to verify the clean air claims in hotel rooms, transparency of IAQ enhancement measures is therefore essential for travelers' trust and online booking intention.

A recent study consolidates prior SEM research involving single measurement items in business situations specifying repeat purchase intention, supervisor rated performance, affecting response to waiting, sales, expense, experience and frequency [110]. However, this study adds BMI into the inventory list of justifiable single measurement items. In addition, the research study represents the first of its kind in justifying and applying the single measurement item—BMI in the theoretical development for modeling in the marketing and hospitality field.

5.2. Practical Implications

Based on the above test findings supporting the proposed relationships of investigated constructs and variables, this study holds several implications for practice. First, hoteliers could make more communication efforts in IAQ enhancement in order to develop a positive evaluation of the hotel by the customers. For example, adding some monitoring devices and displays in hotels may deliver more visible signals for customers and subsequently enhance their visually sensed experience.

Second, since the customers' trust plays the mediating role of the relationship between perceptions of IAQ enhancement and hotel online booking intention, hoteliers could employ multiple methods to strengthen the trust. For instance, in virtual environments, peer to peer opinion is also vital for business and considered as useful signals to provide trustworthy information. Hence, hoteliers could try to use peer to peer opinions or rating on IAQ enhancement to enhance the credibility of IAQ enhancement. In addition, the hotel may consider employing a higher level's independent laboratory to audit and certify the IAQ. Moreover, hotel management should also collaborate with reputable research institutions to conduct studies about IAQ work and present achievements at international conferences.

Third, since the study reveals that the level of health-consciousness of travelers might become a key driver for booking intention, the hotel public relations team should try to apply and compete for the green or wellness award. Subsequently, the team should send the achievement signals to the societies or associations with more health-conscious members such as nurses, doctors, spa-goers and so on. Particularly during the new normal era amid and after the pandemic, cleaning indoor air of tourism-related buildings (including hotels, cruises, museums, exhibition complex, transportation terminals and restaurants) is recognized as a major determinant for the relaunch of operations by both government officials, tourism operators and tourists.

Equally important is that the study represents the pioneer in the tourism and sustainable field to explore the variable BMI which is one of the key indicators for investigating a healthy product market. Given the envisaged growing trend of wellbeing, hotel marketers or tourism managers with prospective healthy products or facilities may take reference of this demonstrated study for the marketing studies about the segment of healthy consumers. On the other hand, most hotel chains have already built up the database of prior guest information or sometimes called guest history files; the internal search for potential guests' BMI-related data—height and weight can thus be performed in an easier, faster and more cost-saving way than hiring a marketing consultant. Thus, if the existing hotel guest infor-

mation system does not contain the BMI-related data, it is worthwhile for management to consider adding the incorporation of automatic height and weight estimation function into the front office management's person recognition scanner.

6. Limitation and Future Research

Nevertheless, there are several limitations of this study worth noting. For instance, the current study was confined to the cleaning effort committed by hotelier, more emphasis could be placed on analyzing customers' reaction to products and marketing methods that are linked to IAQ enhancement effort being used by online travel agencies' platform. Secondly, the sampling and data collection may create bias as the convenience sampling method was carried out on hotel guests in a 5-star hotel. A probability sampling method in different hotels in different regions can be considered to have a more representative sampling population. In addition, it is acknowledged that the data collected are non-random samples due to the field experiment practice; this hinders the formal use of statistical inference to reinforce the studied postulation. Thus, the presented content is more for information and reference. On the other hand, we certainly encourage a more representative sample in future studies. A more rigorous measuring criterion instead of BMI for health-consciousness can be considered and planned in future work. Last but not least, future research should pay more attention to different hotel IAQ demand between people of different genders and ages plus different styles of travelers.

Author Contributions: Conceptualizations: B.S., W.W.C.; Methodology, B.S., W.W.C.; Software, B.S., L.Y.L.; Validation, B.S.; Formal Preparation, B.S., X.C.; Investigation, B.S., X.C., W.W.C., Writing-Review & Edit, C.X.Z., W.W.C.; Project Administration: B.S., X.C., W.W.C. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request but final approval is subject to the studied corporation's decision.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table 1. Adaptation of Trust Scale.

Scale	Intention Item	Reliability Item
	<ul style="list-style-type: none"> Hotel H would be honest and sincere in addressing my concerns in hotel IAQ I could rely on Hotel H to solve the problem related to IAQ Hotel H would make any effort to satisfy me in hotel IAQ Hotel H would compensate me in some way for IAQ-related problem 	<ul style="list-style-type: none"> IAQ measures in Hotel H meets my expectations I feel confidence in IAQ measures in Hotel H Hotel H will never disappoint me in hotel IAQ IAQ measures in Hotel H guarantee my satisfaction

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