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Tourism Getting Back to Life after COVID-19: Can Artificial Intelligence Help?

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Abstract: Measures aimed at keeping physical and social distance during the COVID-19 pandemic have started to be a big challenge for service industries all over the world. The utilization of new technologies such as artificial intelligence (AI robots) in hospitality and tourism can be imposed as a potential safety-related problem solver. This study explores consumers' intentions to use hospitality services once all restrictions related to COVID-19 have been relaxed as well as their perception of how important they find some of the safety-related protective measures when visiting accommodation facilities. Respondents find that more rigorous cleaning techniques, additional disinfection, and hand sanitizer stations are the most important safety-related protective measures when staying at the accommodation facility. Although the respondents do not perceive AI robots as an important protective measure or beneficial in delivering a catering service, the results indicate some significant differences between more and less risk-averse travelers suggesting some potential strategic pathways during the crisis but also in the post-coronavirus future.

Keywords: tourism; COVID-19; protective measures; artificial intelligence; robots

1. Introduction

The COVID-19 pandemic had and still has an unprecedented impact all over the world [1,2]. While struggling to get people vaccinated, national governments and individual organizations prepared different strategies to fight this coronavirus, preserve jobs, and enable the safe restart of economies [3,4]. For instance, complete or partial lockdown, home quarantine, and online working supplement the list of traditional non-pharmaceutical interventions (NPIs) such as keeping physical and social distance, wearing protective masks and gloves, and hand hygiene [5–7]. However, the scale of the pandemic has prompted scientists and workers in healthcare and other industries to look for alternative ways to protect themselves and their clients. Given the prominent rise of technology in this millennium, the implementation of artificial intelligence (AI) devices (e.g., AI robots or other automated devices) is also considered an effective tool in preventing the spread of the virus. AI devices such as robots replace humans in their work assignments, thus reducing human contact and keeping social distance [8–12].

While for manufacturing industries, the adoption of AI devices instead of humans is considered normal [13], services are quite different. Service industries, including tourism-, travel-, and event-related industries, often call for personal contact between a provider and a client. The simultaneous interplay between supply and demand and the tourist's co-creation in producing her/his experiences is at the core of the tourism business [14–17]. The utilization of new technologies (including AI devices) for advancing the consumer experience is not new in hospitality and tourism research because AI devices seem to be more accurate, consistent, and predictable than human beings [18–20]. However, the implementation of AI devices is still a matter of debate since tourists sometimes seem reluctant to interact with AI devices and prefer human contact [21–23]. On the other hand, personal safety and perceived health risk strongly affect choices made by tourists [24–26].

Consequently, tourism-, travel-, and event-related industries were particularly hit by the COVID-19 [5,27–31]. According to UNWTO [32], in 2020, international tourism recorded a 73% decline in tourists, from USD 910 billion to USD 1.2 trillion in export revenues, with more than 100 million jobs at risk due to COVID-19. It is assumed that it will take years for the global tourism industry to fully recover [4].

COVID-19 as a striking health crisis and increased availability of new technologies triggered few conceptual studies discussing the implementation of AI devices as a safety-related measure (i.e., a measure against infectious diseases) in (post-)viral tourism (see, for instance, Seyitoğlu and Ivanov [9,33] and Zeng et al. [11]). Yet, there is a lack of studies examining the perception of tourists (i.e., the demand side) towards AI devices such as robots as a safety-related measure, which is also important to establish trust in the current as well as future post-COVID-19 tourism activities and remains under-researched, too. As argued by Yang et al. [10], only with sustained research efforts both humans and robots will be ready for the next health incident.

To address this gap, this empirical study intends to examine consumers' intentions to use hospitality services and travel to destinations once all restrictions related to COVID-19 have been lifted as well as their perception of how important they find some of the safety-related protective measures when visiting accommodation facilities. In particular, this study is focused on whether AI devices are perceived by respondents as an important asset in managing COVID-19 and how respondents perceive their possible interaction with AI robots during catering service consumption. This study's findings increase the knowledge about human–AI encounters during service consumption and contribute to the discussion on the implementation of AI devices as an important NPI in handling infectious diseases in the tourism and hospitality context. In addition, practitioners could use the results of this study to design optimal travel packages that include NPIs that tourists see as most important to ensure both safety and quality of service.

The structure of this paper is as follows. A literature review introduces some fundamentals on the adoption of AI in tourism, common safety protective measures against infectious diseases, and tourism recovery after a crisis. After explaining the methodological approach, results are presented and discussed. The paper finishes with some concluding thoughts.

2. Literature Review

2.1. Adoption of AI Devices in Tourism

Traditionally perception of tourism as relying on personal contact and interplay between a host and a guest is greatly challenged by the disruptive development and impact of AI devices. Nowadays, AI is more and more infused into the guest's service experience [16,34–37]. In other words, tourism businesses (e.g., hotels and restaurants, airports, and other transportation systems) increasingly incorporate technological elements to provide memorable experiences. There are many reasons for replacing human-to-human interactions with AI devices. Previous studies found that AI devices are capable of delivering more accurate, consistent, and predictable service than human employees are [18,19,38]. There is also an issue of possible reduction of costs since AI devices do not need rest and shifts like humans [39,40]. Still, some academics argue that AI devices cannot completely surpass human contact, which is decisive in delivering experiences [41]. Many people show distrust and fear when interacting with AI devices, and sometimes security issues of data privacy arise [11,23,36,42,43]. In the end, this might lead to service failure [21].

To understand better the implementation of AI in tourism, guests' willingness to use it needs to be explained. It depends on many internal and exogenous variables. For instance, hedonic motivation, social influence, performance expectancy, and emotions seem to affect AI adoption positively, while effort expectancy and anthropomorphism seem to affect AI adoption negatively [19,22,44–48]. To summarize, if people are highly influenced by their reference groups, if they perceive more benefits than costs from the usage of AI, and if they

feel happy and satisfied when using AI, it is more likely their willingness to use AI will increase.

2.2. Safety Protective Measures against Infectious Diseases and AI Robots

The most protective measure against infectious diseases is a vaccine. However, when an effective vaccine for a particular infectious disease does not exist or is not available to everyone, the main strategy to restrain the pandemic relies on NPIs [5]. Traditional NPIs are based on keeping physical and social distance and isolation as well as proper hygiene [6,7]. The introduction of quarantine is not new in fighting against infectious diseases (see Gensini et al. [49]), and last studies related to the COVID-19 pandemic show quarantine is important in reducing incidence and mortality [50]. The results are even better when quarantine and lockdown are combined with other public and personal health measures such as wearing protective masks and gloves and hand hygiene.

While it is argued that a collaboration between the technology and travel and tourism sectors may reduce the COVID-19 difficulties [9,51] and increase the chances for business survival [36], academics also started to question the role of technology in preventing and monitoring the COVID-19 pandemic. In general, technology and AI devices such as robots can contribute to clinical care, logistics, monitoring compliance with prescribed measures, and conducting various socioeconomic functions [10]. For instance, they can be applied to reduce human contact, keep social distance, deliver various items and materials, auto-registration, measure body temperature, sterilization, and disinfection [8,11,12]. This is valid not only for the medical and public health sectors (e.g., hospitals) but for a wide spectrum of social realms, including tourism.

2.3. Tourism Recovery after Crisis and Perceptions of Travel Risks

Safety and security are core building blocks of a tourist experience and a successful tourist operation [4,52,53]. Distressing safety issues such as crime issues, vandalism, terrorist attacks, natural disasters, and pandemics such as COVID-19 negatively influence tourists' decision making and international tourism demand patterns [54]. Insecure destinations struggle in attracting tourists and experience tourism slow down for a shorter or longer time, depending on the size and effect of the risk event. For instance, international studies showed that destinations recorded a decrease in tourists' arrivals after the hazardous event but also an extant degree of resistance and fast recovery [52,55–58].

Tourism resilience and recovery is even more questioned in the case of the COVID-19 pandemic, and many academics discussed this issue [28,29,31,59–64]. A number of studies examine the supply side, that is, destinations and operators making plans to resume businesses and tourist visits [3,65–67] to list only a few, but a huge number of studies also focus on the demand side, that is, tourists [63,64,68–70]. It is even argued that the COVID-19 pandemic can constitute a paradigm shift in future studies on tourists' perceived risk, behavior, and decision making [71].

The extant literature suggests that people differ in their perceptions of risk events [4,53,72–75]. Consequently, their behaviors differ too. When tourists perceive higher travel constraints, they are prone to reduce leisure travel [76]. According to the protection motivation theory [77], people who perceive higher levels of threat appraisal and travel risk behave in a more self-protective manner [72,78]. Thus, preventive behavior (e.g., keeping social distance, personal hygiene, wearing a facemask) is found to be positively correlated with the perceived level of risk [73]. Further, people who perceive lower personal risk show higher intention to visit and revisit a destination [70,79–81]. Hence, we address these issues in the following research question: do people who are more prone to risk and intend to use hospitality services shortly after restrictions on movement are lifted care less about physical/social distancing and other safety-related protective measures? Therefore, we assume that they will give lower importance to such measures (including AI robots) in comparison to risk-averse people who will wait for a while before traveling to a particular destination. Additionally, as AI devices such as robots stand for a method of ensuring

physical and social distancing and as people who intend to use hospitality services soon do not seem to be very concerned about formerly mentioned distancing, we suggest that they will perceive interaction with AI robots as less enjoyable and will not see the functional advantages of AI in service consumption as more cautious people will.

3. Methods

3.1. Study Context

The study was conducted in Croatia, a small European country (4 million residents) whose economy is highly dependent on tourism. For instance, tourism contributed around 19.5% to the Croatian GDP in 2019 [82]. Regarding COVID-19, Croatia was very successful in preventing the virus from spreading during the first wave of pandemic (as of 7 June 2020, Croatia recorded 2247 cases and 104 deaths (https://www.worldometers.info/coronavirus/; accessed on 8 June 2020). After the three-month lockdown, the country started to open to foreign tourists in late May 2020, but despite some protective measures (reduced working hours, social distancing, wearing masks, etc.), the summer season was abruptly interrupted in mid-August because of the second wave. On a yearly basis, 2020 have recorded a strong decrease in tourism activities (50% decline in relation to 2019) [82]. The third wave of the pandemic in winter 2020–2021 affected Croatia more severely, but the government and tourism officials prescribed many protective measures to make (and promote) Croatia a safe country to visit during summer 2021.

3.2. Questionnaire and Data Collection

The prepared questionnaire consisted of respondents' socio-demographic characteristics, their travel preferences, their perceptions of the importance of NPIs when visiting accommodation facilities (19 items proposed according to Lee et al. [6], Xiao et al. [7], and Seyitoğlu and Ivanov [9]), as well as their perception of the possible use of AI robots during consumption catering service (14 items according to Lu et al. [22] and Lin et al. [47]). The survey participants indicated their responses related to their attitudes on NPIs and AI robots on Likert-type scales ranging from 1 (not important at all) to 5 (very important) and ranging from 1 (strongly disagree) to 7 (strongly agree). The survey was administered in the Croatian language. The items were translated into Croatian by the authors and then translated back to English by an official translator to check the content validity. Data were collected from 18 May 2020 to 27 May 2020, the first 10 days after the restrictions on movement in Croatia had been relaxed and people were allowed to visit other places. Using the snowball sampling technique, the link leading to the electronic version of the questionnaire was first sent to an opportunity sample of tourism students; they were then asked to forward it to their social networks and other contacts. All participants were asked to read the description at the beginning of the questionnaire, where the term and application of NPIs and AI devices such as robots were thoroughly explained. Respondents' participation in the survey was voluntary, and their responses remained anonymous. In total, 616 valid responses were collected.

3.3. Data Analysis

Given the research questions, the sample was divided into two sub-groups. The first sub-group (Group 1, N = 219, conveniently called 'early goers') consisted of the respondents who had already visited a particular destination or intended to visit it soon (i.e., within one month). The other sub-group (Group 2, N = 375, conveniently called 'cautious travelers') consisted of people who would, for whatever reason, wait at least a month before visiting a destination. People who declared themselves as non-travelers (never travel/spend the night outside their place of residence; N = 22) were excluded from further analysis. In addition to descriptive statistics, the non-parametric Mann–Whitney U test was conducted to identify statistically significant differences between the two groups regarding their perceptions of the importance of safety-related protective measures when staying at the accommodation facility and the possible use of AI while consuming catering services.

4. Results

The whole sample, as well as the two sub-groups, is female-dominated (around 60%). On average, respondents are 28.5 years old, have secondary or university education, and there is a similar number of employed people (46.5%) and students (42.8%). For their first travel, most of the respondents (around 60%) would like to experience a beach and lakeside getaway. Respondents also prefer other outdoor experiences such as a road trip through scenic countryside and hiking or biking (37% of early goers and 46% of cautious travelers) and visits to urban destinations (37–38%). Visiting SPA centers is a preferred activity too (14%) (the overall sum is higher than 100% because respondents were asked to indicate the top two travel experiences they would like to enjoy first once the shutdown is over). Approximately one quarter of respondents plans to visit a destination abroad, while others would choose a destination in Croatia. In most cases, they plan to travel in company (with family, partner, or friends) and stay in the apartment with a family landlord (33%) or hotel (26%). A considerable part of the respondents, especially within the group of early goers (19%), plans to stay at their own second house. On average, the respondents plan to stay in a destination for 7 days and spend between EUR 333 (early goers) and EUR 170 (cautious travelers).

In general, respondents find that more rigorous cleaning techniques, additional disinfection, and hand sanitizer stations are the most important NPIs when staying at the accommodation facility (Table 1). It seems that they do not perceive AI- and technology-related measures such as robots replacing humans in daily activities or touchless entering and paying as equally important. Early goers attribute less importance to all the measures than cautious travelers, and statistically significant differences exist in all items except one item related to AI (robots instead of waiters taking orders from guests).

Table 2 suggests that respondents, in general, do not perceive AI robots as beneficial in delivering a catering service, except in avoiding unnecessary personal contacts and communication but even then only to a moderate extent.

As shown in Table 2, statistically significant differences between the groups exist in items related to the functional advantages of AI robots in service consumption. Respondents belonging to the group of early goers perceive interaction with AI robots as less enjoyable and see AI robots as less accurate, consistent, dependable, and predictable than respondents belonging to cautious travelers' group.

Table 1. Perception of the importance of safety-related protective measures when staying at the accommodation facility.

Variable	Total (N = 594)		Early Goers (N = 219)		Cautious Travelers (N = 375)		Mann–Whitney U	
	M	SD	M	SD	M	SD	M-W	Z
Hand sanitizer stations throughout the property ***	3.63	1.19	3.33	1.21	3.81	1.15	31,443.5	−4.962
More rigorous cleaning techniques ***	3.78	1.19	3.42	1.21	3.99	1.12	29,096.0	−6.203
Staff wearing masks and gloves	3.14	1.30	2.74	1.22	3.38	1.29	28,610.5	−6.351
Checking temperature of employees ***	3.19	1.37	2.94	1.30	3.34	1.38	33,398.5	−3.904
Checking temperature of guests ***	2.82	1.35	2.54	1.26	2.98	1.37	32,845.0	−4.172
Automated check-in ***	3.02	1.17	2.84	1.13	3.13	1.18	34,284.5	−3.505
Touchless entering the rooms using mobile devices ***	2.78	1.21	2.61	1.21	2.89	1.21	34,755.0	−3.240
Touchless payment using mobile devices ***	2.82	1.27	2.64	1.24	2.92	1.27	34,998.5	−3.102
Additional disinfection of the room immediately before the arrival of the guest ***	3.68	1.24	3.41	1.22	3.83	1.22	32,152.0	−4.601
Optional daily housekeeping (cleaning and towels left outside your door) ***	3.23	1.15	3.01	1.18	3.37	1.12	33,662.0	−3.840
Keep rooms vacant for at least a night after a guest checkout ***	3.10	1.32	2.87	1.34	3.23	1.28	34,032.5	−3.586

Table 1. *Cont.*

Variable	Total (N = 594)		Early Goers (N = 219)		Cautious Travelers (N = 375)		Mann–Whitney U	
	M	SD	M	SD	M	SD	M-W	Z
Possibility of delivery and consumption of food and drinks in the room (room service) ***	3.03	1.17	2.87	1.19	3.12	1.15	35,593.0	−2.832
Chairs separated for social distancing in common areas, restaurants, and bars ***	2.95	1.20	2.68	1.17	3.11	1.18	31,730.0	−4.795
Plexiglas between tables in common areas, restaurants, and bars ***	2.32	1.21	2.12	1.14	2.43	1.23	33,783.5	−3.735
Plexiglas between chairs in common areas, restaurants, and bars ***	2.17	1.18	2.04	1.14	2.25	1.19	35,626.5	−2.805
Plexiglas at check-in desk ***	2.85	1.29	2.53	1.19	3.04	1.31	30,612.0	−5.332
AI robots instead of waiters taking orders from guests	1.85	1.18	1.82	1.17	1.87	1.18	38,337.0	−1.457
AI robots instead of waiters delivering orders to guests' tables **	1.78	1.16	1.68	1.11	1.84	1.19	36,605.0	−2.415
AI robots instead of waiters delivering orders to guests' rooms *	1.81	1.16	1.76	1.13	1.84	1.17	37,850.0	−1.735

Note: M—mean; SD—standard deviation; Likert-type scale where 1—not important at all, 2—of little importance, 3—of average importance, 4—important, 5—very important/essential. *** Significant at 99% level of confidence; ** significant at 95% level of confidence; * significant at 90% level of confidence.

Table 2. Perception of the possible use of AI robots during catering service consumption.

Variable	Total (N = 594)		Early Goers (N = 219)		Cautious Travelers (N = 375)		Mann–Whitney U	
	M	SD	M	SD	M	SD	M-W	Z
AI robots are more accurate than human beings ***	3.40	1.79	3.16	1.84	3.55	1.75	35,579.0	−2.761
Information provided by AI robots is more consistent ***	3.46	1.69	3.16	1.78	3.63	1.60	34,500.5	−3.308
AI robots provide more consistent service than human beings ***	3.00	1.60	2.80	1.62	3.11	1.57	35,759.0	−2.682
AI robots are more dependable than human beings **	3.09	1.66	2.93	1.68	3.18	1.64	36,774.0	−2.163
Service provided by AI robots is more predictable than human service **	3.74	1.86	3.57	1.93	3.85	1.80	37,123.5	−1.982
I am able to avoid unnecessary personal contacts (communication) if I use AI robots ***	4.23	1.83	3.83	1.89	4.46	1.76	32,706.5	−4.203
I would find the interaction with AI robots enjoyable ***	3.10	1.61	2.87	1.63	3.24	1.59	35,081.0	−3.030
Interaction with AI robots will be so difficult to understand and use	3.97	1.63	3.85	1.69	4.04	1.59	38,400.5	−1.349
AI robots will be intimidating to me	3.45	1.84	3.32	1.81	3.53	1.86	37,901.5	−1.591
If I use AI robots, I will feel happy	2.90	1.54	2.82	1.58	2.94	1.52	38,917.5	−1.096
If I use AI robots, I will feel relaxed *	2.99	1.56	2.88	1.59	3.06	1.53	37,615.5	−1.759
If I use AI robots, I will feel optimistic	3.01	1.55	2.96	1.61	3.04	1.51	39,390.0	−0.857
If I use AI robots, I will feel satisfied	3.05	1.55	2.95	1.57	3.11	1.53	38,436.5	−1.348
If I use AI robots, I will feel calm	3.02	1.54	2.96	1.56	3.06	1.52	38,990.5	−1.061

Note: M—mean; SD—standard deviation; Likert-type scale where 1—strongly disagree, 7—strongly agree. *** Significant at 99% level of confidence; ** significant at 95% level of confidence; * significant at 90% level of confidence.

5. Discussion and Conclusions

This study examined how consumers are inclined to travel and use hospitality services in the post-pandemic period and how important they find some traditional as well as technology-based safety-related protective measures within accommodation facilities. The sample profile suggests that more than one third of respondents (i.e., the group of early goers) could be considered as prone to risk. This rather high percentage of respondents willing to travel shortly after restrictions on movement have been lifted confronts some previous studies where respondents showed more caution [83,84]. However, such a result is not particularly surprising because previous research by Boto-García and Leoni [85] showed that those who were more severely affected by the pandemic could show greater readiness to travel than those who were less affected by the pandemic. Certainly, risk tolerance and willingness to travel are multifaceted phenomena [79,81], and conclusions cannot be unequivocal. When it comes to the type of travel experience, respondents primarily choose beach or countryside getaway (by hiking or biking), which are, in the context of COVID-19 or other similar infectious diseases, perceived as outdoor, individual, and, therefore, more safe activities [5,86]. Still, although cities were the main drivers of the rapid spread of the infection [61,87], visiting urban destinations is a wishful option for more than a third of both early goers and cautious travelers. For their first travel, most of the respondents would choose a domestic destination (inside a country), confirming so-called home-is-safer-than-abroad bias [75,88]. In other words, tourists usually perceive international tourism as riskier than domestic tourism [4,5,89]. This is also in line with Fourie et al. [90] and Rastegar et al. [91], who showed that tourists from stable countries and lower-case fatality rates (as Croatia was at the time of the survey) would avoid visiting unstable countries. This is also true for early goers where one out five choose to stay at their own second houses, which is considered as a kind of social distancing. Therefore, it can be argued that early goers compensate higher travel risk with less risky options of stay (travel within the country and staying at apartments and second homes) and type of experience (i.e., outdoor).

Furthermore, at the aggregate level, respondents found traditional NPIs as more essential than technology-based NPIs during their stay in a particular accommodation facility. This can be explained by the fact that traditional personal and environmental NPIs, such as wearing protective masks, disinfection, and sanitization of surfaces and objects, already proved their efficiency during the past health incidents [5–7,49,50,92]. In addition, epidemiologists permanently emphasize the role of NPIs through popular mass media (online portals, television, radio, and social networks) that have a large public response. Traditional NPIs are also cheaper than the implementation of technology-based interventions, especially for day-to-day personal activities. Still, within the business context, from the perspective of businesses, AI devices such as robots replacing humans can speed up some business processes and operations, thus reducing physical and social contact as well as costs [8,11,39,51]. On the other hand, findings on the disaggregated level show that the importance of almost all NPIs as perceived by early goers is significantly lower than the importance perceived by cautious travelers. This confirms previous studies [72,73,78,81], further speaks in favor of the protection motivation theory [77], and supports our assertion that early goers (defined as people more prone to risk) care less about NPIs than cautious travelers (defined as more risk-averse people). Still, as already stated, such attitudes could be partly explained by early goers' compensation of higher travel risk with safer-travel decision making (domestic travel, avoiding hotels, and asking for outdoor experiences).

Again, at the aggregate level, AI robots are not recognized as more efficient or reliable for service operations than humans are. The finding that it is hard to expect that AI robots can entirely replace humans is in line with Samala et al. [41] but contradicts the arguments of Gursoy et al. [19], Bock et al. [18], and Chi et al. [38]. However, respondents find AI robots useful only to a moderate extent when it comes to reducing personal interplay. Although the mean value is only slightly above the threshold, it provides optimism that AI robots can be successful NPI in fighting against COVID-19 as suggested by Khan et al. [8],

Seyitoğlu and Ivanov [9], Yang et al. [10], Zeng et al. [11], and Gursoy and Chi [83]. Such results can be explained by the fact that respondents do not find the interaction with AI robots enjoyable and would not feel happy, relaxed, or satisfied using AI devices such as robots. This could be a question of trust that is acknowledged as one of the major problems in human–AI interaction [11,23,42,43]. Seyitoğlu and Ivanov [9] also raised the question of the so-called technological shield created by service robots that can increase the physical and emotional distance between tourists and service providers. This is quite surprising because the respondents were younger people on average and some previous studies implied that it would be normal to expect that youngsters (e.g., generations Y and Z) use new technologies more frequently and with less effort than their older counterparts [93,94]. Additionally, perceived effort (i.e., the costs a user can expect from the AI robots), which was quite high compared to other items in this study, might lead to a possible negative impact on customers' evaluation of AI devices [19,22,48]. When it comes to differences between early goers (group more prone to risk) and cautious travelers (more risk-averse group), the latter see AI robots as more functional and feel more relaxed when using AI robots than early goers do. This corroborates our second premise that people more prone to risk are less concerned about NPIs and do not see the real advantages of AI in service consumption as more cautious people do. Yet, the mean values are very low and below the threshold except for the item referring to AI robots as a mean to avoiding unnecessary personal contacts (see again Table 2). The mean value of this item for cautious travelers is above the threshold (i.e., 4.46), while for early goers is slightly below the threshold (3.83). This indicates that AI might be beneficial NPI for social distancing, as claimed by Khan et al. [8] and Zeng et al. [11], especially for risk-averse people.

To summarize, accepting the fact that the emergence of AI technology is in full swing, this research started to analyze the extent to which travelers' perceptions of AI technology can be correlated with their attitudes toward travel after the first wave of the COVID-19 crisis. The knowledge gained could potentially promote the successful adoption of such disruptive technology in the health sector. To better understand how travelers respond to the importance of NPIs, this paper reports that cautious travelers rate all NPIs as more important than impatient early travelers do. Although respondents generally do not perceive AI devices as beneficial in delivering a catering service, this research indicates some significant differences between the two types of travelers, depending on their risk aversion. This may suggest that introducing and promoting the acceptance of AI technology in tourism and catering services will be a long-term endeavor of great strategic importance in the aftermath of the crisis.

While many academics question what the future of tourism will look like after COVID-19, pointing to the need for transformations and ecological justice [59,65,95–97], this paper contributed to this discussion, thus yielding several theoretical and practical implications. From a theoretical perspective, this study provided further validation of several constructs from the existing scales related to NPIs as safety protective measures and the use of AI robots during the consumption of catering services (i.e., the items from [6,7,22,47]). Moreover, the study contributed to tourism psychology by investigating tourists' travel intentions and preferences during the period of (post) health crisis. By distinguishing between two groups with different risk aversion, this study is in line with the protection motivation theory, according to which self-protective behavior is positively correlated with the perceived level of risk [72,73,78,79]. The next novel theoretical aspect of this study lies in the analysis of the potential implementation of NPIs in the management of COVID-19 in a tourism context. Given the expected extension of the COVID-19 crisis, this area of research contributes to tourism management and public health studies. By addressing technology-based NPIs within a specific context of health crisis, this study also contributes to the technology acceptance body of knowledge [19,22,44–48]. Additionally, it strengthens the understanding of human–AI encounters during catering service consumption in the post-crisis period. The acceptance of AI robotic devices does not seem to be largely pleasurable, and scientists in the field of tourism and technology should focus their efforts on the

development of new technologies, including AI robots, that will enhance tourists' safety without deteriorating the overall tourism experience. As suggested by Zeng et al. [11], this could mean a new paradigm in which advanced technologies can facilitate the design of better tourism in the post-COVID-19 era. On the other hand, addressing AI devices as NPIs would mean humans and robots will be better prepared for the next health crisis [10].

From the practical point of view, policy makers such as governments and national health authorities should be aware of the existence of the technology era and, consequently, design and publicly promote technology-based NPIs. This is especially true for those sectors where human interactions are frequent or unavoidable. Educational institutions should join these efforts by offering revised curricula that intensify the students' use of AI-focused devices in order to accentuate the importance of new technologies in today's world. Additionally, familiarizing students with new technologies could help in reducing potential mistrust and emotional stress for them. Regarding travel and tourism practices, once all travel restrictions are lifted, tourist agencies and other mediators can obtain some preliminary information about tourists' attitudes related to their travel preferences in terms of when they travel, where they choose to stay, and the types of experiences they prefer. This can help tourism mediators to devise timely and optimal strategies and tourist packages to take a leading competitive position. Additionally, this paper investigated the respondents' attitudes towards traditional and technology-based NPIs when staying at the accommodation facility. Accommodation providers should implement NPIs that tourists perceive as the most important, and this study suggests that traditional NPIs are imperative. On the contrary, providers have to be very careful in implementing technology-based NPIs. This study has shown that the further development and implementation of AI robots will be a great challenge for AI designers, accommodation providers, as well as tourists. While the technological shield created by AI robots might be desirable during a pandemic [9], it could also cause emotional distance in service co-creation. If the consumption of services passes without the involvement of a tourist, it can diminish her/his satisfaction and intention to revisit. Here again, the role of educational institutions and other public institutions in bringing AI devices closer to everyday life should be emphasized. Although respondents were not very positive about the role AI robots could play in catering service consumption, this research highlights some opportunities, particularly in the area of (avoiding) communication. Specifically, unnecessary communication between tourists and hosts could be avoided by offering automated booking and check-in, contactless payments, and automated delivery throughout the facility. However, not all hospitality facilities have equal potential (equipment, know-how, finances, etc.) to use new technologies. Hence, examining the dynamic capabilities of hospitality facilities to adopt AI robots when confronted with a public health crisis is a prosperous avenue for research (see also Jiang and Wen [98]).

Finally, some study limitations should be mentioned. Distinguishing between the respondents prone to risk and risk-averse respondents has been made on the basis of how long they plan to wait to travel on a tourist visit and spend at least a night in a particular destination after restrictions on movement are lifted. Surely, the usage of different risk measurement scales would provide another perspective to the analysis and deepen the overall findings. Because intention does not always translate into actual behavior, other studies could distinguish between the group of those who traveled during COVID-19 and those who intend to travel during/after the pandemic. This way, it would be possible to measure the actual use of both traditional and technology-driven safety protective measures during travel. Since tourists' behavior might depend on a multitude of factors [4,72,76,81], these future studies could also include factors such as tourists' personality, age, education, and income. Furthermore, the sample of respondents may not be considered representative of the population but might instead be specific to the respondents. In this regard, data were collected online during the first wave of the pandemic, right after people were allowed to move more freely and visit other places. As Leiner [99] argues, collecting data fully online is capable of capturing more study participants, but it might result in

false data representations, and future research should consider using other methods of collecting data like on-site surveys to ensure samples that are random and more balanced. Since people living in different countries experienced (and still experience) this pandemic differently [90,91], specific country contexts might affect the results. While governments are trying to increase the number of vaccinated people, new waves of the pandemic might ask them to insist further on some protective measures and restrictions on movement. Therefore, cross-country studies, including countries that fought with the pandemic with more and less success, would enable better interpretation of the results. Finally, future research using the longitudinal method could replicate this approach and then compare the data collected by respondents from the two periods of the pandemic life cycle. This should also increase the generalizability of the findings.

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