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The use of food delivery apps during the COVID-19 pandemic in Brazil: The role of solidarity, perceived risk, and regional aspects

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ABSTRACT

This study aimed to evaluate the use of food delivery apps (FDA) during the COVID-19 pandemic in Brazil. A total of 950 questionnaires were collected, covering four Brazilian regions: Southeast, Central-West, Northeast, and South. The data was collected during the peak of the second wave of the pandemic. A questionnaire with 39 measurement items was applied using an online survey. These items were evaluated using a five-point Likert scale covering the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2). The data was analyzed using covariance-based structural equation modeling. About 47% of consumers use FDA weekly. The continuance intention of FDA during the pandemic in Brazil was affected by performance expectancy ($\beta = 0.496$; $p < 0.001$), social influence ($\beta = 0.094$; $p < 0.001$), hedonic motivation ($\beta = 0.068$; $p = 0.026$), price value ($\beta = 0.103$; $p < 0.001$), habit ($\beta = 0.305$; $p < 0.001$), frequency of using FDA ($\beta = 0.051$; $p = 0.039$), and solidarity with the foodservice sector ($\beta = 0.090$; $p < 0.001$). It was also observed that the continuance intention reduces risk perception ($\beta = -0.403$; $p < 0.001$), and risk perception reduces the frequency of using FDA ($\beta = -0.178$; $p < 0.001$). The results indicate that the UTAUT2 strongly explains consumers' continuance intention. Differences in path estimates among Brazilian regions were observed, indicating some regional differences. It was possible to observe a tendency of using FDA during and after the pandemic, motivated by several factors. The FDA developers and foodservice managers could use this data to improve their services. Policies must be established to increase consumer and employee safety during the delivery service.

1. Introduction

The COVID-19 pandemic significantly affected consumers' relationship with food and eating (Byrd et al., 2021). Given the spread of SARS-CoV-2, which causes COVID-19, the primary measures taken to prevent the virus from spreading aggressively were social distancing and stay-at-home orders. According to the Centers for Disease Control and Prevention (2020), social distancing can be understood as maintaining a safe space between you and other people who are not in your home. To be able to follow this measure, and due to stay-at-home orders, many foodservices were closed, including restaurants and snackbars. Some restaurants then changed their business models to address the coronavirus epidemic's challenges (Gavilan et al., 2021). These changes are being made possible by advances and development in electronic commerce, as "online to offline" (O2O) model (Cho et al., 2019; LI & Mo, 2015; Liu et al., 2017a, 2017b). O2O refers to platforms that allow consumers to buy products or services from physical companies online (LI & Mo, 2015). From the concept of O2O, food delivery applications (FDAs) emerged. FDAs act as a bridge between restaurants and markets with consumers, making it possible to receive food at home. Thus, both consumers and foodservice employees avoid personal contact, in keeping with social distancing. This type of application (hereafter, app) is increasingly widespread, given the advantages of this type of service and the increase in smartphone users, which exceeded five billion in 2019 (Cho et al., 2019; GSMA, 2020).

Due to the pandemic and restrictions on contact between people,

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food delivery has become one of the primary connections between people and the outside world (Blumtritt, 2020). Thus, some behavioral changes resulting from the pandemic may continue even after the stabilization phase (Blumtritt, 2020), such as using FDA if consumers build trust and satisfaction with mobile purchases (Gao et al., 2015). This is the first study attempting to provide empirical evidence of the drivers of FDA use in Brazil. Considering the country's continental size, we enrolled consumers from different regions, comparing them. Therefore, this study investigates the use and continuance intention of FDAs during the COVID-19 pandemic in Brazil using a model based on the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2). In this study, we extended the UTAUT2 by including risk perception and solidarity as new factors.

2. Literature review

2.1. Food delivery in Brazil and the COVID-19 pandemic

The continuous growth of the food delivery sector has been observed in several countries during the past few years. Globally, the overall turnover in the food delivery sector was $107.4 billion in 2019 (Blumtritt, 2020), increasing 17.5% compared to 2018. In Brazil, the growth of the sector is also salient. In 2019, the number of FDA users was 35.7 million, while the expectation for 2021 is 53 million (adjusted forecast for the impact of COVID-19) (Chevalier, 2020b). There was already a growing trend in the food delivery sector. However, the pandemic positively impacted the industry, increasing its sales beyond what was expected. For example, in June 2020, iFood©, the most popular FDA in Brazil (Chevalier, 2020a), managed 39 million orders, 9 million more than March of the same year, and 210% more than were registered November 2018 (Navarro, 2020).

There are several reasons the online food delivery service has become popular, but convenience is the most prominent (Cho et al., 2019). Through an app, the consumer has access to different types of food from a wide range of restaurants, anywhere, and at any time (Chai & Yat, 2019; Yeo et al., 2017). Also, consumers save time (i.e., no need to cook or go out to get food), can make a choice based on other people's ratings (using a restaurant review system), and compare prices (Blumtritt, 2020). In many countries, several official guidelines for restaurants reopening during the pandemic encourage the delivery and carry-out system to be used as the preferred method (Maragoni-Santos et al., 2021). Thus, the food delivery system became an interesting option during the pandemic, causing restaurants to adapt, change, and improve their business (Gavilan et al., 2021). These changes allowed restaurants to continue operating while facing the pandemic's challenges, and allowed consumers to have access to food away from home in a safer way. Therefore, it is crucial to understand which drivers are relevant to consumers regarding FDA services.

2.2. Unified Theory of Acceptance and Use of Technology (UTAUT)

The UTAUT was developed by Venkatesh et al. in 2003 and expanded by Venkatesh et al. in 2012. In its first version, the theory unified eight different models to explain the acceptance and use of technology through four direct determinants: performance expectancy, effort expectancy, social influence, and facilitating conditions (Venkatesh et al., 2003). In 2012, Venkatesh, Thong, and Xu (2012), to cover different contexts, expanded the theory, creating UTAUT2. Unlike the original theory, UTAUT2 focuses on the consumer. According to Venkatesh, Thong, and Xu (2012), specific theories provide a broader understanding of focal phenomena. Thus, UTAUT2 explains consumer behavior by the four original constructs from the UTAUT, adding hedonic motivation, price, and habit. It is believed that the constructs of UTAUT2, expanded with the inclusion of solidarity with the restaurant sector, can explain the intention to use FDAs in Brazil during the pandemic.

The first UTAUT2 construct, performance expectancy, refers to the user's perception of the performance benefit in a given activity resulting from a given technology. Thus, this construct contributes to determining the consumer's interest in adopting new technology. People perceive a lack of time based on several everyday factors. Any convenience is an attempt to save time with operational and time-consuming tasks (Saksena et al., 2018). Recently, Zhao and Bacao (Zhao & Bacao, 2020), in their study carried out in China, showed that performance expectancy positively affects the FDA's continuance intention. Prior studies also showed results reinforcing this effect. Users of FDAs perceive high utility, and express greater intention to continue using this technology (Roh & Park, 2019; Yeo et al., 2017). On the other hand, despite perceived performance advantages, many people experience difficulties in using technology. The effort expectancy is the perceived ease of use of a particular technology (Venkatesh et al., 2003). This construct appears to have a significant role in using mobile apps (Fang & Fang, 2016; Kang, 2014). Some studies have identified greater difficulty for the elderly and older adults to use this technology, requiring more effort to learn how to use smartphone apps (Morris, Venkatesh, & Ackerman, 2005; Zhou, Rau, & Salvendy, 2014). Despite this, users are increasingly familiar with the technology. After the initial contact, the barriers and difficulties may not evolve into an opposing driver of the intention of use (Zhao & Bacao, 2020). In a crisis, like a pandemic, the consumer can overcome difficulties and continue to use FDAs based on their perceived benefits. Accordingly, it is proposed the following hypotheses:

H1—Performance expectancy positively affects the continuance intention of FDAs.

H2—Effort expectancy is not related to the continuance intention of FDAs.

The social influence construct is characterized by an increased willingness of other people (e.g., family, friends, and colleagues) to use a particular technology (Venkatesh et al., 2003). The use of certain technologies seems to affect social inclusion (Hill et al., 2015). Thus, social influence seems to affect the continuance intention of apps, as presented in other studies (Chopdar & Sivakumar, 2019; Lai & Shi, 2015; Zhao & Bacao, 2020). The COVID-19 pandemic has raised concerns in families and among friends and loved ones (Fame-RN, 2020), increasing pressure for distancing measures. This construct must therefore have a substantial effect on the intention to continue during this period, since the use of FDAs minimizes interpersonal interaction (Gavilan et al., 2021; Wen et al., 2020). This leads to the following hypothesis:

H3—Social influence positively affects the continuance intention of FDAs.

According to Venkatesh et al. (2003), the fourth construct, facilitating conditions, is defined as the degree to which the individual believes that there is an adequate organizational and technical infrastructure to support the use of technology. It refers to the set of conditions that allows the consumer to have a greater intention to use technology. Thus, the continuance intention of using technology can be affected by the availability of money, time, internet access, and cognitive and motor abilities (Lu et al., 2008; Morris et al., 2005). In UTAUT, the conditions are measured by the perceived knowledge and resources available for the technology use, leading to the following hypothesis:

H4—Facilitating conditions positively affect the continuance intention of FDAs.

Fun or pleasure derived from the use of technology is evaluated by the construct of hedonic motivation. According to Brown and Venkatesh (Brown & Venkatesh, 2005), these attributes are essential in the acceptance of technology. Despite this, according to Venkatesh, Thong, and Xu (2012), the influence of hedonic motivation is more intense in consumers in the early stages of their experience. With the pandemic, many consumers have changed their ways of consuming food. Therefore, many are in this initial stage, using FDAs due to stay-at-home orders. The increase in experience weakens the effect of hedonic motivation as consumers start using the technology for more pragmatic purposes (Nishi, 2017; Venkatesh et al., 2012). This leads to the

following hypothesis:

H5—Hedonic motivation positively affects the continuance intention of FDAs.

The price value is the sixth construct. As noted by Tam et al., 2020, price is the financial cost to obtain and use a product (Xu et al., 2015), while value is an abstract concept, which varies according to the context (Chiu et al., 2005). Consumers bear the costs of using technology (Venkatesh et al., 2012), directly when paying for an app, or indirectly in the case of FDAs. The most popular and most-used FDA company in Brazil charges between 12% and 23% fees to food sellers (iFood, 2020). This fee is passed on to consumers. However, many sellers using the FDA may offer food at acceptable prices due to the FDA's incentives, increased sales, and lower operating costs such as rent, government taxes, and employees. Thus, the price value positively impacts the continuance intention when the consumer realizes that the benefits are greater than the price itself (Tam et al., 2020; Tandon et al., 2021; Venkatesh et al., 2012). Thus, the following hypothesis is proposed:

H6—Price value is positively related to continuance intention.

Finally, the last construct is habit, characterized as an automatic behavior arising from repeated situations influenced by people, places, or actions (Oulasvirta et al., 2012). Behaviors that become habitual are guided by automated cognitive processes instead of being elaborated by decision processes (Aarts et al., 1998). Besides, the influence of habit on the continuance intention depends on familiarity with the technology; that is, the continuance intention increases as the individual becomes familiar with a particular technology (Nascimento et al., 2018). The role of habit in continuance intention has been studied in different contexts, for example, online shopping (Hsu et al., 2015), e-commerce (Liao et al., 2006), smartwatch use (Bölen, 2020; Nascimento et al., 2018). Habit is classified as a behavioral factor, and in this context, as the frequency of use and past usage of a given technology (Yan, Filieri, & Gorton, 2021). The frequency of technologies' use is generally lower as age increases (Simform, 2021; Statista Research Department, 2021). Even when repeated use becomes a habit, it is difficult for older people to adapt to a new environment (Venkatesh et al., 2012), suppressing new learning (Lustig et al., 2004).

In addition, the habit and frequency of using FDAs may increase the continuance intention during the pandemic. Age may affect the frequency of using FDAs. The frequency of use of technology has been presented as a precedent of continuance intention in other works (Li et al., 2018; Yan, Filieri, & Gorton, 2021). Based on this, it is proposed the following hypotheses:

H7—Habit positively affects continuance intention.

H8—Frequency of using FDAs positively affects continuance intention.

H9—Age negatively affects the frequency of using FDAs.

2.3. Solidarity to the foodservice sector

The role of solidarity has already been positively identified as affecting consumers' intention to visit seated restaurants during the COVID-19 pandemic in Brazil (Hakim et al., 2021). In a moment of crisis, in both health and economic areas, one of the internal responses to reality is solidarity (Mishra & Rath, 2020). Solidarity is an agreement of feeling or action between people who have a common interest and therefore offer mutual support within a group (Solidarity | Definition of Solidarity by Oxford Dictionary, 2021). Attitudes through thoughts of solidarity can become concrete or not, according to financial availability. People's fragility in a social group can distance them from solidarity practices (Mishra & Rath, 2020). In a previous study in Brazil, it was observed that there was solidarity toward the restaurant sector only for consumers who kept their jobs during the pandemic (Hakim et al., 2021).

Due to the lockdown and stay-at-home orders, when there is no possibility of going to a restaurant or there is fear after reopening these establishments, the expression of solidarity can occur by searching for safer ways to use food services, such as delivery. COVID-19 encourages communities to coordinate their efforts to maintain life in this period of crisis and restrictions. O2O commerce is a form of support to the foodservice sector, and contains the virus's spread. Contemplating the needs of disadvantaged members, the collective responsibility of those who can take action in response may come to the fore (Reichlin, 2011), and solidarity has a role in reducing risks to the population during the pandemic crisis (Mishra & Rath, 2020). Considering this, it is offered the following hypothesis:

H10—Solidarity with the foodservice sector positively affects the continuance intention of FDAs.

2.4. Risk perception about COVID-19 and food delivery

The consumer's decision is the result of a balance between the benefits and perceived risks in the acquisition of a product or service. Risk perception is a person's understanding and assessment of the possible negative results derived from their decision-making process (Dowling & Staelin, 1994). In the case of O2O purchases, the perceived risk extends to what the consumer expects as the outcome of an online transaction, which may be a negative (Forsythe & Shi, 2003). In O2O purchases, consumers have fewer cues about the service or product, increasing the uncertainty about achieving their purchase objective (Swinyard & Smith, 2003). The perception of risk in O2O transactions can be motivated by the risk of the product or service not meeting expectations, by the loss of the product in delivery, loss of time, financial loss, and even by the vulnerability of security and data privacy. When consumers perceive those risks as high, they do not intend to continue using O2O transactions (Shao et al., 2019).

In a pandemic situation, in which the population has increased levels of fear and anxiety (Asai et al., 2021; Chen & Eyoun, 2021; Torales et al., 2020), the perception of risk can also include the fear of contagion through food, packaging, and contact with the delivery person at the time of delivery. However, the relationship between risk perception and practices can be confusing. It is observed that risk perception can motivate practices, but the contrary is also true. In routine situations, the practice can increase optimism due to many cognitive biases (Shepperd et al., 2015), especially for hazards with which subjects have little personal experience (Weinstein, 1989). This optimism could hinder efforts, messages, and campaigns aiming at protective behaviors. Therefore, a low perceived risk about food delivery could increase the use of FDAs.

People reduce their perceptions of risk based on many aspects to legitimize their practices (de Andrade, Stedefeldt, Zanin, Zanetta, & da Cunha, 2021). In other words, the UTAUT2 factors will probably have a substantial effect on the FDA's continuance intention. If the consumer perceives as high the risk of COVID-19 when receiving food, there will be a conflict with the other factors favoring this practice, generating anxiety. This anxiety is a psychological response to the feeling of threat (Taha, Matheson, & Anisman, 2014), therefore being rationalized as a risk. Consumers with high continuance intention could have reduced their perceived risk of COVID-19, reducing their anxiety and legitimizing the FDA's use. This effect is possible due to people's uncertainty about the coronavirus's contamination via food or its packaging, despite international organizations' orientations (Food and Drug Admninistraion (FDA), 2020; World Health Organization [WHO], 2020). Considering all of this, it is offered two hypotheses:

H11—The continuance intention may reduce the risk perception of COVID-19 during delivery.

H12—Risk perception may reduce FDA use.

Proposed model

Some different theories explain the intention to use the FDA (Kaur, Dhir, Talwar, & Ghuman, 2021; Lee, Sung, & Jeon, 2019; Ray et al., 2019; Song et al., 2021). However, according to previous studies and literature, the UTAUT is considered a critical and renowned theory (Jadil et al., 2021) to explain the use of information systems and apps. It

is believed that the UTAUT factors will predict FDAs' continuance intention during the COVID-19 pandemic in Brazil. It was expanded the theory by adding solidarity with the foodservice sector, the frequency of using FDAs and risk perception. Zhao and Bacao (2020) suggested and highlighted the importance of comparing different regions or countries. So, it was also attempted to compare four Brazilian regions. Fig. 1 depicts the hypothesis model of this study.

3. Methods

3.1. Sample and data collection

Data were collected using the online platform Google Forms (Alphabeth Inc. Mountain View – U.S.). First, a pilot test was conducted with twenty consumers to evaluate the clarity of the questionnaires and the response time (≅ 10 min). A non-probability purposive, with chain-referral sampling, was employed. Facebook, Instagram, WhatsApp, and SMS (short message service) were used to invite consumers. According to Kyriazos (2018) studies with communalities close to 0.50, factors with multiple indicators (>3), and factors with high loadings (>0.70) must present n ≅ 200. Samples n ≅ 1000 can classified as excellent (Comrey & Lee, 1992). A total of 950 questionnaires were collected from March 11 to March 15, 2021. The sample was proportional, covering four Brazilian regions and populations: South (n = 140), Southeast (n = 357), Central-West (n = 200) and Northeast (n = 253). No restrictions were applied regarding gender or level of education. Since the study population is large and accessible, and online research was used, an increased sample number was employed to increase heterogeneity and reduce sampling error (Hair et al., 2019). The sample power was calculated as 0.99, considering alpha = 0.05; RMSEA = 0.05 and degrees of freedom = 222 (Preacher & Coffman, 2006).

To increase data quality, a verification question was used in the middle of the questionnaire: "Please answer '37' for this question." The position of the correct answer was random, with five possible answers with different numbers. Consumers who answered a number other than 37 were excluded. To avoid straightliners, some questions were included with an inverted answer. Also, the standard deviation (SD) between the indicator variables was checked for each participant. Five participants were excluded for presenting SD = 0.

The study was conducted during the second wave peak of COVID-19 in Brazil. According to data from the Johns Hopkins University (Johns Hopkins University, 2020) platform, Brazil presented 11,278,000 cases of COVID-19 and 272,889 deaths up to the study period. Seven-day moving averages of 1,705 and 1,832 deaths per day were observed on the first and last day of the research, respectively. All participants signed an informed consent form electronically. The University of Campinas Ethics Committee approved the study (protocol: 15065019.3.0000.5404; September 25, 2020).

3.2. Measures

A questionnaire was administered to examine the research hypotheses. The questionnaire had 55 items. The first part had 39 measurement items as indicator variables and was adapted based on numerous studies (Bhattacherjee, 2001; Hakim, Zanetta, & da Cunha, 2021; Venkatesh, Morris, Davis, & Davis, 2003; Venkatesh, Thong, & Xu, 2012; Zhao & Bacao, 2020; Cho et al., 2019; Nishi, 2017; Roh and Park, 2019; Shao et al., 2019). It was used the translated and validated version of UTAUT for Brazilian Portuguese (Nishi, 2017). This part included the constructs of performance expectancy (4 indicators), effort expectancy (4 indicators), social influence (3 indicators), facilitating conditions (3 indicators), hedonic motivation (3 indicators), price value (4 indicators), habit (4 indicators), continuance intention (4 indicators), risk perception (4 indicators), and solidarity with the restaurant sector (4 indicators). The indicators were measured using a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. The second part had 16 questions about sociodemographic characteristics (e.g., sex, age, education level, job situation etc.) and the use of the FDA (e.g., frequency of use, and the average value of orders).

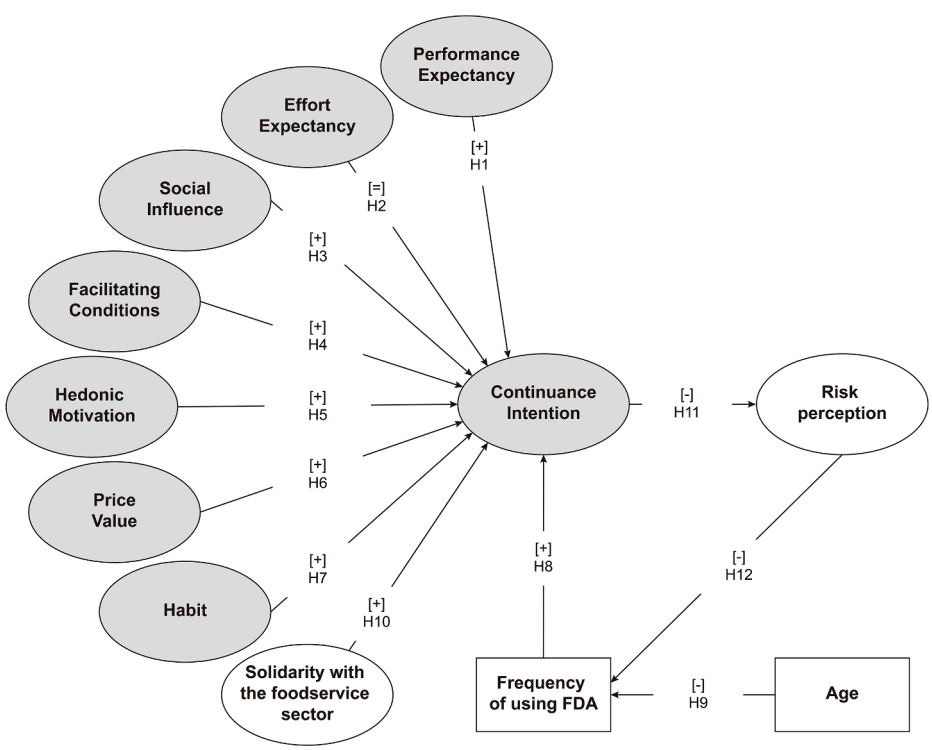

Fig 1. Proposed model. *Ellipses are constructs; Gray ellipses are UTAUT2 constructs; Rectangle is an observed variable. The positive and negative sign indicates the hypothesis direction.*

3.3. Data analysis

Common-method bias was assessed using Harman's single factor score (Podsakoff et al., 2003) (<50% variance). A single factor explaining 28.8% of the total variance was extracted, suggesting that common-method bias did not affect the data.

The hypotheses were tested using a covariance-based structural equation model (SEM). First, a measurement model was assessed using confirmatory factor analysis. The constructs' reliability and validity were verified using composite reliability (CR), Cronbach's alpha, factor loadings, and average variance extracted (AVE). The heterotrait–monotrait (HTMT) ratio of correlations was used to test discriminant validity. A structural model was developed to estimate path coefficients. A bootstrapping procedure with 1,000 samples was applied. Model adjustment was analyzed according to Hu and Bentler (Hu & Bentler, 1999) using the comparative fit index (CFI) > 0.90, the Tucker-Lewis index (TLI) > 0.90, the standard root mean squared residual (SRMR) < 0.10, and the root mean square error of approximation (RMSEA) < 0.06. Model explanatory power was measured (R^2). Values of 0.26, 0.13, and 0.02 were considered large, medium, and small effects (Cohen, 1988).

The multiple-group analysis was used to test the moderating effect of gender, employment status, and different Brazilian regions. The Brazilian regions were analyzed as four dummy variables (e.g., 1 = Southern, 0 = not Southern). First, the chi-square value of the structural weight and unconstrained models were compared. Then, after observing differences, each path was constrained to observe differences among the regions.

There were no problems with missing data since the volunteer had to complete the entire form before submission. Statistical analyses were performed using Statistical Package for Social Sciences (SPSS) v.20 and Analysis of Moment Structures (AMOS) v.26.0. For all analyses, a p-value of < 0.05 was considered significant.

4. Results

4.1. Descriptive and measurement model

A sample of 945 individuals was employed from different Brazilian regions. The sample comprised 40.5% young adults (18–29 years old), 55.0% adults (30–59 years old), and 4.5% elderly (≥60 years old), with an average age of 34.79 ± 11.7 years; 72.9% were female. The sample is highly educated, with 77.1% with a complete higher education and relatively young (Table 1). Thirthy-seven percent of consumers use FDAs at least once a week, especially for dinner on weekends. No differences were found when comparing FDA use and different regions. An important percentage also uses FDAs for lunch (17.4%) and dinner (35.1% during weekdays).

All constructs presented adequate reliability, with high CR > 0.70, factor loadings > 0.50 (Table 2). The Cronbach's alpha for each construct was as follows: performance expectancy (0.796), effort expectancy (0.905), facilitating conditions (0.667), hedonic motivation (0.904), price (0.860), habit (0.864), social influence (0.903), continuance intention (0.874), risk perception (0.806), and solidarity with the foodservice sector (0.893)—all > 0.60 threshold (Hair et al., 2009). Adequate convergent validity was observed, with AVE's square root higher than the latent variables' correlation. Also, all AVE was > 0.50 (Fornell & Larcker, 1981).

The HTMT values ranged between 0.21 and 0.81, below the threshold of 0.85 (Henseler et al., 2015), demonstrating adequate discriminant validity (Table 3). The measurement model presented an adequate fit with CFI = 0.94, TLI = 0.93, SRMR = 0.05 and RMSEA = 0.05.

Table 1
Sample characteristics.

Variable	n	%	Variable	n	%
Sex			*Marital status*		
Male	256	27.1	Single	473	50.1
Female	689	72.9	Married	422	44.7
Age (Years old)			Divorced	44	4.7
18–29	383	40.5	Widow	6	0.6
30–39	303	32.1	*Number of children*		
40–49	138	14.6	One	165	17.5
50–59	78	8.3	Two or more	186	19.7
60 or more	43	4.6	None	594	62.9
Education level			*Family income**		
Incomplete primary education	0	0.0	Up to R$998.00	22	2.3
Complete primary education	6	0.6	R$998.01 to R $1,996.00	77	8.1
Incomplete high school	2	0.2	R$1,996.01 to R $4,990.00	215	22.8
Complete high school	48	5.1	R$4,990.01 to R $9,980.00	270	28.6
Incomplete higher education	160	16.9	R$9,980.01 to R $14,970.00	175	18.5
Complete higher education	247	26.1	R$14,970.01 to R $19,960.00	64	6.8
Postgraduate	482	51.0	More than R $19,960.00	53	5.6
			I do not want to answer	69	7.3
Job situation			*Needed emergency assistance provided by the government (R$ 600.00*)*		
Formal job	294	31.1	Yes	106	11.2
Home Office due pandemic	381	40.3	No	839	88.8
Unable to work due to pandemic	29	3.1	*Frequency of using FDA*		
Informal job	73	7.7	Once a day or more frequently	11	1.2
Unemployed	134	14.2	3 to 6 times a week	83	8.8
Retired	34	3.6	Once or twice a week	351	37.1
			1–3 times per month	357	37.8
*The average value of orders via FDA (including shipping)**			Less than once a month or never	143	15.1
R$10.00 - R$19.99	45	4.8			
R$20.00 - R$ 29.99	124	13.1	*Most frequent meals using FDA*†		
R$30.00 - R$ 39.99	172	18.2	Breakfast (weekdays)	5	0.5
R$40.00 - R$49.99	120	12.7	Breakfast (weekends)	6	0.5
R$50.00 - R$59.99	144	15.2	Lunch (weekdays)	164	17.4
R$60.00 - R$69.99	104	11.0	Lunch (weekends)	174	18.4
R$70.00 - R$79.99	72	7.6	Afternoon snack (weekdays)	70	7.4
R$80.00 - R$89.99	56	5.9	Afternoon snack (weekends)	59	6.2
R$90.00 - R$99.99	39	4.1	Dinner (weekdays)	332	35.1
R$100.00 or more	69	7.3	Dinner (weekends)	722	76.4

* R$5.68 = US1.00;
† The participant could check more than one option.

4.2. Structural model

The final structural model (Fig. 2) presented adequate fit with CFI = 0.92, TLI = 0.91, SRMR = 0.08, and RMSEA = 0.05. Hypotheses 1, 2, 3, 5, 6, 7, 8, 9, 10, and 11 were confirmed, while Hypothesis 4 was not. The continuance intention of FDA during the pandemic in Brazil was affected by performance expectancy (*H*1: $\beta = 0.496$; $p < 0.001$), social influence (*H*3: $\beta = 0.094$; $p < 0.001$), hedonic motivation (*H*5: $\beta = 0.068$; $p = 0.026$), price value (*H*6: $\beta = 0.103$; $p < 0.001$), habit (*H*7: $\beta = 0.305$; $p < 0.001$), frequency of using FDA (*H*8: $\beta = 0.051$; $p = 0.039$), and solidarity with the foodservice sector (*H*10: $\beta = 0.090$; $p < 0.001$). It was also observed that the continuance intention reduces risk perception

Table 2
Factor loadings, means, standard deviation, composite reliability, and average variance extracted of constructs and indicators.

Construct/Indicators	Factor loading	Mean ± SE	CR	AVE
Performance expectancy (Bhattacherjee, 2001; Venkatesh, Morris, Davis, & Davis, 2003; Zhao & Bacao, 2020; Roh and Park, 2019)	–	–	0.82	0.54
I feel that food delivery apps are useful for ordering and receiving delivery food during the COVID-19 pandemic.	0.814	4.79 ± 0.01		
I feel food delivery apps are convenient to order and receive delivery food during the COVID-19 pandemic.	0.803	4.73 ± 0.02		
Using food delivery apps improves the process of ordering and receiving delivery food.	0.746	4.66 ± 0.02		
Using food delivery apps improves the efficiency of ordering and receiving delivery food during the COVID-19 pandemic.	0.604	4.32 ± 0.03		
Effort expectancy (Venkatesh, Morris, Davis, & Davis, 2003; Yuan, Liu, Yao, & Liu, 2014; Zhao & Bacao, 2020)	–	–	0.91	0.72
Learning how to use food delivery apps is easy.	0.895	4.57 ± 0.02		
It is easy to follow all the steps of food delivery apps.	0.911	4.58 ± 0.03		
It is easy to become skillful at using.	0.844	4.52 ± 0.03		
Interaction with food delivery apps is clear and comprehensible.	0.757	4.24 ± 0.03		
Facilitating conditions (Nishi, 2017; Venkatesh et al., 2012)	–	–	0.74	0.50
I have the resources necessary to use food delivery apps.	0.756	4.79 ± 0.02		
I have the knowledge necessary to use food delivery apps.	0.847	4.77 ± 0.02		
Food delivery apps are similar to other apps I use.	0.506	4.13 ± 0.03		
Hedonic motivation (Nishi, 2017; Venkatesh et al., 2012)	–	–	0.90	0.76
Using food delivery apps is fun.	0.838	3.28 ± 0.04		
Using food delivery apps is enjoyable.	0.894	3.70 ± 0.04		
Using food delivery apps is very entertaining.	0.887	3.28 ± 0.04		
Price value (Nishi, 2017; Venkatesh et al., 2012)	–	–	0.88	0.65
Food delivery apps is reasonably priced.	0.839	3.76 ± 0.03		
Food delivery apps is a good value for the Money.	0.906	3.83 ± 0.03		
At current price, food delivery apps provides a good value.	0.860	3.68 ± 0.03		
I believe I can save money when using food delivery apps	0.590	2.87 ± 0.04		
Habit (Nishi, 2017; Venkatesh et al., 2012)	–	–	0.87	0.62
The use of food delivery apps has become a habit for me.	0.879	3.30 ± 0.05		
I'm addicted to using food delivery apps.	0.812	2.70 ± 0.05		
I must use food delivery apps.	0.587	2.32 ± 0.04		
Using food delivery apps has become natural for me.	0.854	3.36 ± 0.05		
Social influence (Venkatesh, Morris, Davis, & Davis, 2003; Zhao & Bacao, 2020)	–	–	0.91	0.71
People who are important to me (e.g., family members, close friends, and colleagues) recommend I use food delivery apps during the COVID-19 pandemic.	0.788	3.22 ± 0.04		
	0.910	3.48 ± 0.04		
People who are important to me think food delivery apps are beneficial during the COVID-19 pandemic.				
People who are important to me think it is a good idea to use food delivery apps during the COVID-19 pandemic.	0.876	3.76 ± 0.04		
People who are important to me support me to use food delivery apps.	0.793	3.60 ± 0.04		
Continuance intention (Bhattacherjee, 2001; Venkatesh, Thong, & Xu, 2012; Zhao & Bacao, 2020; Cho et al., 2019; Shao et al., 2019)	–	–	0.89	0.68
I intend to use food delivery apps during the COVID-19 pandemic continuingly.	0.908	4.23 ± 0.03		
If I have an opportunity, I will continuingly order food through food delivery apps.	0.914	4.20 ± 0.03		
I will always try to use food delivery apps in my daily life.	0.628	3.07 ± 0.04		
I am willing to use food delivery apps in the future continuingly.	0.831	4.07 ± 0.04		
Risk perception (Hakim et al., 2021)	–	–	0.81	0.53
I believe that the risk of contaminating myself with COVID-19 when receiving food at home is low.*	0.802	2.51 ± 0.04		
I believe that the restaurants registered in the food delivery apps follow recommendations to reduce the risk of contamination by COVID-19.*	0.585	2.73 ± 0.03		
The risk of COVID-19 contamination is lower using food delivery apps than going to restaurants.*	0.654	1.85 ± 0.03		
I believe that the risk of package contaminating me is low when using food delivery apps*	0.843	2.53 ± 0.04		
Solidarity with the food services sector (Hakim et al., 2021)	–	–	0.90	0.70
I use food delivery apps during the pandemic to prevent restaurants from closing permanently.	0.935	3.54 ± 0.04		
I use food delivery apps during the pandemic to prevent sector employees from becoming unemployed.	0.950	3.61 ± 0.04		
I use food delivery apps during the pandemic to channel money into the sector.	0.859	3.30 ± 0.04		
I am worried about the restaurant's situation during the pandemic	0.550	4.27 ± 0.03		

*The answers were inverted. Higher values indicate higher risk perception. SE = Standard error; CR = composite reliability; AVE = Average variance extracted.

($H11$: $\beta = -0.403$; $p < 0.001$), and risk perception reduces the frequency of using FDA ($H12$: $\beta = -0.178p < 0.001$). The age reduces frequency of using FDAs ($H9$: $\beta = -0.009p < 0.001$). The continuance intention model presents a large explanatory power ($R^2 = 0.64$). The risk perception and frequency of using FDA presented small ($R^2 = 0.06$) and medium ($R^2 = 0.14$) explanatory power.

Some moderation effects were investigated. In the moderation model, the effect of solidarity is higher for women than men ($p = 0.02$). On the other hand, the employment status has not moderated the effect of solidarity ($p = 0.29$). The age did not moderate any UTAUT2 construct. It was found differences in path estimates among the Brazilian regions (Table 4). Consumers from the Northeast region presented stronger estimates of effort expectancy, price value, and solidarity in the FDA's continuance intention. In the Southeast region, we observed stronger effects of performance expectancy and social influence. Also, a lower effect of continuance intention was observed in the risk perception. Finally, in the Central-West region, a stronger effect of hedonic motivation on continuance intention was observed.

Table 3
Discriminant validity with HTMT correlations with 97.5% confidence intervals.

Constructs	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Performance expectancy (1)	–								
Effort expectancy (2)	0.55 (0.44–0.64)								
Facilitationg conditions (3)	0.64 (0.49–0.75)	0.81 (0.76–0.83)							
Hedonic motivation(4)	0.49 (0.43–0.55)	0.41 (0.33–0.47)	0.38 (0.28–0.45)						
Price (5)	0.46 (0.35–0.53)	0.29 (0.20–0.37)	0.36 (0.25–0.44)	0.46 (0.39–0.52)					
Habit (6)	0.43 (0.38–0.49)	0.34 (0.28–0.38)	0.33 (0.26–0.39)	0.45 (0.38–0.51)	0.31 (0.24–0.36)				
Social influence (7)	0.40 (0.31–0.46)	0.21 (0.13–0.28)	0.23 (0.18–0.36)	0.37 (0.29–0.43)	0.30 (0.21–0.37)	0.58 (0.51–0.63)			
Continuance intention (8)	0.61 (0.54–0.68)	0.42 (0.34–0.49)	0.43 (0.35–0.53)	0.53 (0.48–0.58)	0.46 (0.39–0.52)	0.75 (0.71–0.78)	0.57 (0.50–0.63)		
Risk perception (9)	0.36 (0.27–0.44)	0.31 (0.22–0.39)	0.34 (0.23–0.43)	0.30 (0.21–0.37)	0.39 (0.31–0.46)	0.30 (0.22–0.37)	0.31 (0.23–038)	0.40 (0.31–0.47)	
Solidarity with the food services sector (10)	0.29 (0.21–0.36)	0.21 (0.12–0.29)	0.26 (0.16–0.34)	0.31 (0.23–0.37)	0.22 (0.13–0.29)	0.37 (0.30–0.44)	0.34 (0.26–0.41)	0.45 (0.38–0.52)	0.36 (0.28–0.43)

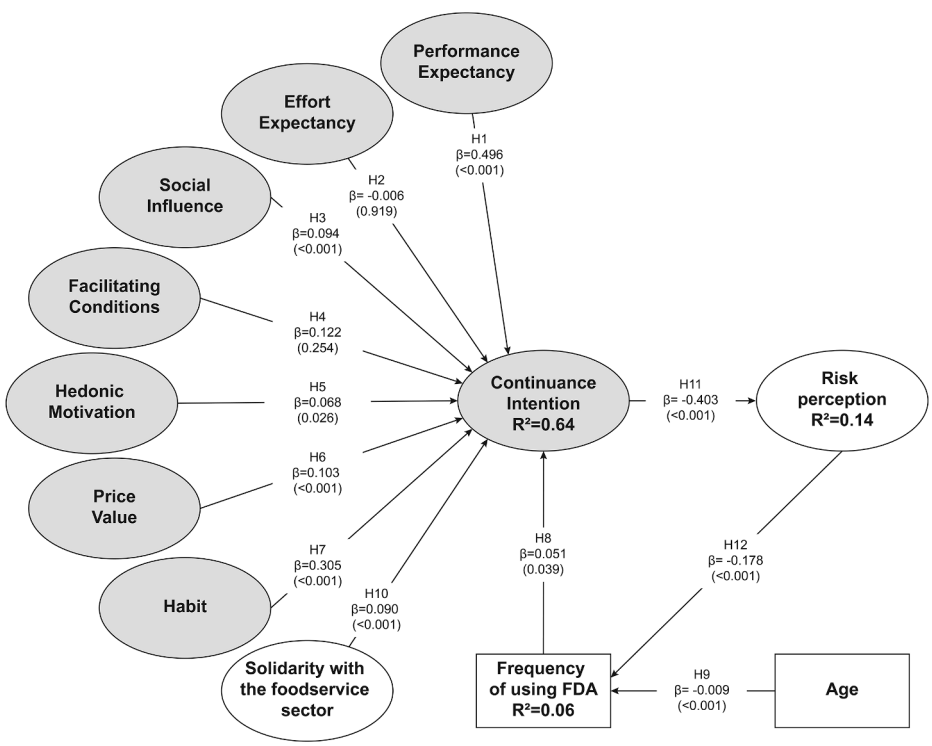

Fig 2. Structural model. *The numbers represent the path coefficient values (β), and the numbers within parentheses represent the p-values. Ellipses are constructs; Gray ellipses are UTAUT2 constructs; Rectangle is an observed variable.*

5. Discussion

5.1. General discussion and theoretical implications

This study aimed to examine the use and intention to continue using the FDA during the COVID-19 pandemic in Brazil. Based on the SEM, it was observed that most of the UTAUT2 constructs, together with solidarity toward the foodservice sector and the frequency of use, predicted the FDA's continuance intention. The theoretical use of UTAUT2 has already proved to be adequate in a study with Jordanians explaning the FDA's continuance intention during the COVID-19 disease, corroborating the findings found here (Alalwan, 2020). In our study, the total variance explained by the proposed factors was 64% for continuance intention. Most of the continuance intention of FDA could be predicted by the identified factors. Performance expectancy was the construct with the largest estimate in continuance intention. Other studies have already reported the primary role of convenience (e.g., saving time) in motivating consumers to buy/browse apps, including food delivery (Furst, Connors, Bisogni, Sobal, & Falk, 1996; Grøtnes, 2009; Lee, Sung, & Jeon, 2019; Cho et al., 2019). The fact that the FDA presents a list of different restaurants, facilitates the choice and experience of the consumer, motivating the use of apps (Ray et al., 2019). The second most important construct that affects continuance intention is habit. The strong effect of habit on continuance intention may result from new habits arising from the pandemic (Zhao & Bacao, 2020). At various times during the pandemic, consumers found themselves locked at home, with few

Table 4
Multiple-group analysis of different Brazilian regions.

Hypotheses and paths	Northeast	Southeast	South	Centerwest	p-value
	Estimates ± SE				
H1: performance expectancy → continuance intention	0.15 ± 0.07	**0.50 ± 0.08**	0.33 ± 0.12	0.28 ± 0.09	**<0.01**
H2: effort expectancy → continuance intention	**0.21 ± 0.06**	0.02 ± 0.06	−0.01 ± 0.11	−0.08 ± 0.07	**<0.01**
H3: social influence → continuance intention	0.04 ± 0.04	**0.18 ± 0.03**	0.08 ± 0.05	0.09 ± 0.05	**0.01**
H4: facilitating conditions → continuance intention	−0.08 ± 0.11	0.04 ± 0.11	−0.03 ± 0.16	0.14 ± 0.13	0.32
H5: hedonic motivation → continuance intention	−0.05 ± 0.06	0.09 ± 0.05	0.20 ± 0.07	**0.24 ± 0.07**	**0.05**
H6: price value → continuance intention	**0.22 ± 0.05**	0.01 ± 0.03	0.10 ± 0.07	0.10 ± 0.05	**0.03**
H7: habit → continuance intention	0.36 ± 0.04	0.30 ± 0.03	0.31 ± 0.05	0.34 ± 0.04	0.24
H8: frequency of using FDA → continuance intention	0.11 ± 0.01	0.11 ± 0.01	0.09 ± 0.01	0.09 ± 0.01	0.61
H9: age → frequency of using FDA	−0.01 ± 0.01	−0.01 ± 0.01	−0.01 ± 0.01	−0.01 ± 0.01	0.28
H10: solidarity → continuance intention	**0.20 ± 0.04**	0.13 ± 0.03	0.05 ± 0.05	0.06 ± 0.04	**0.03**
H11: continuance intention → risk perception	−0.38 ± 0.05	**−0.11 ± 0.05**	−0.30 ± 0.08	−0.42 ± 0.06	**<0.01**
H12: risk perception → frequency of using FDA	−0.05 ± 0.01	−0.03 ± 0.01	−0.02 ± 0.01	−0.05 ± 0.01	0.69

SE = Standard error; Bold values indicate significant value compared with other regions.

options for safe contact with the external environment, and food delivery was one of these options. Consumers can order their favorite dishes in the restaurants they like best during stay-at-home orders. Besides, a practice that eventually emerged was using the FDA to give gifts to others, by sending sweets and drinks, for example. Thus, throughout the pandemic period, with an increased frequency of FDA use, the habit may have strengthened, influencing people to continue using the FDA now, and probably after the pandemic.

Unlike the result presented by Venkatesh et al. (2012), hedonic motivation was not the most robust antecedent of the continuance intention. Kumar & Shah (2021) showed the relevance of pleasure in the FDA's continuance intention during the pandemic. However, this factor seems to be more related to the app's aesthetic issues, differently from what was evaluated in this study. The difference in results may be associated with the type of app evaluated, one's experience, and the participants' gender. Unlike social networking apps or games, FDAs are apps that facilitate routine activities, such as taxis/rideshares, or banking. In this case, consumers value practical apps. However, effort expectancy and facilitating conditions were constructs that did not significantly predict our sample's continuance intention. These constructs were proposed in 2012 (Venkatesh et al., 2012) and are related to the ease of use of the apps and the resources needed to make it possible. In 2012, the use of smartphones and apps was much less widespread than today. The increase in availability, familiarity, and users' experience with this type of technology may have resulted in the non-significance of these constructs' influence in the continuance intention (Song et al., 2021). Our result, associated with Zhao and Bacao (2020) results, indicates that the effort expectancy construct is not relevant for FDA use during the pandemic. Moreover, the effect of facilitating conditions on continuance intention is stronger in studies with smaller sample sizes (e.g., n ≅ 100) (Jadil et al., 2021). This effect should be more explored in a non-pandemic scenario.

The last construct with a significant effect on continuance intention was solidarity. In the study by Hakim et al. (2021), a similar effect of solidarity was observed in the intention to visit restaurants during the pandemic. This effect of solidarity may be associated with admiration for those who work during the pandemic and concern about the economic crisis (Hakim et al., 2021). We extended UTAUT2 to understand the use of FDA in Brazil during the pandemic, including solidarity. We understand that solidarity must be a situational factor. Its effect is likely to be reduced as the pandemic is controlled.

A compelling theoretical contribution is continuance intention reducing the perception of risk. Mehrolia, Alagarsamy, and Solaikutty (2021) had already shown a relationship between perceived risk and a reduced probability of ordering food through online delivery services during the COVID-19 pandemic in India. The risk of ordering food via the FDA is lower than visiting restaurants during the pandemic due to reduced probability of catching the virus. Thus, the consumer ends up having a more optimistic view of the FDA's use, grounded in a perceived lower probability of contraction. The risk in delivery is reduced due to less contact between people, but COVID-19 is a new disease with a high uncertainty level. When comparing their risk when using FDA with a salient high-risk practice (e.g., eating out), the consumer may have cognitive distortions and be excessively optimistic (da Cunha et al., 2014). With many factors favoring the use of the FDA, the consumer avoids the anxiety generated by the risk of contamination and the distance from "normal life" at a time with many restrictions. An over-optimistic consumer may neglect protection practices during contact with delivery employees, which is a dynamic population and may have a high potential for transmission (Ortiz-Prado et al., 2021). This low-risk awareness seems to be the drive by a high continuance intention; that is, the higher the continuance intention, the more confident consumers become, minimizing their risk awareness (da Cunha, Braga, Passos, Stedefeldt, & de Rosso, 2015; de Andrade, Stedefeldt, Zanin, Zanetta, & da Cunha, 2021).

We observed differences between the different regions of Brazil. This was expected, as Brazil is a large country with vast social and cultural differences between regions (Instituto Brasileiro de Geografia e Estatística, 2018). The constructs showed different intensities in the estimates when comparing regions. Interestingly, the Northeast region presented the highest price value estimate and the lowest for performance expectancy. This result may be associated with a low perception of convenience benefits in the use of FDAs, raising the perception of price value. In contrast, the Southeast had the highest beta for performance expectancy and the second-lowest price value. The majority of Northeast states have the lowest human development indices in Brazil, while Southeast's states have the higher indices (Instituto de Pesquisa Econômica Aplicada (IPEA), 2019), probably reflecting those effects. Consumers from the Southeast region had a lower estimate for perceived risk than the other regions, i.e., higher perceived risk for COVID-19. This increased risk perception may be associated with the high number of cases and deaths in the Southeast, totaling 44.5% of Brazil's deaths due to COVID-19 (Johns Hopkins University, 2020). Also, given this slightly higher risk perception, consumers can understand the use of FDA as a protective measure, raising the perception of benefits related to its use, justifying this region's highest beta value for performance expectancy. Still associated with a greater perception of risk in the Southeast, we can highlight the significant differences in social influence construct. Like

previous insights, due to the number of cases and deaths in that region, friends and families may recommend more FDA use as protection. It is important to note that many social and cultural differences may have affected these differences.

5.2. Practical and policy implications

This study has some important practical and policy implications. First, effort expectancy and facilitating conditions had no effect on continuance intention. On the other hand, strong effects were observed for performance and habit. Both FDA companies and restaurants could improve the app and service performance, reducing the time to request and deliver food, for example. About 76% of respondents used FDA for dinners on the weekend. Restaurant owners can explore this behavior, increasing their visibility and promoting attractive options, and be aware of consumers' satisfaction rates, maximizing their interests. Consumer satisfaction can generate positive word-of-mouth and social influence, improving sales and maintaining the foodservice, reducing the negative impacts of the pandemic.

Second, since the intention to use an FDA reduces risk perception, actions to promote employees' and consumers' safety are urgent. Public policies on food safety must clearly state the best practices (e.g., ensure an adequate waiting area in restaurants with accessible toilets) and necessary protection equipment (e.g., face masks) for the delivery employees. Despite the lower risk of contamination during the delivery, the risk still exists. The FDA could be used for education strategies, informing the consumer about protection practices like (a) checking to see if the delivery employee is using a mask; (b) encouraging contactless payment; (c) changing the primary package; and (d) washing hands before receiving the food. Foodservice owners and managers and FDA companies must promote and incentivize safe practices among delivery employees, such as (a) giving employees face masks and incentivizing their use; (b) giving and promoting the use of hand sanitizers; (c) promoting careful hygiene with transport containers; and (d) sending employees home if a manager suspects the workers are sick.

Third, the FDA developers and foodservice owners must be aware of consumers' intentions in different regions. Local assessments are necessary to consider social and cultural aspects, increasing the FDA's interest and continuance intention.

5.3. Limitations and future research

This study has two main limitations. First, due to the pandemic's current scenario, the study was conducted using an online approach. Online research limits the participation of low-income people or those with difficulty accessing the internet or technology. Information from this population stratum may be essential to improve access and use of FDA in Brazil. Second, many FDAs exist in Brazil, three of them highly popular. The responses may differ based on which app is primarily used by the consumer, especially for constructs such as effort expectancy, hedonic motivation, and price value. New studies could focus on those apps, measuring their popularity, use intention, and the drivers of UTAUT.

The risk perception of COVID-19 should be better explored in future research. Even if the risk of contamination via delivery is low, an overly optimistic consumer may neglect several protection measures. Based on heuristics, consumers or someone in their family who had the severe form of the disease could present a higher risk perception, with little or no effect of intention on it. It is paramount to investigate how the optimistic bias and low perceived risk affect other consumers' food-related behavior considering their personal experience and risk factors and comparing them with other hazards (e.g., latent or salient hazards). Also, it is suggested that an in-depth investigation should study delivery employees' hygienic practices and behavior and consumer behavior regarding health choices in the FDA. With the increased use of FDAs, researching these professionals is critical, as they are the final part of the meal production chain.

6. Conclusion

It was possible to investigate the continuance intention of FDAs during the pandemic in Brazil. Through an empirical study with high explanatory power, we examined the use of FDA and its effect on risk perception regarding COVID-19 during food delivery. The positive effects of performance expectancy, social influence, hedonic motivation, price value, habit, solidarity with the foodservice sector, and frequency of using FDAs on continuance intention were observed. The continuance intention reduced the risk perception, indicating that this intention could lead to an optimistic view of COVID-19 risk. At the same time, the reduction in risk perception may increase the use of FDAs.

The COVID-19 pandemic has greatly changed the foodservice industry and consumer perceptions. With the pandemic's tendency to continue, this study's results may help the sector shortly. A new assessment will be necessary if there is an attenuation of the pandemic in the country, including the FDAs use in different population strata.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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