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Perceptions and practices on food safety among food delivery services: insights into their relationship

Percepções e práticas sobre segurança dos alimentos em serviço de *delivery* de alimentos: como se enxerga essa relação

Abstract

Introduction: The purchase of meals through delivery services, a previously established trend, gained momentum in Brazil during the Covid-19 pandemic. *Objective*: To evaluate the perceptions of responsibility and hygiene practices implemented by managers of commercial restaurants to ensure the safety of meals delivered through delivery services. *Method*: A self-administered questionnaire was utilized, which was divided into five sections: I. Analysis of risk perception; II. Identification of the socioeconomic profile of managers; III. Analysis of business characteristics; IV. Assessment of food safety assurance systems; and V. Evaluation of the company's delivery system before and during the Covid-19 pandemic. All sections were answered using a five-point Likert scale. *Results*: Among the 37 participating commercial restaurants, 13 managers reported not feeling responsible for the sanitation of delivery containers (p=0.003), and 25 expressed the same regarding the inclusion of training in good practices for delivery personnel (p=0.049). Although managers self-reported appropriate hygiene practices related to delivery services, most did not consider themselves responsible for providing training and capacity-building for delivery personnel. This finding contradicts the guidance issued by the World Health Organization for food businesses during the Covid-19 pandemic, as well as recommendations from Brazilian authorities such as ANVISA and ABRASEL. *Conclusion*: The findings of this study may serve as a basis for future research evaluating the production and delivery chain of delivery systems in situ, aiming for enhanced food safety control within this sector.

Keywords: Food Safety. Covid-19. Restaurants.

Resumo

Introdução: A compra de refeições pelo sistema de *delivery*, uma tendência já observada, foi impulsionada no Brasil durante a pandemia da Covid-19. *Objetivo*: Avaliar as percepções de responsabilidade e as práticas de higiene adotadas por gestores/responsáveis de restaurantes comerciais, sobre a segurança de refeições entregues por *delivery*. *Método*: Foi utilizado um questionário autoaplicável, dividido em 5 seções: I. Análise da percepção de

risco; II. Identificação do perfil socioeconômico dos gestores; III. Análise das características da empresa; IV. Análise dos sistemas de garantia da segurança dos alimentos; e V. Avaliação do sistema de *delivery* da empresa antes e durante a pandemia da Covid-19. Todas as seções foram respondidas numa escala do tipo Likert de 5 pontos. ***Resultado***: De 37 restaurantes comerciais participantes da pesquisa, 13 gestores responderam não se sentir responsáveis pela higienização dos baús de entrega (p=0,003) e 25 declararam o mesmo sobre a inclusão de treinamento em boas práticas para os entregadores (p=0,049). Apesar de autodeclararem práticas adequadas de higiene relacionadas ao *delivery*, a maioria dos gestores não se sente responsável por fornecer treinamento e capacitação em boas práticas para os entregadores. Tal fato diverge das orientações da Organização Mundial da Saúde para empresas alimentícias durante a Covid-19, e de órgãos brasileiros como ANVISA e ABRASEL. ***Conclusão***: Os dados do presente estudo podem ser usados como ponto de partida para pesquisas que avaliem a cadeia de produção e entrega de sistemas de *delivery in loco,* visando maior controle da segurança dos alimentos nesse sistema.

Palavras-chave: Inocuidade dos Alimentos. Covid-19. Restaurantes.

INTRODUÇÃO

Due to intensified urbanization and industrialization, changes have occurred in income levels, education, access to food, and overall lifestyle since the 1950s.[1] These transformations, coupled with convenience and marketing strategies, have contributed to the preference for ready-to-eat foods[1] and have reinforced the habit of consuming meals outside the home.[2]

In response to this consumer behavior trend, commercial restaurants began to meet the demand for delivery services, allowing consumers to save time and effort associated with commuting.[3,4] In Brazil, revenue from meal delivery is projected to reach approximately $18.83 billion by 2024, with an annual growth rate of 8.69%, potentially reaching $26.28 billion by 2028.[5] During the Covid-19 pandemic, delivery services accounted for 60% of restaurant sales in the country,[6-8] and positively influencing the pre-existing trend in the food delivery sector.[9,10]

The impact of the Covid-19 pandemic on the food sector led to the adoption of sanitary measures to adapt food services to the recommendations of the World Health Organization (WHO) and national technical guidelines.[11,12-16] These recommendations included hand hygiene with 70% alcohol for food handlers and delivery personnel, education on modes of coronavirus transmission, adherence to good manufacturing and food handling practices, regular cleaning of materials and uniforms, use of plastic coverings for card machines followed by sanitization with 70% alcohol after each use, and sanitization of delivery containers with 70% alcohol after every delivery cycle, among other measures.[11,12-16] These efforts aimed to mitigate viral transmission and minimize the risk of contamination through food, including ensuring safe delivery services.[11,12]

Given the necessity for heightened need for attention, agility, and care regarding food safety during the pandemic,[11] and the growing importance of delivery services,[5] it is important to analyze factors related to hygiene and microbiological safety throughout the production process, including during delivery. Moreover, recognizing that the practices and attitudes of food handlers are influenced by their confidence and risk perceptions,[17] it is essential to evaluate these perceptions in the context of practice adequacy.

In Brazil, there are no official guidelines specifically addressing the evaluation of hygiene and sanitation issues in food delivery systems. However, the Resolution of the Collegiate Board of the National Health Surveillance Agency (ANVISA) No. 275 of October 21, 2002,[18] which provides for Standard Operating Procedures and a Checklist of Good Manufacturing Practices for Food Producers/Processors, includes the evaluation of food handlers, training and supervision programs, and the suitability of product transportation. In 2020, during the Covid-19 pandemic, specific guidelines and recommendations were issued for food establishments and delivery services.[11,12-16] Nonetheless, these measures were temporary, and a lack of legislation addressing food safety in this service context persists, which should be ensured even outside of a pandemic scenario.

With regard to delivery apps, such companies are understood to act as intermediaries between establishments and delivery personnel, who are legally classified as self-employed workers.[19] In certain cases, app companies may be held liable under the Civil Code and the Consumer Protection Code, depending on the principle of service or product quality.[19] However, a clear legal framework regarding the responsibilities of delivery app systems in the consumer market is still lacking.

Given these considerations, this study aimed to evaluate the perceptions and practices related to hygiene and safety among managers of commercial restaurants,with regard to the safety of meals delivered during the Covid-19 pandemic.

METHOD

This exploratory and descriptive study was conducted using a self-administered questionnaire and was approved by the Ethics Committee of UNICAMP (No. 4.384.625). The sample was selected based on convenience and consisted of managers and/or individuals responsible for commercial establishments selling ready-to-eat foods. These establishments included self-service restaurants, bars, bakeries, and snack bars. The inclusion criteria required that the commercial establishment be registered with the iFood® application, offer delivery services, and be located in Campinas or Limeira, São Paulo, due to the accessibility and logistical convenience for researchers, should in-person visits be necessary.

The identification of eligible establishments was conducted through the iFood® application, adhering to the stated inclusion criteria. Initially, 116 establishments offering delivery services were selected, prioritizing those listed first on the platform. Subsequent contact was made via telephone, WhatsApp, email, or in person. Ultimately, the sample comprised 40 establishments that responded and agreed to participate in the study. However, only 37 establishments were included in the analysis of hygiene and safety practices within the delivery system, as three questionnaires contained incomplete responses. The evaluation of the managers'/responsible individuals' characteristics and the establishments' structure was based on the full sample of 40 participants.

The questionnaire was administered between January and July 2021. Responses were collected through two methods; online via Google Forms, where participants opted to complete the questionnaire electronically, or in person during visits to the establishments, based on the participants' preference. Of the total, 24 questionnaires were completed online, while 16 were completed in printed form. The questionnaire was directed to individuals self-identified as managers, administrators, or those responsible for the commercial establishment. For standardization purposes, all respondents were referred to as "managers/responsible individuals," despite representing a range of roles, including manager, quality supervisor, cashier, consultant, and nutritionist.

The questionnaire consisted of five sections: I. Analysis of risk perception; II. Identification of the managers' socioeconomic profile; III. Analysis of the establishment's characteristics; IV. Assessment of food safety assurance systems;V. Evaluation of the company's delivery system before and during the Covid-19 pandemic.

Questions in Section I (risk perception) were developed based on the study by Hakim et al.,[20] and assessed topics such as the perceived need to sanitize delivery containers, card payment devices, and hands with 70% alcohol; responsibility for ensuring the safe delivery of uncontaminated food by delivery personnel; and the use of face masks. A five-point Likert scale was used to measure agreement, ranging from 1 ("strongly disagree") to 5 ("strongly agree"). Mean scores (±SD) were calculated for each scale item.

Sections II, III, and IV were adapted from methodological tools employed by Andrade,[21] which were designed based on validated procedures from Cavalli,[22] Frewer, Shepherd & Sparks,[23] and Cunha, Stedefeldt & Rosso.[24] Section II included questions related to the managers' profile, such as gender, education, and training in food-related fields. Section III addressed the characteristics of the establishments, including the type of services offered, the number of meals served before and during the pandemic, and the use of delivery apps. Section IV evaluated food safety-related criteria, such as the implementation of specific management systems, training or certification in best practices for food handlers, and the possession of sanitary operating licenses. In Section V, which focused on the companies' delivery systems, the questions addressed the suitability of the packaging used, the temperature control of transported food, training or certification in best practices for delivery personnel, and the adequacy of delivery areas. All questions in this section were

developed based on hygiene and sanitary recommendations for food establishments offering delivery services during the Covid-19 pandemic, as outlined by ANVISA,[14] SEBRAE,[11] and ABRASEL,[12] as well as the provisions of CVS-15, issued on November 7, 1991, by the São Paulo State Health Secretariat.[25]

Risk perception responses were later regrouped into two categories: responsibility-related attitudes and hygiene-related practices. The responsibility-related attitudes included the following statements: "It is my duty to instruct delivery personnel on hygiene procedures for their delivery containers and during the delivery process"; "It is my responsibility to ensure that food is delivered safely and without risks"; "I do everything within my power to prevent delivery personnel from contaminating meals or consumers." Hygiene-related practices included the following statements: "Sanitizing delivery containers with 70% alcohol is necessary to ensure safe meal delivery"; "Delivery personnel must sanitize their hands with 70% alcohol when collecting meals to ensure safe delivery"; "Delivery personnel must wear masks to ensure safe meal delivery"; "The card payment device must be sanitized with 70% alcohol after each use to ensure safe meal delivery".

Descriptive analyses were conducted for data concerning the characteristics of managers and establishments, as well as the hygiene and safety practices of the delivery system. These results were presented as absolute frequencies. Associations between risk perception responses, regrouped into responsibility-related attitudes and hygiene-related practices, were analyzed using the Mann-Whitney U test with a significance level of $p< 0.05$. All analyses were performed using JASP software (version 0.14.1.0).

RESULTS

Among the general characteristics of managers and/or individuals responsible for the establishments, the majority were male (60%), with 45% (n = 18) identifying as owners and 30% (n = 12) as managers. Other positions included quality supervisors, cashiers, consultants, and one nutritionist. Regarding educational background, 22.5% (n=9) had completed high school, 37.5% (n=15) held a college degree, and 22.5% (n=9) had completed postgraduate studies. A total of 60% (n = 24) had no formal education in the food sector, but reported completing unspecified courses on food hygiene and handling.

With respect to the establishments, 90% (n=36) were classified as micro or small enterprises (1–49 employees). In terms of the type of service provided (à la carte, self-service, mixed, fast food, barbecue, or other with specifications), 60% (n=24) operated as à la carte restaurants, and 20% (n=8) were categorized as mixed services (those selecting "mixed" or indicating multiple service types).

When asked about delivery services prior to the Covid-19 pandemic (March 2020), either using their own delivery staff or through app-based systems, 62.5% reported already offering this service. A significant increase was observed in the share of meals delivered via delivery services during the pandemic, rising from 19.7% to 52.7%. Furthermore, 97.5% (n=39) indicated their intention to continue offering delivery services post-pandemic. The motivations for continuing delivery services included high consumer demand (n=14), the desire to expand their customer base (n=6), and an effort to increase revenue (n=9), among other reasons.

Regarding delivery safety practices, questions related to "risk perception" from the first section of the questionnaire were grouped into two categories: responsibility-related attitudes and hygiene-related practices. The mean scores for each category (responsibility-related attitudes and hygiene-related practices), and their associations with specific categorical variables are presented in Table 1. A significant association (p=0.024) was found between responsibility-related attitudes and whether managers/responsible individuals had completed a course on food hygiene and handling. However, no association (p=0.707) was observed between these courses and hygiene-related practices (Table 1).

Table 1. Association between Managers' Characteristics and Establishment Structure with Responsibility Attitudes and Hygiene Practices in Commercial Establishments Selling Ready-to-Eat Food during Covid-19 pandemic, in São Paulo State (n = 40), January–July 2021.

Variables		n	Female	n	Male	*p*
Gender	Responsibility Attitude	16	4.521 ± 0.740	24	4.569 ± 0.072	0.950
	Hygiene Practice Attitude	16	4.969 ± 0.085	24	4.865 ± 0.255	0.125
		n	Yes	n	No	*p*
Hygiene/Handling Training	Responsibility Attitude	26	4.384 ± 0.848	14	4.857 ± 0.386	0.024
	Hygiene Practice Attitude	26	4.913 ± 0.211	14	4.893 ± 0.213	0.707
		n	Food Expertise	n	No Expertise	*p*
Training in food management	Responsibility Attitude	16	4.437 ± 0.758	24	4.625 ± 0.751	0.160
	Hygiene Practice Attitude	16	4.891 ± 0.258	24	4.517 ± 0.175	0.971
		n	Small/Medium Companies	n	Large Companies	*p*
Type of structure	Responsibility Attitude	36	4.666 ± 0.506	4	4.421 ± 0.949	0.690
	Hygiene Practice Attitude	36	4.952 ± 0.101	4	4.855 ± 0.280	0.307

Values expressed as mean ± standard deviation.Significant differences considered at $p < 0.05$ (Mann-Whitney U test).
Source: Author.

The hygiene and safety practices of the delivery system were assessed regarding their adoption by the participating businesses (Table 2). Data included responses from 37 out of the 40 surveyed establishments, as three questionnaires contained incomplete responses. Noteworthy findings included data on the use of seals on food packaging, the presence of external packaging, temperature checks for food, hand hygiene practices among delivery personnel, the sanitization of delivery containers, and the provision of training in best practices for delivery personnel (Table 2)..

Table 2. Hygiene and Safety Practices in Delivery Systems of Commercial Establishments Selling Ready-to-Eat Food during Covid-19 pandemic, in São Paulo State (n = 37), January–July 2021.

Variables	Yes (%)	No (%)
Adequate package identification	27 (73.0)	10 (27.0)
Safety seals on packages	31 (83.8)	6 (16.2)
External packaging around main package	33 (89.2)	4 (10.8)
Ensuring adequate temperature during transport	31 (83.8)	6 (16.2)
Clean and ventilated waiting areas for couriers	37 (100.0)	0 (0.0)
Verifying courier hand hygiene before handling	29 (78.4)	8 (21.6)
Cleaning delivery boxes	24 (64.9)	13 (35.1)
Training delivery personnel in food safety practices	12 (32.4)	25 (67.6)

Source: Author.

To assess compliance with regulations and recommendations for delivery services during the pandemic, the variables mentioned above were evaluated in relation to managers' risk perception (responsibility attitudes and hygiene practices attitudes) (Table 3).

A positive association was found between responsibility attitudes and ensuring the sanitization of delivery containers (p=0.003), with 65% (n=24) of managers affirming this responsibility. However, the opposite trend was observed regarding the provision of training in best practices for delivery personnel, where 68% (n=25) stated that they did not feel responsible for this aspect (p=0.049) (Table 3).

Table 3. Association Between "Responsibility Attitudes" and "Hygiene Practice Attitudes" and Compliance with Delivery Norms During the Pandemic, in São Paulo State (n = 37), January–July 2021

Variables		n	Yes	n	No	*p*
Presence of security seal	Responsibility Attitudes	31	4,527 ± 0,811	6	4,612 ± 0,533	0,950
	Hygiene Practice Attitudes	31	4,895 ± 0,533	6	4,917 ± 0,129	0,570
Presence of external packaging	Responsibility Attitudes	33	4,545 ± 0,790	4	4,500 ± 0,637	0,720
	Hygiene Practice Attitudes	33	4,917 ± 0,194	4	4,750 ± 0,354	0,350
Food temperature	Responsibility Attitudes	31	4,635 ± 0,685	6	4,053 ± 1,043	0,130
	Hygiene Practice Attitudes	31	4,919 ± 0,163	6	4,792 ± 0,401	0,670
Hand hygiene	Responsibility Attitudes	29	4,586 ± 0,722	5	4,266 ± 1,117	0,470
	Hygiene Practice Attitudes	29	4,922 ± 0,202	5	4,900 ± 0,137	0,530
Cleaning of delivery boxes	Responsibility Attitudes	24	4,875 ± 0,238	13	3,922 ± 1,011	0,003
	Hygiene Practice Attitudes	24	4,958 ± 0,095	13	4,789 ± 0,320	0,110
Training delivery personnel	Responsibility Attitudes	12	4,917 ± 0,208	25	4,360 ± 0,871	0,049
	Hygiene Practice Attitudes	12	4,938 ± 0,113	25	4,880 ± 0,251	0,810

Values expressed as mean ± standard deviation. Significant differences considered at $p < 0.05$ (Mann-Whitney U test). Source: Author.

Data relating to food safety management practices within the establishments were also analyzed. With regard to food safety management systems, 77.5% of participants reported adopting one or more systems, with the most cited being the Manual of Good Manufacturing Practices (47.5%), followed by the 5S system (25%). Additionally, 77.5% of participants reported implementing Standard Operating Procedures (SOPs), and 92% held valid sanitary permits. Moreover, approximately 95% of establishments reported providing employees with training or education in best practices.

DISCUSSION

This study examined the risk perceptions and hygiene and safety practices adopted by managers or those responsible for establishments selling ready-to-eat meals, as well as the expansion of their delivery services during the Covid-19 pandemic. A significant increase in meal delivery services was observed among the participating establishments, when comparing the pre-pandemic and pandemic periods. However, despite reporting appropriate hygiene practices related to delivery services, most managers did not consider themselves responsible for providing training or education in best practices to delivery personnel.

The growth of delivery services in Brazil and other countries was primarily driven by the need for establishments to adapt to social distancing regulations implemented during the pandemic.[26] Nevertheless, this ongoing expansion combines convenience and practicality for both businesses and customers.[26] In this study, the main reasons cited for continuing delivery services even after the normalization of the pandemic situation were "high consumer demand," the "desire to expand the customer base," and "increased business revenue."

A study conducted by the National Restaurant Association[27] highlighted the growing trend of purchasing ready-to-eat foods via delivery or takeout, aligning with contemporary consumer lifestyles. Projections for the restaurant sector indicate that profitability could reach $1.2 trillion by 2030, with delivery, drive-thru, and takeout models as the primary drivers of this growth.[27] Given this context, it is essential to monitor the conditions under which food deliveries are conducted, emphasizing the analysis of risk perception as a key factor. Risk perception is understood as the judgment of potential hazards that may pose a threat to an individual's health or well-being.[28]

In the context of food safety, individuals with a low perception of risks related to food contamination and its potential health impacts may display negative attitudes.[29] This can result in the neglect of adequate hygiene practices, even when individuals are aware of how to perform them, due to a lack of recognition or belief in the inherent risks of improper procedures.[29] Thus, assessing the risk perception of establishment managers is crucial, as this may influence their behavior and subsequently affect the safety of the food served.

In this study, managers who had received food-related training demonstrated a greater sense of responsibility regarding food delivery and safety. However, they did not ensure the implementation of hygiene practices in delivery operations. This aligns with the findings of Zanin et al.,[30] who observed that knowledge acquired through training does not always translate into more appropriate attitudes and practices. Similarly, when asked about the sanitization of delivery containers, most managers acknowledged their responsibility to verify this process. However, they did not view themselves as responsible for providing training on food handling best practices for delivery personnel, revealing a gap between training and the effective execution of hygiene practices. This discrepancy may be explained by the fact that many delivery personnel are affiliated with delivery apps, rather than being permanent staff members of the establishments.[7,13]

Regardless of the employment relationship, there is a clear demand for actions aimed at training delivery personnel, particularly in light of the increasing number of food deliveries made through apps.[7] Furthermore, the social responsibility of companies and restaurants offering these services is noteworthy. Training on food handling best practices enhances the microbiological safety of food during transportation to customers' homes,[31] thereby improving the quality of the service provided.

National studies by Leite,[32] and Santana, Vieira, and Pinto[33] have reported inadequacies in the microbiological quality of meals sold via delivery. While no *Salmonella sp.* or other pathogens were detected in the samples, both studies noted high counts of aerobic mesophiles, molds, yeasts, and even total and

thermotolerant coliforms (fecal coliforms).[32,33] These findings underscore the need for good practices throughout the entire production chain (suppliers, handlers, and delivery personnel) and for enhanced sanitary surveillance.

Another study, conducted by Santos,[31] evaluated food handling practices in a commercial restaurant in Porto Alegre, Brazil, which offered delivery services. Using the Good Practices Checklist for Food Services, the compliance rate for the "Storage and Transportation of Prepared Food" item was only 42.8%.[31] The study identified a lack of temperature control during food transportation, the presence of urban pests and vectors, and reported that delivery vehicles were not exclusively used for transporting food. For instance, some delivery personnel worked for the restaurant only at night and delivered other products during the day.

These findings highlight the critical importance of good manufacturing practices (GMP) in food transportation and the ongoing challenges associated with training, or lack thereof, for delivery personnel. The absence of such training can compromise the hygienic and sanitary quality of meals.[31,32]

With regard to other hygiene and safety practices in the delivery system—such as the identification and sealing of final packaging, maintaining clean and ventilated waiting areas for delivery personnel, and ensuring delivery personnel sanitize their hands before handling products—the average compliance rate was 85.8%. These compliance rates were based on affirmative responses aligned with recommendations for food establishments and delivery services on hand hygiene, packaging, workplace cleanliness, and uniforms, as outlined by SEBRAE, ABRASEL, and ANR.[11-13] Similarly, the measures related to food safety management systems were deemed appropriate.

The practices that were investigated are critical for ensuring the hygienic and sanitary quality of prepared foods, as many contamination issues stem from inadequate application of procedures linked to quality and management in establishments.[34] Food safety management systems are essential in mitigating risks that threaten hygienic and sanitary quality, thereby safeguarding customer health.[35]

Concern regarding food safety compliance is significant due to its adverse health and economic impacts. These include foodborne diseases (FBDs) and the associated treatment costs, borne by consumers or public healthcare systems such as Brazil's Unified Health System (SUS).[36] Additionally, non-compliance with recommendations can have social repercussions, as consumer perceptions of food safety can influence their willingness to patronize establishments.[13] Consequently, investments in strategies to minimize FBD risks are driven by both health and financial incentives, potentially benefiting business owners. Zanetta et al.[37] demonstrated that consumers' willingness to pay up to 30% more for safer meals could serve as a motivating factor for restaurant managers to invest in effective strategies to enhance food quality.

An important aspect to consider is the value of conducting in-person observations to verify the accuracy of reported practices. As highlighted in the study by Cunha et al.,[38] self-reported practices and observed practices represent distinct forms of assessment. Self-reporting often reflects a tendency for individuals to describe their practices as being in alignment with social norms, emphasizing what is perceived as correct rather than actual behavior. In this context, in-person observation would allow for a more accurate analysis of the consistency between reported and actual practices, acting as a tool to complement and reinforce sanitary measures that could strengthen the safety of transported food.

Given the limited literature addressing precautions in food delivery systems, this study represents a preliminary basis for future research. Despite limitations related to sample size and the influence of social desirability bias, the advance of research in this area is essential. This progress would promote increased awareness among consumers, employees, and managers and support the development of stricter regulatory and enforcement measures to establish an effective system that ensures the quality of delivered food.

CONCLUSIONS

The findings of this study provided insights into the perceptions and practices of managers at food establishments selling ready-to-eat meals via delivery services during the Covid-19 pandemic. Notably, a paradox was observed regarding the adequacy of best practices in delivery. While managers claimed compliance with hygiene standards and felt responsible for ensuring safe deliveries, they did not perceive themselves as responsible for providing training or capacity-building on best practices for delivery personnel.

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Contributors

CD Capitani contributed to the study's conceptualization, design, manuscript preparation, and final approval for publication. DT Cunha contributed to data analysis and interpretation, manuscript drafting, and final approval. AHS Paulino, BN Gomes, JS Luz, MP Hakim, and F Feltrin contributed to manuscript preparation, critical review of the intellectual content, and final approval for publication.

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