Systematic mapping of food safety outbreaks in the hospitality sector in the Dominican Republic

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Abstract

Purpose: The hospitality sector underpins the Dominican Republic's (DR) economy but may be a setting where foodborne disease outbreaks (FBDOs) can occur. The purpose of this research is to conduct a systematic mapping exercise on the available scientific literature related to FBDOs in hospitality in the DR and their link to reported food safety and hygienic practices.

Design/methodology/approach: A predefined search protocol applied the principles of PRISMA guidance. Publications (n= 2,793) from databases (e.g. Web of Science, PubMed) were identified, and systematically selected for relevance. A full-text assessment based on the inclusion criteria led to the identification of a refined list of studies and academic publications (n=22) included in this review. The descriptive analysis of the collated data is then presented graphically.

Findings: A low rate of reporting highlights a knowledge gap on FBDOs, the related food safety hazards and how they are mitigated by stakeholders and local health authorities in the DR. Improving government and other stakeholder capacity to report, investigate and understand FBDOs and the practices involved is essential.

Research limitations/implications: The research has implications for Government, businesses and public health officials and managers in the hospitality sector in the DR. A potential research limitation is that the search strategies could miss some relevant articles.

Originality/value: To the best of our knowledge this is the first systematic mapping research assessing evidence of FBDOs affecting hospitality in the DR.

Practical implications: The findings provide a framing for improved risk analysis in implementing food safety management strategies for FBDOs.

Keywords: systematic mapping; foodborne disease outbreaks; hospitality; Dominican Republic.

Paper type: Review article

1. Introduction

Foodborne disease outbreaks (FBDOs) in tourism dependant countries, such as the Dominican Republic (DR), represent a threat to their sustainable socio-economic development (WHO, 2021). Alqurashi *et al.* (2019) stated that there is a close and complex link between food safety and related socio-economic activities such as food business, international trade, and foodservice facilities. Food safety outbreaks, infections and intoxications are significant barriers toward social and economic development in developing countries and the disruption to health and to the economy in developing countries is an obstacle to achieving the Sustainable Development Goals 1-3, No Poverty, Zero Hunger, and Good Health and Well-being (Oduori *et al.*, 2022). FBDOs have the potential to cause significant damage to public health, the local and international economy of the countries concerned, and economic loss in all the business sectors involved (Yeni *et al.*, 2016). Estimates suggest that foodborne illness could cost at least $100 million a year to the economy of developing countries (Jaffee *et al.*, 2019; Oduori *et al.*, 2022).

Travel-related diseases are more likely to occur in less developed geographic regions (Muresu *et al.*, 2020). The study of Indar and Perez (2015) reported that one in forty-nine people fall ill from FBDOs in the Caribbean. The continual potential risk of unsafe food and water is worsened by emerging or newly identified pathogens in food and beverages (Fung *et al.*, 2018; Rahman *et al.*, 2020). Moreover, the DR, like most Caribbean countries, has limited access to foodborne disease surveillance data (Guerra *et al.*, 2016; Hull-Jackson and Adesiyun, 2019; Lee, 2017). Therefore, there is national and local interest from public health authorities and tourism stakeholders to develop effective food hygiene and safety standards and management systems for the distribution of food and beverages in hospitality settings to ensure that they are safe to consume. Moreover, audits and training must occur regularly in accordance with national food safety regulations (Barnes *et al.*, 2022; Elobeid *et al.*, 2019; Insfran-Rivarola *et*

al., 2020; McFarland *et al.*, 2019; Osaili *et al.*, 2021). To sustain this success, proactive and preventive food safety measures in the hospitality industry need to be enforced and adopted by food service facilities, managers, food handlers and public health officials to reduce the risk of FBDOs. Fujisaki *et al*. (2020) state that a well-implemented and maintained food safety system will reduce the likelihood of FBDOs considerably. However, studies assessing FBDOs associated with international travel identified the DR as the third most common destination for travel-associated infections (Johnson *et al.*, 2011), making the country a suitable lens of enquiry, and providing a motivation for the research.

The purpose of this research is to conduct a systematic mapping exercise of the available scientific literature related to FBDOs in hospitality in the DR and their link to reported food safety and hygiene practices. Systematic mapping is an approach that uses a structured a priory methodology to identify gaps and gather available evidence on a particular research topic (James *et al.*, 2016). This systematic map is used to provide some evidence-based recommendations for food safety and microbiological risks in the hospitality sector that can be used by relevant stakeholders, with specific reference to the scope of the research, the DR and other Caribbean countries.

2. Literature review

2.1. Food and tourism

The food and tourism sector have significant importance to countries' economies (Andersson *et al.*, 2017) contributing between 10% and 16% of the gross domestic product of the DR respectively (Goffi *et al.*, 2020; OECD/UNCTAD/ECLAC, 2020; WTTC, 2021). There is a natural synergy between the food and tourism sectors especially when local hotels, restaurant and hospitality promote authenticity and offer guests a pleasurable experience connected with food. This experience can include local products, national cuisine dishes and typical regional culinary delicatessen (Barnerjee *et al.*, 2017; Rousta and Jamshidi, 2019). Moreover, food is

one of the key factors driving tourists' travel preferences (Björk and Kauppinen-Räisänen, 2016; Firdaus Siau *et al.*, 2015; Lee *et al.*, 2019).

In 2019, the arrival of foreign tourists in the DR reached 6.4 million visitors (Peralta, 2021). The tourist influx in the country promoted the development not only of the tourism sector but also the socio-economic development for other sectors such as agriculture, services and construction. For instance, local agricultural production supplied 85% of the total fresh primary products required by the tourism sector. Food and beverage consumption by the tourism industry in 2017 in the DR was estimated to be about USD 490 million in the DR (Meyer, 2020; OECD/UNCTAD/ECLAC, 2020). These relations between local food products, restaurants, tourism are provided by local supply chains which can deliver to the increasing demand for healthy and safe products. This growth in the tourist sector was then hit by the Covid-19 pandemic with its impact on the tourism and hospitality industry across the world through travel restrictions, border closures, and quarantine requirements (Aharon *et al.*, 2021; Kaushal and Srivastava, 2021; Ozbay *et al.*, 2021; Rahman *et al.*, 2021; Song and Kim, 2021). Pre-pandemic, tourists' perception of food safety, and any FBDOs, negatively impacted the national tourism sector and hotels' brand reputation. (Plante, 2019; Romero and Bogel-Burroughs, 2019). Indeed, the hospitality and tourism industry and its competitiveness are highly vulnerable to political instability, terrorism, natural disasters, epidemics, foodborne disease, and health threats (Arbulú *et al.*, 2021; Indar *et al.*, 2020; Ma *et al.*, 2020; Rosselló *et al.*, 2020).

Torrens *et al.* (2015) state that through contaminated food and beverage items humans could be affected by about 200 pathogens and that 30% of emerging infectious diseases in the last 60 years have been caused by microorganisms that are transmitted through edible products. Biological agents e.g. bacteria, fungi, viruses and parasites are the most commonly reported biological hazards causing FBDOs (do Prado *et al.*, 2021). Enteritis and other diarrheal diseases

are among the top five causes of mortality in Latin American and Caribbean countries (Havelaar *et al.*, 2015; Olson *et al.*, 2019). Along with that, Travel Diarrheal (TD) affects 30-70% of international travellers mainly by bacterial etiologic agents in less economically developed countries (Hull-Jackson and Adesiyun, 2019; Yasami, 2021). Hence, food safety incidents create an adverse impact on the tourism and hospitality sectors (Duan *et al.*, 2021).

1.2.Food safety review in the Caribbean

Furthermore, relatively little is known of the incidence and risk of foodborne diseases in the tourism and hospitality sector in Caribbean countries. A detail record of any cases of FBDOs is needed in order to implement the appropriate food safety control measures at the time and in the future (Pires *et al.*, 2012). Food safety risk analysis is a useful tool, via risk assessment, for the identification at the local level of food hazards and risks and taking into account the specifics of the operating food chain (de Bock *et al.*, 2021).

The literature review by Pires *et al.*, (2012), which considered bacterial pathogens between 1993 and 2010, used the data from the Regional Information System on FBDOs of each country within Latin America and the Caribbean. In general, the study concluded that food items such as meat, dairy products, seafood, eggs, vegetables and water were the most important sources of bacterial FBDOs during the investigation timeframe. Findings from this study showed 24 outbreaks in the DR but it does not specify the source of contamination (i.e., food or water). Guerra *et al.*, (2016) reviewed food safety and foodborne zoonoses in the Caribbean Region from 1995 to 2015. Species of *Campylobacter*, *Salmonella* and *Shigella* were the main pathogens in these incidents and although this data does not include the DR specifically, the findings increase the concern regarding FBDOs in the Caribbean region. Moreover, a 12-year review conducted by Hull-Jackson and Adesiyun (2019) aimed to determine the etiological agents, food and locations of FBDOs in Barbados. Findings reported during this period that

149 *Salmonella* was the common pathogen identified and eggs and poultry were the primarily
150 contamination source. Hotels and tourist resorts were the common location associated with
151 these outbreaks.
152 Apart from these review articles there is limited information about FBDOs and public health
153 and the hospitality sector in the DR. Even more scarce is the publicly available literature and
154 information about travel associated FBDOs and only some anecdotal evidence could be found
155 on online blogs and travel websites. On these online blogs some visitors shared their symptoms
156 and the general experience related to foodborne illnesses during their stay in all-inclusive hotels
157 in the DR (Christopher, 2013; Elliot, 2016; Meikle, 2009; TripAdvisor, 2018). Such personal
158 episodes include subjective opinions but can still be used as a first step in a scientifical
159 epidemiological investigation, if combined with more robust evidence. Timely reported
160 personal episodes could be individual, single cases but also could be important early-warning
161 notifications for associated FBDOs. The most important task for the further epidemiological
162 investigation is to identify the causative agents, sources of contamination, the main food
163 involved and the unsafe practices that led to the outbreak. A formal recording process is also
164 an essential part of any surveillance system to preserve people's health and prevent further
165 spread of disease (Ntshoe *et al.,* 2021; do Prado *et al.,* 2021).
166 In this study, we applied the method of systematic mapping which requires a predefined review
167 protocol in order to guide the literature search. This systematic mapping review will be the first
168 one critically appraising food hazards and travel associated risk in the DR. Therefore, we aim
169 to explore and systematically examine the literature, and describe the evidence on foodborne
170 disease associated with travel/tourism in the DR to inform policy, as well as identify research
171 gaps for future studies in the country.
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3. Research methodology

3.1. Research questions and review protocol

Systematic mapping provides a broad overview of a specific research area, systematically organising existing data within the literature (Garcia *et al.*, 2019; Nguyen and Li, 2021). This method uses an a-priori methodology and reduces the likelihood of bias and increases the transparency of the approach (James *et al.*, 2016). Due to the limited information about FBDOs in the Caribbean and the DR, the authors found a need for a more methodical approach to map FBDOs in these countries. Hence, a systematic mapping exercise was carried out. This method was proposed for identifying data, categorising the data, analysing, summarising and reporting the findings of the subject of interest (Adhi Tama and Lim, 2021; Dalponte Ayastuy *et al.*, 2021). There have been previous reviews on food related illnesses in the Caribbean, which have included food safety-related aspects, bacterial foodborne zoonoses and documentation of FBDOs (Guerra *et al.*, 2016; Hull-Jackson and Adesiyun, 2019). However, the study by Hull-Jackson and Adesiyun, (2019) comprised of countries that are full member states of the Caribbean Community organisation (Caricom) of which the DR is not a member. Neither of the previous known reviews used a systematic approach for search and inclusion of studies. The current systematic mapping protocol (Figure 1) follows the guidelines for systematic reviews and maps set by Collaboration for Environmental Evidence (CEE) (Collaboration for Environmental Evidence, 2013; James *et al.*, 2016).

Take in Figure 1

This systematic mapping approach defined two research questions in order to comply with the scope of the research and to satisfy completely the objectives of the study. A predefined protocol was developed to guide the literature search in an attempt to ensure methodological

transparency and reproducibility. The protocol described the criteria which should be applied at each consecutive steps of the systematic mapping. This approach intended to reduce the potential for bias during the preliminary search and to ensure collection of the relevant articles as objectively as possible. A copy of the original review protocol is registered in Open Science Framework (https://osf.io/wq3df). Any changes from protocol are included in the methodology here.

The primary question addressed was: What food safety outbreaks have affected the hospitality sector in the DR? This question has the following components:

Population (s) Hospitality sector in the DR

Occurrence (s) The occurrence of food safety outbreaks in the DR.

The secondary questions of this systematic mapping were:

- What food safety practices have influenced food safety outbreaks in the DR?
- What evidence is there that any food safety outbreaks were caused specifically by a weakness in food safety practices?

Population (s) Areas in the foodservice/hospitality sector in the DR where food safety incidents have occurred.

Intervention (s) different food safety practices

Comparator (s) Any relevant

Outcome(s) outbreaks

Questions were formulated using the PICO (population, intervention, comparator, outcomes) key elements as a process (Arton *et al.*, 2020). The PICO tool in qualitative evidence synthesis studies often does not work fully (Cooke *et al.*, 2012). In this study, the comparator (C) was not part of the search because it is irrelevant when qualitative research questions are used. Studies were included even where no comparator was present.

225 *3.2 Search strategy*

226 The bibliographic databases' search was carried out to test the specificity and sensitivity of the
227 search string. A search of articles was conducted from the 26th of February to 3rd of April 2020.
228 However, any restrictions on the date or the article type were applied. Keyword, Boolean
229 expressions, and Truncation (*) symbol were applied to broaden the search across all included
230 bibliographic databases (Table 1). The grey literature search involved searching through
231 specific organisation websites, grey literature databases and bibliographic databases is
232 presented in Table 1. It was conducted from 27th October to 2nd November 2020 and tried to
233 identify relevant outbreak reports using the combination of key elements with the same search
234 algorithms which were applied for the published articles. Any restrictions on the date or the
235 articles type were applied.

236 **Take in Table 1**

237

238 *3.3 Articles screening*

239 All the relevant articles were retrieved by the search protocol according to the predefined
240 inclusion criteria. The inclusion criteria were as follows: (1) studies which examine food safety
241 outbreaks in hospitality premises in the DR; (2) studies which focused epidemiological
242 investigations of food safety outbreak in the DR; (3) studies in English, Spanish and German
243 which are relevant to the objectives of the survey. Studies which focus on food safety incidents
244 caused by agents with chemical and physical nature and/or allergenic substances were
245 excluded. The initial search used the title and abstract concurrently and applied the predefined
246 inclusion criteria retrieved related articles and all the duplicates detected by the web-based
247 citation management software (RefWorks ver.2.0.) were removed. The relevance of each of
248 the remaining articles was assessed. If the relevance of the article was not clear at the title and
249 abstract assessment stage, the article was assessed during the full-text review. In general, the

articles were assessed independently by a single reviewer. In cases where some queries arose during the inclusion steps a second reviewer took part and screened the article and the final decision on whether to include was resolved by discussion. The articles which provided a solid laboratory confirmation of the microbiological nature of the etiological agent and that food or water was the most probable route for transmission, rather than any other route, were also considered as eligible for the survey. Outbreaks reported in multiple publications were recorded only once.

3.4 Data extraction and analysis

Data from the eligible articles were retained and exported to Microsoft Excel (ver.16.37) for coding and analysis. Preliminary coding of the articles was based on their credentials such as author/s, year and type of publication. After the preliminary coding the content of each article was examined for the presence of the following supplementary information: location, risk factors, major study findings, year of outbreak, food settings, food category, source of contamination, etiological agent, number of people affected, number of laboratory-confirmed cases, number of hospitalisations, sign and symptoms, deaths, food safety practices, and socio-demographic characteristics of targeted participants (see Appendix 1).

Descriptive statistics were used for the data analysis and the results were summarised and presented graphically by Microsoft Excel Chart. The figures presenting the publication/reported year and etiological agents identified are in the results section.

4. Results

4.1. The search process

The preliminary search identified a total of 2,793 articles. Further searching included seven studies from the grey literature and two through reference checking in the primary sources. By using the inclusion and exclusion criteria on titles and abstracts and further full text assessment 22 relevant articles were eligible for systematic mapping (Figure 2). The results were reported using the guidance from Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA, 2015).

Take in Figure 2

The eligible studies included 21 articles which came from diverse official, international scientific and peer-reviewed journals (Appendix 2) and one report from an unpublished investigation by Ministry of Health in the DR (personal communication). Appendix 1 of this paper includes a list of the primary studies along with their main features.

4.2 Scientific literature of travel-associated foodborne diseases in the DR

This study used systematic mapping to gather information and evidence from academic and grey sources on foodborne outbreaks in the DR. The articles analysed were published between 1992 and 2016 (Figure 2) with four articles in 2011 and three in 2015, and either one or two articles in other years.

Take in Figure 3

4.3. The etiological agents involved in the foodborne outbreaks

The systematic mapping identified etiological agents including bacteria, microalgae, parasites and virus (Figure 4). *Salmonella enterica* serotypes Enteritidis, Typhimurium, Newport and

298 Javiana, non-typhoidal *Salmonella* spp., *Campylobacter*, *V. cholerae* serogroup O1 and
299 *Shigella* serogroups, e.g. Shiga toxin (Stx)-producing *S. dysenteriae* type 4 were the most
300 prevalent microbiological agents (40%). Parasites such as *Toxoplasma gondii*, *Cyclospora*
301 *cayetanensis* and *Entamoeba hystolitica* (14%) were also indentified as etiological agents.
302 Some of the articles (14%) identified Norovirus as etiological agent. Others (32%) were linked
303 to ciguatera fish poisoning outbreaks (CFP caused by ciguatoxins) in hotel settings after
304 seafood and fish consumption.
305 **Take in Figure 4**
306
307 The systematic mapping used seven articles that reported FBDOs in food premises such as all-
308 inclusive hotel restaurants (Develoux *et al.*, 2008; Gupta *et al.*, 2007; Lange *et al.*, 1992;
309 Martínez *et al.*, 2011; Ministerio de Salud Publica, 2016; Páez Jiménez *et al.*, 2004; Szakacs
310 and McCarthy, 2007), dining, wedding banquet (Blume *et al.*, 1999; Jiménez *et al.*, 2011), and
311 a guest house (Perez *et al.*, 2001). However, eight articles did not reported the food premises.
312 The FBDOs were categorised into three types: (1) the consumption of unsafe food and water
313 (72%); (2) Travel Diarrhoea (18%); and (3) poor handling in food premises. The results
314 defined the lack of hygiene or care in food handling as the most prevalent factors responsible
315 for the contamination of the food in approximately 83.3% of the articles; the weak sanitisation
316 of the equipment and utensils accounted for 58.3%; and inadequate storage of food was the
317 most prevalent factor in 41.6% of the analysed outbreaks.
318 The summarised data of systematic mapping based on eleven articles showed a broad range of
319 people affected (from three to 74-years-old) and 2.324 people fell ill as estimated in the
320 included articles. The most commonly reported symptoms were acute diarrhoea, abdominal
321 cramps, vomiting, nausea and fever, while seven articles did not provide any information about
322 the symptoms. None of the sources reported how many locals, staff or workers were affected.

During the collection of data, the systematic mapping revealed that few articles provided any information about the implemented control measures in the hotel premises (Doménech-Sánchez *et al.*, 2011; Jimenez *et al.*, 2004; Jiménez *et al.*, 2011; Loharikar *et al.*, 2015).

5. Discussion

This review provides the first comprehensive and systematic examination of published articles (*n=22)* related to FBDOs in hospitality settings in the DR covering a period from 1992 to 2016. The paucity of scientifically based research and investigations into FBDOs has a significant impact on government, non-governmental private sectors such as hospitality, and educational organisations seeking to record and investigate foodborne diseases (Lakhan *et al.*, 2013). In line with previous studies on the Caribbean (Guerra et al., 2016; Hull-Jackson and Adesiyun, 2019; Lakhan et al., 2013), this research finds a low rate of reported or investigated FBDOs. The systematic mapping did detect a greater number of reports in 2011 and 2015. These reports were related to several large outbreaks which affected tourist from different countries and raised international concern. (Jiménez et al., 2011; Loharikar et al., 2015; Newton et al., 2011; Fillion and Mileno, 2015).

The study adopted a systematic mapping approach to provide details such as attribution sources, foodstuff implicated and the type of improper food handling practices that lead to the reported outbreaks. A systematic review approach has been used in the literature before in a similar context. Magalhães *et al.,* (2019) tried to establish the link between published reports of foodborne disease and traceability in the food chain. Similar to this study that the information provided could be used by stakeholders to develop policies and food safety regulations. The literature review conducted by Ortega and Tschirley (2017) which considers less developed economies in Asia and Sub-Saharan Africa concluded that the lack of information on food safety issues affects the development and implementation of agri-food

348 systems. As a result, the tourism industry is also affected especially when it relies on local food
349 production to satisfy visitors‘ food demand. The aforementioned reviews focused on developed
350 and less developed economies and stressed the persistent deficiency of information about
351 foodborne diseases and poor notification systems, thus concurring with this study. Lebelo *et*
352 *al*. (2022) stated that the ability to predict and prevent foodborne disease and food
353 contamination could not be underestimated or neglected because of the negative impact that
354 FBDOs can have on public health and the economy (Gissing *et al.*, 2017). The analysis in this
355 work provides summarised information about the etiological agents which affected travellers
356 on hotel premises (Ingram *et al.*, 2013). The likely contributory factors to FBDOs which the
357 systematic mapping identified were the consumption of unsafe food and water. The primary
358 studies support the findings of this systematic mapping by providing specific evidence of
359 etiological agent related to the cases under investigation (Gray *et al.*, 2015; Gupta *et al.*, 2007;
360 do Prado *et al.*, 2021; Zhi *et al.*, 2021).
361 In comparison with the aforementioned research, this study used a more structured
362 methodology which provided explicit and reproducible systematic mapping. Similarly, Torres
363 et al. (2021) found that a systematic review had been useful in the identification of neglected
364 areas during food safety hazard surveys. Other authors also support the idea that surveillance
365 and epidemiological studies and active laboratory surveillance in the hospitality premises have
366 limitations and leave gaps in the information available about foodborne diseases, sources and
367 etiological agents which is required for proper surveillance (Hull-Jackson and Adesiyun, 2019;
368 Mohammadi *et al.*, 2022; Ntshoe *et al.*, 2021; Torres *et al.*, 2021). In particular, by providing
369 scientific evidence, the systematic mapping could facilitate governmental decisions and policy-
370 makers and their recommendations towards undertaking food safety and risk analysis in
371 hospitality sectors in the DR and in other regions in order to prevent threats for public health.
372 Moreover, assessing the compliance towards food safety regulations and voluntary

certifications will improve the efficacy of food hygiene and safety practices in this sector. Applying the results of systematic mapping could also reduce the foodborne disease burden, and the associated economic and health implications at national and regional levels (Indar *et al.*, 2020). The improved integration of information between health authorities and hotel businesses should enhance the effectiveness of a notification and surveillance system by inclusion of data from several sources e.g. hotels, locals premises, regional and international food supply chains, etc.

6. Conclusion

Systematic mapping is a useful tool to examine existing literature sources to identify the common microbiological agents and sources of food contamination within the scope of a given investigation (time frame, location, types of incidents, location of incidents etc.). Systematic mapping relies on primary research and the lack of sufficient information can decrease its power and effectiveness to draw conclusions. A challenge with systematic mapping is the degree of confidentiality of the information associated with FBDOs affecting staff and workers in hospitality, and how managers or policy-makers control the availability of such information for public scrutiny. Future research should be focused on the risk analysis, management, and communication of foodborne outbreaks. The contribution of this study is to demonstrate the value of systematic mapping of both public and private evidence sources (e.g. government information not publically available) and how this could firstly, reveal the areas and practices that needs improvements in order to prevent FBDOs. Secondly, the appropriate management systems and control measures that should be applied at the local and national level to minimise the risk of FBDOs associated with the hospitality sector can be identified. A further contribution is to suggest in future research combining systematic mapping as the first stage of the research with supporting methodologies such as AcciMap analysis to develop the findings

of systematic mapping further to gain evidence of where practices or contributing socio-technical factors have contributed to FBDOs and what actions can be taken to prevent further problems in the future.

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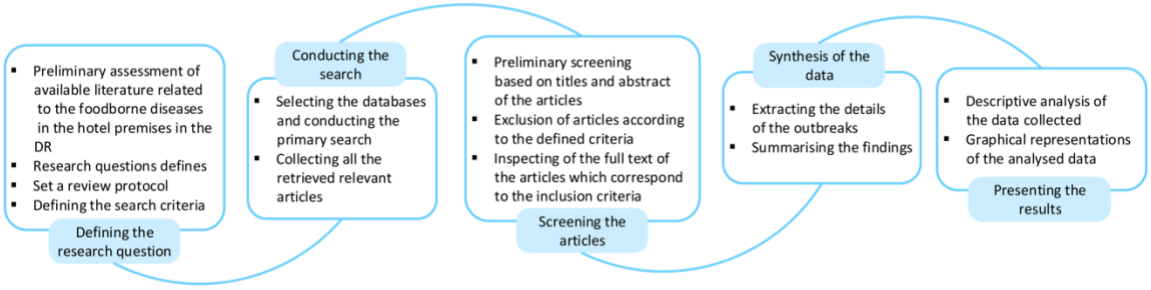

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737 **Figure 1. Consecutive steps of the systematic mapping protocol (adapted from** *Garcia et*
738 *al.*, 2019).
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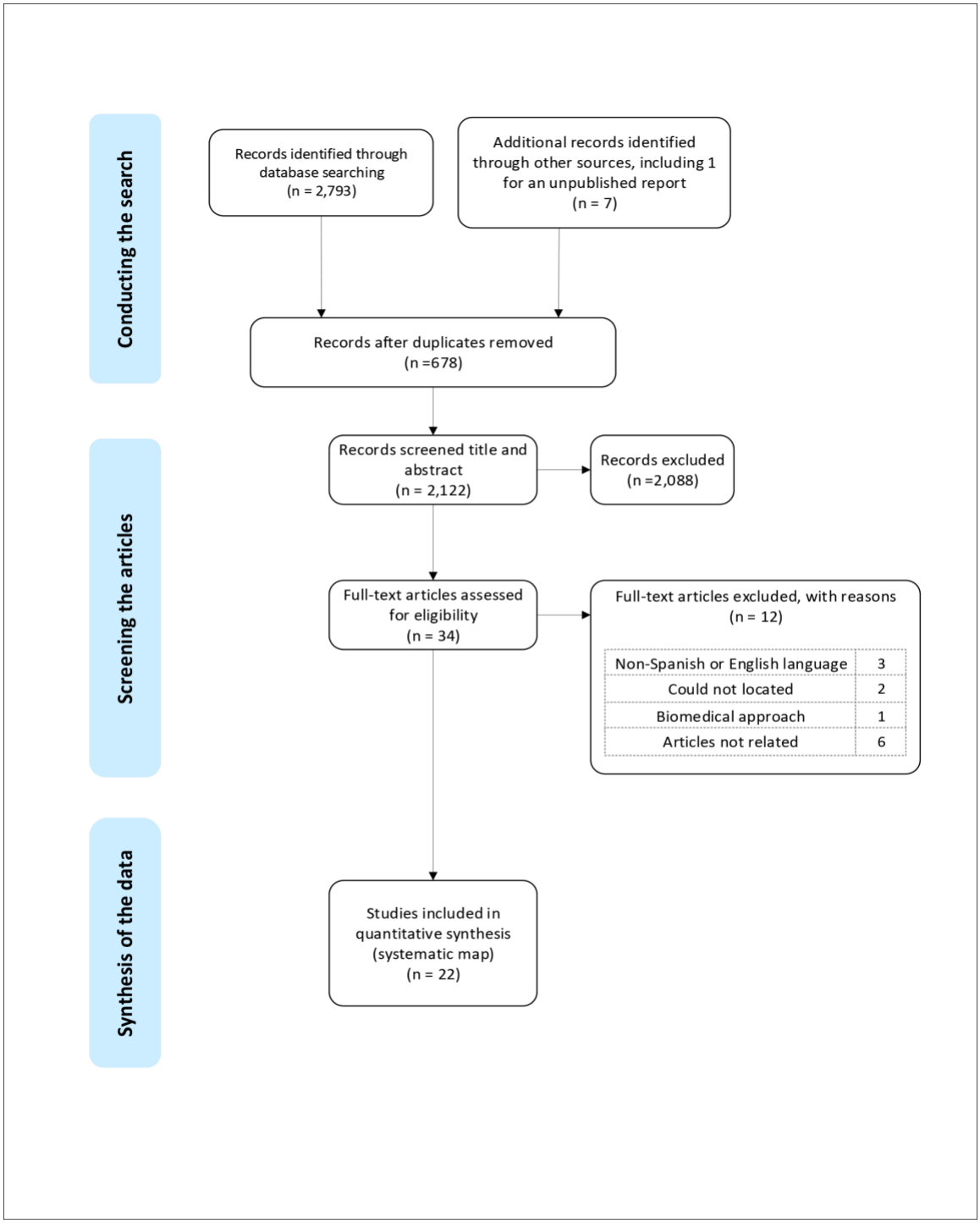

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743 **Figure 2. The applied PRISMA principles and the number (n) of articles included in**
744 **the systematic mapping after the searching process.**
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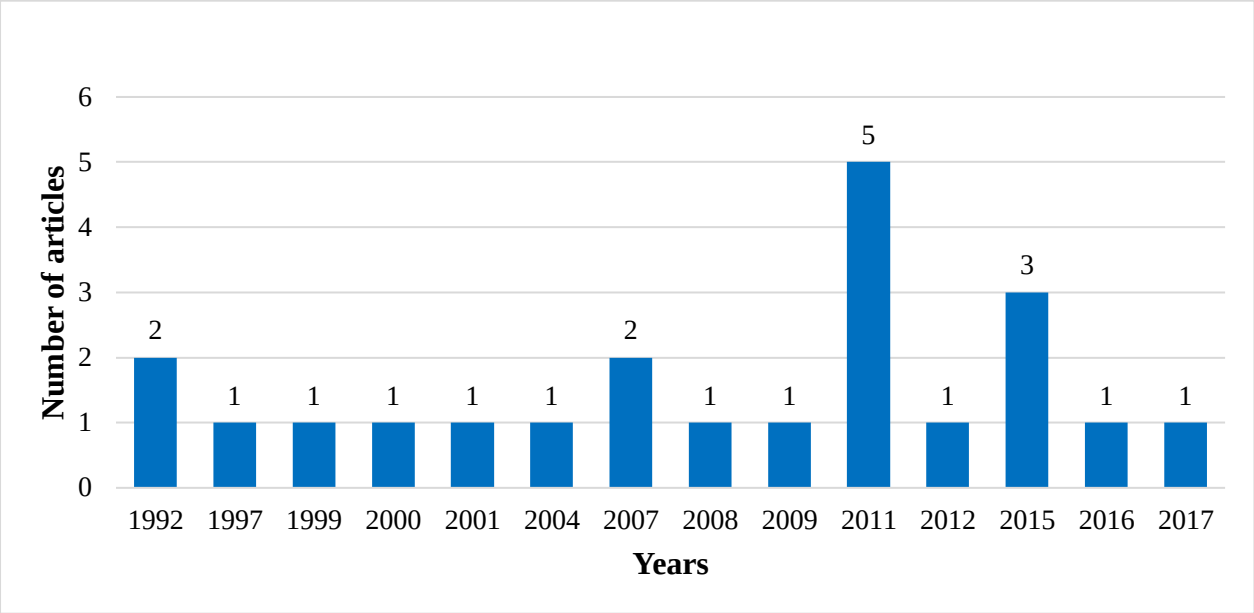

Figure 3. The distribution of eligible articles included in the systematic mapping.

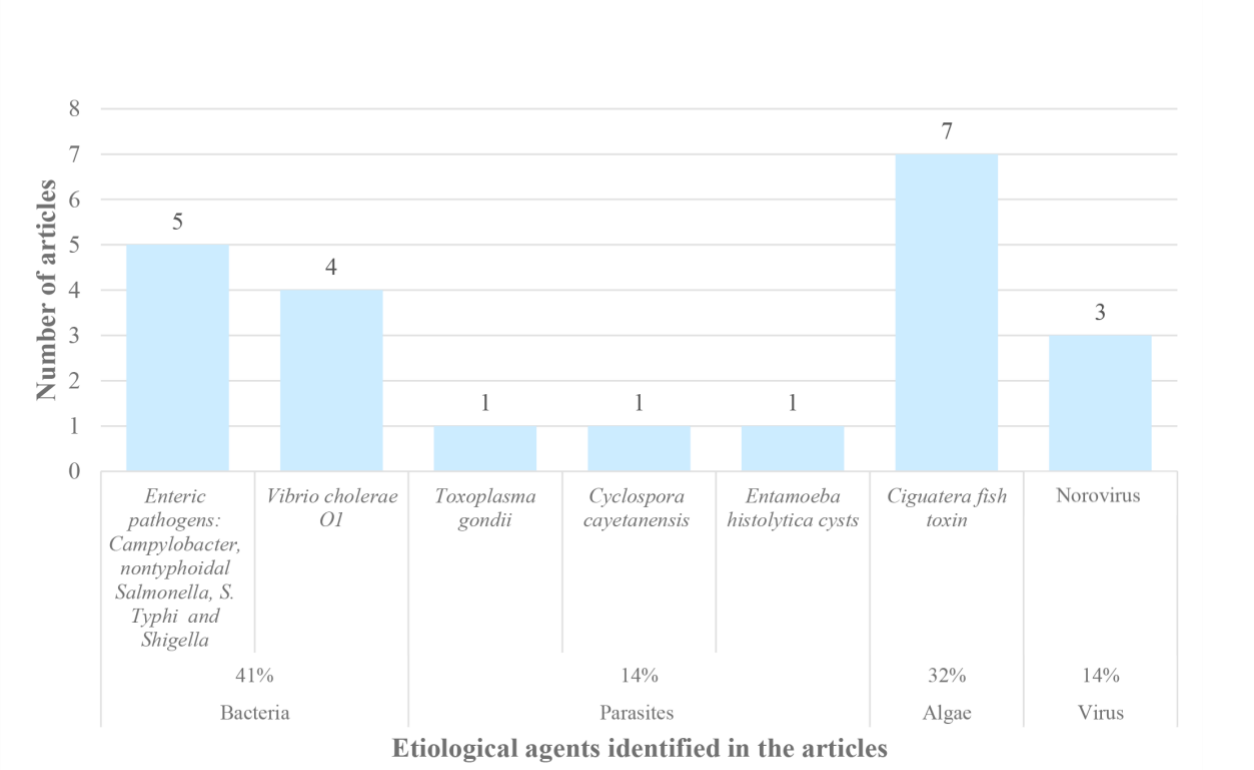

Figure 4. The identified etiological agents related to foodborne outbreaks in the hospitality settings in the DR.

Appendix 1. Summarised characteristics and data extracted of the final studies included in the systematic mapping.

Disease	First author/year (ref)	Title	Contributing Factors	Year Outbreak	Source Implicated	Food Setting	Etiologic Agents	# Of Cases/ People/Where	Symptoms	Socio-Demographic Characteristics
Acute gastroenteritis	Doménech-Sánchez *et al*., 2010	Unmanageable norovirus outbreak in a single resort located in the Dominican Republic	Food and Potable water	2007	Contaminated food or water as the source of the infection.	Not reported	Norovirus	800	Not reported	Not reported
Acute gastroenteritis	Ministerio de Salud Pública, 2016	Brote de gastroenteritis, Complejo hotelero Live Style Resort Puerto Plata	Contaminated water and ice	2016	Contaminated water and ice.	Live Style Resort	Norovirus	301	Not reported	Not reported
Amebic dysentery (amebiasis)	Jiménez *et al.*, 2004	Waterborne outbreak among Spanish tourists in a holiday resort in the Dominican Republic.	Sewage system to the water supply system	2002	Consumption of unsafe foods or drinking untreated fresh water.	Resort	*Entamoeba hystolitica* cysts	76	Acute diarrhoea	The mean age was 31.6 +3.5 years. 61.8% of cases were male
Cholera	Fillion and Mileno, 2015	Cholera in travelers: shifting tides in epidemiology, management, and prevention	Cholera	2010	Not reported	Not reported	*Vibrio cholerae* O1	9 travellers	Not reported	Not reported
Cholera	Jiménez *et al.*, 2011	Multinational cholera outbreak after wedding in the Dominican Republic.	Poor food handling practices	2011	Shrimp and prawns were served on ice or ice sculptures.	Wedding banquet	*Vibrio cholerae* O1	42 case-patients	Watery diarrhoea, nausea, vomiting, cramps	Median age of case-patients was 42.5 years (range 16–84 years); 33 (79%) were male
Cholera	Loharikar *et al.*, 2015	Cholera in the United States, 2001-2011: a reflection of patterns of global epidemiology and travel.	Cholera	2011	Not reported	Not reported	*Vibrio cholerae* O1	40	Not reported	Not reported
Cholera	Newton *et al.*, 2011	Cholera in United States Associated with Epidemic in Hispaniola.	Consumption of contaminated food or water	Not reported	Not reported	Not reported	*Vibrio cholerae* O1	23 associated cases, 9 to Dominicans	Not reported	Not reported
Ciguatera	Develoux *et al.*, 2008	A case of ciguatera fish poisoning in a French traveler	Ciguatera poisoning/ The species of ingested fish could not be specified	2008	The species of ingested fish could not be specified.	A hotel-club of Puerto-Plata	Ciguatera toxin	2	Abdominal cramps and diarrhoea	Not reported

Ciguatera	Lange *et al.*, 1992	Travel and Ciguatera Fish Poisoning.	Risk to travelers to endemic regions	1987 - 1990	Suspected fish included grouper, red snapper, and amberjack.	Hotel restaurant	Ciguatera toxin	1	Paraesthesia of the extremities or around the mouth, weakness, pruritus and diarrhoea	Not reported
Ciguatera fish poisoning	Perez *et al.*, 2001	Treatment of Ciguatera Poisoning with Gabapentin.	Food and Potable water	Not reported	Dusky grouper	Punta Cana	Ciguatera toxin	2 people	Nausea, vomiting, abdominal cramps, and watery diarrhoea	32- 37 years old
Ciguatera fish poisoning	Sanner *et al.*, 1997	Ciguatera fish poisoning following travel to the tropics.	Food and Potable water	Not reported	Meal of grouper	Not reported	Ciguatera toxin	16 people	Vomiting and watery diarrhoea	Not reported
Ciguatera intoxication	Blume *et al.*, 1999	Ciguatera poisoning. Growing differential diagnostic significance in the age of foreign tourism.	Ciguatera fish poisoning	1999	Peak bass and lemon sauce.	Dinning	Ciguatera toxin	4 people	Paraesthesia, nervousness, inverse temperature perception, muscle cramps, headache and dizziness	22 and 31 years
Ciguatera intoxication	Martinez *et al.*, 2011	Un caso de ciguatera en viajera a la República Dominicana	Ciguatera fish poisoning	Not reported	Chillo hervido (*Lutjanus vivanus*).	Lodge in Santo Domingo	Ciguatera toxin	1 people	Nausea, vomiting, chills, and diarrhoea	44 years old woman
Ciguatera intoxication	Thompson *et al.*, 2016	Ciguatera fish poisoning after Caribbean travel.	Ciguatera fish poisoning	Not reported	Dog snapper	Not reported	Ciguatera toxin	2 people	Nausea, vomiting and diarrhoea. Severe generalized pruritus	68 years old
Enteric infection	Kendall *et al.*, 2012	Travel-associated enteric infections diagnosed after return to the United States, Foodborne Diseases Active Surveillance Network (FoodNet), 2004-2009.	Enteric infection	2004-2009	Not reported	Not reported	*Campylobacter* (42%), nontyphoidal *Salmonella* (32%), and *Shigella* (13%	201 Travellers	Not reported	Not reported
Gastroenteritis	Doménech-Sánchez *et al.*, 2009	Gastroenteritis Outbreaks in 2 Tourist Resorts, Dominican Republic	Sewage water	2005	Water	Not reported	Norovirus	773	Diarrhoea, vomiting, headache and fatigue	Not reported
Gastroenteritis	Green *et al.*, 2000	Two Simultaneous Cases of *Cyclospora cayetanensis enteritis* Returning from the Dominican Republic	Not reported	1998	Not reported	Not reported	*Cyclospora cayetanensis*	2 people	Diarrhoea	72-74 year

Salmonellosis	Johnson *et al.*, 20 11	*Salmonella* infections associated with international travel: a Foodborne Diseases Active Surveillance Network (FoodNet) study.	Travel-associated	2004-2008	Not identified	Not reported	*Salmonella enterica* serotype	66	abdominal cramps, and bloody diarrhoea	3-year-old boy
Shigellosis	Gray *et al.*, 2015	Prevalence of Stx-producing *Shigella* species isolated from French Travelers Returning from the Caribbean: An Emerging Pathogen with International Implications	Environmental factors have contributed to the emergence of these species in that region.	Records between 1994 and 2008	Not reported	Not reported	stx-positive. This included nine strains of *S. flexneri* 2a, one *S. dysenteriae* 4, and one *S. flexneri* Y. An *S. flexneri* 2a	Not reported	Not reported	Not reported
Shigellosis	Gupta *et al.*, 2007	Emergence of Shiga toxin 1 genes within *Shigella dysenteriae* type 4 isolates from travellers returning from the Island of Hispanola	Endemic in the island of Hispañola.	2004-2005	Not reported	All-inclusive resort in Punta Cana	Stx1-producing *S. dysenteriae* 4	2 cases / 6 people	abdominal cramping, and non-bloody diarrhoea	17-year-old male resident of Florida / 3-year-old boy
Toxoplasmosis	Roca *et al.*, 1992	Toxoplasmosis and hepatitis.	Eaten raw or partly cooked foods	Not reported	Eaten raw or partly cooked foods.	Not reported	*Toxoplasma gondii*	1	Acute hepatitis; a high fever, general weakness, aching joints and jaundice.	23-year-old male
Typhoid fever	Szakacs and McCarthy, 2007	An all-inclusive vacation.	Food and Potable water	Not reported	Food or water contaminated with faeces.	Resort in Punta Cana	*Salmonella enteritica* serovar Typhi	Not reported	Abdominal cramping, nonbloody diarrhoea and fever	70-year-old

Appendix 2. Review of literature sources of final articles (n=22) included in the systematic mapping exercise.

Journals/source	SRJ (2019) Ranking Medicine Category	Number of articles
Archives of Internal Medicine	66	1
Eurosurveillance	201	2
Clinical Microbiology and Infection	212	1
Emerging Infectious Diseases	249	3
Current Infectious Disease Reports	796	1
American Journal of Tropical Medicine and Hygiene	1183	1
Epidemiology and Infection	1281	1
Clinical Infectious Diseases	4900	2
Medizinische Klinik	4960	1
Canadian Medical Association Journal	-	1
Enfermedades Infecciosas y Microbiología Clínica	-	1
Foodborne Pathogens and Disease	-	1
Medicina Clínica	-	1
Journal of Travel Medicine	297	1
Canadian Medical Association	41	1
Zeitschrift fur Gastroenterologie (Z gastroenterol)	4424	1
The New England Journal of Medicine	8	1
Unpublished report (Public Health Department in the Dominican Republic)	-	1
Total		22

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