

Article

Evolution of Tourism Risk Communication: A Bibliometric Analysis and Meta-Analysis of the Antecedents of Communicating Risk to Tourists

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Abstract: As tourism risk communication has transitioned from an emerging theme to a growing field of research, it is essential to review existing studies to identify developments in it. Nevertheless, there is a lack of extensive research employing both bibliometric and meta-analysis of tourism risk communication, specifically on communicating risk to tourists. To fill this gap, first, we applied bibliometric analysis techniques to identify emerging research clusters by collecting 236 articles from 1985.1.1 to 2023.6.1. Second, to implement the meta-analysis, we selected the empirical results from the collected articles. Then, five studies were used as a series of different structures required for implementing meta-analysis. Through our research, the main results show that (1) emerging research clusters mainly focus on: (i) “risk communication”, “crisis communication”, and “tourism crisis”, (ii) “risk perception”, (iii) “health service”, “health education”, “health behavior”, “environmental health”, and “public health”. (2) Papers aiming at data analysis or modeling are of great value to advance research in the field of tourism risk communication. (3) Tourism risk communication assessments reported by different public agencies are sensitive to factors such as gender, nationality, the experiences of tourists, local tourism boards, local governments, organizational resource allocation, and report evaluation. Based on this, we contribute to knowledge on tourism risk management by discussing the challenges of the present studies and, more significantly, by identifying seven antecedents and future research directions of risk communication strategy. Finally, this paper draws implications for theory development, acknowledges the limitations of this research, and indicates further research directions.

Keywords: tourism risk communication; bibliometric analysis; meta-analysis; antecedents

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1. Introduction

Tourists are exposed to risks that they do not perceive or know how to avoid in daily life. Sometimes, they can anticipate the risk incurred by entering dangerous sites (construction sites, the wilderness, etc.) or engaging in hazardous behavior (drunk driving, etc.). However, in some places, such as tourist destinations or various parks, travelers may not expect or pay attention to the potential risks surrounding them [1–3]. Unlike expected or perceived risks, travelers may regard these tourist destinations as a controlled environment for fun activities. The natural recreation areas that tourists travel to are often not completely controllable or predictable, and they may become unsuitable or even dangerous [4]. Even though tourists may realize that there is a certain level of risk in tourist destinations, they may believe that they cannot control the risk of these locations and that the responsibility for risk mitigation belongs to organizations or the government. Alternatively, they may not understand what specific actions should be taken to avoid the risks [5].

Mair et al. [6] note that existing research on tourism risk management does not pay enough attention to risk communication with tourists. They argue that existing stud-

ies should not be limited to simple descriptive analysis; rather, they should provide a theoretical analytical framework. It is necessary to formulate suitable tourist-oriented communication strategies that take into account the various characteristics of stakeholders [7]. Previous studies have found that many tourist destinations lack tourist-oriented risk communication strategies, mainly focusing on residents' information searching and processing [8–11]. In contrast, tourists' risk information seeking and processing have not been fully discussed [7]. During crisis events, tourists do not have enough information to understand communication information, and they are often in strange locations and short of accessible support systems [12]. In addition, the conclusions of the existing literature are still inconsistent regarding what factors affect tourists' perception of vulnerability and how various information sources influence tourists' opinions on crisis decision-making [13].

Different types of risk communication have some uncertainty when transmitting meaningful information because the receiver may not receive the message or may be unable to decode the message as expected [14–16]. Failure to understand or decode risk communication will prevent visitors from identifying whether the information is relevant to their circumstances [17]. Similarly, the mass media and the reliability of individuals or institutions communicating messages are also important determinants of tourists' perceived risk and decision-making [18]. Risk communication strategies should consider how tourists' cognitive and affective processes affect their understanding, trust, and perceived credibility [13]. In addition, tourists' risk beliefs will affect their decision-making processes and predict their future behavior [19].

Existing studies have explored the causality between risk communication variables, such as knowledge [20], age [21], gender [13], and income [22]. Furthermore, research on communicating risk to tourists starts from an original information source that sends information directly to the final receiver or via intermediary sources such as traditional and nontraditional mass media. Usually, tourists receive risk communication information through different sources [23]. For example, friends, authorities, or celebrities can transmit information. Every information source plays a specific role and influences tourists' decisions in multiple ways. For instance, regarding security risk communication, one-to-one messages, the internet, and brochures are the most typical methods employed.

To synthesize the existing knowledge on risk communication, researchers have published several papers on related topics. Visschers et al. [24] focused on conveying probabilistic information about risk to the public. They argued that the presentation format and scenario can predict how individuals process information and affect their interpretation of risk. Subsequently, Zipkin et al. [25] further focused on the medical field, and they compared the effectiveness of methods of conveying probabilistic information to maximize patients' cognitive and behavioral outcomes. They concluded that visual assistance can improve patients' understanding of probabilistic information. Boase et al. [26] reviewed the psychological model of risk communication to explore the fidelity of the method and identify future research directions. They emphasized that future research should have greater fidelity when applying the psychological model to risk communication. In contrast, Chen [27] studied risk communication in cyberspace. He reviewed and compared human information-processing methods and psychological modeling methods to provide insights for the future utilization of these methods in cybersecurity. Balog-Way et al. [28] comprehensively evaluated the current situation of risk communication and the debate over the direction of future research. They argued that the single and general format of risk communication cannot sufficiently meet expectations. Therefore, interdisciplinary collaboration should be cultivated in the future to promote the next evolutionary stage of risk communication. Ritchie and Jiang [29] employed a thematic review and synthesis method to summarize the states of study on risk, crisis, and disaster management in the tourism and hospitality sectors. They found most existing papers focused on crises and suggested future research should consider hospitality rather than tourism.

Although the studies mentioned above have made outstanding contributions to the field of research on risk communication, we are motivated to fill some gaps in this research.

First, most of these studies emphasize specific areas and directions of risk communication, for example, the presentation and scenarios of risk or crisis communication [24,29], the application of risk communication in the medical field [25], methods of risk communication [26,27], or the evolution of the concept and field of risk communication [28]. Second, most of these papers employ citation analysis, network analysis, or co-citation analysis. None of them considered combining various analysis methods, such as bibliometric analysis and meta-analysis techniques, to depict the visual relationships and empirical results in the literature. Third, these studies neglect research on the antecedents of risk communication: what factors affect the implementation of risk communication strategies? Finally, to the best of our knowledge, few studies have employed both bibliometric analysis and meta-analysis techniques focusing on the field of tourism risk communication. Based on the above, this paper needs to determine what the theoretical model of tourism risk management is. What factors affect the implementation of risk communication strategies? Accordingly, the following research questions are proposed: (1) Which risk communication strategies should be adopted to communicate with tourists? (2) Which information channels should be adopted? (3) How do stakeholders' interests align with the goals of the institution or organization?

To fill the gaps mentioned above, the objective of this paper is to explore a theoretical model of tourism risk management by examining the risk communication and influencing factors of tourists. Therefore, we have conducted the following work: first, we implement a data-driven topic analysis of the field of tourism risk management and focus on all aspects of communicating risk to tourists, such as research trends, thematic evolution, and communication formats. Second, we apply both bibliometric analysis and meta-analysis techniques to explore research on tourism risk communication from the macro- and micro-perspectives. Third, we examine the antecedents of communicating risk to tourists and detect what factors will affect tourists' understanding of messages or risk perceptions. Finally, this paper presents implications for theory development based on the depicted themes and research gaps, and it discusses tourism risk communication from other theoretical perspectives.

Therefore, in theory, this paper screens and analyzes the literature in the field of risk communication through the innovative method of bibliometric and meta-analysis, verifies the knowledge model related to the number of annual publications and the most commonly used models of tourism risk communication and causal reasoning, and analyzes and supplements the research in the field of risk communication in a relatively integrated way. In practice, this paper identifies specific risk communication channels and explores the influencing factors and methods that facilitate the development of risk communication strategies by managers, enabling managers and decision-makers to more easily identify problems in their organizations and thereby better support the release of risk communication strategies and crisis planning.

The rest of this paper is organized as follows. The following section presents the literature on the definition, sources, and antecedents of tourism risk communication. Section 3 introduces the research methods. Section 4 implements the data analysis, including bibliometric analysis and meta-analysis. Section 5 discusses the implications of our research for theory development. Section 6 summarizes this study and provides future research directions.

2. Literature Review

In this section, the article will further elucidate the existing research gaps and clarify the importance of this article by reviewing the research progress of the previous literature on risk communication and its influencing factors, which is divided into three aspects: communicating risk to tourists, antecedents of risk communication, and a comparison of the review literature.

2.1. Communicating Risk to Tourists

Risk communication includes five main goals: to raise awareness, educate the public, inspire the public to take action, reach agreements, and gain people's trust [30,31]. The risk management framework proposed in the existing tourism literature believes that the importance of precisely managing risk communication to achieve these goals is a fundamental process. Given the overlaps in these goals, classifying the stages of risk management is complicated. Faulkner [32] identified six comprehensive stages in risk management: the pre-event, prodromal, emergency, intermediate, recovery, and resolution stages. Similarly, his perspective can also be applied to the disaster risk management stages identified by the tourism industry (mitigation, preparation, response, and recovery). All these stages need to consider risk communication, including clearly articulated agreements to initiate the correct communication strategy for each phase [33]. To achieve this goal, Mair, Ritchie, and Walters [6] suggested that the different stages of Faulkner [32] should be considered and analyzed separately to provide new insights.

Visitors need to be notified in advance and prepared to behave appropriately in an emergency. In the emergency stage, messages contain information and guidance that are provided to visitors in a disaster, including all steps and actions recommended to individuals in the event of a hazardous occurrence [6]. Tourists need to know and be able to grasp warning messages [13]. Informed tourists will be able to identify warnings and understand what actions need to be taken in an emergency. Compared with residents, visitors are particularly vulnerable. They usually travel in unfamiliar environments and face obstacles such as different languages, different traffic regulations, and a lack of contact with local communities [34]. Furthermore, it is difficult for tourists to obtain important information, such as security warnings [35]. In addition, tourists have a low tendency to accept risk information during vacations, leading tourism suppliers to fear that providing security-related information to visitors can affect tourists' travel decisions and disrupt the suppliers' business [36].

Previous social interaction studies focus on examining the effects of warnings and messages taking other formats [37,38]. The researchers conducting these studies aim to explore the various characteristics of warnings, for example, the kind of information, the timeliness, and the tone communicated. However, Dash and Gladwin [39] argued that warnings themselves do not contain any value because they are supposed to be based on the credibility of information and the risk aversion of tourists. Existing research defines source credibility as how the information receiver understands that a source is reliable based on professional knowledge [7,13,40]. The effects of high information source credibility include a higher level of persuasion, as shown by a change in attitudes toward advocacy behavior and a higher likelihood of positive behavior [41]. In tourism risk communication, information source reliability is significant for a couple of reasons. First, the evaluation of the source's credibility has a great impact on the degree of recognition of the information advocated by tourists [17]. Second, different individual characteristics and cultural groups show different risk perceptions based on other variables when evaluating the reliability of official and unofficial information sources, resulting in different impacts on perceived risk and behavioral compliance [42].

Warnings are issued by various sources, for example, meteorological services, the mass media, friends or relatives, and authorities, and their reliability varies [13,18]. Family and relatives are generally regarded as reliable sources, while the credibility of government institutions and the mass media has declined in recent years [43]. The public often regards the government as uncaring when it deals with a crisis, and the mass media are regarded as being unfair and biased in their reports. Meanwhile, social activities help tourists better absorb available messages, causing these activities to be more important than only the warning itself [44]. Furthermore, tourists' beliefs about the credibility of risk information sources will affect their preventive behavior [15]. When the public ranks the credibility of information sources, television is first, followed by radio, newspapers, and peers. These

rankings indicate that television is considered the most reliable for tourists in the event of a crisis [13].

In summary, risk management is divided into six different integrated phases based on the main objectives of risk communication. In each management stage, it is necessary to consider risk communication with tourists and what information sources should be used in the different stages to reliably communicate relevant information to tourists. However, at present, most studies only emphasize the domain-specific direction of risk communication and pay insufficient attention to tourists' risk communication in the field of tourism risk management, lacking a comprehensive description and analysis of the tourism risk management domain. Therefore, this paper will use the bibliometric method to reveal the full picture of current research in the field of tourism risk management, identify research hotspots, and illuminate research frontiers based on the existing literature.

2.2. Antecedents of Risk Communication

Existing studies have identified several factors that influence the success of tourism risk communication strategies, including people's demographic backgrounds, individual characteristics, social interactions, individual experiences and knowledge, the internal and external factors of an organization, and communication channels [13,21,41,42,45].

First, social factors such as individual characteristics, people's demographic backgrounds, and interpersonal interactions affect how tourists assess risks [46]. The basic assumption of the existing literature is that everyone is distinctive in terms of risk and has different opinions on risk and crises. Older people, females, and minority groups are more vulnerable to major disasters such as hurricanes and earthquakes. They often lack official information to support themselves in assessing hazards, which weakens their ability to respond to emergencies [13]. In addition, risk assessment in the vicinity of the crisis area will be affected. A person's residence will affect information search behavior. Compared with the public within the tourism destination, people from outside will employ different information search strategies [47]. For example, during a crisis event, international travelers are more likely to adopt social media than domestic tourists [17].

Second, individuals' experiences with or knowledge of one hazard can be applied in their responses to other emergencies, including utilizing message strategies similar to those employed in the past [48,49]. Some studies have found that past experiences have a positive impact on the information-seeking patterns used by tourists in the decision-making process [13,18]. Compared with individuals who have never experienced crisis events, experienced tourists are more likely to obtain accurate information on dealing with crisis events. However, other studies suggest that tourists who have had crisis experiences in the past tend to employ these experiences to guide their decision-making, exhibiting lower information search behavior [47,50].

Third, an organization's external and internal factors will affect the development of tourism risk communication strategies [41]. Internal factors usually involve the culture of the enterprise, the commitment of top management, the size of the enterprise, and the financial situation of the organization [19]. External factors typically include experience in dealing with crisis events [13], the impact of the media on the organization [18], and the level of control in response to a crisis [51]. Among the internal factors, the commitment of top management to develop a risk communication strategy is the most critical factor in determining the effectiveness of the communication plan and conveying a strong message during and after a crisis [41]. The resource allocation in a crisis event indicates the organization's commitment to risk communication [19]. Here, resources usually include financial and human resources and funds that can be allocated, for instance, to create teams that meet regularly, train staff, attend local emergency operations center meetings, and provide support services to victims [12].

Finally, the medium of communication plays a vital role in restoring an enterprise's reputation [52]. Corporate reputation depends on the enterprise's communication information, which is transmitted between companies, stakeholders, and third parties through

various types of communication channels [53]. Crisis information disclosed via different media channels (for example, corporate websites, newspapers, and social media) can have different impacts on communication strategies [54,55]. Some studies have investigated the impact of the proactive disclosure of risk information by enterprises, suggesting that enterprises should release crisis-related information before a crisis is reported by the media [56,57]. This proactive disclosure is a key factor in assessing the credibility and popularity of organizations [58]. Some researchers believe that direct messages from an enterprise are effective, providing direct communication with stakeholders during a crisis. Others believe that information from the news media is more neutral and reliable than the information disclosed by an organization [59,60]. Therefore, it can be concluded that information coming from direct and indirect sources will variously affect stakeholders' perceptions of organizational crisis communication strategies [21].

To summarize, the conclusions of the existing literature on the factors affecting tourism risk communication strategies are not consistent. Thus, we combine bibliometric analysis and meta-analysis to implement a descriptive review and quantitative analysis and visualize the research results by combining and evaluating the quantitative results of existing empirical studies. More specifically, we intend to conduct a meta-analysis of accumulated tourism risk communication studies to estimate the true effect sizes of the relationship between risk communication and its antecedents.

2.3. Summary of the Related Works

Scholars have made some effort to integrate the existing research findings on risk communication. This paper selects three review studies in this field to analyze the current related work based on the advantages, disadvantages, methodology used, and research gaps targeted. Among them, Aliperti and Cruz [34] focused on the field of disaster management, providing a systematic review of dynamic influences on the adoption of disaster mobile applications while proposing a future research agenda that takes into account differences in the geographical distribution of research, the research techniques used, and the theories adopted; Wut, Xu, and Wong [12] expanded the scope of the research; systematically examined and evaluated the literature on crisis management in the hotel and tourism industries by using a systematic literature review method; and proposed a new conceptual framework and ten possible fields for further research in the TCM (theory–context–method) model. At the same time, the corresponding specific research problems were further proposed for the future research field; on the basis of Wut, Xu, and Wong [12], Pascual-Fraile et al. [61] mainly conducted bibliometrics research on the impact of crisis communication on destination image. They provided insights into communication strategies based on recent crises and disasters combined with research frontiers; they also summarized and proposed a research agenda and emerging themes useful to future scholars. A summary is shown in Table 1, below.

In summary, it can be seen that, despite the current fruitful results in the field of risk communication, there is still the problem that research is mostly focused on specific fields and directions, resulting in a failure to provide a comprehensive analysis of the field. At the same time, although there are existing studies that use bibliometric methods to analyze related fields, there is still a lack of research that combines bibliometric analysis and meta-analysis to accurately identify the influencing factors of risk communication.

Table 1. Summary of the related works.

Related Works	Advantage	Disadvantage	Used Methodology	Gaps
Wut, Xu, and Wong [12]	<ul style="list-style-type: none"> The literature on crisis management in the hotel and tourism industry is systematically examined and evaluated. The scope of the review paper's analysis of studies related to crisis management, risk management, and disaster management is expanded. Lower-impact journals are also included in the analysis. 	<ul style="list-style-type: none"> The papers collected were published in a specific time period (1985–2020). 	Systematic literature review.	<ul style="list-style-type: none"> There is a lack of review articles in the field of crisis events and crisis management, and the research field needs to be analyzed through the latest systematic literature review techniques of crisis management research in the hotel and tourism industry to show the progress made in recent decades and the progress that is likely to be made in the near future.
Aliperti and Cruz [34]	<ul style="list-style-type: none"> A research agenda is proposed taking into account the geographical distribution of the research, the research techniques used, and the theories adopted. This systematic literature review is the first attempt to assess mobile adoption research knowledge to adapt it to a disaster management perspective. 	<ul style="list-style-type: none"> Potential works directly related to the subject but published in other sources may be omitted. This research focuses only on the adoption of disaster mobile applications. 	Scoping review process.	<ul style="list-style-type: none"> A systematic review of the dynamic factors affecting the adoption of mobile applications is necessary for the disaster management field. The existing literature only partially addresses and assesses this gap.
Pascual-Fraile, Talón-Ballester, Villacé-Molinero, and Ramos-Rodríguez [61]	<ul style="list-style-type: none"> The first bibliometric research to analyze the impact of crisis communication on destination image (pre-crisis, crisis, and post-crisis). Provides insights into communication strategies based on recent crises and disasters combined with research frontiers. Proposes a research agenda and its emerging topics that will be useful for future scholars' research. 	<ul style="list-style-type: none"> The use of a single database (WoS) and a fixed time period (from 2017 to 2021, including both years) limits the scope of the study's conclusions. Bibliographic coupling presents inherent limitations in detecting "research frontiers" and is only applicable to a short and limited time frame of about 5 to 10 years. 	Bibliographic coupling research, complemented by H-Classic classification and thematic analysis.	<ul style="list-style-type: none"> This bibliometric analysis of tourism crisis and disaster management (TCDM) pays no particular attention to the communication of destination images, and the academic literature on TCDM is fragmented and disconnected.

3. Methodology

3.1. Search Strategy

This section describes the development stage of bibliometric research on tourism risk communication and its antecedents. To replicate this study in other research areas of tourism risk management or to update the empirical conclusions of this research in the future, this paper conducts a systematic literature review that depends on other reviews collected in existing studies. Therefore, we follow the procedure described by Tranfield et al. [62] as follows.

- (1) Identify research opportunities.
- (2) Outline the collection steps and the database for topic selection.
- (3) Propose a classification for quantifying and subsequently analyzing scientific publications in the field of research.
- (4) Conduct bibliometric analysis to identify the study patterns and future research opportunities in this field.

The first step, the identification of research opportunities, has already been confirmed in the introduction section of this study, which is linked to the theme of tourism risk communication. Therefore, the utilization of bibliometric analysis in this study involves the critical principle of identifying risk communication patterns and influencing factors in the field of tourism risk management [63].

The second step is to determine the steps of selecting papers and databases to implement the selection. Therefore, the database chosen to select papers is the Web of Science (WoS) because of its tremendous number of publications and because it has the most diverse collection of studies from around the world. In addition, other bibliometric analysis studies have employed this excellent database [63–65].

Then, the keywords within the topic are specified to guide the identification of sample studies. Therefore, the selected keywords meet the objectives of this paper: risk communication, tourism, and tourists. The combination of keywords for searching for and selecting studies is presented as follows.

Group 1: Risk communication—to identify the concept of risk communication and its variants in this paper;

Group 2: Tourism management—to identify papers that focus on the field of tourism management;

Group 3: Antecedents—to confine the search for studies with any influencing factors.

Then, we employ the Boolean “AND” operator to separate the keyword combinations. Similarly, the combinations of words are separated by the “OR” operator. Table 2 presents the keywords that were chosen in this study.

Table 2. Keywords and justifications.

Group	Keywords	References
Group 1 AND	“Risk communication” OR “crisis communication” OR “communicating risk”	[7,12,66]
Group 2 AND	“Tourism” OR “tourist*” OR “traveler*” OR “visitor*” OR “vacationer*” OR “sightseer*” OR “hospitality” OR “destination*” OR “recreation” OR “leisure”	[2,16,44,55,67]
Group 3	“Factor*” OR “determinant*” OR “impact*” OR “influence*”	[13,41,42]

Note: * means a variant spelling of the word.

In addition, we employ other filters to refine the collection of publications. First, only English articles are chosen, as this language is trendy in publications on bibliometric research. In addition, Bocanegra-Valle [68] believes that this language ensures the maximum readership and research collaboration opportunities that can be detected through the utilization of bibliometric analysis techniques.

This work is also confined to searching for papers, conference proceedings, reviews, and early-access publications in the WoS database within a time limit for annual publications (time span: Jan 1985–June 2023). The search settings for this topic (including titles, keywords, and abstracts) resulted in 236 papers imported into the *EndNote 20*[®] software.

Meanwhile, the data collection process, including the inclusion and selection criteria and the different stages of the search, is shown in Figure 1.

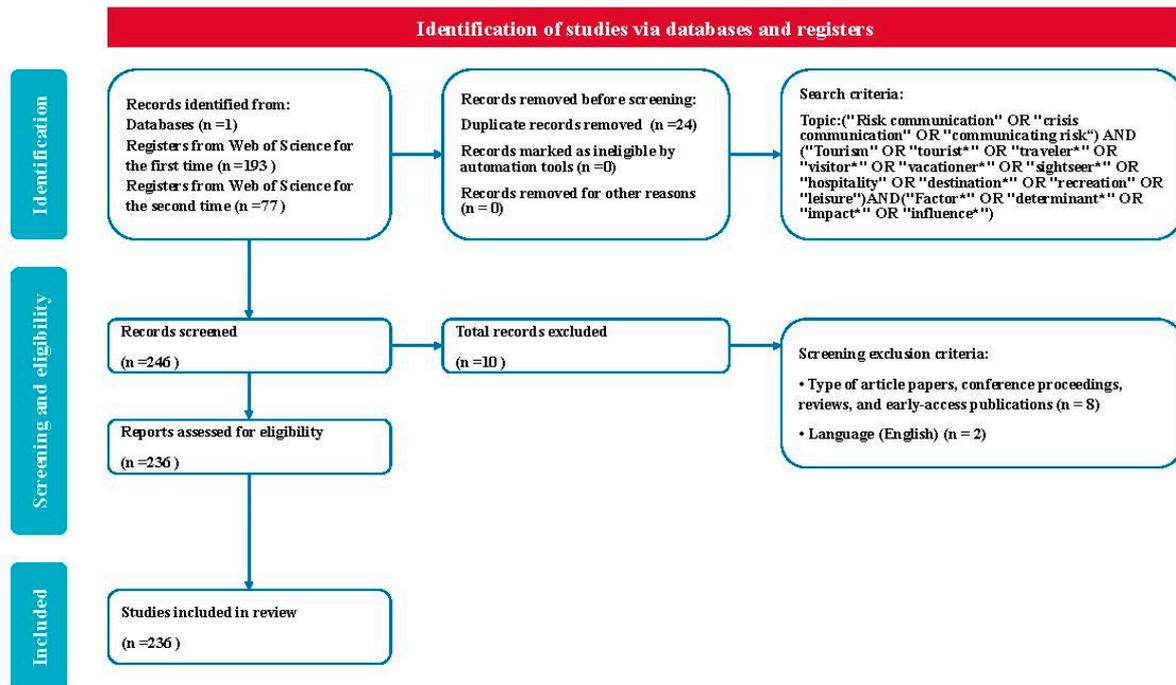


Figure 1. Data collection through the PRISMA method.

The third step describes the detailed classification to aid in the extraction of data from the selected articles. This step is based on the goal proposed in the introduction of this study. Thus, the following categories are selected to enrich the analysis of the subject [63]: the authors with the greatest production of publications; the countries with the greatest production of publications and their collaborations; the most influential journals; and the papers with the most citations. After defining the categories for data collection, we continue to conduct a meta-analysis of the documents selected in the third step to identify the influencing factors of tourism risk communication.

Then, starting from refined research, we employ the *R 3.3*, *COOC (Co-Occurrence) 13.5* and *VOSviewer 1.6.19* software to implement visualization analysis. This paper uses the authors' keywords described in Luiz et al. [69] for bibliometric analysis. Therefore, the *RStudio 3.3*[®] software uses packages to draw indicators from samples with analyses based on different perspectives [70]. The *Bibliometrix 3.05* package was released particularly for bibliometric analysis in *R* [71]. The *COOC 13.5* software is employed to present burst keyword map. The *VOSviewer 1.6.19* software has an excellent function for generating maps and visualizing topic clusters [72]. The maps generated in this study depict the nexus of authors' keywords and their appearance over the last decade. The meta-analysis is implemented using the *Stata 17* software to examine the heterogeneity and effect size of the factors that affect tourism risk communication.

Finally, articles are selected for meta-analysis based on the following standards: (1) the article must include a dependent variable reflecting tourism risk communication; (2) the article must include independent variables reflecting the influencing factors of risk communication; (3) the article must report the estimated effects of influencing factors on tourism

risk communication; and (4) the article must provide information on the estimation results (standard error or significance).

3.2. Modeling

Compared with bibliometric analysis, meta-analysis can quantitatively analyze the causes of inconsistent research results on the same topic. The analysis steps of the meta-analysis are as follows: first, the published or unpublished literature on a research topic is collected, and then, information from the collected literature—including the statistics of the dependent variables (parameter estimators, significance, *t*-statistics) and the characteristics of the independent variables (sample selection, model design, and proxy indicators)—is extracted. Finally, a corresponding model is established to examine the effects of the independent variables on the dependent variables. Based on Stanley and Jarrell [73], the regression model of meta-analysis is as follows:

$$Y_{ij} = \beta_0 + \sum_{k=1}^N \beta_k X_{kij} + \varepsilon_{ij}, i = 1, 2, \dots, n \quad (1)$$

where Y_{ij} is the dependent variable from the i th estimate of the j th article, X_{kij} is the effect size of the k th independent variable from the i th estimate of the j th article, β_k is the coefficient for the k th independent variable, N represents the total number of moderator variables, n is the sample size of meta-regression, and ε_i is the residual error. The regression model applies ordinary least squares (OLS) estimation, and the proxy of effect size can be the regression coefficient, *t*-statistics, significance, or partial correlation coefficient. Given the different models employed in various studies, *t*-statistics and significance are generally adopted in meta-regression. Based on the results reported in the collected articles, we employ significance to represent the effect size and apply the weighted average method to synthesize the significance of the results in the existing literature.

Nevertheless, because of the possibility of paper selection bias in the collected sample, Equation (1) cannot be applied. Therefore, to model and address this bias, we implement the following model proposed by Stanley et al. [74]:

$$Y_{ij} = \beta_0 + \beta_1 SE_{Y_{ij}} + \sum_{k=1}^N \beta_k X_{ijk} + \varepsilon_{ij} \quad (2)$$

where Y_{ij} represents the effect size from the i th estimate of the j th article; $SE_{Y_{ij}}$ is the standard error of the respective Y value; X is the series of explanatory variables; and ε is the error term.

3.3. Moderator and Dependent Variables

Determining moderator variables is a critical step in meta-regression analysis. Nunkoo et al. [75] argued that identifying moderator variables is an important routine in meta-analyses, that is, the characteristics of studies or samples related to research results. An effect size (coefficient) demonstrates the direction and magnitude of the nexus of various variables. In fact, a moderator variable can be any variable that affects the effect size in meta-analysis. Moderator variables can be independent and/or dependent variables because the purpose for which investigators manipulate them can affect the regression coefficients reported in a study. Therefore, exploring the effects of moderator variables in meta-analysis implies examining the dissimilarities between the estimates of various subgroups [76]. Based on our previous discussion on the literature about tourism risk communication and its influencing factors, we identify 25 variables that may affect tourism risk communication in various studies. We divide them into five categories to indicate various characteristics of the moderator variables, and they are presented in Table 3.

Table 3. Description of variables.

Variables	Descriptions
Dependent variable (Y)	The significance derived from the estimate of the tourism risk communication relationship
Individual characteristics	
Gender	=1 if gender is used as a proxy
Residence	=1 if residence is used as a proxy
Experience or knowledge	=1 if experience or knowledge is used as a proxy
Age	=1 if age is used as a proxy
Factors characteristics	
Family and friends	=1 if family and friends are used as a proxy
Television	=1 if television is used as a proxy
Social group	=1 if a social group is used as a proxy
Local tourism office	=1 if the local tourism office is used as a proxy
Weather channel	=1 if a weather channel is used as a proxy
Local authority	=1 if a local authority is used as a proxy
Newspaper	=1 if a newspaper is used as a proxy
Radio	=1 if radio is used as a proxy
Social network	=1 if a social network is used as a proxy
Locals	=1 if a local is used as a proxy
Resource Allocation	=1 if resource allocation is used as a proxy
Evaluation of Reports	=1 if the evaluation of reports is used as a proxy
Data characteristics	
Observation	=1 if observation data are used
Survey	=1 if survey data are used
International	=1 if international data are used
Regional	=1 if regional data are used
Estimation characteristics	
Ordered probit	=1 if ordered probit is used for the estimation of the regression coefficients
OLS	=1 if ordinary least square (OLS) is used for the estimation of the regression coefficients
SEM	=1 if the structural equation model (SEM) is used for the estimation of the regression coefficients
Logit	=1 if Logit is used for the estimation of the regression coefficients
Publication characteristics	
Year	The year of publication of the article

Another critical step in meta-analysis is to detect appropriate moderator variables adopted in the model. If the model includes all 25 moderators, it will lead to spurious regression. In addition, the 25 moderators indicate 2^{25} feasible combinations, which cannot feasibly be enumerated in statistical analysis, and this is regarded as model uncertainty [77]. Therefore, we employ the Bayesian model averaging (BMA) method to confirm the optimal moderator combinations. This method can construct the best models through a weighted average; this procedure is called posterior model probabilities. Furthermore, BMA presents information on possibilities, which is denoted by the posteriori inclusion probability (PIP) of selecting moderator variables in meta-regression [78]. The PIP is estimated using the sum of the probabilities of models. Values between 15% and 75%, between 75% and 95%, between 95% and 99%, and greater than 99% are regarded as weak, substantive, strong, and decisive, respectively [77].

4. Results and Discussions

This section presents the results of the bibliometric analysis and the meta-analysis, including descriptive statistics, network analysis, and discussions.

4.1. Bibliometric Analysis

The first observation result reveals the annual growth rate of the number of publications in the collected articles. During the observation period, the annual growth rate was 10.48%. The number of published articles in the study area has increased significantly since 2011. In the selected samples, the number of publications increased from 8 to 24 over a

5-year period (2014 to 2019). Meanwhile, it is noteworthy that the literature in the related field has increased by 57 articles in the last 2 years [42,61,79–133]. This result demonstrates that the way managers and tourists employ the risk communication model has stimulated the interest of researchers. Figure 2 depicts the annual number of publications between 1990 and 2023.

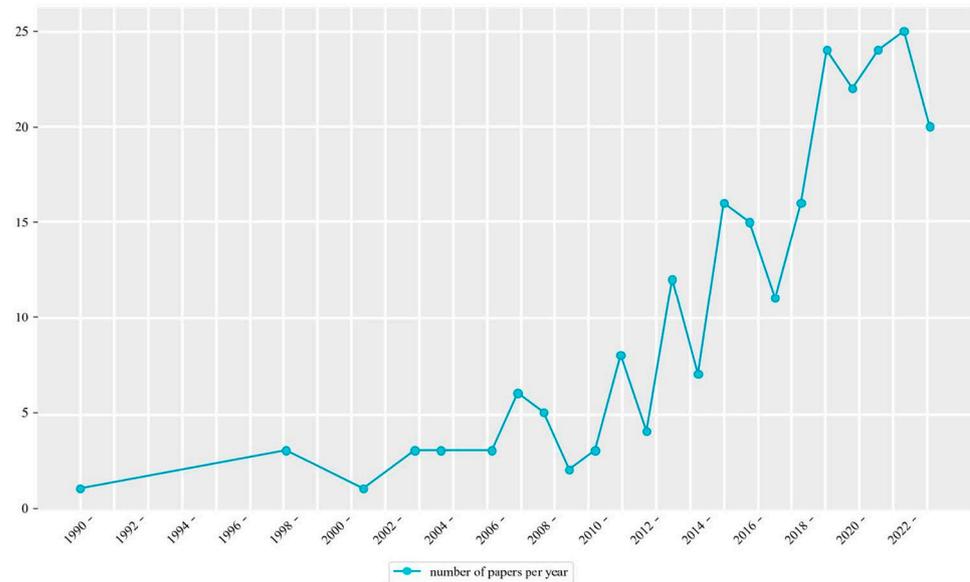


Figure 2. The annual publication numbers between 1990 and 2023.

Once the annual number of publications was obtained, it was essential to seek the journals that were popular among researchers. Figure 3 reveals the ten journals publishing the largest number of articles in this field of research.

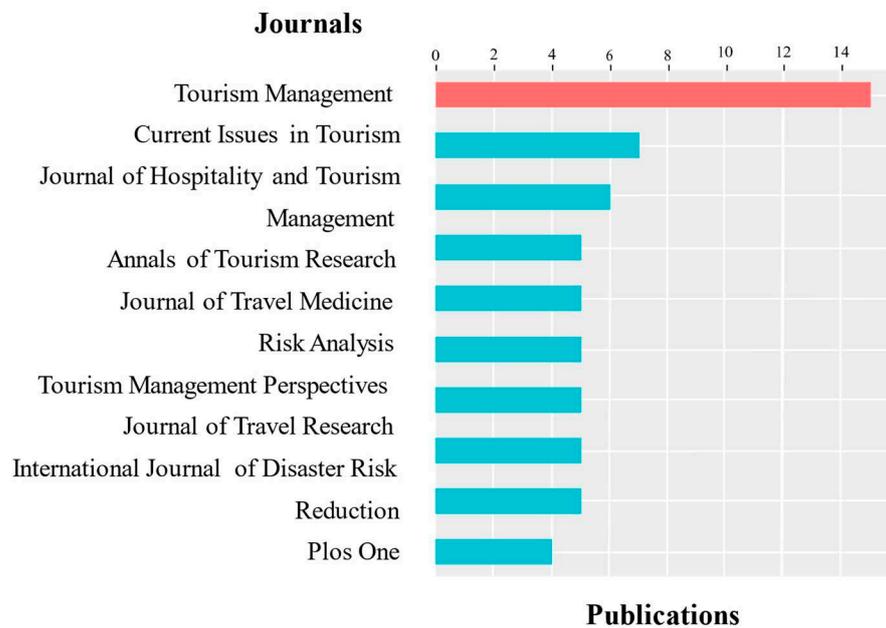


Figure 3. Number of publications per journal.

The journal with the largest number of published papers was *Tourism Management*, accounting for 15 of the sample papers, which is a large number considering that no other journal published more than 8 papers. The journal *Current Issues in Tourism* accounted for seven articles, and the *Journal of Hospitality and Tourism Management* accounted for six

articles, implying that these journals can be considered alternatives for publishing research on tourism risk communication, which may raise the number of readers.

Then, it is also valuable to confirm the number and citations of articles published in the subject journals. Thus, Table 4 presents the 10 most cited articles in the research sample, showing that the article with the largest number of citations has 125 citations.

Table 4. The top ten cited publications.

Author/Year	Title of Publication	Journal	Citations
Avraham [2]	Destination image repair during crisis: Attracting tourism during the Arab Spring uprisings	<i>Tourism Management</i>	223
Kebede, Yitayih, Birhanu, Mekonen, and Ambelu [40]	Knowledge, perceptions and preventive practices towards COVID-19 early in the outbreak among Jimma university medical center visitors, Southwest Ethiopia	<i>Plos One</i>	149
Wilder-Smith [134]	The severe acute respiratory syndrome: Impact on travel and tourism	<i>Travel Medicine and Infectious Disease</i>	133
Garforth et al. [135]	Farmers' attitudes to disease risk management in England: A comparative analysis of sheep and pig farmers	<i>Preventive Veterinary Medicine</i>	131
Luo and Zhai [55]	"I will never go to Hong Kong again!" How the secondary crisis communication of "Occupy Central" on Weibo shifted to a tourism boycott	<i>Tourism Management</i>	107
Orchiston and Higham [20]	Knowledge management and tourism recovery (de)marketing: the Christchurch earthquakes 2010–2011	<i>Current Issues in Tourism</i>	98
Wut, Xu, and Wong [12]	Crisis management research (1985–2020) in the hospitality and tourism industry: A review and research agenda	<i>Tourism Management</i>	98
Penney, Snyder, Crooks, and Johnston [14]	Risk communication and informed consent in the medical tourism industry: A thematic content analysis of Canadian broker websites	<i>BMC Medical Ethics</i>	91
Fagerlin, Zikmund-Fisher, and Ubel [48]	"If I'm better than average, then I'm ok?": Comparative information influences beliefs about risk and benefits	<i>Patient Education and Counseling</i>	81
Fenichel et al. [136]	Skip the Trip: Air Travelers' Behavioral Responses to Pandemic Influenza	<i>Plos One</i>	84

Notably, the most cited papers were published in the journal *Tourism Management*, indicating its popularity among researchers. Interestingly, all ten articles with the highest number of citations were empirical studies, revealing that these publications, which aimed to conduct data analysis or modeling, hold great value for advancing research in the field of tourism risk communication.

Next, it is also essential to confirm the researchers who have the most published articles in this field. Figure 4a depicts the 15 authors with the most published papers. The top author published 12 papers, and those ranked second published 7 papers each. Interestingly, as shown in Figure 4b, we further found that the same author uses LIU B and LIU-LASTRES B with different affiliations. LIU B is at the University of Florida, while LIU-LASTRES B is at Indiana University–Purdue University Indianapolis. Thus, this author has published 12 papers ranked first among these 15 authors.



Figure 4. Authors with the most published papers. (a) Number of publications per author; (b) Network of contributions between authors.

To seek research that can be referenced in tourism risk communication, it is important to identify the patterns involved in the keywords that researchers employed. Figure 5 reveals the distribution of the keyword network. The keywords “risk communication”, “crisis communication”, “tourism crisis”, and “risk perception” are highlighted. The keyword “risk communication” links to various ways of citing the keywords “tourist”, “visitor”, and

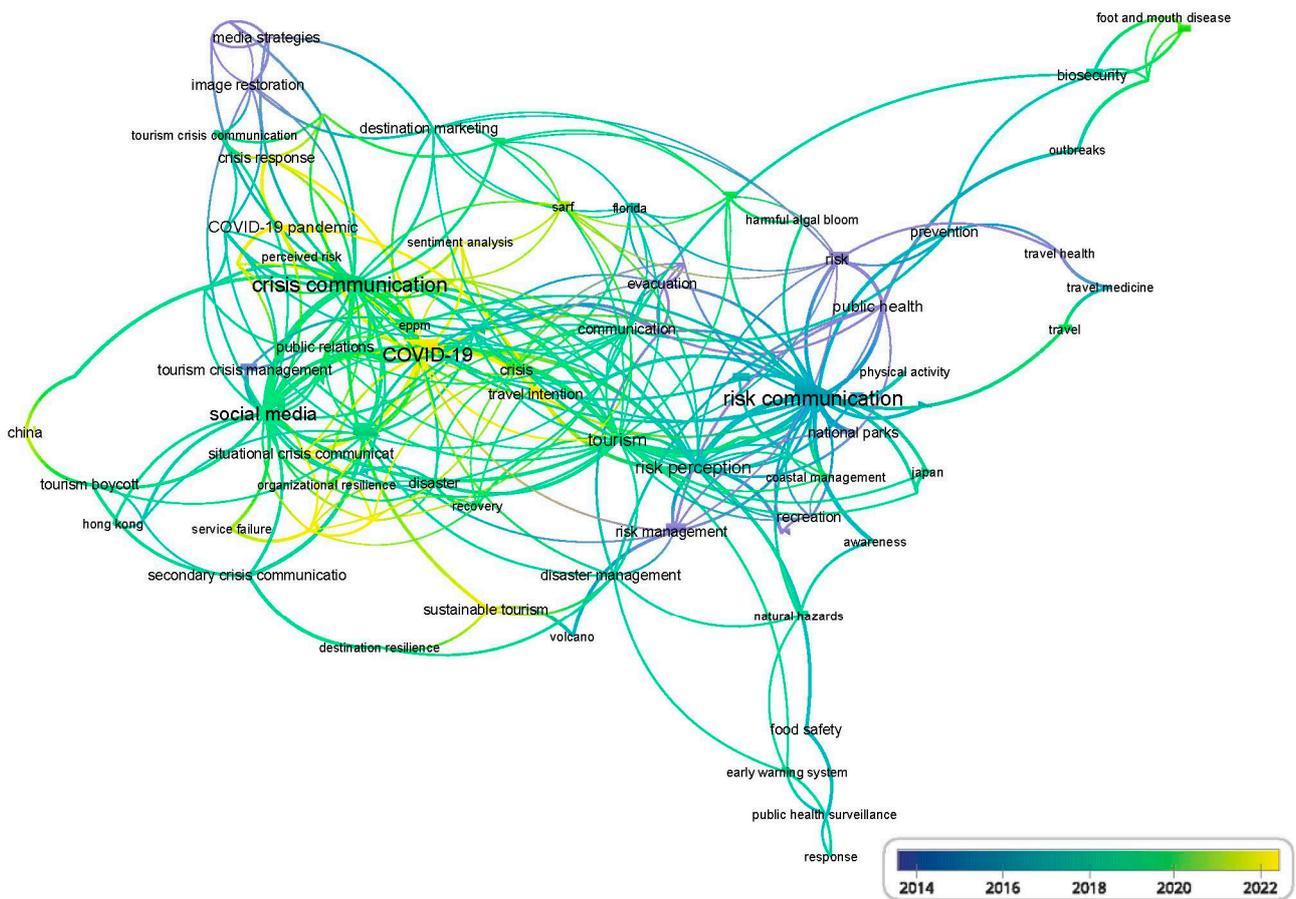


Figure 6. Keyword network analysis over time.

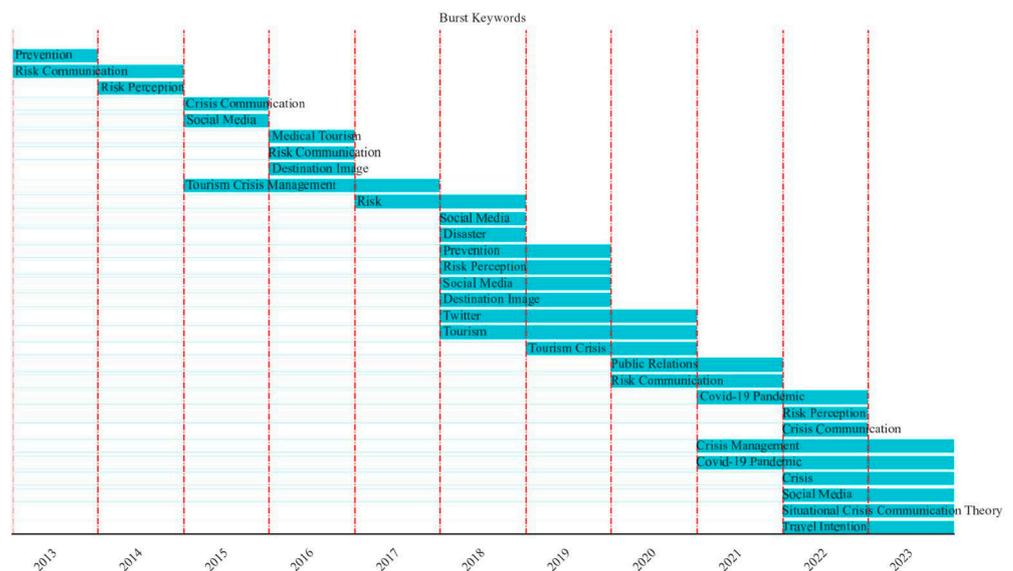


Figure 7. Burst keywords. Note: This map is generated through COOC 13.5 software.

Concerning the countries of origin in collaborations, Figure 8 presents the number of publications per country, showing that the United States, China, England, and Australia are the countries that have published the most papers. This finding reveals that the authors during the study period were residents of the United States, England, China, and Australia and prominent in the subject of research. Thus, the collaborations of these authors with

researchers from other countries should be checked and quantified. Figure 9 depicts the network of collaborations between researchers from various countries. Researchers from the United States, China, and England have the largest magnitude of collaborations in the field of tourism risk communication.

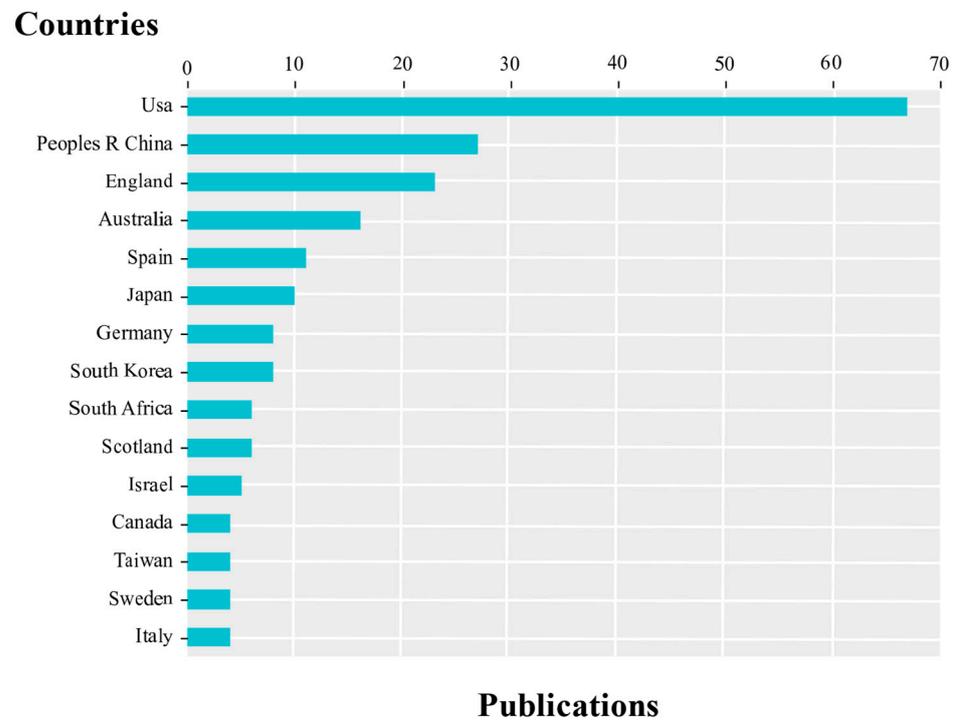


Figure 8. Number of publications by country.

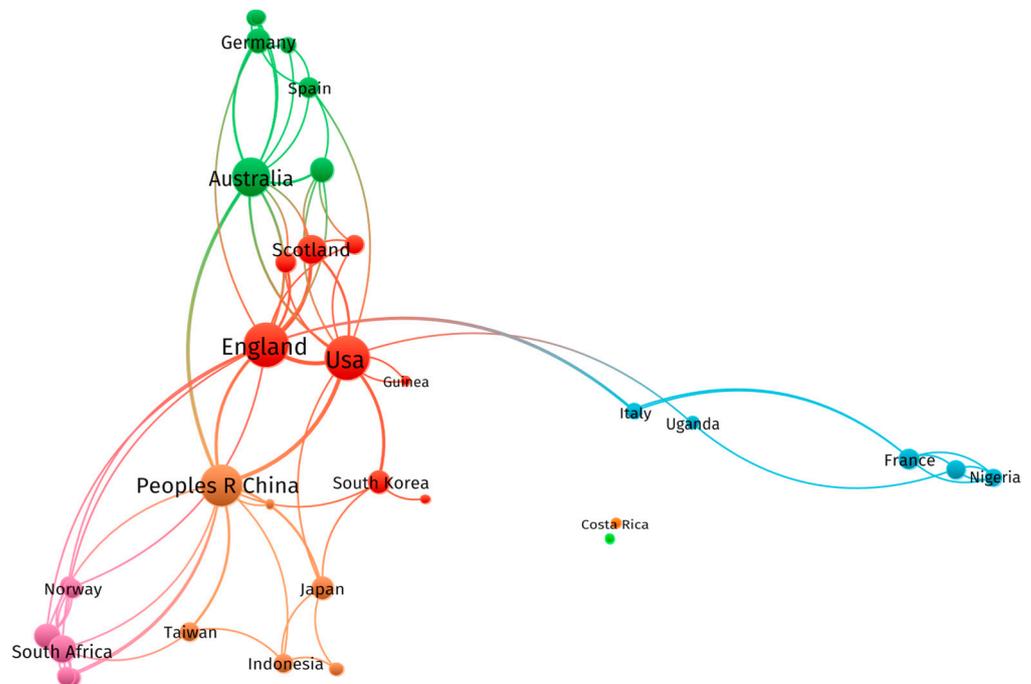


Figure 9. Network of contributions between countries.

Finally, we analyze these three categories together by emphasizing the countries, authors, and keywords. Therefore, Figure 10 demonstrates authors from their own countries

linked to other countries and the keywords of the most productive researchers, revealing that the keywords emphasized in the former figures are utilized widely by the researchers.

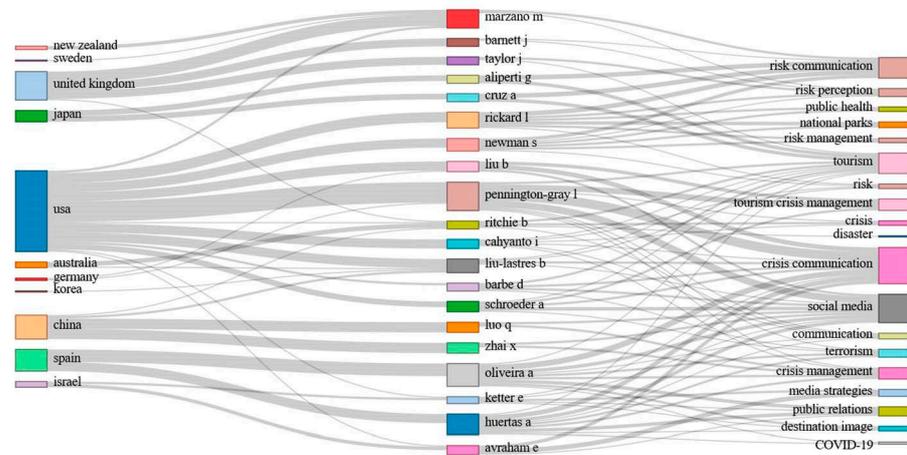


Figure 10. Relationships between authors, countries, and keywords.

4.2. Meta-Analysis

4.2.1. Heterogeneity Analysis

Figure 11 presents a forest plot that illustrates the individual estimates selected from five studies in the data sample. To gain an estimate of the average effects of various influencing factors on tourism risk communication from the studies, we employ the random effect model to implement meta-analysis. The performance of this model is better than that of the fixed effect model because of its unconditional inferences [137]. The estimator of the random effect model suggests that the overall weighted value is 1.6 with a 95% confidence interval (0.64, 4.00) for the impact of various factors on tourism risk communication, demonstrating some variability factors in existing studies.

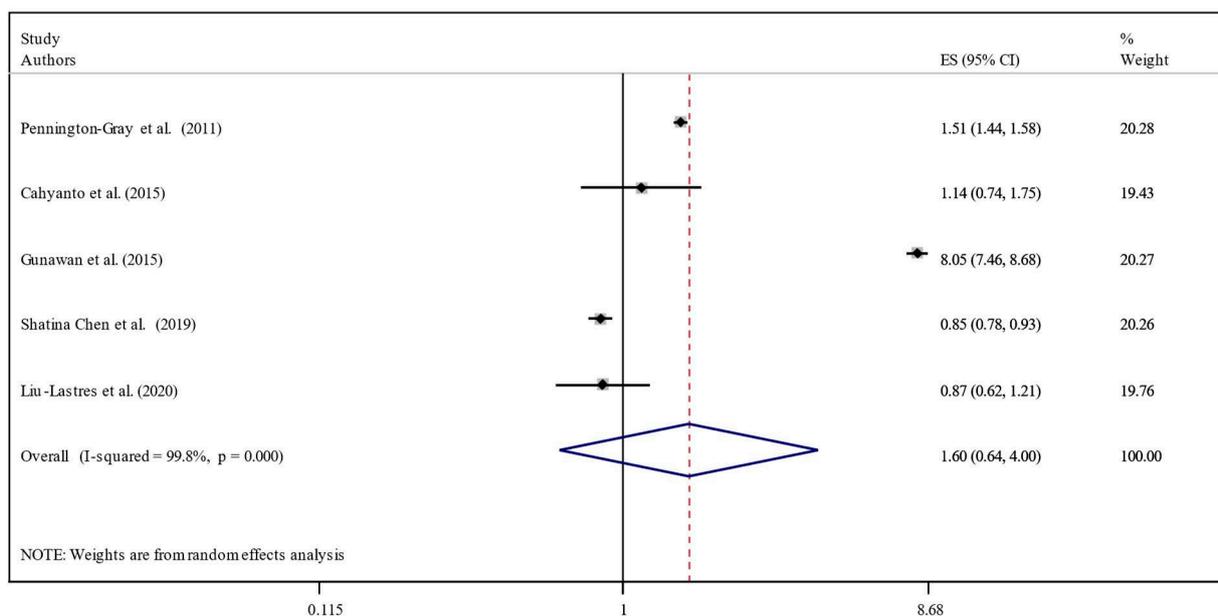


Figure 11. Forest plot of individual estimates [13,21,41,42,45].

4.2.2. Publication Bias

Given the preferential reporting of significant results, identifying and controlling publication bias are an essential routine in meta-analysis [138]. Two potential sources of

publication bias can exist in studies. Type I publication bias relates to researchers' preference for reporting results in a particular direction. Type I publication bias is evaluated through a funnel diagram, as depicted in Figure 10. The Y of tourism risk communication estimation and the precision are assessed on the horizontal axis and vertical axis, respectively. If there is no publication bias, the funnel diagram is symmetrical; otherwise, the funnel diagram is dispersed. We confirm that the funnel diagram is dispersed in Figure 12, revealing the existence of Type I publication bias. Furthermore, given the subjective interpretation of the funnel diagram, we need a more precise method to examine publication bias.

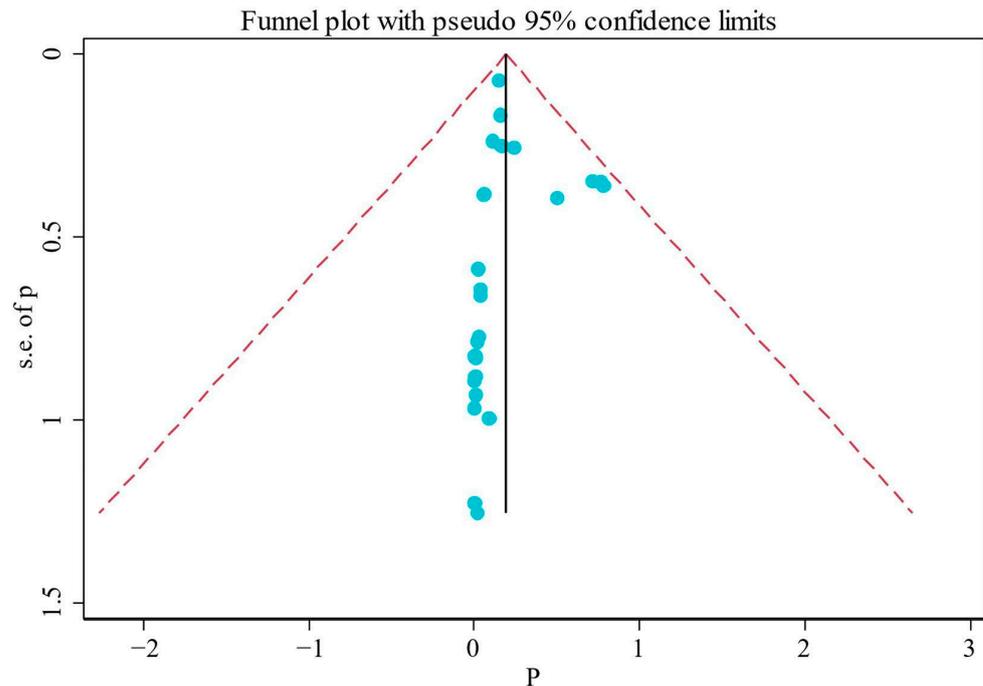


Figure 12. Funnel plot for tourism risk communication estimates.

Therefore, following Stanley and Jarrell [73], we implement a funnel asymmetry test (FAT)–multiple regression analysis (MRA) to examine the existence of Type I publication bias. Table 5 presents the FAT-MRA results, which are consistent with the funnel diagram results. Thus, we believe that the studies focused on tourism risk communication prefer to report positive results. In addition, the precision term's coefficient is 0.1823 with a 0.001 significance level, indicating that most of the publications focused on tourism risk management preferred to report positive relationships between influencing factors and risk communication, regardless of the significance level between the relationships.

Table 5. Funnel asymmetry test.

	Coefficient	Std. Err.	p-Value
Test for Type I publication bias			
Precision (true effect beyond bias)	0.1823	0.038	0.000 ***
Constant (publication selection bias)	0.1057	0.139	0.000 ***
Observations	25		
Studies	5		
Test for Type II publication bias			
Precision (true effect beyond bias)	0.1786	0.049	0.002 **
Constant (publication selection bias)	0.079	0.1786	0.000 ***
Observations	25		
Studies	5		

Note: The response variable is the effect size of the estimated coefficient on tourism risk communication, which is estimated using the mixed effects model. ** $p < 0.01$; *** $p < 0.001$.

Type II publication bias arises when researchers are disproportionately likely to report results with a significance level [73]. This publication bias can lead to immoderate variations, which can be examined through a Galbraith diagram. This diagram is a scatter chart with precision on the horizontal axis and the statistical significance of the estimates on the vertical axis. In the absence of Type II publication bias, only 10% of the t -values of the studies should be greater than 1.65 in absolute value. However, as shown in Figure 13, more than 10% of the samples exceed 1.65 in absolute value. To confirm the existence of Type II publication bias, we adopt an updated FAT-MRA model. Table 5 reveals that the constant is statistically significant, indicating that empirical studies on tourism risk communication are more likely to report statistically significant results, which confirms the results of the Galbraith plot.

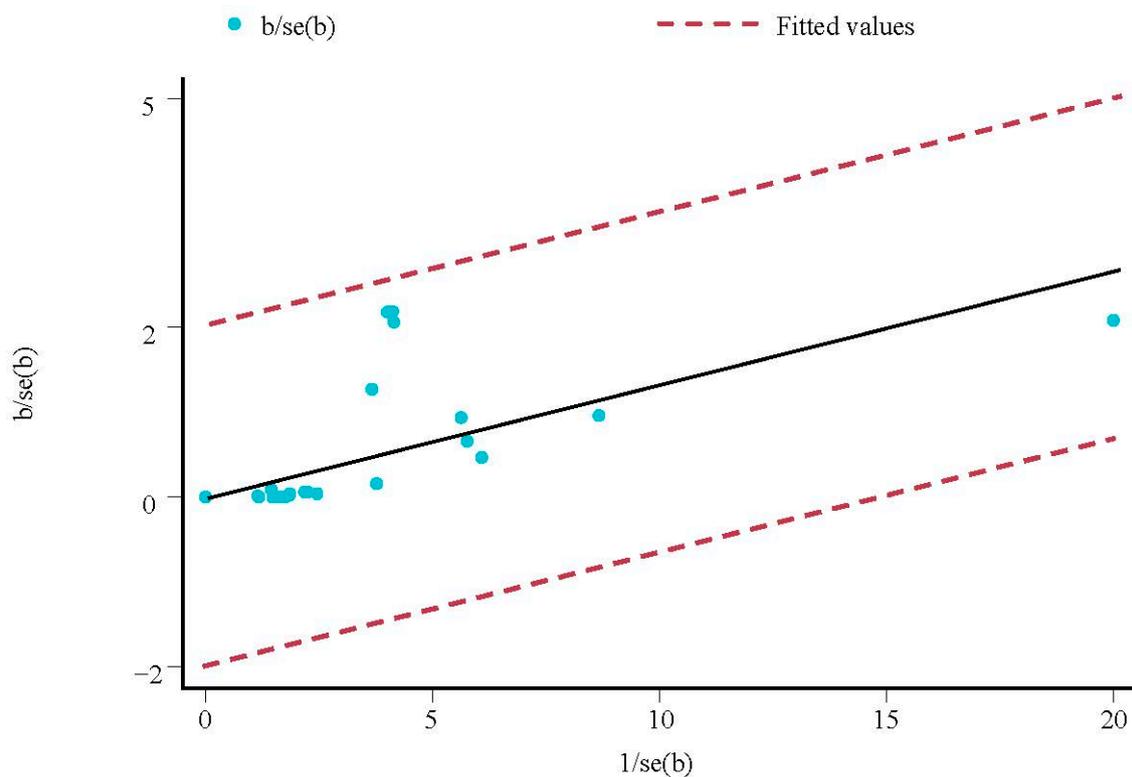


Figure 13. Galbraith plot for tourism risk communication estimates.

Based on the results above, it is necessary to check the extent to which publication bias will threaten the meta-regression results in our data sample. Therefore, this study employs a smart technique, the Orwin Fail-Safe N [139], to examine publication bias. The result of this technique is twenty-five, indicating that the estimated results of the impact of tourism risk communication are not sensitive to these two types of publication bias.

4.2.3. Bayesian Model Averaging for Moderator Variables

We employ the BMA method to confirm which moderator variables should be included in the regression models. The results of the BMA estimation are shown in Table 6. The PIP shows the possibility that a variable should be employed in the regression model. The PIP values of some variables are lower than 0.1, indicating that they may not be important [140]. The PIP values of 15 moderator variables are between 0.1 and 1, indicating that these variables possibly affect the regression coefficients of the impact of factors on tourism risk communication. These moderator variables contain four individual characteristics (*age, gender, residence, and experience or knowledge*), eight variables from the factor characteristics (*family and friends, television, social groups, local tourism offices, local authorities, radio, resource allocation, and the evaluation of reports*), one variable from the data characteristics

(*international*), and two variables from the estimation characteristics (*OLS* and *Logit*). In the following regression, we employ variables whose PIP values are greater than 0.1 to conduct a meta-analysis.

Table 6. Bayesian model averaging.

Response Variable: Y	Coefficient	Std. Err.	PIP
Individual characteristics			
Age	−0.3002	0.3738	0.46
Gender	−0.0020	0.0493	0.21
Residence	0.0084	0.0622	0.15
Experience or knowledge	0.0073	0.0507	0.12
Factors characteristics			
Family and friends	−0.0348	0.1362	0.10
Television	0.0475	0.2581	0.12
Social group	−0.0174	0.0988	0.17
Local tourism office	0.0213	0.1079	0.15
Weather channel	−0.0171	0.0980	0.07
Local authority	0.0326	0.1196	0.11
Newspapers	0.0120	0.0664	0.08
Radio	−0.0402	0.1464	0.11
Social networks	−0.0032	0.0510	0.05
Locals	0.0008	0.0653	0.05
Resource allocation	0.0276	0.1342	0.10
Evaluation of reports	0.0345	0.1580	0.13
Data characteristics			
Observation	0.0235	0.0155	0.07
Survey	0.1583	0.2691	0.08
International	0.3174	0.3108	0.57
Regional	0.0256	0.1184	0.07
Estimation characteristic			
Ordered probit	0.0008	0.0455	0.07
OLS	0.1554	0.2288	0.37
SEM	0.1891	0.2465	0.08
Logit	−0.0177	0.0770	0.11
Publication characteristics			
Year	0.3574	0.3266	0.08

Note: The Bold number means PIP value is great than 0.1.

4.3. Meta-Regression and Discussion

Table 7 presents the results of the meta-analysis with a robustness check, indicating that estimating the relationship between antecedents and risk communication is susceptible to many factors.

First, the estimate of gender is susceptible to tourism risk communication. Existing studies have found that women are more credible than men in most risk communication channels, including family and friends, television, local authorities, and hotel staff [13,141]. Usually, females perceive higher risk than males in specific events such as air travel and outdoor adventures. These differences can be explained by factors such as fear, knowledge, and experience. For example, females perceive danger if they feel ill-informed, while males perceive danger when they worry about future events [142]. The results also indicate that tourism risk communication is sensitive to experience. There are significant dissimilarities between visitors with knowledge or experience regarding disaster impacts and visitors without such knowledge or experience, especially in information channels such as newspapers, local tourism offices, and hotel employees [143]. Those who have experienced disasters are shown to be slightly more credible than those without such experience.

Table 7. Meta-regression with robustness check.

Response Variable: Y	Mixed Effects ML		OLS		IV-2SLS	
	Coeff.	Robust Std. Err.	Coeff.	Robust Std. Err.	Coeff.	Robust Std. Err.
Constant	0.85 **	0.17	0.61 **	0.13	0.63 **	0.07
<i>Individual characteristics</i>						
Age	−0.72	0.66	−0.52	0.25	−0.56	0.21
Gender	0.06 ***	0.76	0.03 **	0.37	0.03 **	0.15
Residence	0.27	0.77	0.15	0.29	0.12	0.15
Experience or knowledge	0.39 **	0.16	0.14 **	0.29	0.07 *	0.14
<i>Factors characteristics</i>						
Family and friends	−0.28	0.31	−0.36	0.13	−0.37	0.18
Television	−0.48	0.23	−0.36	0.13	−0.38	0.19
Social group	−0.27	0.15	−0.26	0.12	−0.28	0.17
Local tourism office	0.25 **	0.19	0.21 **	0.13	0.20 **	0.18
Local authority	0.27 **	0.06	0.22 **	0.09	0.27 **	0.16
Radio	−0.38	0.11	−0.37	0.13	−0.39	0.19
Resource allocation	0.29 **	0.34	0.43 **	0.29	0.19 **	0.36
Evaluation of reports	0.89 **	0.27	0.25 **	0.04	0.36 **	0.25
<i>Data characteristics</i>						
International	0.39 **	0.33	0.50 *	0.28	0.16 **	0.42
<i>Estimation characteristic</i>						
OLS	0.24	0.23	0.11	0.27	0.11	0.30
Logit	0.14	0.21	0.16	0.26	0.14	0.11

Note: The regression model employs only variables with a PIP value greater than 0.1. ML: maximum likelihood; OLS: ordinary least squares; IV-2SLS: instrumental variable for two-staged least squares. *, **, and *** represent significance levels at 10%, 5%, and 1%, respectively.

Second, the utilization of proxies for factor characteristics has some consequences for the result estimates. In major crisis events, critical loss of life occurs when tourists reject official evacuation recommendations, thus losing their lives. Some information channels that are regarded as credible and that are employed to gather information on disaster evacuation are not critical factors in evacuation decisions. This phenomenon is best explained by the fact that even when the public is skeptical about the government or local authorities sufficient credibility remains [13]. When local authorities issue evacuation orders to tourists, tourists will take these orders seriously and be much more likely to leave. This situation demonstrates that well-published and well-timed evacuation rules are meaningful for travelers in deciding whether to wait and be rescued or evacuate. Furthermore, local tourism offices play a vital role in influencing evacuation decisions. For example, those who seek information from local tourism offices prefer to leave. Therefore, emergency agencies, local tourism offices, and the travel industry should collaborate on messaging and communicating.

In addition, the results are sensitive to other factors, such as resource allocation and the evaluation of reports. The meta-regression results indicate that resource allocation is a predictor of tourism risk communication, which is consistent with the results of the existing literature [41]. That is, internal factors such as top management commitment and process resource commitment are important factors that determine the possibility of an effective plan. Thus, it can be concluded that resource allocation is a strong predictor of communication strategies among travel organizations.

Furthermore, media reports have a significant positive impact on tourism risk communication. The mass media outline the agenda-setting effect of crisis events in which the perceived evaluation of the stakeholders of tourism risks depends on the media's agenda-setting and framework reporting [45]. In other words, the positive media coverage of a crisis indicates the high efficiency of the risk communication strategy.

Finally, international tourists are more likely to seek more information from different information channel options. Typically, international travelers utilize more social media

than domestic travelers [13,17]. Thus, it is essential to notify international travelers of which reliable social media they can use to quickly obtain the newest messages about tourism crisis events. Moreover, among the previous review studies, Aliperti and Cruz [34] analyzed the adoption of disaster mobile apps exploring the field of disaster management; Wut, Xu, and Wong [12] focused on systematically summarizing the types of crises and different industry sectors in hospitality and tourism; and Pascual-Fraile, Talón-Ballester, Villacé-Molinero, and Ramos-Rodríguez [61] used a single bibliometric approach to explore the themes affecting the image of tourist risk communication in the field of specific destinations, all of which have limitations. Therefore, the combination of bibliometrics and meta-analysis in this paper is conducive to supplementing the research on various aspects of tourist risk communication in the field of tourism risk management, and accurately identifying the factors that have a significant impact on the communication process. Specifically, this paper visualizes and analyzes the annual publication volume, journal publication volume, author publication volume, author collaboration networks, national collaboration networks, and burst word detection results through bibliometric methods, and it presents a comprehensive overview of the research status quo in the field of risk communication, identifies emerging research clusters, analyzes the corresponding research frontiers, and provides directions for future research in the field. Furthermore, this paper examines the heterogeneity and effect sizes of factors affecting risk communication via a meta-analysis of the screened literature; makes up for the deficiency in the research field where the single use of bibliometric methods or traditional literature review methods fails to quantitatively analyze the reasons for inconsistent research results on the same topic; quantifies the impact of various factors on the estimated results reported by various researchers; and clarifies the differences between various studies in the existing literature. Finally, this paper identifies seven factors that show a significant impact on the implementation of risk communication strategies through meta-analysis, namely, gender, experience or knowledge, local tourism offices, local authorities, resource allocation, the evaluation of reports, and international issues, which will enable managers and decision-makers to identify problems more efficiently and choose appropriate communication paths, thus formulating more reasonable risk communication strategies.

5. Implications for Theory Development

5.1. Implications of the Bibliometric Analysis

This paper employs bibliometric analysis techniques to distinguish the 236 papers by year of publication, leading to time period coverage, the publication status per year, and the most productive journals in the field of tourism risk communication. By analyzing publications between 1985 and 2023, we observe a significantly increasing number of publications on tourism risk communication. There was a slight increase in the number of publications in the period between 2014 and 2019, which could be explained by the growing concern over crisis events and communication procedures in tourism management. This phenomenon seems to encourage researchers to obtain valuable experience or knowledge involving tourism risk communication and decision-making processes. Furthermore, researchers may consider publishing more articles in journals such as the journals *Current Issues in Tourism* and the *Journal of Hospitality and Tourism Management* so as to attract more readers' attention to this field.

Seeing the analysis results, it is possible to identify patterns in tourism risk communication that are being developed. One of the main issues in the current research is that, despite risk communication initiatives in travel organizations, time and instruments for assessing their effectiveness are lacking. In this context, further studies should conduct empirical investigations and assessments of various risk communication actions to provide valuable information to the decision-makers responsible for formulating risk communication plans. In addition, these studies may consider the role of other travel suppliers, such as airline companies [66]. Furthermore, future research topics and trends should continue to focus on topics such as "risk communication", "crisis communication", "tourism crisis",

“risk perception”, “health service”, “health education”, “health behavior”, “environmental health”, and “public health”.

In this sense, some suggestions provided by tourism suppliers and researchers are taking a step forward. These suggestions are related to the crisis risk information provided by media channels. Social networks are a noteworthy channel, but travel providers generally do not seem aware of them [144]. If required by the government, they declare that they can provide tourists with information about them. The key to facilitating this process seems to be related to the development of multimedia, integration, and “light” risk communication.

5.2. Implications Based on Meta-Regression Analysis

The meta-regression results indicate that publication bias exists in studies on tourism risk communication, and such bias is mainly caused by the nonreporting of null or negative effects, distorting the existing theoretical foundation. Such bias will also threaten the communication of ideas and information meant to promote scientific efforts [75]. Therefore, publication bias can lead researchers to make overoptimistic inferences on the contributions of risk communication to tourism management, which, in turn, can hinder frontier knowledge development. Furthermore, this can cause tourism security regulations to have little or no impact on risk communication information channels [15]. Thus, researchers need to understand that increasing our insights into the relationship between risk communication and tourism management requires us to understand not only the conditions for establishing tourism risk communication information channels but also what the antecedents are and under what circumstances they do not apply. Anything less than this point will lead us to misleading conclusions about the relationship between tourism management and risk communication. Therefore, this issue must be addressed if we intend to advance theory.

Theoretical falsification is an excellent scientific virtue [145]. Researchers should follow the standard according to which they must transmit the entirety of a message to support those people who intend to judge the importance of the knowledge they contribute to tourism risk management and evaluate the significance of the theories that underpin their research, not just empirical results that confirm the proposed hypothesis or the expected conclusion. They should be determined to present their conclusions, regardless of the results, as long as they are based on sound science. Indeed, any discovery should coincide with solid arguments, methodologies, and contexts. Meanwhile, editors and reviewers should be more willing to accept null or negative results. Some editors or reviewers who are reluctant to accept null or negative results may lead researchers to pursue the significance level of the variable coefficients by manipulating sample data until they reach a certain significance level. In the absence of a replication procedure, it becomes quite difficult to demonstrate what antecedents of tourism risk communication are falsifiable, thus hindering theoretical advancement.

The meta-analysis results demonstrate that the estimates reported in different publications on tourism risk communication are sensitive to many factors, such as the gender, nationality, and experience of tourists; local tourism offices and local authorities; organizational resource allocation; and the evaluation of reports. Although the inclusion of these factors as explanatory variables in the tourism risk communication equation is fairly obvious, researchers need to control for these factors in modeling tourism risk management to more accurately understand the relationship between risk communication and its antecedents. For example, Pennington-Gray, Thapa, Kaplanidou, Cahyanto, and McLaughlin [41] discussed crisis planning and preparedness in the tourism sector and found that organizational resource allocation is a critical antecedent of risk communication. Cahyanto and Pennington-Gray [13] explored how the inclusion of gender, nationality, and experience variables affected the results of hurricane evacuation communication to tourists. They argued that local tourism offices and local authorities are important information communication channels for tourists to evacuate. Gunawan, Shieh, and Pei [45] investigated the impact of media reports and risk communication strategies on corporate image. They concluded that the evaluation of reports has a significant positive impact on com-

munication news. Therefore, beyond the theoretical argument of this effort, it is necessary to incorporate these antecedents into the tourism risk communication model to reduce estimation bias. In addition, considering the impact of gender on resource allocation and the evaluation of reports, it is valuable for researchers to account for not only gender but also gender differences or inequality as a control variable in future studies on tourism risk communication.

6. Conclusions

The purpose of our research is to identify the theoretical patterns of tourism risk management by exploring risk communication to tourists and its antecedents for perceived risk and decision-making, which we believe has been accomplished.

We first apply bibliometric analysis techniques to analyze 236 papers collected from the *WoS* database, verifying the knowledge patterns linked to the number of publications per year and the most commonly used tourism risk communication and causal inference models. Therefore, this paper aims to identify specific risk communication channels and explore influencing factors that are beneficial for managers in formulating risk communication strategies. From the results of our study, managers and decision-makers can more easily identify issues in their organizations and determine which factors should be considered key antecedents. Thus, our research is important because it explores and detects important antecedent factors and methodologies to support risk-communication-strategy-issuing processes and crisis planning. As the number of tourism consumers increases, organizations and local authorities should consider risk communication channels and the findings presented in this study to identify new ways of communicating risks to tourists.

Our study also selected 15 moderators drawn from 5 studies in the meta-regression to quantify the impact of various factors on the estimated results reported by various studies, clarifying the variations between various studies in the existing literature. In addition, rather than depending on a dataset on the risk communication of one or a series of countries, we examine statistical structures that appear to be an attribute of all the studies on tourism risk communication and its antecedent nexus, causing our research to be more representative than existing studies. Our study contributes some knowledge to the literature and demonstrates important findings that are valuable for theory development. The meta-regression results provide support for the formulation of tourism risk communication strategies; however, they indicate that the estimates have a high sensitivity to many factors. This sensitivity reveals that greater efforts should be made in the literature to report estimated results of tourism risk communication and its antecedents through a variety of individual characteristics, factor characteristics, and data characteristics. The existence of publication bias also indicates that researchers should pay more attention to explaining the estimated results of previous studies and outlining the theoretical contributions of their own research.

Accordingly, our research results on the following key questions can support many decisions: Which risk communication strategy should be implemented? What information channel should be adopted? How can stakeholders' interests be consistent with the goals of an institution or organization? Solving these issues will raise opportunities for successfully communicating risk to tourists and cause the decision-making process to be more assertive and reasonable.

Finally, in addition to the advantages of bibliometric analysis and meta-regression analysis, our paper still has limitations. Although bibliometric analysis is a suitable approach for investigating the number of publications and confirming the knowledge patterns or trends, some limitations exist in the characteristics of keyword combinations. When researchers intend to explore and identify gaps in previous studies, they should observe these limitations. Furthermore, the reliability of the results obtained through meta-analysis depends on the data sources from the various publications. Our study is susceptible to the results reported by these studies, such as regression coefficients, *t*-statistics, and the standard error of the relationship between tourism risk communication and its antecedents.

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