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Tourist ports of entry and biosecurity preparedness: Lessons learned from Ireland

Domhnall Melly [1]* and James Hanrahan [2]

[1] Edinburgh Napier University, Scotland, UK. Email: d.melly@napier.ac.uk
[2] Atlantic Technological University Sligo, Sligo, Ireland. Email: hanrahan.james@mail.itsligo.ie

*Corresponding author

Abstract
This study provides a unique vista of tourism biosecurity preparedness for a destinations' tourist ports of entry. Existing tourism biosecurity research deals with organisational resilience and tourists' biosecurity behaviour, however, has not explicitly examined tourism biosecurity preparedness at global or destinations tourist ports of entry levels. To fill this gap, this research utilises twenty-six tourism biosecurity criteria generated from a systematic international literature review to analyse international biosecurity instruments and Irish tourist ports of entry. A mixed-method approach was utilised through content analysis of international biosecurity instruments and Irish tourist ports of entry. A survey and semi-structured interviews were used to support the findings of the content analysis at Irish tourist ports of entry. Analysis determined the Irish tourist ports of entry sampled were severely lacking any provision for tourism biosecurity preparedness. International biosecurity instruments had a necessary level of biosecurity standards; however, a notable omission of tourism that adversely impacts tourism biosecurity preparedness. This research recommends international biosecurity instruments improve capacities for tourism-specific measures. Tourist ports of entry should integrate specific tourism biosecurity measures into passenger operations to ensure greater destination resilience.

Keywords: tourism biosecurity preparedness, tourist ports of entry, tourism biosecurity planning, destination resilience

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1. Introduction

Long before the COVID-19 pandemic, tourism scholars had warned about the risk of an infectious disease outbreak of global significance (Hall, 2006; Smith and Guégan 2010; Morse *et al*., 2012). These warnings stemmed from increasingly rapid tourist movements through global air transportation pushing the spread of harmful pathogens into previously unaffected destinations (Findlater and Bogoch, 2018; Gössling *et al*., 2021). Advances in technology, transportation, social media, and increasing globalisation through complex tourism travel networks have had a profound impact on the reach and speed of tourists (Sönmez *et al*., 2019). Tourists can inadvertently vector zoonotic diseases (animal to human), epizootic diseases (animal to animal), communicable diseases (human to human), and invasive alien species (IAS) between multiple destinations anywhere in the world in a short space of time (Hulme, 2015; Baker, 2015; Hall, 2019; Smith *et al*., 2020). This has led to the growing need for a globally unified approach to biosecurity that incorporates the increasing mobility of human vectors.

Ports of entry, as tourist's first physical point of contact with a destination; should have appropriate measures in place such as inspection; communication; cleaning and disinfection; and quarantine facilities to mitigate the level of biosecurity risk entering the destination (Martin and Boland, 2018; Sherring, 2021). However, such measures should be linked to an international biosecurity surveillance system that would ensure global coordination for rapid response to emerging biosecurity threats (WHO, 2020). The integration of recommended risk management capacities from official international organisations such as the World Health Organisation (WHO, European Commission (EC), and the European Centre for Disease Prevention and Control (ECDC) would mean greater synchronisation within the global tourism biosecurity system. With that in mind, recommended capacities for biosecurity at tourist ports of entry should be fully implemented to ensure a globally coordinated network.

Biosecurity is often perceived as a complex subject due to risks effecting human, animal, and plant health. The primary focus of 20th century biosecurity leaned toward threats posed to global agriculture such as foot and mouth disease (FMD) and avian influenza viruses which led to the adoption of biosecurity measures to reduce the risk of spread of animal disease on farms (CDC, 1997; Laanen *et al*., 2014). The focus of biosecurity moving into the 21st century has shifted towards environmental threats consisting of IAS causing severe impacts to biodiversity, ecosystem services, and environmental quality (Kelly *et al*. 2013; Gallardo *et al*., 2019). This trend is apparent in recent biosecurity definitions of that time that have embraced the environment, but also an all-encompassing approach to biosecurity that includes the economy and human health:

> *"The management of risks posed by organisms to the economy, environment, and human health through exclusion, mitigation, adaptation, control, and eradication"* Pyšek and Richardson (2010:31).

The issue of biosecurity and tourism has previously been discussed in the context of tourism mobility facilitating biological invasions (Hall, 2011), and the vectoring of diseases such as Botrytis Cinerea, a fungal rot affecting grapes representing a significant biosecurity risk for wineries (Hall, 2005). As with many biosecurity threats, this required a strategic and integrated method by adopting a three-stage approach from pre-border to post-border which involved raising tourists' awareness of biosecurity, passenger locator forms, and disinfection procedures. Thus, tourist ports of entry played a key role at the border stage by facilitating an approach to proactive risk mitigation, rather than costly disease control and eradication.

Now that the pandemic phase of COVID-19 has receded in many destinations, there now exists the need for extensive research into building tourism destination resilience and the role of tourism planners in this transformation process (Gössling *et al*., 2021; Hall *et al*., 2020). Destination resilience has been discussed by Traskevich and Fontanari (2021) in the context of advanced sustainable management in tourism. This indicates that post-COVID-19 destination resilience goes much further than mitigating tourism biosecurity risk, but how the industry itself must adapt to what is termed as newly normal framework conditions. In the context of biosecurity, tourism industry sustainability and destination resilience will involve a rethink of normal industry orientations and the creation of a new and unique competitive advantage for stakeholders embracing new technologies for tourism biosecurity preparedness.

Although biosecurity planning and preparedness is clearly an issue for all tourism stakeholders including organisations and governments, this research focuses in on tourist ports of entry as the tourist's first point of contact with a destination. Thus, this paper will analyse international biosecurity regulations, frameworks, policies, plans, and tools (international biosecurity instruments thereafter) and tourist ports of entry in Ireland for the presence of essential tourism biosecurity criteria. This study contributes to new knowledge in tourism biosecurity research by identifying gaps in specific tourism biosecurity planning at tourist ports of entry and their compliance with international biosecurity instruments. The findings allow tourism planners and policymakers to improve the implementation of tourism biosecurity capacities specifically at tourist ports of entry outside of pandemic conditions. This could lead to the development of more resilient tourism destinations throughout the tourism industry.

2. Literature Review

Existing biosecurity research has investigated the link between perceived destination risk and tourists traveling intentions (Teeroovengadum *et al*., 2021), and the need for effective tourism biosecurity communication and smart mobile technology (Melly and Hanrahan, 2018; Hanrahan and Melly 2019). Furthermore, regenerative tourism growth and advanced sustainable management of the destination value-chain have been examined as a way of building destination and crisis resilience (Traskevich and Fontanari 2021; Ketter, 2022). Although infectious disease detection and screening at airports have recently been examined (Tabares, 2021; Li *et al*., 2021), there appears to be a major gap in research pertaining to all-encompassing tourism biosecurity preparedness at tourist ports of entry through appropriate tourism biosecurity planning and management. This is despite the urgent need for robust biosecurity measures to safeguard destinations post-Covid-19 at tourist ports of entry. This research will therefore bridge this gap by utilising tourism biosecurity criteria derived from recent research on national-level planning for tourism biosecurity (Melly and Hanrahan, 2020). The essential biosecurity criteria were designed through a systematic review of literature and include vector mitigation measures, biosecurity legislation, biosecurity communication, and biosecurity planning. To provide an international perspective, this research will also investigate the presence of the same criteria within international biosecurity preparedness plans and strategies set out by standard-setting organisations such as the WHO (World Health Organisation) and IATA (International Air Transport Association).

Biosecurity is considered interdisciplinary based on multilateral agreements comprising instruments to protect both public health and environmental protection (Bielecka and Mohammadi, 2014). Thus, International law and standard-setting organisations like the WHO, EC, UNWTO, and the ECDC offer the opportunity to align national tourism biosecurity approaches for human and environmental health internationally. Their aim is to direct national-level policy and legislative frameworks to effectively regulate the transboundary movement of potential biosecurity threats (Black and Bartlett, 2020). Vectoring can occur from tourists unknowingly transmitting both zoonotic and other communicable

diseases into multiple destinations (Herfst *et al.*, 2017, WHO, 2017). Therefore, proactive biosecurity planning should fully incorporate tourist-centric measures and procedures from international to tourist port of entry levels. For example, emergency plans, preparing vaccinations, conducting regular inspections, and raising tourists' awareness of health risks should be the upmost priority of tourism planners and policymakers, especially considering also how tourists' perception of disease risk can influence their behaviour during a critical biosecurity breach situation (Chen *et al.*, 2021).

Resources for tourist communication, biosecurity monitoring, surveillance, quarantine, and rapid response are required at ports of entry under the International Health Regulation (IHR) capacities (WHO, 2019). This is to improve national tourism biosecurity capacities, but also to achieve international biosecurity coordination through the Global Outbreak Alert and Response Network (GOARN). Coherent and consistent communication is essential for a coordinated and aligned approach to biosecurity from global right down to local levels (WHO, 2010). Tourist behaviours can be significantly influenced through trustworthy biosecurity communication which can increase their compliance with appropriate risk management measures (Hall, 2011). However, communication should also support coordination between other tourist ports of entry at national and international levels. Achieving international coordination is essential to mitigating the threat associated with biosecurity threats with a global reach. Biosecurity measures therefore must facilitate international tourist mobility and consider different social characteristics associated with tourists (Melly and Hanrahan, 2020). For example, during a pandemic; contradictory, vague, and inaccurate information can have a profound impact on the level of engagement with communication and subsequent crisis response measures (Sellnow *et al.*, 2019; Husnayain *et al.*, 2020). This is often attributed to different social and cultural characteristics, gender, generational contrasts, language inclinations, strict convictions, religious beliefs, and varying literacy (Reddy and Gupta, 2020). Adapting biosecurity communication to tourists' social characteristics can play a key role in the acceptance of information. Therefore, policies aimed at managing tourism biosecurity risk may not succeed due to a failure to accurately convey risk perception and achieve the desired tourist behaviour (Arce *et al.*, 2017). Several international approaches such as Hawaii and New Zealand have integrated a strategic border stage approach for biosecurity communication to alleviate a misalignment of desired tourist biosecurity behaviour. These incorporate biosecurity best practice for tourists including the communication of deterrents such as fines, confiscations, and other penalties in place at border inspection which play a vital role in enforcing regulations (Magarey *et al.*, 2009; Sherring, 2019). However, this must be carefully planned as research by Kim *et al.* (2021) identified how a better understanding of tourist attitudes towards biosecurity measures is crucial for targeting education and marketing communication campaigns to impact tourist behaviour. Tourism planners must take into consideration the dynamic social characteristics of tourists when designing tourism biosecurity communications at tourist ports of entry.

Capacities for biosecurity monitoring and surveillance can play a critical role in the early detection, rapid response, and eradication of harmful and costly biosecurity breaches (Aarestrup and Koopmans, 2016). This can consist of risk analyses of pests, diseases, and pathways to prioritise screening, inspections at pre-border, and monitoring programs at major ports based on the results of pathway risk assessments (Gaber *et al.*, 2009; Martin and Boland, 2018). Appropriate monitoring and surveillance can proactively initiate best practices and appropriate rapid response for government agencies, industry, and tourists to follow at the destination level (HISC, 2017). According to Turner *et al.* (2020), the value of inspections in terms of risk mitigation is not in the immediate number of biosecurity interceptions, but rather the deterrent effect of having inspections in place and the implications of fines, confiscation, or even deportation or imprisonment (Springborn *et al.*, 2016). Thus, appropriate legislative instruments are critical to the implementation of biosecurity capacities at tourist ports of entry.

This could support the implementation of tourist deterrents, but also underpin crucial quarantine processes in the event of a biosecurity breach. Quarantine is an essential biosecurity measure to control outbreaks and has proved imperative in preventing the spread of COVID-19 (Altuntas and Gok, 2021). The importance of such tourism biosecurity capacities has been recognised within tourism scholarly literature (Chiu *et al*., 2014; Martin and Boland, 2018; Kandel *et al*., 2020). However, COVID-19 has brought into question the motivation of planners and policymakers to fully incorporate such crucial capacities specifically at tourist ports of entry.

A reorganisation of the tourism industry post-COVID-19 may well involve the adoption of automation technologies such as wearable and implanted technologies and self-service kiosks that could streamline the implementation of biosecurity measures among tourists without impeding tourist experiences (Ivanov *et al*., 2020). Furthermore, utilising information and communication technologies (ICTs) to incorporate issues of tourism biosecurity could be part of a much larger phenomenon towards smart tourism destinations (STDs). STDs have been discussed in the context of promoting a destination fertile innovation environment, drawing new investments, and entrepreneur initiatives (Cavalheiro *et al*., 2019). STDs may well have a role to play in the tourism industry's recovery process by creating sustainable and resilient tourism destinations through streamlining tourist biosecurity measures. Therefore, automation technologies and ICTs could be integral to the tourism industry's fulfillment of essential capacities such as biosecurity communication and rapid response.

According to Škare *et al*., (2021), a new international crisis-readiness mechanism must be put in place by tourism planners and policymakers to fight a current pandemic crisis as well as future crises. One of the most relevant examples of international biosecurity instruments for tourism are the core capacities at ports of entry within the IHR 2005. The purpose of these additional core capacities was to alleviate the threat of a global pandemic from tourist movements based on frailties identified in earlier IHR during the 2003 Severe Acute Respiratory Syndrome (SARS) outbreak (Baker and Fidler, 2006). Despite representing a focal point for international tourists and the ideal setting to perform essential biosecurity measures, theory has often discussed large disparities of appropriate capacities in place at destinations' tourist ports of entry (de Rooij *et al*., 2020). As countries utilised WHO support mechanisms to complete self-assessments and self-reporting to ensure IHR compliance, they received criticism for a lack of transparency and not representing the true measure of capacity (WHO, 2015; Gostin and Katz, 2016). Thus, a global, comparative metric for measuring biosecurity preparedness could support resource allocation and mobilisation in capacity-building efforts and ensure government accountability (Bartolini, 2020). Assessment resources such as the Joint External Evaluation (JEE) and IHR monitoring framework 2015 have been put in place as a process to help countries assess their compliance with specified IHR core capacities (Gupta *et al*., 2018). Furthermore, the use of preparedness assessment tools such as the Infectious Disease Risk Assessment and Management (IDRAM) and the Fragile States Index (FSI) have been suggested to measure national compliance with the IHR and overall national performance of infectious disease preparedness (Oppenheim *et al*., 2019; Tuite *et al*., 2020). However, issues of national compliance with international biosecurity instruments are complex and include poor political willingness, inadequate biosecurity awareness, and a lack of robust biosecurity legislative instruments (Gupta *et al*., 2018). Nevertheless, the harsh economic implications of pandemics and environmental biosecurity breaches may force political leaders to facilitate tourism planners from a resource provision context to ensure the meaningful development of appropriate capacities to mitigate tourism biosecurity risk.

2.1. Theoretical Framework

This research has identified twenty-six essential tourism biosecurity criteria from a systematic international literature review of key theory and incorporated these into the theoretical framework for assessing tourism biosecurity preparedness (figure 1). Tourism and tourist vectoring is one of the most prevalent pathways of introduction for biosecurity threats globally (Tatem, 2009; Gottwald *et al.*, 2019). Thus, processes of communication, inspection, quarantine, and response at tourist ports of entry to comply and align with international and European agreements and guidelines can all be underpinned through appropriate biosecurity planning (Hall and Baird, 2013; Cole *et al.* 2018; Melly and Hanrahan, 2020). Accurate communication is a fundamental component of any tourism biosecurity system as a way of ensuring compliance from tourists (Hall, 2011). It is therefore essential that a process of timely communication of accurate information is in place at all times and in the event of a biosecurity breach at tourist ports of entry.

A biosecurity pathway risk mitigation strategy comprising tourist pathway surveillance, tourist alerts, and an appropriate response process is crucial to the early detection, prevention, and reduction of the lasting negative impacts of a biosecurity breach (Pickering *et al.*, 2007; Hulme, 2015; Leuven *et al.*, 2017; Wilson *et al.*, 2018; Nagbe *et al.*, 2019). Thus, personnel that have adequate training and experience are vital for the implementation of essential biosecurity processes at ports of entry especially in the event of a biosecurity breach (Findlater and Bogoch, 2018; Mouchtouri *et al.*, 2019). As ports of entry are considered tourist focal points, they are in the strategically favourable position to implement pre-border, border, and post-border biosecurity protocols (Hall, 2005). Pre-border biosecurity protocols ensure detection as early as possible from the destination of origin and thus a response that has the best chance to enable eradication (Hall, 2005; Cunningham *et al.*, 2019). Border biosecurity protocols are essential at tourist ports of entry, especially in island destinations through appropriate monitoring and quarantine processes as a way of utilising isolation for segregation in the event of a major global biosecurity breach (Mahadew and Appadoo, 2019). Post-border biosecurity protocols can engage all stakeholders to support a biosecurity emergency response task force to participate in coordinated surveillance and response for the control and mitigation of biosecurity breaches (Jeggo, 2012).

The first five criteria are specific to tourism and the remaining twenty-one are overall human health and environmental biosecurity criteria. These essential biosecurity criteria emerged from consistent strong themes in the in-depth systematic international literature review from which the study emerged from. The essential biosecurity preparedness criteria will determine if appropriate tourism biosecurity planning and management are incorporated into the relevant instruments of international standard-setting organisations. Furthermore, this study will also determine the state of tourism biosecurity planning and management at tourist ports of entry in Ireland. The findings will be analysed and discussed in the context of tourist destination resilience from biosecurity threats. The recommendations from this study will be crucial to ensuring appropriate tourism biosecurity planning and management is undertaken at destinations' tourist ports of entry to build tourist destination's resilience in a complex global biosecurity landscape.

Implementing a preparedness approach for biosecurity, Sherring, (2021) rightly addresses behaviour change for biosecurity at the border however, the sole focus is on the agricultural and environmental perspective and ignores human health. Hulme (2015) investigates pathway management as a strategic approach to preventing a biosecurity breach through the tourism pathway, yet this is void of biosecurity from a human health perspective through an omission of human health. Martin and Boland (2018) appraise rapid response capabilities at airports which highlight the need for interagency responsibility and collaboration, along with appropriate biosecurity equipment and infrastructure in place at all times. However, there is an apparent lack of knowledge addressing all tourism biosecurity preparedness from

a human and environmental perspective at tourist ports of entry. This research will address this gap in knowledge by utilising essential biosecurity criteria including tourist awareness and communication, pathway management for human and environmental health threats, and appropriate biosecurity planning in place through the three-border stages.

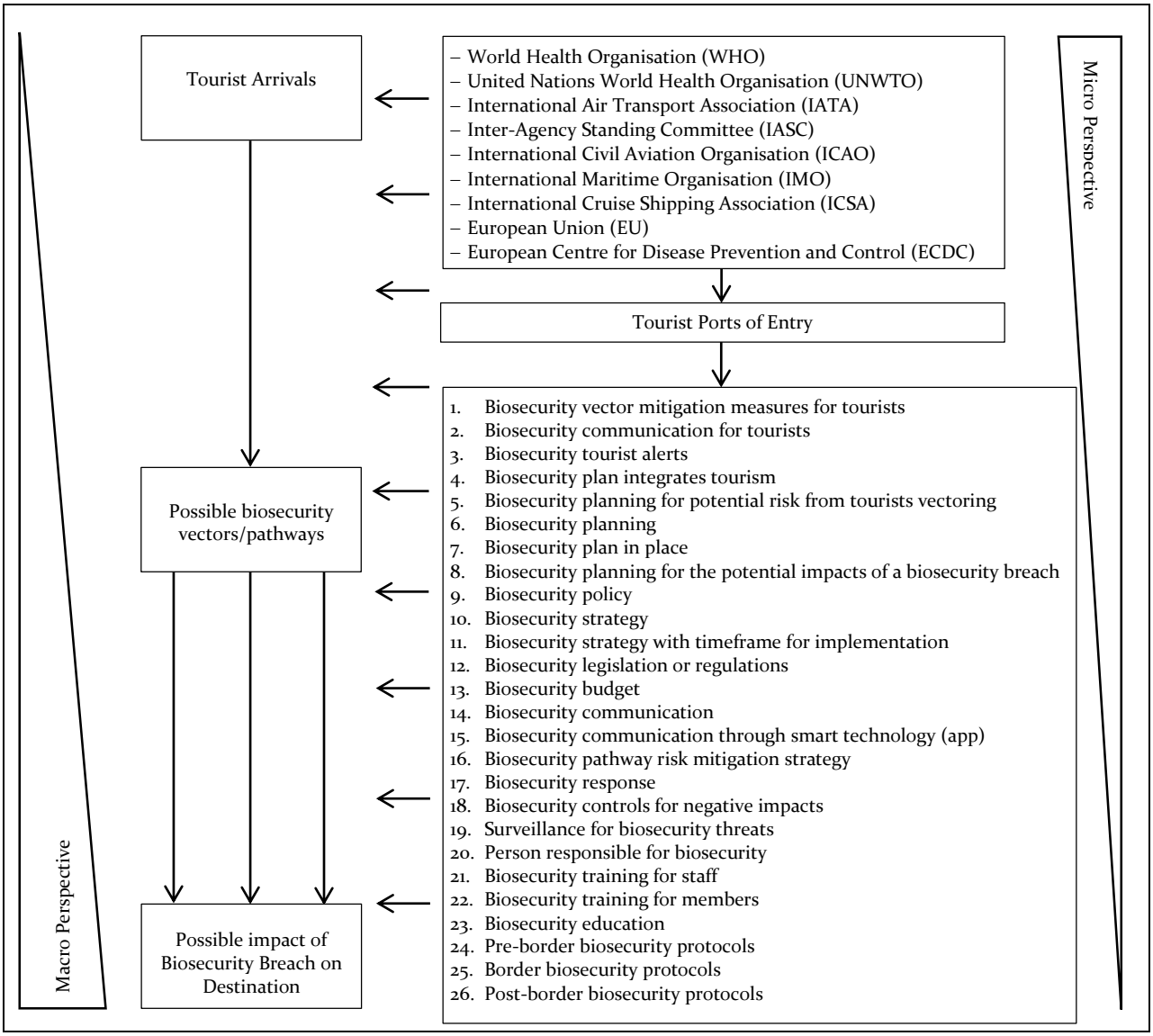


Figure 1. *Theoretical framework for assessing tourism biosecurity preparedness*

3. Methodology

The overarching aim of this research was to analyse international biosecurity instruments for tourist destinations internationally and examine their implementation at Irish tourist ports of entry. Furthermore, this paper also addresses issues pertaining to national conformity with suggested

international biosecurity instruments from official international organisations such as the WHO, ECDC, and UNWTO by probing Ireland's biosecurity preparedness at tourist ports of entry. A mixed-method research approach was deemed most appropriate for this research. Initially, a comprehensive review of literature on tourism biosecurity preparedness was conducted. To analyse preparedness set out in instruments of international standard-setting organisations, twenty-six essential criteria which include five specific tourism criteria were used for this study.

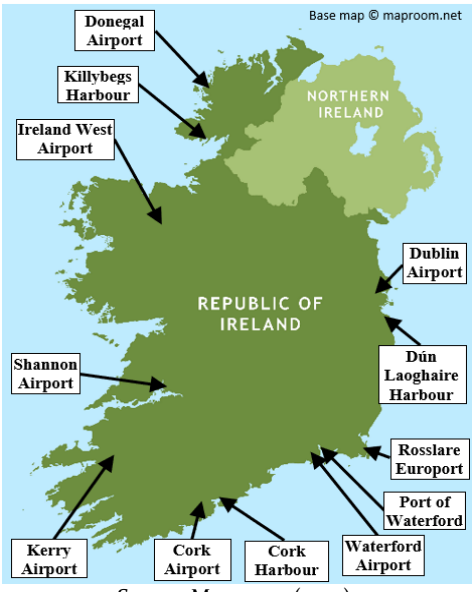
A theoretical framework was constructed through the comprehensive review of international tourism biosecurity literature. This established the twenty-six essential biosecurity criteria for use in this research (Melly and Hanrahan, 2020). By determining consistent criteria to include and exclude content or categories meant a systematic analysis was achievable (Holsti, 1968; Camprubí and Coromina, 2016). Berg (2009) implies content analysis as a method which supports the comprehensive and systematic investigation of material as a process to uncover meanings. The data was extracted through a process of content analysis which facilitated the investigation of criteria through the application analysis for themes, patterns, and meanings within appropriate documentation (Paisley, 1969; Berg, 2009). An international biosecurity preparedness assessment matrix tool was constructed and tested by combining the essential criteria and running a pilot test of analysis to ensure the reliability of the findings. Interpretive content analysis was used as a way of considering both manifest and latent communication within the selected international instruments (Drisko and Maschi, 2016). This facilitated the interpretation of meaning from material within the instruments that were not overly evident, while also capturing literal or obvious meanings relating to each specific essential criterion. The researcher adopted an interpretative content analysis approach to identify both the obvious presence of criteria being met and also the interpretation of communication where criteria met may not be overly apparent. This approach was utilised to identify the presence of essential biosecurity preparedness criteria of the chosen sample of international biosecurity instruments. This entailed multiple examinations of large quantities of content to determine the presence of each specific criterion in place within all the regulations, frameworks, policies, plans, and tools of relevant international standard-setting organisations.

Irish tourist ports of entry were assessed for the presence of the same twenty-six essential biosecurity criteria through a content analysis of all official plans, policies, strategies, and media of each port. Additionally, this content analysis approach was reinforced with semi-structured interviews with a representative sample of senior managers. Interview questions centred around their perception of tourism biosecurity risk, and the need for appropriate preparedness at tourist ports of entry that included: 'Is there a need to manage the risk of tourists visiting Ireland vectoring potential biosecurity threats?', and 'What measures does your organisation have in place to manage the risk of tourists vectoring biosecurity threats?'. Interviews were conducted over the telephone which were recording ensuring consent, before being transcribed for analysis to uncover themes such as experience, Department of Agriculture, and funding. Specifically designed questionnaires incorporating both open and closed-ended questions were used to support the findings from the content analysis. The questions from the questionnaire were closely aligned to the essential tourism biosecurity criteria. Furthermore, the depth of the responses was enhanced by obtaining further qualitative insights into funding, assistance with planning, and participation in the national planning process for tourism biosecurity through the open-ended aspect of the questions. By adopting a multi-method approach, the researcher can answer questions that the other single paradigms cannot and are sometimes considered superior to single method designs (Hammond, 2005; Pole, 2007). The semi-structured interviews and open-ended questions allowed the researcher to probe and unearth knowledge on current and future tourism biosecurity at the tourist ports of entry in Ireland.

3.1. Sampling

The international biosecurity instruments were purposefully selected using non-probability sampling. This allowed the researcher to apply some judgment and arbitrary ideas to locate a representative sample and explicitly seek diversity within the sample (Vehovar *et al.*, 2016). The sample of twenty-three international biosecurity instruments was carefully chosen based on theoretical understandings centred on global biosecurity for tourism. The instruments were extracted by initially identifying all international organisations, agencies, treaties, and associations responsible for coordinating, guiding, and implementing essential biosecurity processes at tourism and ports of entry such as the WHO, IATA, and the IMO. Comprehensive searches through online repositories, websites, and search engines allowed the researcher to identify the appropriate instruments to be analysed for tourism biosecurity preparedness in this research. With the exception of the "WHO 2019 Novel Coronavirus Strategic Preparedness and Response Plan", and the "ICAO Declaration adopted by the ICAO Council at the Fourth Meeting of the 219th Session on 9 March 2020 relating to the outbreak of novel coronavirus (COVID-19)", all the biosecurity preparedness analysed in table 1 were in place before the COVID-19 pandemic. This provides clarity to determine the extent of recommended tourism biosecurity preparedness within the relevant instruments before the outbreak occurred.

For the content analysis part of this research, a sample of twelve Irish tourist ports of entry (figure 2) was selected using a non-probability purposive sampling method. For the questionnaire and semi-structured interviews, the researcher obtained responses from senior managers of eight tourist ports of entry between 24/05/2019 and 24/07/2019. Semi-structured interviews were obtained from senior management of the tourist ports of entry. These interviews ranged in length between 10mins and 57secs to 22mins and 05secs as interviewees expressed differing views on the importance of biosecurity for tourism and at ports of entry. Some difficulties were experienced in identifying appropriate interviewees as some staff members were unsure whose role biosecurity was within the ports of entry. In some cases, there was a misunderstanding as to what biosecurity actually meant in some cases which was worrying and meant the research needed to explain its meaning at the start of the interview.



Source: Maproom. (2022).

Figure 2. *Irish tourist ports of entry*.

A specifically designed questionnaire was constructed which incorporated the 26 essential criteria from the content analysis. The open-ended components of the questionnaire meant there was a greater emphasis on the interviewee expanding on points of interest for future potential developments for tourism biosecurity preparedness such as planning and funding. The semi-structured interviews enabled the process of cross-checking with content analysis results to reinforce the findings, as well as add depth and rich qualitative data which have been interpreted within the findings from the tourism biosecurity preparedness perspective.

4. Results and discussion

4.1. International biosecurity preparedness

This analysis reveals that the specialised international standard-setting organisations that are vital for coordinating, guiding, and implementing essential biosecurity processes conform to the majority of the twenty-one essential criteria for biosecurity preparedness. However, this analysis identified a contrast to these results when analysing specific tourism criteria which were not found to be in place within most of the international biosecurity instruments assessed (table 1). This is despite their potential to ensure the appropriate planning and management are in place for the global spread of infectious disease as a result of rapid tourist movements. Furthermore, they can ensure that global infectious disease and tourism policy is aligned and coordinated to effectively deal with biosecurity threats that do not respect international borders. A greater emphasis on tourism biosecurity within international biosecurity instruments would place tourism and tourist vectoring higher on the agenda of tourism planners and policymakers of all participating states.

An initial finding of this research is the clear disparity in the total percentage of biosecurity criteria met (40.4%) compared to the total percentage of five tourism criteria met (12.2%) (table 1). This indicates a shortfall of specific tourism biosecurity criteria, leaving Ireland as a destination vulnerable to biosecurity breaches through tourist vectoring.

The analysis revealed a high percentage (82.6%) of all international biosecurity instruments analysed were found to have no biosecurity vector mitigation measures for tourists. This is despite the increasing recognition that tourism significantly assists the diffusion of infectious diseases globally. Analysis also determined a large portion (91.3%) of all international biosecurity instruments analysed had no evidence of biosecurity communication for tourists in place. This would leave the communication of vital tourist biosecurity risk awareness, vector mitigation measures, biosecurity breach alerts, and assistance with biosecurity monitoring and surveillance severely lacking. Especially considering what is now an essential need during a global pandemic and also how tourists' perception of disease risk can influence their behaviour post-pandemic, communicating the risks and threats to biosecurity and the appropriate best practice guidelines should now be considered a prerequisite for tourist destinations going forward and this should be recognised within key international biosecurity instruments. Furthermore, 95.7% were found to have no biosecurity tourist alerts in place. Although the WHO Assessment Tool for Core Capacity Requirements at Designated Airports, Ports, and Ground Crossings document does outline communication procedures during a public health emergency, this needs to be in place at all times.

Table 1. *International biosecurity preparedness assessment matrix*

International Biosecurity Preparedness	Tourism Criteria					Criteria Assessed																					
	Biosecurity Vector mitigation measures for Tourists	**Biosecurity Communication for Tourists**	**Biosecurity Tourist Alerts**	**Biosecurity Plan Integrates Tourism**	**Biosecurity Planning for Potential Risk from Tourists Vectoring**	Biosecurity Planning	Biosecurity Plan in Place	Biosecurity Planning for the Potential Impacts of a Biosecurity Breach	Biosecurity Policy	Biosecurity Strategy	Biosecurity Strategy with Timeframe for Implementation	Biosecurity Legislation or Regulations	Biosecurity Budget	Biosecurity Communication	Biosecurity Communication through Smart Technology (App)	Biosecurity Pathway Risk Mitigation Strategy	Biosecurity Response	Biosecurity Controls for Negative Impacts	Surveillance for Biosecurity Threats	Person Responsible for Biosecurity	Biosecurity Training for Staff	Biosecurity Training for Members	Biosecurity Education	Pre-border Biosecurity Protocols	Border Biosecurity Protocols	Post-border Biosecurity Protocols
Human Health																											
WHO Action Plan to Improve Public Health Preparedness and Response in the WHO European Region 2018–2023						X	X	X	X	X	X	X	X				X		X		X					X	
WHO Recommended Strategies for the Prevention and Control of Communicable Diseases 2001						X		X	X	X			X	X			X		X	X	X		X				
WHO 2019 Novel Coronavirus Strategic Preparedness and Response Plan				X		X	X	X				X					X		X		X					X	
WHO Strategic Framework for Emergency Preparedness 2017				X		X	X	X		X		X	X	X			X	X	X		X	X				X	
WHO Assessment Tool for Core Capacity Requirements at Designated Airports, Ports and Ground Crossings 2009						X			X	X	X	X		X			X		X	X	X	X				X	
WHO Health Emergency and Disaster Risk Management Framework 2019						X		X	X	X		X	X	X			X	X	X	X	X	X	X				
WHO International Health Regulations 2005	X				X	X		X	X			X		X			X	X	X	X	X					X	
WHO Handbook for the Management of Public Health Events in Air Transport 2015		X		X	X	X	X		X			X		X	X		X		X		X		X	X	X	X	
WHO Handbook for Management of Public Health Events on Board Ships 2016					X	X			X			X		X			X		X		X		X		X		
UNWTO Travel and Tourism under Pandemic Conditions –Second Review and Preparation Exercise 2009		X				X		X				X		X			X										
IATA Emergency Response Plan 2018	X						X					X	X	X			X									X	
IASC Common Framework for Preparedness 2013						X	X	X				X	X	X			X										

International Biosecurity Preparedness	Tourism Criteria					Criteria Assessed																										
	Biosecurity Vector mitigation measures for Tourists	Biosecurity Communication for Tourists	Biosecurity Tourist Alerts	Biosecurity Plan Integrates Tourism	Biosecurity Planning for Potential Risk from Tourists Vectoring	Biosecurity Planning	Biosecurity Plan in Place	Biosecurity Planning for the Potential Impacts of a Biosecurity Breach	Biosecurity Policy	Biosecurity Strategy	Biosecurity Strategy with Timeframe for Implementation	Biosecurity Legislation or Regulations	Biosecurity Budget	Biosecurity Communication	Biosecurity Communication through Smart Technology (App)	Biosecurity Pathway Risk Mitigation Strategy	Biosecurity Response	Biosecurity Controls for Negative Impacts	Surveillance for Biosecurity Threats	Person Responsible for Biosecurity	Biosecurity Training for Staff	Biosecurity Training for Members	Biosecurity Education	Pre-border Biosecurity Protocols	Border Biosecurity Protocols	Post-border Biosecurity Protocols
ICAO Declaration adopted by the ICAO Council 2020 relating to outbreak of novel coronavirus (COVID-19)			X									X														
IMO Guidance for Ship Operators for the Protection of the Health of Seafarers 2020	X			X			X					X									X				X	
IMO Report of the Maritime Safety Committee on its Ninety-Sixth Session 2016																										
International Cruise Shipping Association Public Health 2019																			X							
EU Decision No 1082/2013: Serious Cross-Border Threats to Health	X					X		X				X		X			X		X					X	X	X
ECDC Strategic Multi-Annual Programme 2014–2020						X	X	X	X	X		X	X	X	X		X	X	X		X	X		X		
ECDC Long-Term Surveillance Strategy 2014–2020						X		X	X		X		X	X	X				X		X	X				
ECDC Country Support Strategy 2016						X		X	X	X		X		X			X		X		X	X	X			
ECDC Public Health Training Strategy 2015																					X	X				
ECDC Single Programming Document 2019–2021						X			X			X	X	X	X		X		X		X	X				
ECDC Single Programming Document 2020–2022						X						X	X	X	X		X		X		X	X	X			

X= Compliant

Strategic planning for tourism is critical to the sustainability of a destination as it monitors impacts and protects future growth along with protecting host communities and should have a comprehensive focus on biosecurity. Although there were more promising results from the smaller percentage (26.1%) of international biosecurity instruments analysed was found to not incorporate planning for biosecurity, unfortunately, there was a much larger percentage (87%) that were lacking specific biosecurity planning

for the potential of tourist vectoring. This is despite the increasing mobility of human vectors, particularly through tourist movements which allow destinations to become inter-connected and thereby accelerate global biosecurity breaches. Conversely, a similar lack of planning for tourist vectoring was evident within the WHO 2019 Novel Coronavirus Strategic Preparedness and Response Plan. This was concerning especially considering the pandemics and the potential role of tourist vectoring biosecurity threats. If planning approaches at tourist ports of entry are going to incorporate the substantial biosecurity risk associated with tourist vectoring, international biosecurity instruments first should reflect a tourism focussed approach to biosecurity.

The analysis also determined that a considerable percentage (65.2%) of international biosecurity instruments (table 1) did not advocate a biosecurity plan in place. This research also facilitated a representative sample of international destinations' preparedness specifically at a national level regarding a national biosecurity plan in place which offers a global snapshot pre-pandemic (Melly and Hanrahan, 2020). This determined that a considerable percentage of essential biosecurity criteria were not met in Ireland due to the lack of a national biosecurity plan in comparison to New Zealand, Hawaii, and Australia. Considering the overall lack of sufficient international preparedness pertaining to the development of specific biosecurity plans that incorporate tourism and tourist vectoring, there is a real concern that this shortfall is also reflected in the national approaches of other WHO participating nations.

The implications of this lack of tourism-related biosecurity planning were experienced internationally with many examples. For instance, a new variant of COVID-19 spread rapidly to the USA on travellers from Brazil (CDC, 2021), and when over 20,000 Irish residents travelled freely to an annual horse-racing carnival in Cheltenham, England containing 250,000 international spectators three months into the COVID-19 pandemic before returning back to Ireland (Hunter, 2020; Irish Independent, 2020). Lessons from the 2003 SARS outbreak clearly have not been learned. An effective biosecurity plan could have activated a predetermined biosecurity response at borders to initiate emergency border closures for non-essential travel, initiate emergency contact tracing, and ensure tourists were aware of the risk and appropriate quarantine procedures were in place. National planning approaches should therefore reflect the approach within the IHR and implement specific core capacities at tourist ports of entry through a national biosecurity plan.

The presence of essential biosecurity criteria within international biosecurity instruments is commended. However, considering experiences from past outbreaks of SARS in 2003, and Swine flu in 2009, meeting the essential tourism criteria is a minimum. However, the lack of tourism-specific criteria within the international biosecurity instruments assessed reflects what happened during the early stages of pandemics as the disease spread throughout the world at an unprecedented rate. International biosecurity instruments are vital for guiding national-level policymakers to maximise the use of national resources and comply with international biosecurity requirements, especially at tourist ports of entry. If national planning approaches are to incorporate a proactive approach to mitigating tourism biosecurity risk at tourist ports of entry, all of the essential criteria including tourism criteria, first need to be incorporated into all of the relevant biosecurity instruments of international standard-setting organisations.

4.2. Tourist points of entry in Ireland

The results from Ireland's tourist points of entry outline a very concerning situation. None of the essential criteria was found to be in place at any of the points of entry assessed. Despite the importance of airports and ports playing a central role in carrying out vital biosecurity processes, Irish tourist ports

of entry clearly have not realised this. The serious lack of any biosecurity planning and management at Ireland's tourist ports of entry leaves the surveillance, interception, quarantine, and communication of biosecurity information to tourists critically lacking, or non-existent. This is despite a requirement for airports and ports under the IHR to have specific capacities including diagnostic facilities and appropriately trained personnel for inspection and processing of infected travellers in place to manage the risk of tourists from vectoring biosecurity threats (WHO, 2005). Thus, it appears that international standard-setting organisations have designed current biosecurity instruments, specifically the IHR core capacities requirements for designated airports, ports, and ground crossings, to alleviate some biosecurity risk from tourism. However, these are all missing within all the Irish tourist ports of entry sampled.

The results of the closed-ended questionnaires reflected the significant lack of biosecurity preparedness where all responses indicated that none of the criteria was met. Furthermore, open-ended responses indicated there was some confusion about whose role biosecurity was and a misunderstanding as to what biosecurity meant in some cases. This misunderstanding may have changed since the widely documented and ongoing COVID-19 pandemic, meaning tourist ports of entry have since been forced to pay attention to biosecurity. However, this confusion just a few months before the COVID-19 pandemic took place speaks volumes for how unprepared Ireland was for a biosecurity breach. Furthermore, the researcher was often directed towards Ireland's Department of Agriculture by several tourist ports of entry as it was not their responsibility.

> *"Not our responsibility - implemented by Department of Agriculture"* (Tourist port of entry 3)

> *"We rely on the Department of Agriculture to provide us with information and posters/signage in relation to any specific biosecurity threat. We have displayed posters and fact sheets received from the Department in prominent positions within the airport and have also facilitated attendance by officials from the Department of Agriculture to implement vector mitigation measures for specific threats in the past"* (Tourist port of entry 5)

Although the Department of Agriculture is the lead department for biosecurity in Ireland, this responsibility stems from previous agricultural outbreaks of Foot and Mouth and Tuberculosis. Tourist ports of entry should be proactive in their approach to preventing a biosecurity breach of pandemic scale and protect the very industry they are dependent on.

It is worrying that regardless of Ireland having three specifically designated IHR airports (Dublin, Shannon, and Cork) under S.I. No. 411/2009 - Infectious Diseases (Aircraft) Regulations 2009, and five seaports (Dublin, Cork, Limerick, Waterford, Rosslare) under S.I. No. 4/2008 - Infectious Diseases (Shipping) Regulations 2008, to maintain core capacities to deal with possible cross-border health threats in Ireland, no such capacities were found to exist. This would suggest a much larger problem exists in terms of a lack of overall biosecurity planning that could set out specific provisions for tourism biosecurity preparedness. However, a lack of funding may also be an issue with 6 of the sample surveyed indicating that they needed funding support to implement the criteria for tourism biosecurity preparedness.

> *"We don't have the experience or funding to address this issue. This issue should be addressed by a government department"* (Tourist port of entry 8)

Furthermore, the majority (6) of respondents said that they need assistance with the planning process for tourism biosecurity. With such a specialised area of tourism biosecurity, tourist ports of entry clearly require the relevant financial and expertise support. Responses interestingly indicated that 5 of the 8 of respondents should participate in the national planning process for tourism biosecurity. It is apparent that while such a crucial issue cannot be ignored by authorities at destinations' tourist ports of entry, it will require the appropriate industry support, expertise, and participation in future planning processes. Still, the apparent lack of legally binding core capacities at specified tourist ports of entry; and indeed all of the criteria missing within this analysis reflects this lack of an overall planned approach that could have set out strategic goals for biosecurity communication, surveillance, and rapid response. This leaves Ireland as a popular tourist destination welcoming nearly 10 million overseas visitors annually (Fáilte Ireland, 2020) through all tourist ports of entry extremely vulnerable to existing and future pandemics. These worrying findings are compounded by the fact that there is no ground crossing designated under IHR between Northern Ireland and Ireland as this is considered an 'invisible border'. Therefore, IHR core capacities are not applicable there. This has exacerbated Ireland's problems in managing a pandemic and the exponential growth in records of positive COVID-19 cases in regions of the Republic of Ireland situated along the Northern Ireland border reflect this.

Destinations of island and coastal characteristics relating to remoteness and geographic isolation, along with a perceived lack of infectious disease resources are considered particularly vulnerable to a biosecurity breach (Crump *et al.*, 2001; Parra-López and Martínez-González, 2018). However, an increased level of isolation and geographical insularity presents a potential advantage for destinations to streamline quarantine operations (Godamunne *et al.*, 2022). The lack of any land crossings would allow for a more rapid activation of quarantine processes as tourists are confined to specific airports and seaports. However, such an approach would conflict with political trade agreements such as the common travel area between Great Britain and Ireland which represents an open borders area between the United Kingdom, Ireland, Isle of Man, and the Channel Islands. Such agreements, although good for travel and trade between jurisdictions; creates a dilemma for biosecurity. Political reluctance to activate entry restrictions would delay biosecurity rapid response and quarantine process, thus greatly diminishing their impact in the event of a biosecurity breach. Going forward, a collaborative agreement between jurisdictions should come with an integrated mechanism to activate essential biosecurity measures in the event of a serious biosecurity breach. This could avoid delays to essential quarantine measures and lead to a greatly reduced level of biosecurity risk in island destinations.

5. Conclusion and implications

This paper assessed the provision of essential criteria within international biosecurity instruments for the tourism industry and investigated their implementation at tourist ports of entry in Ireland just before the COVID-19 pandemic. Firstly, despite researchers having long warned about the potential for a major global infectious disease event as a result of tourism and international travel, the analysis has exposed a notable omission of tourism-specific criteria within current international biosecurity instruments. This factor has no doubt played a significant role in the rapid spread of COVID-19 around the world. Nations failed to address tourist vectoring as a pathway for the highly-infectious disease and were subsequently facilitating the spread of the disease through air and sea travel despite previous warnings from SARS and Ebola. Tourism-focused measures including pre-flight passenger locator forms, accurate communication from experts at the pre-border, border, and post-border stages, surveillance systems, and appropriate quarantine facilities may well have suppressed the significant level of infection witnessed globally. Fundamentally, these could have allowed current contract-tracing and other disease suppression measures to succeed at national levels and a much earlier easing of strict COVID-19 restrictions that have crippled Ireland's tourism industry.

Although the WHO has acknowledged the role of international tourism as a pathway for pandemics to spread globally from experiences of the 2003 SARS outbreak in Hong Kong, it is the authors' contention the resulting core capacities did not incorporate enough biosecurity preparedness measures that appropriately mitigate tourism biosecurity risk. This is notwithstanding issues relating to national-level implementation and the lack of accuracy from national JEE's. Nevertheless, if destinations at the national level are to comply with international standard-setting organisations and incorporate effective tourism-specific preparedness measures, they should be contained within all international biosecurity instruments as a matter of urgency.

From a national perspective, international biosecurity instruments provide valuable sources of planning expertise and subsequent recommendations so that lessons from past biosecurity breaches are used to guide future biosecurity policies, particularly at tourist ports of entry. Furthermore, it is vital to attain a globally synchronised approach through international coordination, especially concerning rapid response measures. However, planners and policymakers within destinations such as Ireland should take responsibility for the threats posed to their destination and avoid minimal approaches simply aimed at achieving compliance with international regulations. Tourist ports of entry require planning assistance for issues of tourism biosecurity, a specific budget for tourism biosecurity to ensure meaningful capacities are in place and need to have their voices heard at the decision-makers table during the planning process. As the global tourism industry's recovery process will require careful planning in order to avoid falling into the pitfalls of the volume growth model leading to unsustainable over-tourism within destinations which represents a 'perfect storm' from a biosecurity perspective, the recommendations from this study are vital.

The speed which COVID-19 was transported throughout the world should absolutely be used to learn lessons and take proactive measures going forward. Ireland should not be in a position where none of the major ports in this study meet any of the essential criteria. Tourism, including airports and seaports must be part of new international monitoring and rapid response plan in which Ireland should fully participate especially with the advantage of its 'island status'. Tourist ports of entry have already long been recognised as focal points for tourism biosecurity operations elsewhere. However, the freedom of EU citizens to move and reside freely within the territory of the Member States may create challenges to Ireland adopting similar approaches used internationally. For example, only residents of the country were allowed to enter in New Zealand and undertake a compulsory quarantine period during COVID-19. This approach would have several obstacles for Member States due to the Schengen agreement that has abolished internal EU border checks. The Schengen Borders Code (SBC) sets out rules and governance for any interference to the free movement of persons across EU borders. Crucially from a biosecurity perspective, there exists a mechanism for the reintroduction of short-term border control at the internal borders in the event of a serious threat to public policy or internal security. An event constituting significant threat to heath such as the COVID-19 pandemic could have triggered this mechanism as a temporary measure of risk mitigation across member states.

Ireland as an 'island destination' and with co-ordination with Northern Ireland authorities has the potential to initiate a fortress Ireland approach to biosecurity by allocating and implementing planned provisions for effective risk mitigation at all tourist ports of entry. However, the current lack of planning at ports of entry leaves Ireland exposed and vulnerable in its preparedness to prevent and respond to potential biosecurity breaches, particularly in line with WHO and EU capacities and regulations.

Several policy implications can be taken from this study. There is now a need for a clear and consistent process for the exchange of vital information during a biosecurity breach as has been experienced from public mistrust during the COVID-19 pandemic. This could have profound impact on tourist and public compliance with biosecurity measures and behaviours especially at a critical time of a biosecurity breach. Therefore, future international biosecurity preparedness will need to explicitly outline specific tourist biosecurity communication processes that are evidence-based. In order to ensure accurate information is conveyed to tourists, international guidance for biosecurity communication should incorporate theoretical models to assess tourist behaviour and modify dissemination platforms accordingly. For example, incorporating the Health Belief Model (HBM) into current international biosecurity instruments could align international biosecurity communication for tourists and the public during a pandemic yet remain region-specific based on different pandemic and destination conditions. The HBM identifies four core components that affect the prospect of individuals adhering to protective measures: (i) perceived susceptibility (risk perception); (ii) perceived severity (seriousness of the consequences of the condition); (iii) perceived benefits (perceived effectiveness of reducing risk); and (iv) perceived cost (required resource) (Guidry *et al.*, 2019). Adopting the HBM could tailor strategic communication and awareness approaches to the specific level of risk, and with the support of smart mobile and wearable technology, could match the mobile communication aspect needed to cater for vast tourist mobility at all the border stages and associated vectoring of infectious disease. This would also allow for risk mitigation measures to target appropriate stages of the tourism pathway. Pre-border biosecurity communication could target communication of tourist alerts, and destination-specific measures, while automation technologies could streamline passenger locator form processes. This could ensure tourists are biosecurity aware and compliant before they reach the border stage of the destination.

Several policy implications have arisen from the tourist port of entry findings that could also be applied to other international destinations. Despite a shortfall of tourism-specific criteria within international biosecurity instruments, it would be unfair to pin all of the blame for Ireland's serious port of entry non-compliance and sheer lack of tourism biosecurity preparedness on international standard-setting organisations. Issues of national non-compliance specifically with the IHR 2005 and European regulations have long been recognised globally, in addition to funding and planning issues identified in this study. The absence of an appropriate multilateral agreement may be undermining global governance initiatives regarding biosecurity. 'One Biosecurity' has been promoted as an approach to biosecurity policy that incorporates several disciplines by enabling a connection across human, animal, plant, and environmental health. This resembles the national biosecurity approach from New Zealand which have the 'Biosecurity 2025' strategy and 'Biosecurity act 1993' legislation in place. Adopting an appropriate legislative framework specifically designed for biosecurity within a national plan developed with input from tourist ports of entry would set out the responsibilities of all relevant stakeholders that are legally binding. Relevant tourism stakeholders would then be obligated to incorporate specific essential tourism biosecurity criteria to ensure that an appropriate level of preparedness is maintained that are in line with international biosecurity instruments.

This research supports the development of robust destination-specific legal biosecurity compliance mechanisms within a national biosecurity plan that ensures widespread alignment with all relevant international biosecurity instruments. Tourism planners and policymakers hold the key to tourist destination resilience by adopting an interdisciplinary approach to planning for biosecurity by adopting the One Biosecurity concept. A national biosecurity plan could ensure appropriate biosecurity capacities are developed and underpinned through effective national legislation. This would represent a proactive approach to tourism biosecurity and also facilitate an alignment to international regulations

and all appropriate international biosecurity instruments which could be vital in the tourism industry's recovery process.

6. Limitations and opportunities for future research

This research encountered a limitation in terms of its all-island coverage in Ireland. This research primarily focuses on the Republic of Ireland which excludes Northern Ireland. This is despite the COVID-19 pandemic exposing a severe weakness to Ireland's biosecurity along the counties bordering Northern Ireland where infection rates have risen steeply. Tourists can freely travel across this border without adhering to the appropriate biosecurity measures due to the IHR core capacities not being applicable along this border due to a unique political agreement in place called the Good Friday Agreement. As this research was limited by financial resources, it was unable to extend to an all-island study which would have also included tourist ports of entry in Northern Ireland. Nevertheless, there exists an opportunity for future research to extend to capture biosecurity preparedness for the entire island of Ireland. Furthermore, such research could explore the potential for a cross-border agreement termed 'Fortress Ireland' which was previously adopted for agricultural biosecurity purposes. Essential to such research would be to examine the feasibility of adopting such an approach without interfering with the Good Friday Agreement

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