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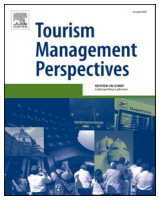

Current Issue in Tourism

Selfies to die for: A review of research on self-photography associated with injury/death in tourism and recreation

Betty Weiler [a,*], Anna M. Gstaettner [b], Pascal Scherrer [c]

[a] School of Business & Tourism, Southern Cross University, Coolangatta, QLD, 4225, Australia
[b] College of Arts, Business, Law & Social Sciences, Murdoch University, 90 South Street, Murdoch, WA 6150, Australia
[c] School of Business & Tourism, Southern Cross University, Lismore, NSW 2480, Australia

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ABSTRACT

This paper reviews empirical research on the extent and nature of risks associated with dangerous tourist self-photography (selfies) and management responses. Global epidemiological studies have captured the *extent* of the problem, with studies recording 250+ media-reported deaths within the past decade. Nearly half occurred in natural environments, with key hazards being cliff edges, waterbodies, and wildlife.

Researchers exploring the *nature* of the phenomenon identify contextual factors along with technology-induced distractions, as risk factors in selfie-taking. Demographics also feature, with the majority of casualties being young males.

The literature points to *management responses* that relate to either the social or the risky nature of the phenomenon. The most prevalent are communication-related, ranging from education and awareness-raising to persuasive communication. Targeted communications that invoke social norms and innovative media are suggested for addressing the problem.

1. Introduction

Photography is an integral component of the contemporary tourist experience, with recent trends in technology and a growing online culture sparking the act of self-presentation through photography (selfies) within tourist environments. The sharing of selfies via social media is arguably a twenty-first century phenomenon, with the term "selfie" first appearing in the literature in 2002. According to the Oxford English Dictionary (2020), the use of social media is embedded within the definition of a selfie: "A photograph one has taken of one's self, typically with a smartphone or a webcam, and shared via social media". Thus, besides taking photos for the sake of creating and enhancing the tourists' memories of their trip, taking and uploading selfies is inherently a social act (Pearce & Moscardo, 2015; Weilenmann & Hillman, 2020). This includes sharing selfies with remote audiences as well as engaging members of the travel group as co-subjects or observers (Weilenmann & Hillman, 2020).

The act of self-photography, or taking a selfie while travelling, however, can quickly turn into a safety issue. News media reports of tourist injuries and deaths associated with taking selfies abound, particularly in relation to falling from heights such as cliff-edges (Cuthbert & Smith, 2018; Panashchuk, 2020), waterfalls ("French tourist dies trying to take selfie at Na Mueang 2 waterfall in Thailand, 2019") and volcano edges (Stack, 2019), and incidents relating to water bodies ("Saudi tourist drowns in River Nile while taking selfie, 2019") and wildlife photography (Fitzner, 2019). Equipped with mobile phones in their hands, tourists seek to enhance their own tourist experiences by sharing them with imagined audiences, with the process of capturing an image often overshadowing the experience (Walsh, Johns, & Dale, 2019). While scholars have expressed concern that the act of selfie-taking can compromise the first-hand experience of the tourism destination or attraction (Christou, Farmaki, Saveriades, & Georgiou, 2020), this becomes far more problematic when selfie-taking leads to tragedy.

The selfie phenomenon and its consequences has gained scholarly attention across a diversity of fields, including environmental management, media and communication, medicine, and, to a lesser extent, tourism. Despite the close association of travel with the selfie phenomenon and high levels of media attention to selfie incidences at visitor sites, the tourism research community has not established a strong and coherent body of knowledge about the issue of self-photography and the risks associated with dangerous photography behaviour in tourism contexts. Nonetheless, there is increasing recognition of selfie-taking as

* Corresponding author.
E-mail addresses: betty.weiler@scu.edu.au (B. Weiler), a.gstaettner@murdoch.edu.au (A.M. Gstaettner), pascal.scherrer@scu.edu.au (P. Scherrer).

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a visitor management issue such as highlighted for example by Cherry, Leong, Wallen, and Buttke (2016) in the context of visitors approaching dangerous wildlife in national parks. In a letter to the editor of the *Annals of Emergency Medicine*, Mehmood and McNicholl (2017) urge the medical profession to take this public health hazard seriously. In a similar vein, Flaherty and Smith (2019) call for creative intervention, also reminding practitioners of their obligations to prevent these incidents. Bhogesha, John, and Tripathy (2016) note that more research is required to better understand the selfie phenomenon, particularly in tourism contexts.

The aim of the present paper is to develop a better understanding of the phenomenon by means of conducting a systematic review of published empirical research on self-photography behaviour and associated risks. The focus of the present paper is on incidents where the injury or death of an individual or a group of people could have been avoided had the individual(s) not been taking a selfie (Lamba et al., 2016). In order to develop a clearer picture of antecedent human and situational variables and risk factors, this paper poses the research question: What is the current state of knowledge in academic literature on the interaction between people (visitors/tourists) taking selfies and the risk of injury or harm?

This systematic review of the current discourse builds on existing knowledge while identifying key gaps, in order to inform conceptualisation, further research, and evidence-based management interventions for harm minimisation.

2. Methods

Pickering, Grignon, Steven, Guitart, and Byrne (2015) advocate for the use of systematic literature review technique in the social sciences. This review method focuses on synthesising findings of empirical studies to provide a state of knowledge about a topic and to identify and highlight interconnected issues within the literature. Following the method outlined by Pickering and Byrne (2013), selected papers are quantitatively assessed to provide a systematic overview of the published research, including the temporal and geographical spread of studies, data sources, and research methods used. Focusing on only one single question, search protocols are used to outline the process for selecting papers, also defining specific inclusion and exclusion criteria that systematically guide the paper selection process.

Following the PRISMA statement of preferred structuring and reporting of systematic literature reviews (Moher, Liberati, Tetzlaff, & Altman, 2009), scholarly academic databases were searched to identify original research papers in English published in electronic format. The databases searched included: EBSCOhost, Science Direct, ProQuest and Google Scholar. Boolean functions were applied to combine relevant keywords taking into consideration the syntax requirements of each database (see Table 1). There was no limitation on the year of publication; however, for Google Scholar the year 2000 was selected to reduce the search results to a manageable number, while ensuring that the search incorporated the reported year of first use of the term selfie in 2002 (Murray, 2015). There were no geographic limitations on the inclusion of studies. Literature searches were conducted in August 2019.

Keyword searches involved the combination of topic and context words (Table 1). All articles talking about the phenomenon used the word *selfie* somewhere in their text. Following exploratory searches using a variety of keywords and their combinations, neither 'photography' nor 'image' was included as a keyword because doing so increased the number of 'hits' dramatically without increasing the number of suitable articles. The word image mostly referred to destination image studies while photography mostly referred to forensics studies when combined with the second string of search words

This literature search identified 2661 papers potentially relevant for this review (Fig. 1). The titles and abstracts of database search results

Table 1
Search terms that were combined to find relevant papers.

Primary search terms	Secondary search terms	Tertiary search terms
• Selfie	• Risk • Death • Fatality • Injury	• Tourism • Recreation

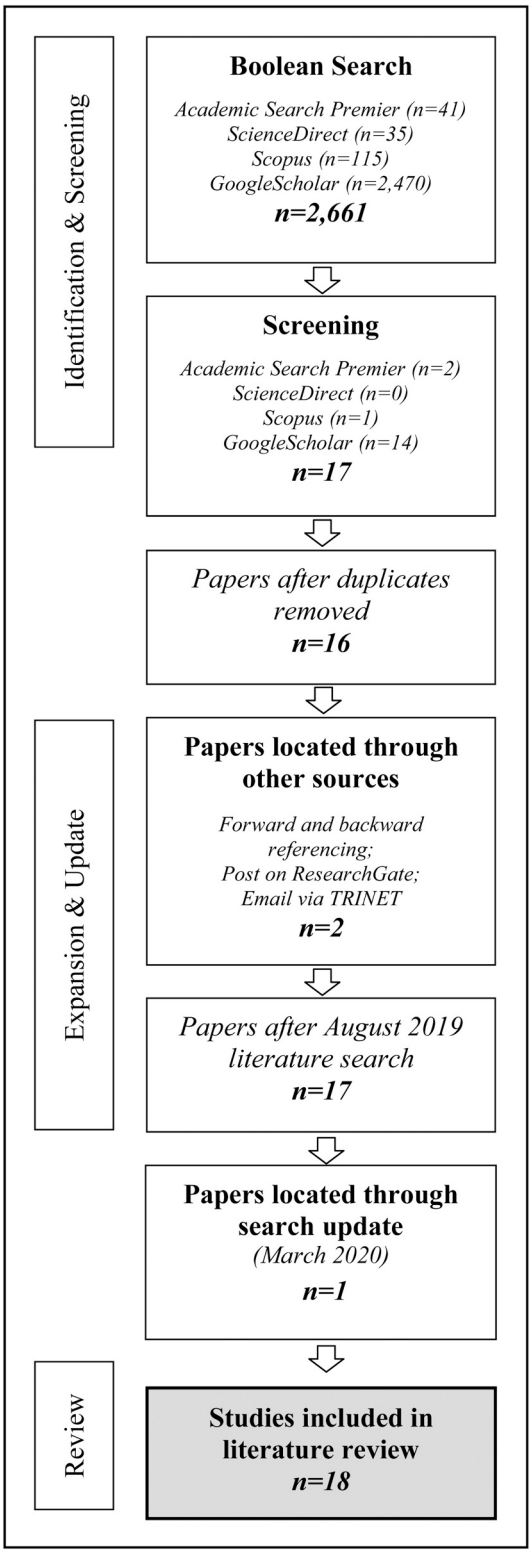

Fig. 1. Flow diagram of the literature review process.

were manually reviewed to select papers discussing dangerous or risky self-photography in a tourism and/or recreation context. To qualify for inclusion, the papers had to report on original (empirical) research directly concerning risky photography or be a study of a related topic which included a discussion of the risks associated with the phenomenon as a major aspect of the paper. Whilst focusing on papers written in the context of tourism and recreation, this aspect was treated as a guide rather than as strict inclusion criteria.

Grey literature such as government plans and reports and tourism operator policies are not included in this review as they represent management responses to risk and action to improve visitor safety in relation to self-photography, rather than a review of research on the topic. Similarly, conference papers were excluded due to their inconsistencies in peer-review and publication standards (Kelly, Sadeghieh, & Adeli, 2014). Also excluded were medical case reports as these only focus on reporting the mechanisms of injury, as well as research studies investigating the act of taking selfies as a harmful activity in terms of mental health issues (e.g. negative body image, selfie taking as obsessive behaviour).

The 15 papers that remained in the dataset were used to identify further literature by means of forward and backward referencing checks (i.e. reviewing reference lists or following citations of articles selected using Google Scholar). Reference lists of excluded literature were also reviewed to search for additional publications to include. A further two papers were identified this way. In addition, a search request was posted online on ResearchGate on the 11th August 2019[1] as well as via the email-based international Tourism Research Information Network (Trinet) on the 24th August 2019. No additional published papers were identified through either of these channels. Lastly, a basic literature search was conducted in March 2020 using Google Scholar to check for new papers being published during writing stage. One additional paper was identified during this search, making a total of 18 empirical studies included in our systematic review.

2.1. Limitations

Besides common research limitations such as a focus on literature published in English language only, chief among the limitations for our study was that the novel nature of the topic meant that much of the published material located during the literature search consisted of conference papers and opinion pieces of varying standards. The systematic approach proposed by Pickering et al. (2015) requires a focus on peer-reviewed, empirical studies and the exclusion of all grey literature including conference papers. While this approach resulted in the systematic selection of 18 key studies, we nonetheless decided to incorporate a further three papers into our discussion of results. This includes two conference publications, included due to their transparent methods and the relevancy of their contributions (Pearce & Moscardo, 2015; Virk & Dhall, 2019), along with a recent literature review paper by Pagel, Orams, and Luck (2020). Incorporating the pertinent observations made in these three papers about the nature of the selfie and risk phenomenon (section 3.3) and innovative management strategies to reduce incidences of injury and death from risky selfie-taking (section 3.4) help reduce the limitations of more strictly adhering to the systematic review approach.

3. Risky selfies: their extent, nature and proposed management responses

3.1. Overview of literature characteristics

A total of 18 empirical studies were analysed in this review. The focus was on empirical research published in academic peer reviewed journals ($n = 16$); however, two dissertations were also included given these, too, tend to follow coherent peer review processes (Evans, 2018; Reid, 2017). Of the research reported here, ten were directly concerned with the issue of self-photography and the risks associated with dangerous photography behaviour. The remaining eight papers indirectly addressed this issue when discussing a related problem, such as selfie deaths being included in a study on overall tourist fatalities (Reid, 2017).

Papers were published in a range of different research fields, including medicine ($n = 5$) and safety (n = 1) research, environmental management ($n = 4$), media and communication (n = 4), tourism ($n = 2$), cultural studies (n = 1) and computer science (n = 1). As can be seen in Fig. 2, the earliest publication was in 2016, with output peaking in 2018 with seven published papers.

The papers derived from the search have a wide geographical spread. Several of the studies ($n = 8$) maintained a global outlook; four studies focused on one particular country (i.e. Belgium, Italy, United Arab Emirates, U.S.); and some studies explored the phenomenon within a particular setting context ($n = 6$), such as particular national parks or specific dangerous sites. Research output in terms of author location stemmed predominantly from U.S. (n = 6) and/or India ($n = 3$). This outcome may be a function of the keyword combinations and selection criteria applied to the search (i.e. English language), but may also be due to the geographic prevalence of the problem (see section 3.2).

The majority of papers used quantitative research methods ($n = 12$), with only six papers applying qualitative or mixed methods research techniques. The quantitative papers were predominantly epidemiological studies using media resources (n = 6) or coronial inquest files (n = 1) to quantify the extent of the dangerous self-photography issue. A further five ($n = 5$) quantitative studies applied either survey ($n = 4$) or participant observation (n = 1) methods. One study, whilst quantitatively orientated, reported using a mixed method approach as their questionnaire also included free text responses.

Papers approached the issue of dangerous self-photography behaviour from three different viewpoints: (1) examining the *extent* of the risky selfie phenomenon; (2) exploring the *nature* of the risky selfie phenomenon; and (3) proposing *management responses*. The subsequent sections of this review present and discuss the reviewed literature in relation to these three themes. Where a paper addresses more than one of these themes, it is discussed in more than one of the following subsections. See Table 2 for an overview of the characteristics of these studies, including the author(s) and date of publication, the authors' location, the study's geographical location, the focus of the study, the research field, and study methods. Finally, each study is classified based on whether it addresses the extent of, the nature of, and/or management responses to dangerous selfie phenomenon.

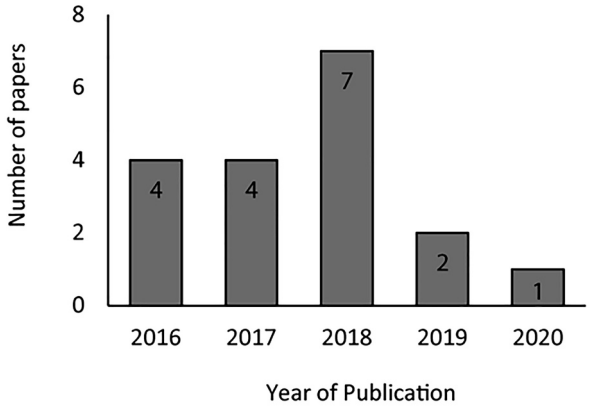

Fig. 2. Number of publications per year.

[1] https://www.researchgate.net/post/Have_you_published_on_risky_selfies

Table 2
Summary of papers reviewed.

Author (year)	Author location	Study location	Study focus	Research Field	Method	Data source	Data collection	*Extent*	*Nature*	*Management responses*
Girasek, Marschall, and Pope (2016a)	USA	Yosemite NP	Dangerous park behav.	Env. Mgt.	Quant.	Park visitors	Observation	x		
Lamba et al. (2016)	USA & India	Global	Selfie deaths	Comp. science	Quant.	Media resources	Internet search	x	x	x
Jain and Mavani (2017)	India	Global	Selfie deaths	Safety research	Quant.	Media resources	Internet search	x		
Reid (2017)	USA	Global	Tourist deaths	Tourism	Quant.	Media resources	Internet search	x		
Bansal, Garg, Pakhare, and Gupta (2018)	India	Global	Selfie deaths	Medicine	Quant.	Media resources	Internet search	x		x
Dokur, Petekkaya, and Karadag (2018)	Turkey	Global	Selfie deaths & injuries	Medicine	Quant.	Media resources	Internet search	x		
Flaherty and Caumes (2018)	Ireland & France	Cliffs of Moher	Dangerous park behaviour.	Medicine	Quant.	Inquest files	Files review	x		
Gioia et al. (2020)	Italy	Italy	Selfie deaths	Medicine	Quant.	Media resources	Internet search	x		
Flaherty and Choi (2016)	Ireland & Malaysia	Global	Selfie deaths & injuries	Medicine	Qual.	Media resources & literature	*unclear*		*x*	*x*
Girasek, Marschall, and Pope (2016b)	USA	Yosemite NP	Dangerous park behaviour.	Env. Mgt.	Quant.	Park visitors	Survey		x	
Du Preez (2017)	South Africa	Global	Selfie deaths	Cultural studies	Qual.	Media resources & literature	*unclear*		x	
Maddox (2017)	USA	Global	Selfie behaviour	Media & Comm.	Qual.	Media resources & literature	*unclear*		x	
Ayeh (2018)	UAE	United Arab Emirates	Selfie behaviour	Tourism	Qual.	Internat. Tourists	Focus group & interviews		x	
Evans (2018)	USA	USA	Dangerous park behaviour.	Media & Comm.	Mixed	College students	Survey		x	x
Chen, Schreurs, Pabian, and Vandenbosch (2019)	China & Belgium	Belgium	Selfie behaviour	Media & Comm.	Quant.	School students	Survey		x	
Phongkhieo and Sangchoey (2018)	Thailand	5 Thai National Parks	Regulation compliance	Env. Mgt.	Quant.	Park visitors	Survey			x
Tapply (2018)	Australia	Great Sandy NP	Wildlife management	Env. Mgt.	Quant.	Secondary sources	*unclear*			x
Towner (2019)	USA	Yellowstone NP	Warning signs	Media & Comm.	Qual.	General public	Survey			x

3.2. Papers examining the extent of the issue

The first theme emerging from the analysis was the *extent* of the issue of dangerous self-photography behaviour. A total of eight papers were included in this category. Refer to Table 2 for an overview of the eight papers that were assigned to this theme.

Four out of the eight papers examined the extent of selfie-related deaths occurring on a global scale based on a review of news media reports published in English language. The first analysis of selfie deaths undertaken, with a preliminary report published in November 2016, included curating a comprehensive dataset of incidents involving the 'death of an individual or a group of people that could have been avoided had the individual(s) not been taking a selfie' (Lamba et al., 2016). With this definition, the authors also included accidents where people died as they attempted to save those who had clicked the selfies. Jain and Mavani (2017) as well as Bansal et al. (2018) took a stricter

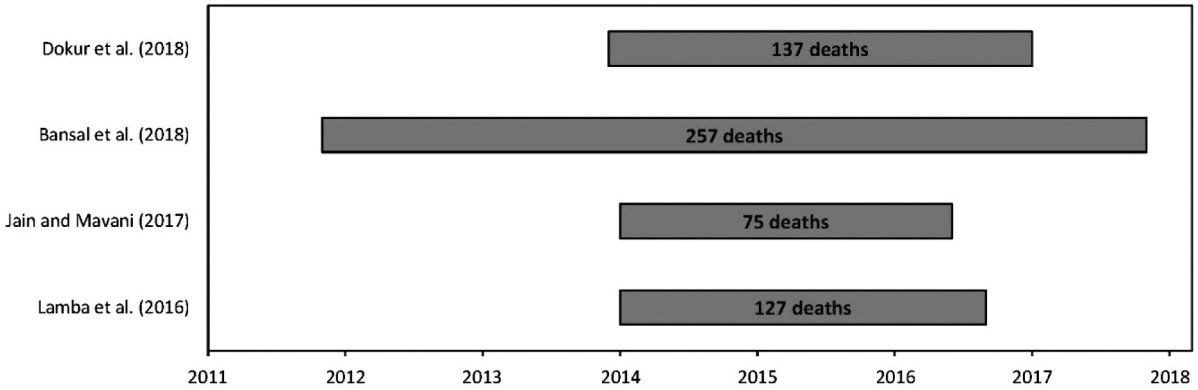

Fig. 3. Global epidemiological studies on selfie deaths.

approach in their decision to include or exclude cases in their analysis, focusing only on those casualties who were directly involved in dangerous selfie behaviour. Dokur et al. (2018) decided to include deaths of other people involved in the incident, going as far as also counting the number of people being reported injured without fatal injuries sustained.

As can be seen in Fig. 3, three of the four studies identified the first fatal incident to have occurred in early 2014; however, one study reported that three selfie deaths had occurred in late 2011 and a further two in 2013 (Bansal et al., 2018). Frequency of selfie deaths in the studies ranged between 2.6 deaths (Jain & Mavani, 2017) and 4 deaths (Lamba et al., 2016) per year, on average. With a total of 72 months, the study by Bansal et al. (2018) was the longest period of data analysis published. It is worth noting, however, that the works of Lamba et al. (2016) refer to a research group webpage, presenting their dataset on selfie-related deaths being updated in regular intervals (http://labs.precog.iiitd.edu.in/killfie/). At the time of writing this literature review, this research team recorded a total of 255 selfie deaths between 2014 and 2019.

All four global epidemiological studies of selfie-related deaths found that the great majority of casualties were male and/or under the age of 25 years of age. The greatest range in victim age was identified by Bansal et al. (2018), ranging from nine to 68 years. India was identified by all studies as the country with the greatest number of selfie-related fatalities, which was usually followed by USA and Russia; only Lamba et al. (2016) also listed Pakistan among their top three countries of selfie death occurrence. All four studies identified falling from a height as the main cause for selfie related deaths, with exposure to water-bodies also identified as a major risk factor. Dokur et al. (2018) noted that nearly half of all selfie-related fatalities and injuries occurred in natural environments. The study by Jain and Mavani (2017) identified that about 10% of all selfie-related casualties were international tourists.

Stemming from the limitation that global epidemiological studies base their analysis on media reports published only in the English language, one recent study focused their analysis on one individual (non-English speaking) country. By reviewing Italian media articles between January 2014 and December 2018, Gioia et al. (2020) identified a total of twelve fatalities over this period. Results on casualty demographics and incident classification were similar to other global studies, with the majority of cases being young males and the most preferred site for taking selfies being the natural environment (Gioia et al., 2020).

In line with the findings of the epidemiological studies on selfie deaths, i.e. that many incidents related to the exposure to cliff edges, a further two studies included in this review section particularly focused on this aspect of dangerous self-photography behaviour in national parks. The first study of this nature was an observation of visitor behaviour at a dangerous walking track section at a waterfall in Yosemite National Park (Girasek et al., 2016a). The researchers were particularly interested in how visitors approached the cliff edge, noting that about 17% of those did so to take a picture or to pose for a picture. A further study, conducted in Ireland at the Cliffs of Moher, reviewed Coroners' files of deaths which occurred on or at the base of the cliffs between 1993 and 2017 (Flaherty & Caumes, 2018). A particular focus of the analysis revolved around international tourist fatalities, with dangerous self-photography identified as a likely contribution for at least two out of eighteen tourist fatalities (or 11%) at this site. Whilst initially inspired by the observation of "unsafe behaviour of multiple tourists taking or posing for photographs at or close to the cliff edge" (p. 2), the authors of that paper postulated that suicidal antecedents might be a more prominent cause of fall incidents at the site, although gaps in data availability resulted in difficulties to derive conclusive results.

Finally, with a particular focus on tourism studies, a further epidemiological study investigated global trauma-based tourist fatalities more generally (Reid, 2017). Also using media news reports as the data source, this study found that only 14 out of 3121 tourist casualties (or <1%) were linked to dangerous selfie behaviour, indicating that selfie deaths, whilst a growing phenomenon, do not make up a large percentage of tourist fatalities as a whole.

3.3. Papers exploring the nature of the issue

A second theme evident in the literature review consists of attempts to explore, examine or explain the *nature* of selfie-taking behaviour. Again, refer to Table 2 for an overview of these eight studies included in this section. Five sub-themes were extracted from the literature and are discussed below.

Travel-related factors arising from tourism being the context for photography form the initial sub-theme. Photography has long been an integral component of the travel experience while self-photography has become mainstream behaviour more recently (Flaherty & Choi, 2016). Gioia et al. (2020) assert that both the practice of taking selfies and selfie-related dangerous behaviours are increasing. Travel-related factors such as jet-lag, climatic differences, unfamiliar surroundings, engagement in adventure activities and hedonistic tendencies such as indulgence in alcohol or other drugs may exacerbate a traveller's vulnerability to selfie-related injury or death (Flaherty & Choi, 2016). More specifically, Lamba et al. (2016) identify several contextual factors, including those found in natural environments visited by tourists, that are commonly associated with selfie deaths, including falling from heights (e.g. cliff edges) and animal attacks (e.g. by bison or kangaroos). These and others such as water-related incidents (Bansal et al., 2018) are all associated with the process of capturing oneself in an image with a spectacular backdrop (Flaherty & Choi, 2016).

A second sub-theme is that of *demographic influences* on selfie-taking, which are generally consistent with those of high-risk behaviour more generally. Epidemiological studies discussed in the previous section show that most selfie victims are male teenagers and young adults, while Girasek et al. (2016a) document that younger hikers were more inclined to enter high risk zones for self-photography than older hikers. It may be that, particularly for young people, the value of 'self' is ever evolving and deeply connected to contextual society (Pearce & Moscardo, 2015); indeed Pearce and Moscardo see selfies as "fundamentally social" (p.67). They argue that selfie-taking is a "communicative and transformative practice reflecting various social connections and self-expression needs of individuals" (p.68). According to Georgakopoulou (2016), there are three salient types of self-photography or selfies, namely 'me selfies', 'significant other selfies' and 'group selfies'. Each of these can emerge as different contextualised co-constructed presentations of the self as they stand in relationship with their intended audiences. Similarly, Flaherty and Choi (2016) note that selfies may capture single or multiple individuals and that the presence of other tourists either in or observing the photo can be important.

Thirdly, *technology-induced distractions* have altered the way tourists experience destinations. Ayeh (2018) highlights the issue of 'mobile distraction', whereby the tourist gaze is distracted by ubiquitous connectivity and (sometimes subconscious) multitasking. These visual, manual and cognitive distractions can result in inattentional blindness that affect the quality and scope of the travel experience, social interaction, relationships and – of particular relevance here – the wellbeing of tourists, potentially resulting in accidents, injury and even death (Ayeh, 2018; Flaherty & Choi, 2016). Selfie sticks, for example, have reportedly contributed to a lack of selfie-takers' awareness of their surrounds as they are transfixed by the images on their media device (Du Preez, 2017; Flaherty & Choi, 2016). Evans (2018) and Pagel et al. (2020), in the context of wildlife photography, point to the increased risks to the image-takers while seeking to position themselves in the photo frame. Risks may range from being approached or attacked by an animal while turning their back to them, to losing footing in difficult terrain (Evans, 2018).

Fourthly, while individual reasons for taking selfies may vary, *identity* and popularity needs have been identified as key factors, with tourists seeking to present an authentic and original identity in order to

enhance social ties and their popularity status for the purpose of social rewards (e.g. 'likes' for posts on social media sites) (Chen et al., 2019; Du Preez, 2017; Evans, 2018). As flagged earlier, sharing of photos on social media is embedded in the selfie culture. Social media facilitates the rapid distribution of selfies to a variety of audiences and acts as a motivating force for taking them. Chen et al. (2019), with a focus on adolescents, highlight that social media provides exposure to high-risk selfie behaviour, which in turn provides motivation to copy or extend such high-risk behaviour that then may lead to enhanced online identity but also potentially to harm (Chen et al., 2019). Du Preez (2017) and Evans (2018), focussing on adults, further highlight the ever-increasing pressure and desire to create connections, expand networks, share information, self-disclose and push boundaries to establish unique self-identity in the online space. Evans (2018:44) thus postulates that the "combination of technology and online identity management is potentially creating a risky photography culture", suggesting that the perceived risk involved in taking a photograph may be considered less by the photographer than the value gained for their online identity. Evans (2018) further points out that that this development is increasingly blurring people's online and offline identities.

Finally, Maddox (2017:195) highlights that actions occurring in selfie-related deaths are sometimes described as *exhibitionism* – "extravagant behavior that is intended to attract attention to one's self". Exhibitionism may motivate some tourists to undertake daring selfie perspectives of experiences at spectacular destinations. It harnesses social media to communicate high-risk behaviour with an ex-situ audience via selfie-sharing. Du Preez (2017:2) further delves into this social phenomenon by focussing on "selfies taken in pursuit of experiencing a sublime encounter with mortality". The lure of closing the distance between the sublime experience (e.g. encounter with mortality by standing on a cliff edge) and reality (e.g. death after falling from a great height) is driven by the power it unleashes which is inversely proportional to size of the gap between the sublime experience and reality (Du Preez, 2017).

In conclusion, tourist selfie-taking is by nature a social practice, and as such, its practice as well as its sometimes tragic consequences are impacted by society and technology changes. It must be noted that some of the factors are, of course, not unique to selfie-deaths, nor does their presence necessarily lead to a death or even a high risk of injury. Research to date has simply revealed that certain factors such as being of a particular age and a tendency toward exhibitionism seem to be associated with selfie-related deaths, with the jury still out as to what actually causes injury or death in some instances but not in others.

Despite the inherent complexities in both social practices and contexts, the review identified two overarching and interacting factors that contribute to tourist injury or death while taking selfies. The first is *distraction*, which is a consequence of multiple travel-related, contextual, demographic and technological factors. The second is *social influences,* which includes identity-management and in some cases manifests as exhibitionism.

3.4. Papers proposing management responses to the issue

The final theme that emerged across the literature is concerned with *management responses* that can reduce the possibility of injury, harm or death associated with dangerous self-photography. Again referring back to Table 2, a total of seven papers included in the systematic review point to strategies for reducing risk.

Most prevalent are a suite of strategies that can loosely be called communication. The most common of these is *persuasive communication*, particularly on-site messaging by way of signs, visitor centre information/interpretation, fliers and face-to-face communication. Persuasion by way of face-to-face communication, while typically the most expensive, is suggested by many to offer the greatest efficacy, in part because park managers, tourism operators and guides can customise face-to-face communication for specific audiences, and deliver it where and when it is most needed. For example, Evans (2018) argues for the use of messaging around risk perception and wildlife risk norms. She describes the need for creating and then appealing to wildlife risk social norms by using targeted versions of the generic message: "most people view getting close to wildlife for photography as dangerous". To be effective, the target audience or referent group for the communication would be substituted for the words "most people" (e.g. most hikers, amateur photographers, or college students) and a particular species would be substituted for the word "wildlife". In addition, the more specific the desired and appropriate behaviour is communicated (e.g. how close to the animal), the better. Evans goes on to say that telling people what they can do (as opposed to can't do) in these situations adds to persuasiveness, as it creates self-efficacy.

Similarly, Phongkhieo and Sangchoey (2018) call for the development of injunctive social norms to gain compliance with park regulations. In the case of selfie-taking, this would require regulating behaviour, making visitors aware of what is compliant behaviour (e.g. regulating against the taking of selfies in certain contexts) and the legal consequences of non-compliance (Evans, 2018), and then convincing the target audience that relevant referent groups (e.g. other visitors similar to themselves) hold this social norm. All of this is possible with written as well as verbal communication.

Also falling under the banner of communication is *education and awareness-raising*. Bansal et al. (2018), Evans (2018), Pagel et al. (2020) and others note the important of improving tourists' understanding of what is safe and what is risky, and why. For example, Evans' (2018) study of risky wildlife photography concludes that more education is needed regarding the risks not only to humans but also to wildlife, and what a tourist can do to reduce that risk. The latter includes a better understanding of what constitutes a safe distance for photographing any particular species and why. With respect to dingos, Tapply (2018), although not focused on photo-taking behaviour, argues for the merits of using videos both in visitor centres and on-line for enhancing visitors' interpretation of dingo behaviour and thus addressing the "why". Pagel et al. (2020) make a similar recommendation about marine wildlife, stressing that wildlife tourism operators in particular have a role to play in educating their clients about what particular marine wildlife behaviours mean (e.g. behaviours that indicate the animal is stressed or fearful) and which behaviours by visitors (such as approaching, being too close and being in too large a group), including for the purposes of self-photography, might precipitate a wildlife response that poses a risk to visitors.

In addition to the nature of the communication, several studies suggest specific *on-site media* that can be employed to reduce risky selfie-taking, such as signs (Evans; Flaherty & Choi, 2016), posters (Lamba et al., 2016) and videos (Evans, 2018). Safety and warning signs (with text, images or both) are usually the medium of choice of park management authorities to convey what is safe and appropriate and what is not, particularly where it is not feasible to have a staff presence (Saunders, Weiler, Scherrer, & Zeppel, 2019). Signage is mentioned in several of the studies (Flaherty & Choi, 2016; Tapply, 2018; Towner, 2019). Towner (2019) suggests particular strategies such as the use of graphic images in warning signs, but acknowledges that his research found that longer descriptive text-only signs were more effective at promoting safe viewing and photography of wildlife.

Many of the studies reviewed argue for *face-to-face interaction* between managers/operators/guides and tourists as a particularly important medium of on-site communication (Evans, 2018). Flaherty and Choi (2016) make special mention of the roles of tour operators and their guides/leaders in on-site messaging. Tapply (2018) suggests that face-to-face communication by tour operators as well as monitoring and managing dangerous selfie-taking behaviour be made a condition for gaining a licence to operate a tour in a national park.

Education and persuasive communication can also happen *off-site*. Flaherty and Choi (2016) draw attention to the responsibilities of mobile telephone manufacturers and even travel health clinics in conveying

appropriate off-site messaging about the risks of selfie-taking. Lamba et al. (2016) and Tapply (2018) suggest using *social media* in particular to convince tourists to "behave" or change the way they plan to behave including photo-taking and sharing. As on-going monitoring and use of social media by staff can be time-consuming and costly for park managers, Pearce and Moscardo (2015: 68) recommend that managers "work with online intermediaries to establish guidelines about the posting of inappropriate tourist selfies and other images".

Building on social media as a communication vehicle, Lamba et al. (2016) recommend and indeed have developed *innovative communication media*. The authors initiated a Twitter account (#selfietodiefor) and a website (www.selfietodiefor.org/), both aimed at disseminating news about selfie-related deaths. While these are aimed at sharing what is risky behaviour with the intention of reducing the behaviour and its negative consequences, the extent to which research underpins these initiatives is unclear, and there seems to be both limited uptake of these (i.e. few followers) and limited evidence of their efficacy. Lamba and colleagues have also developed a smartphone app (Saftie) which nudges the mobile photo user if the scene is assessed to be dangerous. They developed the app based on a dataset which marks locations as dangerous and uses this, together with information about the phone user (such as their current elevation and other features), to notify the user that photo-taking is unsafe. Similarly, Virk and Dhall (2019) report on the development of their smartphone app (Garuda) which works with a phone's camera firstly to detect when a selfie is being taken, and secondly to analyse the background of the photo in order to classify the selfie into one of five categories: safe, low danger, moderate danger, high danger and extreme danger. The app was based on classifying images "scraped" from the web and using this analysis to write software that assesses the level of danger. In addition to conveying (by the display of a colour circle on the screen) the level of danger, an extreme level of danger prompts the display of a pop-up message to the phone user: "CAREFUL: Your background is dangerous". While both these initiatives are commendable, neither paper reports on the uptake and efficacy of the app in reducing risky selfie-taking nor potential applications at the provider level (e.g. standard installation on new phone releases). Ironically, such applications could inadvertently contribute to technology-induced distraction as discussed in section 3.3, potentially inadvertently contributing to increased risk.

Beyond on-site and off-site persuasive communication and education, the appropriate use of *marketing communication* is advocated by several authors. The responsibilities of tour operators (Flaherty & Choi, 2016) in pre-trip communication via websites, brochures and other media is particularly highlighted. Pagel et al. (2020) argue that wildlife tourism operators need to refrain from using photos of unrealistic (and unsafe) activities such as feeding and touching wildlife, and images that depict unsafe distances between the photographer and the subject matter. Pagel et al. (2020) also argue for refraining from images and text that portray animals as passive, powerless objects, as this can be harmful and potentially dangerous to both tourists and wildlife. Appropriate use of photographs and imagery in marketing can equally apply to other types of tourism products, such as avoiding the use of scenes taken at unsafe times and locations or from unsafe vantage points. This offers important lessons for destination marketers and promoters who are vulnerable to engage in such practices in their efforts to highlight and differentiate visitor destinations and experiences.

Finally, there are a suite of what might be called *tangible or hard management* strategies for reducing risky selfie-taking by tourists. The most common on-site strategy mentioned by researchers is restricting visitation (e.g. numbers at any one time, or requiring children to be accompanied by an adult) including temporary, seasonal and even permanent closure of sites (Tapply, 2018). Restricting and preventing access, however, tends to be the least-preferred approach by park managers (Worboys et al., 2015). Closely related is the establishment of "no selfie zones" (Lamba et al., 2016) such as near water bodies and cliff edges (Bansal et al., 2018), presumably by way of signage, legislation and enforcement (Tapply, 2018) with penalties ranging from fines to eviction (Pagel et al., 2020). Again, the latter is likely to be a labour-intensive and thus a costly approach for park managers.

A somewhat more heavy-handed management approach is the use of barriers such as ropes, fences (Tapply, 2018) including electrified fences, and steel cages for selfie-taking (Gioia et al., 2020). To complement or replace these strategies, Evans (2018) shares her respondents' suggestions for substitute and virtual wildlife experiences such as the creation of safe wildlife viewing areas and opportunities to interact with captive animals, the use of taxidermied animals, and opportunities to view videos and live-cam footage. However, many will regard such experiences as precluding (and therefore no substitute for) selfie-taking, not to mention falling short of delivering the benefits normally associated with visiting national parks (Moyle & Weiler, 2017). While hard management strategies may be less resource-intensive and in some cases are already being used, they have issues associated with them. The most obvious one is that they inhibit the sense of freedom and the benefits of enjoying time in nature that many people seek when visiting national parks and other natural areas (Mason, 2005).

4. Avenues for further research

Pearce and Moscardo (2015), Pagel et al. (2020) and indeed most of the authors cited in the current review remind us that both research on and management of the practice of selfie-taking and its risks in tourism contexts are still in their early days, while the frequency of the practice is likely to further increase. Most of the studies reviewed for this paper make generic calls for more research into the problematic use of mobile technologies by visitors to natural environments including traveller selfie-taking behaviour and the causes and potentially hazardous consequences of photo-taking in risky environments. In addition, as the body of research about selfie-related deaths grows, a meta-analysis would be a very useful undertaking.

Many of the authors also offer specific recommendations for future research. For example, Jain and Mavani (2017), Ayeh (2018), Evans (2018) and Chen et al. (2019) call for the use of different theoretical, epistemological and methodological approaches and research designs. Their recommendations range from more qualitative research to the use of experimental design and the implementation of large-scale trials. We suggest that the inconclusive findings of epidemiological studies in our review highlight the infancy of research on the topic. Framing such research with psychological, sociological and philosophical lenses and theories may well bring fresh perspectives as to the causal and contextual factors associated with selfie-related deaths.

Pagel et al. (2020) note the lack of research on tourist photo-taking in the marine tourism context and Towner (2019) notes the need for research on specific context variables such as the presence of distractions. Phongkhieo and Sangchoey (2018) and Chen et al. (2019) advocate for further research on the effect of behavioural and attitudinal variables. More specifically, Evans (2018) and Chen et al. (2019) call for a more thorough investigation of normative influence, including how each type of social norm (descriptive, injunctive, subjective) impacts risky photo-taking behaviour. Further research on the influence of being in a group versus solo while taking a selfie is warranted. Other constructs that could be investigated in future research include values and beliefs (Evans, 2018).

As already noted, understanding the target audience is critical. Pearce and Moscardo (2015) argue for a better understanding of how selfie photo-taking and photo-sharing fit into the larger picture of a tourist's experience and their online communication. Chen et al. (2019) concur, noting that more research is needed on why adolescents become online daredevils. Towner (2019) advocates for more research investigating how best to communicate to high risk-taking audiences such as young males. Several researchers call for the review of non-English language literature and media reporting (Bansal et al., 2018), and for follow-up studies across different cultures (Chen et al., 2019) including

profiling of different nationalities in relation to causal factors (Gioia et al., 2020).

Finally, studies that apply previous research findings to design and assess the efficacy of risk-reducing measures by public health authorities and the travel industry (Flaherty & Choi, 2016; Reid, 2017), including specific communication messages (Evans, 2018), would be particularly useful avenues for researchers to pursue.

Based on the systematic review conducted for this paper, it is clear that both effective visitor communication strategies, whether they be for the purposes of persuasion, education or marketing, as well as hard management strategies must be underpinned by theory and research. Without theory- driven research on the subject of risky selfie-taking, interventions aimed at managing or mitigating the practice are less to succeed.

5. Conclusion

Photography has been a part of the tourist experience for as long as researchers have been studying and writing about tourist behaviour. However, the desire to share selfies via social media is a twenty-first century phenomenon. Severe injury or death as a consequence of tourist photo-taking has not previously been considered as widespread, but has become a concurring issue of the selfie trend.

This paper employed a systematic review of published empirical research to examine the extent and nature of risks associated with dangerous tourist self-photography (selfies), and management responses to these. The review identified eight studies examining the extent of the phenomenon, most of which were epidemiological studies quantifying the implications of dangerous self-photography on a global scale. These studies reveal that selfie-related deaths are common in natural environments, and that the danger more often than not is associated with taking a selfie near a cliff edge, whilst in or near a water body, or with dangerous wildlife being too close. Young males are the demographic most associated with selfie injuries and death.

The eight studies that considered the nature of the phenomenon point to tourists being susceptible to injury from selfie-taking because of the distractive nature of the activity. More specifically, being a tourist can mean that they are affected by jet-lag, climatic differences and lack of familiarity with their surroundings. Moreover, the technological aspects of selfie-taking provide further distraction that are not typical of other forms of tourist photography. Finally, individuals who are motivated by the social nature of photo-sharing and by the desire to present a particular on-line image may be more likely to take risks with their travel selfies.

Finally, strategies for reducing selfie-related injury and death were put forward by seven studies. Communication-related strategies dominate, including education, awareness-raising, persuasion and marketing. The studies advocate targeted messaging using on-site and off-site communication and both traditional and innovative media including smartphone apps. These aim to either improve tourist understanding of the dangers of the behaviour and factors contributing to these, or they aim to appeal to the social, identity-creating nature of selfie-taking and sharing, or they do both. Managers can also resort to hard management approaches that effectively restrict or remove opportunities for risky selfie-taking.

In conclusion, there is insufficient research at this time to be able to conclusively say that any of the multiple travel-related, contextual, demographic and technological factors identified in this study are "causal" factors in selfie-related deaths. Further research is certainly warranted to optimise both understanding and management responses in relation to the risks and the sometimes tragic consequences of selfie-taking by tourists. The new post-COVID-19 environment cannot be relied on to usher in a new era of tourists taking fewer risks associated with photography including selfie-taking and thus fewer injuries and deaths. An early indicator of this is a May 2020 news story by Panashchuk (2020). Ms. Olesia Suspitsina, a 21 year old Kazakhstan woman, was described in the story as an avid traveller and experienced tour guide who takes some of the most dangerous selfies in the world. Tragically, on 1st May she was reported as falling to her death while posing for a photo near the edge of a cliff in Turkey while on a hike to celebrate the end of coronavirus lockdown. It seems unlikely that any event or intervention, whether communication or hard-management based, will ever fully eliminate the risks associated with visitors engaging in dangerous selfie-taking behaviour.

Contributions

Weiler – conceptualisation and project management; review and analysis of selected literature; structuring, drafting, editing and finalising manuscript.

Gstaettner – literature search and creation of database; review and analysis of selected literature; drafting and review of sections of the manuscript.

Scherrer – review of conceptualisation; review and analysis of selected literature; drafting and editing sections of the manuscript.

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Betty Weiler is a Research Professor at Southern Cross University. Much of Betty's research focuses on the tourist experience and visitor management in protected areas, and the role of the tour guide in nature-based settings and zoos. A particular area of interest is the use of persuasive communication to influence visitor behaviour and as a management tool. She collaborates with a range of industry and government partners, particularly managers of protected areas and wildlife attractions. She is a past or current member of several technical and scientific advisory committees including the Gondwana Rainforests World Heritage Area.

Anna M Gstaettner is a current PhD candidate in the College of Arts, Business, Law & Social Sciences at Murdoch University, Western Australia. Her research focuses on visitor risk and safety management in natural protected areas.

Dr. Pascal Scherrer is a Senior Lecturer at Southern Cross University (SCU), New South Wales, Australia. With a background in environmental science and ecotourism, Pascal's main research interest is in sustainable tourism and visitor management in natural and cultural landscapes, addressing the areas of environmental, social and cultural impacts and their relationship. His research experience spans a variety of tourism contexts, including coastal, island, indigenous, remote and protected area settings. Pascal is a member of the IUCN World Commission of Protected Areas (WCPA) and serves on the Regional National Parks advisory board.