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Contents lists available at ScienceDirect

Journal of Safety Research

journal homepage: www.elsevier.com/locate/jsr

www.nsc.org

Q1 The influence of trait mindfulness on incident involvement among 2 Chinese airline pilots: The role of risk perception and flight experience

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8 A R T I C L E I N F O

9 Article history:

10 Received 6 March 2017

11 Received in revised form 24 April 2018

12 Accepted 11 July 2018

13 Available online xxxxx

14

15 Keywords:

16 Trait mindfulness

17 Risk perception

18 Flight experience

19 Incident involvement

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1. Introduction

Oster, Strong, and Zom (2013) concluded that human error was a contributing factor in 83% of aviation accidents from 1990 to 2013. However, not every error or hazardous situation leads to an accident; accidents are sometimes referred to as the tip of the iceberg, in the sense that errors and hazardous events can occur below the perceived surface and may not directly result in accidents (Hunter & Stewart, 2011). Usually, errors are caught in time and hazardous situations avoided; thus, the hazardous events that do occur have gained attention in recent years. Grabowski, Ayyalasomayajula, Merrick, Harrald, and Roberts (2007) reported that hazardous events can be termed 'accident precursors' in many settings and can, therefore, be used as indicators of the safety status of a system or individual. Similarly, hazardous events in aviation may be considered surrogates for an actual measure of risk – a notion that certain scholars have focused on in researching the prevalence of hazardous events in the aviation industry (Hunter, 1995; O'Hare & Chalmers, 1999). The application of such a surrogate measure of risk is arguably advantageous in research terms because it greatly shortens the time required to complete a study.

Various studies have tried to identify the factors that may be involved in hazardous events. Some have demonstrated that pilots' personality traits are frequently related to involvement in aviation

A B S T R A C T

Introduction The primary objective of this study is to investigate the relationships between trait mindfulness, risk perception, flight experience, and incident involvement among Chinese airline pilots. *Method* The study used a sample consisting of 295 commercial airline pilots from China Southern Airlines Ltd. *Results* The results show that trait mindfulness has a direct and negative effect on airline pilots' incident involvement, and an indirect effect on incident involvement through influencing risk perception. Flight experience was also found to strengthen the negative and direct effect of trait mindfulness on incident involvement. *Practical applications* The practical implications of the study include recommendations as to injury prevention efforts in incident involvement. Future research directions are also discussed.

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accidents/incidents; these traits include sensation-seeking, aggression, and social deviance (Dillinger, Wiegmann, & Taneja, 2003; Musson, Sandal, & Helmreich, 2004), proactive personality (Ji, Liu, Jin, Yang, & Chen, 2015), narcissistic personality (Ju, Ji, Lan, & You, 2016), and risk tolerance (Ji, You, Lan, & Yang, 2011; Pauley, O'Hare, & Mullen, 2008). Others have found that hazardous events are influenced by certain social cognitive variables, such as attitude to safety, perceived risk, social norms, and perceived behavioral control (Hunter, 2006; O'Hare, 1990; You, Ji, & Han, 2013). Conversely, other studies have concluded that most aviation safety campaigns based on personality traits and social cognition have not had any effect on the number of accidents and incidents (O'Dea, O'Connor, Kennedy, & Buttrey, 2010).

One important reason for the latter may be that certain trait variables, such as conscientiousness (Zhang & Wu, 2014), locus of control (Stewart, 2006; You et al., 2013), and mindfulness (Bishop et al., 2004; Sutcliffe, Vogus, & Dane, 2016), might be poorly understood and, consequently, be chronically ignored. These trait variables are not traditional personality traits that are characterized by stability across time and context; rather, they are state-like conditions, or situational states, which are similar to the *Character Strengths and Virtues* in the field of positive psychology (Peterson & Seligman, 2004). They are affected by both innate and acquired factors, especially acquired variability. Indeed, in a dynamic environment, state-like trait factors may outweigh disposition factors in terms of being predictors of performance. Another reason for the lack of connection made between personal traits and safety outcomes could be that these trait factors might have indirect effects, which might be underestimated when incidents are analyzed.

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Theoretically, at least, personal traits are thought to affect an individual's perception and evaluation of the environment (You et al., 2013). In light of this, the current study attempts to integrate individual trait approaches and social cognition approaches to provide a better understanding of the mechanisms underlying airline pilots' incident involvement.

1.1. Mindfulness

Mindfulness refers to having receptive attention to and awareness of present events and experience (Bishop et al., 2004). It is traditionally defined as the state of being attentive to and aware of what is taking place in the present. For example, Thera (1972) called mindfulness "the clear and single-minded awareness of what actually happens to us and in us at the successive moments of perception." Similarly, mindfulness has been described as "a receptive state of mind where in attention, informed by awareness of present experience, simply observes what is taking place" (Niemiec et al., 2010).

As with many state-level concepts (e.g., positive and negative affect), mindfulness can be conceptualized and measured not only as a state but also as a personality trait (Bishop et al., 2004; Sutcliffe et al., 2016). Indeed, several scholars have argued that mindfulness is an inherent human disposition, not just a state or a product of practice (Brown & Ryan, 2003; Kabat-Zinn, 2003). Trait mindfulness involves a more constant receptivity to internal and external stimuli as they occur, in contrast to the conceptually-driven mode of processing wherein occurrences are habitually filtered through appraisals, evaluations, and other forms of cognitive manipulation (Brown & Cordon, 2009). For example, individuals need to be aware of their own inner activities, such as in the practice of breathing; when someone's attention shifts away from observing the breath to other aspects, it can quickly return to focus on the observation, with curiosity, openness, and receptivity. In aviation, mindful pilots are able to focus their attention on 'the right object' and shift attention away from the 'wrong object.'

Mayer's (2000) investigation found that mindfulness, as a characteristic of individual difference, has a number of benefits in human functioning. Brown and Ryan (2003) found trait mindfulness to be positively associated with autonomous self-regulation, related negatively to neuroticism, and heightened between implicit and explicit affect. In threatening situations, the receptive attention that characterizes trait mindfulness is thought to facilitate exposure, or less defensive processing of threat (Baer, 2003). Research also suggests that mindfulness promotes desensitization and reduced emotional reactivity (Arch & Craske, 2006); greater tolerance of unpleasant states (Eifert & Heffner, 2003); reduced habitual responding (Wenk-Sormaz, 2005); and more adaptive responding in threatening social situations (Barnes, Brown, Krusemark, Campbell, & Rogge, 2007).

As a positive trait, mindfulness not only helps individuals to increase their mental health, but also has a crucial effect on safety professionals (Chiesa & Serretti, 2009). Specifically, highly mindful people tend to be more aware of external stimuli and internal processes that might be unnoticed by others, enabling them to maintain a more tranquil mind and more stable emotional state. Evidence also suggests that trait mindfulness is positively related to safety performance among operators who hold jobs high in task complexity (Zhang & Wu, 2014), and to job performance among those working in a dynamic performance environment (Dane & Brummel, 2014). Furthermore, people with a high level of trait mindfulness are better able to notice potential risks (Kontogiannis & Malakis, 2009), and can make suitable decisions to avoid risky behaviors (Feldman, Greeson, Renna, & Robbins-Monteith, 2011; Lakey, Campbell, Brown, & Goodie, 2007). In the context of aviation, Weick and Roberts (1993) showed that reliable operations on naval aircraft carrier flight decks resulted from the "collective mind" embodied in the interrelation of crewmembers' social activities and interactions, whereby a wrong decision by a pilot typically resulted from a distraction by one of the crewmembers. Brown, Ryan, and Creswell

(2007) found that a high level of trait mindfulness can lead pilots to use their attention flexibly and decrease the likelihood of incidents.

Based on these arguments, our first hypothesis is as follows:

H1. Trait mindfulness will negatively predict pilots' incident involvement. A high level of trait mindfulness will be associated with decreased incident involvement, and a low level of trait mindfulness will be associated with greater incident involvement.

1.2. Risk perception

Risk perception refers to the cognitive ability to discern the risk inherent in a situation; this ability involves an accurate appraisal both of the external situation and one's personal capacities (Hunter, 2002). Risk perception is crucial in hazardous flight situations as it allows a pilot to make a certain judgment on risk according to his/her understanding of the latter. In a high-risk task, pilots need to assess the risk accurately; any under- or over-estimation of risk will result in varying degrees of danger. A high level of risk perception requires the pilot to accurately appraise the situation and optimum ways of addressing it, and then act accordingly.

Wiggins (2014) further suggests that the development of certain cognitive competencies is critical for risk-related decisions. The relationship between risk perception and the occurrence of hazardous events is clearly a strong one. For example, Pauley, O'Hare, and Wiggins (2008) found that the weaker a pilot's implicit association between adverse weather and risk, the greater the number of hazardous events that the pilot had been involved in. This suggests that implicit processes may play an important role in aeronautical decision-making. Ji et al. (2011) also found that pilots who perceived risk as high exhibited higher safety operation behaviors than those who perceived risk as low. Ji et al. (2015) also found that risk perception mediated the relationship between a proactive personality and flying cadets' situational judgment (Ji et al., 2015).

Bearing the latter in mind, our second hypothesis is as follows:

H2. Risk perception will negatively predict pilots' involvement in incidents.

Risk perception has also been found to be closely related to trait mindfulness, as the process of paying attention to and being aware of objects in the present moment – nonjudgmentally, without evaluating and with acceptance and openness (Brown & Ryan, 2003) – plays a role in risk perception. There is some evidence to suggest that trait mindfulness may affect the time perception (Wittmann & Schmidt, 2014) and judgment of potential risks (Kontogiannis & Malakis, 2009). Conte, Ratto, and Karasu (1996) gathered similar evidence, indicating that the development of trait mindfulness would tend to be associated with an increased capacity to see relationships between thoughts, feelings, and actions, and to discern the significance and causes of experience and behavior. Individuals with high trait mindfulness have high levels of attention and awareness ability.

These theories and empirical evidence led us to the following hypothesis:

H3. Mindfulness will positively predict pilots' risk perception. A high level of trait mindfulness will be associated with a high level of risk perception, but lower levels of trait mindfulness will be associated with lower levels of risk perception.

We concluded that trait mindfulness may directly influence risk perception, and that risk perception directly influences pilots' involvement in incidents. Thus, we argue that trait mindfulness can be expected indirectly to affect pilots' involvement in incidents through its effect on risk perception. Based on this theory, we extended H2 and H3 to make the following prediction:

H4. Risk perception will mediate the relationship between trait mindfulness and pilots' involvement in incidents.

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