



A longitudinal study on the alteration of consumer perceptions and the use of pilot medication



Scott R. Winter ^{a,*}, Stephen Rice ^b, Taylor Rains ^a, Mattie Milner ^b

^a Florida Institute of Technology, USA

^b Embry-Riddle Aeronautical University, USA

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ABSTRACT

In 2010, the United States' Federal Aviation Administration (FAA) approved the use of four antidepressant medications that could be prescribed to pilots on active flight duty, provided the pilot adhered to detailed policies and protocols. These medications were praised by many in the aviation community who were concerned with pilots underreporting mental health issues or engaging in self-medication. The purpose of this study was to complete a follow-up to a study, initially conducted prior to a 2015 Germanwings accident where a European commercial airliner crashed in an alleged case of pilot suicide. In the previous study, consumers were asked their willingness to fly when their pilot was taking various medications (fluoxetine, loratadine, ibuprofen or clonidine); and the findings suggest that the fluoxetine condition produces the lowest willingness to fly scores. The current study was replicated longitudinally in the weeks following the Germanwings accident. The findings of the current study reveal a significant drop in willingness to fly scores for the fluoxetine condition immediately after the accident; however, there is no significant change to the other medications. After 12-weeks, the fluoxetine condition returns to its pre-accident levels.

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1. Introduction

When passengers board a commercial airliner, there is an expectation that their pilots are not only certified to operate the aircraft but are also medically sound and fit for flight. Pilots must undergo medical examinations every 6–12 months to command commercial airline flights; however, there are a number of medical conditions that could revoke their medical flying credentials. In the past, a pilot suffering from depression would be grounded (removed from flight status). However, within the last five years, the FAA has allowed four antidepressant medications to be prescribed for commercial pilots and established a procedure for their proper use. A prior study (Rice et al., 2015b) examined consumers' willingness to fly depending on if their pilot was taking certain medications. The data was collected for that study two weeks before the Germanwings accident. The purpose of the current study is to examine if there is a hangover effect on consumers' willingness to fly after a major aircraft accident attributed to alleged pilot

suicide and how that would affect the findings of the original study.

1.1. Mental health and depression in the general population

Three hundred and fifty million people suffer from depression in the general population according to the World Health Organization (2012). More importantly, over 80% of those individuals with clinical depression remain undiagnosed every year (Healthline, 2015). Although there are some common factors leading to depression, there is no particular country, region, culture, or even age group more prone to this illness than others. Although depression can occur at any age, the median age of people suffering from this condition is 32 years (Depression and Bipolar Support Alliance, 2015). Extensive medical research has aimed to identify factors that could help people predict which individuals would be more susceptible to depression (National Institute of Mental Health, 2015). We know that a person's environment and surroundings can have a direct impact on their psychological state, and sudden or complex changes to such environments can lead to the onset of some forms of depression (National Institute of Mental Health, 2015). The most common symptoms of this disorder involve overarching feelings of sadness, hopelessness, pessimism, suicidal

* Corresponding author. College of Aeronautics, Florida Institute of Technology, 150 West University Blvd., Melbourne, FL 32901, USA.

E-mail address: scott.winter@mac.com (S.R. Winter).

thoughts, and many more (Depression and Bipolar Support Alliance, 2015; National Institute of Mental Health, 2015). These symptoms have been substantiated by analyzing the areas of the brain, in depressed patients, that control mood, thinking, sleeping, appetite, and behavior, and comparing the results to patients not depressed. These issues may indirectly affect everyday activities such as sleep, fatigue levels, work efficiency, appetite, sexual interest, and can even affect interpersonal relationships (National Institute of Mental Health, 2015).

Not only is depression difficult to predict, but another difficulty arises in that there are numerous types of depression, and they manifest differently in different people. Furthermore, this type of psychiatric illness is not necessarily confined to one episode or instance and can re-manifest itself throughout various stages of life. While depression is treatable, it can reappear many years later when external pressures, stressors, or tragic life events trigger issues into resurfacing (Kendler et al., 2000). While depression can reappear many years later, or an individual may go for extended periods of time without suffering, some individuals may experience persistent depressive disorder. This disorder occurs when the depressed mood lasts for two or more years and includes times of major depressive episodes, as well as episodes with less severe symptoms. However, as previously stated, the illness is highly individualized and people may experience a wide range of severities, durations, and frequencies associated with depression.

Another form common amongst women who have just given birth is postpartum depression, which is the result of hormone imbalances that occur after pregnancy. Furthermore, another look at environmental factors suggest that the reduced amount of sunlight during winter months can also lead to a form of depression known as seasonal affective disorder (SAD). All these different types, manifestations, and symptoms of depression show the severity of the illness and the need for more research in the field. It also shows how diverse, and in turn, how difficult such a problem is to remedy.

1.2. Mental health in aviation

Despite their role of command and authority, pilots are humans and suffer from all conditions, both physical and mental, that affect the rest of the population. Stressors can come from either personal or professional realms. Working in the aviation industry produces extra stressors such as, varying schedules, time away from home, and jet lag, which are all unique to the aviation industry. However, there is no denying that pilots, along with others that work in high consequence industries, operate with an extremely small margin of error. It was not until 2010 that pilots suffering from depression were able to receive prescribed medication and remain on flight duty. This led to concern within the industry that pilots may not be reporting mental health issues so as to avoid being grounded and losing their livelihood (Bor and Hubbard, 2006). Cooper and Sloan (1985) and Raschmann et al. (1990) completed research that demonstrated that strong social networks at home can help minimize workplace stress among pilots.

While pilot suicide is rare, unfortunately, it is not unheard of in aviation. From 1991 to 2010 the word 'antidepressant' appears in 137 accident reports from the National Transportation Safety Board (NTSB). In most of these cases, the pilots failed to disclose on their medical application that they were taking antidepressants (Thurber, 2010). Unlike the United States, Australia has allowed pilots to fly with anti-depressant medications since 1987. In 2007, a study on pilots using prescribed anti-depressants was completed in Australia (Ross et al., 2007). The time period of this study was January 1993 to June 2004. The researchers did not discover any significant differences between control groups and medicated

groups of pilots in terms of the number of incidents or accidents. Also, no significant difference was found for the time period before or after the pilot started the antidepressant medication.

Sadly, in extreme cases, there are situations of pilot suicide. In the United Kingdom from 1970 to 1996, pilot suicide was noted between 0.72 and 2.4 percent in general aviation accidents (Cullen, 1998). Within the United States between 1983 and 2003, 37 accidents were attributed to pilot suicide in general aviation (Bills et al., 2005). Alcohol abuse was attributed to 25% of the accidents while illegal substance abuse accounted for 14% of accidents. At the commercial aviation level, an accident involving Egypt Air Flight 990, a Boeing 767, was determined by US authorities to be a case of pilot suicide, although this was disputed by Egyptian authorities. In 1997, an Indonesian carrier, Silk Air, had a Boeing 737 crash attributed to pilot suicide (Morse and Bor, 2006). More recently in March 2015, Germanwings 9525 crash in the French Alps was allegedly caused by pilot suicide (Brown et al., 2015).

Prior to 2010, the Federal Aviation Administration prohibited commercial pilots from being prescribed any type of anti-depression medication while on flight duty. Therefore, any pilot that was suffering from depression would be grounded, provided they admitted to the condition. A concern of this policy was that cases of depression in pilots were being under-reported (Bor and Hubbard, 2006). Pilots may refrain from discussing these issues with their aeromedical physician, receive treatment from a different physician and not report it on their aeromedical exam or self-medicate the condition. However, in 2010, the FAA revised their policy on anti-depressant medications and approved four types of selective serotonin reuptake inhibitors (SSRI) to be used by pilot on active flight duty. The four SSRIs were: Fluoxetine (Prozac), Sertraline (Zoloft), Citalopram (Celexa), and Escitalopram (Lexapro) (AOPA, 2010).

In allowing four SSRIs to be prescribed to pilots on flight duty, the FAA also implemented procedures for their usage. When a pilot is prescribed one of these four medications by an aviation medical examiner, the pilot must refrain from flight duty for a period of six months (FAA, 2015). The purpose of this waiting period is for the patient to accustom themselves to the medication and to ensure there will be no adverse and disqualifying side effects of the drug. After the six-month waiting period, and without any adverse side effects, the aviation medical examiner may approve the pilot's flight duty. Any issues of psychosis, suicidal ideation, electro convulsive therapy, multi SSRI use, or other psychiatric drug use by the patient would be disqualifying (FAA, 2015).

1.3. Social stigmas towards depression and mental health

Aviation safety is a major component of the airline industry, and an area of research that many professionals are working hard to improve. Airline crashes, although tragic, can be useful in identifying the flaws in the system. In most cases, investigators find pilot error to be the major cause of accidents rather than mechanical error. This leads to studies being conducted on pilot behavior in the cockpit and passenger perceptions of their pilots. Prior to a recent accident involving a Germanwings passenger jet, a study (Rice et al., 2015c) examined how an airline passenger's level of trust during flight changes as they interact socially with their pilots. As defined by Cheek and Buss (1981), sociability is "a tendency to affiliate with others and to prefer being with others to remaining alone" (p. 330). In this specific study, sociability was observed in two categories: introverts (unsociable) and extroverts (sociable). Introverts are reserved and tend to avoid social situations, while extroverts are much more outgoing and enjoy social settings (Winter and Rice, 2015). Researchers created a hypothetical scenario in which passengers overheard flight attendants discussing

the pilot's behavior before a flight. The flight attendants described one pilot's personality as reserved and unsociable and the other pilot as outgoing and sociable. After questioning participants, results show that they were more trusting of the sociable pilot over the unsociable one. Many passengers stigmatized the introverted personality and associated it with an increased likelihood of mental illness, suggesting that there is a correlation between a customer's level of trust and their pilot's psychological state (Winter and Rice, 2015). Caldwell (2012) explains that certain levels of neuropeptides produced in the hypothalamus could affect a person's sociability and indicate a mental disorder.

Although we did not study how a pilot's personality effects his or her ability to safely operate an aircraft, the study does show that a passenger's concern for their safety, in relation to their pilot's level of sociability, stems from certain stigmas and their personal affect. Research conducted on emotional influence over decision-making and rational thinking suggests that affect plays a large role in how a pilot processes, analyzes, and assesses certain situations (Bodenhausen, 1993; Bower, 1991; Clore et al., 1994; Forgas, 1995; Frijda, 1986; Levenson, 1994; Loewenstein, 1996; Oatley and Johnson-Laird, 1996; Schwarz and Clore, 1996; Zajonc, 1998). Additional research suggests that emotions can interfere in decision-making and other cognitive processes that involve a person's memory or judgement (Johnson-Laird and Oatley, 1992; Lazarus, 1991; Schwarz, 1990; Simon, 1967; Tooby and Cosmides, 1990). Recent research discovered that passengers tend to judge pilots based on their emotions during social interactions with pilots rather than the pilot's specific skill set (Winter and Rice, 2015). Different types of people are drawn to different types of personalities, and many establish an opinion based on affect associated with sociability. The strong emotion displayed by this study's subjects is a quality of the affect heuristic. The affect heuristic is one's tendency to make quick decisions driven by emotion where little information is known. Therefore, when passengers only received information about their pilot's sociability, they may have relied upon the affect heuristic when determining trust in their pilot (Alkhakami and Slovic, 1994). From these observations, one could suggest that a person's level of trust in others is influenced, at least initially, by affect (Winter et al. 2014).

In addition to affect, the same study analyzed how stigmas play a role in people's perception of pilots. Stigmas are defined as the prejudices that may be held against another because they are part of or perceived to be part of a specific group (Crocker et al., 1998). The study found that participants stigmatized unsociable airline pilots (Winter and Rice, 2015). As stated earlier, passengers labeled their pilot's unsociable personality as a mental illness, suggesting that social stigmas against mental health disorders may have influenced the study's findings. Results of the study show that people suffer from stigmas and affect bias when determining a sociable or unsociable pilot's reliability in operating an aircraft, which in turn can affect the consumer's willingness to fly (Winter and Rice, 2015).

Recent studies have developed a framework describing how stigmas and affect hinder trust in airline passengers, suggesting that they can lead people to make quick decisions driven by emotion or wrongful judgment (Winter and Rice, 2015). After the Germanwings accident, the purpose for this study emerged as more questions about mental health issues, such as depression, arose in the industry. Depression is a known mental health disorder that could inhibit a pilot's ability to perform tasks safely or make rational decisions. According to the Depression and Bipolar Support Alliance, depression can occur at any point in life but are most common among those in their early 30s, the age in which many pilots are first officers (2015). Depression can cause disruptions in a pilot's behavior and decision-making process (National Institute of

Mental Health, 2015).

1.4. Aviation safety: economic impacts of an accident

Aviation accidents can have an impact not only on consumer perceptions, but also on investor and financial relations. Studies in the financial sector have examined the impacts of aircraft accidents on the stock value of the accident airline, along with other airlines. Mitchell and Maloney (1989) found that when an aircraft accident occurred, the effect on stock price was related to the reason of the accident. When the accident was attributed to pilot error (the airline was at fault), this resulted in negative stock returns, but in those situations where the airline was ruled to not be at fault, there was no stock market reaction. In addition, researchers have also found that the negative stock events were recovered within one day and two days (Chance and Ferris, 1987; Kaplanski and Levy, 2010). These findings indicate that, at least in investor's minds, there was a minimal alteration in the perception of safety toward the aviation industry. Additionally, Chance and Ferris (1987) found other airlines stock values were not impacted by the accident airline suggesting no type of contagion affect across the aviation industry as the result of one accident; however, consumers may view this differently. During one study (Winter et al., 2015), consumers were presented with a hypothetical scenario in which one airline experienced a fatal accident. Consumers were then asked to rate their trust in the accident airline along with other airlines. When compared to a control condition with no accident, consumers that were placed in the accident group rated their trust in all the airlines as lower when compared to those in the non-accident group. Therefore, it is possible that investors and consumers may be impacted differently by aircraft accidents.

2. Current study

A prior study (Rice et al., 2015b) researched consumer willingness to fly depending upon whether the pilot of their hypothetical flight was using various approved medications, including anti-depressants. That study found consumers were least willing to fly when their pilot was taking anti-depressant medications, especially at a high dose. This data was also collected two weeks prior to the Germanwings Flight 9525 accident in which the first officer allegedly committed an act of pilot suicide and crashed the aircraft into the French Alps. This tragic accident created an opportunity to research the affect airline accidents would have on consumer perceptions toward pilots using anti-depressant medications over a period of time. Therefore, the purpose of this study was to complete a longitudinal analysis after the accident, to determine how it would affect consumers' views towards pilots taking anti-depressant medications. The current study tests the following hypotheses:

- H₁: Willingness to fly and affect scores will be differentially affected as a function of the medication type.
- H₂: Specifically, the fluoxetine condition should result in lower scores compared to the other medications.
- H₃: Willingness to fly and affect scores in the fluoxetine condition will take longer to recover after the accident compared to the other medications.

3. Methods

3.1. Participants

A total of 1015 (406 females) participants took part in the study.

The mean age was 34.28 ($SD = 11.44$). Participants were recruited via a convenience sample using Amazon's[®] Mechanical Turk[®] (MTurk). MTurk is an online community of participants who are willing to complete human intelligence tasks in exchange for monetary compensation. Prior research (Berinsky et al., 2012; Buhrmester et al., 2011; Germiné et al., 2012) has shown data collected via MTurk is as reliable as normal laboratory data.

3.2. Materials and stimuli

Participants first signed an electronic consent form and were then given instructions. Participants were presented with one of five hypothetical scenarios, in which they were given information about a pilot who is taking different types of medication (no medication, Prozac (fluoxetine), Claritin (loratadine), Ibuprofen, or Catapres (clonidine)). Prozac, Claritin, Ibuprofen, and Catapres are typically prescribed to treat depression, allergies, pain of various forms, and high blood pressure, respectively. In the study, participants were shown the brand names of the drugs in order to facilitate their recognition. An example of the hypothetical situation for the Ibuprofen condition was, "Imagine a situation where you will be flying on a commercial aircraft from one major city to another. The captain (pilot) in charge of the aircraft has been taking Ibuprofen (arthritis medication) for the past two months. Given this information, please respond to each of the following questions below."

Participants were then asked to rate their level of affect towards the hypothetical situation by responding on a five-point scale from strongly negative/unfavorable/bad (−2) to strongly positive/favorable/good (+2). Following this, participants responded to how willing they were to fly in the hypothetical situation by responding to a Willingness to Fly (WTF) scale developed and validated by Rice et al. (2015a). This scale consisted of seven items, with participants responding on a five-point scale of strongly disagree (−2) to strongly agree (+2).

Lastly, participants provided demographic information, were debriefed, and then dismissed. This same methodology was used for five collection times: 1) One week before the accident; 2) One week after the accident; 3) Three weeks after; 4) Six weeks after; and 5) twelve weeks after.

4. Design

A between-participants design was employed. There were five data collection points in time. During each data collection point, different participants were used, as it was not possible to keep the same participants throughout the study.

5. Results

The data was subjected to a MANOVA, using Time and Type of Medication as between-participants factors, and Affect and Willingness to Fly as the two dependent variables. For Affect, there was a significant main effect of Time, $F(4, 2533) = 3.05, p < 0.05, \text{partial } \eta^2 = 0.005$, and a significant main effect of Type of Medication, $F(4, 2533) = 264.98, p < 0.001, \text{partial } \eta^2 = 0.30$. However these main effects were qualified by a significant interaction between Time and Type of Medication, $F(16, 2533) = 3.44, p < 0.05, \text{partial } \eta^2 = 0.009$. For Willingness to Fly, there was a significant main of Time, $F(4, 2533) = 3.62, p < 0.01, \text{partial } \eta^2 = 0.006$, and a significant main effect of Type of Medication, $F(4, 2533) = 240.04, p < 0.001, \text{partial } \eta^2 = 0.28$. However these main effects were qualified by a significant interaction between Time and Type of Medication, $F(16, 2533) = 3.36, p < 0.05, \text{partial } \eta^2 = 0.009$.

Fig. 1 breaks down each of the data collection times, while

showing the ratings for Affect and Willingness to Fly. This figure reveals that the Willingness to Fly ratings for no medication, loratadine, ibuprofen and clonidine did not change much over the course of the data collection period (all p 's > 0.05). However, it is clear that the Willingness to Fly ratings for fluoxetine dropped dramatically just after the accident, $t(198) = 2.69, p = 0.008$. There was no statistically significant change from Week 1 to Week 3, $t(198) = 0.18, p = 0.86$, nor from Week 3 to Week 6, $t(198) = 1.30, p = 0.20$. From Week 6 to Week 12, the WTF ratings were significantly different, $t(198) = 2.16, p = 0.03$, as they rose back to pre-accident levels. Fig. 2 provides an alternate depiction of the data showing the 5 individual data collection periods along with the standard error bars.

6. General discussion

The purpose of this study was to complete a longitudinal follow-up from a prior study completed by Rice et al. (2015b) which reviewed aviation consumer perceptions on pilots taking various medications. In that study, the data suggests that consumers were least willing to fly when the pilot of their hypothetical flight was taking antidepressant medications, especially a high dosage. This data was collected shortly before the Germanwings accident that took place on 24 March 2015 during a flight from Spain to Germany. The co-pilot had been previously treated for suicidal tendencies, but failed to report said instances, locked the Captain out of the cockpit, and intentionally crashed the aircraft into a mountain. The researchers completed the same study at multiple points in the aftermath of the accident to determine how this event would affect consumer perceptions towards pilots taking antidepressant medications.

The first hypothesis predicted that willingness to fly and affect scores would be differentially affected by medication type. As with the original study, the data supported this hypothesis. Consumers were least willing to fly when their pilot was taking fluoxetine than any of the other medications at all points in time. Prior research has shown that people tend to stigmatize those with mental illness and may offer a possible explanation to these findings (Berscheid and Walster, 1974; Farina, 1982; Harris et al., 1982; Newman, 1976).

The second hypothesis predicted that fluoxetine would produce the lowest willingness to fly rating compared to the other medications and the findings of the study support this hypothesis. As with the original study, at all points of data collection, fluoxetine resulted in the lowest willingness to fly. It may be possible that people have a negative view towards either the medication or those taking it, which results in these lower scores (Crocker et al., 1998). Another possible explanation, perhaps due to stigmas associated with mental illness, could be that people believe depression is something the affected person can control, whereas the other medications may be for illnesses outside of the person's control. Regardless of the reasoning, from the multiple data collection intervals, it is clear that fluoxetine produces the lowest willingness to fly ratings.

The last hypothesis predicted that the willingness to fly scores would take more time to recover after the accident than the other medications. The findings of this study support this hypothesis. Within one week after the accident, the fluoxetine condition had a significant drop in willingness to fly scores as depicted in Fig. 1. Over time, this drop in scores gradually reduced before returning to its pre-accident levels around the 12-week point in time. The drop in willingness to fly for this medication is not surprising given the high profile nature of this accident and extensive media coverage. Affect may have strongly influenced participants in their responses (Alkhakami and Slovic, 1994). What is perhaps interesting is that this result seems to return to pre-accident levels about three

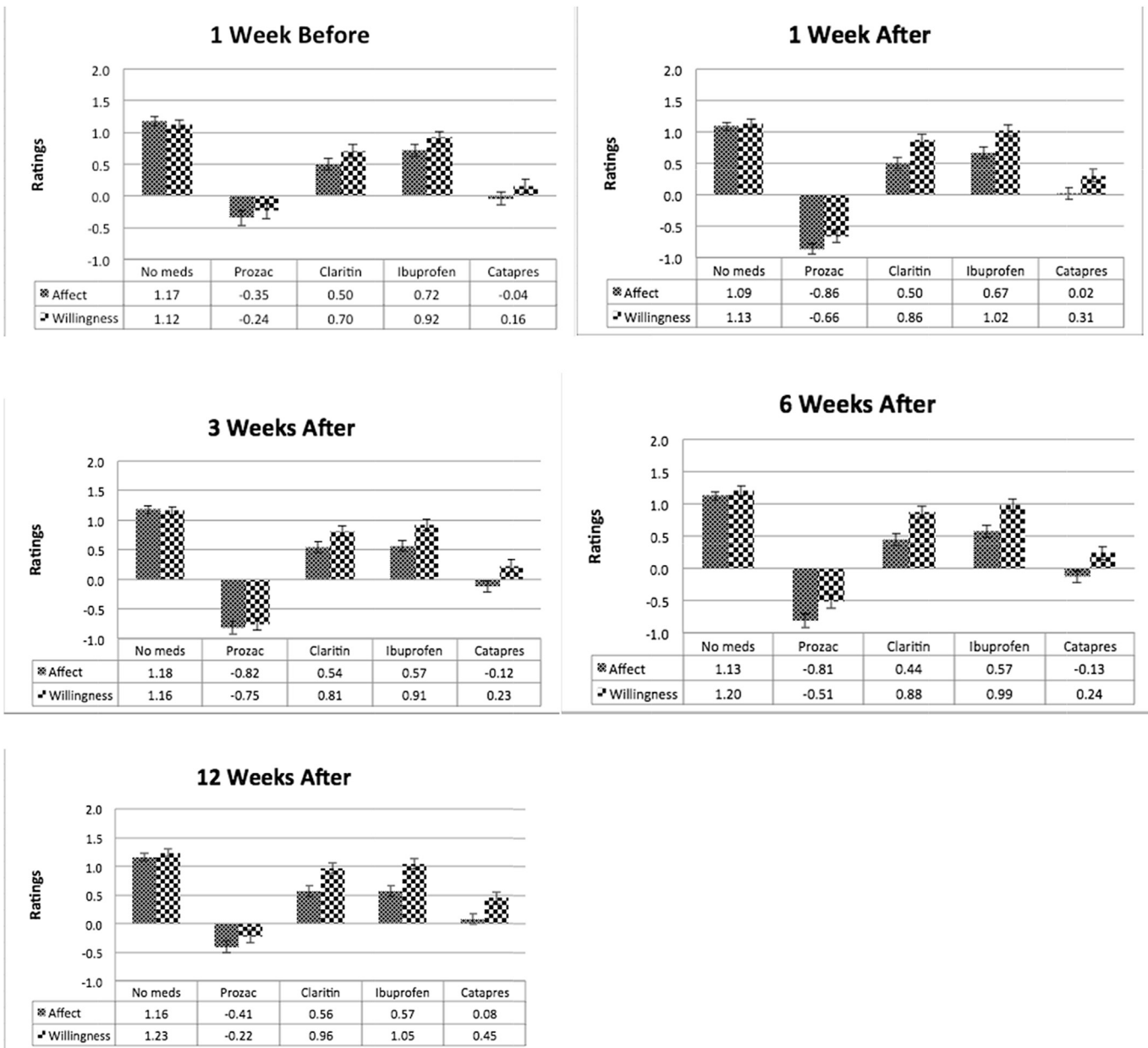


Fig. 1. Willingness to Fly ratings over the five data collection periods.

months after the accident.

7. Practical implications

There are a few practical implications from this study. As mentioned in the literature review, there were extensive industry concerns about the under reporting and/or self-medicating that could occur if pilots feared losing their careers due to a depression related diagnosis (Bor and Hubbard, 2006; Thurber, 2010). However, it also appears that consumers are least willing to fly when their pilot is taking an SSRI, or at least the one used in this study. To account for this gap, it may be important for governing agencies, such as the Federal Aviation Administration, to focus efforts on informing the flying public as to the advantages of this program. Additionally, the FAA should ensure consumers that safeguards are in place to help pilots address their mental health needs, and also to protect the safety of their passengers. Furthermore, the

longitudinal nature of the study shows a timeline of public perception after an accident. There is a negative reaction associated with the immediate shock after an accident, and then eventually, a dissipation as public perception returns to pre-accident levels. The length of time it takes for the negative effect to wear off is of interest and practical use to all involved parties within the aviation industry to understand consumer mindsets.

There may be criticism of allowing pilots with depression to maintain flight status, even with prescribed medication. Pilot suicides are extreme and tragic examples of this issue. However, it is important that the aviation community discriminate between criticizing pilots using anti-depressants and the procedure that is in place while pilots take anti-depressants. Without the ability for aviation medical examiners to prescribe antidepressants, the aviation industry would return to the pre-2010 era in the United States where there would be concern over the under-reporting or possible hiding of mental health conditions that could lead to

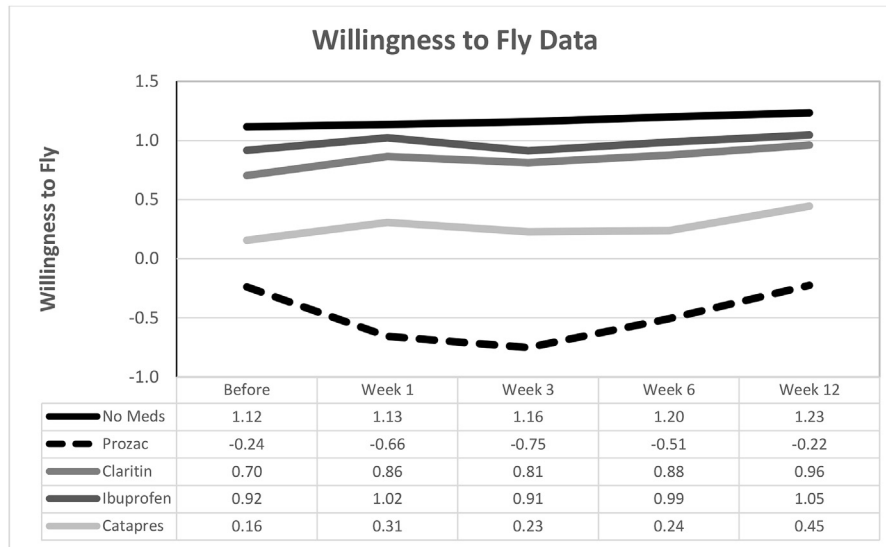


Fig. 2. Affect and Willingness to Fly ratings over the five data collection periods. SE bars are included.

future cases of pilot suicide. Perhaps instead, a review should be completed of the procedure in which the use of antidepressants is implemented. For example, are required check-ups and monitoring of the patient on the medication being completed? Can the pilot's physician communicate directly with the airline in the event of a significant change in the mental health of the patient? These questions may help enhance the procedure of how antidepressant medications are administered to pilots without restricting or encouraging a culture that shuns these types of conditions.

8. Limitations

As with all behavioral research, this study has certain limitations. First, the participants were presented with hypothetical scenarios read on a computer screen. People may respond differently to a hypothetical scenario than they would to a real-life scenario. For obvious ethical reasons, it is impossible to test the hypotheses in a real-world situation. Second, the results of the study cannot be generalized beyond those types of persons that complete online human intelligence tasks or those outside of the MTurk community. While this data has been shown to be as valid and reliable as normal laboratory data (Berinsky et al., 2012; Buhrmester et al., 2011; Germine et al., 2012), it may not represent the overall American population. Similarly, American data considered as WEIRD (Western, Educated, Industrialized, Rich, and Democratic) doesn't provide representation for the rest of the world (Henrich et al., 2010a, 2010b). Finally, there was not a requirement that participants be active flyers or have flown on commercial airlines to complete the study. Based on these limitations, further research should be completed to verify the accuracy of these findings.

9. Conclusions

This study completed a longitudinal study of consumers' perceptions the various medications used by their pilot. The data was collected in the week prior to and after a major airline accident that was allegedly related to pilot suicide. The findings of the study suggest that fluoxetine, an antidepressant medication, produced the condition in which participants were least willing to fly. Also, there was a significant drop in those willingness to fly scores in the

aftermath of the accident. The data shows that about 12 weeks after the accident, consumers' willingness to fly scores returned to their pre-accident levels.

Author note

The authors of this paper would like to extend their sympathies and condolences to all impacted by the tragic events of the Germanwings Flight 9525.

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