

# Research Article

## WAYS OF ACQUIRING FLYING PHOBIA

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**Background:** *The few studies that have explored how flying phobia is acquired have produced contradictory results. We hypothesized that classical conditioning plays a role in acquiring flying phobia and investigated if vicarious (model) learning, informational learning through media, and experiencing stressful life events at the time of onset of phobia also play a role.* **Method:** *Thirty patients with flying phobia and thirty healthy controls matched on age, sex, and education were interviewed with the Mini-DIPS, the short German version of the Anxiety Disorders Interview Schedule (DSM-IV diagnostic criteria) and the Fear-of-Flying History Interview.* **Results:** *Fifty Percent of patients with flying phobia and 53% of healthy controls reported frightening events in the air. There was no significant difference between the two samples. Thus there were not more classical conditioning events for patients with flying phobia. There also was no significant difference between the two samples for vicarious (model) learning: 37% of flying phobia patients and 23% of healthy controls felt influenced by model learning. The influence of informational learning through media was significantly higher for the clinical sample (70%) than for the control group (37%). Patients with flying phobia experienced significantly more stressful life events in the period of their frightening flight experience (60%) than healthy controls (19%).* **Conclusions:** *Frightening experiences while flying are quite common, but not everybody develops a flying phobia. Stressful life events and other factors might enhance conditionability. Informational learning through negative media reports probably reinforces the development of flying phobia. Clinical implications are discussed. Depression and Anxiety 33:136–142, 2016.* © 2015 Wiley Periodicals, Inc.

**Key words:** *phobic disorders; anxiety disorders; life events/stress; panic attacks; cognitive behavior therapy*

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## INTRODUCTION

Fear of flying is a common phobia, affecting the general population with a lifetime prevalence rate of 13.2%.<sup>[1]</sup> So far, most of the research on flying phobia has focused on its treatment. Although most psychotherapeutic treatments are based on conditioning theories, research into conditioning as the pathway to acquiring flying phobia is scarce. The present article therefore focuses on how flying phobia is acquired.

Traditionally, an anxiety disorder or phobia has been considered a learned fear response to a stimulus after a

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frightening experience with that stimulus, and classical conditioning has been the most popular theory to explain this learned fear response.<sup>[2,3]</sup> According to this theory, fear of flying is conditioned through the association of an aversive, possibly threatening event (unconditioned stimulus, or UCS), such as heavy turbulence, that inherently produces fear (unconditioned response, or UCR) with a formerly neutral stimulus (conditioned stimulus, or CS), such as flying. The CS becomes a signal of danger (UCS) and thus produces fear (false alarm). Rachman<sup>[4]</sup> suggested that besides classical conditioning, there are two additional acquisition processes (the three-pathway account) for anxiety disorders: vicarious and informational learning. For example, a person might develop flying phobia after sitting next to someone who has a serious fear reaction in the plane (vicarious learning) or might become fearful about flying as a result of watching too many television broadcasts about plane crashes (informational learning).

Three studies<sup>[5-7]</sup> examined conditioning processes in patients with flying phobia. First, in a sample of 17 agoraphobic and 17 simple phobic patients with fear of flying<sup>[5]</sup> the simple phobic patients reported a threatening event during a flight (41%) or vicarious acquisition (12%) as an etiological factor, whereas the agoraphobic group cited no such conditioning process. For 71% of the simple phobic patients, verbal or media information (e.g., about crashes) played an important role in the etiology of their fear of flying. These results show the importance of learning events in the acquisition of flying phobia, though there was no healthy control group in this study, which makes conclusions about the causality of learning events difficult. Second, in a study comparing patients with severe fear of flying with healthy controls,<sup>[6]</sup> 62% of the patients had been involved in a conditioning event such as an airplane emergency (27%), severe air turbulence (27%), or even an airplane accident (8%), whereas only 24% of the control sample reported a traumatic event. These results indicate that classical conditioning might indeed play an important role in flying phobia. The role of other learning processes<sup>[4]</sup> was also investigated.<sup>[6]</sup> Vicarious learning was defined as “someone in family or well-known afraid of flying” (p. 251). The percentage of vicarious learning according to this definition was 51% for the patients with flying phobia and 48% for the control sample. Informational learning, defined as “seen on TV, heard, or read about airplane accident” (p. 251) was found for 76% of the phobic patients and 57% of the control sample. In the third study,<sup>[7]</sup> researchers investigated a Dutch sample of 2001 fearful flyers who applied for a flying treatment program. Only 5.7% had experienced an eventful or traumatic flight. The great majority of 85.6% had flown before and reported that their flights had been uneventful, and 8.7% had had no previous experience with flying. These results are very divergent from those reported above<sup>[5,6]</sup> and the researchers assumed that their sample was more representative than that of one of the earlier studies.<sup>[6]</sup> They suggested that

traumatic conditioning by external aversive events is less prevalent in the acquisition of fear of flying than previously assumed.

The contradictory results do not allow an accurate estimation of classical conditioning in flying phobia. One of the reasons for the divergent results may be that different studies used different definitions of aversive experiences. In one study,<sup>[7]</sup> an uneventful flight was defined as a flight without severe turbulence or thunderstorm. But for some passengers a flight with mild turbulence might also be frightening if they do not know that turbulence is not dangerous. It is also not possible to rule out methodological differences, as how the conditioning events were assessed was not described in detail in all three studies.

In sum, many roads lead to Rome, as different conditioning and learning processes may all contribute to the development of flying phobia. Furthermore, the context in which this learning takes place may be very important. For example, stressful life events play an important role at the beginning of panic attacks.<sup>[8]</sup> The experience of stress due to negative life events may lead directly to a false alarm that becomes closely associated with the specific situation of flying.

In the present study, we explored the different pathways to flying phobia. In contrast to other studies, we investigated both a clinical and control sample. We investigated not only the three pathways of learning but also the influence of stressful life events. We expected that classical conditioning would play a role in the acquisition of flying phobia but that other learning processes would be just as important. If classical conditioning is not the only way of acquiring flying phobia, this will have important implications for the treatment of flying phobia. Regarding stress, we hypothesized that stressful life events enhance the individual vulnerability to developing a flying phobia.<sup>[9]</sup>

## MATERIALS AND METHODS

The study was approved by the Ethics Committee of the German Society for Psychology on October 15, 2005. Before diagnostic assessment, informed consent was obtained.

### PARTICIPANTS

The present sample consisted of 30 patients with flying phobia according to the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; *DSM-IV*)<sup>[10]</sup> criteria of specific phobia and 30 healthy controls. The clinical sample was recruited from 33 patients who were interested in a fear-of-flying weekend seminar (a cognitive behavioral treatment including technical information about flying and a flight in Europe at the end of the seminar). Three patients with a comorbid diagnosis of panic with agoraphobia were excluded from the clinical sample because these patients were focused mainly on internal fears (e.g., fear of heart attack), which differ in their content from fears associated with specific flying phobia, which are mainly external. Table 1 presents current primary and secondary diagnoses and past diagnoses. Ten patients with flying phobia had a secondary diagnosis of another anxiety disorder. Seven (23%) patients had the following other specific phobia: fear of

**TABLE 1. Sociodemographics, DSM-IV diagnoses, and clinical characteristics of the study sample**

Characteristic	Flying phobia patients ( <i>N</i> = 30)	Healthy controls ( <i>N</i> = 30)
Mean age (SD)	37 years (9.7)	37 years (10.6)
Sex (% female)	60%	60%
Education		
High school diploma	47%	47%
Undergraduate degree	33%	33%
Graduate degree	20%	20%
Current diagnosis (DSM-IV)		
Primary diagnosis		
Specific phobia (flying)	100%	0%
Secondary diagnosis		
Other specific phobia	23%	0%
Social phobia	3%	0%
Generalized anxiety disorder	6%	0%
Past diagnoses		
Major depression	17%	6%
Panic disorder with agoraphobia	6%	0%
Posttraumatic stress disorder	6%	0%
Eating disorder	6%	3%
Pain disorder	3%	0%
Level of fear of flying (0–100), mean (SD)	77.4 (14.4)	10.8 (11.1)
Duration of fear of flying in years, mean (SD)	12.3 (7.8)	
Mean trait anxiety (SD) <sup>a</sup>	40.2 (9.4)	32.2 (7.1)

DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, 4th ed.; SD, standard deviation.

<sup>a</sup>State-Trait Anxiety Index.<sup>[17]</sup>

heights (*N* = 5, 17%), fear of water (*N* = 1, 3%), and fear of vomiting (*N* = 1, 3%).

The control sample was recruited through announcements at the University of Basel and was pairwise matched regarding age, sex, and education with the clinical sample. Healthy participants had no lifetime anxiety disorder or actual psychiatric disorder and were not airline employees. The sociodemographic, diagnostic, and clinical characteristics of the study sample are given in Table 1.

All participants of the clinical and the control samples had flown before. As a reward, participants of the clinical sample received free counseling about their fear of flying before deciding to take part in the seminar. Participants of the control sample received giveaways from a Swiss airline, such as T-shirts and key fobs, for participation. The participants were also experimentally investigated (reported elsewhere<sup>[11]</sup>).

## MEASURES

**DSM-IV Diagnosis.** For the *DSM-IV* diagnosis, all participants were interviewed with the Mini-DIPS,<sup>[12]</sup> a short version of the DIPS,<sup>[13]</sup> the German version and extension of the Anxiety Disorders Interview Schedule,<sup>[14]</sup> which covers the following disorders: anxiety, affective, somatization, obsessive-compulsive, eating, and addiction. The interrater reliability of the Mini-DIPS is 92% for anxiety disorders and 97% for specific phobias.<sup>[12]</sup>

**Fear-of-Flying History Interview.** All participants were interviewed with the Fear-of-Flying History Interview constructed by the authors. This interview is based on the Phobic Origins Questionnaire.<sup>[15]</sup> For the control sample, the Fear-of-Flying History Interview was slightly changed to adapt it to their situation. Flying phobia patients were first asked for how many years they had been afraid of flying (Table 1). Then all participants had to rate their fear of flying (question 2) on a scale of 0 to 100 (Table 1). In question 3, the clinical sample was asked how their fear of flying had changed since onset of fear of flying. The answer categories were (1) remained the same, (2) has increased, (3) has decreased, and (4) up and down. In question 4 patients were asked if there had been a triggering frightening event in a plane at the beginning of their fear of flying. The control sample was asked if they had ever had a negative experience in a plane that frightened them. The answers were categorized into “yes” or “no.” Controls were categorized in the yes category only if they could clearly remember and describe a negative flight experience and if they had really experienced fear during their negative flight experience. All participants then described their negative flight experiences in detail. In question 6, patients and controls were asked whether they had experienced any relevant stressful life events at the time of their frightening flight experience. The answers to question 6 were categorized into “yes” or “no.” If participants answered with yes, they were given the following list of possible stressful life events: stress at work, examinations, relationship problems, death of a relative, other. They were then asked to explain their life events in detail. Only if they could remember exactly the time in life and the particulars of a life event that caused strain and distress were they definitively coded in the yes category. In the following questions, all participants were asked whether a family member or another important person suffered from fear of flying in the past or currently. The answers were coded “yes” or “no” for intrafamilial model learning if their father or mother had been afraid of flying during the participants’ childhood. Patients with flying phobia were also asked, if watching somebody in their family going through a strong fear reaction during flying worked as a triggering event for their flying phobia. For example, a patient remembered flying with her mother at the age of 9 years to London. She witnessed her mother being very anxious, so this flight was the beginning of her fear of flying. In the next question, the clinical sample was asked if media information influenced their attitude toward flying. If the patients with flying phobia answered “yes,” they were also asked if some particular media information worked as a triggering event for their fear of flying or if they were influenced more in general by media information. For example, a patient remembered that the crash of Swissair Flight 111 in Halifax, Nova Scotia, had greatly increased his fear of flying. The 1998 crash was a shock for many Swiss people and was documented in the media in great detail.

**General Anxiety Level.** Participants also completed the trait scale of the State-Trait Anxiety Inventory.<sup>[16]</sup>

## DATA ANALYSES

Two independent raters classified all ratings. Interrater agreement was 100% for the control group and 97% for the clinical sample. The single disputed case was reviewed and discussed with a third rater.

According to their answers in the Fear-of-Flying History Interview, participants were classified into categories: classical conditioning, intrafamilial model learning, and informational learning. Negative events in the plane were subdivided into “frightening flight experience” (e.g., turbulence) and “panic attack in the plane.” Panic attacks in the plane can also be categorized as conditioning events, because panic attacks per se can be traumatic and associated strongly with the situation of flying.<sup>[6]</sup> Patients were categorized into intrafamilial model learning, if model learning was a triggering event and also if it was

**TABLE 2. Categories of fear acquisition for patients with flying phobia and controls**

Category	Flying phobia patients (N = 30; %)	Healthy controls (N = 30; %)	OR	95% CI
Direct conditioning	50	53	0.875	0.318–2.41
Frightening flight experiences <sup>a</sup>	30	50	<b>0.100</b>	<b>0.010–0.971</b>
Panic attack in the plane <sup>a</sup>	20	3	<b>9.995</b>	<b>1.030–96.953</b>
Intrafamilial model learning	37	23	1.902	0.617–5.863
Informational learning	70	37	<b>4.03</b>	<b>1.372–11.839</b>

Note: Odds ratios that are significant ( $P < .05$ ) are denoted by bold typeface odds ratios and confidence intervals.

OR, odds ratio; CI, confidence interval.

<sup>a</sup>Controlled for direct conditioning.

not defined as a triggering event. Likewise for informational learning, patients were classified in this category if seeing information about crashes or other negative events triggered their phobia and also if it was not a triggering event. Participants could be classified in more than one group, because different learning processes might play a role in the acquisition of the flying phobia in the same person. For instance, somebody could have a fearful triggering event such as turbulence at the beginning of his flying phobia and also feel influenced by media information about crashes. Patients and controls were also compared regarding stressful life events. Participants were included in the analysis only if they had experienced frightening flight experiences and remembered clearly their stressful life events at this point in time. For example, a patient remembered a flight 5 years before the study with turbulence, a thunderstorm and lightning. This was the beginning of her flying phobia. One month before this flight, she failed a very important examination and felt sad and disappointed.

Statistical group comparisons were made by logistic regression (odds ratio, OR).

## RESULTS

### CONDITIONING PROCESSES

Table 2 shows the self-reported events that fit into categories of conditioned fear acquisition: 50% of the patients with flying phobia reported a frightening flight experience as a trigger at the beginning of their flying phobia. Fifty-three percent of the control group also reported a frightening flight experience (OR = 0.875, not significant). The different frightening flight experiences are listed in Table 3. We also discussed the remembered events in the plane with an experienced pilot. None of the listed experiences seemed to be life threatening or dangerous. Patients with flying phobia reported significantly more panic attacks in the plane than controls (OR = 9.995,  $P < .05$ ). For intrafamilial model learning we did not find a significant difference between patients with flying phobia (37%) and healthy controls (23%; OR = 1.902,  $P > .05$ ). Only two patients (6%) mentioned intrafamilial model learning as a

**TABLE 3. Frightening flight experiences rated as classical conditioning events**

Kind of event during a flight	Flying phobia patients (N = 30; %)	Healthy controls (N = 30; %)
Technical problems at take off	3	7
Go-around	0	7
Thunderstorm and lightning	3	3
Engine failure	3	3
Unexpected landing	7	0
Turbulence	13	30
Unexpected panic attack	20	3

Note: Participants could be classified in only one category.

**TABLE 4. Stressful life events at the time of frightening flight experiences**

Kind of stressful life event	Flying phobia patients (N = 15; %) <sup>a</sup>	Healthy controls (N = 16; %) <sup>a</sup>
Stress at work	27	6
Examinations	13	0
Relationship problems	7	6
Death of a relative	7	0
Other	7	6

Note: Participants could be classified in only one category.

<sup>a</sup>The number of patients and controls is now smaller because only participants who went through a frightening flight experience were asked about stressful life events.

triggering event at the beginning of their flying phobia. Regarding informational learning a significantly higher percentage of patients with flying phobia (70%) compared to controls (37%) felt influenced by media information about crashes and other flight accidents (OR = 4.03,  $P < .05$ ). Only three patients (9%) remembered informational learning as triggering their flying phobia at the beginning. The majority mentioned the influence of media information about crashes and other flight accidents after the beginning of their phobia

### STRESSFUL LIFE EVENTS IN THE HISTORY OF FLYING PHOBIA

Table 4 shows all categories of stressful life events at the time of the frightening flight experiences. The total number of participants is now smaller because only those with a frightening flight experience were included. Although the numbers of the clinical and the control sample are quite small, there is a significant difference: 60% of the patients with flying phobia experienced stressful life events at the time of their frightening flight experience, while only 19% of controls did (OR = 6.5, CI = 1.279–33.034,  $P < .05$ ).

### COURSE SINCE ONSET OF PHOBIA

The clinical sample was asked how their fear of flying had changed since onset. The results were 13% “remained the same,” 67% “has increased,” 7% “has decreased,” and 13% “up and down.”

### COMORBID PAST DIAGNOSIS AND STRESSFUL LIFE EVENTS IN THE PAST

As shown in Table 1, a total of 38% of the flying phobia sample has reported some form of comorbid past diagnosis. There was no significant correlation between the past diagnosis and the stressful life events in the past (OR = 3.81, CI = 0.707–20.533,  $P > .05$ ).

## DISCUSSION

Our results show that half of the patients with flying phobia remembered some kind of traumatic event at the beginning of their flying phobia that triggered their phobia and half of the healthy controls also remembered a frightening event in the air. Patients experienced significantly more panic attacks in a plane than controls. For intrafamilial model learning, we did not find a significant difference between patients with flying phobia and controls. Unlike vicarious learning, where the influence remains unclear, informational learning seems to have a measurable impact on flying phobia. In our study, 70% of the patients with flying phobia felt influenced by media information about accidents and crashes. But the majority mentioned the influence of media information after the beginning of their phobia, not as a triggering learning process at the beginning. Our results also support the hypothesis that the experience of stress due to negative life events may have an influence in the acquisition of flying phobia.

Our percentage of patients with flying phobia who experienced some kind of traumatic event at the beginning of their flying phobia (50%) is comparable to that found by McNally and Louro<sup>[5]</sup> (41%) and Wilhelm and Roth<sup>[6]</sup> (62%) but much higher than that found by Nousi et al.<sup>[7]</sup> (5.7%). We assume that Nousi et al.’s definition of “traumatic flight” was different from our definition. The most interesting result in our study is that the same number of individuals in the perfectly matched healthy control group experienced a frightening flight experience similar to that reported by the patients with flying phobia. Frightening experiences in a plane such as turbulence or go-around seem to be quite common and many people seem to have fearful moments sometimes in a plane. For human beings it is not natural to move in the air, enclosed in a tight room, with no control over the situation. In addition, taking a flight can produce a number of unknown bodily sensations associated with the flying environment, for example, in response to acceleration, pressure changes, and turbulence. Preparedness<sup>[17]</sup> is likely high for flying phobia. However, our results show that many people manage to forget these fearful experiences without developing a fear of flying. Why do

only some people develop a flying phobia after a frightening flight experience?

The present results suggest that classical conditioning may play a role at the beginning of flying phobia, but this cannot explain it sufficiently. Different influences may play a role at the beginning of flying phobia and enhance an individual’s vulnerability. People suffering from stress due to negative life events may have a higher baseline fear, which can enhance fear conditionability for specific phobia. Researchers<sup>[18]</sup> showed in an experimental study that state anxiety influences the conditionability of fear. In our study, we showed that a majority of flying phobia patients suffered from stress due to negative life events at the moment of their frightening flight experience, while for controls this was not the case. However, these results have to be interpreted carefully for the following reasons.

First, all our data are retrospective and rely on the memory and interpretation of each individual. Phobia onset was on average 12 years ago, so some memories of the conditioning processes may be distorted. Memory bias may have led participants to construe a direct relationship between a conditioning event, some stressful life events, and the beginning of flying phobia when there actually was none (illusory correlation). It may be possible that patients with flying phobia generally have an enhanced stress level in life, not only at the time of their frightening flight experience. In addition, healthy controls may have a memory bias: Although half of them remembered a frightening flight experience clearly, they may have had only an unclear memory about the circumstances of their life at this time, because they were never searching for a reason for the beginning of a phobia. Second, there also may have been comorbid disorders in the past that could have influenced patients’ vulnerability at the beginning of the flying phobia. Thirty-eight percent of the patients had a comorbid disorder in the past, mostly depression (17%), but also anxiety disorders (12%) and others (Table 1). As mentioned above, we did not find a correlation between stressful life events and comorbid diagnosis in the past. These two influences seem to be independent of each other. In addition, other factors may render an individual more vulnerable to developing a flying phobia, such as a genetic predisposition to anxiety, personal traits (e.g., anxiety sensitivity,<sup>[19,20]</sup> the tendency to interpret anxiety-related bodily sensations in a threatening way), or subclinical physiological dysfunctions. A critical evaluation of all the factors is given elsewhere.<sup>[21]</sup>

After a flying phobia has been acquired, a majority (67%) of fearful flyers in our sample experienced an increase of their fear of flying over the years. This may be related to the influence of informational learning. In our study, 70% of the flying phobia patients felt influenced by media information about accidents and crashes. This is in agreement with other studies that found between 71<sup>[5]</sup> and 76%<sup>[6]</sup> of flying phobia patients felt influenced by having seen on television, heard, or read about airplane accidents. Media information probably reinforces flying phobia in a kind of vicious circle: Individuals who

suffer from fear of flying may feel a need to get as much information about flying as possible. The only information they usually get in newspapers and on television and the Internet is about crashes. They look at the pictures of crashed planes, which are very terrifying. However, media information gives a very distorted view of the world of flying. Today flying is very safe. In the year 2013, there was only one major accident for every 2.4 million flights.<sup>[22]</sup> Nevertheless, media information reinforces the fear of flying and catastrophic thoughts such as “it could happen to me” or “how would I feel in this situation.” Thus, a majority of flying phobia patients seems to be captured in this vicious circle of distorted information about flying and catastrophic thinking.

To sum up, classical conditioning can still be seen as one way of acquiring flying phobia for about half of flying phobia patients. However, fearful moments in a plane are common, so classical conditioning takes place only if an individual is especially vulnerable to acquiring a phobic disorder at this point in his or her life, perhaps related to increased life stress at this time. After fear of flying has emerged, informational learning probably reinforces the flying phobia.

Our results must be interpreted in light of the following limitations: First, our data are retrospective, possibly influenced by the accuracy of memory. Retrospective evidence for conditioning models is often equivocal. Longitudinal studies would carry more conviction but are difficult to collect. Second, the time frame for the comparison of the two samples relating to frightening flight experiences was different: Controls could not be asked about the time frame at the beginning of their phobia. Though if controls remembered a frightening flight experience, they usually remembered it clearly. However it is also possible, that they experienced more than one situation that was frightening and that not all experiences were remembered. Third the results of our question about intrafamilial model learning have certain limitations, because having a family member who is afraid of flying does not necessarily mean this is model learning. This could also be a genetic predisposition to anxiety. Future studies, for example studies with adoptive parents, should examine this hypothesis. Fourth, there might be a selection bias in our sample, as we investigated a clinical sample of people who had enrolled in a fear-of-flying seminar and were highly motivated to overcome their fear. There are probably a number of unrecorded cases of people who avoid flying completely and are not motivated to change anything. Results for these people with flying phobia could be different.

Despite these limitations, our results have the following clinical implications. Our findings on informational learning indicate that reevaluating flying as a very safe mode of transportation might help. Information about flying given by experts may help promote a realistic idea about flying that contradicts media information. Van Gerwen et al.<sup>[23]</sup> reviewed international fear-of-flying programs for passengers that in most cases included not only psychological cognitive behavior therapy but also

a wide range of information about flying disseminated through airline crews.

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**Conflict of interest.** The authors report no conflicts of interest

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