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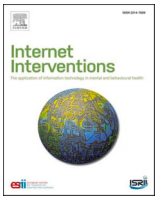

# An internet-based treatment for flying phobia using 360° images: A feasibility pilot study

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ABSTRACT

*Background:* More research is needed in the field of Internet-delivered Cognitive Behavioral Treatments (ICBTs) for specific phobia in order to understand which characteristics are important in online exposure scenarios. The aim of the present work was to conduct a feasibility pilot study to explore participants' opinions, preferences, and acceptability ratings of two types of images (still images vs 360° navigable images) in an ICBT for Flying Phobia (FP). A secondary aim was to test the potential effectiveness of the two active treatment arms compared to a waiting list control group. An exploratory aim was to compare the role of navigable images vs. still images in the level of sense of presence and reality judgment and explore their possible mediation in treatment effectiveness.
*Methods:* Participants were randomly allocated to three conditions: NO-FEAR Airlines with still images ($n = 26$), NO-FEAR Airlines with still and navigable images (n = 26), and a waiting list group (n = 26). Primary outcome measures were participants' opinions, preferences, satisfaction, and acceptance regarding the images used in the exposure scenarios. Secondary outcome measures included FP symptomatology outcomes and measures of sense of presence and reality judgment.
*Results:* Participants in the study preferred navigable images over still images before and after treatment (over 84%), and they considered them more effective and logical for the treatment of their problem. However, adherence in the experimental conditions was low (42.3% dropout rate), and more participants withdrew from the group that included navigable images compared to the group that only included still images (14 vs. 8), with no statistical differences in attrition between the two conditions. NO-FEAR Airlines proved to be effective in reducing FP symptomatology compared to the control group, with large between-group effect sizes on all FP measures (ranging from 0.76 to 2.79). No significant mediation effect was found for sense of presence or reality judgment in treatment effectiveness.
*Discussion:* The results of the current study suggest that participants prefer more immersive images in exposure scenarios, providing data that can help to design useful exposure scenarios to treat specific phobias in the future. They also provide evidence supporting the effectiveness of an ICBT for FP.
*Trial registration:* Registered at Clinicaltrials.gov (NCT03900559) on April 9, 2019. Retrospectively registered.

## 1. Introduction

Flying phobia (FP) is a situational specific phobia (SP) classified as an anxiety disorder in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013). It can cause serious interference in people's lives and have an impact on important life events, personal relationships, professional opportunities, and leisure time (Foreman et al., 2006; Medialdea and Tejada, 2005). Fear related to flying is present in up to 13% of adults in the general population according to epidemiological data (Eaton et al., 2018), but only

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about 1.3% meet the diagnostic criteria for FP (Wardenaar et al., 2017). People suffering from FP use different safety behaviors when a flight cannot be avoided (Oakes and Bor, 2010), including the use of alcohol or anxiolytics (Wilhelm and Roth, 1997), which contributes to the maintenance of the problem (Clark and Rock, 2016).

In vivo exposure is the treatment of choice for SP, and it has been established as the most effective intervention for this disorder (Choy et al., 2007; Wolitzky-Taylor et al., 2008). However, access to the phobic stimulus can be difficult and expensive, as in the case of FP. Virtual reality exposure therapy (VRET) has become a popular alternative for in vivo exposure, and its effectiveness for the treatment of FP has been demonstrated (Botella et al., 2004; Cárdenas et al., 2016; Czerniak et al., 2016; da Costa et al., 2008; Riva et al., 2001; Rothbaum et al., 2006). There is a need to develop interventions that are not based on the dominant face-to-face individual model (Kazdin, 2015).

Internet-delivered cognitive behavioral treatments (ICBTs) have great potential for facilitating access to psychological treatments (Andersson et al., 2019). They also have other advantages, such as cost-effectiveness, enhanced learning and retention for patients, and faster therapist support (Andersson and Titov, 2014). The effectiveness of ICBTs has been shown for a wide range of disorders, including anxiety disorders (Andersson, 2016; Andrews et al., 2018), but research on the treatment of SP is still scarce in this field. Two randomized controlled trials (RCT) for the treatment of animal phobias can be found in the literature (Andersson et al., 2009, 2013), in which an ICBT was compared to an active treatment control group condition. Other non-randomized studies have been conducted, including a study for children with several SP (Vigerland et al., 2016), a study for children and adolescents with dental anxiety (Shahnavaz et al., 2018), a series of case studies for small animal phobia (Botella et al., 2008), and two studies with arachnophobic participants (Matthews et al., 2011, 2012). A more detailed description of these studies and a synthesis of the findings on ICBT for SP to date can be found in a recent systematic review (Mor et al., 2021b).

To the best of our knowledge, only one ICBT has targeted FP. NO-FEAR Airlines is a self-help Internet intervention developed by our research group that includes different images related to flying so that the patient can carry out exposure tasks online. This program demonstrated its effectiveness in a recent RCT (Campos et al., 2019), where two experimental conditions (a group with therapist guidance and a completely self-administered condition) were compared to a waiting list control group. Both experimental groups showed reductions in FP symptomatology, with no differences found between them. However, only still photographs were used in the exposure scenarios, and although the program was well accepted, patients rated the usefulness of the images lower than other components and indicated that they would prefer other types of images, such as 360° photographs or short videos with movement (Campos et al., 2018).

Immersive technology can help to increase the sense of presence, defined as the sense of being in a virtual environment (Steuer, 1992), as well as the emotional response experienced in a virtual scenario (Ling et al., 2014). Immersion is not the only factor that influences the sense of presence. The studies carried out in this field with VRET showed that, when a scenario engaged with the emotions, the sense of presence increased, and at the same time, presence was a significant predictor of emotional responses (Gromer et al., 2019; Riva et al., 2007). It has been suggested that, although high levels of immersion might not be necessary with clinical participants (Kwon et al., 2013), some immersive factors, such as a wider field of view, have an impact on presence (Cummings and Bailenson, 2016). Thus, 360° panoramas could have potential because they can evoke similar cognitive and emotional responses to the ones experienced in a real physical environment, and they are more realistic than still images (Minns et al., 2018; Higuera-Trujillo et al., 2017). Another factor that might be important to consider in virtual environments is reality judgment, defined as the extent to which an experience is acknowledged as real in terms of willingness to interpret the virtual experience as veridical (Baños et al., 2000). However, this construct has been poorly studied to date.

Research on the sense of presence and reality judgments has been conducted in VRET (Gromer et al., 2019; Cummings and Bailenson, 2016, Price and Anderson, 2007; Baños et al., 2000), but no studies have been found in the literature on these topics in ICBTs. As previously mentioned, NO-FEAR Airlines only included still images in the exposure scenarios in the previous study (Campos et al., 2016, 2019). The aim of the present work is to report the results of a feasibility pilot study conducted to explore participants' opinions, preferences, and acceptance of two types of images in the exposure scenarios of the program (still images vs 360° navigable images). As a secondary aim, the results on the potential effectiveness of the two active treatment arms compared to a waiting list control group will be reported. Finally, the results of an exploratory study comparing navigable images and still images on their level of sense of presence and reality judgment and whether these variables mediate treatment efficacy will also be described. The hypothesis for the main aim of the current study is that both treatment conditions will be well accepted by the participants, but participants will prefer 360° images over still images.

## 2. Method

### 2.1. Study design

A pilot study on the feasibility of an ICBT intervention for FP using two types of images was conducted. Participants were randomly allocated to three conditions: NO-FEAR Airlines with still images (NFA), NO-FEAR Airlines with still and navigable images (NFA + NI), and a waiting list (WL) control group. Participants agreed to participate in the study without knowing to which condition they would be allocated, and the randomization was conducted by an independent researcher who was not involved in the study. Assessments were carried out at pre-treatment, posttreatment, and 3- and 12-month follow-ups. For ethical reasons, participants in the WL control group were offered treatment when they completed the assessment after the 6-week waiting period, and so data from the follow-ups were not available for this group. An online informed consent form was signed by participants before randomization. Participation was completely voluntary, and participants were able to leave the study at any time.

The sample size was based on practical considerations and the previous study using NO-FEAR Airlines (Campos et al., 2016), as well as the expected dropout rate in ICBTs (around 20% according to recent studies; Carlbring et al., 2018). Therefore, the number of participants needed to reasonably evaluate the feasibility goals was 60 (20 participants per condition), in line with the recommendation proposed by Viechtbauer et al. (2015).

The study was registered at clinicaltrials.gov (NCT03900559) on April 9, 2019. Further details about the intervention and the study can be found in the study protocol published elsewhere (Mor et al., 2021a).

The study was approved by the Ethics Committee of Universitat Jaume I (Castellón, Spain; 7/2017) and conducted following the international standards of the Declaration of Helsinki and good clinical practice.

### 2.2. Participants, recruitment, and eligibility criteria

Participants made contact to engage in the study via email, through the intervention website (https://fobiavolar.labpsitec.es), or by calling the emotional disorders university clinic. A 30–45 min telephone interview was arranged with people interested in receiving treatment to explain the study conditions and ensure that they fulfilled the inclusion criteria. Participants from any part of the world could participate in and benefit from the intervention, as long as they understood Spanish.

Inclusion criteria were as follows: (1) at least 18 years old; (2) meet diagnostic criteria for FP; (3) able to use a computer and have an

Internet connection; (4) have an email address; and (5) able to understand and read Spanish. Exclusion criteria were: (1) currently receiving psychological treatment for FP; (2) meeting the criteria for another severe mental disorder, including alcohol or other substance abuse or dependence, psychotic disorder, dementia, and bipolar disorder; (3) diagnosed with a severe personality disorder; (4) presence of depressive symptomatology or suicidal ideation; (5) presence of heart disease; and (6) pregnancy (from the fourth month).

A psychologist with a Master's Degree in Clinical Psychology was in charge of conducting the telephone interview at pretreatment, posttreatment, and follow-up. The clinical team discussed the inclusion or exclusion of each participant assessed to ensure a reliable diagnosis. Participants were randomly allocated to one of the study conditions after signing the informed consent form.

### 2.3. Measures

There was no face-to-face contact with the therapist during the study; therefore, all outcome measures were completed online or by telephone. A more detailed description of the assessment can be found in the study protocol (Mor et al., 2021a).

*Diagnostic interview*: Anxiety Disorders Interview Schedule (ADIS-IV; Brown et al., 1994). This interview was administered to ensure that participants met the criteria for FP.


**Fig. 1.** NO-FEAR Airlines screenshots.

*Primary outcome measures of feasibility*: Participants' adherence to the program; Expectations Scale and Satisfaction Scale (adapted from Borkovec and Nau, 1972), administered before and after the treatment on a scale from 0 to 10; and preferences questionnaire to assess the user's preferences for the two types of images (assessed before and after completing the program). Participants in the NFA condition were shown a short video of the navigable images, and then a qualitative interview was conducted to assess their opinions of the intervention program after finishing it. This interview had questions that could be answered on a scale ranging from 1 ("very little") to 5 ("very much"), with the option to explain their answers, as well as open questions about the program and images. Participants in the NFA + NI group had additional questions about the two types of images because they saw both during the intervention.

*FP symptomatology outcomes*: Fear of Flying Questionnaire (FFQ-II; Bornas et al., 1999); Fear of Flying Scale (FFS; Haug et al., 1987); Fear and Avoidance Scales (adapted from Marks and Mathews, 1979); The Clinician Severity Scale (adapted from DiNardo et al., 1994); Patient's Improvement Scale (adapted from the Clinical Global Impression scale, CGI; Guy, 1976); Behavioral outcomes such as whether participants took a flight at post-assessment, number of flights taken, and use of safety behaviors.

*Sense of presence and reality judgment measures*: Reality Judgment and Presence Questionnaire (RJPQ; adapted from Baños et al., 2005), administered during and after the intervention; questions about sense of presence and reality judgment after the exposure scenario were answered on scales ranging from 0 to 10.

### 2.4. Intervention

NO-FEAR Airlines is an ICBT for the treatment of FP that includes exposure scenarios with real images and sounds related to flying. The program's graphics were designed using airline motifs, and they are presented in a linear navigation mode to make the experience easier for users (see Fig. 1). The intervention has three main components: psychoeducation, which includes information related to FP with the aim of helping the participants to understand their problem; exposure, which is the main component of the intervention and consists of videos of six different scenarios (flight preparation, airport, boarding and take off, flight, landing, and news related to plane accidents); and overlearning, an optional final module where participants can choose to repeat any of the exposure scenarios or even add more difficult conditions, such as bad weather or turbulence.

The order of appearance of the exposure scenarios changes depending on participants' responses to one of the measures in pretreatment (FFQ-II; Bornas et al., 1999). The program builds a personalized exposure hierarchy for each user, except in the case of the scenario about news related to plane accidents, which is always the last one presented. The level of anxiety after each exposure scenario is recorded by the program, and if anxiety is moderate or high (3 or more on a scale from 0 to 10), the system repeats that same scenario until the anxiety level decreases.

Participants were recommended to do two exposure scenarios per week, although they were free to advance at their own pace because this was a self-paced program. They were given a maximum period of six weeks to complete the intervention, but they could finish it sooner depending on the pace at which they moved through the program. Therapist support was not provided in this study, based on previous results with this program showing no differences in treatment efficacy (Campos et al., 2019). However, an email was sent every two weeks reminding them to log on to the platform. Participants were encouraged to take a flight within two weeks after finishing the intervention, but they could book it at another time if it worked better for them. Taking the flight was not mandatory because the costs were not covered by the study, but it was highly recommended by the program and therapists.

Two types of images were used in the exposure scenarios: 1) Still images, shown in the exposure scenarios as a string of different still photographs related to the scenario on display; and 2) Navigable images, shown in the exposure scenarios as 360° panoramic photographs that allowed participants to look at their surroundings in all directions, controlling the image rotation using a keyboard or mouse. The two formats in which the program was implemented were: a) NO-FEAR Airlines with still images (NFA) and b) NO-FEAR Airlines with still and navigable images (NFA + NI).

A sample of the flight exposure scenario for the still (http://repositori.uji.es/xmlui/bitstream/handle/10234/189216/Fijas%20avio%cc%81n.mp4?sequence=1&isAllowed=y) and navigable images (http://repositori.uji.es/xmlui/bitstream/handle/10234/189216/Navegables%20avio%cc%81n.mp4?sequence=2&isAllowed=y) presented in each condition is available online.

Because still images had already demonstrated their efficacy in reducing FP symptomatology in a previous study (Campos et al., 2019), and we aimed to assess the participants' acceptance, opinions, and preferences for the two types of images before changing them all, only two of the exposure scenarios in one of the experimental conditions consisted of 360° navigable images. Thus, participants in this experimental condition were able to see the two types of images.

### 2.5. Statistical analyses

Analyses of the sociodemographic and baseline measures were conducted to verify that there were no significant differences between the groups. For this purpose, one-way ANOVAs for continuous data and chi-square tests for categorical variables were used. Shapiro-Wilk tests were conducted for all variables to check the normality of the sample distribution and select the appropriate tests for each.

To examine participants' satisfaction, preferences, opinion, and acceptance, means, standard deviations, ranges (minimum-maximum), and percentages/frequencies were calculated for each feasibility measure. Mann-Whitney's *U* tests were conducted to explore whether there were differences between the groups with regard to treatment expectations at pretreatment, treatment satisfaction at posttreatment, and the quantitative questions from the qualitative interview. Wilcoxon tests were performed to explore significant changes between the expectations at pretreatment and satisfaction at posttreatment in the experimental conditions, and significant differences on the specific questions for the NFA + NI group in the qualitative interview. Percentages of dropout rates and attrition were calculated. Percentages for the preference questions at pre- and posttreatment were also calculated.

Intent-to-treat (ITT) mixed-model analyses were conducted to test the potential effectiveness of the intervention for each FP symptomatology outcome measure in order to handle missing data (Salim et al., 2008). The assessment moment was used as a within-group factor, and the experimental condition as a between-group factor. Significance effects were corrected using Bonferroni tests. Little's MCAR tests were conducted to verify that data were missing at random. Between- and within-group effect sizes were calculated using Cohen's *d* (Cohen, 1988). Chi-square tests were also calculated to assess group differences in behavioral outcomes (whether a flight was taken and safety behaviors used) at posttreatment. To explore maintenance at 3- and 12-month follow-ups, *t*-tests were conducted.

Bootstrap regression analyses were carried out using the PROCESS approach (https://afhayes.com/; Preacher and Hayes, 2004) to explore the relationship between the group condition and the FP symptomatology outcome measures, considering sense of presence and reality judgment at posttreatment as proposed mediators. Separate mediation and moderation analyses were conducted to explore the association between the experimental condition and the sense of presence and reality judgment assessed at posttreatment, and to test whether the questions on sense of presence and reality judgment after each exposure scenario indicated significant mediation/moderation in this relationship.

All statistical analyses were performed using IBM SPSS version 26.0 and the jAMM program from Jamovi interference (Gallucci, 2019).

## 3. Results

### 3.1. Baseline data and participant characteristics

Participants' characteristics and clinical data related to their FP history are presented in Table 1, divided by group. No significant differences were found in any of the sociodemographic variables or FP outcome measures at baseline. Overall, the sample consisted of 56 women (71.8%) and 22 men (28.2%) between 19 and 66 years of age (M = 37.99, SD = 9.99). The gender proportion and mean age in each condition were: 19 (73.1%) women and a mean age of 35.54 (SD = 10.02) for the NFA condition; 17 women (65.4%) and a mean age of 38.65 (SD = 7.88) for the NFA + NI condition; and 20 women (76.9%) and a mean age of 39.77 (SD = 11.60) for the WL condition. The majority of the participants were from Spain (93.6%, $n = 73$), but there were also participants from Argentina (3.8%, $n = 3$), Mexico (1.3%, $n = 1$), and Costa Rica (1.3%, n = 1). Only three participants were taking anxiolytics at the time of assessment. Only one of the three reported changes (increase) at post-assessment, and all three were from the WL condition. One participant in the navigable condition who was not taking any medication at pretreatment reported taking anxiolytics at posttreatment for another anxiety problem.

**Table 1**
Participants' sociodemographic and clinical data.

| | NFA (n = 26) | NFA + NI (n = 26) | WL (n = 26) | Between-group comparison |
|---|---|---|---|---|
| Gender (n, %) | | | | |
| Female | 19 (73.1%) | 17 (65.4%) | 20 (76.9%) | $\chi^2(2) = 0.886$, $p = .642$ |
| Male | 7 (26.9%) | 9 (34.6%) | 6 (23.1%) | |
| Age mean (SD) | 35.54 (10.02) | 38.65 (7.88) | 39.77 (11.60) | $F(2,75) = 1.262$, $p = .289$ |
| Marital status (n, %) | | | | |
| Married/in a relationship | 19 (73.1%) | 23 (88.5%) | 22 (84.6%) | $\chi^2(6) = 5.906$, $p = .434$ |
| Single | 6 (23.1%) | 3 (11.5%) | 3 (11.5%) | |
| Divorced/ separated | 1 (3.8%) | – | – | |
| Widowed | – | – | 1 (3.8%) | |
| Education level (n, %) | | | | |
| Elementary education | 1 (3.8%) | – | 1 (3.8%) | $\chi^2(4) = 2.241$, $p = .691$ |
| Secondary education | 4 (15.4%) | 7 (26.9%) | 7 (26.9%) | |
| Higher education | 21 (80.8%) | 19 (73.1%) | 18 (69.2%) | |
| Employment status (n, %) | | | | |
| Student | 3 (11.5%) | – | 2 (7.7%) | $\chi^2(8) = 13.543$, $p = .094$ |
| Employed | 21 (80.8%) | 26 (100%) | 23 (88.5%) | |
| Unemployed | 1 (3.8%) | – | – | |
| Work leave | – | – | 1 (3.8%) | |
| Retired | 1 (3.8%) | – | – | |
| Medication (n, %) | | | | |
| No | 25 (96.2%) | 25 (96.2%) | 25 (96.2%) | $\chi^2(2) = 0.000$, $p > .999$ |
| Yes | 1 (3.8%) | 1 (3.8%) | 1 (3.8%) | |
| Experience flying (n, %) | | | | |
| No | 2 (8%) | – | – | $\chi^2(2) = 3.948$, $p = .139$ |
| Yes | 24 (92%) | 24 (100%) | 24 (100%) | |
| FP duration (n, %) | | | | |
| < 6 months | 1 (3.8%) | – | – | $\chi^2(8) = 6.002$, $p = .647$ |
| 6–12 months | 1 (3.8%) | – | – | |
| 1–5 years | 3 (11.5%) | 5 (19.2%) | 6 (23.1%) | |
| 5–11 years | 5 (19.2%) | 7 (26.9%) | 7 (26.9%) | |
| > 11 years | 15 (57.7%) | 12 (46.2%) | 11 (45.8%) | |

NFA: NO-FEAR Airlines with still images; NFA + NI: NO-FEAR Airlines with still and navigable images; WL: waiting list control group.

### 3.2. Feasibility results

#### 3.2.1. Participant flow and attrition

Participant recruitment was carried out between January 2018 and April 2020. As the flow diagram shows in Fig. 2, 172 people were initially interested in the study, and 108 were assessed for eligibility criteria. After excluding 30 participants who did not meet inclusion criteria, 78 participants were included in the study and randomly allocated to one of the three conditions: NFA ($n = 26$), NFA + NI (n = 26), and WL (n = 26). Of those who started the program, 22 participants (42.3%) withdrew from the experimental conditions, and 4 (15.4%) did not complete the assessment after WL. Although dropouts were higher in the NFA + NI group, no significant differences in attrition rates were found at posttreatment between the two treatment groups ($\chi2$ (1) = 2.836, $p = .092$). Following ITT analyses, 26 participants in each condition were included for the potential effectiveness analyses. At the 3-month follow-up, 11 participants completed the assessment (21.2%), with no significant differences between the groups ($\chi2$ (1) = 2.882, $p = .090$), and 13 participants (25%) completed the final follow-up after 12 months, also with no significant differences in attrition rates ($\chi2$ (1) = 2.564, $p = .109$). Little's MCAR test showed that the missing data were random ($p > .05$). Due to the small number of participants at follow-up, these were not included in the ITT analyses.

Table 2 shows the number of exposure scenarios completed by the 22 participants who dropped out of the experimental conditions. Because this was a self-applied intervention and participants had the "overlearning" module to repeat any of the exposure scenarios if they wanted to before finishing the program, participants who did not complete the post-assessment on the webpage were considered dropouts. For this reason, some of the people who withdrew from the intervention had already completed the six exposure scenarios, as Table 2 shows. A scenario was considered complete by the program when the participants answered the question about their anxiety level after the scenario with a rating of less than 3. Of those who did not complete any scenario, four participants did not even access the first one.

#### 3.2.2. Preferences

Table 3 shows participants' preferences in both experimental conditions regarding the type of images they would like to see in the exposure scenarios, assessed before and after completing the program. Only the experimental groups were included in the analysis.

Overall, participants preferred navigable images, believing that they would be more likely to help them overcome their fear and more logical for treating FP. A high proportion said they would recommend them to a friend before and after the treatment. Navigable images were considered more aversive than still images at pretreatment. However, after the intervention, this impression decreased significantly in the NFA + NI condition compared to the NFA condition ($\chi2$ (1) = 4.112, $p = .043$). Despite the higher aversiveness ratings, navigable images were still preferred by participants. No significant differences were found between the two groups on the other items before or after treatment.

#### 3.2.3. Expectations and satisfaction

Ratings of participants' expectations before they started the treatment and participant satisfaction after they finished the treatment are presented in Table 4, divided by group.

Results showed high expectations and satisfaction scores on all the items before and after the treatment, except on the item related to "Aversiveness," which showed low mean scores. Shapiro-Wilk tests revealed that none of the variables followed a normal distribution ($p <$

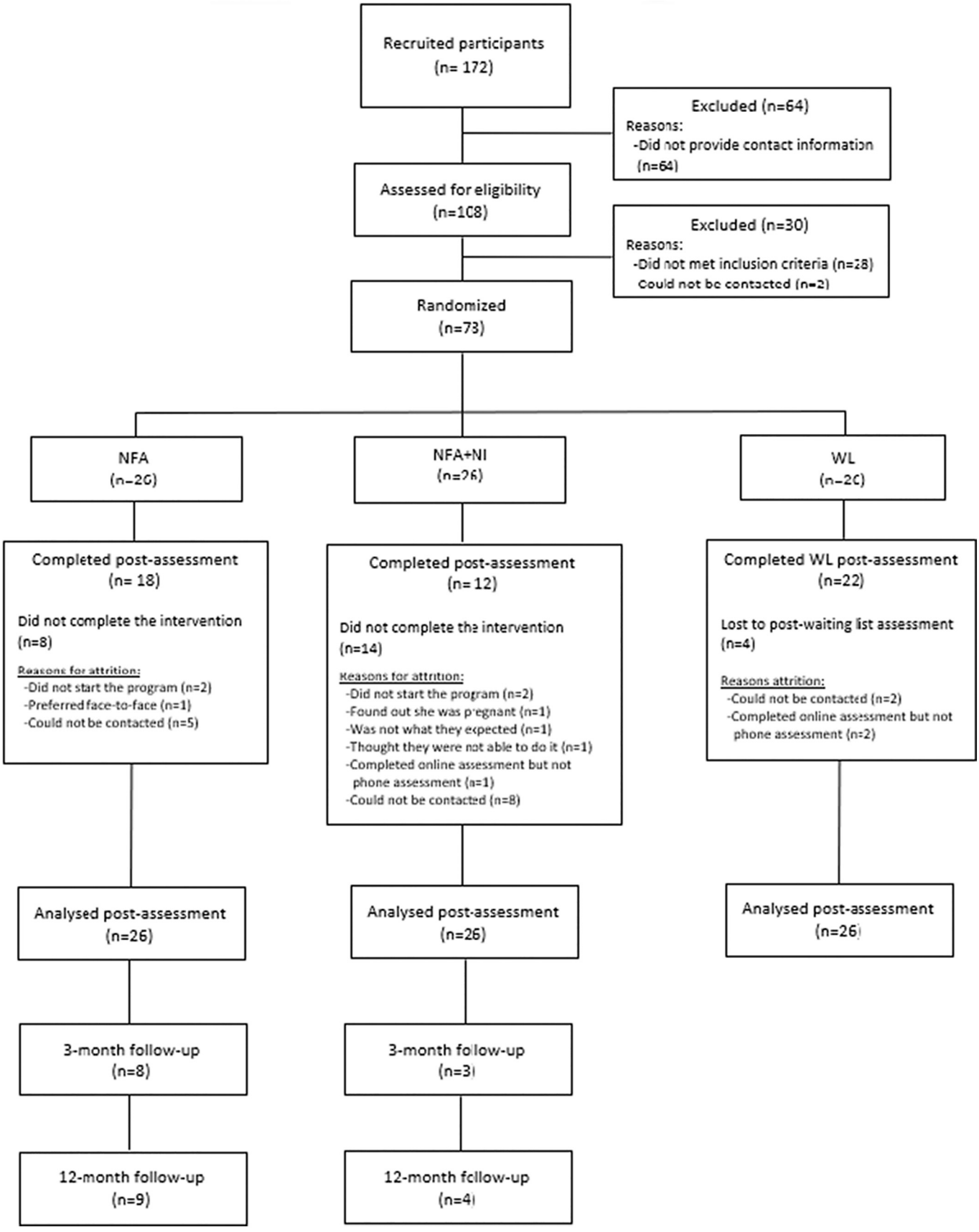


**Fig. 2.** Flow diagram of the study.

**Table 2**
Number of scenarios completed by participants who withdrew from the intervention.

| Number of scenarios completed | NFA | NFA + NI | Both conditions |
|---|---|---|---|
| 0 | 3 (37.5%) | 8 (57.1%) | 11 (50%) |
| 2 | 1 (12.5%) | – | 1 (4.5%) |
| 3 | – | 2 (14.3%) | 2 (9.1%) |
| 4 | – | 1 (7.1%) | 1 (4.5%) |
| 5 | – | 1 (7.1%) | 1 (4.5%) |
| 6 | 4 (50%) | 2 (14.3%) | 6 (27.3%) |

NFA: NO-FEAR Airlines with still images; NFA + NI: NO-FEAR Airlines with still and navigable images.

**Table 3**
Participants' preferences about the type of images before and after treatment.

| | Before treatment ($n$ = 52) | | After treatment ($n$ = 25) | |
|---|---|---|---|---|
| | NFA ($n$ = 26) | NFA + NI ($n$ = 26) | NFA ($n$ = 13) | NFA + NI (n = 12) |
| Preference | | | | |
| Navigable images | 92.3% (n = 24) | 96.2% ($n$ = 25) | 84.6% (n = 11) | 91.7% ($n$ = 11) |
| Still images | 7.7% (n = 2) | 3.8% (n = 1) | 15.4% (n = 2) | 8.3% (n = 1) |
| Subjective effectiveness | | | | |
| Navigable images | 100% (n = 26) | 100% ($n$ = 26) | 84.6% (n = 11) | 91.7% ($n$ = 11) |
| Still images | – | – | 15.4% (n = 2) | 8.3% (n = 1) |
| Logic | | | | |
| Navigable images | 96.2% (n = 25) | 100% (n = 26) | 84.6% (n = 11) | 91.7% (n = 11) |
| Still images | 3.8% (n = 1) | – | 15.4% (n = 2) | 8.3% (n = 1) |
| Subjective aversiveness | | | | |
| Navigable images | 88.5% ($n$ = 23) | 92.3% (n = 24) | 84.6% (n = 11) | 45.5% (n = 5) |
| Still images | 11.5% (n = 3) | 7.7% (n = 2) | 15.4% (n = 2) | 54.5% ($n$ = 6) |
| Recommendation | | | | |
| Navigable images | 100% (n = 26) | 96.2% (n = 25) | 69.2% ($n$ = 9) | 91.7% (n = 11) |
| Still images | – | 3.8% (n = 1) | 30.8% (n = 4) | 8.3% (n = 1) |

NFA: NO-FEAR Airlines with still images; NFA + NI: NO-FEAR Airlines with still and navigable images.

.05 in all variables). No significant differences were found between the means of the two experimental conditions on either of the scales at the two assessment times (Mann-Whitney's U, $p > .05$ in all comparisons).

A general reduction in means from pretreatment to posttreatment was found in both groups. Wilcoxon tests showed that this difference was statistically significant for treatment satisfaction in the NFA group ($z = -2.03, p = .42$) and the NFA + NI group ($z = -2.20, p = .028$), and for usefulness for themselves in the NFA + NI group ($z = -2.27, p = .24$).

### 3.2.4. Qualitative interview

As shown in Table 5, results show that, on average, participants in both conditions rated the exposure scenarios and the psychoeducation and overlearning component as "useful." Including real images and sounds was rated as "very useful," with the usefulness of sounds showing the highest means of all the variables in both conditions. Results also showed that participants rated the exposure scenarios as "somewhat realistic", and they felt "somewhat present" in them. No significant differences were found in any of the means between the two experimental conditions.

Participants in the navigable condition were asked about the usefulness and sense of presence in both types of images. Results showed that the means for usefulness and presence were higher in navigable scenarios than in still scenarios. Wilcoxon tests showed that these differences were statistically significant ($p < .05$). Specifically, the proportion of participants who rated the usefulness of navigable images with a 4 or 5 (on a scale from 1 "very little" to 5 "very much") was 91.7%, whereas for still images, this percentage was 5.8%. For presence, 44% of participants rated navigable images with a 4 or 5, and 11% gave these high ratings for still images. Additionally, participants in this condition were asked what type of image they would have liked to have seen in all the exposure scenarios, and 91.7% ($n = 11$) chose "navigable images," whereas only 8.3% (n = 1) chose "indifferent."

Regarding the qualitative data obtained in this interview, some participants reported that they had to try to feel like they were in the situation ("*Sometimes you are very aware that you are in front of a computer and the situation is not real*"), and that they would like to see images with better quality and more variety in the scenarios. A number of participants said they would prefer images with movement or videos. Qualitative responses about the two types of images from participants in the NFA + NI condition highlighted their preference for navigable images

**Table 5**
Participants' ratings on questions from the qualitative interview.

| | NFA (n = 18) M (SD) | NFA + NI (n = 12) M (SD) |
|---|---|---|
| Usefulness of exposure scenarios | 3.17 (0.92) | 3.25 (0.97) |
| Usefulness of real images in exposure scenarios | 4.00 (0.84) | 4.17 (0.83) |
| Usefulness of real sounds | 4.67 (0.48) | 4.59 (0.67) |
| Usefulness of psychoeducation | 3.83 (1.04) | 3.67 (0.89) |
| Usefulness of overlearning | 3.72 (1.23) | 3.83 (1.11) |
| Sense of presence in exposure scenarios | 3.28 (0.83) | 2.92 (1.00) |
| Realism of exposure scenarios | 3.67 (1.08) | 3.33 (0.89) |
| Usefulness of navigable images | – | 3.92 (1.00) |
| Usefulness of still images | – | 2.67 (1.00) |
| Presence in navigable scenarios | – | 3.44 (1.13) |
| Presence in still scenarios | – | 2.33 (1.00) |

NFA: NO-FEAR Airlines with still images; NFA + NI: NO-FEAR Airlines with still and navigable images.

**Table 4**
Participants' expectations and satisfaction with the intervention.

| | NFA | | NFA + NI | |
|---|---|---|---|---|
| | *Pretreatment expectations* $M$ (*SD*) ($n$ = *26*) | *Post-treatment Satisfaction* $M$ (*SD*) ($n$ = *18*) | *Pretreatment expectations* $M$ (*SD*) ($n$ = *26*) | *Post-treatment Satisfaction* $M$ (*SD*) ($n$ = *12*) |
| Intervention logic | 8.04 (1.56) | 7.94 (1.70) | 8.65 (1.23) | 8.50 (1.31) |
| Treatment satisfaction | 8.42 (1.36) | 7.50 (1.76) | 8.65 (1.41) | 7.0 (2.34) |
| Treatment recommendation | 8.77 (1.68) | 8.39 (1.72) | 9.04 (1.22) | 8.0 (2.49) |
| Useful to treat other problems | 7.31 (1.89) | 7.33 (2.17) | 7.65 (1.67) | 7.08 (1.83) |
| Useful for themselves | 7.77 (1.70) | 7.11 (1.94) | 8.31 (1.60) | 6.92 (2.07) |
| Aversiveness | 3.96 (3.08) | 2.56 (2.45) | 4.08 (3.08) | 2.17 (2.52) |

NFA: NO-FEAR Airlines with still images; NFA + NI: NO-FEAR Airlines with still and navigable images.

over still images because "*they offered more possibilities. You could see images with more perspective.*"

### 3.3. Potential effectiveness results

#### 3.3.1. Changes in FP measures from pre- to posttreatment

Within-group comparisons showed a significant reduction from pre- to posttreatment in the experimental conditions on all the FP measures, with large effect sizes, and no significant intragroup changes were found for the WL group (see Table 6 for more details). A significant interaction effect of time (pretreatment and posttreatment) and experimental condition (NFA, NFA + NI, or WL) was also found for all the measures: FFS ($F(2, 61.37) = 24.904$, $p < .001$), FFQ-II ($F(2, 62.43) = 17.098$, $p < .001$), Fear ($F(2, 62.28) = 39.385$, $p < .001$), Avoidance ($F(2, 61.94) = 44.396$, $p < .001$), Belief ($F(2, 68.33) = 31.751$, $p < .001$), Interference ($F(2, 55.91) = 17.545$, $p < .001$), and Severity ($F(2, 55.65) = 27.189$, $p < .001$). Compared to the WL condition, both experimental conditions showed an improvement in all the measures assessing FP symptomatology, with large effect sizes ranging from Cohen's d 0.76 to 2.79 (see Table 7). No significant differences were found in the comparisons of the two experimental conditions except for the belief in catastrophic thoughts, where the navigable-image condition showed a significantly lower mean at posttreatment than the still-image condition ($p = .016$).

Regarding the behavioral outcomes assessed at posttreatment, 10 participants from the NFA condition took a flight after the intervention (55.6%), with a mean of 3.1 flights, five participants from the NFA + NI condition (41.7%), with a mean of 2.4 flights, and six participants from the WL condition (27.3%), with a mean of 3.0 flights. No significant differences were found between conditions ($\chi2(2) = 3.300$, $p = .192$). Of those who took a flight at posttreatment, one participant used safety behaviors in the NFA condition (10%), two in the NFA + NI condition (40%), and six in the WL condition (100%), with significant differences ($\chi2(2) = 12.425$, $p = .002$). These differences were found between the NFA condition and the WL condition ($\chi2(1) = 12.343$, $p < .001$) and between the NFA + NI condition and the WL condition ($\chi2(1) = 4.950$, $p = .026$).

The patients' improvement at posttreatment was assessed on a scale that ranged from 1 ("a lot worse") to 7 ("a lot better"). No comparisons with pretreatment could be made because this measure only assesses patients' level of improvement in their FP after the intervention or WL. Means for participants' perceived improvement in the experimental conditions were significantly higher than for participants in the WL group, with 5.61 (SD = 0.21) for the NFA group and 5.66 (SD = 0.26) for the NFA + NI group, compared to 3.96 (SD = 0.19) for the WL group.

**Table 7**
Between-group effect sizes at posttreatment.

| | NFA vs. WL, *d* (95% CI) | NFA + NI vs. WL, *d* (95% CI) | NFA vs. NFA + NI, *d* (95% CI) |
|---|---|---|---|
| FFS | −1.52 (−2.23, −0.82) | −2.03 (−2.88, −1.18) | −0.20 (−0.93, 0.53) |
| FFQ-II | −1.58 (−2.28, −0.88) | −1.48 (−2.23, −0.72) | 0.08 (−0.63, 0.80) |
| Fear | −2.38 (−3.19, −1.56) | −2.79 (−3.75, −1.82) | −0.01 (−0.74, 0.72) |
| Avoidance | −2.02 (−2.79, −1.26) | −2.42 (−3.33, −1.51) | −0.12 (−0.85, 0.61) |
| Belief | −1.76 (−2.49, −1.03) | −2.75 (−3.71, −1.79) | −0.60 (−1.35, 0.14) |
| Interference | −1.26 (−1.94, −0.58) | −0.76 (−1.48, −0.03) | 0.37 (−0.37, 1.11) |
| Severity | −1.41 (−2.10, −0.71) | −1.77 (−2.58, −0.95) | −0.20 (−0.94, 0.53) |
| Improvement | 2.17 (1.39, 2.96) | 2.25 (1.37, 3.14) | 0.05 (−0.68, 0.78) |

FFS: Fear of Flying Scale; FFQ-II: Fear of Flying Questionnaire.

#### 3.3.2. Maintenance of treatment changes at follow-up

Due to the small number of participants who were assessed at follow-ups ($n = 11$ at 3-month follow-up and $n = 12$ at 12-month follow-up), these data were not included in the ITT mixed-model analysis. Shapiro-Wilk tests revealed that data from the follow-ups were normally distributed ($p > .05$); therefore, preliminary *t*-test comparisons were conducted to compare pretreatment scores with 3-month and 12-month follow-up scores. Results showed a significant reduction in symptomatology based on the means of all the FP measures at the follow-ups compared to pretreatment ($p < .05$). Because of the small sample, both groups were included together in the analyses. For the FFQ-II, a few

**Table 6**
Treatment outcomes and within-group effect sizes.

| | NFA | | | | NFA + NI | | | | WL | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Pre M (SD)* | *Post (estimated) M (SE)* | *F (df)* | *d (95% CI)* | *Pre M (SD)* | *Post (estimated) M (SE)* | *F (df)* | *d (95% CI)* | *Pre M (SD)* | *Post (estimated) M (SE)* | *F (df)* | *d (95% CI)* |
| FFS | 64.81 (7.73) | 45.47 (2.05) | 97.73 (1, 60.16)*** | 2.43 (3.24, 1.61) | 63.88 (6.98) | 43.16 (2.41) | 79.19 (1, 66.43)*** | 2.88 (3.78, 1.98) | 65.62 (8.20) | 62.20 (1.90) | 3.59 (1, 56.65) | 0.40 (0.63, 0.17) |
| FFQ-II | 209.25 (30.73) | 144.46 (8.20) | 59.25 (1, 63.98)*** | 2.04 (2.86, 1.22) | 206.58 (31.44) | 151.62 (9.44) | 32.51 (1, 67.62)*** | 1.69 (2.31, 1.07) | 212.04 (27.20) | 208.38 (7.32) | 0.234 (1, 54.94) | 0.13 (0.30, −0.03) |
| Fear | 8.96 (1.18) | 4.95 (0.34) | 120.0 (1, 60.52)*** | 3.29 (4.35, 2.22) | 8.46 (1.33) | 5.06 (0.40) | 60.73 (1, 70.04)*** | 2.47 (3.31, 1.63) | 8.77 (1.34) | 8.87 (0.31) | 0.118 (1, 55.59) | −0.07 (0.27, −0.41) |
| Avoidance | 8.04 (1.96) | 3.80 (0.48) | 79.08 (1, 60.57)*** | 2.44 (3.22, 1.66) | 8.65 (1.62) | 3.24 (0.56) | 91.48 (1, 67.91)*** | 3.23 (4.32, 2.14) | 7.92 (2.06) | 8.51 (0.44) | 1.77 (1, 56.56) | −0.28 (−0.01, −0.55) |
| Belief | 8.65 (1.60) | 5.34 (0.40) | 54.82 (1, 66.47)*** | 2.01 (2.77, 1.25) | 8.69 (1.38) | 3.81 (0.48) | 87.05 (1, 76.45)*** | 3.43 (4.51, 2.35) | 8.54 (1.42) | 8.67 (0.37) | 0.92 (1, 61.26) | −0.09 (0.21, −0.39) |
| Interference | 5.65 (1.55) | 3.03 (0.43) | 47.70 (1, 55.01)*** | 1.64 (2.28, 0.99) | 5.81 (2.38) | 3.93 (0.50) | 17.13 (1, 59.84)*** | 0.78 (1.18, 0.39) | 5.19 (2.04) | 5.50 (0.41) | 0.80 (1, 52.23) | −0.15 (0.10, −0.04) |
| Severity | 5.85 (1.43) | 3.57 (0.35) | 46.73 (1, 55.36)*** | 1.54 (2.19. 0.89) | 6.15 (1.49) | 3.29 (0.40) | 54.76 (1, 60.69)*** | 1.87 (2.51, 1.23) | 5.40 (1.50) | 5.73 (0.32) | 1.23 (1, 50.25) | −0.21 (0.04, −0.46) |

FFS: Fear of Flying Scale; FFQ-II: Fear of Flying Questionnaire.[a]

[a] *** $p \leq 0.001$

more participants could be included in the analysis because they answered the questions on the webpage but could not be contacted by phone. Table 8 shows descriptive data and statistics for these analyses.

Means for patient's improvement were 5.91 (SD = 0.94) at the 3-month follow-up and 5.84 (SD = 1.14) at the 12-month follow-up, showing that participants continued to feel "much better" about their FP at follow-up. No significant differences were found in the *t*-test comparisons of improvement between the two follow-up periods compared to posttreatment.

### 3.4. Sense of presence and reality judgment

#### 3.4.1. Descriptive measures

Scores on the RJPQ during the intervention (after half of the scenarios had been presented to the patient) were M = 107.69 (SD = 30.79) for the NFA condition and M = 116.18 (SD = 16.19) for the NFA + NI condition. The scores on the RJPQ at post-assessment were M = 114.41 (SD = 23.70) for the NFA condition and M = 106.73 (SD = 21.83) for the NFA + NI condition. No significant differences were found between the means.

The means for the sense of presence and reality judgment questions presented after the two navigable scenarios were calculated in the NFA + NI group and compared with the same two still scenarios in the NFA condition. Results for the NFA + NI condition showed a mean of 6.12 (SD = 2.23) for presence and 6.06 (SD = 2.46) for reality judgment for the airport scenario ($n = 17$), and 5.64 (SD = 2.68) for presence and 5.69 (SD = 2.81) for reality judgment for the plane scenario. Results for the NFA condition showed a mean of 6.33 (SD = 2.39) for presence and 5.86 (SD = 2.65) for reality judgment for the airport scenario, and 5.57 (SD = 2.76) for presence and 5.19 (SD = 2.77) for reality judgment for the plane scenario. Mann-Whitney's *U* tests showed no significant differences.

#### 3.4.2. Mediation effects

Mediation effects of sense of presence and reality judgment between the use of navigable images and the change on the FFS and FFQ-II did not show statistical significance in any of the mediation models proposed. The only significant result found in these analyses was in the relationship between the sense of presence and the change in the FFQ-II once the treatment condition was controlled, b = 7.28 (95% CI: 1.06, 13.32; $z = 2.33$, $p = .020$). See Fig. 3 for the proposed model. The sample size for the mediation analyses was $n = 26$ for the FFQ-II and $n = 24$ for the FFS.

**Table 8**
Data from follow-ups and comparisons with pretreatment scores.

| | M (SD) | Pre- and follow-up comparisons |
|---|---|---|
| FFS | | |
| Pre ($n = 52$) | 64.34 (7.31) | |
| 3 m f-u ($n = 11$) | 42.00 (8.10) | $t(10) = 6.516$, $p < .01$ |
| 12 m f-u ($n = 13$) | 43.46 (14.42) | $t(12) = 6.352$, $p < .01$ |
| FFQ-II | | |
| Pre ($n = 48$) | 207.92 (30.79) | |
| 3 m f-u ($n = 14$) | 106.14 (41.91) | $t(13) = 7.791$, $p < .01$ |
| 12 m f-u (n = 12) | 119.50 (64.46) | $t(11) = 5.196$, $p < .01$ |
| Fear | | |
| Pre (n = 52) | 8.71 (1.27) | |
| 3 m f-u (n = 11) | 4.1 (1.58) | $t(10) = 4.524$, $p < .05$ |
| 12 m f-u (n = 13) | 4.54 (2.33) | $t(12) = 5.326$, $p < .01$ |
| Avoidance | | |
| Pre (n = 52) | 8.35 (1.67) | |
| 3 m f-u (n = 11) | 2.10 (2.07) | $t(10) = 11.209$, $p < .01$ |
| 12 m f-u (n = 13) | 1.92 (2.99) | $t(12) = 7.019$, $p < .01$ |
| Belief | | |
| Pre (n = 52) | 8.67 (1.48) | |
| 3 m f-u (n = 11) | 4.18 (2.52) | $t(10) = 4.978$, $p < .05$ |
| 12 m f-u (n = 13) | 5.00 (2.55) | $t(12) = 4.954$, $p < .01$ |
| Interference | | |
| Pre (n = 52) | 5.73 (2) | |
| 3 m f-u (n = 11) | 1.36 (1.50) | $t(10) = 5.068$, $p < .01$ |
| 12 m f-u (n = 13) | 2.00 (1.68) | $t(12) = 5.448$, $p < .01$ |
| Severity | | |
| Pre (n = 52) | 6 (1.46) | |
| 3 m f-u (n = 11) | 2.64 (1.12) | $t(10) = 5.590$, $p < .01$ |
| 12 m f-u (n = 13) | 2.69 (1.89) | $t(12) = 7.229$, $p < .01$ |

FFS: Fear of Flying Scale; FFQ-II: Fear of Flying Questionnaire.

## 4. Discussion

ICBTs for SP have already been developed, and research suggests that they are able to reduce phobic symptomatology (Mor et al., 2021b). However, the features that an online exposure scenario must include to be effective should be further explored. The present study aimed to assess the feasibility of including navigable images in the exposure scenarios in an ICBT for FP. For this purpose, participants' preferences, opinions, and acceptance of this type of image were analyzed. A secondary aim was to explore the potential effectiveness of two experimental conditions (NO-FEAR Airlines with still images and NO-FEAR Airlines with still and navigable images) compared with a WL group. Third, an exploratory aim was to compare the role of sense of presence and reality judgment in navigable images and observe possible mediation effects on treatment efficacy.

Regarding the main aim, participants in the study preferred navigable images over still images before and after treatment, confirming the hypothesis established in this study. Specifically, the posttreatment preference and opinion results are interesting because participants responded after having seen both types of images, and they still preferred navigable images. They considered them more effective and logical, and they would be more likely to recommend them to a friend. In addition, participants in the NFA + NI condition, who experienced the two types of exposure scenarios during their intervention, gave statistically significant higher ratings to the usefulness of the navigable images. At posttreatment, when asked in the qualitative interview how present they felt with each type of image, participants in the NFA + NI gave significantly higher ratings to the navigable images.

Adherence to the experimental conditions was lower than expected, based on more recent data suggesting dropout rates of less than 20% in ICBTs (Carlbring et al., 2018), with 42.3% of participants withdrawing from our intervention. This was a higher rate than the previous study using NO-FEAR Airlines (Campos et al., 2019), but closer to dropout rates traditionally proposed in the literature, where an average dropout rate of 31% has been reported (Melville et al., 2010), and similar to previous studies carried out with phobic patients, which report a 40.8% dropout rate (Kok et al., 2014). In our study, a participant was considered to have dropped out when the post-assessment was not completed. Some participants completed the six exposure scenarios but did not finish the overlearning module and, therefore, did not complete the post-assessment, which means they could also have withdrawn from the program because they felt better. Because this is a self-applied program, we do not have data on the evolution of their symptomatology. In

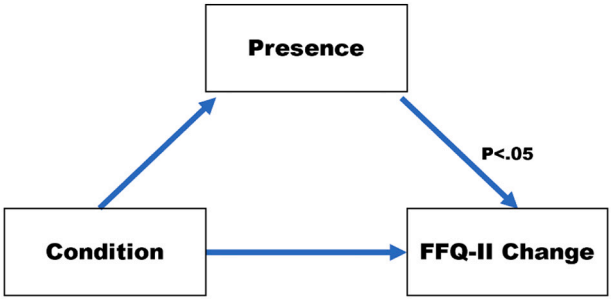


**Fig. 3.** Proposed mediation model of sense of presence between the use of navigable images and the improvement on the FFQ-II.

addition, the outbreak of COVID-19 while this study was taking place could have produced a loss of interest as well, given that flying was very limited or almost impossible in several countries.

Criteria for dropout in other studies could differ from those used in the current study. In a recent systematic review, a 27.3% dropout mean was reported in ICBT and mobile-based interventions for SP (Mor et al., 2021b). However, it is important to note that, in this review, both guided interventions and self-applied interventions were included, and this could be an important issue to consider regarding dropout from ICBTs. Other self-applied Internet-based interventions that have used images of phobic stimuli for exposure purposes presented high dropout rates ranging from 64 to 98% (Matthews et al., 2011, 2012).

Although more participants withdrew from the NFA + NI condition than from the NFA condition (14 vs. 8), no statistical differences were found in attrition between the two conditions, and tests showed that missing data were random. However, this is something that should be taken into consideration because the aim of the study was to explore the feasibility of this type of image with the future aim of changing all the exposure scenarios if they were more readily accepted. A possible explanation would be that participants perceived navigable images as more aversive than still images. The rate was lower at posttreatment, but 68% of participants still considered navigable images to be more aversive, in line with previous research about more realistic exposure scenarios (Bretón-López et al., 2015).

The high dropout rates could also be related to the lack of therapist support. In this study, therapist support was not provided, based on the results of a previous study where no differences in efficacy and attrition rates were found between a totally self-applied condition and a condition with weekly support calls (Campos et al., 2019). Instead, e-mails were sent to participants every two weeks to remind them to log onto the program. There are still mixed findings on this topic in the literature, with some studies suggesting that therapist support might not be as important as originally thought (Berger et al., 2011; Karyotaki et al., 2017; Titov et al., 2016), and other studies showing that guided ICBTs are linked to better outcomes and lower dropout rates (Furukawa et al., 2021; Andersson et al., 2015; Baumeister et al., 2014; Mewton et al., 2014; Richards and Richardson, 2012). Avoidance is a key clinical feature of SP, and perhaps therapist support would help patients to continue with the exposure and ensure that the scenarios in the program are not just one more situation they might avoid. The role of the therapist in offering support, guidance, and reinforcement during exposure could be important (Bretón-López et al., 2015).

One intermediate solution could be to offer support on demand (Zetterberg et al., 2019). Another important result related to adherence is that 50% of the participants in the two experimental groups did not complete the first scenario, which means that they did not answer the assessment questions after that scenario. Although some participants did not start the exposure component ($n = 4$), others participated in the scenarios but left the program before completing it. Some possible reasons might be that participants did not like the characteristics of the exposure scenarios or thought they would not be useful to them, they did not feel anything when viewing the scenarios, or the scenarios caused them more anxiety than they could deal with. Studying the real reasons for dropout in participants would help to improve the program.

When comparing the means for the sense of presence and reality judgment questions after the exposure scenarios in the NFA + NI and NFA groups, in the scenarios where they differed (that is, the scenarios where the NFA + NI condition had navigable images and the NFA condition had still images), no significant differences were found. Navigable images seem to be preferred, but more could be done to improve the program, given that satisfaction with the treatment after completing the intervention was significantly lower than the expectation before the treatment, as were the ratings for the usefulness of the intervention in the NFA + NI group. One possible explanation for the decrease in the usefulness ratings in the NFA + NI condition is that, because only two of the six scenarios were navigable, participants had the impression that the program was "incomplete" or unpolished, which could have influenced results. This result, together with the ratings for the usefulness of the exposure scenarios in the qualitative interview, shows that, although still effective, some characteristics of the program could be improved and should be further explored.

Some suggestions made by participants in the qualitative interview were the use of videos or images with movement in exposure scenarios. Videos have been shown to elicit more fearful reactions in phobic patients than real still images (Courtney et al., 2010). In addition, Matthews et al. (2012) found that moving images led to greater completion rates of exposure scenarios than static images, although in some participants with high levels of phobic symptoms, the moving images made them drop out of the program. In a recent study in which images and videos were shown to a sample of people with SP (Ruiz-García and Valero-Aguayo, 2020), both types of multimedia stimuli were linked to clinical improvements in anxiety symptomatology. However, whether there were differences between them or whether one was more accepted than the other was not explored, which highlights the importance of conducting more research on this topic because the data are still unclear.

The fact that some participants suggested using more immersive scenarios, like videos, while for other participants having more immersive scenarios from the start of the treatment could be experienced as more aversive, also highlights the need to take into consideration participants' individual characteristics and their phobic symptomatology to design online exposure scenarios. Having feedback about the anxiety experimented during the exposure scenarios could help to distinguish which patients need more or less aversive stimuli and, based on this feedback, adjusting the virtual reality stimuli in real time to achieve greater efficiency of the system, as well as a "patient-friendly" procedure, resulting in more individualized and accepted treatments (Kritikos et al., 2021).

With regard to the secondary aim of the study, NO-FEAR Airlines was effective in reducing symptoms of FP symptomatology compared with a WL control group, with large within- and between-group effect sizes on all the FP measures, supporting the results of the previous study with this program (Campos et al., 2019). No differences were found between the two experimental conditions, except for the belief in catastrophic thoughts, which was significantly lower in the NFA + NI group at posttreatment. Due to the high attrition rates, follow-up results should be interpreted with caution, but the clinical changes seemed to be maintained after 3 and 12 months. This is in line with previous findings that ICBTs can be effective for the treatment of SP (Andersson et al., 2009, 2013; Shahnavaz et al., 2018; Vigerland et al., 2013). Furthermore, although it was not statistically significant, the proportion of participants who took a flight after the intervention was higher in the experimental conditions, and they used safety behaviors significantly less than those in the control group. This is a positive result because the program seems to reduce avoidance and encourage people to face the phobic situation in real-life scenarios. Finally, participants who finished the program referred to feeling "much better" with regard to their FP after the intervention, and this was maintained at follow-ups.

For the exploratory aim of the study about the mediation effect of sense of presence and reality judgment in changes in the two questionnaires assessing FP symptomatology at posttreatment, none of the models were significant, meaning that no mediation effect was found for either variable in treatment effectiveness. This is in line with findings for VRET, where presence does not seem to be related to treatment outcomes (Tardif et al., 2019). However, a significant relationship was found between sense of presence and clinical change on the FFQ-II (with no effect in the intervention group). This is an interesting result. Given the small sample size and the other results for presence found in this study, no conclusions can be drawn, but this relationship should be explored in future research.

The present study has some limitations that have to be acknowledged. First, there was a high dropout rate at posttreatment, and even higher at follow-ups, and for this reason, the results presented here could

be biased and should be interpreted with caution. Second, only two exposure scenarios had navigable images in one of the experimental conditions, and although this study aimed to explore the feasibility of using these images, they might not have been sufficient to observe significant differences. Third, some participants experienced technical problems with the program, which might have influenced their experience with the intervention and their adherence. Fourth, most of the sample included in the study had a high educational level, which might affect the generalizability of the results. Another limitation is that the questions about sense of presence and reality judgment after the exposure scenario were presented when the level of anxiety was less than 3. This means that some participants could have answered these questions after several repetitions of the scenario, which could have had an impact on their responses.

Despite its limitations, the current study provides data that can help in the design of future Internet-delivered exposure scenarios for SP, which still needs more research. Online exposure to airplane related scenarios helps to reduce phobic symptomatology, as showed with the potential effectiveness analysis of this study and the efficacy results obtained earlier by Campos et al. (2019), but participants' opinions manifested a preference for more immersive scenarios in NO-FEAR Airlines. In conclusion, such systems, which can be self-applied by patients in their own home and when they wish, can be very useful in helping all those who need it, as they can include less or more immersive and more or less threatening stimuli and thus help more people, improve their experience and opinion of treatment, as well as their treatment adherence to it.

### 4.1. Future perspectives

The results of the current study indicate several questions that need further exploration in future research to extend the knowledge in this field. First, because the navigable images appeared to be well accepted, a future study where all the exposure scenarios are navigable should be conducted. It would be useful to explore what types of images work best in eliciting anxiety, sense of presence, and reality judgment without being aversive enough to lead to dropout. For this purpose, a study that is not focused on the treatment of the problem, but instead on the sense of presence and reality judgment, could be conducted with different types of images for participants with FP. Another possibility would be to combine different types of images in the program, including less immersive images in the first stages of exposure and more immersive exposure scenarios as the user makes progress or leave the patients to choose which type of images want to use and when in each exposure scenario, according to their level of fear. It is important to take into consideration the severity of the phobia and how it influences what type of stimuli to use. Presenting the images in virtual reality with an inexpensive head mounted display might increase the immersion (Ma et al., 2021).

The role of therapist support in NO-FEAR Airlines should also be explored further to analyze whether this factor influences attrition and satisfaction with the program. Finally, mediation effects between sense of presence, reality judgment, and change at posttreatment should be explored with a larger sample size to see whether the significant relationship found in the current study is maintained.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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