

# Development and Validation of the Spanish Interval Scale of Anxiety Response (ISAR)

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As increasing attention is paid to disparities in oral health care, cross-cultural means for assessing dental fear, a significant barrier to dental care, are in high demand. There is, however, a surprising shortage of Spanish-language dental fear measures in the literature, despite evidence of dental fear and avoidance in Spanish-speaking populations. The goals of the current series of studies were to develop and validate a Spanish-language version of the Interval Scale of Anxiety Response (ISAR). Magnitude estimation, a technique in which participants are asked to assign a number to indicate the perceived intensity of a stimulus or phrase, was used to compare the Spanish ISAR to the original English ISAR during the development studies. As a result of the 4 initial development studies, modifications were made to both the Spanish and English scales. Once 2 seemingly equivalent scales were established, validation studies were completed with native Spanish- and English-speaking dental patients. The results suggest that both the Spanish and modified English ISAR scales are valid measures of state anxiety associated with dental treatment. Additionally, the results of these studies highlight the importance of thoroughly testing translated measures to ensure they are accurately assessing that which they purport to measure.

**Key Words:** Dental anxiety; Psychometrics; Visual analog scale; Translating.

In recent years, increasing attention has been paid to addressing oral health disparities. According to the 2000 US Surgeon General's report on Oral Health in America, non-Hispanic whites have generally better oral health than non-Hispanic blacks, Hispanics, American Indians, and Alaska Natives.<sup>1</sup> Even among these underserved populations, however, oral health disparities are not evenly distributed, and the factors associated with poor oral health are not equivalent.

Within the United States, individuals of Hispanic descent seek dental treatment less often than non-Hispanic whites and are more likely to have untreated dental disease.<sup>1</sup> The Surgeon General's report, however, notes that disparities in the utilization of dental services in His-

panic subgroups, particularly among Mexican Americans, cannot be explained by socioeconomic factors alone. The report recommends that nonfinancial factors such as language and behaviors should be examined as potential contributors to the disparity. Additionally, a recent report on Latino oral health highlighted the need for standardized, validated instruments to assess behavioral factors in Hispanics.<sup>2</sup>

Fear of dentistry poses a significant barrier to receiving dental care, with 5 to 10% of US adults reporting that they have previously avoided seeking dental treatment because of fear.<sup>3</sup> Previous studies of attitudes toward dentistry in multiethnic samples have suggested that individuals of Hispanic descent experience greater dental fear and less dental utilization than do their non-Hispanic white counterparts, coupled with a stronger preference for treatment by Hispanic providers.<sup>4-5</sup> Prior work in Spanish translations of dental fear measures has focused on dental trait (continuously-felt) anxiety scales,

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such as the Dental Anxiety Scale (DAS), the Modified Dental Anxiety Scale (MDAS), and the Dental Fear Survey (DFS).<sup>6–8</sup> Work has not focused on validating measures of state (currently-felt) anxiety. Dental state anxiety scales allow a concise way for patients to indicate how much anxiety they are experiencing while in the immediate dental situation. Such scales are useful in assessing the effectiveness of both pharmacologic and nonpharmacologic interventions to reduce anxiety.

The Interval Scale of Anxiety Response (ISAR)<sup>9</sup> is a labeled vertical visual analog scale developed to measure state anxiety associated with dental treatment. The ISAR includes phrases aligned along the scale at intervals representing the psychological distance between each phrase, developed through magnitude estimation. The ISAR was designed for patients to report anxiety during, in anticipation of, or immediately after dental treatment, and has been shown to have good reliability and validity.<sup>9–10</sup>

The current 6-part study sought to develop and validate a Spanish-language version of the ISAR for use in research on dental fear in Hispanic populations. Magnitude estimation, a technique in which participants are asked to assign a value to indicate the psychological intensity of a stimulus or phrase,<sup>11–12</sup> was used to determine the perceived intensity of the Spanish and English ISAR terms. A similar magnitude estimation technique was also used in developing the original ISAR scale.<sup>9</sup> Validation studies were then completed with both native Spanish- and English-speaking dental patients.

### Study 1: Initial Development of the Spanish ISAR

Study 1 involved the initial translation of Corah's English ISAR terms into Spanish, and the comparison of the magnitude estimates and rankings of these Spanish terms in comparison to the original English ISAR. This study was completed in the Regional Clinical Dental Research Center at the University of Washington in Seattle (UW-RCDRC) and at St Aloysius Catholic Church in Toppenish, Washington.

**Participants.** Thirty-two native English speakers ( $M_{\text{age}} = 27.1$  [SD  $\pm$  7.6] years, 47% female) and 31 native Spanish speakers ( $M_{\text{age}} = 35.9$  [SD  $\pm$  18.5] years, 65% female) participated in Study 1. Participants were recruited via flyers written in Spanish and English and posted at the University of Washington in Seattle. To recruit participants in Toppenish, Washington, an announcement was made by a native Spanish-speaking research team member (LJG) during church services in St Aloysius Catholic Church on the day of the study, inviting individuals to participate in the study at the church

**Table 1.** Anxiety Terms Used in Interval Scale of Anxiety Response (ISAR) Magnitude Estimation Tasks

Study	English	Spanish
1	Calm, Relaxed A Little Nervous Tense, Upset Afraid* (modulus = 10)  Very Afraid Panicked Terrified	Calmado, Relajado Un Poco Nervioso Tenso, Disgustado Tener Miedo* (modulus = 10) Mucho Miedo Con Pánico Aterrorizado
2	Calm, Relaxed A Little Nervous Tense† Afraid Very Afraid* (modulus = 12) Panicked Terrified	Calmado, Relajado Un Poco Nervioso Tenso† Asustado† Muy Asustado*† (modulus = 12) Con Pánico Aterrorizado
3	Calm, Relaxed A Little Nervous Tense Afraid Very Afraid* (modulus = 12) Panicked Completely Terrified†	Same as Study 2
4	Calm, Relaxed A Little Nervous Tense Afraid Very Afraid* (modulus = 12) Panicked Absolutely Terrified†	Same as Study 2

\* Modulus always presented first.

† Modified from previous study.

after services. Participants received \$20 or \$50 (for Spanish speakers in Seattle) for their participation in the study. All study procedures were reviewed and approved by the University of Washington Human Subjects Division. Informed consent was obtained from all participants 18 years of age and older, and participant assent and parental consent was obtained from all participants between the ages of 12 and 17 years. Children under the age of 12 years were not recruited for this study.

### Procedures

**Term Selection.** English terms from Corah's original ISAR (Table 1) were translated into Spanish by a native English-speaking research team member fluent in Spanish (LWG) and then reviewed with a native Spanish-speaking research team member fluent in English (LJG) to check for accuracy. Once agreement had been reached between the 2 investigators on the Spanish translations, the English and Spanish terms were used

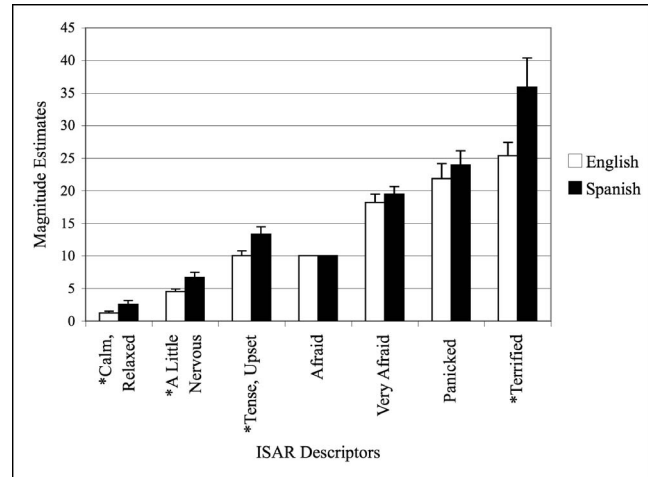
in the magnitude estimation and ranking tasks described below.

**Methods.** Magnitude estimation and ranking procedures were explained to participants in English (for native English speakers) or Spanish (for native Spanish speakers). For the magnitude estimation task, participants were told the purpose of the task, namely, to assign a number to each word or phrase to indicate its perceived intensity. To aid participants in this task, one word was consistently presented first as the modulus and given a set value. For Study 1, “Afraid” in English (“Tener Miedo” in Spanish) was used as the modulus and assigned the value 10. All words, English and Spanish, were printed on individual laminated cards and held up while the examiner read each word. (See Table 1 for English and Spanish words used for each study.)

Once presented with the modulus phrase and its value, participants were asked to assign values to the following phrases in proportion to their relative intensity compared with the modulus. To make this clear, the following instructions were given to the participants:

“I am going to ask you to give numbers to indicate the intensity described by a word or phrase. I want you to assign the number proportionally. So, for example, consider the words ‘Mild,’ ‘Moderate,’ and ‘Strong’ to describe pain. In this case, I want you to start with the word ‘Moderate’ [examiner holds up card reading ‘Moderate’]. The first word I give you will be assigned the value 10. Since ‘Moderate’ is the first word, we’ll give it the number 10. If you think that the word ‘Strong’ [holds up card reading ‘Strong’] indicates pain twice as great as ‘Moderate’, you would give a number twice as large as the number for ‘Moderate.’ The number twice the size of 10 is 20, so you would say 20. If ‘Strong’ seems more than twice the intensity, you might want to give it a number like 25 or 30, or even 40 or 50. You can go up as high in numbers as you think is appropriate. Next, I’ll give you the word ‘Mild’ to describe pain [holds up card reading ‘Mild’]. If you think that ‘Mild’ pain is half as strong as ‘Moderate’ pain, you would say 5 for ‘Mild.’ However, if they seem more similar, you would give a number closer to 10, such as 8 or 9, or even the same number 10 if you feel that ‘Mild’ and ‘Moderate’ pain are the same thing.”

Participants then completed a practice task, using words to describe height (“Average,” “Tall,” “Short,” “Towering,” “Squat”). Participants’ understanding of magnitude estimation was assessed during this task, and further explanations given as needed. Once it was determined that participants understood the task, we proceeded with the magnitude estimation tasks using the words shown in Table 1. The modulus was always pre-



**Figure 1.** Study 1—Initial Spanish ISAR versus Original English ISAR Magnitude Estimates. The asterisk indicates significance at  $P < .05$ . Modulus = 10 (Afraid/Tener Meido). T-bars indicate standard error.

sented first. The order of the remaining words was determined by a Latin Square design.

The examiner held up laminated cards with each word as the word was read out loud. The participant provided numerical values for each word, which were recorded by the examiner. The magnitude estimation task was repeated twice for each set of words. Once the magnitude estimation task was completed, each participant was handed the entire set of words on laminated cards and asked to place the words in order (from least to most intense) on a table set in front of the participant. The examiner recorded the order provided by the participant. For analyses, numbers recorded by the examiner were entered into an SPSS (version 11) database and checked line by line for accuracy against the paper recording.

**Data Analysis.** Raw magnitude estimates were averaged across the 2 trials. Mean magnitude estimates were then entered into a 2 (language version) by 6 (phrase) repeated measures analysis of variance (ANOVA) to test for language version differences in magnitude estimates.  $T$ -tests were subsequently used to confirm significant differences in magnitude estimates between each English phrase and its Spanish translation. Within each language, sign tests were used to confirm that rankings significantly differed between each of the phrases.

**Results.** Spanish speakers provided higher magnitude estimates than did English speakers for 4 of 6 terms (Figure 1). Specifically, independent sample  $t$ -tests showed that Spanish speakers were rating the following terms as more intense than their English-speak-

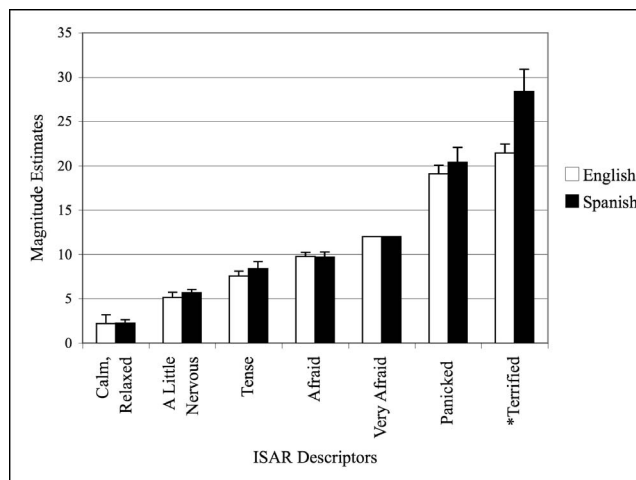
ing counterparts: “Calmado, Relajado” (“Calm, Relaxed”;  $t = 2.05, P < .05$ ), “Un Poco Nervioso” (“A Little Nervous”;  $t = 2.34, P < .05$ ), “Tenso, Disgustado” (“Tense, Upset”;  $t = 2.40, P < .05$ ), and “Aterrorizado” (“Terrified”;  $t = 2.17, P < .05$ ).

For the ranking task, rankings for all English phrases were significantly different from each other ( $P < .01$ ). Two Spanish phrases, however, did not significantly differ in ranking from one another. Specifically, rankings for “Tenso, Disgustado” (“Tense, Upset”) were not significantly different from rankings for “Tener Miedo” (“Afraid”; sign test = 1.44,  $P = 0.15$ ).

**Discussion.** Four of 6 terms tested significantly different between Spanish and English, with Spanish speakers giving them higher intensities. Additionally, the 2 other terms tested showed nonsignificant trends to be higher in Spanish than in English. One possible explanation for this is that the phrase selected for the Spanish modulus was not equivalent to the phrase selected as the English modulus. Instead, it is possible that the phrase used as the Spanish modulus has a lower perceived intensity compared with the phrase used as the English modulus. In a situation where the phrase assigned the value 10 in Spanish actually has a lower perceived intensity than the phrase assigned 10 in English, all the phrases tested in Spanish would receive artificially inflated magnitude estimates compared with the English terms. Since all 6 Spanish terms were rated as more intense than the corresponding English terms, 4 significantly so, we felt this was a likely explanation for the large discrepancy in perceived magnitudes observed between language versions. The Spanish translation of the term used for “Afraid” was therefore revisited by the research team.

The word “Afraid” was reviewed by a native Spanish speaker of Mexican descent (LJG) and a native English speaker fluent in Spanish (KAB). The English word was retranslated as “Asustado” in an attempt to develop more comparable scales. For Study 2, “Tener Miedo” (“Afraid”) was replaced with “Asustado,” and “Mucho Miedo” (“Very Afraid”) was replaced with “Muy Asustado.”

A further change resulted from the debriefing of participants in Study 1. Participants indicated that including the word “upset,” in the phrase, “Tense, upset,” made the ranking task difficult and raised the perceived intensity of the entire phrase. After discussion by the research team, the third descriptor, “Tense, upset,” was changed to “Tense,” in order to reduce its perceived intensity. Accordingly, “Tenso, Disgustado,” was changed to “Tenso,” to maintain consistency between the scales. The phrase used as the modulus was also



**Figure 2.** Study 2—Modified Spanish ISAR versus Original English ISAR Magnitude Estimates. The asterisk indicates significance at  $P < .05$ . Modulus = 12 (Very Afraid/Muy Asustado). T-bars indicate standard error.

changed to “Very Afraid” (“Muy Asustado”) and set to 12.

### Study 2: Modification of the Spanish ISAR

Study 2 was conducted to assess the magnitudes of the new Spanish phrases compared with their English equivalents.

**Participants.** Thirty native English speakers ( $M_{\text{age}} = 28.6$  [SD  $\pm$  6.7] years, 63% female) and 30 native Spanish speakers ( $M_{\text{age}} = 28.1$  [SD  $\pm$  9.6] years, 67% female) participated in Study 2, conducted entirely in the UW-RCDRC.

**Procedures.** Magnitude estimation and ranking tasks were performed as described in Study 1. However, for Study 2, the modulus was “Very Afraid/Muy Asustado,” which was assigned a value of 12.

**Data Analysis.** Data from the magnitude estimation and ranking tasks were analyzed in the same manner as described in Study 1.

**Results.** Spanish speakers provided higher ratings than did English speakers at the highest end of the scale (Figure 2). Specifically, “Aterrorizado” was rated significantly higher than “Terrified” ( $t = 2.6, P < .05$ ). There were no other significant differences between Spanish and English terms.

On the ranking task, the rankings for all but 2 English phrases were significantly different from each other. Specifically, rankings for “Panicked” were not significantly different than rankings for “Terrified” (sign test



= 1.28,  $P = .20$ ). The rankings for all Spanish terms were significantly different from one another.

**Discussion.** These results suggest a problem with the English ISAR, rather than the Spanish version. That participants failed to discriminate between “Panicked” and “Terrified” suggests that these 2 words are too closely related in intensity. In Study 3 therefore “Terrified” was replaced with “Completely Terrified” in an attempt to match the perceived intensity of “Aterrorizado” and to produce more distinct differences between the 2 phrases at the upper end of the scale.

### Study 3: Reexamination of the English ISAR

For Study 3, native English speakers were tested with the new English phrases and the results were compared to Spanish speakers’ data from Study 2.

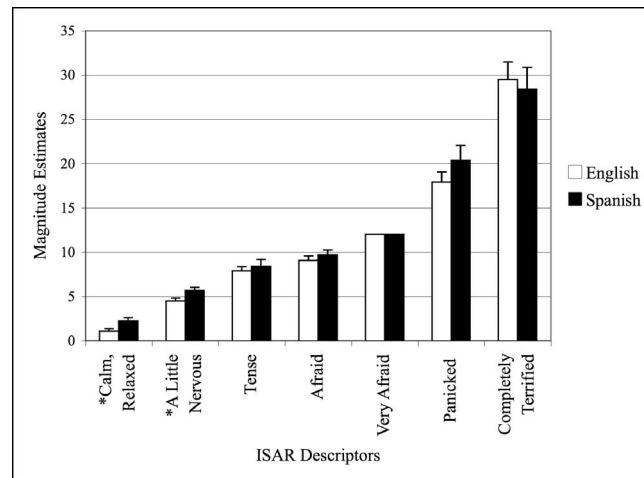
**Participants.** Thirty native English speakers ( $M_{\text{age}} = 33.4$  [SD  $\pm 14.4$ ] years, 50% female) participated in Study 3, conducted in the UW-RCDRC.

**Procedures.** Participants completed the magnitude estimation and ranking tasks as described previously. Only English words were assessed in this study, and all terms were identical to those in the original ISAR, with the following exceptions: “Tense, Upset,” was shortened to “Tense,” and “Terrified” was changed to “Completely Terrified.”

**Data Analysis.** Data from the magnitude estimation and ranking tasks were analyzed in the same manner as the previous 2 studies. Data from the Spanish speakers in Study 2 were used for comparison with English speaker data collected in Study 3.

**Results.** When compared with the magnitude estimates for the Spanish scale from Study 2, significant differences were found on the lower end of the scale (Figure 3). Specifically, English speakers rated “Calm, Relaxed” as less intense than “Calmado, Relajado” ( $t = 2.55$ ,  $P < .05$ ), and rated “A Little Nervous” as less intense than “Un Poco Nervioso” ( $t = 2.48$ ,  $P < .05$ ). On the ranking task, the rankings for all English terms were significantly different from one another ( $P < .05$ ).

**Discussion.** We hypothesized that the lowering of magnitudes of phrases at the low end of the scale compared with the magnitudes provided in Study 2 may be due to a context effect.<sup>13</sup> Specifically, the inclusion of a high intensity phrase may have lowered the value estimates for other phrases presented in the same set. This suggests that “Completely Terrified” may be more in-



**Figure 3.** Study 3—Modified Spanish ISAR (from Study 2) versus Modified English ISAR Magnitude Estimates. The asterisk indicates significance at  $P < .05$ . Modulus = 12 (Very Afraid/Muy Asustado). T-bars indicate standard error.

tense than “Aterrorizado,” although the magnitude estimates for these 2 terms are not significantly different from one another. Therefore, for Study 4, “Completely Terrified” was replaced with “Absolutely Terrified.”

### Study 4: Modification of the English ISAR

The second revision of the English phrases was assessed in Study 4.

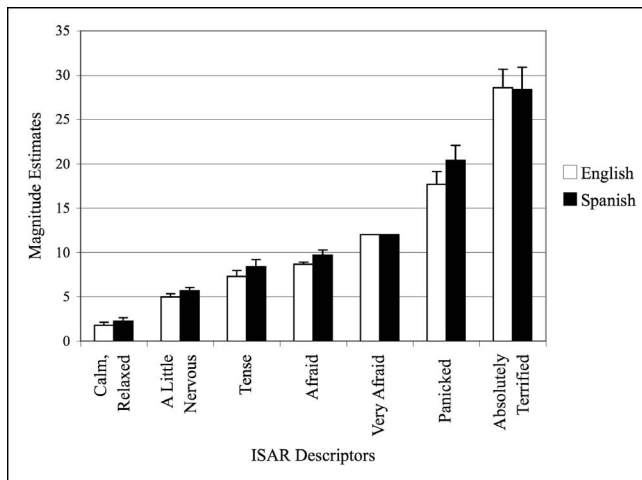
**Participants.** As in Study 3, 30 native English speakers ( $M_{\text{age}} = 33.8$  [SD  $\pm 16.9$ ] years, 50% female) participated in this study, conducted entirely in the UW-RCDRC.

**Procedures.** Tasks were completed in an identical manner to Study 3, with the exception that the English phrase, “Completely Terrified” was replaced with “Absolutely Terrified.”

**Data Analysis.** Data from the magnitude estimation and ranking tasks were analyzed in the same manner as described in Study 3.

**Results.** When compared with the magnitude estimates for the Spanish scale from Study 2, no significant differences were found between the Spanish and English scales (Figure 4).

On the ranking task, the rankings for all but 2 English phrases were significantly different from each other. Specifically, rankings for “Very Afraid” were not significantly different than rankings for “Panicked” (sign test = 1.28,  $P = .20$ ).



**Figure 4.** Study 4—Modified Spanish ISAR (from Study 2) versus Revised English ISAR Magnitude Estimates. Modulus = 12 (Very Afraid/Muy Asustado). T-bars indicate standard error.

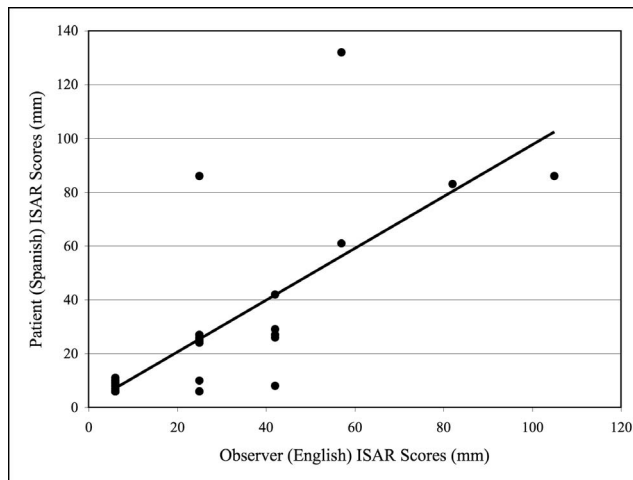
**Discussion.** Although in Study 4, the rankings of “Very Afraid” and “Panicked” did not significantly differ from one another, we took this to be a spurious result, as these phrases were ranked differently in the previous 3 studies. The perceived intensity of the terms on the Spanish ISAR from Study 2 and the modified English ISAR from Study 4 showed no significant differences; therefore, we concluded that we have identified phrases with matched intensities in English and Spanish. The remaining 2 studies were completed to assess the validity of a new Spanish scale with the phrases tested in Study 2 and a revised English scale with the phrases tested in Study 4 in dental patient populations.

**Study 5: Validation of the Spanish ISAR in a Dental Patient Sample**

The goal of Study 5 was to test the validity of the Spanish ISAR in a native Spanish-speaking dental patient population.

**Participants.** Ninety-nine ( $M_{age} = 27.6 [SD \pm 10.9]$  years, 65% female) Spanish-speaking dental patients from a rural Washington dental clinic participated in Study 5. Patients were recruited into the study, and consented to participate, prior to their dental procedures. Participants received \$10 gift cards to a local grocery store for their participation in the study.

**Procedures.** Following their dental procedures, patients indicated their anxiety during their dental appointment on a 140-mm vertical visual analog scale with the Spanish-language phrases tested in Study 2 (see Table 1) used as labels along the scale. Labels were presented



**Figure 5.** Study 5—Correlation between Spanish and English ISAR. Spearman’s  $r = .69, P < .001$ .

at distances in the same proportion as used in Corah’s original scale.<sup>8</sup> Patients also checked off the dental procedure(s) they had completed from a list of possible procedures. A dental assistant from the research team (LJG) familiar with this population (and blind to patients’ responses) rated how anxious each patient appeared to be during the dental procedures using Corah’s original English-language scale.<sup>9</sup>

Afterwards, patients completed Spanish translations of the Modified Dental Anxiety Scale (MDAS),<sup>14</sup> Dental Fear Survey (DFS),<sup>15</sup> and Needle Survey,<sup>6–7,16</sup> as well as demographic questions.

**Data Analysis.** Spearman’s bivariate correlations were conducted to assess the relationships between dental fear measures. Nonparametric tests were used as conservative measures of the relationships between the ISAR and other measures due to the nonequal intervals between descriptors on the ISAR. Mann-Whitney  $U$  tests were conducted to examine differences in self-reported dental fear by gender, as well as by treatment type. Cases with missing data were excluded from analysis.

**Results.** Patients’ self-ratings on the Spanish ISAR were significantly correlated with the dental assistant’s observer-ratings of their anxiety reported on Corah’s original English ISAR (Spearman’s  $r = .69, P < .001$ ; Figure 5). Patient’s self-ratings on the Spanish ISAR also significantly correlated with the other 3 Spanish dental fear measures ( $P < .01$ ; Table 2). There were no significant differences by gender or treatment type in patients’ ISAR scores. No gender differences emerged for the 3 Spanish dental fear measures ( $P > .05$ ).

Twenty-three patients did not indicate what treatment

**Table 2.** Study 5—Spearman’s *r* Correlations Between the Spanish ISAR and Other Spanish Dental Fear Measures\*

	Spanish ISAR	Spanish DFS	Spanish MDAS	Spanish Needle Survey
Spanish ISAR	—			
Spanish DFS	.51 <sup>A</sup>	—		
Spanish MDAS	.49 <sup>A</sup>	.66 <sup>A</sup>	—	
Spanish Needle Survey	.40 <sup>A</sup>	.44 <sup>A</sup>	.36 <sup>A</sup>	—

\* ISAR indicates Interval Scale of Anxiety Response; DFS, Dental Fear Survey; and MDAS, Modified Dental Anxiety Scale.

<sup>A</sup> *P* < .01.

they had done. The 5 patients indicating that they had received extractions tended to have higher ISAR scores than patients receiving other treatments; however, power to detect this was low and the trend did not reach statistical significance (*U* = 97.5, *P* = .09).

**Discussion.** An observer’s ratings of patient anxiety significantly correlated with patients’ self-ratings on the Spanish ISAR. This version of the Spanish ISAR was positively and significantly correlated with previously-developed Spanish versions of other dental fear measures. The Spanish-language ISAR thus appears to be valid in a Mexican-American dental patient population.

**Study 6: Validation of the Revised English ISAR in a Dental Patient Sample**

The goal of Study 6 was to validate the Revised English ISAR in a sample of native English-speaking dental patients. The Revised English ISAR was validated against the English versions of the MDAS (DAS),<sup>14</sup> DFS,<sup>15</sup> and Needle Survey.<sup>16</sup>

**Participants.** One hundred native English speakers (*M*<sub>age</sub> = 43.4 [SD ± 15.4] years, 54.6% female) participated in this study, conducted at a private dental practice in Longview, Washington. Participants received \$10 gift cards to a local grocery store for their participation in the study and were recruited by the staff of the dental clinic as they checked in for their previously scheduled appointments.

**Procedures.** Participants completed the consent process prior to receiving their scheduled treatments. After the procedure, but before leaving the operatory, participants were given a paper form of the Revised English ISAR to complete, and asked to rate their anxiety “in general” during that day’s procedure. They were also asked to indicate what treatment(s) they had

**Table 3.** Study 6—Spearman’s *r* Correlations Between the Modified English ISAR and Other English Dental Fear Measures\*

	Modified English ISAR	English DFS	English MDAS	English Needle Survey
Modified English ISAR	—			
English DFS	.76 <sup>A</sup>	—		
English MDAS	.61 <sup>A</sup>	.78 <sup>A</sup>	—	
English Needle Survey	.48 <sup>A</sup>	.64 <sup>A</sup>	.63 <sup>A</sup>	—

\* ISAR indicates Interval Scale of Anxiety Response; DFS, Dental Fear Survey; and MDAS, Modified Dental Anxiety Scale.

<sup>A</sup> *P* < .001.

completed that day. After completing the paper form, the participants were escorted to a separate room to complete computerized dental fear measures (MDAS, DFS, Needle Survey).

Participants were instructed to use the code number written on the paper ISAR form to sign in to the computer program in order to match the paper and computerized data without personal identifiers. Data from the computerized measures were encrypted for security purposes. Participants then completed the MDAS, DFS, Needle Survey, and questions on demographic information (age, gender, racial background, ethnicity, education, and family’s country of origin), all presented on a Macintosh iBook G4 laptop computer.

**Data Analysis.** Data from the computerized measures were decrypted and transferred into an SPSS (version 11) database. Data from the paper forms were entered into this database by hand and 100% were verified for accuracy.

Spearman’s bivariate correlations were conducted to assess the relationships between dental fear measures. Nonparametric tests were used as conservative measures of the relationships between the ISAR and other measures due to the nonequal intervals between descriptors on the ISAR. Mann-Whitney *U* tests were conducted to examine differences in self-reported dental fear by gender, as well as by treatment type.

**Results.** Revised English ISAR scores were positively and significantly correlated with scores on all dental fear measures, and all these measures were positively correlated with one another (*P* < .05; Table 3). Females reported higher levels of fear on the DFS (*U* = 793.5, *P* < .01) and Needle Survey (*U* = 965.5, *P* < .01), while no gender differences were noted for ISAR (*U* = 970.5, *P* > .05) or MDAS scores (*U* = 1032.0, *P* > .05).

Patients receiving prophylactic (cleaning) treatment ( $N = 21$ ) reported lower anxiety on the Revised English ISAR ( $U = 529.0$ ,  $P < .05$ ) and DFS ( $U = 582.5$ ,  $P < .05$ ) than those receiving other types of treatment. Patients having extractions ( $N = 10$ ) scored higher on the Needle Survey than patients not having extractions ( $U = 252.5$ ,  $P < .05$ ). No other differences by treatment type were noted.

**Discussion.** Given the strong correlations between the Modified English ISAR and other valid and reliable dental fear measures in a dental patient sample, the Modified English ISAR appears to be a valid means of assessing dental anxiety.

## GENERAL DISCUSSION

The 2 primary goals of this study were to develop and validate a Spanish-language version of the ISAR. Other dental fear measures have been translated into several different languages, such as Portuguese,<sup>17</sup> Chinese,<sup>18</sup> Japanese,<sup>19</sup> Turkish,<sup>20–21</sup> and Swedish.<sup>22</sup> Yet historically, there has been a shortage of Spanish-language dental fear measures available in the literature. Recent efforts in this area have focused on Spanish translations of dental trait anxiety scales, such as the Dental Anxiety Scale and Dental Fear Survey.<sup>6–8</sup> The current study represents the first attempt to develop and validate a Spanish-language dental state anxiety measure, that is, a measure that can be used to assess state anxiety unique to the dental situation.

The first 4 studies focused on the development of a Spanish version of the ISAR that is equivalent to the English version developed by Corah and colleagues.<sup>9–10</sup> Through magnitude estimation, used by Corah in the development of the original scale, and translation efforts and discussion within the research team, Spanish terms were identified that very closely matched the perceived intensity of the original ISAR terms. Slight modifications to the English ISAR terms produced 2 very similar scales whose terms matched in perceived intensity.

The steps taken in the first 4 development studies highlight the importance of thoroughly testing translated measures to ensure that the translated measure is consistent with the original scale. Had additional testing not been done on the Spanish ISAR translation, use of the original translation would have resulted in underestimates of dental fear in Spanish-speaking samples.

The current study also served to validate the Spanish and Modified English ISAR scales in both native Spanish- and English-speaking dental patient samples. Both scales correlated positively and significantly with previously developed reliable and valid dental fear measures,

and, in the case of the Spanish ISAR, with observer ratings of anxiety. Similar to previous work by Corah and colleagues, patients having teeth extracted in the Spanish-speaking sample tended to score higher on the self-reported ISAR than patients not having teeth extracted.<sup>10</sup> While laboratory testing with magnitude estimation is important for the initial development of a scale such as the ISAR, it is critical to validate such a scale under “real world” conditions to ensure that it measures what it purports to measure in the population of interest.

We recognize that as the current Spanish-language ISAR was developed and tested with Spanish speakers of Mexican descent, its utility with other Spanish-speaking populations (eg, individuals from Puerto Rico, Cuba, Spain) is yet unknown. Further adaptation of the scale may be needed to address these populations, and future research will focus on other Spanish-speaking populations. The current scales also rely on an individual’s level of literacy, although to a lesser extent than multi-item measures. No participants in either the Spanish- or English-speaking groups reported difficulty with the ISAR measure, although some may be hesitant to admit to having difficulty reading or understanding the scale. Our group is currently examining how to assess dental fear in ways that do not require high levels of literacy.

Despite the work still to be done, the current study serves to address a need for a valid and reliable dental state anxiety assessment that may be used with both Spanish- and English-speaking populations. In addition to such barriers as economic, language, and geographic factors, dental fear poses a significant barrier to gaining adequate oral health care for underserved populations. The Spanish and Modified English ISAR measures may be used as tools to help better understand the role that dental fear plays in the greater realm of oral health disparities.

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