Original Article

The Italian Version of the Weinstein Noise Sensitivity Scale

Measurement Invariance Across Age, Sex, and Context

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Abstract. The Weinstein's Noise Sensitivity Scale (WNSS) is one of the most widely used questionnaires to measure noise sensitivity, the most important subjective factor moderating the impact of noise on perceived annoyance. The present study evaluates the psychometric properties of the Italian version of the WNSS, tests the measurement invariance of this scale as a function of internal and external factors, and evaluates the effect of age, sex, and context on noise sensitivity. The scale was administered to a sample of 413 adults (40% females) living in quiet or noisy contexts. Dimensionality, reliability, invariance, validity, and equivalence were analyzed. Results confirmed that the WNSS is a reliable, valid, and invariant scale. Furthermore, noise sensitivity is affected by both subjective factors, such as age and sex, and external factors, such as living context.

Keywords: Weinstein Noise Sensitivity Scale, measurement invariance, measurement equivalence, age, sex, and noisy context

In everyday life noise is one of the main factors producing environmental pollution and psychosocial stress, with a considerable negative effect on individual health (Niemann et al., 2006). In the literature, the effect of noise annoyance on people has been widely investigated in different domains and in different countries. The results indicate that noise exposure, and consequently noise annoyance, negatively influences health, cognitive abilities, and general quality of life. For example, a recent study showed an association between noise exposure and cardiovascular risks (Sobotova, Jurcovicova, Stefanikova, Sevcikova, & Aghova 2010). Jakoljevič, Belojevič, Paunovič, and Stojanov (2006) found that people living in noisy areas are at a higher risk for sleep disturbance than people living in quiet areas. Pawlaczyk-Łuszyńska, Dudarewicz, Waszkowska, and Szymczak (2005) reported that noise, even at moderate levels, negatively affects cognitive tasks requiring high attentional resources.

However, several studies have shown that other factors than noise exposure codetermine the annoyance, either additionally or in interaction with noise exposure (for a review, see Miedema & Vos, 2003). For example, noise annoyance is regulated by some external factors, such as context (Jakoljevič et al., 2006), and by some internal or individual factors, such as age (Michaud, Keith, & McMurchy, 2008; Van Gerven, Vos, Van Boxtel, Janssen, & Miedema, 2009), sex (Dratva et al., 2010; Melamed, Fried, & Froom, 2004), and educational level (Michaud et al., 2008).

Among others, one internal factor that has revealed a robust impact on noise annoyance and health is noise sensitivity. Noise sensitivity is conceptualized as a stable subjective attribute, independent of noise exposure, that influences personal reactions to environmental noise (Weinstein, 1978, 1980). Several studies demonstrated that the negative effects of noise exposure on health are modulated or mediated by noise sensitivity (Miedema & Vos, 2003; Paunovič, Jakoljevič, & Belojevič, 2009; Schreckenberg, Griefahn, & Meis, 2010; Smith, 2003). Noise sensitivity has related to hypertension and chest pain (Fyhri & Klaeboe, 2009), and the risk for cardiovascular mortality is higher in noise-sensitive women than men (Heinonen-Guzejev et al., 2007). Moreover, noise sensitivity is one of the factors affecting noise-induced sleep disturbance (Aasvang, Moum, & Engdahl, 2008; Nivison & Endresen, 1993).

Several studies have shown from a psychological perspective that noise sensitivity modulates the negative impact of noise on cognitive abilities. When people have to perform tasks that require the active component of working memory, noise-sensitive individuals are more distracted by noise than less sensitive ones (Sandrock, Schütte, & Griefahn, 2009). Further, noise sensitivity seems to be correlated with academic performances and some personality factors. For example, Weinstein (1978) found that noise-sensitive students were lower in scholastic ability, felt less secure in social interactions, and had a greater desire for privacy than their less noise-sensitive peers. Finally, several researchers suggested that noise sensitivity is associated

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with affective states, that is noise-sensitive people are less satisfied with their living environment and with their general quality of life than those who are less noise sensitive (Nijiland, Hartemink, van Kamp, & van Wee, 2007; Weinstein, 1980).

Since noise annoyance does not depend exclusively on noise exposure levels – or the physical features of the sound – and since subjective responses have a fundamental relevance for the prediction of people's reaction to noise, researchers have developed different instruments to measure noise sensitivity. Among them, the Weinstein's Noise Sensitivity Scale (WNSS) is the one most widely used and best validated.

The WNSS consists of 21 items that express affective reactions and attitudes to noise in general and to a variety of everyday environmental sounds (Table 1). To avoid the response effect, 7 out of 21 items are formulated in the reverse direction. For every statement, participants have to indicate their agreement by means of a 6-point Likert scale, which ranges from *disagree strongly* to *agree strongly*. Agreement with the item indicates greater noise sensitivity of the respondent. The scale showed adequate reliability indices (reliability coefficient = .83; 8-month test-retest correlation was .63; Weinstein, 1978).

Since its development, the WNSS has been translated into different languages and has shown good psychometric properties, although it is important to note that, to our knowledge, its crossculture measurement invariance (MI) has not yet been tested. Zimmer and Ellermeier (1999) translated the WNSS into German and compared the scale with three self-report measures of noise sensitivity. A group of 213 German college students (aged 19–44 years) was submitted to the German WNSS, a newly constructed noise-sensitivity questionnaire, and two 1-item self-ratings capturing susceptibility to sounds and susceptibility to noise. Results indicated that the WNSS was the instrument with the best psychometric properties (reliability coefficient = .87). Alimohammadi, Nassiri, Azkhosh, Sabet, and Hosseini (2006) translated the WNSS into Persian and investigated the reliability, validity, and dimensionality of the scale in a sample of 287 nonindustrial Iranian employees (age range 17–76 years, M = 34.2 years). They observed an adequate reliability (reliability coefficient = .78) and an adequate 9-week test-retest correlation (r_{tt} = 66). Besides, an explorative principal components factor analysis confirmed the unidimensionality of the scale, where the first component explained 20.6% of the total variance (with an eigenvalue = 4.3). In a sample of 236 Swedish university students, Ekehammar and Dornic (1990) evaluated the reliability and construct validity of the adapted Weinstein Noise Sensitivity Scale. In this case, too, the results indicated satisfactory psychometric properties of the scale (reliability coefficients > .84) and supported the external validity.

To our knowledge, there is no Italian version of the WNSS, and the dimensionality of the scale has not been analyzed by means of confirmative factorial analyses. The present study aimed to develop an Italian version of the WNSS and to investigate its psychometric properties. Moreover, because noise sensitivity has been associated in the literature with internal and external factors, an additional aim of the present paper was to investigate the effects of age, sex, and context on noise sensitivity. To this end, we analyzed the dimensionality and reliability of the scale. To investigate the comparability of the noise sensitivity scores as a function of age, sex, and context, we performed MI tests so as to exclude any measurement artifact in the cross-

Table 1. Factor loadings for explorative factor analysis with promax rotation of 20-item WNSS

Item No.	Wording	F1	F2
1*	I wouldn't mind living on a noisy street if the apartment I had was nice.	.082	**.333**
2	I am more aware of noise than I used to be.	**.487**	–.046
3*	No one should mind much if someone turns up his stereo full blast once in a while.	–.080	**.399**
4	At movies, whispering and crinkling candy wrappers disturb me.	**.538**	–.061
5	I am easily awakened by noise.	**.439**	.093
6	If it's noisy where I'm studying, I try to close the door or window or move somewhere else.	**.467**	.048
7	I get annoyed when my neighbors are noisy.	**.557**	.169
8*	I get used to most noises without much difficulty.	–.012	**.727**
9	How much would it matter to you if an apartment you were interested in renting was located across from a fire station?	–	–
10	Sometimes noises get on my nerves and get me irritated.	**.775**	–.143
11	Even music I normally like will bother me if I am trying to concentrate.	**.519**	.004
12*	It wouldn't bother me to hear the sounds of everyday living from neighbors (footsteps, running water, etc.).	–.132	**.563**
13	When I want to be alone, it disturbs me to hear outside noises.	**.540**	.030
14*	I am good at concentrating no matter what is going on around me.	.080	**.626**
15*	In a library, I don't mind if people carry on a conversation if they do it quietly.	.054	**.362**
16	There are often times when I want complete silence.	**.716**	–.143
17	Motorcycles ought to be required to have bigger mufflers.	**.508**	.028
18	I find it hard to relax in a place that's noisy.	**.591**	.078
19	I get mad at people who make noise that keeps me from falling asleep or getting work done.	**.548**	.084
20*	I wouldn't mind living in an apartment with thin walls.	.090	**.341**
21	I am sensitive to noise.	**.668**	.081

Note. Factor loadings > .30 are in **boldface**. *Reverse item. Dash indicates excluded items.

group comparisons. Further, several studies reported that noise annoyance and noise sensitivity are associated with affective states, such as anxiety and quality of life. Therefore, to assess the nomological validity and the equivalence of the WNSS, we analyzed the relationship between the WNSS and measures of anxiety, quality of life, and depression. Finally, the effects of internal and external factors on noise sensitivity were investigated by means of ANOVAs.

Method

Participants

The sample included 413 adults living in southern Italy (Campania), aged between 18 and 60 years (164 females, 249 males; $M_{age} = 36.8$, $SD = 12.9$). Paper-and-pencil questionnaires were administered individually. In terms of living situation, 21.1% of participants lived in a historical city center, 43.1% in an intermediate zone, 29.9% in a peripheral zone, and 5.9% in a rural zone. Participants were classified as living in a quiet place ($n = 187$, 45.3%) or in a noisy place ($n = 226$, 54.7%) according to the description of the characteristic of the living places.

Measures

The WNSS

An Italian version of the WNSS was developed using standard forward- and backtranslation procedures (Maxwell, 1996). The Italian version the WNSS also consists of 21 items (7 reversed), and participants have to indicate their agreement by means of a 6-point Likert scale. The 7 reversed items were scored in the same direction of the other items.

State-Trait Anxiety Inventory Form Y (STAI)

The STAI (Spielberger, 1989) consists of two 20-item scales that measure state and trait anxiety. In this study we only used the trait scale, which assesses long-term manifestation of anxiety by asking participants how they typically feel. Items were rated on a 4-point Likert scale, from 1 (*almost never*) to 4 (*almost always*). In the current study the reliability of the scale measured by means of Cronbach's α was .913.

Quality of Life and Depression

The Italian version of the Psychological General Well-Being scale (PGWB; Dupuy, 1984; Grossi, Mosconi, Groth, Niero, & Apolone, 2002) was used as a measure of quality of life. This is a 22-item questionnaire designed to measure self-representations of intrapersonal affective or emotional states reflecting a sense of subjective well-being or distress. Items are organized into six subscales that measure anxiety, depressed mood, positive well-being, self-control, general health, and vitality. For each item, participants are asked to rate the intensity or frequency of the experience during the past month on a 6-point Likert scale. The scale showed adequate validity and reliability indices for both the total scale and the subscales. To test the concurrent and discriminant validity of the WNSS, we considered the total score of the PGWB (general quality of life; QoL) and the depressed mood subscale (DS), respectively. In the current study the reliability of the scales measured by means of Cronbach's α were .949 and .806 for the general score and the depressed mood, respectively.

Procedure

Participants were recruited for participation in the study by an ad hoc sampling from different cities in the Campania region. Each participant first completed a demographic form, followed by the other measures administered in random order.

Analyses

Item Homogeneity

Range and mean of interitem correlations were used as a measure of item homogeneity.

Explorative Factor Analysis

The latent dimensionality of the 20-WNSS was analyzed by an exploratory principal axis factoring analysis. The oblique (promax) rotation was performed to interpret the factorial solution.

Confirmatory Factor Analysis (CFA)

CFA was used to test the factorial structure of the 20-item scale. Two models were compared: A one latent factor model (1-factor model) and a two correlated latent factors (2-factor model). As fit indices, we used maximum likelihood χ^2 goodness-of-fit test statistics in conjunction with other practical tests of fit that are less dependent on N (Cheung & Rensvold, 2002): (a) the root mean square error of approximation index (RMSEA; Steiger, 1990); (b) the comparative fit index (CFI; Bentler, 1990); (c) the nonnormed fit index (NNFI; Tucker & Lewis, 1973); and (d) the ratio χ^2/df (Kline, 2005). For χ^2, test values associated with $p > .05$ were considered well-fitting models; for the RMSEA index, values up to .06 or lower were considered indicating good fitting models (Hu & Bentler, 1998); for the CFI (Bentler, 1990) and for the NNFI indices, values > .90 were considered as indicating adequate fit of the model to the data; for the ratio χ^2/df values < 3 were considered as indicating adequate fit. Finally, the difference in χ^2 statistics (χ^2_{diff}), and CFI values (ΔCFI, Cheung & Rensvold, 2002) were used to test the relative fit of nested models (Vandenberg & Lance, 2000).

Measurement Invariance (MI)

Measurement Invariance (MI) across groups is a logical prerequisite for conducting substantive group comparisons (Vandenberg & Lance, 2000). In the absence of the MI of a measure, we cannot be sure that the same construct is being assessed across groups and whether results can be ascribed to group differences or to measurement artifacts (Chan, 2000; Meredith, 1993). In their review of the MI literature, Vandenberg and Lance (2000) recommended moving beyond tests of the reliability and validity of a scale and evaluating the MI of the scale. To test MI, one first assesses the omnibus test of the equality of covariance matrices across groups. If this test holds, no further tests are needed. In the absence of covariance matrices equality, the configural invariance test, the metric invariance test, the scalar invariance test, the invariant uniquenesses test, and the invariant factor variance and factor covariance tests should be executed (Vandenberg & Lance, 2000) to define the specific invariances that hold for the measure.

Reliability

Reliability was examined using Cronbach's α and split-half for the 20-WNSS score. Also, to test the invariance of the measure the Cronbach's α coefficients were compared according to the invariance factors (Feldt, 1969).

Nomological Validity and Measurement Equivalence

Pearson product-moment correlations were used to measure the association between the 20-WNSS score and the other selected measures. Given the multiple hypothesis testing, to control the increase of type I error, we applied the Hommel's correction to the *p* values of the correlation coefficients (Hommel, 1988). Further, to test the measurement equivalence of the WNSS score the correlation coefficients were compared according to the measurement invariant factors (Drasgow, 1984; Vandenberg & Lance, 2000).

Results

Interitem Correlations

Interitem correlations for all 21 items were computed, and the results revealed that item 9 had unacceptably weak interitem relationships (Tabachnick & Fidell, 1996), mean interitem correlation between item 9 and other items being $M_r = .054$ ($SD = .056$). For this reason item 9 (see Table 1) was excluded from subsequent analyses. The mean interitem correlation of the 20-item scale was $M_r = .247$ (ranged from $r = .01$ to $r = .505$).

Exploratory Factor Analysis (EFA)

The principal axis factoring EFA was conducted. The scree plot based on the full correlation matrix and the other criteria suggested extraction of two latent factors. Eigenvalues for the first two factors were, respectively, 5.947 and 1.645. Explained variance was 26.6% for the first factor and 4.9% for the second factor. The promax-rotated solution was interpreted. Factor loading and communalities are reported in Table 1. All items showed an adequate loading on a single factor (range = .333 – .775) (Comrey & Lee, 1992), and no item crossloaded. The second factor was saturated by the reverse items (1, 3, 8, 12, 14–15, and 20) and the two factors were highly correlated $r = .598$, suggesting a general unidimensionality of the scale (Spector, Van Katwyk, Brannick, & Chen, 1997).

Confirmatory Factor Analysis (CFA)

The factor structure of the 20-item scale was also tested by means of CFA. The CFA was conducted using LISREL software 8.30. Two models were compared: A one latent factor model (1-factor model) and a two correlated latent factors model (2-factor model). In the latter model items 2, 4–7, 10–11, 13, 16–19, and 21 were specified to load on the first factor, while items 1, 3, 8, 12, 14–15, and 20 were specified to load on the second factor. The obtained fit indices provided a partial support for the 1-factor model, $\chi^2(170) = 609.3$; $p < .001$; RMSEA = .079; ECVI = 1.67; CFI = .93; NNFI = .92; $\chi^2/df = 3.6$, and indicate that the 2-factor model significantly improved the fit, $\chi^2(169) = 411.3$; $p < .001$; RMSEA = .059; ECVI = 1.20; CFI = .96; NNFI = .95; $\chi^2/df = 2.4$; $\chi^2_{diff}(1) = 198$; $p < .001$; ΔCFI = .03. Standardized factor loadings of the 2-factor model ranged from .32 to .72 ($M = .53$). Factors were highly correlated ($r = .64$; $p < .001$), and this confirmed the substantial unidimensionality of the scale.

Measurement Invariance

In order to test MI, covariance matrices were compared by contrasting three groups with different ages (group 1: participants from 18 to 30 years, $n = 161$; group 2: participants from 31 to 45 years, $n = 132$; group 3: participants from 46 to 60 years, $n = 127$), males vs females, and people living in quiet vs noisy contexts. Results indicate MI of the WNSS across age ($\chi^2[420] = 540.9$; $p < .001$; RMSEA = .046; ECVI = 2.34; CFI = .97; NNFI = .96; $\chi^2/df = 1.29$), sex ($\chi^2[210] = 250.9$; $p < .05$; RMSEA = .031; ECVI = 1.63; CFI = .99; NNFI = .98; $\chi^2/df = 1.19$), and context ($\chi^2[210] = 281.2$; $p < .001$; RMSEA = .041; ECVI = 1.71; CFI = .98; NNFI = .97; $\chi^2/df = 1.34$).

Reliability

Regarding the reliability, the 20-item scale showed an acceptable level of internal consistency as measured by means of Cronbach's $\alpha = .863$. Still the split-half coefficient (first vs second half) indicated a good reliability $r = .849$. As showed by the Feldt's test (Feldt, 1969), the reliability indices were equivalent across age (respectively $\alpha_{18\text{–}30\ \text{years}} = .864$; $\alpha_{31\text{–}45\ \text{years}} = .886$; $\alpha_{46\text{–}60\ \text{years}} = .874$; $p > .05$), sex (respectively $\alpha_{\text{males}} = .884$; $\alpha_{\text{females}} = .860$; $p > .05$), and context (respectively $\alpha_{\text{noise}} = .872$; $\alpha_{\text{quiet}} = .873$; $p > .05$).

Nomological Validity and Measurement Equivalence

In order to evaluate the validity of the WNSS, we computed the correlation coefficients between the 20-item mean score and the criterion measures. As expected, results highlighted a positive association between WNSS and STAI ($r = .237$; Hommel's $p < .001$; $N = 413$), and a weak and negative association between WNSS and quality of life ($r = –.173$; Hommel's $p = .007$; $N = 413$). The WNSS was not correlated with the depression scale. To test the measurement equivalence of the WNSS across Age, Sex, and Context, the correlation coefficients were compared according to these factors by means of Fisher's z test (Fisher, 1921). Results showed a substantial invariance of the indices.

Effects of Age, Sex, and Context on Noise Sensitivity

To evaluate the effects of age, sex, and context on noise sensitivity, total scores at the 20-item scale were analyzed in a factorial 3 × 2 × 2 between subject ANOVA that treated Age (14–30 years, 31–45 years, and 46–70 years), Sex (males and females), and Context (noisy and tranquil contexts) as between-participant fixed-effect variables. The Bonferroni correction was used to analyze post-hoc effects. Results showed significant main effects of Age ($F[2, 401] = 3.58$, $p = .029$; $\eta_p^2 = .018$), Sex ($F[2, 401] = 4.16$, $p = .042$, $\eta_p^2 = .010$), and Context ($F[2, 401] = 8.99$, $p = .003$, $\eta_p^2 = .022$), and a significant Sex × Context interaction, $F(2, 401) = 6.47$, $p = .011$, $\eta_p^2 = .016$. Neither Sex × Age interaction, $F(2, 401) = 0.20$, $p = .819$, $\eta_p^2 = .001$, nor Sex × Context × Age interaction, $F(2, 401) = 2.15$, $p = .118$, $\eta_p^2 = .011$, were significant. Post-hoc analyses showed that some were more noise sensitive: females ($M = 80.7$) more than males ($M = 77.2$), people older than 45 years ($M_{46\text{–}60} = 82.1$) more than younger people ($M_{31\text{–}45} = 77.7$ and $M_{18\text{–}30} = 77.0$), people living in noisy contexts ($M = 81.5$) more than people living in tranquil contexts ($M = 76.4$). The interaction effect showed that the quality of context influenced females (respectively, for tranquil and noisy contexts: $M = 75.9$ and $M = 85.4$, $p < .001$) but not males (respectively, for tranquil and noisy contexts: $M = 76.8$ and $M = 77.6$).

Discussion

This study assesses the psychometric properties of the Italian version of the WNSS and investigates the role of internal and external factors on noise sensitivity. The WNSS is the most widely used instrument with the best psychometric indices for the evaluation of noise sensitivity (Alimohammadi et al., 2006; Ekehammar & Dornic, 1990; Zimmer & Ellermeier, 1999). To our knowledge, the current study is the first to use confirmatory methods to analyze the factor structure of the WNSS and, most importantly, the first to evaluate the invariance and the equivalence of the scale across different internal and external factors. Results of this study confirmed that the WNSS is a unidimensional, reliable, and valid scale. Explorative and confirmative factorial analyses showed that an oblique two-factor solution is the best fitting model to explain interitem correlation, and that the second factor saturates the reverse items and is highly correlated with the first factor. As supported by different researches, the scale can be considered substantially unidimensional because the second factor can be accounted for as an effect of the direction of item wording more than an expression of a different dimension (Spector et al., 1997). This was also confirmed by the strong correlation between the two latent factors. Regarding the item analysis, the interitem correlation showed that item 9 should be excluded from the scale because of a weak correlation with all other items. A possible explanation is that item 9 is the only one formulated as a question and not as a statement (see Table 1). The reliability analyses conducted by means of Cronbach's α and split α indices confirmed a good reliability of the 20-item WNSS; reliability is invariant across Age, Sex, and Context factors. The MI analyses, executed according to Vandeberg and Lance (2000), showed that the variance-covariance matrices were identical across the considered factors. This confirmed a full MI of the scale and thereby ruled out the risk of ascribing group differences to measurement artifacts (Chan, 2000). The correlation analyses between the scale and the criterion variables confirmed the nomological validity of the scale, that is, noise sensitivity had a positive relationship with anxiety (Nivison & Endresen, 1993; Zimmer & Ellermeier, 1999) and a negative relationship with quality of life (Nijiland et al., 2007; Weinstein, 1980) – and was independent of depression. Further, the comparison of correlation coefficients confirmed that the noise sensitivity scores are equivalent across the measurement invariant factors. Both the MI and the measurement equivalence results allowed us to compare noise sensitivity scores across the Age, Sex, and Context factors (Vandeberg & Lance, 2000) in a meaningful way. Results showed that both internal and external factors affect noise sensitivity, albeit only weakly (η_p^2s < .022). As regards internal factors, in line with previous studies (Michaud et al., 2008; Van Gerven et al., 2009), data showed that aging increases noise sensitivity, that females have greater noise sensitivity than males, and that females are affected more by environmental noise (Dratva et al., 2010; Melamed et al., 2004).

These results seem to refute the concept of noise sensitivity as a stable and invariant individual trait, independent of noise exposure (Weinstein, 1978, 1980). Recent theories of personality have suggested that personality traits cannot be conceived of as stable invariant attributes, completely independent of the influence of environmental factors. Traits may be thought of as a stable predisposition whose expression can be modulated by contextual factors (McCrae & Costa, 1999). Therefore, the cumulative effect of chronic exposure to noisy contexts may affect especially more noise-sensitive individuals. Indeed, in our study the data showed an interaction between sex and context: The external context affected the expression of noise sensitivity only in females. In our opinion, the weak context effect in conjunction with the age effect supports the idea that noise sensitivity can vary across the lifespan according to an intrinsic developmental course (McCrae & Costa, 1999) or as a function of the external context (Belojevič, Jakovljevič, & Slepcevič, 2003).

In summary, the results of our study are relevant both theoretically and methodologically. From a theoretical point of view, they confirm that individual factors must be taken into account when studying noise. Indeed, above and beyond other factors, noise sensitivity is affected by internal factors (such as sex and age) as well as external factors (such as context). However, more studies are needed to understand the contribution of the various internal and external factors.

From a methodological point of view, the results of this study confirm that the Italian version of the WNSS is reliable and valid and can therefore be used to compare people of different age, of different sex, and living in different contexts. This is particularly useful for planning future psychoacoustics studies. Indeed, the validated instrument will allow researchers to select homogeneous samples and to disentangle the role of external noise effects from individual noise sensitivity.

Because of the importance of noise sensitivity in noise annoyance studies, and given that the WNSS is one of the best known instruments to assess noise sensitivity in different countries, in our opinion the next step should be to verify the measurement equivalence and invariance of the scale across different versions and populations. Only if we demonstrate by means of direct tests that the WNSS is invariant can we be sure that the dimension considered is the same so that we can compare the results across nations.

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