Positive and Negative Suicide Ideation (PANSI) Inventory: Initial Psychometric Properties as a Suicide Risk Screening Tool Among Nigerian University Students

Olutayo Aloba1, Sunday Adefemi2 and Tolulope Aloba3

1Department of Mental Health, Obafemi Awolowo University, Ile-Ife, Nigeria. 2Department of Psychology, Obafemi Awolowo University, Ile-Ife, Nigeria. 3Department of Nursing Science, Obafemi Awolowo University, Ile-Ife, Nigeria.

ABSTRACT

OBJECTIVE: The objective of this study is to examine the factor structure, validity, reliability, and the screening properties as a suicide risk assessment tool of the 14-item Positive and Negative Suicide Ideation (PANSI) in a nonclinical sample of Nigerian university students.

METHODS: A total of 514 students completed the PANSI, in addition to the Beck Depression Inventory-II (BDI-II) and the General Health Questionnaire-12 (GHQ-12).

RESULTS: Prior to the factor analysis, the sample was randomly divided into two. In one half of the sample (sample 1), exploratory factor analysis of the inventory yielded a 2-factor model (Negative Suicide Ideation [PANSI-NSI] and Positive Ideation [PANSI-PI]), whereas confirmatory factor analysis in the other half (sample 2) produced a 2-factor model with indices of fitness that indicated a satisfactory model fit (χ²/df = 93.8; χ²/degree of freedom = 1.400; P = .017; goodness of fit index = 0.951; Tucker-Lewis index = 0.964; comparative fit index = 0.974; root mean square error of approximation = 0.040). The internal consistencies of the items of the PANSI-PI and PANSI-NSI subscales were 0.75 and 0.79, respectively. The construct validity of the 2 subscales was modestly satisfactory: PANSI-PI had negative correlations with the GHQ-12 (r = −.239, P < .001) and the BDI-II (r = −.190, P < .001), whereas the PANSI-NSI had positive correlations with the GHQ-12 (r = .248, P < .001) and the BDI-II (r = .376, P < .001). In addition, a cutoff total score of 17 on the PANSI-NSI was associated with the best sensitivity (80.0%) and specificity (92.5%) in the identification of those students who endorsed experiencing suicidal ideation (area under the curve = 0.82, 95% confidence interval = 0.58-1.00).

CONCLUSIONS: The PANSI has exhibited satisfactory psychometric properties as a self-rated suicidal behavior assessment instrument in the evaluation of the positive and negative thoughts associated with suicidal ideation among Nigerian university students.

KEYWORDS: suicidal ideation, Nigerian students, reliability, validity, sensitivity

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Introduction

Among young adults, suicidal behavior which encompasses suicidal ideation, plans, and attempts is now recognized as a public health issue.1 In the United States, suicide is the second cause of death within the population of undergraduate university students.2,3 A study in 2012 reported that about 10% of undergraduate students in the United States indicated a positive response to enquiries of whether they have been having thoughts of engaging in suicidal behavior in the previous 12 months.4 It has been suggested that thoughts deliberating on plans and actions of suicide are more prevalent than it was initially believed among young adults.5 Only a minority of university students with previous history of suicidal behaviors had ever had contact with their institution’s psychological or counseling services.6 Likewise, only a negligible percentage (20%) of university undergraduates who eventually died by committing suicide received any form of psychological treatment before the act.7 In contrast to the studies in developed countries, few studies in Nigeria that have evaluated suicidal ideations and attempts were focused primarily on adolescents in secondary schools. Suicidal ideations and attempts were estimated as 20% and 12%, respectively, within the previous year in a study that involved 1429 adolescents aged 10 to 17 years.8 In another recent study in Nigeria, the authors recruited 500 adolescents from secondary schools in south-western Nigeria and reported a 3 months prevalence rate of 17% and 7.8% for suicidal ideations and attempts, respectively.9 The authors in these studies adopted the 2 suicide-related items of the DISC Predictive Scales10 but did not indicate whether the overall scale was valid or reliable. In developing African countries such as Nigeria, there is a dearth of reliable data regarding attempted suicide and death by suicide within the young adult population.11 Most of the attempted suicide and deaths by committing suicide in Nigeria go unreported due to the adverse

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sociocultural stance toward suicide.12 Due to the psychosocial and emotional consequences associated with suicide, the World Health Organization now considers its prevention among adolescents and young adults to be of utmost public health importance.13 For several young adults and adolescents, transferring from the familiar home environment to the university setting can be stressful with an associated risk of inducing psychological disturbances.14

Fundamentally, suicide risk assessment has been evaluated adopting 2 approaches: clinical interviews and self-reported measures. Both approaches have their advantages and disadvantages. Clinical interview for suicide risk assessment despite being currently perceived as the benchmark is rather expensive in terms of the trained personnel needed to conduct such interviews and the amount of time it will require especially within the nonclinical population.15 However, the self-reported measures of suicide risk are beneficial in screening larger proportions of individuals, are less expensive, and can be completed within shorter time frames.15 Self-reported instruments also have the advantage of making the respondents more motivated to provide sensitive information about themselves and to relate to the items on the measures in a manner that is not possible in the context of a clinical interview.16

The Positive and Negative Suicide Ideation (PANSI) inventory is a self-reported measurement consisting of 2 subscales that evaluate suicide-related vulnerability and protective factors.17 Satisfactory psychometric characteristics of the PANSI inventory have been reported among normal population of adolescents,17 in a cross-sectional sample of young adults,18 and adolescents receiving inpatient psychiatric care.19 The translated versions of the PANSI inventory have also been reported to exhibit satisfactory validity and reliability in outpatient populations in Malaysia20 and China.21

The importance of large-scale screenings for suicide ideation and other suicide-related behaviors is buttressed by the observation that more than 80% of young adults who attempted suicide were not identified as being dangerous to themselves after contact with health care workers months prior to the attempt.22 Thus, the application of suicide risk assessment instruments with satisfactory psychometric properties can be effective in the recognition and prompt management of suicidal behavior.23 It has been suggested that screening for suicidal behavior among young adults may be effective in the early recognition and prevention of self-harm.24

We are of the opinion that the first step toward identifying Nigerian young adults with an elevated tendency to engage in suicidal behavior will be the availability of a suicide risk evaluation instrument that has demonstrated satisfactory psychometric properties within the Nigerian young adult population. We decided on the PANSI due to the fact that it is brief, self-administered, and captures a number of vulnerability and protective variables relating to suicidal behavior. In addition, the PANSI is available for public use without financial payment, which will encourage its usage by health care personnel. This is the first study among Nigerian university students to examine the psychometric and suicide risk screening properties of an instrument that specifically assesses the positive and negative factors associated with suicidal ideation.

The objectives of our study were to (1) examine whether the 2 factors of the PANSI inventory will be extracted on subjecting it to exploratory factor analysis (EFA) among Nigerian undergraduate university students, (2) to examine the satisfactoriness of the indices of fitness of the model obtained with EFA applying confirmatory factor analysis (CFA), (3) evaluate the reliability and validity of the PANSI inventory subscales in relation to measures of depression and psychological distress, and (4) explore the screening characteristics of the Negative Suicide Ideation (PANSI-NSI) subscale as an assessment tool for the identification of Nigerian students who are experiencing suicidal ideations by calculating the area of the receiver operating characteristic (ROC) curve that is associated with the optimal sensitivity and specificity in relation to the best cutoff score in the classification of the students with thoughts of suicidal ideation.

Materials and Methods
Sample population
A total of 530 undergraduate students of the Obafemi Awolowo University were initially recruited for the study. They were consecutively selected from their official halls of residence located within the university grounds. To be eligible to participate in this study, the student must not have a current or previous history of a psychiatric disorder, absence of a chronic medical disorder (we wanted a nonclinical sample), and the student must give consent to participate (those who did not consent were not given the study instruments). We included a number of questions in the sociodemographic questionnaire formulated specifically for this study that will enable the identification of those to be excluded from the study. (1) Have you had or currently have a psychiatric disorder? (If yes, please state the diagnosis). (2) Do you currently having any medical problems? (If yes, please state the diagnosis). The respondents respond to each question by indicating a yes or no option.

The ethical approval for the study protocol was granted by the Ethics and Research Committee of the university. We excluded 4 students who attested that they were on treatment for epilepsy, and 7 who indicated that they were receiving treatment for a psychiatric disorder (schizophrenia). A total of 5 students who had incomplete data on the PANSI were also excluded. Thus, data obtained from 514 undergraduate students (96.9% response rate) were analyzed.

Measures
Sociodemographic and academic-related data
This consisted of variables such as age and sex. The suicide risk status of the students was defined as subjectively reported
thoughts of engaging in suicidal behavior. Because there was no gold standard for suicidal ideation, this was examined through the inclusion of a question in the sociodemographic questionnaire (“Have you been repeatedly having thoughts of killing yourself?”), with a dichotomous response (yes or no).

**PANSI inventory**

This is a 14-item subjectively completed inventory that consisted of 2 subscales: the PANSI-NSI subscale composed of 8 items and the Positive Ideation (PANSI-PI) subscale consisting of 6 items. The original study leading to the inventory’s development was conducted in 2 phases. In the first study, the authors performed EFA which extracted the 2 factors that constituted the subscales, in a total number of 450 undergraduate students (150 men and 300 women) recruited from a large Midwestern university in the United States. The second study involved 286 undergraduate students recruited from the same institution as the first study; the authors conducted CFA to explore which of the 1-factor or 2-factor models of the inventory will exhibit the best indices of fitness. Following CFA, the most satisfactory fit was exhibited by the 2-factor model. The subscale which consists of the vulnerability or negative items, labeled the PANSI-NSI subscale, is composed of 8 items, whereas the subscale that examines the protective or positive items, labeled the PANSI-PI subscale, consisting of 6 items. The possible total scores on the PANSI-NSI and PANSI-PI subscales range from 8 to 40 and 6 to 30, respectively. Higher scores on the PANSI-NSI and lower scores on the PANSI-PI reflect greater risk for suicidal behavior. Each of the items on the 2 subscales are rated on a 5-point Likert scale (1 = none of the time to 5 = most of the time). The respondents completed the scale bearing in mind the preceding 2 weeks including the day the inventory has been completed. The students completed the inventory in English language, which is the language of communication in all the Nigerian universities.

**General Health Questionnaire-12**

The students were also administered the General Health Questionnaire-12 (GHQ-12), which is a nonspecific screening tool for the identification of individuals who are psychologically distressed or potentially psychiatrically disturbed. The bimodal scoring method of 0-0-1-1 was adopted in this study. The total score on the GHQ-12 ranges from 0 to 12, with higher scores indicative of psychological distress. Satisfactory psychometric characteristics of the scale in the context of the primary health care setting have been reported in Nigerian. In this study, the reliability coefficient of the scale was satisfactory (Cronbach \( \alpha \) = 0.84).

**Beck Depression Inventory-II**

This is a 21-item self-rated inventory that assesses the severity of depressive symptomatology. Each of the scale’s items has 4 responses, rated from 0 to 3, thus the possible lowest and highest scores on the Beck Depression Inventory-II (BDI-II) are 0 and 63, respectively, with higher scores reflective of more severe depressive symptoms. Satisfactory validity and reliability of the BDI-II have been reported among adolescents and young adults in south-western Nigeria. In this study, the items of the BDI-II had a Cronbach \( \alpha \) of 0.87.

**Data analysis**

All statistical analyses were performed with the SPSS software, 21st version. Prior to factor analysis, we randomly divided our sample (\( n = 514 \)) into 2 halves. A factorial analysis approach is similar to the method adopted by the original authors of the inventory. First, to identify the number of latent factors within the 14 items of the PANSI scale, we performed EFA applying Principal Axis Factoring (PAP) with oblimin rotation and Kaiser normalization on one half of our sample (sample 1). Kaiser-Meyer-Olkin test (should be > 0.70) and Bartlett test of sphericity (\( P < .001 \)) were performed to ensure that our sample 1 data were suitable for subjection to EFA. Second, on the other half (sample 2), we conducted CFA using the maximum likelihood method to examine the factor structure yielded by the EFA in sample 1. Confirmatory factor analysis was performed with the Analysis of Moment Structure (AMOS) software, 20th version. We based the satisfactory indices of fitness of the CFA model on the Hu and Bentler criteria, in which the goodness of fit index (GFI), comparative fit index (CFI), and Tucker-Lewis index (TLI) values will be approximate to or exceed 0.95; root mean square error of approximation (RMSEA) less than 0.05; \( \chi^2/ \text{degree of freedom} \) ratio less than 2, and a nonsignificant \( P > .05 \). The reliability of the PANSI subscales’ items was determined by calculating the Cronbach \( \alpha \). The construct validity of the PANSI subscales was examined through correlational analyses with the BDI-II and the GHQ-12. Prior to the correlational analyses, we eliminated item 9 (suicidal thoughts or wishes) in the BDI-II. We examined the applicability of the PANSI-NSI and PANSI-PI subscales in discriminating between the students who positively endorsed experiencing suicidal ideations (coded as 1) and those who denied experiencing suicidal ideations (coded as 0), via logistic regression analyses. We also attempted to identify the best cutoff score on the scale with the negative risk factors (PANSI-NSI) that will be optimal for the correct classification of the students who endorsed experiencing suicidal ideations. We calculated the area under the curve (AUC) that will indicate the optimal sensitivity and specificity, in association with the Youden index. The other parameters that we evaluated in relation to the best cutoff score on the PANSI-NSI include positive predictive value (PPV) and negative predictive value (NPV) and the positive (LR+) and negative (LR−) likelihood ratios. An AUC value nearer to 1 is reflective of a more satisfactory discriminatory ability. All statistical tests were 2-tailed and the level of significance was set at \( P \) value less than .05.
Results
Sociodemographic characteristics and study measure scores of the students (n = 514)

As depicted in Table 1, the mean age of the undergraduate students was 21.99 (SD: 3.06) years. Men constituted 55.8% of the total sample. The mean scores on the PANSI-NSI and PANSI-PI subscales were 10.08 (SD: 3.77) and 22.63 (SD: 5.14), respectively. When we compared the mean PANSI subscale scores between the 2 sexes, we observed that the men have significantly \( (P < .001, t = 3.765) \) higher mean PANSI-NSI scores (10.63 [SD: 4.17]) compared with the women (9.38 [SD: 3.05]), but there were no significant differences \( (P = .272, t = -0.517) \) in the PANSI-PI mean scores between the men (22.53 [SD: 5.36]) and the women (22.76 [SD: 4.85]). Mean scores on the BDI-II and GHQ-12 were 7.42 (SD: 8.01) and 6.52 (SD: 5.72), respectively. Fifteen (2.9%) of the students indicated a “yes” to the question, “Have you been repeatedly having thoughts of killing yourself?”.

Table 2 shows that in sample 1, PAF with oblimin rotation yielded 2 factors, with the 8 PANSI-NSI items (1, 3, 4, 5, 7, 9, 10, and 11) and 6 PANSI-PI items (2, 8, 6, 12, 14, and 13) loading on factor 1 (PANSI-NSI) and factor 2 (PANSI-PI), respectively. The internal consistencies (Cronbach \( \alpha \)) of the PANSI-NSI and PANSI-PI items were 0.76 and 0.77, respectively, with each having an eigenvalue of 3.880 (PANSI-NSI) and 2.303 (PANSI-PI). The corrected item total correlation for the 8 items of the PANSI-NSI ranged from 0.379 to 0.555, whereas it ranged from 0.369 to 0.626 for the 6 items of the PANSI-PI. Examination of the Cronbach \( \alpha \) values if an item is deleted showed that the removal of any of the items on the PANSI subscales will not significantly improve the overall Cronbach \( \alpha \) values of each subscale. Figure 1 depicts the AMOS path analysis diagram obtained with CFA and the indices of fitness which were all satisfactory \( (\chi^2 = 93.8; df = 67; CMIN/DF = 1.400; P = .017; GFI = 0.951; TLI = 0.964; CFI = 0.974; RMSEA = 0.040) \).

Construct validity between the PANSI subscales and the other study measures

As demonstrated in Table 3, PANSI-NSI had moderately significant positive correlations with the GHQ-12 \( (P < .001) \) and BDI-II \( (P < .001) \), whereas the PANSI-PI demonstrated moderately negative correlations with the GHQ-12 \( (P < .001) \) and BDI-II \( (P < .001) \).

Discriminative validity (logistic regression analyses)

Table 4 shows a positive relationship between PANSI-NSI scores and the probability of experiencing suicidal ideations among the students. A 1-point increase in the PANSI-NSI subscale multiplies the odds of positively endorsing the experience of suicidal ideations among the undergraduate students by a factor of 1.24 (regression model: \(-5.692 + 0.211*PANSI-NSI - 0.078*PANSI-PI\)). There was no statistically significant association between PANSI-PI and the students’ suicidal ideation status.

Psychometric details of the PANSI subscales at different cutoff scores

Table 5 shows that the best cutoff score on the PANSI-NSI to identify the undergraduate students who positively endorsed experiencing suicidal ideation was 17 and above. At this cutoff score, 80.0% of those with thoughts of suicidal
ideation will be correctly identified (sensitivity), whereas 92.5% of those who are not having such thoughts will be correctly identified (specificity). The PPV, NPV, LR+, and LR− were 91.4%, 82.2%, 10.667, and 0.216, respectively. The AUC at this cutoff score is 0.82.

**Discussion**

The results of our exploratory and confirmatory factor analyses revealed that the items of the PANSI inventory loaded on the 2 subscales as recommended by the original developers of the scale. The factor models we obtained among the Nigerian undergraduate students are further supported by what has been described by other authors.18,19,35 The same factor models have been reported in a cross-sectional descriptive study of 195 adolescents receiving treatment in a psychiatric facility19 and in another study that involved 217 healthy adolescents.35 Our findings are also in keeping with the 2-factor model that was reported in a diverse sample of young adults who were recruited from the undergraduate student population of an American university.18 The Chinese version of the inventory whose psychometric characteristics were explored in a sample that included more than 2000 middle and high school adolescents also exhibited the same 2-factor structure after subjecting to both exploratory and confirmatory factor analyses.21 The Malay version also yielded the same 2-factorial models among medical outpatients in Malaysia.20 Confirmatory factor analysis of the 2-factor model also exhibited satisfactory indices of fitness in our sample of Nigerian university undergraduate students. We can therefore, to a reasonable extent, state that the PANSI-NSI and PANSI-PI subscales consist of items that, respectively, explore the negative and positive risk factors associated with suicidal ideation among our respondents.

In our study, the internal consistencies of the PANSI-NSI and PANSI-PI subscales among the Nigerian university students were 0.76 and 0.77, respectively. The Cronbach α values of 0.70 and above are generally regarded as acceptable,36 and values exceeding 0.90 indicates the likelihood of redundancy among the instrument’s items.37 We want to point out that these values were relatively lower compared with what has been

| ITEM | FACTOR 1 (PANSI-NSI) | FACTOR 2 (PANSI-PI) |
|------|---------------------|---------------------|
| 11. Felt lonely or sad that you wanted to kill yourself so that you could end your pain | 0.820 | — |
| 7. Thought you could not find solution to a personal problem | 0.773 | — |
| 5. Thought you could not accomplish something important in your life | 0.681 | — |
| 9. Thought about killing yourself because you felt like a failure in life | 0.617 | — |
| 1. Considered killing yourself | 0.583 | — |
| 3. Felt hopeless and wondered | 0.536 | — |
| 10. Thought problems were overwhelming that suicide was the only option for you | 0.403 | — |
| 4. Felt unhappy about your relationship with someone that you wished you were dead | 0.385 | — |
| 13. Felt that life was worth living | — | 0.820 |
| 12. Felt confident about ability to cope with most of the problems in your life | — | 0.812 |
| 14. Felt confident about your plans for the future | — | 0.799 |
| 2. Felt you were in control | — | 0.593 |
| 6. Felt hopeful about the future because things were working out well for you | — | 0.455 |
| 8. Felt excited because you were doing well at school or at work | — | 0.327 |
| Cronbach α | 0.76 | 0.77 |
| Eigenvalue | 3.880 | 2.303 |
| Total variance explained, % | 27.72 | 16.45 |
| Kaiser-Meyer-Olkin test of sampling adequacy | 0.734 | 

Abbreviations: PANSI-NSI, Negative Suicide Ideation; PANSI-PI, Positive Ideation.
reported in previous studies. The authors who originally developed the scale reported a much higher Cronbach \( \alpha \) values of 0.91 and 0.80 for the PANSI-NSI and PANSI-PI, respectively, among American university students. The Cronbach \( \alpha \) values for the PANSI-NSI (0.96) and PANSI-PI (0.89) were also reportedly higher in a sample of adolescent psychiatric patients. The reliability values for the Chinese version of the inventory had Cronbach \( \alpha \) values of 0.94 and 0.86, respectively, for the PANSI-NSI and PANSI-PI subscales. We also observed that the corrected item total correlations for the PANSI-NSI (0.379-0.555) and PANSI-PI (0.369-0.626) among our student respondents were also relatively lower to what was reported in the original study, in the Chinese, and the Malay versions. We are of the opinion that despite the lower Cronbach \( \alpha \) values of the PANSI inventory subscales and the corrected item total correlations, the inventory is still a reliable measurement for the assessment of the vulnerability and protective risk factors regarding thoughts of suicidal behavior among the Nigerian university students. It is difficult to categorically state the reasons for why the PANSI inventory exhibited relatively different psychometric characteristics especially in terms of the internal consistencies of the subscales’ items among Nigerian university undergraduate students compared with previous studies. Although the Cronbach \( \alpha \) values for the PANSI-NSI and PANSI-PI were lower, they are still within satisfactorily acceptable range.

In our study, 2.9% of the respondents positively endorsed experiencing suicidal ideations. This value is relatively lower to what was previously reported by authors who also adopted a single item to assess suicidal ideation among Nigerian secondary school adolescents. An extensive electronic literature search revealed that no study has been conducted to estimate the prevalence of suicidal ideation among Nigerian university students. One other observation in our study was that the male undergraduate students compared with the female students had higher scores on the PANSI-NSI subscale. Similarly, some authors have reported higher suicidal ideation scores among male university undergraduate students.

We have provided the preliminary evidence that supports to a moderate extent the construct validity of the PANSI inventory among our respondents. The directions of the associations between the PANSI subscales and the BDI-II and GHQ-12 among our respondents were as expected. The undergraduate students with higher scores on the negative suicidal ideation subscale (PANSI-NSI) had higher levels of depressive symptomatology and elevated levels of psychological distress. In contrast, the students who had higher levels on the PANSI-PI subscale had lower scores on the depression (BDI-II) and psychological distress (GHQ-12) scales. Previous studies involving university undergraduate students have reported strong positive correlations between suicidal ideation and depressive symptoms. In a longitudinal study, more than 60% of youths with depressive disorders reported suicidal ideation at the entry stage of the study. Studies have also demonstrated statistically that depression is the main determinant of suicidal ideation among adolescents and young adults.

Previous studies have consistently demonstrated the association between suicidal behavior and psychiatric disorders. The observation of the positive correlation between the PANSI-NSI and the BDI-II among our respondents further buttress the fact that the psychiatric disorder that has been reported to be most commonly associated with the spectrum of suicidal behavior is depressive disorder. Recent studies based on psychological autopsies that adopted the current diagnostic systems have estimated depressive disorder to have a rate ranging from 59% to 87% among individuals who died by committing suicide. Eventually, the cause of mortality in approximately 15% of those receiving treatment for depressive disorder is suicide. Compared with the general population, individuals with major depressive disorder have 20 times increased likelihood of

Figure 1. Confirmatory factor analysis path diagram depicting the item loadings for the PANSI-NSI (1) and PANSI-PI (2) items. Total sample = 257; goodness of fit indices: \( \chi^2 = 93.8; df = 67; \text{CMIN/DF} = 1.400; P = .017; \text{GFI} = 0.951; \text{TLI} = 0.964; \text{CFI} = 0.974; \text{RMSEA} = 0.040. \text{CFI}, \text{comparative fit index}; \text{CMIN/DF}, \chi^2/\text{degree of freedom}; \text{GFI}, \text{goodness of fit index}; \text{PANSI-NSI}, \text{Negative Suicide Ideation}; \text{PANSI-PI}, \text{Positive Ideation}; \text{TLI}, \text{Tucker-Lewis index}; \text{RMSEA}, \text{root mean square error of approximation}. \)
The identification and prompt treatment of major depression at all the levels of health care will significantly contribute to the prevention of suicide. Relatively newer antidepressants such as duloxetine, norepinephrine, and serotonin reuptake inhibitor have proved their efficacy in the treatment of major depressive disorder in randomized control trials. Thus, the adequate pharmacologic treatment of major depression has been statistically demonstrated to have a protective effect against suicidal behavior. 

We also explored the discriminative validity of the PANSI-NSI and PANSI-PI among our respondents. We noticed that following logistic regression analyses, the PANSI-NSI could discriminate between the students who positively and negatively endorsed experiencing suicidal ideation. This finding approximates to what was reported by Osman and colleagues, in which the PANSI-NSI could delineate between the adolescents who had severe risk for suicide and those without such risk. The PANSI-PI subscale had no significant association with the students’ statuses regarding self-reported suicidal ideation. Despite this, we can tentatively conclude that the PANSI inventory has demonstrated satisfactory construct validity and to some extent discriminative validity in relation to a self-report survey more than a 10-year period revealed that the most statistically significant contributor to suicidal thoughts and attempt was hopelessness. Another study has also prospectively demonstrated that hopelessness is the strongest predictor of suicidal ideation. 

Table 3. Construct validity of the PANSI subscales among the total sample of students (n=514).

| VARIABLE     | PANSI-NSI | PANSI-PI | GHQ-12 | BDI-II |
|--------------|-----------|----------|--------|--------|
| PANSI-NSI    | 1         |          |        |        |
| PANSI-PI     | -0.242**  | 1        |        |        |
| GHQ-12       | 0.248**   | -0.239** | 1      |        |
| BDI-II*      | 0.376**   | -0.190** | 0.501**| 1      |

Abbreviations: BDI-II, Beck Depression Inventory-II; GHQ-12, General Health Questionnaire-12; PANSI-NSI, Negative Suicide Ideation; PANSI-PI, Positive Ideation. *Item 9 (suicidal thoughts and wishes) has been removed. **P<.001.

Table 4. Logistic regression analyses.

| REGRESSION | B     | SE    | WALD  | SIGNIFICANCE | OR (EXP.) (95% CI) |
|------------|-------|-------|-------|--------------|-------------------|
| PANSI-NSI  | 0.211 | 0.073 | 8.329 | .004         | 1.235 (1.070-1.420) |
| PANSI-PI   | -0.078| 0.083 | 0.887 | .346         | 0.925 (0.786-1.088) |
| Constant   | -5.692| 2.092 | 7.399 | .007         | 0.003             |

Abbreviations: 95% CI, 95% confidence interval; OR, odds ratio; PANSI-NSI, Negative Suicide Ideation; PANSI-PI, Positive Ideation. The significance of the bold is to indicate the item that statistically has an association with the expression of suicidal ideation among the students.

Table 5. Psychometric details of the PANSI-NSI at different cutoff scores against the students’ response to “Have you been repeatedly having thoughts of killing yourself?”.

| Cutoff score | SENSITIVITY | SPECIFICITY | YOUDEN INDEX | PPV | NPV | LR+ | LR− | ACCURACY |
|--------------|-------------|-------------|--------------|-----|-----|-----|-----|----------|
| >16          | 0.800       | 0.898       | 0.698        | 0.887 | 0.818 | 7.843 | 0.223 | 0.849    |
| >17          | 0.800       | 0.925       | 0.725        | 0.914 | 0.822 | 10.667 | 0.216 | 0.863    |
| >18          | 0.600       | 0.937       | 0.537        | 0.905 | 0.701 | 9.524 | 0.427 | 0.769    |

Abbreviations: LR+, likelihood ratio for a positive test; LR−, likelihood ratio for a negative test; NPV, negative predictive value; PANSI-NSI, Negative Suicide Ideation; PANSI-PI, Positive Ideation; PPV, positive predictive value. Bold values indicate the best cutoff score on the PANSI-NSI.
single-item suicide ideation question. Although, due to the limitations associated with the use of a single item to assess suicidal ideation among our respondents, we believe that more studies are still needed to further explore the construct and discriminatory validities of the PANSI among the Nigerian young adult population.

Analysis of the ROC curve revealed that on the PANSI-NSI, the best total cutoff score to identify the Nigerian undergraduate students with thoughts of suicidal ideation was 17. This is lower than the total cutoff score of 19 on the PANSI-NSI that was reported in a study of adolescents in Taiwan. Among our respondents, a cutoff score of 17 on the PANSI-NSI could identify 80% of the Nigerian students with thoughts of suicidal ideation and 92.5% of those without such thoughts. The acceptable minimal requirement for the sensitivity of a screening tool should exceed 70%. To reduce over-referrals, it has been suggested that the specificity level of a screening measurement should be at least 80%. Thus, the application of the PANSI-NSI as a screening tool for thoughts of suicidal ideation among our respondents will be associated with the lowest rate of false positives at a total cutoff score of 17. In addition, this cutoff score on the PANSI-NSI yielded the highest PPV (91.4% of the students classified as having thoughts of suicidal ideation who truly have such thoughts) and NPV (82.2% of the students recognized as not having thoughts of suicidal ideation who truly have no such thoughts). The cutoff score of 17 on the PANSI-NSI was associated with the highest likelihood ratio for a positive test (LR+) and smallest likelihood ratio for a negative test (LR−). The LR+ value exceeds 10, which indicates a large and conclusive probability that the students who are true positives for thoughts of suicidal ideation who truly have no such thoughts.

Likewise, at this cutoff score, the smallest LR− value indicates that students without thoughts of suicidal ideation (true negatives) will be correctly classified. The AUC of 0.82 is another evidence to buttress the modest discriminatory ability of the PANSI-NSI at this cutoff score. We want to highlight that the application of the PANSI inventory, especially the PANSI-NSI subscale, as a screening tool among Nigerian university students is a preliminary phase in a more elaborative process. Students with high aggregative scores on the PANSI-NSI may require further psychological and social investigations with the possibility of being referred to mental health specialists. In our study, those students who indicated a positive response to the 1-item query regarding experiencing thoughts of suicidal ideation were referred to the mental health team of the university health center for further evaluation and treatment.

Our study has a number of limitations. First, we recruited a modest nonclinical sample size from only one large university in south-western Nigeria. Second, caution is needed in generalizing our findings to other students and young adult population in the other parts of the country. One other important limitation was the “gold standard” approach we adopted in the evaluation of suicidal ideation. This is because the PANSI-NSI subscale consists of items that are overlapping with the single self-reported item we used (Have you been repeatedly having thoughts of killing yourself?). It has been insinuated that a single-item approach to the evaluation of suicide-related behaviors in terms of ideations and attempts may result into previous suicidal behaviors being wrongly classified. It has also been suggested that a 1-item suicide behavior–related question fails to encompass the different forms of suicidal thoughts and behaviors. The need to subsequently employ further queries and assessments to correctly evaluate risk of suicidal behaviors has been emphasized. Another limitation regarding our 1-item approach to the evaluation of suicidal ideation was that we did not include a time frame in terms of either onset or duration in relation to this query. It was therefore not possible for us to perform the statistical comparisons of the mean PANSI subscale scores between those with recent onset of suicidal ideations and those who have been having thoughts of suicidal ideations for a longer period. Finally, another limitation we needed to highlight was that we were not able to explore the full range of the validity (ie, predictive and concurrent validities) of the inventory due to the limited assessments that our respondents completed.

In summary, despite some differences in our study compared with previous studies and the limitations, we have provided some preliminary evidence to support the validity and reliability of the PANSI inventory among Nigerian university students. We have also demonstrated that the PANSI-NSI could also be applied as a screening tool for suicidal ideation among Nigerian university students. The availability of a valid and reliable instrument such as the PANSI in Nigeria may be of benefit in the context of the fact that death through committing suicide in developing countries accounts for more than 75% of the total global suicide. Additional studies are still needed to further explore and confirm the factor structure and other psychometric characteristics such as the concurrent and predictive validities and test–retest reliability of the inventory among other nonclinical and patient populations in Nigeria and sub-Saharan Africa.

Author Contributions
OA and SA conceived and designed the study. OA, SA and TA analyzed the data. OA wrote the first manuscript draft. OA, SA and TA equally contributed to the writing of the revised manuscript. All the authors reviewed and gave approval for the final manuscript.

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