

## ORIGINAL ARTICLE

# The Agreement between State-Trait-Anxiety-Inventory (STAI) and Beck Anxiety Inventory (BAI) on Measuring Anxiety Level Among Adult Patients Before Venepuncture Procedure

Izzaty Dalawi, Mohamad Rodi Isa, Faizul Haris Mohd Hatta, Muhammad Fairuz Rahmat

Department of Public Health Medicine, Faculty of Medicine, Universiti Teknologi Mara (UiTM) Sungai Buloh Campus, 47000, Selangor, Malaysia

## ABSTRACT

**Introduction:** Venepuncture procedure is painful and anxiety associated with venepuncture is common. There are many tools for assessing anxiety levels in an outpatient setting. Hence, this study is to compare the degree of agreement between State-Trait-Anxiety-Inventory (STAI) and Beck Anxiety Inventory (BAI) for measuring anxiety levels among adult patients before venepuncture procedure. **Methods:** A cross-sectional pilot study was conducted among patients while waiting for a venepuncture procedure in the Phlebotomy Unit, UiTMMC in April 2020. The Malay-validated version of the State-Trait-Anxiety-Inventory (STAI) and Beck Anxiety Inventory (BAI) were used to assess the anxiety level. Differences between sets of data were plotted as described by Bland-Altman to determine the agreement between these two assessment tools. **Results:** A total of 330 patients participated in the study with a mean age of  $46.34 \pm 14.34$  years old and gender was equally distributed. The scores of state-anxiety (STAI-S), trait-anxiety (STAI-T) and BAI score were  $30.04 \pm 20.74$ ;  $29.51 \pm 19.11$ ; and  $40.98 \pm 20.45$ , respectively. The score of anxiety using BAI was higher compared to STAI-S ( $p < 0.001$ ) and STAI-T ( $p < 0.001$ ). The mean difference between the STAI-S and BAI was  $-10.94$  (95%CI:  $-53.01, 26.87$ ) and between the STAI-T and BAI was  $-11.47$  (95%CI:  $-42.26, 19.32$ ). However, very few patients' scores outside the 95% LOA for both differences. **Conclusion:** The STAI and BAI are concordances in measuring anxiety levels among these patients. However, the anxiety score using BAI was higher than STAI. Thus, both assessment tools can be used in clinical practice in measuring anxiety in the out-patients setting. *Malaysian Journal of Medicine and Health Sciences* (2023) 19(3):254-261. doi:10.47836/mjmhs19.3.33

**Keywords:** State-anxiety, Trait-anxiety, Beck Anxiety Inventory, Agreement, Venepuncture

## Corresponding Author:

Mohamad Rodi Isa, DrPH  
Email: rodi@uitm.edu.my  
Tel: +60361267209

## INTRODUCTION

Anxiety is when our body's natural response to stress (1). Kazdin (2) defined it as an emotion characterised by feelings of tension, worried thoughts and physical changes. Generally, an anxiety reaction may be developed due to acute or chronic pain (3). It can be a normal and expected feeling in life. However, when it causes disproportions and interferences to the daily activities, job performance and relationship of the individual, it is called an anxiety disorder. Spielberger et al. (4) have classified anxiety into two types which is state anxiety and trait anxiety. State anxiety can also be called "right-now anxiety" which psychological and physiological transient reactions directly related to adverse situations in a specific moment. In contrast, trait anxiety refers to a general tendency to respond with anxiety to perceived threats in the environment and is a

relatively stable characteristic of an individual (5).

Venepuncture is the process of obtaining intravenous access and one of the most frequent medical procedures whereby the vein is punctured with the needle to withdraw the blood or for intravenous medication purposes. However, approximately 10% of individuals in medical settings report an excessive fear of the needle which subsequently may lead to significant avoidance, distress and problems in managing and treating the patients (6, 7). For children in hospital, venepuncture is one of the most fearful and painful aspects, which makes them feel most anxious (8).

Anxiety associated with blood and injections is a common problem in medical settings. Several researchers have investigated the anxiety and pain of venipuncture and cannulations procedures in recent years. However, the studies were more focused on the children and young adult populations (9-12). Some studies reported the prevalence of anxiety could be as low as 3 to 5% (13) to 20 to 50% (10) or as high as 73.3% (14) among young adults and adults. It was shown that adults also face

the same problem of venepuncture-related anxiety as children. The needle fear also may extend to another procedure such as blood donation and may affect those with chronic conditions that require injection such as diabetes mellitus (10).

There are several factors associated with anxiety toward venepuncture. A study by Bisogni et al., (8) found children who suffered from the chronic disease reported more pain (median pain of 8) and showed more signs of behavioural distress (median score of 27) compared to non-chronic children. It was shown that the clinical condition causes them to be frequently exposed to invasive procedures makes them more anxious. Age was found an inverse correlation with pain and distress during invasive procedures (8, 15-17). It was due to pain tolerance increasing with age (16). A randomized control trial by Alireza et al., (18) found the "presence of the untrained" family member caused significantly less anxiety. The presence of accompanying family members provides support during the implementation of invasive procedures. Other than that, venipuncture services and patient's satisfaction also shown to be related to venipuncture-related anxiety symptoms (19-23).

There are many instruments used to assess anxiety in the primary care setting. Different tools have the aim of assessing anxiety. Hamilton Anxiety Rating Scale is a tool to measure the severity of anxiety symptoms, and it is widely used in both clinical and research settings (24). Depression, Anxiety, Stress Scale (DASS) is a set of three self-report scales to measure three emotional states which are depression, anxiety and stress. The anxiety subscale assesses the autonomic arousal, skeletal muscle effects, situational anxiety, and subjective experience of anxious affect (25). It can be used for non-clinical samples (25) and clinical samples (26) to assess anxiety levels Beck Anxiety Inventory (BAI) is an inventory rating scale used to assess the severity of anxiety symptoms in the intensity of physical and cognitive anxiety symptoms during the past week (27). BAI is used as a severity indicator of anxiety in primary care patients with different anxiety disorders (28). The State-Trait-Anxiety Inventory (STAI) was developed to measure the state and trait anxiety of adult patients to assess how strong a person's feelings of anxiety are (29).

Although many tools can be used to assess anxiety levels among the clinical and non-clinical sample, not many studies were conducted to determine the degree of concordance between two or more sets of measurement. Therefore, this study was conducted to determine the agreement between the State-Trait-Anxiety Inventory (STAI) and Beck Anxiety Inventory (BAI) to assess the anxiety level among patients while waiting for venepuncture procedure in UiTM Medical Centre Sungai Buloh (UiTMCC).

## MATERIALS AND METHODS

### Study design

A cross-sectional study was conducted at the Phlebotomy Unit, UiTM Medical Centre Sungai Buloh (UiTMCC) from April 2020 until August 2020. The phlebotomy services are operating on weekdays from 7.30 am to 4.00 pm. All patients who attended the Phlebotomy Unit for venepuncture procedure during the period was set as the target population.

### Study population, Inclusion and Exclusion criteria

The study population consisted of all patients who attended the Phlebotomy Unit UiTMCC for venepuncture procedure between March 2020 until May 2020 who fulfilled the inclusion and exclusion criteria for the study.

The inclusion criteria for the study were patients aged 18 years old and above, Malaysian citizens, able to speak and understand in Malay and had at least experienced one venepuncture procedure in UiTMCC before. However, a patient who has been diagnosed with any psychiatry problems and under psychiatry clinic active follow up, a patient who is on any psychotropic drugs such as antidepressants, sedatives (anxiolytics, hypnotics) or antipsychotics medications or patient who are not consented to participate in the research has been excluded from the study.

Systematic random sampling was used to select the patients whereby every alternate two patients who were available and eligible for the study during the data collection session were approached. Patients who had provided written informed consent would be recruited for the study.

### Data collection methods and instruments

All patients who attended the outpatient Phlebotomy unit, UiTMCC were screened through the registration number of the patients during the study recruitment. From the patient registration number (RN), their medical record was retrieved to ensure the patients with underlying psychiatry illnesses or on psychotropic medications have been excluded. Every two alternate patients were approached and informed about the study. A patient information sheet that consisted of brief information about the study was given to the approached patient. Once the patient agreed to participate, informed consent was signed by the patient, and a copy will be kept each by the patient and researcher for record-keeping.

Subsequently, the patient was given a set of questionnaires that consisted of three parts. Part 1 consisted of the sociodemographic details of the patient (age, gender, ethnicity, marital status, occupation,

education level, occupational status, smoking status and living arrangement); and past venepuncture history (frequency of venepuncture per year, history of complications upon venepuncture in the past; and the presence of accompanying for venepuncture procedure during the data collection day).

Part 2 was the assessment for anxiety level using State-Trait-Anxiety Inventory (STAI Form Y1 and Y2) questionnaire and Part 3 was the assessment for anxiety level using Beck Anxiety Inventory (BAI) questionnaire.

### Instruments

The first instrument was the State-Trait-Anxiety Inventory (STAI) Form Y. It was developed by Spielberger et al., (29). The inventory can measure the state-anxiety and trait-anxiety of the adult patient. It has two parts which are STAI Form Y1 (STAI-S) to assess the state-anxiety and STAI Form Y2 (STAI-T) to assess the trait-anxiety level. The Malay version of STAI Form Y was used in this study. It was translated and validated by Hashim et al. (30). It has very high reliability as the Cronbach alpha from STAI Form Y1 (STAI-S) and STAI Form Y2 (STAI-T) was 0.94 and 0.84 respectively. The STAI Form Y1 scale consisted of 20 statements that evaluate how the patient feels "right now, at this moment, before the venepuncture procedure takes place". There is a four-points Likert scale for the patient to choose the number that best describes the intensity of their feelings at that particular moment. The scales were: 1 = not at all; 2 = somewhat; 3 = moderately; and 4 = very much. The STAI Form Y2 scale consisted of 20 statements that evaluate how the patient feels "generally". The patient needs to choose and rate their feelings on the following four-points Likert scale. There scales were: 1 = almost never; 2 = sometimes; 3 = often and 4 = almost always. The sum of the scores on all items remarks the individual patient score. The scores for both state anxiety and trait anxiety can be varied from a minimum of 20 to a maximum of 80. The structured face-to-face interview was done whereby every patient who has consented to participate in the study was interviewed using the questionnaire. It took about 10 to 15 minutes to complete the interview per patient.

The second instrument used was the Beck Anxiety Inventory (BAI). It was developed by Beck AT & Steer RA (27). This inventory is a rating scale used to assess the severity of anxiety symptoms such as nervousness, dizziness, inability to relax etc (31). BAI has 21 items and was assessed on a four-point Likert scale from 0 to 3 for the patients to choose the number that best describes the intensity of physical and cognitive anxiety symptoms during the past week. The scales were: 0 = not at all; 1 = mildly, but didn't bother me much; 2 = moderately – it wasn't pleasant at times; and 3 = severely – it bothered me a lot. The minimum score is 0 and the maximum score is 63. The original version of BAI has good internal consistency with Cronbach's alpha of 0.92 and the test-

retest reliability was 0.75. The validity of the inventory was also good with moderately correlated with The Hamilton Anxiety rating scale of 0.51 (32). The Malay version of BAI was used in this study. It was translated and validated in Malay by Firdaus M & Nor-Sheeren Z (33). The three-factor structure was appeared to be subjective anxiety, autonomic, and neurophysiology. The Cronbach's alpha ranged from 0.66 to 0.89 with an overall of 0.91 (33).

### Standardization of the score

The score of state-anxiety (STAI Form Y1), state-anxiety (STAI Form Y2) and Beck Anxiety Inventory were presented in continuous data. The minimum and maximum scores of both inventories were not the same. The final score of both inventories was standardized into 100. The formula for the standardization:

Standardized score for STAI (Form Y1 and Y2) =  
(Score – 20)/60 x 100

Standardized score for BAI = (Score/63) x 100

### Ethics approval

The study was conducted in compliance with the ethical principles outlined in the Declaration of Helsinki and Malaysia Good Clinical Practice Guideline. Research ethical approval was obtained from the UiTM Research Ethics Committee with the approval code REC/05/2020(MR/103) and also granted permission to conduct the data collection from the Deputy Dean of Clinical Service, UiTM Sungai Buloh Campus. All study participants have signed written informed consent before their study participation.

### Statistical analysis

Data were analysed using the statistical software IBM SPSS Version 26.0 (34). For descriptive statistics, data were presented with the absolute number (n) and percentage (%) for categorical data. For numerical data, it was presented by the mean and standard deviation for normally distributed data. For non-normal distributed data, it was presented by the median and interquartile range (IQR). Normality of the distribution of the continuous variables was evaluated using skewness and kurtosis as well as the Kolmogorov-Smirnov normality test.

The dependent variable in this study was the State-Trait-Anxiety Inventory (STAI Form Y1 (state-anxiety) and Y2 (trait-anxiety)) and Beck Anxiety Inventory (BAI) scores. The correlation between state-anxiety and beck anxiety inventory scores; and trait-anxiety and beck anxiety inventory scores were analyzed using simple correlation. The difference in the score between state anxiety and BAI; and between trait-anxiety and BAI was analyzed using paired t-test.

Differences between sets of data were plotted as described by Bland-Altman (35). Based on previously

pre-defined clinically acceptable limits, the agreement between state-anxiety (STAI-S) and Beck Anxiety Inventory scores; and trait-anxiety (STAI-T) and Beck Anxiety Inventory scores were acceptable when the plots are within  $\pm 2$  standard deviations of the mean difference of the two scores.

The steps on plotting the Bland-Altman involved few steps: Step 1 – calculating the difference in scores between STAI-S or STAI-T and BAI; Step 2 – calculating the mean between STAI-S or STAI-T and BAI; Step 3 – Determining the mean and standard deviation of differences in scores to calculate the interval for mean  $\pm 2$  standard deviation; Step 4 – Plot the scatter plot (difference in the score (x-axis) versus mean (y-axis)) and Step 5 – determine if there any dot outside the range of 95% confidence of the mean.

The 95% confidence intervals (CI) ‘limits of agreement’ (LoA) was calculated as the mean of the two values, minus plus (1.96 times standard error). This 95% CI should contain the difference between the two measuring systems for 95% of future measurement pairs.

**Table 1: Sociodemographic and venepuncture history of the respondents (N=330)**

Variables	Frequency, (N=330), n (%)	Mean $\pm$ SD
Age		46.34 $\pm$ 14.34
Gender:		
Male	162 (49.1%)	
Female	168 (50.9%)	
Ethnicity:		
Malay	202 (61.2%)	
Chinese	78 (23.6%)	
Indian	40 (12.1%)	
Others	10 (3.0%)	
Marital status:		
Married	261 (79.1%)	
Not Married	44 (13.3%)	
Widow/separate/divorce	25 (7.6%)	
Educational level:		
Primary	9 (2.7%)	
Lower secondary	26 (7.9%)	
Upper secondary	192 (58.2%)	
Post-secondary	18 (5.5%)	
University	85 (25.8%)	
Occupation:		
Working	180 (54.5%)	
Not working	107 (32.4%)	
Pensioner	43 (13.0%)	
Smoking status:		
Current smoker	109 (33.0%)	
Ex-smoker	19 (5.8%)	
Non-smoker	202 (61.2%)	
Living arrangement:		
Living alone	18 (5.5%)	
Living with family & Partner	213 (94.5%)	
Accompany by someone:		
Yes	167 (50.6%)	
No	163 (49.4%)	
Frequency of venepuncture:		
At least once a month	16 (48%)	
At least once in 3 months	197 (59.7%)	
At least once in 6 months	89 (27.0%)	
At least once a year	28 (8.5%)	
History of complication:		
Yes	44 (13.3%)	
No	286 (86.7%)	

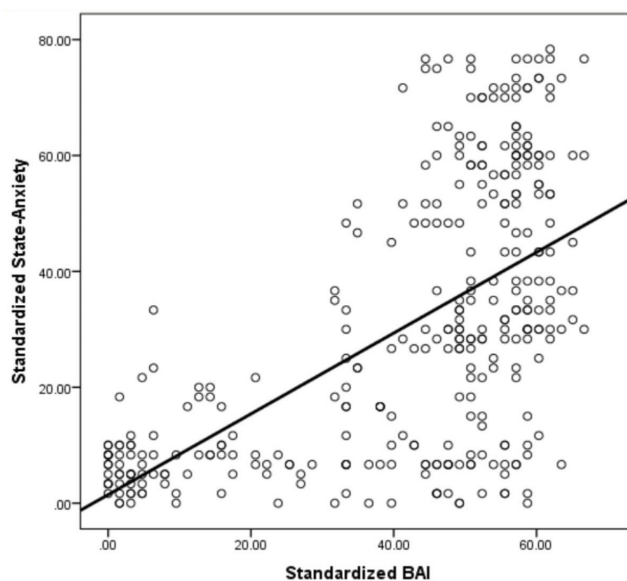
LoA provides a straightforward and intuitive approach to the agreement between different methods for measuring the same quantity (36).

**RESULTS**

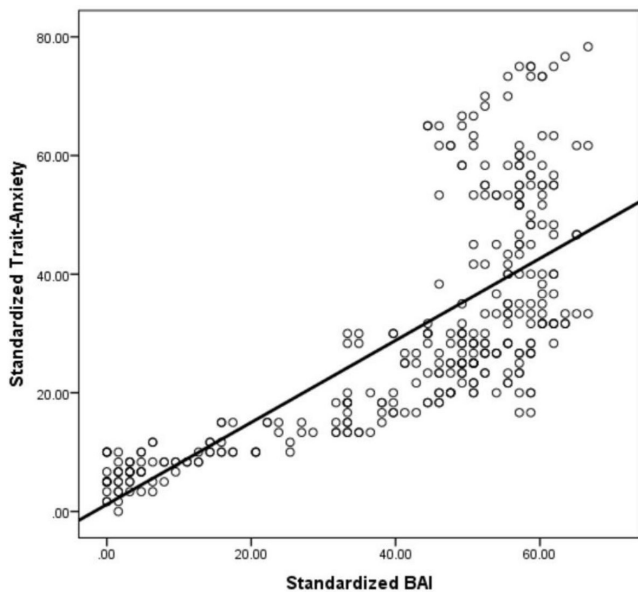
The overall response rate for our study was 89.5%. The sociodemographic characteristics and venepuncture history of the respondents are presented in Table 1. A total of 330 patients participated in the study with a mean age of 46.34  $\pm$  14.34 years old and gender was equally distributed. The majority of the patients were Malay (61.2%), married (79.1%) and more than half of the patients had their education until the upper secondary level (58.2%) with 54.7% currently still working (54.7%). The majority of patients were non-smokers (61.2%) and 94.5% were staying with their family or partner. 59.7% of the patients came to the unit quite frequent at least every 3-monthly and the majority of the patient had no history of venepuncture complications in the past (86.7%).

The mean of the STAI-S and STAI-T scores were 30.04  $\pm$  20.74 and 29.51  $\pm$  19.11, respectively. Meanwhile, the mean of the BAI was 40.98  $\pm$  20.45. All these scores were normally distributed with skewness values of 0.462, 0.672 and -0.897 respectively. The Kolmogorov-Smirnov (KS) tests were not statistically significant for the three variables ( $p > 0.05$ ).

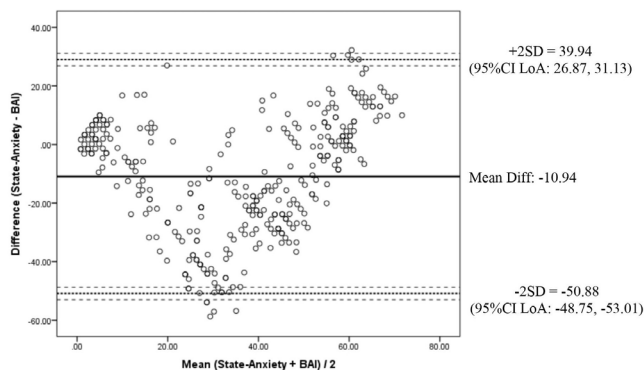
There was a significant difference in the score of STAI-S and BAI (paired difference: -10.94 (95%CI: -13.10, -8.78),  $p < 0.001$ ) where the score of STAI-S was lower compared to BAI (30.04  $\pm$  23.74 versus 40.98  $\pm$  20.45, respectively). There was also a significant difference in the score of STAI-T and BAI (paired difference: -11.47 (95%CI: -13.02, -9.92),  $p < 0.001$ ) where the score of STAI-T was lower compared to BAI (29.51  $\pm$  19.11



**Figure 1: Simple correlation between state-anxiety and BAI (r = 0.600,  $p < 0.001$ )**



**Figure 2: Simple correlation between trait-anxiety and BAI (r = 0.740, p<0.001)**



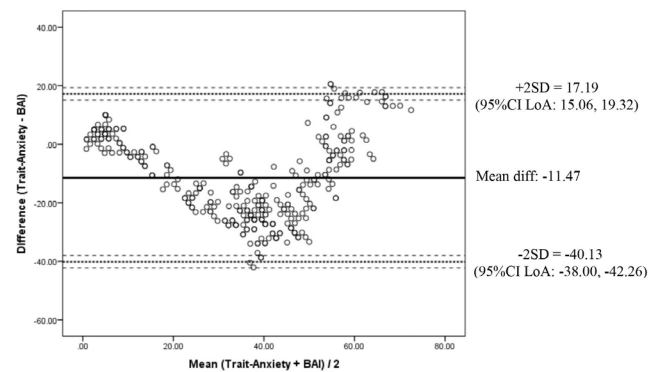
**Figure 3: Bland-Altman plot of the differences between State-anxiety and BAI measurements**

versus  $40.98 \pm 20.45$ , respectively)

There was a positive correlation between STAI-S score and BAI score ( $r = 0.600$ ,  $p < 0.001$ ; Figure 1). There was also a positive correlation between the STAI-T score and BAI score ( $r = 0.740$ ,  $p < 0.001$ ; Figure 2)

The Bland-Altman plot of the differences between STAI-S and BAI measurements is shown in Figure 3. The mean difference between the two readings (with limits of agreements (LoA)) between STAI-S and BAI was  $-10.94$  (95%CI:  $-53.01$ ,  $26.87$ ). There were five patients' data points were outside the upper and lower 95% confidence intervals of LoA.

The Bland-Altman plot of the differences between STAI-T and BAI measurements is shown in Figure 4. The mean difference between the two readings (with LoA) between STAI-S and BAI was  $-11.47$  (95%CI:  $-42.26$ ,  $19.32$ ). There was only one patient's data point was outside the upper and lower 95% confidence intervals of LoA.



**Figure 4: Bland-Altman plot of the differences between Trait-anxiety and BAI measurements**

## DISCUSSION

This study was conducted to determine the agreement between the State-Trait-Anxiety Inventory (STAI) and Beck Anxiety Inventory (BAI) to assess the anxiety level among patients while waiting for venepuncture procedure. Both tools are self-report questionnaires that can be administered in an individual format (31). The mean of the STAI-S and STAI-T scores were  $30.04 \pm 20.74$  and  $29.51 \pm 19.11$ , respectively. The score of STAI-S was lower compared to STAI-T. The result was consistent with a study by Han-Kyong et al., (37). It could be due to STAI-S being more responsive to change than the trait-anxiety subscale (31). Moreover, the STAI-S scale is assessing of current feelings "at this moment" but the STAI-T scale in assessing the frequency of feelings "in general" cause a higher score in the STAI-S compared to STAI-T (31).

This study has positively answered the answer "how well the STAI agree with BAI on assessing anxiety level at the out-patients department. However, doubts have been expressed about the accuracy of using these tools since the score using STAI scales was found to be significantly lower compared to BAI. Patients indicate how much they have been bothered by each symptom over the past week (31). However, the STAI scale indicates patients' intensity of current feeling "at this moment" (31) cause the score in BAI was higher compared to the STAI score. However, a study by Han-Kyong et al., (37) found different findings where the BAI score was lower compared to STAI-S and STAI-T scores. However, BAI has superior strength in the ability to differentiate anxiety from depression when compared with the STAI (38).

This study found a positive correlation between STAI-S score and BAI score; and STAI-T score and BAI score ( $r = 0.600$ ,  $p < 0.001$  and  $r = 0.740$ ,  $p < 0.001$ , respectively). A study by Han-Kyong et al., (37) found the significant correlation between STAI-S and BAI was ( $r = 0.49$ ,  $p < 0.001$ ) and correlation between STAI-T and BAI ( $r = 0.50$ ,  $p < 0.001$ ). Both correlations were lower compared to this study. However, a simple correlation was not

a good statistical method for assessing an agreement. The correlation between methods is always misleading and should not be used for assessing the method of agreement and comparability (39). A high correlation coefficient does not indicate a good agreement (40) and a high agreement indicates a high correlation (41).

A Bland-Altman (BA) plot is very important to display the relationship between two-paired variables using the same scale (42). The plot consists of a plot of the difference between paired readings of two variables over the average of these readings with  $\pm 2$  standard deviations (SD) parallel to the mean difference line (43). In this study, the BA plot for the difference between STAI-S and BAI measurements shows five patients' data points and the BA plot of the differences between STAI-T and BAI measurements shows only one patient's data point was outside the upper and lower 95% confidence intervals of LoA. The BA analysis recommends that 95% of the data point should lie within  $\pm 2$  SD of the mean difference (39). It can be concluded that STAI-S and BAI; and STAI-T and BAI have an agreement in assessing the anxiety level among patients while waiting for venepuncture procedure.

There were many studies conducted applying BA analysis to determine the accuracy or agreement between two assessment tools. A study by Gasim et al., (44), found tympanic thermometry is a reliable and accurate as axillary mercury glass thermometry. Therefore, tympanic thermometry can be used in clinical practice mostly in the emergency setting. From BA analysis also found a poor agreement between conductive and infrared devices for measuring skin temperature at rest, during exercise in the heat and recovery. Therefore, infrared devices may not be suitable tools to measure skin temperature in the presence of metabolic and environmental induces heat stress (45).

### The implication in clinical practice

As mentioned earlier, no similar study was found primarily in a Malaysian setting. Although many tools can be used to assess anxiety levels in the clinical sample, no study has been conducted on the agreement between the tools used. Therefore, STAI and BAI can be used to assess the anxiety level because the degree of concordance was good based on the Bland-Altman analysis. The BAI can be used to assess the anxiety level as a whole although the results from this study show an agreement to assess both state anxiety and trait-anxiety. However, it was always forgotten that anxiety could be experienced in a lifetime regardless of the time as long as there is a stressful event that may stimulate it.

This study used validated and very good reliability tools on assessing the anxiety level in the clinical sample. Therefore, it can be applied to patients even while waiting for the venepuncture procedure. Large samples in this study reduce the error. Therefore, the

wider 95% confidence intervals show the high precision of this study. The study used probabilistic sampling in recruiting the samples which were able to eliminate the bias in sample selection.

There were several limitations to this study. Since both tools are self-report questionnaires that are administered in an individual format, many factors can be influenced how the patients assess their anxiety levels. It was conducted in only one health care facility. Therefore, caution should be given in interpreting and applying the study findings to other health care facilities in different geographic locations which may have slight differences in a phlebotomy service setting. Therefore, caution should be considered when giving interpretation the study findings.

### CONCLUSION

In this study, BAI can be used to assess both state and trait-anxieties. However, the interpretation for state and trait anxiety needs to be interpreted while using BAI. Thus, both tools can be used in clinical practice because it is easy to use and the speed of obtaining anxiety level in an out-patient setting.

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