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Validation of the simplified therapeutic intervention scoring system in the intensive care units of a public sector hospital in Johannesburg

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CHAPTER 4

DATA ANALYSIS AND RESULTS

4.1 INTRODUCTION

This chapter describes the method of data handling together with the approach used for analysis of the results. Data was collected in two stages (stage I and II) and at the end of data collection in each stage, raw data was entered on Microsoft excel spreadsheet for analysis. The data was cleaned to correct any errors made during data entry. Once data entry and cleaning was complete, data were then imported into the computer statistical software package 'STATA 10' for windows and verified by the statistician.

The results from the study were described and analyzed using descriptive and inferential statistics to achieve the study objectives. The statistical tests that were used in this study include Pearson product moment correlation coefficient (r), paired t-test (t) and an intra-class correlation coefficient test. Frequencies (f), percentages (%), ranges, mean and standard deviations (SD) were used where applicable to describe the data. Bar charts, scatter plots and tables were used to present the study results for easier interpretation and understanding of the study outcomes.

Stage I of the study included face and content validation of TISS-28. In this stage, biographic information and TISS-28 rating scores from a panel of ICU experts (n=6) were obtained in order to meet the study's objectives. This was followed by stage II which included determination of the instruments' (TISS-28) concurrent; construct validity and inter-rater reliability. In this stage, biographic information and the scores were obtained

from ICU participants (n=105) using SAPS II, TISS-28 and TISS-76 checklists. Both stage I and stage II results will be reported in this chapter.

4.2 APPROACH TO DATA ANALYSIS

The data were analyzed in two parts starting with stage I followed by stage II of the study. A significance level of 0.05 (p=0.05) was decided upon for all statistical tests and all confidence intervals (CI) given are at 95% level. All totals are rounded to two decimal places. The approach to the study's data analysis is summarized diagrammatically in **Figure 4.1** followed by a brief discussion.

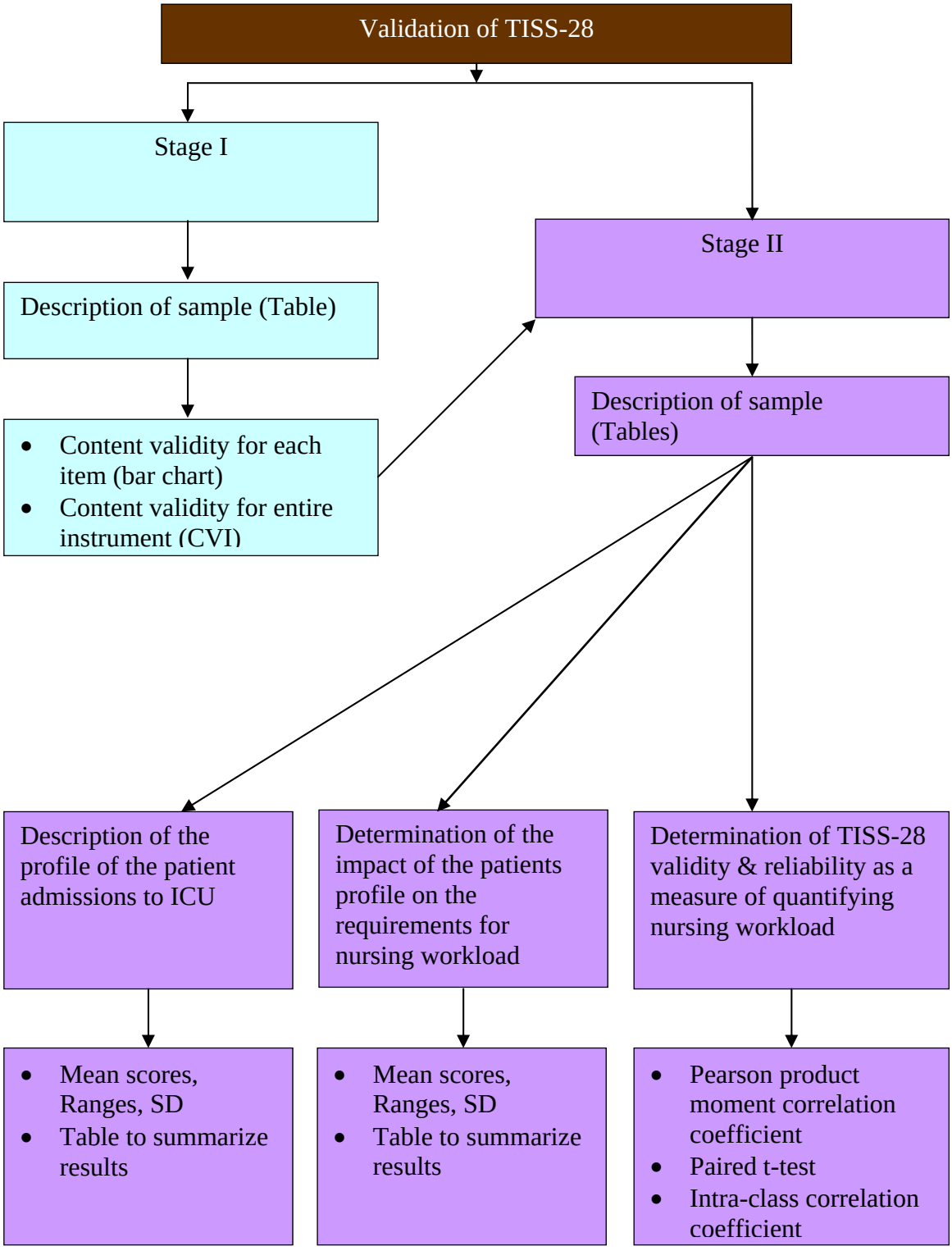


Figure 4.1: Approach to data analysis

4.2.1 Stage I

Descriptive statistics were used to analyze the results in stage I of the study. Demographic data of the participants was analyzed and thereafter the face and content validity of each item in the instrument and the instrument as a whole was determined using statistical method (CVI) described by Lynn (1986), and the outcome thereof is described.

4.2.2 Stage II

Demographic data of the participants was analyzed using descriptive statistics, including mean, percentages and ranges where applicable. In this stage, data was analysed in order to describe the profile of patients admitted to ICU as well as the impact of these patients' profile on the requirements for nursing workload. Inferential statistics were used to assess the validity of TISS-28 as a measure of quantifying nursing workload in ICU. This was mainly achieved by assessing concurrent and construct validity as well as inter-rater reliability of TISS-28 using different statistical tests as described below.

Pearson product moment correlation coefficient is both descriptive and inferential statistic and it is used to summarise the magnitude and direction of a relationship between two variables as well as to test hypotheses about population correlations respectively (Polit, Hungler & Beck, 2001). This test was used to determine the strength of the relationship between TISS-28 and TISS-76 as well as TISS-28 and SAPS II in order to determine the concurrent validity of TISS-28. Paired t-test is used when the researcher wishes to compare the means of two groups in order to determine whether the differences between the means are significant or caused by chance (Brink, et al., 2006). Paired t-test was used to test for the difference between TISS-28 mean score of ICU patients and ward patients in order to

determine construct validity of TISS-28. On the other hand, intra-class correlation was used to assess the consistency or reliability of TISS-28 in the hands of two raters. The intra-class correlation is used to demonstrate the strength of the relationship between one observer's ratings and another's (Polit & Beck, 2004:420).

4.3 RESULTS AND ANALYSIS OF STAGE I

The biographic information of the participants will be presented followed by determination of content validity of each item in TISS-28 and the entire instrument.

4.3.1 Demographic Data of the Participants

Table 4.1: Demographic data for panel of ICU nurse experts (n = 6)

Demographic data		f (%)
Age group in years	30-39	2 (33.33)
	40-49	1 (16.67)
	50-59	3 (50.00)
Academic qualification	Diploma in intensive care nursing only	4 (66.66)
	Diploma and Masters in intensive care	1 (16.67)
	Masters in intensive care and PhD	1 (16.67)
Position held	ICU nurse/Shift leader	2 (33.33)
	Clinical instructor	3 (50.00)
	Unit manager	1 (16.67)

Age group of the participants in the discussion group were as follows: Two (33.33%) of the six ICU nurse expert participants were between ages 30-39 years, one (16.67%) of them was between 40-49 years whereas three (50.00%) of them were between 50-59 years.

Academic qualifications of the participants in the discussion group were as follows: Of the six nurse experts, four (66.66%) had a diploma in intensive care nursing. One (16.67%) had obtained a diploma and an additional Master's degree in intensive care nursing whereas one (16.67%) had both Master's and PhD qualifications. Apart from the intensive care nursing specialization presented in **table 4.1** above, some of the nurse experts had also obtained different additional qualifications. Of the six nurse experts, one had a diploma in midwifery, two had a diploma in community and psychiatry nursing, one had a certificate in HIV/AIDS care and one had a Bachelors' curriculum in both nursing Education and administration (results not shown in the table).

Position held by the participants in the discussion group included: Two (33.33%) of the six participants were ICU nurse/shift leaders, three (50.00%) of them were clinical instructors whereas one (16.67%) of them was intensive care unit manager.

Years of ICU experience of the participants ranged from five to twenty five years with the mean years of experience being 16. (These results are not presented in the **table 4.1**).

4.3.2 TISS-28 item Content Validity

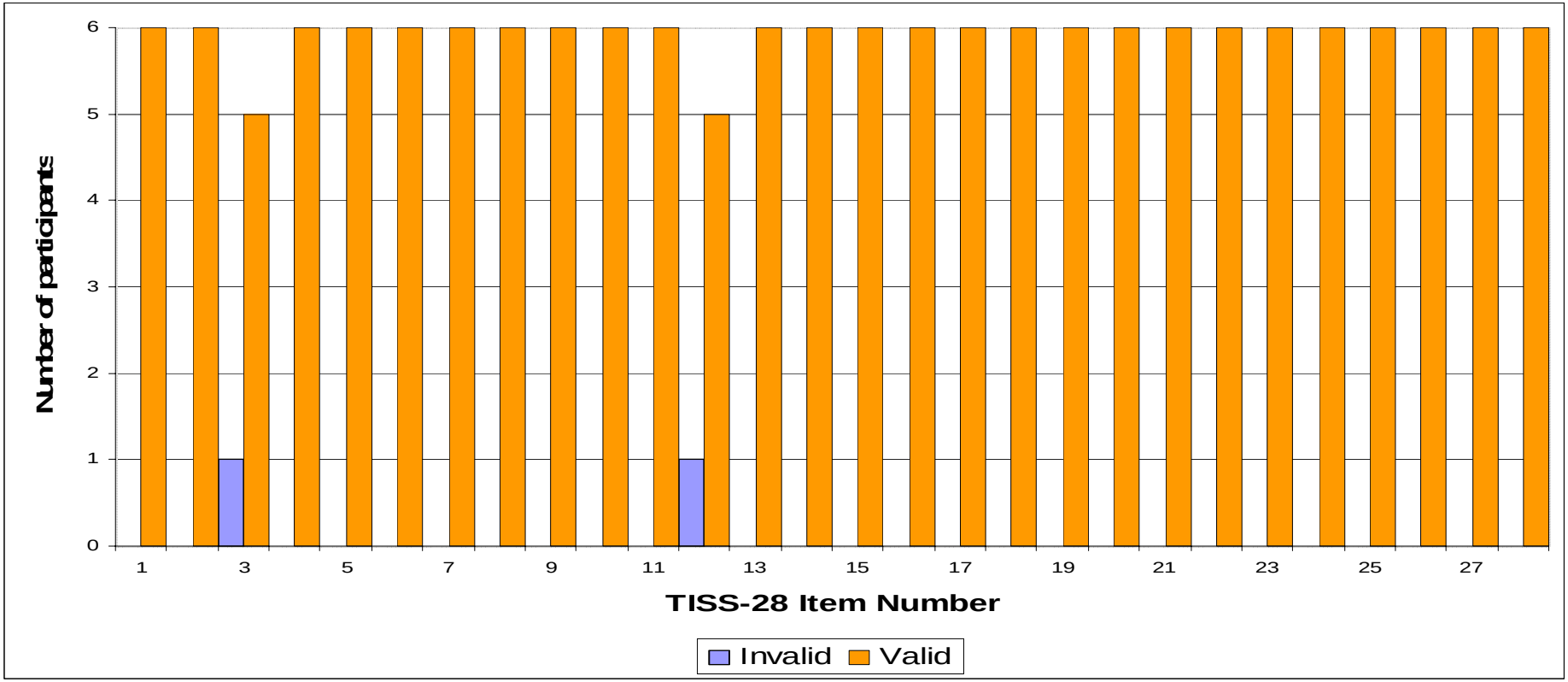


Figure 4.2: Participants' ratings for each of the TISS-28 items

The statistical method advocated by Lynn (1986) was used to determine content validity of each item and the entire instrument. According to this method, four of the six respondents in this stage had to rate each item as either a three or four to ensure that the item was content valid. Items three and twelve (refer **Appendix H**) were rated as content valid by five of the six experts giving an 83% agreement rate. All the remaining items were rated as content valid by all the experts (i.e. rated as either a three or a four on the rating scale). The results are shown in **figure 4.2** above.

4.3.3 Instruments (TISS-28) Content Validity

The content validity of the whole instrument was the percentage or proportion of items judged as valid by the experts. Out of 28 items, 26 items were rated as content valid. According to Polit and Beck (2006), an instrument should have a minimum content validity index of 0.90. The content validity of the entire instrument was 0.93 slightly exceeding the 0.90 minimum level. The experts in the quantification stage therefore rated the whole instrument as being content valid.

4.4 RESULTS AND ANALYSIS OF STAGE II

In this section, the demographic data of stage II are presented followed by the analysis and results of the data.

4.4.1 Demographic Data of the Participants

Table 4.2: Participants' characteristics

Variable	Obs. (%)	Mean	SD	Min.	Max.
Age (years)	105	43	17.67	18	88
Gender					
Female	43(40.95)				
Male	62(59.05)				
Reason for ICU admission					
Medical	40(38.10%)				
Scheduled surgery	38(36.19%)				
Unscheduled surgery	27(25.71%)				
Length of ICU stay (days)	105	6.58	6.68	1.5	37

105 participants consented and took part in the study. The mean age of these participants was 43 years with range of 18-88 years and a SD of 17.67.

The majority were male participants being 62 (59.05%) of the study participants whereas the minority were female only accounting to 43 (40.95%) of the study participants.

The participants were admitted to the ICU for three different reasons i.e. either for Medical reasons, scheduled surgery or unscheduled surgery. The majority being 40 (38.10%) of the study participants were admitted for medical reasons followed by 38 (36.19%) of the study participants who were admitted for scheduled surgery and the least were 27 (25.71%) study participants who were admitted for unscheduled surgery.

The average length of ICU stay for the study participants was 6.58 days with length of stay ranging from 1.5 to 37 days and SD of 6.68.

Out of the 105 participants, 2(1.90%) participants died after 24 hours and before 48 hours of ICU admission. In total, 20 (19.05%) participants died after 24 hours of ICU admission before they were discharged to the ward. (Results not presented in the table).

4.4.2 TISS-28 Scores By Reason For ICU Admission

Table 4.3: TISS-28 scores obtained by reason for ICU admission

Reason for ICU admission	Obs.	Mean	SD	Min. score	Max. score
Medical	40	28.60	6.46	14	42
Scheduled surgery	38	29.76	5.95	14	47
Unscheduled surgery	27	30.19	5.66	21	43

Participants admitted for unscheduled surgery had the highest TISS-28 scores with a mean of 30.19 and SD of 5.66 and a range of 21-43 points. Those admitted for scheduled surgery were second highest with a mean of 29.76 and SD of 5.95 and a range of 14-47 points. Participants admitted for medical reasons had the lowest TISS-28 score with a mean of 28.68 and SD of 6.46 and range of 14-42 points.

According to Polit et al. (2001), SD tells us how much, on average, the scores deviate from the mean. The greater the SD the more spread out the scores are about the mean in a distribution (Brink, et al., 2006). With SD, variances of different sets of measurements can be meaningfully compared: the greater the dispersion, the larger the variance (De Vos, et al., 2005:236). By comparing the SD for the three groups in **table 4.3**, participants admitted for medical reasons had greater dispersion with individual TISS-28 scores distributed far from the mean as compared to scheduled surgery and unscheduled surgery participants.

4.4.3 Description of SAPS II, TISS-28 and TISS-76 Scores

Table 4.4: Summary of the scores obtained from SAPS II, TISS-28 and TISS-76 in ICU.

Instrument	At 24 hours				At 48 hours			
	Obs.	Mean	SD	Score ranges	Obs.	Mean	SD	Score ranges
SAPS II	105	40.88	19.18	8-97				
TISS-28	105	29.43	6.06	14-47	103	26.47	6.45	9-43
TISS-76	105	29.80	9.71	12-53	103	25.19	9.00	6-49

SAPS II scores obtained from 105 participants within 24 hours of ICU admission ranged from 8-97 points with a mean of 40.88 and SD of 19.18. TISS-28 scores obtained from 105 participants 24 hours after admission ranged from 14-47 points with a mean of 29.43 and a SD of 6.06. TISS-28 scores obtained 48 hours after admission from 103 participants ranged from 9-43 points with a mean of 26.47 and SD of 6.45. TISS-76 scores obtained from 103 participants 24 hours after admission ranged from 12-53 points with a mean of 29.80 and SD 9.71. TISS-76 scores obtained after 48 hours of admission from 103 participants ranged from 6-49 points with a mean of 25.19 and SD of 9.00. The SD from the three instruments' scores depicts that SAPS II scores had a greater dispersion and scores were distributed far from the mean as compared to TISS-28 and TISS-76 scores.

Table 4.5: Summary of the scores obtained from TISS-28 in the ward after discharge from ICU

Instrument	Between 24- 48 hours			
	Obs.	Mean	SD	Score ranges
TISS-28	85	10.05	4.51	3-24

On the other hand, TISS-28 scores obtained from 85 participants in the ward 24 to 48 hours after discharge from ICU ranged from 3-24 points with a mean of 10.05 and SD of 4.51. The SD depicts that TISS-28 scores among ward patients had a greater dispersion and scores distributed far from the mean.

4.4.4 Description of TISS-28 Scores

Table 4.6: Summary of participants' TISS-28 score categories in ICU and after discharge to the ward

Score ranges	TISS-28 scores in ICU (n=105)			TISS-28 scores in Ward (n=85)		
	f (%)	Mean	SD	f (%)	Mean	SD
0-20	5(4.76)	16.20	2.05	82(96.47)	9.60	3.91
21-35	85(80.95)	28.41	3.73	3(3.53)	22.33	1.53
36-60	15(14.29)	39.60	2.85	0(0.00)	0.00	0.00

Table 4.6 presents the summary of how the participants were distributed on the four different categories after grouping them based on their TISS-28 scores. These categories were used as per a study conducted by Miranda et al. (1996:67) and it guides in detecting different time spending patterns during the care of ICU patients. Majority of the participants in ICU (80.95%) had between 21-35 scores with a mean score of 28.41 and SD of 3.73. 14.29% of the participants had 36-60 scores with a mean of 39.60 and SD of 2.85. A few participants (4.76%) had scores ranging from 0-20 with a mean score of 16.20 and a SD of 2.05. Majority of the participants in the ward (96.47%) had scores between 0-20 with a mean of 9.60 and SD of 3.91. 3.53% of the participants had 21-35 scores with a mean score of 22.33 and SD of 1.53. ICU participants had higher scores in all categories. Moreover, ICU participants had more spread out TISS-28 scores about the mean than the ward participants as can be seen by comparing their SD.

Table 4.7: Frequency distributions of participants' TISS-28 scores for each item in ICU and after discharge to the ward

ITEMS	ICU (n = 105)			Ward care (n = 85)		
	f (%)	Mean	SD	f (%)	Mean	SD
Basic activities						
Standard monitoring	104(99.05)	4.95	0.49	15(17.65)	0.88	1.92
Laboratory investigations	105(100.0)	1.00	0.00	77(90.59)	0.91	0.29
Single medication	0(0.00)	0.00	0.00	5(5.88)	0.12	0.47
Multiple intravenous medications	97(92.38)	2.77	0.80	31(36.47)	1.09	1.45
Routine dressing change	12(11.43)	0.11	0.32	28(32.94)	0.33	0.47
Frequent dressing changes	0(0.00)	0.00	0.00	1(1.18)	0.01	0.11
Care of drains	40(38.10)	1.14	1.46	12(14.12)	1.10	2.06
Cardiovascular support						
Single vasoactive medication	25(23.81)	0.71	1.28	1(1.18)	0.04	0.33
Multiple vasoactive medications	26(24.76)	0.99	1.73	0(0.00)	0.00	0.00
Intravenous replacement of large fluid losses	11(10.48)	0.42	1.23	0(0.00)	0.00	0.00
Peripheral arterial catheter	94(89.52)	4.48	1.54	3(3.53)	0.18	0.93
Left atrial monitoring	3(2.86)	0.23	1.34	0(0.00)	0.00	0.00
Central venous line	102(97.14)	1.94	0.33	60(70.59)	1.41	0.92
Cardiopulmonary resuscitation after cardiac arrest	6(5.71)	0.17	0.70	0(0.00)	0.02	0.22
Ventilatory support						
Mechanical ventilation	69(65.71)	3.29	2.38	1(1.18)	0.06	0.54
Supplemental ventilatory support	33(31.43)	0.63	0.93	58(68.24)	1.36	0.94
Care of artificial tube	71(67.62)	0.68	0.47	14(16.47)	0.16	0.37
Treatment of improving lung Function	84(80.00)	0.80	0.40	79(92.94)	0.93	0.26
Renal Support						
Dialysis	13(12.38)	0.37	0.99	7(8.24)	0.25	0.83
Quantitative urine output Measurement	98(93.33)	1.87	0.50	67(78.82)	1.58	0.82
Active diuresis	7(6.67)	0.20	0.75	0(0.00)	0.00	0.00
Neurological support						
Measurement of intracranial Pressure	0(0.00)	0.00	0.00	0(0.00)	0.00	0.00
Metabolic support						
Treatment of complicated metabolic acidosis/alkalosis	3(2.86)	0.11	0.67	0(0.00)	0.00	0.00
Intravenous hyperalimentation	5(4.76)	0.14	0.64	2(2.35)	0.07	0.46
Enteral feeding	47(44.76)	0.90	1.00	8(9.41)	0.19	0.59
Specific interventions						
Single interventions in ICU	35(33.33)	1.02	1.42	0(0.00)	0.00	0.00
Multiple specific interventions	2(1.90)	0.10	0.69	0(0.00)	0.00	0.00
Specific interventions outside of ICU	8(7.62)	0.38	1.33	0(0.00)	0.00	0.00

Frequency distributions for each of the TISS-28 items for all participants after the first 24 hours of ICU admission and between 24-48 hours after discharge to the ward are presented in **table 4.7** above. Data obtained revealed that all ICU patients required laboratory investigations (100%), nearly all patients were on standard monitoring (99.05%), had a central venous line (97.14%), were on quantitative urine output measuring (93.33%), and on multiple intravenous medications (92.38%). The majority of the patients in the ward required treatment of improving lung function (92.94%), laboratory investigations (90.59%), quantitative urine output measuring (78.82%), central venous line (70.59%) and supplemental ventilatory support (68.24%). The scores obtained from ICU participants were much varied as compared to the scores from ward participants.

Table 4.8: Description of therapeutic intervention groups of participants' TISS-28 scores in ICU and after discharge to the ward

Therapeutic intervention groups	**ICU (n =105)**		**Ward (n = 85)**	
	Mean	**SD**	**Mean**	**SD**
Basic activities (7 items)	9.93	1.71	3.76	2.90
Ventilatory support (4 items)	8.94	3.35	1.65	1.57
Cardiovascular support (7 items)	5.39	2.09	2.52	1.29
Renal support (3 items)	2.44	1.16	1.82	1.26
Neurologic support (1 items)	0.00	0.00	0.00	0.00
Metabolic support (3 items)	1.15	1.29	0.26	0.73
Specific interventions (3 items)	1.50	2.16	0.00	0.00

Table 4.8 above indicates that most of the patients admitted to ICU required basic activities reflected by the mean of 9.93 and SD of 1.71. This requirement is closely followed by the need for ventilatory support (mean = 8.94; SD = 3.35). The need for cardiovascular support (mean = 5.39; SD = 2.09) comes after ventilatory support followed by the need for renal support (mean = 2.44; SD = 1.16). A minority of the patients admitted

required both specific interventions and metabolic support with mean of 1.50 and SD of 2.16 and mean of 1.15 with SD of 1.29 respectively. None of them required neurological support. A few patients in the ward required basic activities, cardiovascular support, renal support, ventilatory support, with the least requirement being metabolic support as indicated in **table 4.8** above. Comparison of SD for ICU and ward participants in **table 4.8** above shows that ICU patients had more diverse requirements than ward patients.

4.4.5 Concurrent Validity of TISS-28

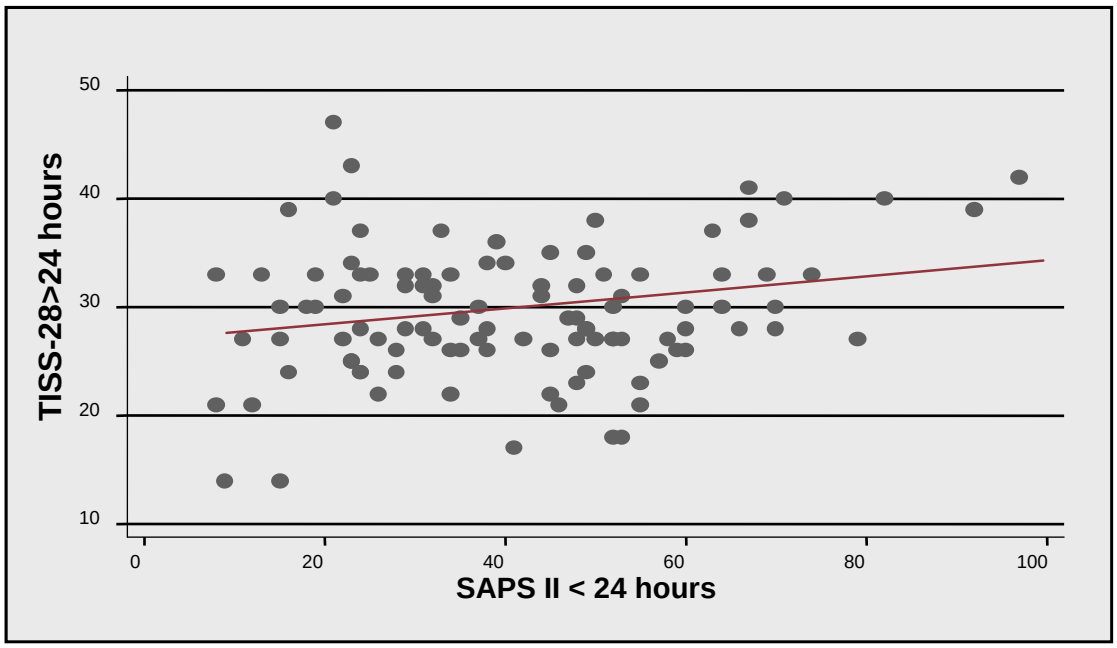


Figure 4.3: Relationship between TISS-28 > 24hours and SAPS II < 24hours

The scatter plot in **figure 4.3** shows that there was a significant weak positive correlation between TISS-28 scores 24 hours after ICU admission and SAPS II scores within the first 24 hours of ICU admission ($r = 0.2098$, $p = 0.0317$).

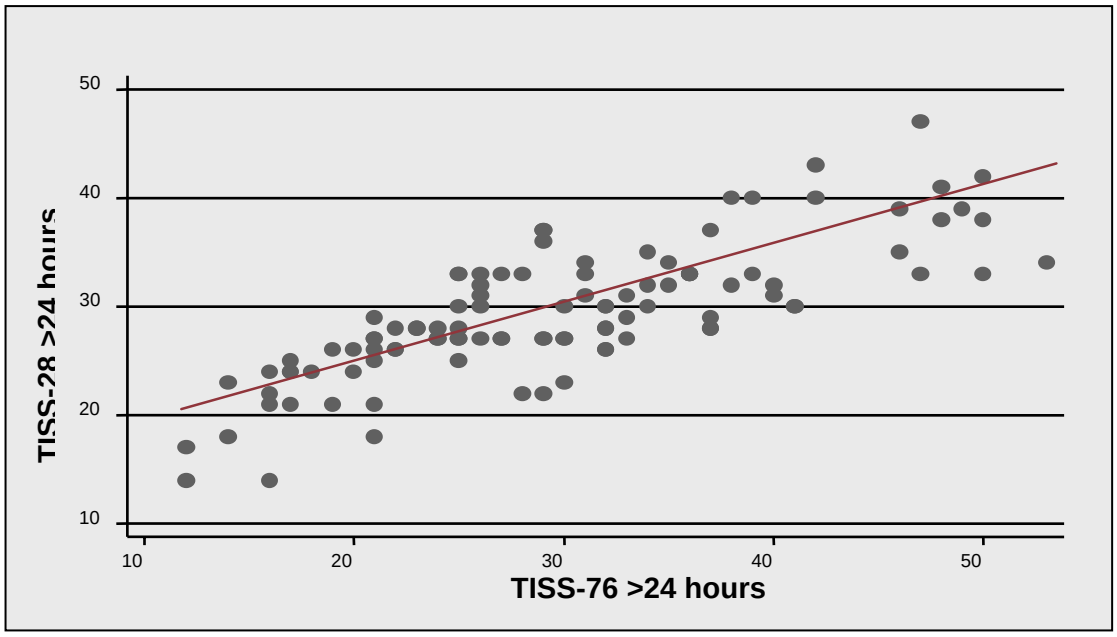


Figure 4.4: Relationship between TISS-28 >24 hours and TISS-76 >24 hours

Figure 4.4 indicates that there was a significant strong positive correlation between TISS-28 scores after 24 hours of ICU admission and TISS-76 scores after 24 hours of ICU admission (r = 0.7857, p = 0.0001).

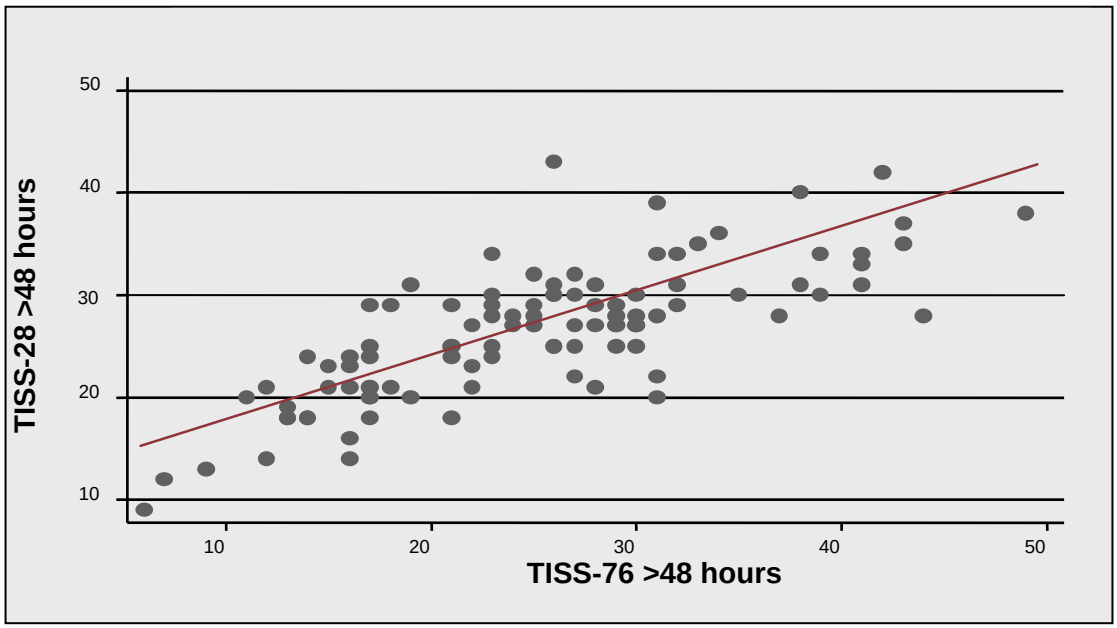


Figure 4.5: Relationship between TISS-28 >48 hours and TISS-76 >48hours

The scatter plot in **figure 4.5** shows that there was a significant strong positive correlation between TISS-28 scores after 48 hours of ICU admission and TISS-76 scores after 48 hours of ICU admission (r = 0.7677, p = 0.0001).

4.4.6 Construct Validity of TISS-28

Table 4.9: Comparison of TISS-28 scores between ICU patients and Ward patients after discharge from ICU

TISS-28 scores	Mean	SD	P-Value	95% CI	
				Lower	Upper
In ICU >24 hours (n=105)	28.93	5.97	0.0001	27.64	30.22
In ICU >48 hours (n=103)	25.19	5.86	0.0001	23.92	26.45
In Ward 24-48 hours (n=85)	10.05	4.51	0.0001	9.07	11.02

A significant difference was found between the TISS-28 scores among ICU patients and ward patients (p = 0.0001). ICU participants had more spread out scores about the mean than ward participants.

4.4.7 Inter-rater Reliability of TISS-28

Table 4.10: Comparison of data collected by the researcher and assistant expert researcher using TISS-28 in ICU

TISS-28 scores (>24hours)				TISS-28 scores (>48hours)			
Intra-class Correlation	P-Value	95% CI		Intra-class Correlation	P-Value	95% CI	
		Lower	Upper			Lower	Upper
0.99	0.0001	0.995	1.000	0.99	0.0001	0.994	1.000

An intra-class correlation coefficient test was used to determine the degree of agreement between the data collected by the researcher and the expert assistant researcher. A significant intra-class correlation was found between the data collected by the researcher and the expert assistant researcher both at 24 and 48 hours with an intra-class correlation coefficient of 0.99 and a p-value of 0.0001.

4.5 SUMMARY

This chapter dealt with the results obtained from the study and discussed the descriptive and inferential statistics used to describe and analyze data. This has been presented in form of descriptive tables scatter plots and graphs to enhance interpretation of the results.

The following chapter will present a summary of the study, the main findings and discussion, conclusions and recommendations.