Technical Whitepaper

July, 2001

Prorating Scale Scores

Consequential analysis using scales from:

BDI (Beck Depression Inventory)

NAS (Novaco Anger Scales)

STAXI (State-Trait Anxiety Inventory)

PIP (Psychotic Inpatient Profile)

WARS (Ward Anger Rating Scale)

Paul Barrett – 24th May, 2017

This research was conducted in 2001, while the first author was a Research Associate, and second author the Chief Research Scientist at the High Security Forensic Psychiatric State Hospital, Carstairs, Scotland, UK.

The work provides some detailed data and graphics on the consequences of prorating scale scores.

It may be helpful for those looking for some empirically justified insights in this area, especially when small sample sizes contraindicate multiple imputation methods.

The State Hospital Anger Project

This analysis, implemented by **Charles Marley**, investigated the accuracy of using prorated scale scores with a variety of scales from the State Hospital Anger Management project. The scales were chosen as representative of the item length and internal consistency of all the scales used in the project. The aim is to permit a rational examination of the problem, and to decide upon a common fixed "lower bound" for all the tests, based upon the analysis results below. The only alternative to this approach (which still yields some patients with unscored scales), is to use multiple imputation of the missing item data, using either the AMELIA or NORM programs (using the EM routine) to impute the most likely missing value for every occurrence. This is something we are looking at for the future.

Selecting Bound Values for Pro-Rating Missing Items

The scales are chosen from five of the more commonly used anger assessments, and all the scales vary in the amount of items that make up the scale. The Scales used and the items that make up the scales are listed below:

Assessment	Scale	No. items	Items	Alpha	Page
BDI	Total Score	21	1-21	0.86	2
NAS	Behaviour	15	11-14; 26-29; 41-44; 56-59	0.90*	5
NAS	Regulation	12	5,10,15,20,25,30,35,40,45,50,55,60	0.85*	8
STAXI	State Anger	10	1-10	0.94*	11
STAXI	Anger Expression	24	21-44	0.75*	14
PIP	Hostile Belligerence	8	11,28,31,36,51,54,67,72	0.86	17
PIP	Disorientation	5	92-96	0.89	20
WARS	Anger Attributes	7	19-25	0.94*	23
WARS	Self Aggression	4	12-15	?	26

Data

The data was obtained from the State Hospital Anger Admission Project and Anger Intervention Group Files. Each analysis is produced with approximately 60 male patients per assessment. The *alphas are obtained from State Hospital Anger Admission research report.

Procedure Followed

The number of items to be missing from each scale was set at 5% intervals from 5% to 50% - this allocated different amounts of items to be missing, for each of the scales, based on the number of items in the scale. The scores were obtained for the scale, with the missing items, and then the pro-rated score was calculated using the following equation:

$$T_p = \left(\frac{T_R}{N_R} \right) * N_T \quad \text{where ...}$$

T_p = Prorated Total Scale Score
T_R = Total Raw Score based upon those items which have been responded to
N_R = Number of items which have been responded to
N_T = The total number of items in the scale

The prorated scores were then subtracted from the total score, (data obtained from the admissions data file except for the BDI data, which was obtained from the anger group data file), to obtain the differences. The prorated scores were then correlated with the each of the prorated scores to produce correlation matrices, and descriptive statistics were calculated for the total score, the prorated score and the differences between both of these scores. Box whisker plots of the median of the differences between the pro-rated total and the true score total, the inter-quartile points of these differences and the minimum and maximum differences are displayed, showing the variability of the scores at different levels of pro-rating.

Note: the item exclusions were semi-random – but represent only one out of many possible item selections.

BDI – Total Score

Missing Items

Percentage	(%) value of 21 items	No. of items excluded	Items excluded
5	1.05	1	2
10	2.1	2	10,17
15	3.15	3	3,14,19
20	4.2	4	1,5,9,10
25	5.25	5	4,5,6,13,16
30	6.3	6	1,4,5,7,9,21
35	7.35	7	3,8,11,15,18,19,20
40	8.4	8	1,2,8,12,15,18,20,21
45	9.45	9	6,7,8,11,12,15,17,19,20
50	10.5	10	1,2,5,9,12,15,16,19,20,21

BDI Total Score - After Item Exclusion and Pro-Rating
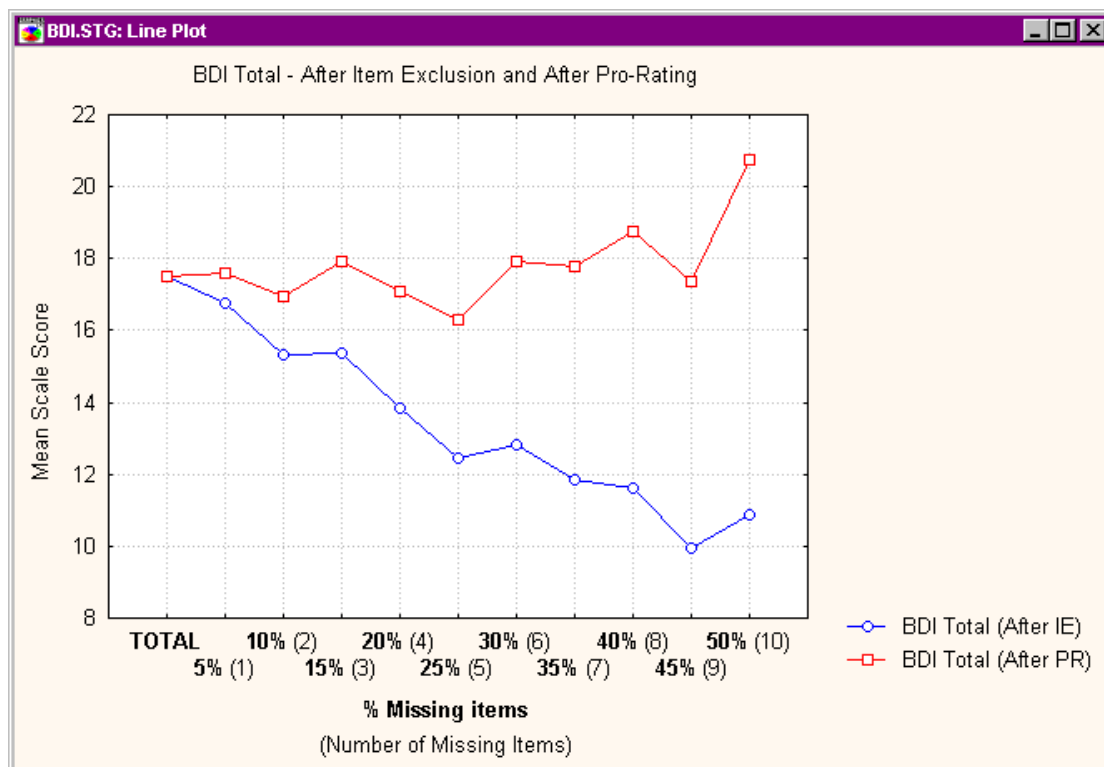
BDI Total Score - Descriptive Statistics after Item Exclusion

Descriptive Statistics

Continue...	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
No Miss	46	17.50000	15.50000	0.00	40.00000	11.83545	.307226
5% Miss	46	16.76087	15.50000	0.00	37.00000	10.95077	.235381
10% Miss	46	15.32609	13.50000	0.00	34.00000	10.76425	.277851
15% Miss	46	15.36957	13.00000	0.00	37.00000	10.51424	.358601
20% Miss	46	13.82609	12.50000	0.00	31.00000	9.45705	.321650
25% Miss	46	12.43478	11.00000	0.00	30.00000	8.83843	.378245
30% Miss	46	12.80435	12.00000	0.00	29.00000	8.37621	.309873
35% Miss	46	11.84783	11.00000	0.00	31.00000	8.57637	.543742
40% Miss	46	11.60870	11.00000	0.00	28.00000	7.47879	.260558
45% Miss	46	9.93478	9.00000	0.00	27.00000	7.41890	.433631
50% Miss	46	10.86957	10.00000	0.00	26.00000	6.94937	.241210

BDI Total Score - Descriptive Statistics after Pro-Rating

Descriptive Statistics (prorated + differences.sta)

| BASIC STATS	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
No Miss	46	17.50000	15.50000	0.00	40.00000	11.83545	.307226
5% Miss	46	17.59891	16.27500	0.00	38.85000	11.49831	.235381
10% Miss	46	16.93936	14.92105	0.00	37.57895	11.89733	.277851
15% Miss	46	17.93116	15.16667	0.00	43.16667	12.26662	.358601
20% Miss	46	17.07928	15.44118	0.00	38.29412	11.68224	.321650
25% Miss	46	16.32065	14.43750	0.00	39.37500	11.60044	.378245
30% Miss	46	17.92609	16.80000	0.00	40.60000	11.72669	.309873
35% Miss	46	17.77174	16.50000	0.00	46.50000	12.86455	.543742
40% Miss	46	18.75251	17.76923	0.00	45.23077	12.08113	.260558
45% Miss	46	17.38587	15.75000	0.00	47.25000	12.98308	.433631
50% Miss	46	20.75099	19.09091	0.00	49.63636	13.26698	.241210

BDI Total Score / Pro-Rated Value – Descriptive Statistics of Differences

Descriptive Statistics (prorated + differences.sta)

| BASIC STATS	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
5% Miss	46	-.09891	-.27500	-1.4500	1.950000	.815781	.782499
10% Miss	46	.56064	.52632	-2.6316	3.684211	1.528561	-.031588
15% Miss	46	-.43116	-.58333	-4.1667	3.333333	1.543035	-.035827
20% Miss	46	.42072	.02941	-2.7059	7.294118	2.072094	1.078420
25% Miss	46	1.17935	.43750	-3.8125	6.812500	2.430300	.314085
30% Miss	46	-.42609	-.50000	-6.2000	6.000000	2.441715	.368880
35% Miss	46	-.27174	0.00000	-7.5000	6.500000	2.990181	-.279976
40% Miss	46	-1.25251	-1.65385	-9.2308	3.615385	2.771778	-.167920
45% Miss	46	.11413	0.00000	-8.2500	7.000000	3.063996	-.446822
50% Miss	46	-3.25099	-3.09091	-13.6364	4.636364	4.133324	-.244225

BDI Mean Total / BDI Pro-Rated Mean – Correlation

Correlations (prorated + differences.sta)

Marked correlations are significant at p < .05000
N=46 (Casewise deletion of missing data)

Variable	Total	5% PR	10% PR	15% PR	20% PR	25% PR	30% PR	35% PR	40% PR	45% PR	50% PR
Total	1.00	1.00	.99	.99	.98	.98	.98	.97	.97	.97	.95
5% PR	1.00	1.00	.99	.99	.98	.98	.98	.97	.97	.97	.95
10% PR	.99	.99	1.00	.98	.99	.96	.96	.96	.96	.96	.93
15% PR	.99	.99	.98	1.00	.97	.97	.97	.98	.95	.97	.93
20% PR	.98	.98	.99	.97	1.00	.95	.98	.94	.96	.94	.95
25% PR	.98	.98	.96	.97	.95	1.00	.96	.94	.93	.95	.93
30% PR	.98	.98	.96	.97	.98	.96	1.00	.94	.97	.93	.96
35% PR	.97	.97	.96	.98	.94	.94	.94	1.00	.95	.97	.91
40% PR	.97	.97	.96	.95	.96	.93	.97	.95	1.00	.94	.97
45% PR	.97	.97	.96	.97	.94	.95	.93	.97	.94	1.00	.91
50% PR	.95	.95	.93	.93	.95	.93	.96	.91	.97	.91	1.00

Charles Marley and Paul Barrett: The State Hospital, Carstairs

BDI Total - Mean Differences between Pro-Rated and Total Scores
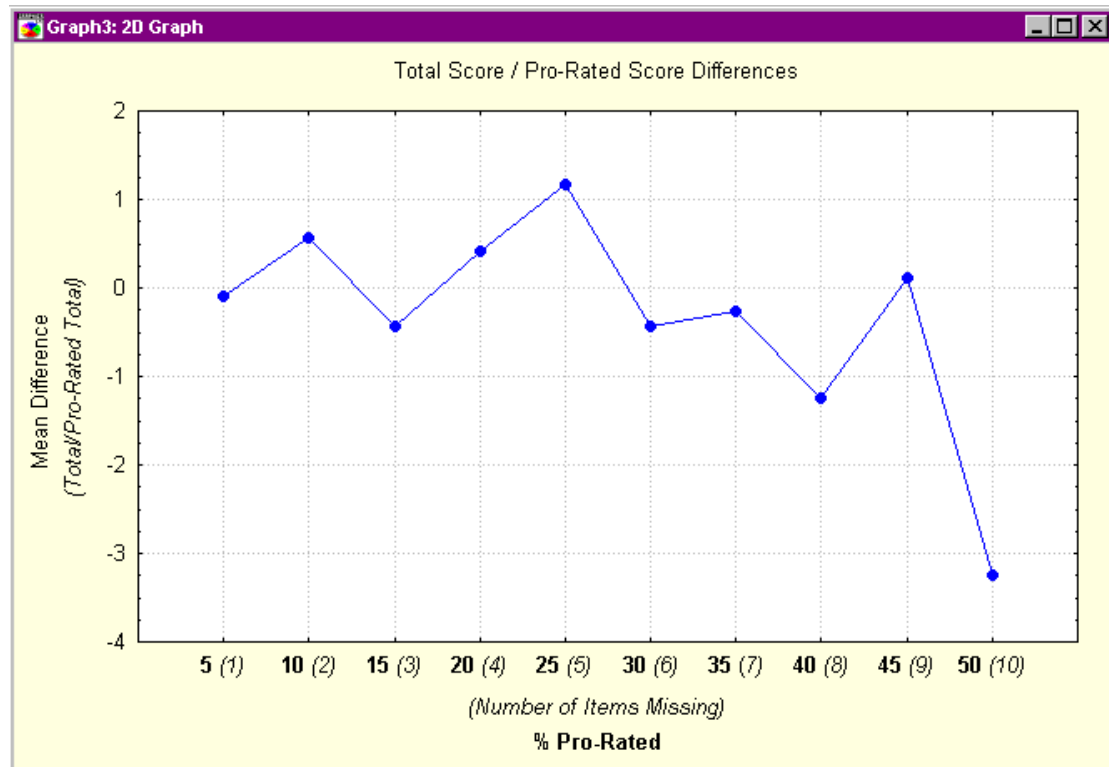
## BDI Total Score - Pro-Rated Scale Total / Scale Total Differences – Variability
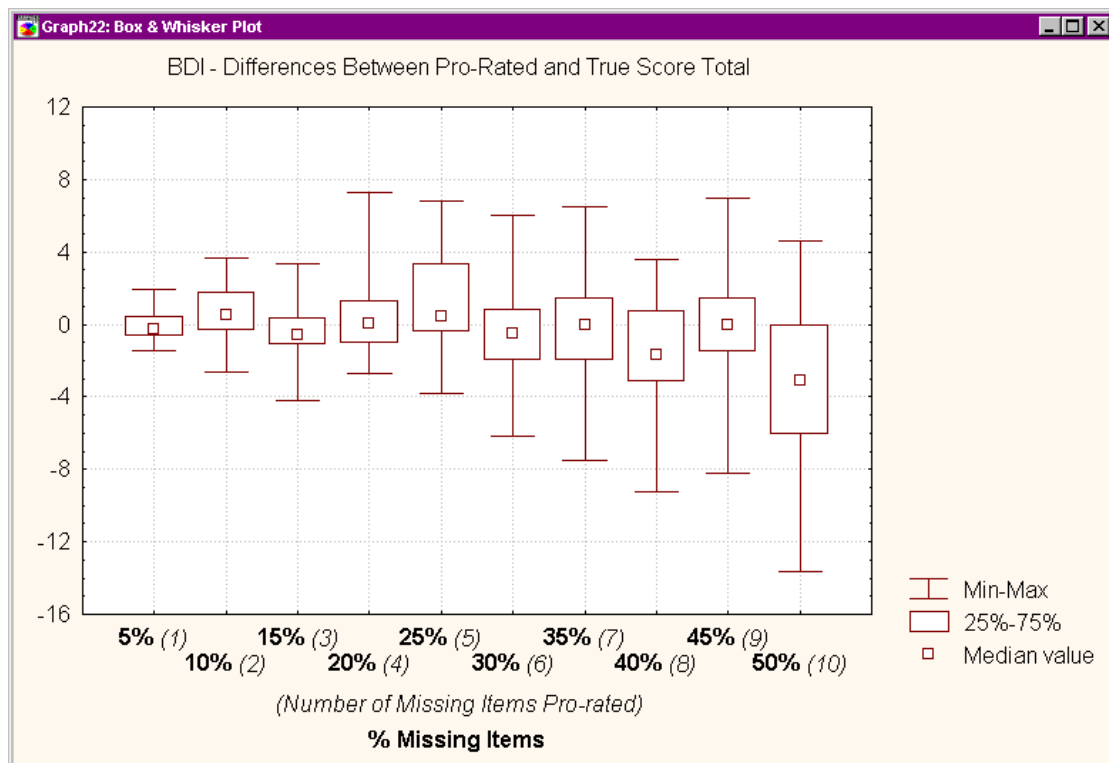
NAS – Behaviour Total Score

Missing Items

Percentage	(%) value of 15 items	No. of items excluded	Items excluded
5	0.75	0	
10	1.5	1	14
15	2.25	2	43, 59
20	3	3	11,12,13
25	3.75	4	12,26,29,43
30	4.5		
35	5.25	5	11,27,41,56,57
40	6	6	13,14,29,43,56,59
45	6.75	7	14,29,41,44,56,57,58
50	7.5	8	12,14,28,29,41,44,56,57

NAS Behaviour Score - After Item Exclusion and Pro-Rating
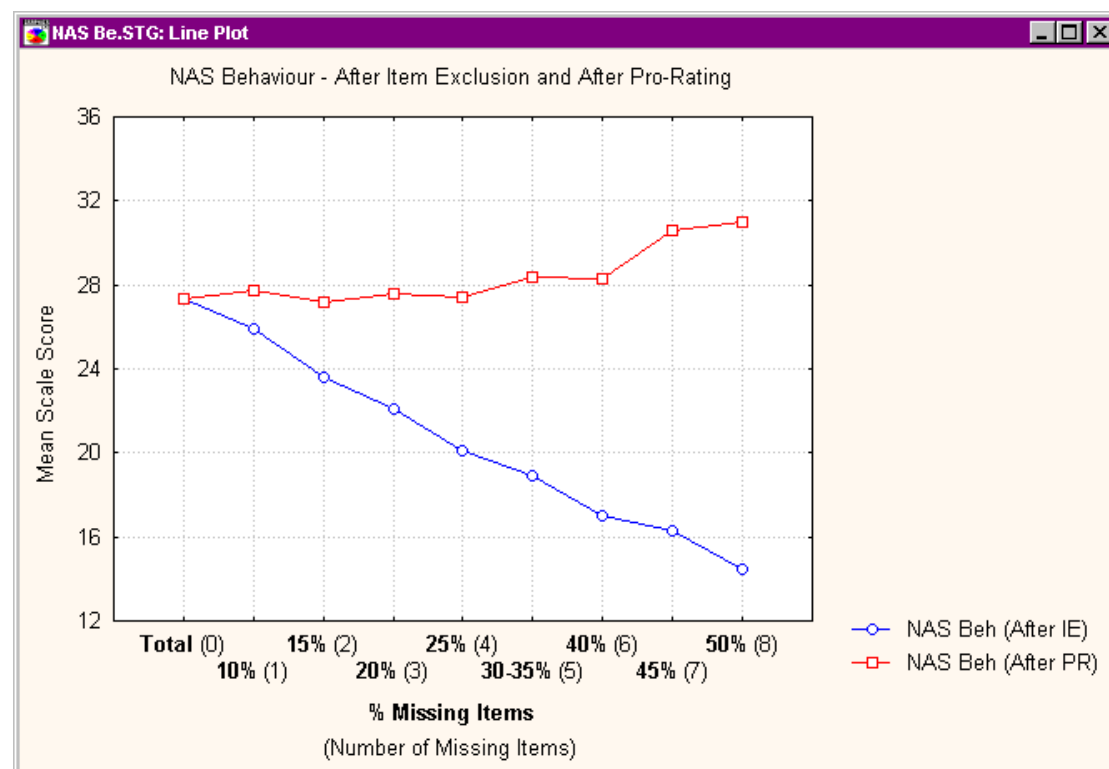
NAS Behaviour (Mean) Score after Item Exclusion

Descriptive Statistics	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
No Miss	60	27.36667	25.50000	17.00000	44.00000	7.398962	.498413
5-10% Miss	60	25.90000	24.50000	16.00000	42.00000	7.002905	.508408
15% Miss	60	23.56667	21.50000	14.00000	39.00000	6.931546	.589658
20% Miss	60	22.08333	21.00000	14.00000	35.00000	5.755739	.528210
25% Miss	60	20.08333	19.00000	12.00000	32.00000	5.690586	.570443
30-35% Miss	60	18.93333	18.00000	11.00000	29.00000	4.765222	.408335
40% Miss	60	17.00000	15.50000	10.00000	29.00000	5.035467	.647628
45% Miss	60	16.31667	16.00000	10.00000	26.00000	4.304084	.359927
50% Miss	60	14.45000	14.50000	9.00000	23.00000	3.734516	.396795

NAS Behaviour Total - Descriptive Statistics after Pro-Rating

| BASIC STATS	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
No Miss	60	27.36667	25.50000	17.00000	44.00000	7.398962	.498413
5-10% Miss	60	27.75000	26.25000	17.14286	45.00000	7.503112	.508408
15% Miss	60	27.19231	24.80769	16.15385	45.00000	7.997938	.589658
20% Miss	60	27.60417	26.25000	17.50000	43.75000	7.194674	.528210
25% Miss	60	27.38636	25.90909	16.36364	43.63636	7.759890	.570443
30-35% Miss	60	28.40000	27.00000	16.50000	43.50000	7.147834	.408335
40% Miss	60	28.33333	25.83333	16.66667	48.33333	8.392446	.647628
45% Miss	60	30.59375	30.00000	18.75000	48.75000	8.070158	.359927
50% Miss	60	30.96429	31.07143	19.28571	49.28571	8.002534	.396795

NAS Behaviour (Mean) Total / Pro-Rated Total – Descriptive Statistics

BASIC STATS	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
5-10% Miss	60	.383333	.357143	-.92857	1.78571	.543660	-.02587
15% Miss	60	-.174359	-.307692	-2.92308	2.69231	1.074673	.19838
20% Miss	60	.237500	.500000	-2.25000	2.25000	1.097402	-.36577
25% Miss	60	.019697	-.090909	-3.09091	3.63636	1.439258	.35565
30-35% Miss	60	1.033333	1.500000	-4.50000	4.50000	1.561905	-1.09240
40% Miss	60	.966667	1.000000	-3.00000	5.33333	1.851044	.12531
45% Miss	60	3.227083	2.625000	-2.50000	9.12500	2.558064	.57514
50% Miss	60	3.597619	3.357143	-2.71429	10.71429	2.929884	.35280

NAS Behaviour Total / Pro-Rated Total – Correlation

Marked correlations are significant at p < .05000
N=60 (Casewise deletion of missing data)

Variable	Total	5-10% PR	15% PR	20% PR	25% PR	30-35 PR	40% PR	45% PR	50% PR
Total	1.00	1.00	.99	.99	.98	.98	.98	.95	.93
5-10% PR	1.00	1.00	.99	.99	.98	.98	.98	.96	.95
15% PR	.99	.99	1.00	.98	.98	.96	.98	.92	.90
20% PR	.99	.99	.98	1.00	.98	.96	.97	.92	.91
25% PR	.98	.98	.98	.98	1.00	.95	.97	.92	.92
30-35% PR	.98	.98	.96	.96	.95	1.00	.95	.96	.94
40% PR	.98	.98	.98	.97	.97	.95	1.00	.94	.93
45% PR	.95	.96	.92	.92	.92	.96	.94	1.00	.98
50% PR	.93	.95	.90	.91	.92	.94	.93	.98	1.00

NAS Behaviour (Mean) Total / Pro-Rated Score – Differences
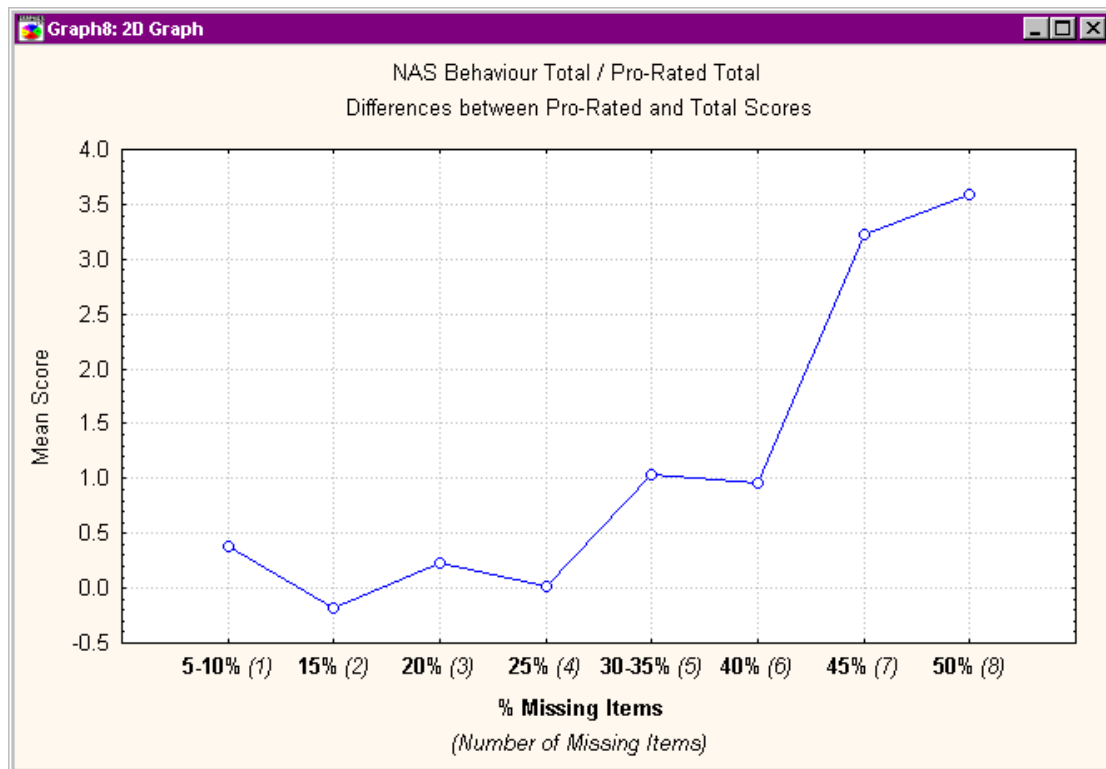
NAS – Behaviour Scale – Pro-Rated Scale Totals / Scale Totals Differences - Variability
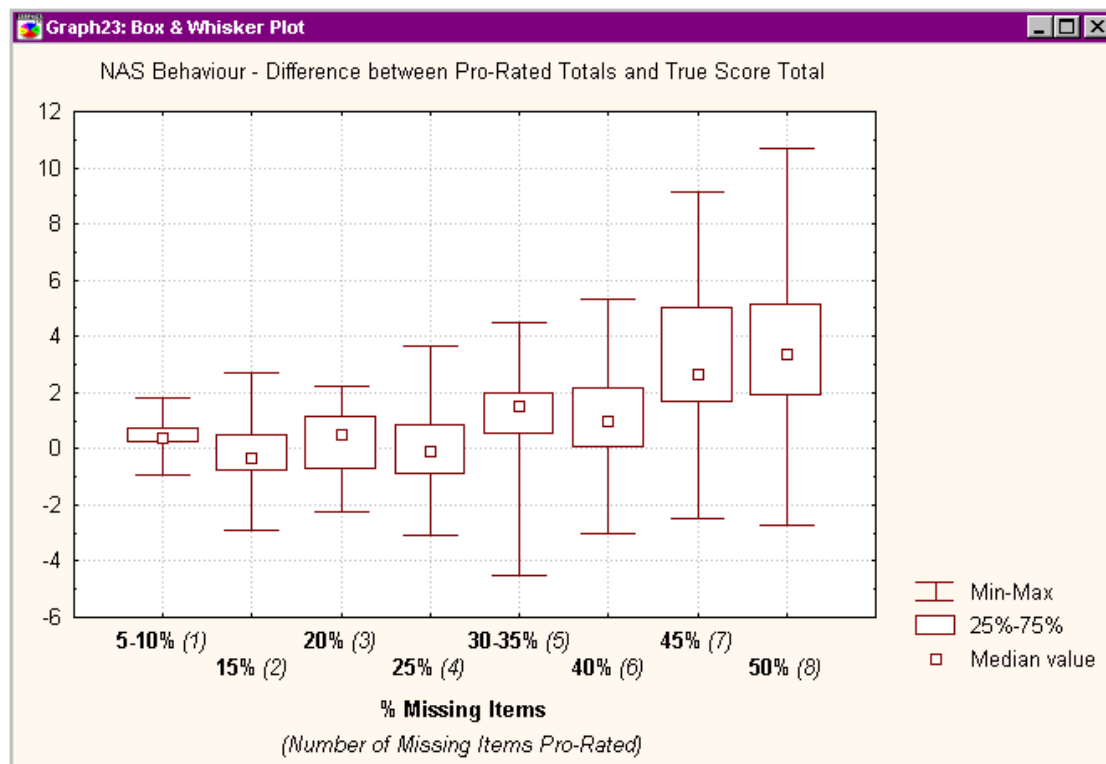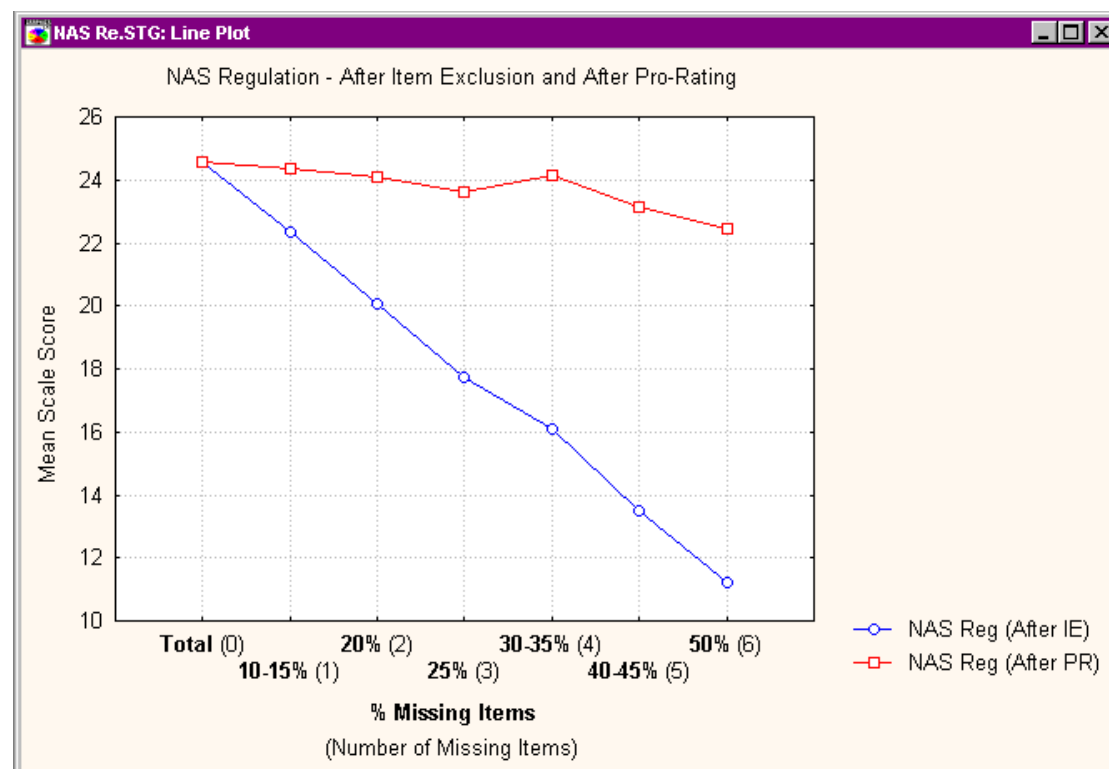
NAS – Regulation Total Score

Missing Items

Percentage	(%) value of 12 items	No. of items excluded	Items excluded
5	0.6	0	
10	1.2		
15	1.8	1	45
20	2.4	2	20,55
25	3	3	10,30,60
30	3.6		
35	4.2	4	25,40,50,55
40	4.8		
45	5.4	5	15,30,40,50,60
50	6	6	10,15,35,40,45,55

NAS Regulation Score - After Item Exclusion and Pro-Rating

NAS Regulation Scale after Item Exclusion– Descriptive Statistics

Descriptive Statistics

Continue...	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
0% Miss	60	24.55000	24.50000	12.00000	33.00000	4.626471	-.450917
5-15% Miss	60	22.33333	22.50000	11.00000	30.00000	4.136103	-.473184
20% Miss	60	20.08333	20.00000	10.00000	27.00000	3.872072	-.527388
25% Miss	60	17.71667	17.00000	9.00000	24.00000	3.464550	-.299222
30-35% Miss	60	16.10000	16.00000	7.00000	21.00000	3.166027	-.495852
40-45% Miss	60	13.50000	13.00000	7.00000	18.00000	2.677591	-.284966
50% Miss	60	11.23333	12.00000	6.00000	15.00000	2.126242	-.447756

NAS Regulation Total after Pro-Rating – Descriptive Statistics

Descriptive Statistics (prorated + differences.sta)

BASIC STATS	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
No Miss	60	24.55000	24.50000	12.00000	33.00000	4.626471	-.450917
10-15% Miss	60	24.36364	24.54545	12.00000	32.72727	4.512112	-.473184
20% Miss	60	24.10000	24.00000	12.00000	32.40000	4.646486	-.527388
25% Miss	60	23.62222	22.66667	12.00000	32.00000	4.619400	-.299222
30-35% Miss	60	24.15000	24.00000	10.50000	31.50000	4.749041	-.495852
40-45% Miss	60	23.14286	22.28571	12.00000	30.85714	4.590155	-.284966
50% Miss	60	22.46667	24.00000	12.00000	30.00000	4.252483	-.447756

NAS Regulation Total /Pro-Rated Total (Mean) Differences – Descriptive Statistics

Descriptive Statistics (prorated + differences.sta)

BASIC STATS	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
10-15% PR	60	-.18636	-.18182	-1.36364	1.272727	.588070	.479292
20% PR	60	-.45000	-.50000	-2.20000	1.400000	.823901	.154715
25% PR	60	-.92778	-.83333	-3.33333	1.000000	.982122	-.314325
30-35% PR	60	-.40000	-.50000	-3.50000	2.500000	1.349199	-.155489
40-45% PR	60	-1.40714	-1.28571	-4.71429	1.714286	1.434329	.038603
50% PR	60	-2.08333	-2.00000	-6.00000	6.000000	2.117655	1.143202

NAS Regulation Total / Pro-Rated Total – Correlation

Correlations (prorated + differences.sta)

Marked correlations are significant at p < .05000
N=60 (Casewise deletion of missing data)

BASIC STATS Variable	Total	10-15% PR	20% PR	25% PR	30-35% PR	40-45% PR	50% PR
Total	1.00	.99	.98	.98	.96	.95	.89
10-15% PR	.99	1.00	.98	.96	.94	.94	.88
20% PR	.98	.98	1.00	.95	.95	.91	.90
25% PR	.98	.96	.95	1.00	.92	.96	.84
30-35% PR	.96	.94	.95	.92	1.00	.90	.87
40-45% PR	.95	.94	.91	.96	.90	1.00	.81
50% PR	.89	.88	.90	.84	.87	.81	1.00

NAS Regulation Total Score / Pro-Rated Score - Mean Differences
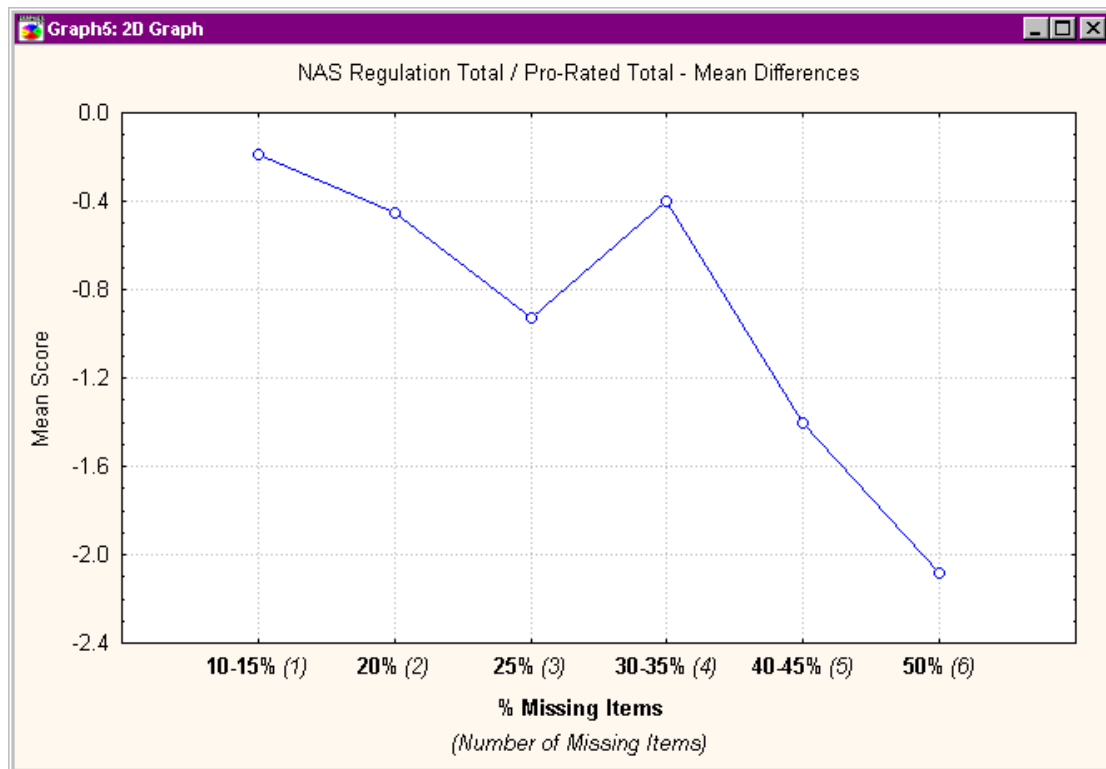
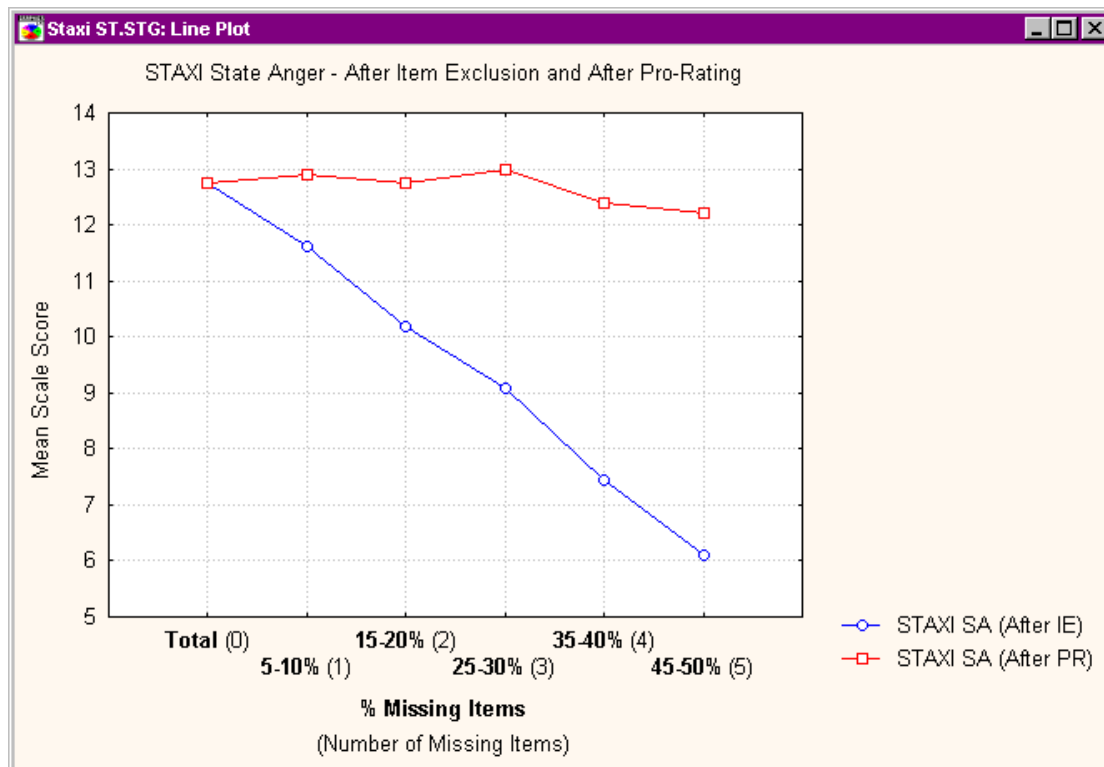**NAS – Regulation Scale – Pro-Rated Totals / Total Score Differences - Variability**
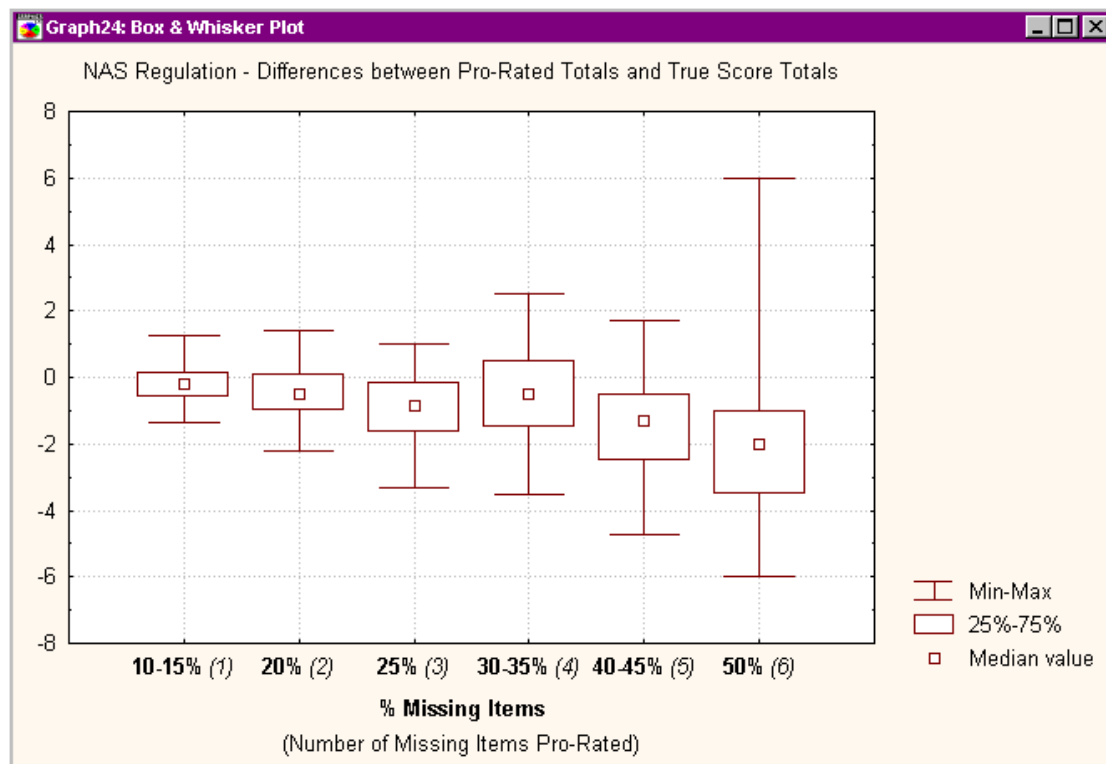
STAXI – State Anger Total Score

Missing Items

Percentage	(%) value of 10 items	No. of items excluded	Items excluded
5	0.5		
10	1	1	6
15	1.5		
20	2	2	1,10
25	2.5		
30	3	3	3,5,6
35	2.5		
40	4	4	2,4,7,10
45	4.5		
50	5	5	1,2,5,7,9

STAXI State Anger Total – After Item Exclusion and Pro-Rating

STAXI State Anger Total after Item Exclusion – Descriptive Statistics

Descriptive Statistics	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
0% Miss	60	12.75000	10.00000	10.00000	37.00000	5.516155	2.816775
5-10% Miss	60	11.61667	9.00000	9.00000	36.00000	5.307787	2.918461
15-20% Miss	60	10.20000	8.00000	8.00000	29.00000	4.261773	2.682537
25-30% Miss	60	9.08333	7.00000	7.00000	28.00000	4.315096	2.879299
35-40% Miss	60	7.43333	6.00000	6.00000	21.00000	2.993590	2.882104
45-50% Miss	60	6.10000	5.00000	5.00000	17.00000	2.426548	2.979224

STAXI State Anger Total After Pro-Rating – Descriptive Statistics

| Descriptive Statistics	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
No Miss	60	12.75000	10.00000	10.00000	37.00000	5.516155	2.816775
5-10% Miss	60	12.90741	10.00000	10.00000	40.00000	5.897541	2.918461
15-20% Miss	60	12.75000	10.00000	10.00000	36.25000	5.327217	2.682537
25-30% Miss	60	12.97619	10.00000	10.00000	40.00000	6.164423	2.879299
35-40% Miss	60	12.38889	10.00000	10.00000	35.00000	4.989317	2.882104
45-50% Miss	60	12.20000	10.00000	10.00000	34.00000	4.853096	2.979224

STAXI State Anger Total / Pro-Rating Total Differences – Descriptive Statistics

BASIC STATS	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
5-10% PR	60	.157407	0.00	-.77778	3.000000	.515218	3.03377
15-20% PR	60	0.000000	0.00	-2.25000	2.000000	.678046	.01582
25-30% PR	60	.226190	0.00	-2.71429	4.714286	1.073337	.89553
35-40% PR	60	-.361111	0.00	-6.00000	2.666667	1.316692	-2.07467
45-50% PR	60	-.550000	0.00	-5.00000	2.000000	1.320311	-1.39650

STAXI State Anger Total / Pro-Rating Totals – Correlation

BASIC STATS	Marked correlations are significant at p < .05000 N=60 (Casewise deletion of missing data)					
Variable	Total	5-10% PR	15-20% PR	25-30% PR	35-40% PR	45-50% PR
Total	1.00	1.00	.99	.99	.97	.98
5-10% PR	1.00	1.00	.99	.99	.97	.97
15-20% PR	.99	.99	1.00	.98	.96	.96
25-30% PR	.99	.99	.98	1.00	.94	.95
35-40% PR	.97	.97	.96	.94	1.00	.97
45-50% PR	.98	.97	.96	.95	.97	1.00

STAXI State Anger Total / Pro-Rating Total – Differences
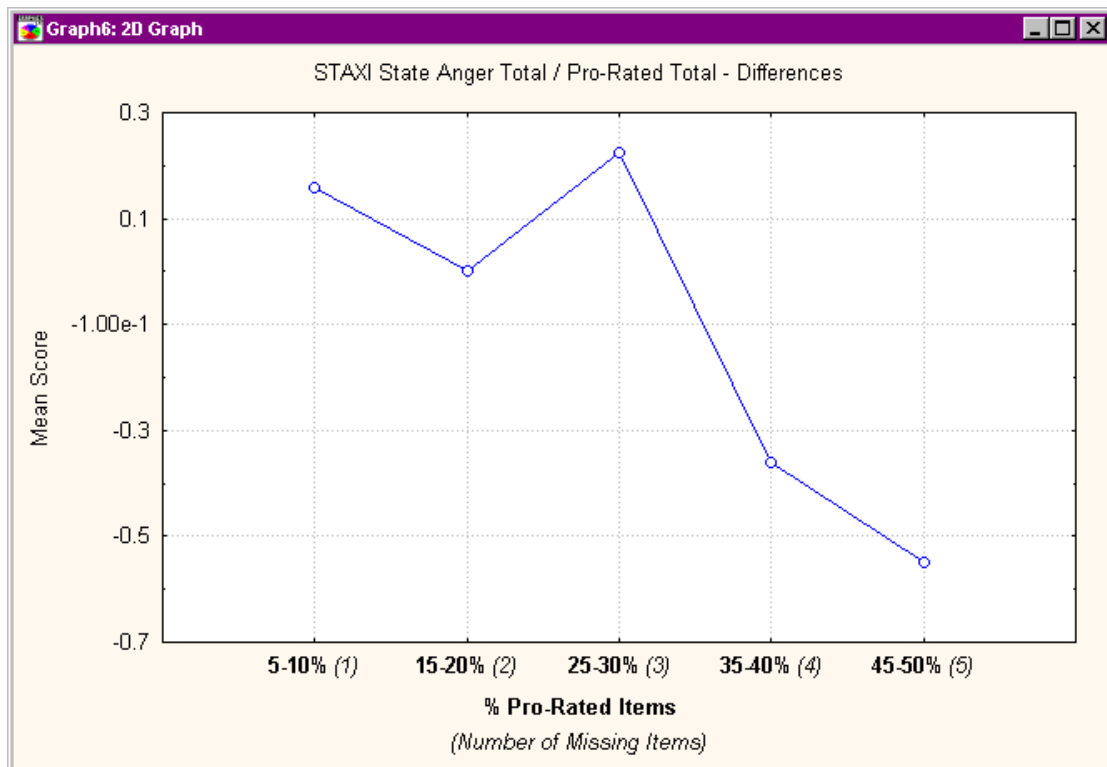
## STAXI State Anger Scale – Pro-Rate Totals / Total Score Differences - Variability
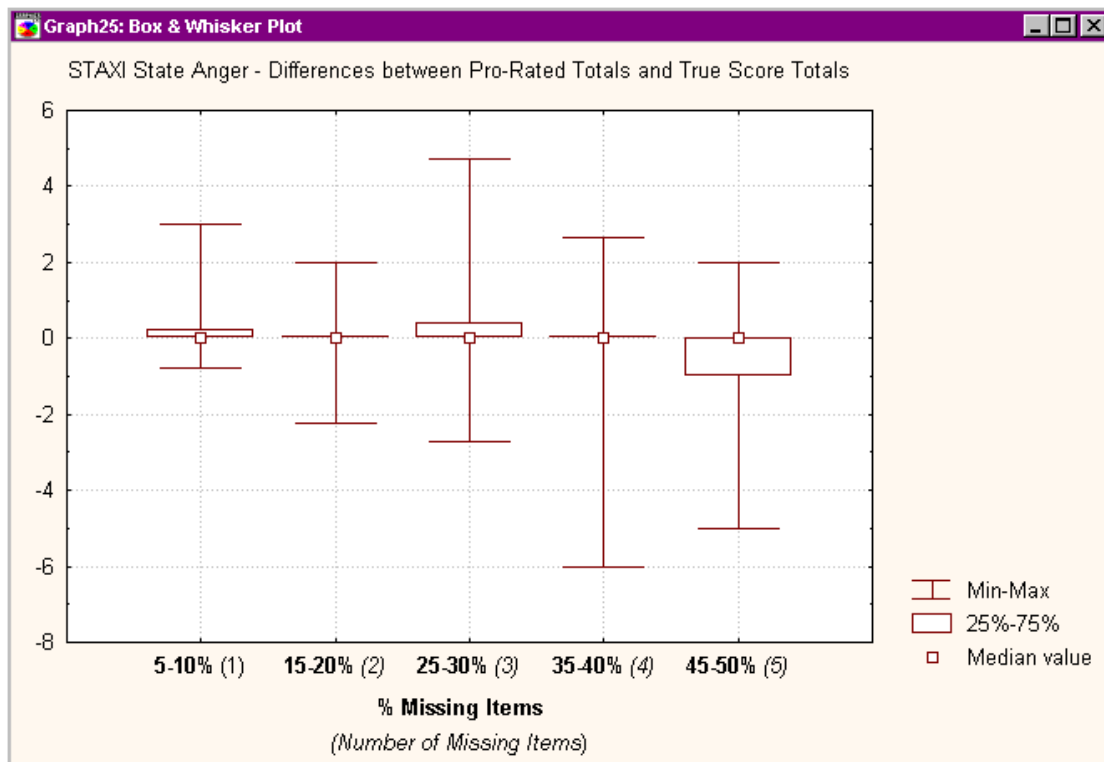
STAXI – Anger Expression Total Score

Missing Items

Percentage	(%) value of 24 items	No. of items excluded	Items excluded
5	1.2	1	23
10	2.4	2	42,43
15	3.6	4	31,35,38,40
20	4.8	5	22,25,37,38,39
25	6	6	23,25,27,31,40,41
30	7.2	7	23,25,26,35,38,40,41
35	8.4	8	24,28,30,33,36,40,41,44
40	9.6	10	21,23,24,25,31,32,35,41,42,44
45	10.8	11	21,23,25,28,31,33,37,38,41,42,43,
50	12	12	21,23,25,26,29,32,34,36,38,40,42,43

STAXI Anger Expression Total – After Item Exclusion and Pro-Rating
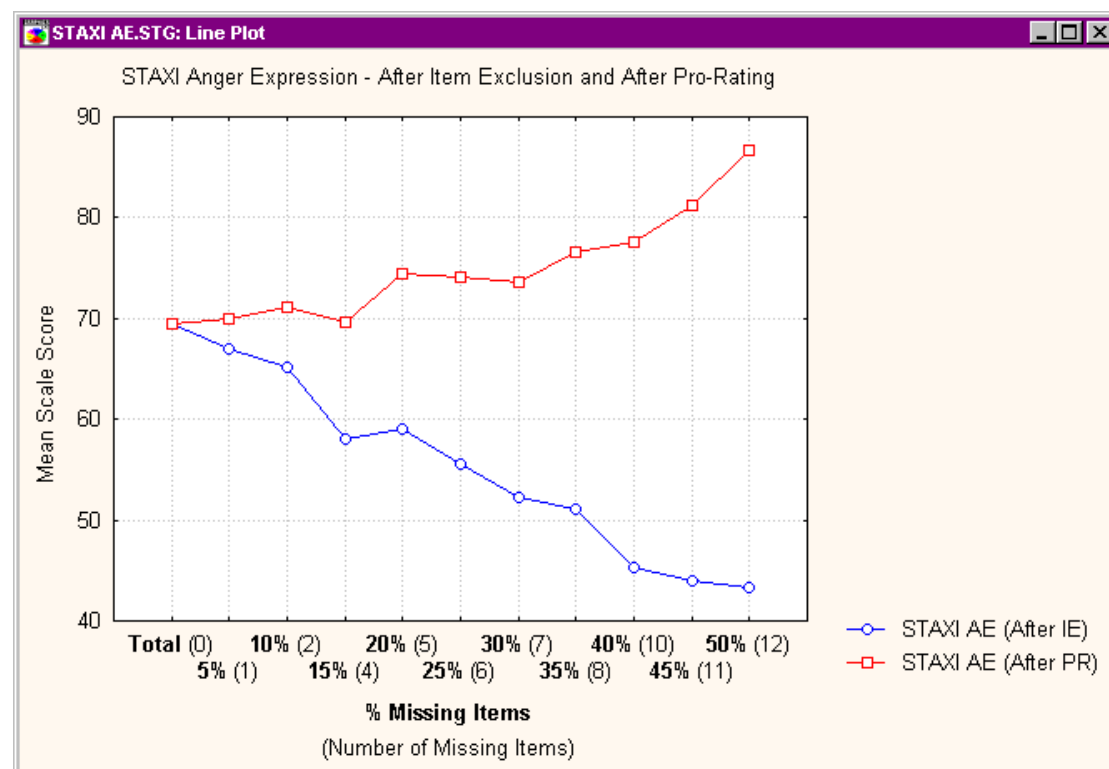
STAXI Anger Expression Total After Item Exclusion – Descriptive Statistics

Descriptive Statistics

Continue...	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
Total	60	69.43333	69.00000	40.00000	91.00000	8.531828	-.365721
5% Miss	60	67.00000	66.00000	39.00000	90.00000	8.080107	-.233921
10% Miss	60	65.25000	65.50000	38.00000	86.00000	8.331327	-.287172
15% Miss	60	58.10000	57.00000	36.00000	78.00000	8.416489	.226217
20% Miss	60	58.96667	58.50000	35.00000	75.00000	6.886407	-.593607
25% Miss	60	55.61667	55.00000	34.00000	74.00000	6.775058	-.138765
30% Miss	60	52.18333	51.50000	33.00000	72.00000	6.421605	.256937
35% Miss	60	51.03333	51.50000	32.00000	66.00000	6.356544	-.076759
40% Miss	60	45.26667	44.00000	30.00000	61.00000	5.833471	.302489
45% Miss	60	44.00000	43.50000	29.00000	60.00000	5.048913	.396434
50% Miss	60	43.31667	43.00000	28.00000	57.00000	4.989792	-.095467

STAXI Anger Expression Total After Pro-Rating – Descriptive Statistics

Descriptive Statistics (prorated + differences.sta)

| BASIC STATS	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
0% Miss	60	69.43333	69.00000	40.00000	91.0000	8.53183	-.365721
5% Miss		69.91304	68.86957	40.69565	93.9130	8.43142	-.233921
10% Miss	60	71.18182	71.45455	41.45455	93.8182	9.08872	-.287172
15% Miss	60	69.72000	68.40000	43.20000	93.6000	10.09979	.226217
20% Miss	60	74.48421	73.89474	44.21053	94.7368	8.69862	-.593607
25% Miss	60	74.15556	73.33333	45.33333	98.6667	9.03341	-.138765
30% Miss	60	73.67059	72.70588	46.58824	101.6471	9.06579	.256937
35% Miss	60	76.55000	77.25000	48.00000	99.0000	9.53482	-.076759
40% Miss	60	77.60000	75.42857	51.42857	104.5714	10.00024	.302489
45% Miss	60	81.23077	80.30769	53.53846	110.7692	9.32107	.396434
50% Miss	60	86.63333	86.00000	56.00000	114.0000	9.97958	-.095467

STAXI Anger Expression Total / Pro-Rated Total Differences – Descriptive Statistics

Descriptive Statistics (prorated + differences.sta)

| BASIC STATS	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
5% PR	60	.47971	.67391	-1.26087	2.91304	1.023794	-.030739
10% PR	60	1.74848	1.90909	-3.36364	4.54545	1.841405	-.589144
15% PR	60	.28667	.20000	-6.00000	8.40000	4.097352	.280000
20% PR	60	5.05088	4.86842	.84211	11.05263	2.152917	.430709
25% PR	60	4.72222	4.83333	0.00000	9.00000	1.971708	.023175
30% PR	60	4.23725	4.23529	-3.82353	11.58824	3.425677	-.025584
35% PR	60	7.11667	7.50000	-1.00000	17.50000	3.953508	.379616
40% PR	60	8.16667	7.50000	.71429	19.85714	4.646193	.523538
45% PR	60	11.79744	11.38462	5.30769	21.23077	3.304278	.543769
50% PR	60	17.20000	17.00000	7.00000	27.00000	4.371712	-.023722

STAXI Anger Expression Total / Pro-Rated Total – Correlation

Correlations (prorated + differences.sta)

BASIC STATS: Marked correlations are significant at p < .05000
N=60 (Casewise deletion of missing data)

Variable	Total	5% PR	10% PR	15% PR	20% PR	25% PR	30% PR	35% PR	40% PR	45% PR	50% PR
Total	1.00	.99	.98	.92	.97	.98	.93	.91	.89	.94	.90
5% PR	.99	1.00	.97	.91	.96	.98	.94	.90	.89	.95	.91
10% PR	.98	.97	1.00	.85	.97	.94	.86	.83	.81	.91	.92
15% PR	.92	.91	.85	1.00	.83	.93	.94	.95	.94	.89	.75
20% PR	.97	.96	.97	.83	1.00	.94	.87	.81	.79	.90	.92
25% PR	.98	.98	.94	.93	.94	1.00	.96	.92	.92	.94	.87
30% PR	.93	.94	.86	.94	.87	.96	1.00	.92	.92	.92	.84
35% PR	.91	.90	.83	.95	.81	.92	.92	1.00	.90	.86	.72
40% PR	.89	.89	.81	.94	.79	.92	.92	.90	1.00	.87	.73
45% PR	.94	.95	.91	.89	.90	.94	.92	.86	.87	1.00	.88
50% PR	.90	.91	.92	.75	.92	.87	.84	.72	.73	.88	1.00

STAXI Anger Expression Total / Pro-Rating Total – Differences
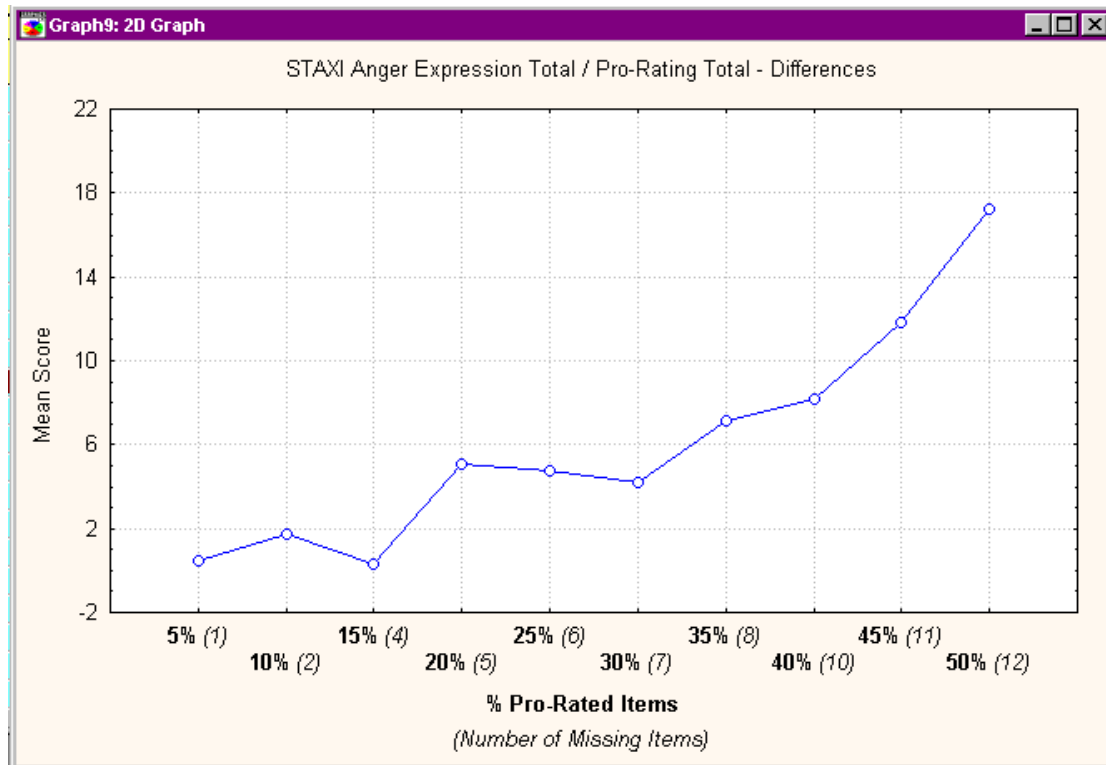
STAXI Anger Expression Scale – Pro-Rate Total / Total Score Differences - Variability
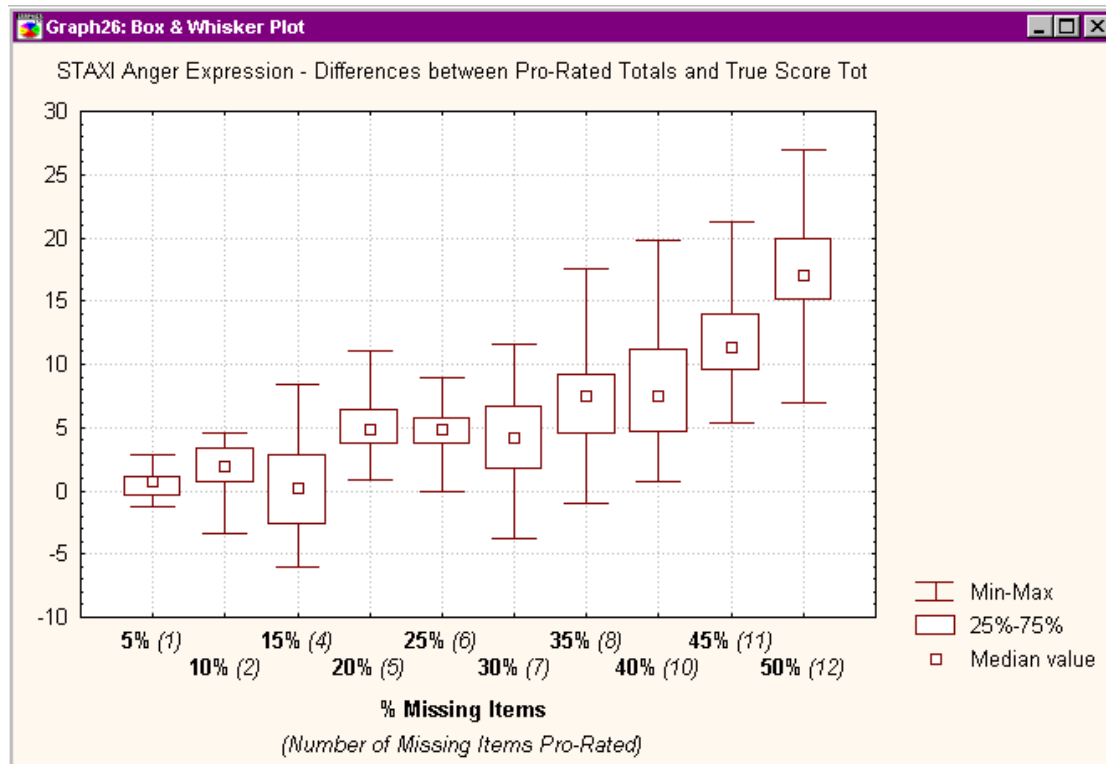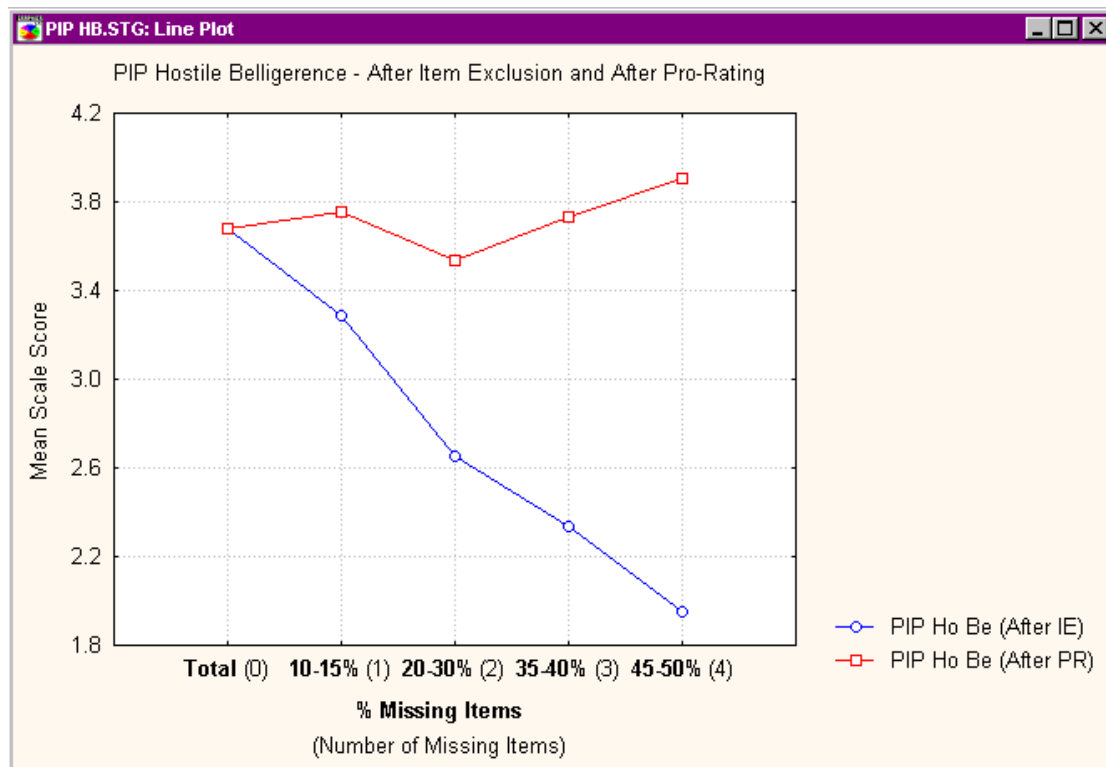
PIP – Hostile Belligerence Total Score

Missing Items

Percentage	(%) value of 8 items	No. of items excluded	Items excluded
5	0.4	0	
10	0.8		
15	1.2	1	28
20	1.6		
25	2		
30	2.4	2	36,54
35	2.8		
40	3.2	3	54,67,72
45	3.6		
50	4	4	11,28,36,51

PIP – Hostile Belligerence Total – After Item Exclusion and Pro-Rating

PIP – Hostile Belligerence Total after Item Exclusion – Descriptive Statistics

Descriptive Statistics	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
0% Miss	63	3.682540	2.000000	0.00	15.00000	4.122423	1.151649
10-15% Miss	63	3.285714	2.000000	0.00	14.00000	3.691440	1.188307
20-30% Miss	63	2.650794	2.000000	0.00	10.00000	2.930148	1.031847
35-40% Miss	63	2.333333	1.000000	0.00	10.00000	2.533645	1.043312
45-50% Miss	63	1.952381	1.000000	0.00	9.00000	2.344717	1.346142

PIP – Hostile Belligerence Total after Pro-Rating – Descriptive Statistics

| BASIC STATS	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
0% Miss	63	3.682540	2.000000	0.00	15.00000	4.122423	1.151649
10-15% Miss	63	3.755102	2.285714	0.00	16.00000	4.218788	1.188307
20-30% Miss	63	3.534392	2.666667	0.00	13.33333	3.906864	1.031847
35-40% Miss	63	3.733333	1.600000	0.00	16.00000	4.053831	1.043312
45-50% Miss	63	3.904762	2.000000	0.00	18.00000	4.689433	1.346142

PIP – Hostile Belligerence Total / Pro-rating Total Differences – Descriptive Statistics

BASIC STATS	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
10-15% PR	63	.072562	0.00	-1.28571	1.428571	.509213	-.32464
20-30% PR	63	-.148148	0.00	-2.00000	2.333333	.747224	-.03115
35-40% PR	63	.050794	0.00	-4.40000	2.600000	1.065572	-1.32304
45-50% PR	63	.222222	0.00	-3.00000	4.000000	1.275633	.33744

PIP Hostile Belligerence Total / Pro-Rating Total – Correlation

BASIC STATS	Marked correlations are significant at p < .05000				
	N=63 (Casewise deletion of missing data)				
Variable	Total	10-15% PR	20-30% PR	35-40% PR	45-50% PR
Total	1.00	.99	.98	.97	.97
10-15% PR	.99	1.00	.96	.96	.97
20-30% PR	.98	.96	1.00	.95	.94
35-40% PR	.97	.96	.95	1.00	.88
45-50% PR	.97	.97	.94	.88	1.00

PIP – Hostile Belligerence Total / Pro-Rating Total – Differences
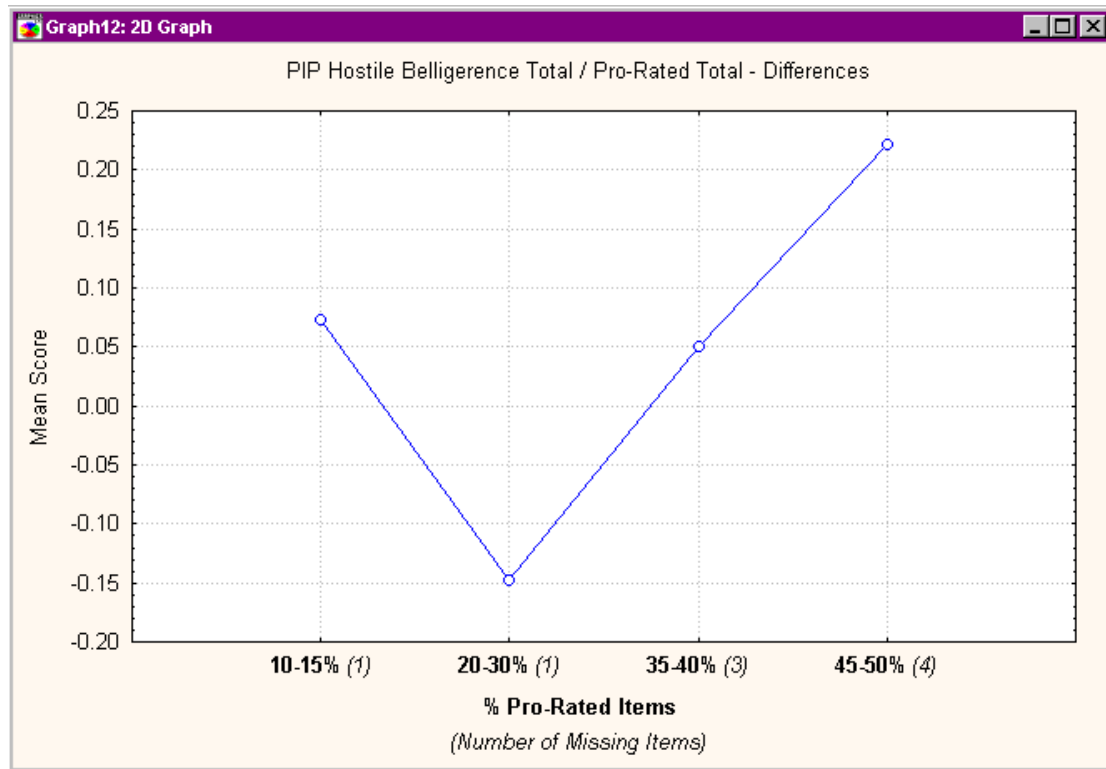
PIP – Hostile Belligerence Scale – Pro-Rate Total / Total Score Differences - Variability
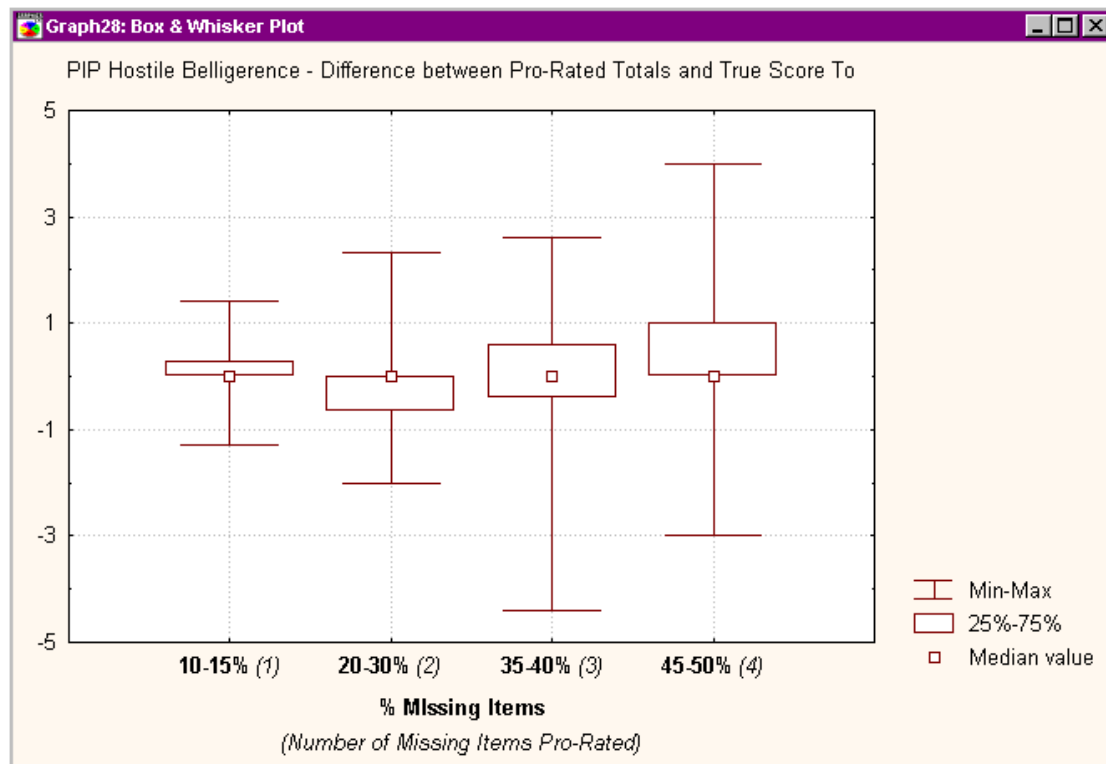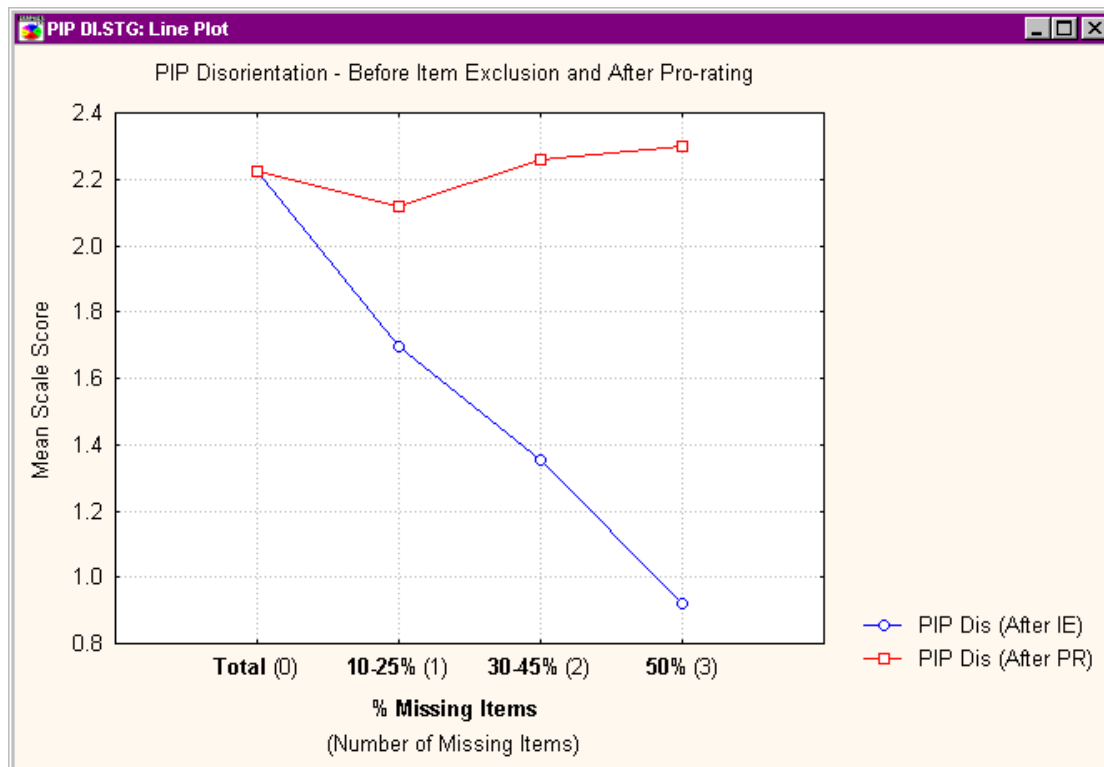
PIP – Disorientation Total Score

Missing Items

Percentage	(%) value of 5 items	No. of items excluded	Items excluded
5	0.25	0	
10	0.5		
15	0.75		
20	1		
25	1.25	1	92
30	1.5		
35	1.75		
40	2		
45	2.25	2	94,96
50	2.5	3	93,94,95

PIP – Disorientation Total – After Item Exclusion and Pro-Rating

PIP – Disorientation Total after Item Exclusion – Descriptive Statistics

Descriptive Statistics	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
0% Miss	62	2.225806	0.00	0.00	15.00000	5.151538	2.041840
10-25% Mis	62	1.693548	0.00	0.00	12.00000	4.087521	2.130154
30-45% Mis	62	1.354839	0.00	0.00	9.00000	3.105240	2.012425
50% Miss	62	.919355	0.00	0.00	6.00000	2.074817	1.965927

PIP – Disorientation Total After Pro-rating – Descriptive Statistics

Descriptive Statistics	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
0% Miss	62	2.225806	0.00	0.00	15.00000	5.151538	2.041840
10-25% Mis	62	2.116935	0.00	0.00	15.00000	5.109401	2.130154
30-45% Mis	62	2.258065	0.00	0.00	15.00000	5.175400	2.012425
50% Miss	62	2.298387	0.00	0.00	15.00000	5.187042	1.965927

PIP – Disorientation Total / Pro-Rating Total Differences – Descriptive Statistics

BASIC STATS	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
10-25% P	62	-.108871	0.00	-3.00000	0.000000	.505342	-4.80406
30-45% P	62	.032258	0.00	-1.00000	2.000000	.311934	4.14315
50% PR	62	.072581	0.00	-1.50000	4.500000	.632759	5.73587

PIP – Disorientation Total / Pro-Rating Total – Correlation

Correlations (prorated + differences.sta)

BASIC STATS Variable	Marked correlations are significant at p < .05000 N=62 (Casewise deletion of missing data)			
	Total	10-25% PR	30-45% PR	50% PR
Total	1.00	1.00	1.00	.99
10-25% PR	1.00	1.00	.99	.98
30-45% PR	1.00	.99	1.00	.99
50% PR	.99	.98	.99	1.00

PIP – Disorientation Total / Pro-Rating Total – Differences
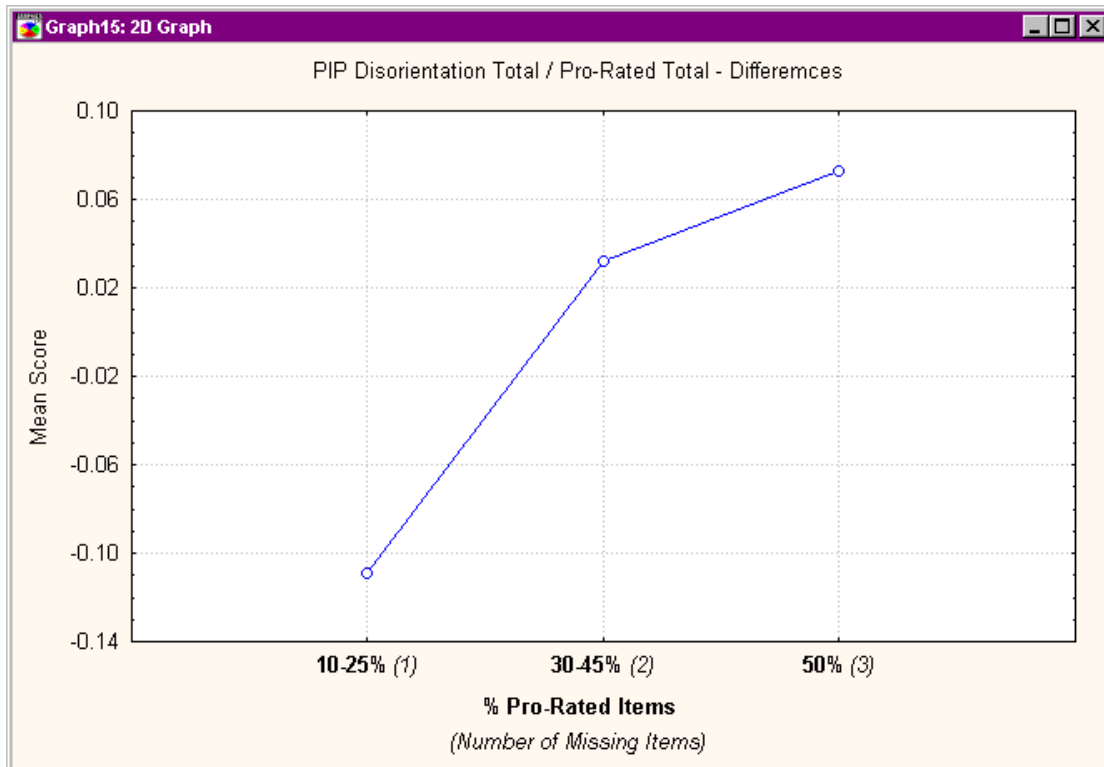
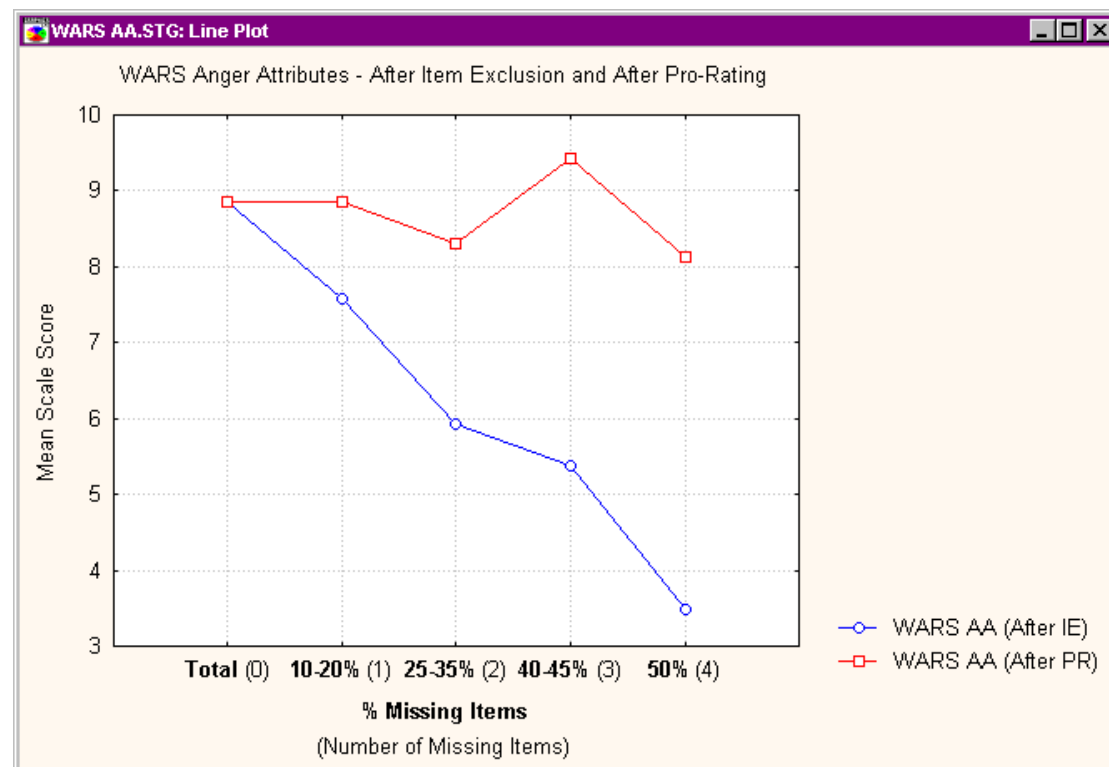**PIP –Disorientation Scale – Pro-Rate Total / Total Score Differences - Variability**
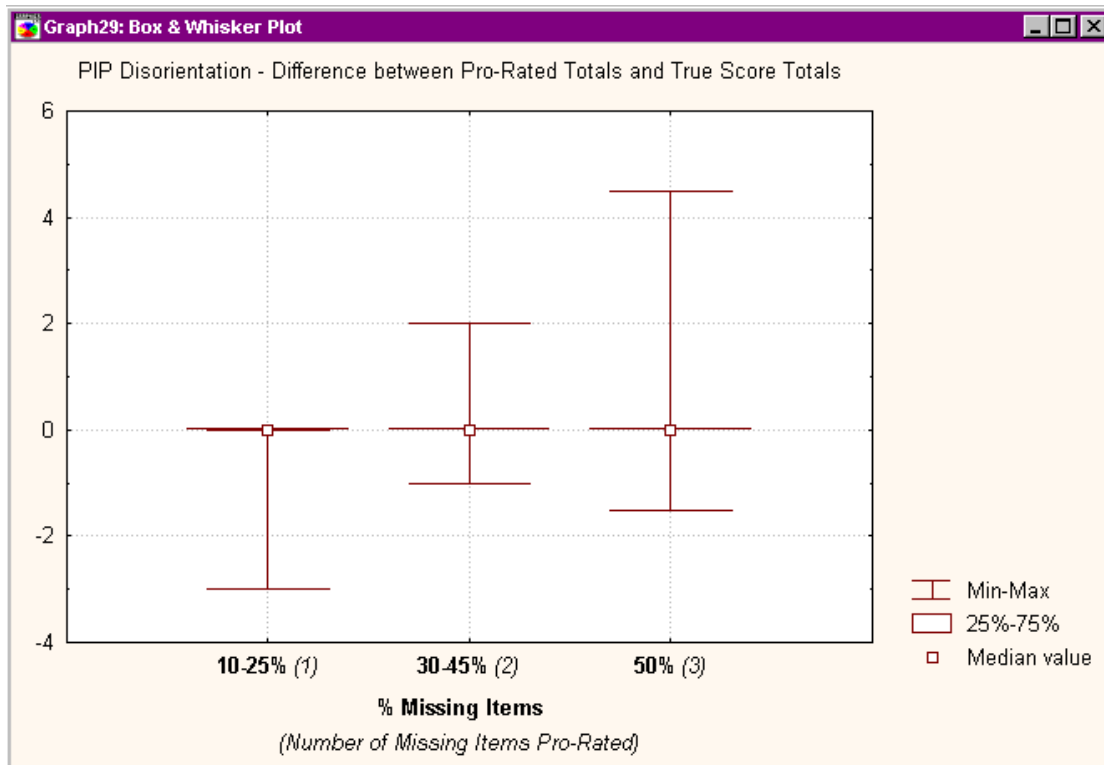
WARS – Anger Attributes Total Score

Missing Items

Percentage	(%) value of 7 items	No. of items excluded	Items excluded
5	0.35	0	
10	0.7		
15	1.05		
20	1.4	1	20
25	1.75		
30	2.1		
35	2.45	2	23,24
40	2.8		
45	3.15	3	19,21,25
50	3.5	4	19,20,21,23

WARS – Anger Attributes Total – After Item Exclusion and Pro-Rating

WARS – Anger Attributes (Mean) Total after Item Exclusion – Descriptive Statistics

Descriptive Statistics	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
0% Miss	70	8.857143	6.000000	0.00	28.00000	7.478056	.736558
10-20% Mis	70	7.585714	5.500000	0.00	24.00000	6.461688	.757715
25-35% Mis	70	5.928571	5.000000	0.00	20.00000	5.379299	.771433
40-45% Mis	70	5.385714	4.000000	0.00	16.00000	4.578756	.679649
50% Miss	70	3.485714	2.000000	0.00	12.00000	3.521128	.837744

WARS – Anger Attributes Total after Pro-Rating – Descriptive Statistics

BASIC STATS	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
0% Miss	70	8.857143	6.000000	0.00	28.00000	7.478056	.736558
10-20% Miss	70	8.850000	6.416667	0.00	28.00000	7.538636	.757715
25-35% Miss	70	8.300000	7.000000	0.00	28.00000	7.531018	.771433
40-45% Miss	70	9.425000	7.000000	0.00	28.00000	8.012824	.679649
50% Miss	70	8.133333	4.666667	0.00	28.00000	8.215966	.837744

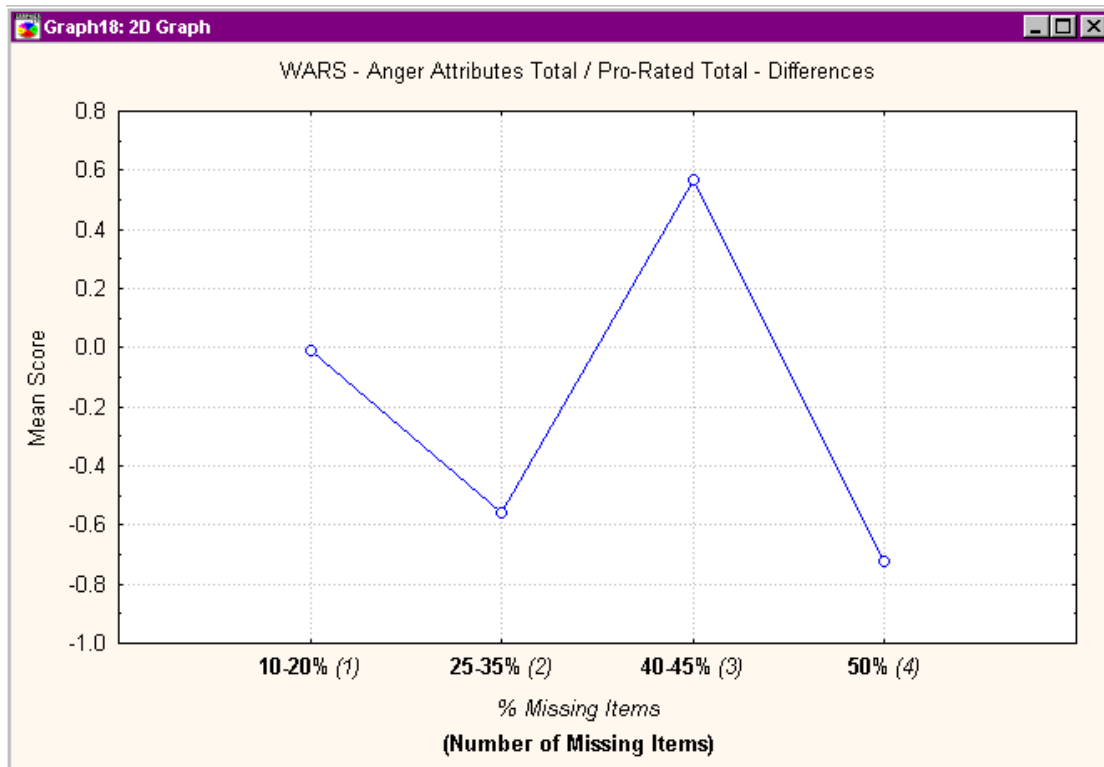**WARS – Anger Attributes Total / Pro-Rated Total Differences – Descriptive Statistics**

BASIC STATS	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
10-20% PR	70	-.007143	0.000000	-1.50000	1.666667	.620656	-.171592
25-35% PR	70	-.557143	-.400000	-5.60000	2.400000	1.539770	-.677308
40-45% PR	70	.567857	.500000	-4.00000	7.000000	1.942060	.375571
50% PR	70	-.723810	-.166667	-8.00000	4.333333	2.326748	-.424476

WARS – Anger Attributes Total / Pro-Rated Total – Correlation

BASIC STATS Variable	Total	10-20% PR	25-35% PR	40-45% PR	50% PR
Total	1.00	1.00	.98	.97	.96
10-20% PR	1.00	1.00	.97	.97	.97
25-35% PR	.98	.97	1.00	.91	.93
40-45% PR	.97	.97	.91	1.00	.94
50% PR	.96	.97	.93	.94	1.00

Marked correlations are significant at p < .05000
N=70 (Casewise deletion of missing data)

Charles Marley and Paul Barrett: The State Hospital, Carstairs

WARS – Anger Attributes Total / Pro-Rated Total – Differences

WARS – Anger Attributes Scale – Pro-Rate Total / Total Score Differences - Variability
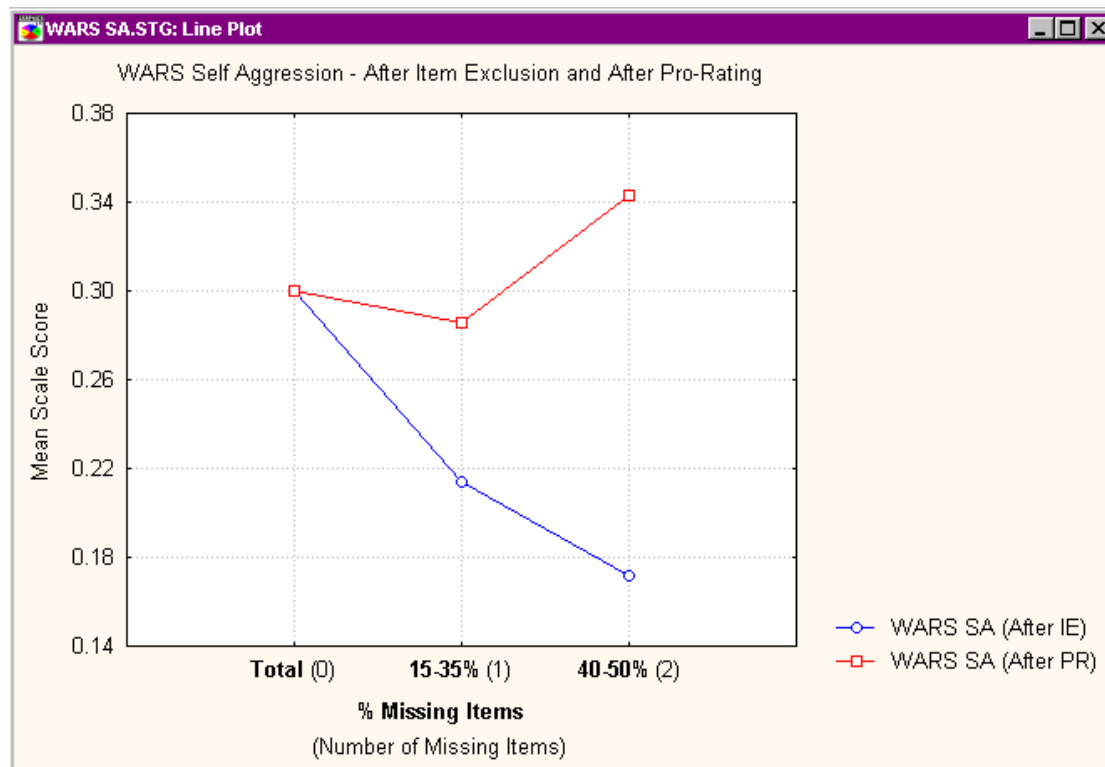
WARS – Self Aggression Total Score

Missing Items

Percentage	(%) value of 4 items	No. of items excluded	Items excluded
5	0.2		
10	0.4	0	
15	0.6		
20	0.8		
25	1		
30	1.2		
35	1.4	1	12
40	1.6		
45	1.8		
50	2	2	13,15

WARS – Self-Aggression Total – After Item Exclusion and Pro-Rating

WARS Self Aggression - After Item Exclusion and After Pro-Rating

WARS – Self Aggression Total after Item Exclusion – Descriptive Statistics

Descriptive Statistics	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
0% Miss	70	.300000	0.00	0.00	4.000000	.786664	3.085426
15-35% Miss	70	.214286	0.00	0.00	3.000000	.561903	3.053063
40-50% Miss	70	.171429	0.00	0.00	2.000000	.480683	2.881075

WARS – Self Aggression Total after Pro-Rating – Descriptive Statistics

Descriptive Statistics	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
WRSSATOT	70	.300000	0.00	0.00	4.000000	.786664	3.085426
WRSSA15P	70	.285714	0.00	0.00	4.000000	.749204	3.053063
WRSSA40P	70	.342857	0.00	0.00	4.000000	.961365	2.881075

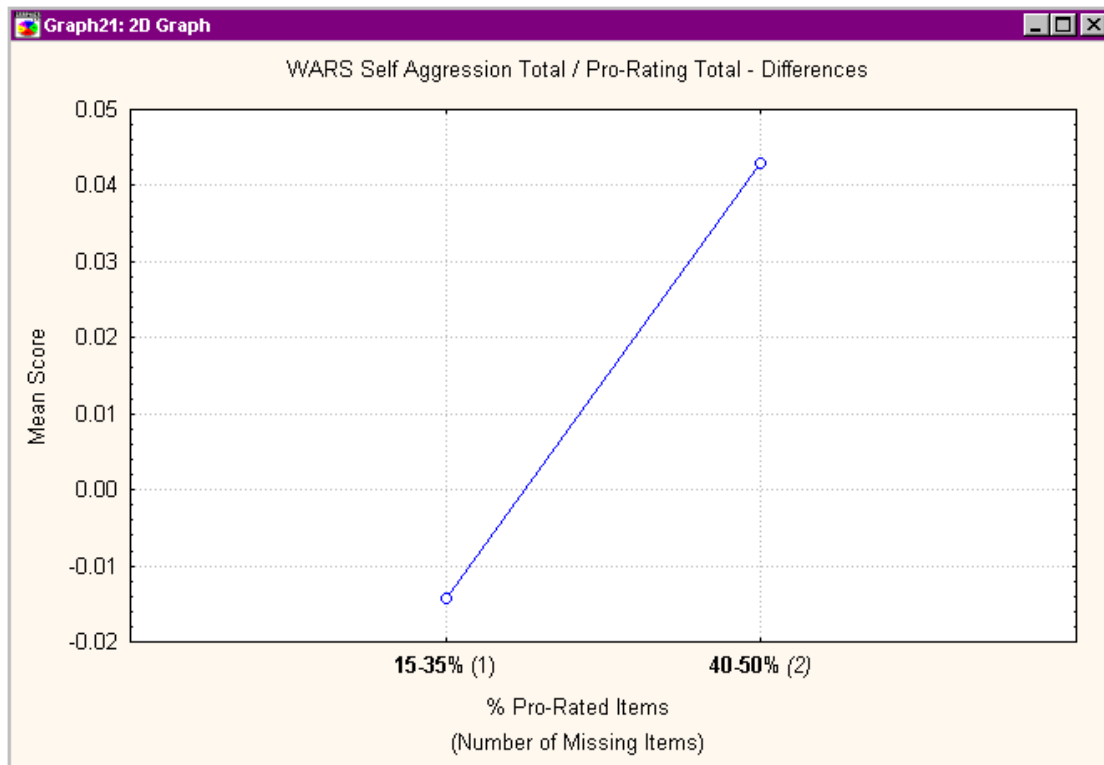**WARS – Self Aggression Total / Pro-Rating Total Differences – Descriptive Statistics**

BASIC STATS	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewnes
15-35% PR	70	-.014286	0.00	-1.00000	.333333	.200126	-2.4677
40-50% PR	70	.042857	0.00	-1.00000	1.000000	.358569	.5999

WARS – Self Aggression Total / Pro-Rating Total – Correlation

Correlations (prorated + differences.sta)

BASIC STATS Variable	Marked correlations are significant at p < .05000 N=70 (Casewise deletion of missing data)		
	Total	15-35% PR	40-50% PR
Total	1.00	.97	.94
15-35% PR	.97	1.00	.88
40-50% PR	.94	.88	1.00

WARS – Self Aggression Total / Pro-Rating Total – Differences

WARS – Self Aggression Scale – Pro-Rate Total / Total Score Differences - Variability
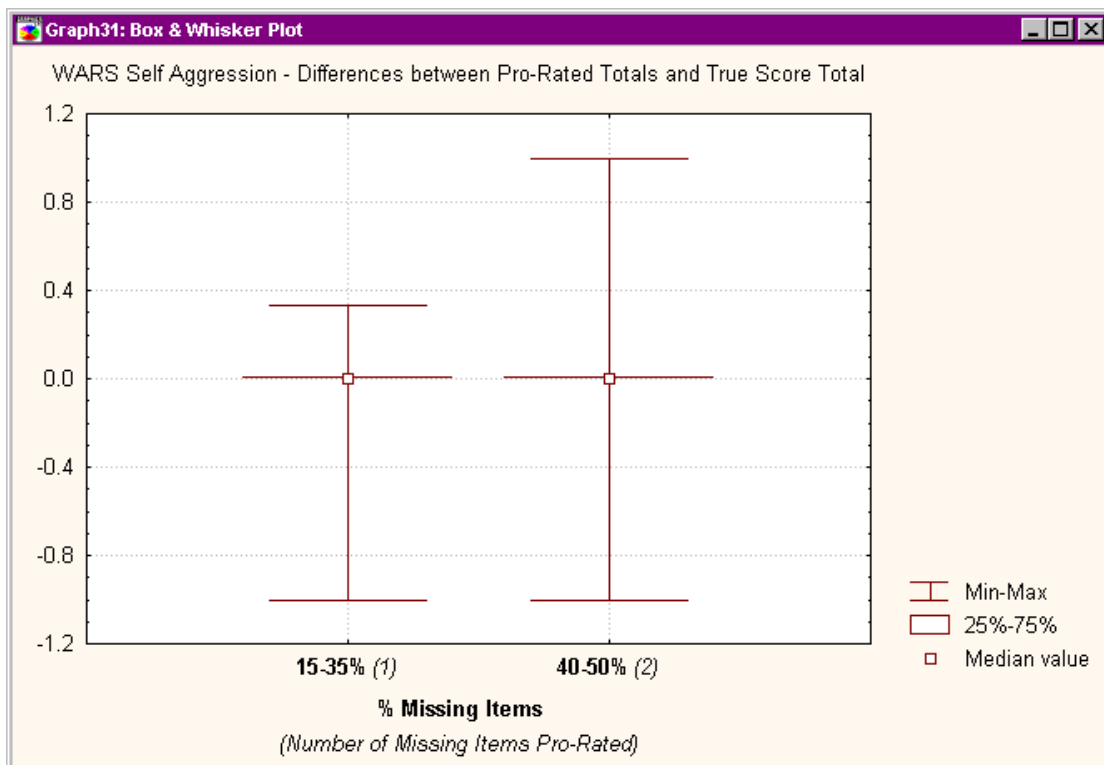
Discussion Points

When pro-rating missing items it would seem possible to correlate up to 50% of the items based on the high correlation co-efficient. This is partly true. When applying statistical techniques that analyse the covariance between scales, or the covariance of one of the scales with a separate measure, it would be appear acceptable to pro-rate substantive amounts of missing data. The correlation matrix for each of the scales shows high levels of correlation between the total score and up to 50% of the pro-rated scores. This is due to the total score and the pro-rated score being monotonically related – if the total score is high the pro-rated score will also be proportionately high and as the true score gets higher the pro-rated score will also get higher (this is shown by the linear fit of the scores after pro-rating).

When looking at the absolute value of the scores and the reproducibility of these scores through pro-rating, other factors have to be taken into account, as product-moment (pearson) correlation will be insensitive to these actual values. The box-whisker plots display the variability of the absolute value of the score after pro-rating. The inter-quartile range shows the 50% of the data can be situated 2-3 points above or below the median but the minimum and maximum values of the data can be up to ten points above or below the median on certain levels of pro-rating. This could make a difference in the classification of an individual on the particular trait being measured. This is clearly demonstrated when pro-rating 35% of the items in the Beck Depression Inventory (BDI). When 35% of the items are pro-rated, a difference of 6.5 points above or 7.5 points below the true score, which is obtained with the same data but with no missing items, is reached – this could make the difference to a individual being classified as depressed or not.

The above two paragraphs make it clear that two issues need to be considered here: prorating scores for use in covariance analysis only, in which by standardising the data prior to computing agreement, the actual size of scores is lost. If say we wish to compute a factor analysis using correlations, or perhaps a standardised regression analysis, then prorating the scores to a larger degree (say up to 50%) may be considered acceptable. However, to prorate such large missing amounts of data for a summated scale score will only be reasonable if the alpha (internal consistency) coefficient is larger than at least 0.80 (which represents a correlation of 0.89 between the observed and true scores). The second issue is the one that we have to face here. We are prorating scores primarily to preserve as many valid cases with test scores as possible. Yet, the actual value of the prorated score will be used as a meaningful score in its own right, and will be interpreted as though the individual had completed all the items within a scale. This means that prorating error can have significant effects on the classification and "change-score" status for an individual.

Of course, as mentioned in the first paragraph on the first page, we might have used multiple imputation for every missing value. From Joe Schafer's text … "Multiple imputation is a simulation-based approach to the statistical analysis of incomplete data. In multiple imputation, each missing datum is replaced by $m>1$ simulated values. The resulting m versions of the complete data can then be analyzed by standard complete-data methods, and the results combined to produce inferential statements (e.g. interval estimates or p-values) that incorporate missing-data uncertainty". However, this methodology requires some "research" attention as it is pretty sophisticated and sometimes computationally intensive. See/download: *Longitudinal and multi-group modelling with missing data.* Werner Wothke, Smallwaters Corp: http://www.smallwaters.com/whitepapers/longmiss/ and … the AMELIA program site at: http://gking.harvard.edu/stats.shtml and the NORM and EMCOV programs (and Joe Schafer's explanations) at: http://methcenter.psu.edu/mde.shtml

So, the final question to be addressed and answered, is "what missing data bound should we use to prorate scale scores for the Anger Management project?" The recommendation is a **15% bound** – across all tests, given the evidence in this document. We are trying to preserve the maximum number of patients' data whilst taking care to constrain the error to a tolerable and sensible amount. In fact, this is somewhat generous – but, given further analysis, you can see that the error induced is still acceptable for all practical purposes.

Some justification of the chosen 15% bound.

Let's take a few scales –

BDI Total Score / Pro-Rated Value – Descriptive Statistics of Differences

BASIC STATS	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
5% Miss	46	-.09891	-.27500	-1.4500	1.950000	.815781	.782499
10% Miss	46	.56064	.52632	-2.6316	3.684211	1.528561	-.031588
15% Miss	46	-.43116	-.58333	-4.1667	3.333333	1.543035	-.035827
20% Miss	46	.42072	.02941	-2.7059	7.294118	2.072094	1.078420
25% Miss	46	1.17935	.43750	-3.8125	6.812500	2.430300	.314085
30% Miss	46	-.42609	-.50000	-6.2000	6.000000	2.441715	.368880
35% Miss	46	-.27174	0.00000	-7.5000	6.500000	2.990181	-.279976
40% Miss	46	-1.25251	-1.65385	-9.2308	3.615385	2.771778	-.167920
45% Miss	46	.11413	0.00000	-8.2500	7.000000	3.063996	-.446822
50% Miss	46	-3.25099	-3.09091	-13.6364	4.636364	4.133324	-.244225

A 15% missing bound (3 items) incurs at least one error of –4.1667 and +3.3333 on the relevant "true" scores. However, the mean difference is just –0.433. From the associated box-whisker plot of errors, we can see that 50% of the estimation errors lie within a ±1.0 bound. To check this, we computed a frequency distribution of all estimate errors:

Frequency table: BTD15P: 15% prorated MIN

Category	Count	Cumulative Count	Percent	Cumulative Percent
-4.166666667	1	1	1.42857	1.4286
-4.166666667	1	2	1.42857	2.8571
-2.666666667	2	4	2.85714	5.7143
-2.166666667	1	5	1.42857	7.1429
-2.166666667	1	6	1.42857	8.5714
-1.666666667	1	7	1.42857	10.0000
-1.666666667	2	9	2.85714	12.8571
-1.333333333	1	10	1.42857	14.2857
-1.166666667	1	11	1.42857	15.7143
-1.166666667	1	12	1.42857	17.1429
-1	4	16	5.71429	22.8571
-.8333333333	1	17	1.42857	24.2857
-.8333333333	4	21	5.71429	30.0000
-.6666666667	1	22	1.42857	31.4286
-.6666666667	1	23	1.42857	32.8571
-.5000000000	2	25	2.85714	35.7143
-.3333333333	1	26	1.42857	37.1429
-.1666666667	1	27	1.42857	38.5714
-.1666666667	1	28	1.42857	40.0000
0	6	34	8.57143	48.5714
.33333333333	1	35	1.42857	50.0000
.50000000000	1	36	1.42857	51.4286
.66666666667	1	37	1.42857	52.8571
.83333333333	1	38	1.42857	54.2857
1	1	39	1.42857	55.7143
1.5000000000	1	40	1.42857	57.1429
1.6666666667	1	41	1.42857	58.5714
1.6666666667	1	42	1.42857	60.0000
2.1666666667	3	45	4.28571	64.2857
3.3333333333	1	46	1.42857	65.7143
Missing	24	70	34.28571	100.0000

Here we see that only two cases have estimates in error to –4.1667, with just one case at 3.333. Further, this maximum error of –4.1667 is 10% of the score range (40). Given the ordinal nature and interpretation of the scores, it is felt that such a discrepancy is not likely to be critical. However, this depends upon the actual score originally achieved. The two –4 cases originally scored 32 and 39, with the +3.33 overestimate occurring with a an original score of 33.

If exactitude is required, then no prorating should take place – however, it is felt that the degree of error incurred with a 15% prorating is probably acceptable from a clinical perspective, however, this is a ultimately a matter for clinicians to consider.

STAXI State Anger Total / Pro-Rating Total Differences – Descriptive Statistics

Descriptive Statistics (prorated + differences.sta)							
BASIC STATS	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewness
5-10% PR	60	.157407	0.00	-.77778	3.000000	.515218	3.03377
15-20% PR	60	0.000000	0.00	-2.25000	2.000000	.678046	.01582
25-30% PR	60	.226190	0.00	-2.71429	4.714286	1.073337	.89553
35-40% PR	60	-.361111	0.00	-6.00000	2.666667	1.316692	-2.07467
45-50% PR	60	-.550000	0.00	-5.00000	2.000000	1.320311	-1.39650

A 15% missing bound (2 items) incurs at least one error of –2.25 and +2.0 on the relevant "true" scores. However, the mean difference is just 0.00. From the associated box-whisker plot of errors, we can see that 50% of the estimation errors lie within a ±0.0 bound. To check this, we computed a frequency distribution of all estimate errors:

	Frequency table: STD15P: 15-20% Prorated			
Category	Count	Cumulative Count	Percent	Cumulative Percent
-2.250000000	1	1	1.42857	1.4286
-1.500000000	1	2	1.42857	2.8571
-1.250000000	2	4	2.85714	5.7143
-1	1	5	1.42857	7.1429
-.7500000000	3	8	4.28571	11.4286
-.5000000000	1	9	1.42857	12.8571
-.2500000000	2	11	2.85714	15.7143
0	37	48	52.85714	68.5714
.25000000000	3	51	4.28571	72.8571
.50000000000	3	54	4.28571	77.1429
.75000000000	2	56	2.85714	80.0000
1.5000000000	2	58	2.85714	82.8571
1.7500000000	1	59	1.42857	84.2857
2	1	60	1.42857	85.7143
Missing	10	70	14.28571	100.0000

Once again, the number of cases with the large marginal errors are low (only 2 cases), which again supports the 15% bound. It is of interest to note that as we move to a 25-30% prorating bound (3 items), the error jumps to +4.7. This is considered unacceptable, or at least undesirable.

	Frequency table: STD25P: 25-30% Prorated			
Category	Count	Cumulative Count	Percent	Cumulative Percent
-2.714285714	1	1	1.42857	1.4286
-2.571428571	1	2	1.42857	2.8571
-2	1	3	1.42857	4.2857
-1.571428571	1	4	1.42857	5.7143
-.4285714286	1	5	1.42857	7.1429
-.1428571429	2	7	2.85714	10.0000
0	36	43	51.42857	61.4286
.42857142857	3	46	4.28571	65.7143
.71428571429	2	48	2.85714	68.5714
.85714285714	3	51	4.28571	72.8571
1.1428571429	2	53	2.85714	75.7143
1.1428571429	1	54	1.42857	77.1429
1.4285714286	1	55	1.42857	78.5714
1.5714285714	1	56	1.42857	80.0000
1.7142857143	1	57	1.42857	81.4286
2	1	58	1.42857	82.8571
3	1	59	1.42857	84.2857
4.7142857143	1	60	1.42857	85.7143
Missing	10	70	14.28571	100.0000

However, the frequency table for this 3-item (25-30%) prorating is not too bad … but the error is large, and for simplicity it is easier to stick with a 15% bound throughout – also, these results are dependent upon just one set of item exclusions – so cannot be considered definitive. The conservative approach is to limit prorating to just 2 items.

WARS – Self Aggression Total / Pro-Rating Total Differences – Descriptive Statistics

Descriptive Statistics (prorated + differences.sta)							
BASIC STATS	Valid N	Mean	Median	Minimum	Maximum	Std.Dev.	Skewnes
15-35% PR	70	-.014286	0.00	-1.00000	.333333	.200126	-2.4677
40-50% PR	70	.042857	0.00	-1.00000	1.000000	.358569	.5999

The WARS "scale" has just 4 items, with a total score of 4, and no published alpha reliability coefficient. If we exclude just one item, we incur an error of up to –1.0 through to 0.333. If we exclude two items. Our prorating error becomes –1.00 through to +1.00. Looking at the distribution of estimation errors, we have:

1 item exclusion prorated

	Frequency table: WSD15P: 15 - 35% Prorate			
Category	Count	Cumulative Count	Percent	Cumulative Percent
-1	1	1	1.42857	1.4286
-.6666666667	2	3	2.85714	4.2857
-.3333333333	2	5	2.85714	7.1429
0	59	64	84.28571	91.4286
.33333333333	6	70	8.57143	100.0000
Missing	0	70	0.00000	100.0000

and with 2 items prorated

	Frequency table: WSD40P: 40 - 50% Prorate			
Category	Count	Cumulative Count	Percent	Cumulative Percent
-1	3	3	4.28571	4.2857
0	61	64	87.14286	91.4286
1	6	70	8.57143	100.0000
Missing	0	70	0.00000	100.0000

Since an error of ±1 represents 25% change in the scale score, this just might be significant given such a low score range in the first place. In reality, the WARS Self-Aggression "scale" is not a "scale at all", but merely a collection of items. A quick item analysis of the 4 items comprising the WARS Self Aggression scale shows …

	Summary for scale: Mean=.300000 Std.Dv.=.786664 Va Cronbach alpha: .738709 Standardized alpha: .758350 Average inter-item corr.: .450229				
variable	Mean if deleted	Var. if deleted	StDv. if deleted	Itm-Totl Correl.	Alpha if deleted
WARS112	0.214	0.311	0.558	0.706	0.567
WARS113	0.186	0.294	0.542	0.622	0.629
WARS114	0.214	0.368	0.607	0.480	0.711
WARS115	0.286	0.518	0.720	0.454	0.754

Three features stand out – the very low mean score (0.30 out of 4), a standard deviation over twice as large as the mean (0.79), and an alpha of just 0.76. Whether we prorate or not, this scale is making poor measurement *as a summated scale*. Look at the frequency distribution of scores …

| | Frequency table: WRSSATOT: WARS Self A | | | |
Category	Count	Cumulative Count	Percent	Cumulative Percent
0	58	58	82.85714	82.8571
1	7	65	10.00000	92.8571
2	2	67	2.85714	95.7143
3	2	69	2.85714	98.5714
4	1	70	1.42857	100.0000
Missing	0	70	0.00000	100.0000

What this shows is that out of 70 patients, only 5 score higher than 1.0 on the scale. The items of this "scale" are:

> 12. Talked of suicide
> 13. Attempted suicide
> 14. Talked of injuring self
> 15. Attempted to injure self.

If we look at the frequency distributions for each item …

| | Frequency table: WARS112: talked suicide (| | | |
Category	Count	Cumulative Count	Percent	Cumulative Percent
no	64	64	91.42857	91.4286
yes	6	70	8.57143	100.0000
Missing	0	70	0.00000	100.0000

| | Frequency table: WARS113: talked self-injur | | | |
Category	Count	Cumulative Count	Percent	Cumulative Percent
no	62	62	88.57143	88.5714
yes	8	70	11.42857	100.0000
Missing	0	70	0.00000	100.0000

| | Frequency table: WARS114: attempted self-i | | | |
Category	Count	Cumulative Count	Percent	Cumulative Percent
no	64	64	91.42857	91.4286
yes	6	70	8.57143	100.0000
Missing	0	70	0.00000	100.0000

| | Frequency table: WARS115: attempted suici | | | |
Category	Count	Cumulative Count	Percent	Cumulative Percent
no	69	69	98.57143	98.5714
yes	1	70	1.42857	100.0000
Missing	0	70	0.00000	100.0000

I suspect that the best way of treating this "scale" is to actually use the individual items as indicators rather than try and summate them as though they measured a single psychological attribute. However, I digress! Prorating this scale seems a somewhat arbitrary action, for the meaning of items 12 and 13 is quite different from that in items 14 and 15. Prorating items 14 and 15 on the basis of 12 ad 13 would be a very strange assumption about suicide being equivalent to self-harm (a "scale" of items assumes unidimensionality of measurement). Prorating the scale even with one item exclusion may be unwarranted because of the item mix. I suspect that when we come to analysis of the WARS, an individual item profile analysis per patient may be the significant analysis, rather than relying upon summated scales. However, I suggest we continue with a single item-prorating as the most conservative way forward at the moment.