

Validation of the *Personality Coping Styles Scale (PCSS)* to the Rasch Measurement Model,
GAIN Methods Report 1.0

Kendon J. Conrad
University of Illinois at Chicago

Karen M. Conrad
University of Illinois at Chicago

Barth B. Riley
Chestnut Health Systems

Rod Funk
Chestnut Health Systems

Michael L. Dennis
Chestnut Health Systems

Abstract

Purpose. The purpose of this report is to provide a brief psychometric analysis of the *Personality Coping Styles Scale (PCSS)* using the Rasch measurement model. The *PCSS* consists of 21 items and is a count of past-year symptoms related to ways of handling emotional issues.

Methods. Rasch analysis included an examination of: person and item reliabilities; construct validity including item and person fit statistics; and differential item functioning (DIF) across subgroups. DIF analysis allowed us to determine if the relative item estimates (i.e., item difficulty estimates) remained invariant across subgroups of persons. The person fit group analysis allowed us to examine the expected and unexpected patterns of raw scores in terms of the expectations of the Rasch model. The response patterns for each fit group are discussed relative to the response pattern for the overall mean. Data were collected on 18,317 persons who presented for substance problem screening.

Results. The *PCSS* performs well as a measure of the construct of ways of handling emotional issues. Items appear to form a reasonable, theoretically expected hierarchy with a person internal consistency reliability of .81 and an item reliability of 1.00. The persons' responses generally conformed to the expectations of the Rasch model. The person reliabilities for the three subscales were very low: *Cautious Personality* = .22; *Impulsivity Personality* = .46; and *Worrying Personality* = .41. This is not unexpected given that theory suggests that the three personality clusters overlap and thus, the scale is best viewed as consisting of the entire 21 items. Twelve of the 21 *PCSS* items exhibited significant DIF (i.e., $> .5$ SD = .60 logits). Significant DIF occurred in one item for gender, 9 items for age, 4 items for race when using African American as the reference group, and 5 items for primary substances when using opioids as the referent. No items misfit using the criterion of .75-1.33 MNSQ for both infit and outfit. All three atypical groups tended to have scores that underestimated their personality coping style symptoms.

Conclusion. Youth more readily endorsed the easiest items whereas adults more readily endorsed harder, more serious items. Five of the items were easier for youth to endorse (e.g., "*Not like being told what to do*") while four items were easier for adults to endorse, (e.g., "*Concern about health*"). Thus, the item hierarchies are very different for youth vs. adults. This suggests that separate measures or appropriate adjustments would help to refine the sensitivity of the measures and reduce potential differential test functioning

Three items were easier for African Americans than all other races to endorse (e.g., “*Not trust people*”) while one item was harder for this race to endorse (i.e., “*Not like being told what to do*”). The DIF involving opioids is likely related to the age DIF finding since opioids users tend to be older. Other DIF analyses did not discern obvious imbalance that could result in differential test functioning, but they did reveal some issues that might be of theoretical interest. *PCSS* fit groups could be characterized as two types that differ by degree. The persons in Atypical Groups 1 and 2 will have overall measures that under-represent the seriousness of their coping style symptoms to a certain extent. The persons in Atypical Group 3 will have overall measures that under-represent the seriousness of their coping style symptoms to an even greater degree. We recommend combining Atypical Groups 1 and 2. We further recommend flagging all persons in the three atypical groups for clinicians in the evaluation/validity concerns section of the *GAIN*. More work on construct validity would be helpful to understand these fit groups better and to ensure proper interpretation of measures.

Citation. Conrad, K. J., Conrad, K. M., Riley, B.B., Funk, R. & Dennis, M. L. (2010). Validation of the *Personality Coping Styles Scale (PCSS)* to the Rasch Measurement Model, *GAIN Methods Report 1.0*. Chicago, IL: Chestnut Health Systems. Retrieved from TBA

Purpose

The purpose of this report is to provide a brief report of a psychometric analysis of the *Personality Coping Styles Scale (PCSS)* using the Rasch measurement model (Bond & Fox, 2007; Rasch, 1960). The Rasch analysis was conducted using *Winsteps* software (Linacre, 2009). The tables and figures are annotated to summarize the main points.

Background

The *PCSS* is a scale that is part of the larger *Global Appraisal of Individual Needs (GAIN)*. The *GAIN* is a biopsychosocial assessment that integrates research and clinical practice to do diagnosis, placement, individualized treatment planning, and program evaluation and meets major reporting requirements. The *GAIN* is a series of related instruments that share the same general instructions, questions (and variable names in most cases), scoring, interpretation, and clinical decision trees (Chestnut Health Systems, [*GAIN*] v 5.6.2).

The Personality Coping Styles Scale (PCSS)

The *PCSS* consists of 21 items and is a count of past-year symptoms related to ways of handling emotional issues. Higher values indicate increased levels of overly emotional means of handling problems. Clients with personality disorders are particularly likely to misread or miss social information from peers, react impulsively, or with preemptive defensiveness and or be dependent on substance use to control themselves. While they are still experimental for individuals, the *GAIN*'s *PCSS* is divided into three subscales based on earlier work by Chestnut Health Systems (2001). The subscales for the three personality clusters (and their associated *DSM-IV-TR* Axis II diagnoses) are as follows: *Cautious Personality for Cluster A* (paranoid, schizoid, and schizotypal) personality disorders characterize people who often appear odd or eccentric. *Impulsive Personality for Cluster B* (antisocial, borderline, histrionic, and narcissistic) personality disorders characterize people who often appear dramatic, emotional, or erratic and have a hard time picking up on social cues. *Worrying Personality for Cluster C* (avoidant, dependent, and obsessive-compulsive) personality disorders characterize people who often appear anxious or fearful.

The first subscale, *Cautious Personality*, consists of six items related to handling emotional issues by avoidance, distrust, or escaping. Higher values are associated with more cautious or withdrawn coping and personality styles (e., g., paranoid, schizoid). The second subscale, *Impulsivity Personality* consists of seven items endorsed relating to handling emotional issues by ignoring them, acting impulsively, lying, or manipulating others to own way. Higher values are associated with more angry, denial or energetic coping and personality styles. Higher scores also suggest the client is likely to misread social information from peers. The third subscale, *Worrying Personality*, is a count of past year items related to handling emotional issues by over thinking, worrying, criticizing self or criticizing others.

The item stems begins: "Please answer the following questions using yes or no. Do each of the following statements describe you **during the past 12 months?**" The response format is Yes/No (coded: no=0, yes=1). The scale names, item stems, *GAIN* item numbers, Rasch output item location codes, and item labels are shown in the table below.

PCSS Scale and Item Information

Subscale Name and Item Stem	GAIN Item Number	Rasch Output Item Number	Item Label
<i>Cautious Personality</i>			
a. You could not really trust most people?	1.	25.	M4ANotTrustPeople
b. Rather than get mad, you wanted to get even?	2.	26.	M4BRatherThanGetMadGetEven
c. You daydreamed or tried to space out the world a lot?	3.	27.	M4CDaydreamedSpaceOut
d. You did not care to be around other people much?	4.	28.	M4DDidntCareBeAroundOthers
e. You were not very emotional about other people or things?	5.	29.	M4ENotEmotionalAboutOthers
f. You were afraid that you were crazy?	6.	30.	M4FAfraidCrazy
<i>Impulsivity Personality</i>			
g. You often just did not pay bills or live up to your commitments?	7.	31.	M4GNotLiveUpCommitments
h. You lied often and easily?	8.	32.	M4HLiedOftenEasily
j. You got bored easily or hated routines?	9.	33.	M4JBoredEasilyHatedRoutines
k. You often acted before thinking about the trouble you might get into?	10.	34.	M4KActedBeforeThinkingAboutTrouble
m. You were a very moody person or had your feelings toward others change drastically?	11.	35.	M4MMoody
n. You did not like being told by others what you should be doing?	12.	36.	M4NNotLikeBeingToldWhatToDo

Subscale Name and Item Stem	GAIN Item Number	Rasch Output Item Number	Item Label
p. You could usually get people to do things your way?	13.	37.	M4P UsuallyGetPeopleDoThingsYourWay
q. Other people think your problems are worse than they really are?	14.	38.	M4QPeopleThinkYourProblemsWorseThanAre
<i>Worrying Personality</i>			
r. You spent a lot of time trying to think through your problems or what to do?	15.	39.	M4RSpentTimeTryingThinkThroughProblems
s. You got mad at yourself a lot because you did not do a good enough job?	16.	40.	M4SGotMadAtYourselfALot
t. You felt like you could not make it through life?	17.	41.	M4TFeltNotMakeItThroughLife
u. You had a hard time deciding what to do?	18.	42.	M4UHardTimeDecideWhatToDo
v. You had a hard time changing the way you did things?	19.	43.	M4VHardTimeChangeWayDoThings
w. You often felt critical of others or picked on them?	20.	44.	M4WFeltCriticalOfOthersPickedOnThem
x. You were very concerned about your health and other things that happened to you?	21.	45.	M4XConcernAboutHealth/Other

Data Source

Data on the 18,317 cases reported in this paper came from 12 projects/programs including 70 sites from around the country. All interviews were conducted by interviewers with three to four days of training followed by rigorous field-based certification procedures. Field interviewers had ongoing supervision by local trainers who were trained and certified by Chestnut staff on the use of the *GAIN*.

Full details about the *PCSS* may be obtained at the following:

<http://www.chestnut.org/LI/gain/index.html>

Rasch Analysis

The Rasch measurement model (Rasch, 1960) was chosen for this analysis because it is the only item response theory model that has the desirable scaling properties of linear, interval measurement (Embretson & Reise, 2000). Therefore, Rasch measures are the most valid for mathematical operations, such as correlation and regression analysis, as well for assessing change. Rather than tailor models to fit the data, the Rasch one parameter model fulfills the requirements of fundamental measurement, i.e., linear interval scale (Bond & Fox, 2007), and examines the data, i.e., items and persons, for flaws or problems that are indicated by their failure to fit the model.

Quality control with fit statistics. Rasch analysis provides fit statistics to test assumptions of fundamental measurement (Wright & Stone, 1979). “Fitting the model” simply means meeting basic assumptions of measurement, e.g., high scorers should endorse or get right almost all of the easy items. Once identified, persons and items that “misfit” can then be examined qualitatively to determine the causes of the problems. Problems may include items with confusing wording or items that assess a construct that is different from the principal one being measured, i.e., multidimensionality. Understanding poor fit can lead to improving or dropping items.

The fit of the data to the model is evaluated by fit statistics that are calculated for both persons and items. The following link provides a handy guide to interpreting fit statistics: <http://www.rasch.org/rmt/rmt82a.htm>. The Rasch model provides two indicators of misfit: infit and outfit. The infit is sensitive to unexpected behavior affecting responses to items near the person ability level and the outfit is outlier sensitive. Mean square fit statistics are defined such that the model-specified uniform value of randomness is 1.0 (Wright & Stone, 1979). Person fit indicates the extent to which the person’s performance is consistent with the way the items are used by the other respondents. Item fit indicates the extent to which the use of a particular item is consistent with the way the sample respondents have responded to the other items. For this type of analysis, values between .75 and 1.33 logits (log odd units) are considered acceptable (Wilson, 2005). In addition to fit statistics, principal component analysis of residuals is used to examine whether a substantial factor exists in the residuals after the primary measurement dimension has been estimated (Linacre, 1998; Smith, 2002).

Construct Validation

In Rasch analysis the item hierarchy that is created by the item difficulty estimates provides an indication of construct validity (Smith, 2001). The items should form a ladder of low severity symptoms on the bottom to high severity symptoms on the top.

In summary, the advantages of Rasch analysis are that:

- Standard errors differ across scores of items and persons, e.g., improved estimation of error in extreme scores.
- Enables shorter measures that are more reliable, e.g., eliminate bad items, and via computerized adaptive testing.
- Facilitates analysis of construct validity
- Enables comparable scoring across different measures, i.e., item and test equating.
- Unbiased estimates of item difficulties can be obtained from non-representative samples.
- Interval scale properties are achieved. How? Probabilities, or log odds, are used.
- Analysis of response category usefulness is enhanced.
- Analysis of person and item characteristics is enhanced through fit statistics.
- Enables analysis of differential item functioning, sometimes called item bias
- Enables analysis of differential test functioning sometimes called test bias.
- Facets beyond persons and items that affect the measures may be estimated

For references to articles that illustrate the applications noted above, we recommend Conrad & Smith (2004). For a complete treatment of Rasch analysis, we recommend Bond & Fox (2007) which includes a glossary of Rasch measurement terminology. Terminology may also be accessed online via *Rasch Measurement Transactions* located at <http://www.rasch.org/rmt/>. The tables below are output from Winsteps (Linacre, 2009 with annotated explanations and interpretations.

Background Characteristics of the Sample

As shown in the following table, the sample was predominately under 18 years of age (88%) and male (71%). Almost half were Caucasian (42%), a fifth were African American (20%), and the remainder Hispanic or mixed race. Of the top five most severe primary drugs reported, marijuana was reported by over 50% of the sample. The drug least often reported was opioids at 3%. Other drugs reported included amphetamines (16%), cocaine (6%), and alcohol (19%). Slightly over 4% percent of the sample reported other primary drugs.

Table 2. Demographic Characteristics of the Sample (N=18, 317^a)

	Percent	Number
Age, Mean (sd) 17.63 (6.39)		
< 18 years	87.5	15,979
≥18 years	12.5	2,275
Gender		
Male	70.6	12,889
Female	29.4	5,358
Race		
African American	19.8	3,602
Caucasian	41.7	7,596
Hispanic	20.4	,711
Mixed/other	18.1	3,296
Drug, primary, most severe		
Alcohol	19.0	3,475
Amphetamines	15.6	2,850
Marijuana	52.4	9,591
Cocaine	5.9	1,075
Opiates	2.8	517
Other drug	4.3	794

^a Numbers may not add up to 18, 317 due to missing values

Table 3. Person and Item Reliability

SUMMARY OF 11040 MEASURED (NON-EXTREME) PERSONS								
	RAW SCORE	COUNT	MEASURE	MODEL ERROR	INFIT		OUTFIT	
					MNSQ	ZSTD	MNSQ	ZSTD
MEAN	10.3	21.0	-.06	.55	1.00	.0	.99	.0
S.D.	4.8	.2	1.33	.12	.18	.8	.37	.8
MAX.	20.0	21.0	3.36	1.05	1.80	4.1	6.63	3.9
MIN.	1.0	12.0	-3.33	.47	.56	-2.2	.25	-2.0
REAL RMSE	.59	ADJ.SD	1.20	SEPARATION	2.04	PERSON RELIABILITY	.81	
MODEL RMSE	.57	ADJ.SD	1.21	SEPARATION	2.13	PERSON RELIABILITY	.82	
S.E. OF PERSON MEAN = .01								
MAXIMUM EXTREME SCORE: 92 PERSONS								
MINIMUM EXTREME SCORE: 264 PERSONS								
LACKING RESPONSES: 6760 PERSONS								
DELETED: 161 PERSONS								
VALID RESPONSES: 99.9%								
SUMMARY OF 11396 MEASURED (EXTREME AND NON-EXTREME) PERSONS								
	RAW SCORE	COUNT	MEASURE	MODEL ERROR	INFIT		OUTFIT	
					MNSQ	ZSTD	MNSQ	ZSTD
MEAN	10.1	21.0	-.13	.59				
S.D.	5.1	.3	1.54	.26				
MAX.	21.0	21.0	4.63	1.95				
MIN.	.0	3.0	-4.60	.47				
REAL RMSE	.66	ADJ.SD	1.39	SEPARATION	2.10	PERSON RELIABILITY	.81	
MODEL RMSE	.65	ADJ.SD	1.40	SEPARATION	2.16	PERSON RELIABILITY	.82	
S.E. OF PERSON MEAN = .01								
PERSON RAW SCORE-TO-MEASURE CORRELATION = .98 (approximate due to missing data)								
CRONBACH ALPHA (KR-20) PERSON RAW SCORE RELIABILITY = .86 (approximate due to missing data)								
SUMMARY OF 21 MEASURED (NON-EXTREME) ITEMS								
	RAW SCORE	COUNT	MEASURE	MODEL ERROR	INFIT		OUTFIT	
					MNSQ	ZSTD	MNSQ	ZSTD
MEAN	5496.8	11378.6	.00	.02	1.00	-.6	.99	-.8
S.D.	1704.8	13.9	.90	.00	.12	7.1	.20	7.2
MAX.	8447.0	11392.0	1.89	.03	1.25	9.9	1.43	9.9
MIN.	2103.0	11325.0	-1.57	.02	.81	-9.9	.73	-9.9
REAL RMSE	.02	ADJ.SD	.90	SEPARATION	37.88	ITEM RELIABILITY	1.00	
MODEL RMSE	.02	ADJ.SD	.90	SEPARATION	38.68	ITEM RELIABILITY	1.00	
S.E. OF ITEM MEAN = .20								

- Person reliability is acceptable at .81
- Items are placed reliably on the ruler.
- The person reliabilities for the individual subscales were very low: *Cautious Personality* = .22; *Impulsivity Personality* = .46; and *Worrying Personality* = .41.
- Cronbach alpha = .86
- Cronbach's alpha is higher because it estimates extreme scores as measured perfectly, i.e., with no error.
- A separation value of 2.04 gives approximately two separation levels, thus splitting the persons into about 3 groups on the Rasch ruler.
- Note that the Rasch analysis using the *Winsteps* software program was conducted on the 11,040 persons with non-extreme scores.

- Good item reliability of 1.00.
- Item separation is high at 37.88 meaning items are placed reliably on the ruler.

ITEM STATISTICS

Table 4. Principal Component Analysis of Standardized Residual Correlations for Items

Table of STANDARDIZED RESIDUAL variance (in Eigenvalue units)

		-- Empirical --	Modeled
Total raw variance in observations	=	30.7 100.0%	100.0%
Raw variance explained by measures	=	9.7 31.5%	29.7%
Raw variance explained by persons	=	4.6 14.9%	14.0%
Raw Variance explained by items	=	5.1 16.7%	15.7%
Raw unexplained variance (total)	=	21.0 68.5%	100.0% 70.3%
Unexplnd variance in 1st contrast	=	2.0 6.4%	9.3%
Unexplnd variance in 2nd contrast	=	1.6 5.2%	7.7%
Unexplnd variance in 3rd contrast	=	1.4 4.5%	6.5%
Unexplnd variance in 4th contrast	=	1.2 3.9%	5.7%
Unexplnd variance in 5th contrast	=	1.1 3.7%	5.3%

CON-	TRAST	LOADING	INFIIT		OUTFIT	ENTRY	NUMBER	ITEM
			MEASURE	MNSQ					MNSQ
1		.58	-.06	.81	.73	A	42	M4UHardTimeDecideWhatToDo
1		.52	-.01	.96	.93	B	40	M4SGotMadAtYourselfALot
1		.51	1.40	.88	.74	C	41	M4TFeltNotMakeItThroughLife
1		.45	-.11	.83	.76	D	43	M4VHardTimeChangeWayDoThings
1		.32	-.79	1.13	1.25	E	39	M4RSpentTimeTryingThinkThrough
1		.24	1.89	.92	.75	F	30	M4FAfraidCrazy
1		.15	-.11	1.25	1.43	G	45	M4XConcernAboutHealth/Other
1		.07	-.08	.93	.90	H	27	M4CDaydreamedSpaceOut
1		.03	1.12	.97	.93	I	31	M4GNotLiveUpCommitments
1		-.35	-1.57	.97	.96	a	36	M4NNotLikeBeingToldWhatToDo
1		-.35	-.05	1.11	1.15	b	37	M4P UsuallyGetPeopleDoThingsYo
1		-.34	-.27	.99	.99	c	26	M4BRatherThanGetMadGetEven
1		-.31	.54	1.16	1.24	d	29	M4ENotEmotionalAboutOthers
1		-.22	.16	.98	.95	e	32	M4HLiedOftenEasily
1		-.20	-1.23	.95	.90	f	33	M4JBoredEasilyHatedRoutines
1		-.19	-1.56	1.04	1.14	g	34	M4KActedBeforeThinkingAboutTro
1		-.18	.24	1.20	1.31	h	38	M4QPeopleThinkYourProblemsWors
1		-.18	1.34	.95	.85	i	44	M4WFeltCriticalOfOthersPickedO
1		-.15	-.89	1.04	1.09	j	25	M4ANotTrustPeople
1		-.12	-.11	.85	.78	K	35	M4MMoody
1		-.08	.16	1.03	1.03	J	28	M4DDidntCareBeAroundOthers

- To judge the strength of the measurement dimension, we used the following internal guidelines for variance explained by the measure: $\geq 40\%$ is considered a strong measurement dimension (Linacre, 2006), $\geq 30\%$ is considered a moderate measurement dimension, and $\geq 20\%$ is considered a minimal dimension. The 20% criterion is taken from Reckase (1979).
- The variance explained by the measure is 31.5%.
- The fact that only 9.3% of the variance is explained by the first factor of residuals supports unidimensionality
- Thus, the PCSS is considered unidimensional using these guidelines.

- Re: Misfit
- No items exhibited both Infit and Outfit Misfit
- One item exhibited OUTFIT Misfit: *M4XConcernAboutHealth/Other* (1.43 MNSQ)

Table 5. Most Unexpected Item Responses in Terms of Measure

MOST UNEXPECTED RESPONSES

ITEM	MEASURE	PERSON
		111111111 111111111 111111111 111
		53333222983322111 266433322722 7866332065465095555
		29532430001086970299596422083134154512600338083110
		31978057670170428395032558277219215393958725069219
		32421394001829833079020743885991983034276734827044
		high-----
36 M4NNotLikeBei	-1.57 K	.....0.....0.0.0.0..0.....
34 M4KActedBefor	-1.56 F	....0.....0...0..0.0.0...0.000.....
33 M4JBoredEasil	-1.23 h	0.....0.....0.....0.....
25 M4ANotTrustPe	-.89 G	..00.0.0...0.....1.....
39 M4RSpentTimeT	-.79 C	.0....0.00...0.00.0.....1.....
26 M4BRatherThan	-.27 I	.....0.....
45 M4XConcernAbo	-.11 A	.....1.....1.....
27 M4CDaydreamed	-.08 f	.....1.....
37 M4P UsuallyGe	-.05 E	.....0.....
40 M4SGotMadAtYo	-.01 i	.....1...1.....
32 M4HLiedOftenE	.16 J	.....0.....0.....1.....
29 M4ENotEmotion	.54 D	.....0.....1.11111.11
31 M4GNotLiveUpC	1.12 j	.....0.....1..1.11111.....
44 M4WFeltCritic	1.34 g	.....11.....1..
41 M4TFeltNotMak	1.40 d	.....1.....
30 M4FAfraidCraz	1.89 e	.....1.....
		-----low-
		11111111983322111211111111172231111111165411195555
		53333222001086970326643332283117866332000365083110
		29532430670170428099596422077294154512658738069219
		31978057001829833 950325582859 9215393976725027044
		32421394 790207438 19830342 348

- This table shows the items and their measures on the left and the persons with the most unexpected responses on the right.
- For example, Person #17491 had a low measure of -2.05 (data not shown). In spite of this low measure, this person endorsed the high severity item *M4FAfraidCraz* (1.89)

Table 6. Most Unexpected Item Responses in Terms of OUTMSQ

ITEM	OUTMNSQ	PERSON
		111111111 111111111 111111111 111
		53333222983322111 266433322722 7866332065465095555
		29532430001086970299596422083134154512600338083110
		31978057670170428395032558277219215393958725069219
		32421394001829833079020743885991983034276734827044
		high-----
45 M4XConcernAbo	1.43 A	.....1.....1.....
39 M4RSpentTimeT	1.25 C	.0....0.00...0.00.0.....1.....
29 M4ENotEmotion	1.24 D	.....0.....1.11111.11
37 M4P UsuallyGe	1.15 E	.....0.....
34 M4KActedBefor	1.14 F	...0....0...0..0.0.0...0.000.....
25 M4ANotTrustPe	1.09 G	..00.0.0...0.....1.....
26 M4BRatherThan	.99 I	.....0.....
32 M4HLiedOftenE	.95 J	.....0....0....1.....
36 M4NNotLikeBei	.96 K	.....0.....0.0.0.0..0.....
31 M4GNotLiveUpC	.93 j	.....0.....1..1.11111.....
40 M4SGotMadAtYo	.93 i	.....1...1.....
33 M4JBoredEasil	.90 h	0.....0.....0.....
44 M4WFeltCritic	.85 g	.....11.....1..
27 M4CDaydreamed	.90 f	.....1.....
30 M4FAfraidCraz	.75 e	.....1.....
41 M4TFeltNotMak	.74 d	.....1.....
		-----low-
		1111111198332211121111111117223111111165411195555
		53333222001086970326643332283117866332000365083110
		29532430670170428099596422077294154512658738069219
		31978057001829833 950325582859 9215393976725027044
		32421394 790207438 19830342 348

This table shows the most misfitting items in terms of OUTMNSQ. Using our criterion for misfit, one item had an OUTFIT MSQ ≥ 1.33 . To the right of the items, we see the persons who unexpectedly endorsed or did not endorse an item given their overall measure. Item #45 *M4X Concern About Health/Other Things that Happened to You* has the highest outfit (1.43) because a few people with low overall measures endorsed it (the 1's) even though it was in the moderate range on the item hierarchy (-.11 logits). We see that Person # 17,491 is one of those individuals.

PERSON STATISTICS

Table 7. Person Statistics: Misfit Order (table abridged due to space limitations)

ENTRY NUMBER	TOTAL SCORE	COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORR.	PT-MEASURE EXP.	EXACT OBS%	MATCH EXP%	PERSON
2872	20	21	3.36	1.05	1.18	.5	6.63	2.4	A-.39	.19	95.2	95.2	12659 1 1 0 1 1 2 1 1 1 3
230	20	21	3.36	1.05	1.18	.5	6.54	2.4	B-.39	.19	95.2	95.2	14561 2 2 0 2 2 2 2 1 1 2
1948	20	21	3.36	1.05	1.18	.5	6.54	2.4	C-.39	.19	95.2	95.2	11120 1 4 0 1 2 2 2 1 1 2
3101	20	21	3.36	1.05	1.18	.5	6.54	2.4	D-.39	.19	95.2	95.2	1296 1 2 1 2 2 2 1 1 1 3
13281	20	21	3.36	1.05	1.18	.5	6.54	2.4	E-.39	.19	95.2	95.2	10376 2 2 1 2 2 2 2 1 1 4
2129	19	21	2.57	.77	1.36	.8	6.04	3.0	F-.56	.26	90.5	90.5	6072 1 3 0 1 2 2 1 1 1 3
5120	1	21	-3.33	1.04	1.16	.5	5.13	2.0	G-.33	.17	95.2	95.2	16006 2 2 0 2 2 2 2 1 1 2
15233	20	21	3.36	1.05	1.17	.5	4.75	1.9	H-.31	.19	95.2	95.2	17382 2 3 0 1 2 1 1 1 1 1
13620	19	21	2.57	.77	1.31	.7	3.90	2.2	I-.33	.26	90.5	90.5	12483 2 1 0 1 1 2 1 1 1 3
16959	19	21	2.57	.77	1.29	.7	3.70	2.1	J-.29	.26	90.5	90.5	18091 1 3 1 1 2 2 2 1 1 2
13685	18	21	2.06	.66	1.45	1.1	3.66	2.6	K-.43	.30	85.7	85.7	17273 2 1 0 1 1 2 1 1 1 3
13254	19	21	2.57	.77	1.28	.6	3.62	2.1	L-.25	.26	90.5	90.5	8901 2 2 1 2 2 2 2 1 1 2
14932	19	21	2.57	.77	1.24	.6	3.41	2.0	M-.18	.26	90.5	90.5	67 2 2 0 2 2 2 1 1 1 3
3018	20	21	3.36	1.05	1.17	.5	3.40	1.6	N-.22	.19	95.2	95.2	9667 2 2 0 2 2 2 1 1 1 3
12074	20	21	3.36	1.05	1.17	.5	3.40	1.6	O-.22	.19	95.2	95.2	7145 1 1 1 1 1 2 2 1 1 4
12403	20	21	3.36	1.05	1.17	.5	3.40	1.6	P-.22	.19	95.2	95.2	2291 1 1 1 1 1 2 2 1 1 4
13372	20	21	3.36	1.05	1.17	.5	3.40	1.6	Q-.22	.19	95.2	95.2	15644 1 1 1 1 1 2 1 1 1 3
13594	20	21	3.36	1.05	1.17	.5	3.40	1.6	R-.22	.19	95.2	95.2	10894 1 1 0 1 1 2 1 1 1 3
17491	3	21	-2.05	.65	1.33	.9	3.34	2.4	S-.27	.27	85.7	85.7	4586 1 4 0 1 2 2 2 1 1 2
1850	18	21	2.06	.66	1.44	1.1	3.29	2.4	T-.39	.30	85.7	85.7	2413 2 4 0 1 2 2 1 1 1 3
3631	4	21	-1.67	.59	1.32	1.0	3.27	2.8	U-.28	.30	81.0	80.9	5951 1 4 0 1 2 1 1 1 1 1
12028	19	21	2.57	.77	1.10	.4	3.24	1.9	V-.04	.26	90.5	90.5	4631 2 1 1 1 1 2 2 1 1 4
12283	19	21	2.57	.77	1.10	.4	3.20	1.9	W-.04	.26	90.5	90.5	15949 2 1 1 1 1 2 2 1 1 4
7878	19	21	2.57	.77	1.09	.4	3.19	1.9	X-.03	.26	90.5	90.5	6178 1 2 0 2 2 2 1 1 1 3
13193	2	21	-2.55	.77	1.25	.6	3.17	1.9	Y-.25	.23	90.5	90.5	5772 2 2 1 2 2 1 1 1 1 1
16500	19	21	2.57	.77	.97	.1	3.16	1.9	Z-.06	.26	90.5	90.5	7744 1 1 0 1 1 2 1 1 1 3
4077	17	21	1.67	.59	1.49	1.4	3.10	2.7	-.37	.33	76.2	81.5	11934 1 2 1 2 2 2 2 1 1 4
11946	18	21	2.06	.66	1.38	.9	3.09	2.3	-.29	.30	85.7	85.7	1690 2 1 1 1 1 2 2 5 1 5
15928	17	21	1.67	.59	1.37	1.1	2.97	2.6	-.25	.33	76.2	81.5	10906 2 1 0 1 1 2 2 1 1 2
12304	17	21	1.67	.59	1.30	.9	2.89	2.6	-.23	.33	85.7	81.5	16529 1 1 1 1 1 2 2 1 1 4
10691	4	21	-1.67	.59	1.49	1.4	2.81	2.4	-.39	.30	81.0	80.9	6890 1 3 0 1 2 2 1 1 1 3
1007	18	21	2.06	.66	1.39	1.0	2.77	2.0	-.26	.30	85.7	85.7	7742 2 2 0 2 2 2 2 1 1 2
15303	18	21	2.06	.66	1.39	1.0	2.77	2.0	-.26	.30	85.7	85.7	3288 1 2 0 2 2 2 2 1 1 2

There is minimal person misfit when using the criterion of less than 5% of the sample having both infit and outfit ≥ 1.33 logits. In this case, 4% (N=402) of the sample misfit. Further analysis of person misfit is discussed later in this report.

Table 8. Persons with Most Unexpected Responses in Terms of Measures (Continued)

MOST UNEXPECTED RESPONSES

PERSON	MEASURE	ITEM
		333232434243432323443
		643596355727028891410
		high-----
230 14561	2 2 0 2 2 2 2 1 1 2	3.36 B .0.....
1083 2907	2 4 0 1 2 2 2 5 1 5	3.36 .0.....
1723 6878	1 4 0 1 2 2 2 1 1 4	3.36 .0.....
1948 11120	1 4 0 1 2 2 2 1 1 2	3.36 C .0.....
2609 15672	2 2 0 2 2 2 2 1 1 6	3.36 .0.....
2872 12659	1 1 0 1 1 2 1 1 1 3	3.36 A 0.....
3018 9667	2 2 0 2 2 2 1 1 1 3	3.36 N .0.....
3101 1296	1 2 1 2 2 2 1 1 1 3	3.36 D .0.....
8070 7491	2 3 0 1 2 2 2 1 1 6	3.36 .0.....
9060 17806	2 4 0 1 2 2 1 1 1 3	3.36 .0.....
12074 7145	1 1 1 1 1 2 2 1 1 4	3.36 O .0.....
12359 456	1 1 1 1 1 1 1 1 1 1	3.36 .0.....
12403 2291	1 1 1 1 1 2 2 1 1 4	3.36 P .0.....
13281 10376	2 2 1 2 2 2 2 1 1 4	3.36 E .0.....
13372 15644	1 1 1 1 1 2 1 1 1 3	3.36 Q .0.....
13594 10894	1 1 0 1 1 2 1 1 1 3	3.36 R .0.....
13912 648	1 4 0 1 2 2 2 1 1 4	3.36 .0.....
15233 17382	2 3 0 1 2 1 1 1 1 1	3.36 H .0.....
12997 15918	2 2 1 2 2 2 2 1 1 4	3.26 .0.....
319 13553	1 2 0 2 2 2 2 1 1 6	2.57 .0.....0.....
2129 6072	1 3 0 1 2 2 1 1 1 3	2.57 F 00.....
2375 17953	1 1 0 1 1 2 1 1 1 3	2.57 .0.....
7878 6178	1 2 0 2 2 2 1 1 1 3	2.57 X .0.....
12028 4631	2 1 1 1 1 2 2 1 1 4	2.57 V 0.....
12283 15949	2 1 1 1 1 2 2 1 1 4	2.57 W .0.....
13254 8901	2 2 1 2 2 2 2 1 1 2	2.57 L 0.....0.....
13457 2443	1 1 0 1 1 2 1 1 1 3	2.57 .0.....0.....
13620 12483	2 1 0 1 1 2 1 1 1 3	2.57 I 0....0.....
14932 67	2 2 0 2 2 2 1 1 1 3	2.57 M .0.....0.....
16500 7744	1 1 0 1 1 2 1 1 1 3	2.57 Z 0.....
16959 18091	1 3 1 1 2 2 2 1 1 2	2.57 J .0.....0.....

We see some of the high scorers with unexpected non-endorsement of low severity items, especially items #36 and #34. Here we see the zeros on the left meaning that person did not endorse the item.

Table 8. Persons with Most Unexpected Responses in Terms of Measures (Continued)

MOST UNEXPECTED RESPONSES														
PERSON		MEASURE										ITEM		
												333232434243432323443		
												643596355727028891410		
17491	4586	1	4	0	1	2	2	2	1	1	2	-2.05	S	.....1..1.....1
4377	10554	1	4	0	1	2	2	1	1	1	3	-2.55		.....1.....1...
5086	2127	2	4	0	1	2	2	2	1	1	2	-2.55		.....11.....
6057	15058	1	2	0	2	2	2	1	1	1	3	-2.55		.....1.....1...
10692	6970	1	3	0	1	2	2	1	1	1	3	-2.55		.....1.....1...
12234	14163	2	2	1	2	2	1	1	1	1	1	-2.55		.....1..1.....
13193	5772	2	2	1	2	2	1	1	1	1	1	-2.55	Y	.....1.....1.
13530	7098	1	1	0	1	1	2	1	1	1	3	-2.55		...1.....1...
16453	1808	1	4	0	1	2	1	1	1	1	1	-2.55		.....1.....1..
16518	9368	1	1	0	1	1	1	1	1	1	1	-2.55		...1.....1.....
18129	13952	2	1	0	1	1	2	2	1	1	2	-2.55		.....1.....1...
5094	4543	2	3	0	1	2	2	2	1	1	2	-3.33		.....1.....
5114	14026	2	4	0	1	2	2	2	1	1	2	-3.33		.....1.....
5120	16006	2	2	0	2	2	2	2	1	1	2	-3.33	G	.....1.....
5397	8618	1	1	0	1	1	1	1	1	1	1	-3.33		.....1.....
9862	7651	1	2	0	2	2	1	1	1	1	1	-3.33		.....1.....
10008	881	1	2	0	2	2	1	1	1	1	1	-3.33		.....1.....
15854	7736	1	2	0	2	2	2	2	1	1	2	-3.33		.....1.....
16323	1659	1	2	0	2	2	2	2	1	1	2	-3.33		.....1.....
-----low-----														
												333232434243432323443		
												643596355727028891410		

The other unexpected responses are the low scorers who are endorsing moderately high severity



Table 9. Person with Most Misfitting Response Strings in Terms of OUTMNSQ

MOST MISFITTING RESPONSE STRINGS														
PERSON	OUTMNSQ									ITEM				
	333232434243432323443													
	643596355727028891410													
	high-----													
2872	12659	1	1	0	1	1	2	1	1	1	3	6.63	A	0.....
230	14561	2	2	0	2	2	2	2	1	1	2	6.54	B	.0.....
1948	11120	1	4	0	1	2	2	2	1	1	2	6.54	C	.0.....
3101	1296	1	2	1	2	2	2	1	1	1	3	6.54	D	.0.....
13281	10376	2	2	1	2	2	2	2	1	1	4	6.54	E	.0.....
2129	6072	1	3	0	1	2	2	1	1	1	3	6.04	F	00.....
5120	16006	2	2	0	2	2	2	2	1	1	2	5.13	G	.....1..
15233	17382	2	3	0	1	2	1	1	1	1	1	4.75	H	..0.....
13620	12483	2	1	0	1	1	2	1	1	1	3	3.90	I	0....0.....
16959	18091	1	3	1	1	2	2	2	1	1	2	3.70	J	.0.....0.....
13685	17273	2	1	0	1	1	2	1	1	1	3	3.66	K	0.0.....0.....
13254	8901	2	2	1	2	2	2	2	1	1	2	3.62	L	0.....0.....
14932	67	2	2	0	2	2	2	1	1	1	3	3.41	M	.0.....0.....
3018	9667	2	2	0	2	2	2	1	1	1	3	3.40	N	...0.....
12074	7145	1	1	1	1	1	2	2	1	1	4	3.40	O	...0.....
12403	2291	1	1	1	1	1	2	2	1	1	4	3.40	P	...0.....
13372	15644	1	1	1	1	1	2	1	1	1	3	3.40	Q	...0.....
13594	10894	1	1	0	1	1	2	1	1	1	3	3.40	R	...0.....
17491	4586	1	4	0	1	2	2	2	1	1	2	3.34	S	.....1...1.....1
1850	2413	2	4	0	1	2	2	1	1	1	3	3.29	T	.0.0..0.....
3631	5951	1	4	0	1	2	1	1	1	1	1	3.27	U	.....1.....11
12028	4631	2	1	1	1	1	2	2	1	1	4	3.24	V	0.....
12283	15949	2	1	1	1	1	2	2	1	1	4	3.20	W	.0.....
7878	6178	1	2	0	2	2	2	1	1	1	3	3.19	X	.0.....
13193	5772	2	2	1	2	2	1	1	1	1	1	3.17	Y	.....1.....1.
16500	7744	1	1	0	1	1	2	1	1	1	3	3.16	Z	0.....
		-----low-												
		333232434243432323443												
		643596355727028891410												

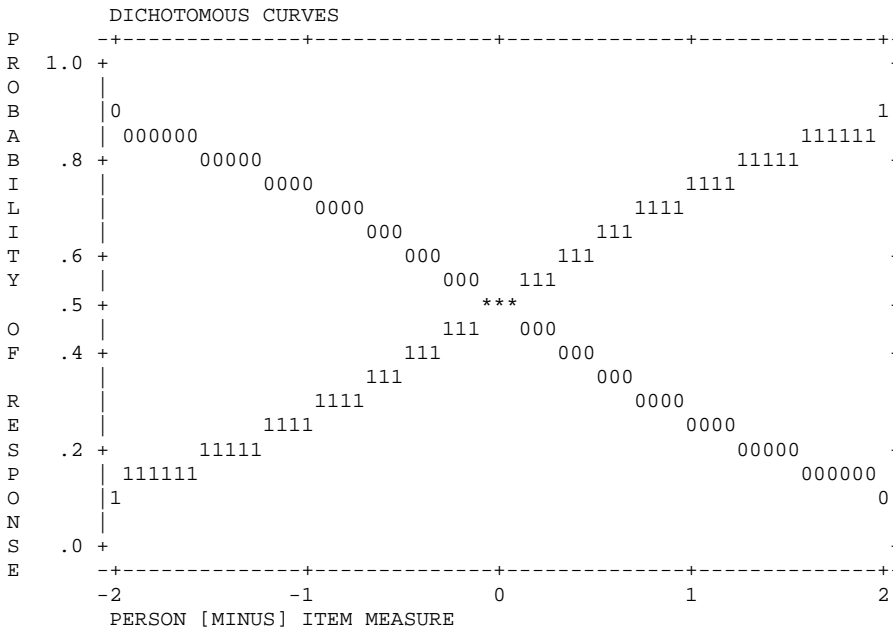
▪ This table shows the persons with high OUTFIT MSQ. Here we see that most of the Person OUTFITmisfit is being caused by items #36, #34, and #33. These are the 3 easiest items yet persons like #2874; for example, who has a high overall measure of 3.36 (data not shown) but didn't endorse Item #36.

Table 10. Summary of Category Structure

SUMMARY OF CATEGORY STRUCTURE. Model="R"

CATEGORY LABEL	OBSERVED SCORE	OBSVD COUNT	SAMPLE %	AVRGE	EXPECT	INFINIT MNSQ	OUTFIT MNSQ	COHERENCE M->C	C->M	ESTIM DISCR
0	0	117994	51	-.93	-.93	1.01	1.03	74%	75%	0
1	1	113500	49	.84	.84	1.00	.96	74%	72%	1.00
MISSING		346	0	.00						

OBSERVED AVERAGE is mean of measures in category. It is not a parameter estimate.
 M->C = Does Measure imply Category?
 C->M = Does Category imply Measure?



51% of all responses were zeros (did not endorse items).

Differential Item Functioning for Age, Gender, Race, and Primary Drug Severity for the Personality Coping Styles Scale

As Bond and Fox (2007) note, the Rasch model requires that relative item estimates (i.e., item difficulty estimates) remain invariant across subgroups of persons (e.g., females and males). DIF allows us to examine whether items have significantly different meanings for different groups. They suggest that items that show DIF should be investigated to determine what may be inferred about the underlying construct and what that implies about the samples of persons detected. A significant DIF contrast is based on ≥ 0.60 logit difference for all comparisons which is approximately half a standard deviation for persons (Table 3, top panel) for the items (Norman, Sloan, & Wyrwich, 2003; Conrad, Dennis, Bezruczko, Funk, & Riley, 2007).

The figures below present easily interpretable graphs of the relationships of the various groups on the PCSS items. Table 11 contains the data that formed these graphs, and provides the information to compute the exact differences between groups on each item. For example, to get the DIF contrast between males and females on *M4ENotEmotionalAboutOthers*, subtract $.34 - 1 = -.66$, which is a significant DIF contrast.

Gender DIF. In Figure 2, there was only one item with significant DIF, *M4ENotEmotionalAboutOther*, an item that was easier for males to endorse. Since there was only one item with a DIF contrast of $-.66$, i.e., just slightly over our criterion of half a standard deviation of $.6$, we regarded the gender DIF as of minor concern.

Age DIF. In Figure 3, there were nine items with significant DIF, i.e., greater than $+ \text{ or } -.6$. Five of the items were easier for youth to endorse (in descending order of DIF contrast): *M4NNotLikeBeingToldWhatToDo*, *M4KActedBeforeThinkingAboutTrouble*, *M4JBoredEasilyHatedRoutines*, *M4BRatherThanGetMadGetEven*, and *M4WFeltCriticalOfOthersPickedOnThem*. Four items were easier for adults to endorse (in descending order): *M4SGotMadAtYourselfALot*, *M4XConcernAboutHealth/Other*, *M4RSpentTimeTryingThinkThroughProblems*, and *M4GNotLiveUpCommitments*. Although these items would appear to balance out, it is clear that youth and adults respond very differently on nine of the items. It is also true that youth more readily endorse the easiest items whereas adults more readily endorse harder, more serious items. In other words, the item hierarchies are very different for youth vs. adults. This suggests that separate measures or appropriate adjustments would help to refine the sensitivity of the measures and reduce potential differential test functioning (see Conrad et al. 2007). This would be essential if the PCSS were to be used in a computerized adaptive testing platform.

Race DIF. As seen in Figure 4, we observed that there was significant DIF for four items when comparing African-Americans to all others whereby it was easier for African-Americans to endorse: *M4ANotTrustPeople*, *M4XConcernAboutHealth/Other*, and *M4DDidntCareBeAroundOthers*. It was more difficult for African-Americans to endorse *M4NNotLikeBeingToldWhatToDo*. When comparing Caucasians to all others, there was one item with DIF whereby it was harder for Caucasians to endorse *M4ANotTrustPeople*

Primary Drug Severity DIF. With six different types of primary drugs, we observed in Figure 5 that there was no item DIF when we compared marijuana to other types of drugs. However, when we examined item DIF for opioids ($n = 517$; 2.8%) vs. all other primary drugs, we found five significant DIF contrasts. It was easier for opioid users to endorse *M4SGotMadAtYourselfALot* and *M4GNotLiveUpCommitments*. It was more difficult for opioid users to endorse *M4NNotLikeBeingToldWhatToDo*, *M4WFeltCriticalOfOthersPickedOnThem*,

and M4BRatherThanGetMadGetEven. In examining Figure 5, one can see that cocaine users were quite similar to opioid users. We note that this pattern is somewhat similar to the hierarchy generated by adults in Figure 3. Since opioid and cocaine users tend to be older, these differences would probably be reduced in age-specific or age-adjusted measures. It may be necessary to account for the differing hierarchy for opioid and cocaine users in a computerized adaptive testing environment however.

Table 11. PCSS Item Measures by Demographic Groups (Items Listed in Severity Order)

ITEM	PCSS MEASURE	Gender		Age		Race				Primary Drug					
		Male	Female	<=18	>18	AA	Cau	Hisp	Mix/Oth	Alcohol	Amp	Mar	Coc	Opioids	All Other Drugs
'M4NNotLikeBeingToldWhatToDo	-1.57	-1.57	-1.57	-1.73	-0.8	-1.04	-1.89	-1.57	-1.6	-1.57	-1.55	-1.73	-0.8	-0.78	-1.73
'M4KActedBeforeThinkingAboutTrouble	-1.56	-1.61	-1.4	-1.7	-0.86	-1.15	-1.85	-1.45	-1.56	-1.46	-1.5	-1.72	-1.06	-1.2	-1.2
'M4JBoredEasilyHatedRoutines	-1.23	-1.28	-1.11	-1.37	-0.57	-0.86	-1.47	-1.23	-1.21	-1.23	-1.16	-1.35	-0.61	-1.07	-1.19
'M4ANotTrustPeople	-0.89	-0.86	-0.97	-0.93	-0.71	-1.45	-0.47	-1.19	-0.95	-0.79	-1.16	-0.89	-0.65	-0.67	-0.94
'M4RSpentTimeTryingThinkThroughProblems	-0.79	-0.84	-0.68	-0.67	-1.51	-1.04	-0.74	-0.7	-0.72	-0.9	-0.71	-0.74	-1.18	-1.02	-0.46
'M4BRatherThanGetMadGetEven	-0.27	-0.42	0.09	-0.4	0.4	-0.35	-0.04	-0.56	-0.36	-0.17	-0.31	-0.43	0.4	0.31	-0.39
'M4MMoody	-0.11	0.05	-0.51	-0.11	-0.03	-0.07	-0.2	0.03	-0.11	-0.06	-0.25	-0.09	-0.15	-0.04	-0.22
'M4VHardTimeChangeWayDoThings	-0.11	-0.06	-0.25	-0.02	-0.6	-0.04	-0.2	0.01	-0.16	-0.11	-0.16	0.03	-0.68	-0.67	-0.36
'M4XConcernAboutHealth/Other	-0.11	-0.16	0	0.03	-0.88	-0.77	0.21	-0.07	-0.05	-0.25	-0.07	-0.02	-0.62	-0.48	0.43
'M4CDaydreamedSpaceOut	-0.08	-0.02	-0.22	-0.16	0.32	0.24	-0.27	-0.08	-0.05	-0.08	-0.11	-0.14	0.4	0.21	-0.42
'M4UHardTimeDecideWhatToDo	-0.06	0.08	-0.39	-0.02	-0.26	0.22	-0.2	0.06	-0.21	-0.15	-0.14	0.05	-0.28	-0.02	-0.28
'M4P UsuallyGetPeopleDoThingsYourWay	-0.05	-0.05	-0.05	-0.05	0.04	-0.14	-0.08	0	0.1	-0.13	-0.05	-0.05	0.23	-0.37	-0.13
'M4SGotMadAtYourselfALot	-0.01	0.03	-0.12	0.18	-1.03	-0.19	0.08	-0.01	0.01	-0.09	0.05	0.17	-1.04	-0.68	0.05
'M4DDidntCareBeAroundOthers	0.16	0.2	0.08	0.23	-0.17	-0.34	0.44	0.16	0.18	0.16	-0.01	0.24	-0.08	0.11	0.18
'M4HLiedOftenEasily	0.16	0.11	0.27	0.1	0.48	0.48	0.06	-0.03	0.18	0.39	0.24	0.08	0.19	-0.13	0.03
'M4QPeopleThinkYourProblemsWorseThanAre	0.24	0.1	0.55	0.18	0.54	0.19	0.29	0.09	0.33	0.24	0.59	0.06	0.43	0.51	0.73
'M4ENotEmotionalAboutOthers	0.54	0.34	1	0.48	0.86	0.37	0.67	0.47	0.54	0.5	0.48	0.48	0.98	0.83	0.54
'M4GNotLiveUpCommitments	1.12	1.12	1.1	1.28	0.48	1	1.12	1.19	1.25	1.24	1.15	1.29	0.34	0.34	1.21
'M4WFeltCriticalOfOthersPickedOnThem	1.34	1.28	1.47	1.23	1.83	1.59	1.19	1.49	1.22	1.32	1.29	1.23	1.85	2.03	1.18
'M4TFeltNotMakeItThroughLife	1.4	1.59	1.05	1.5	1	1.45	1.4	1.4	1.3	1.37	1.49	1.54	0.95	0.99	1.13
'M4FAfraidCrazy	1.89	2.04	1.64	1.98	1.58	2.12	1.69	2.11	1.85	1.77	1.89	1.98	1.65	2.18	1.83

Figure 2. PCSS Gender DIF

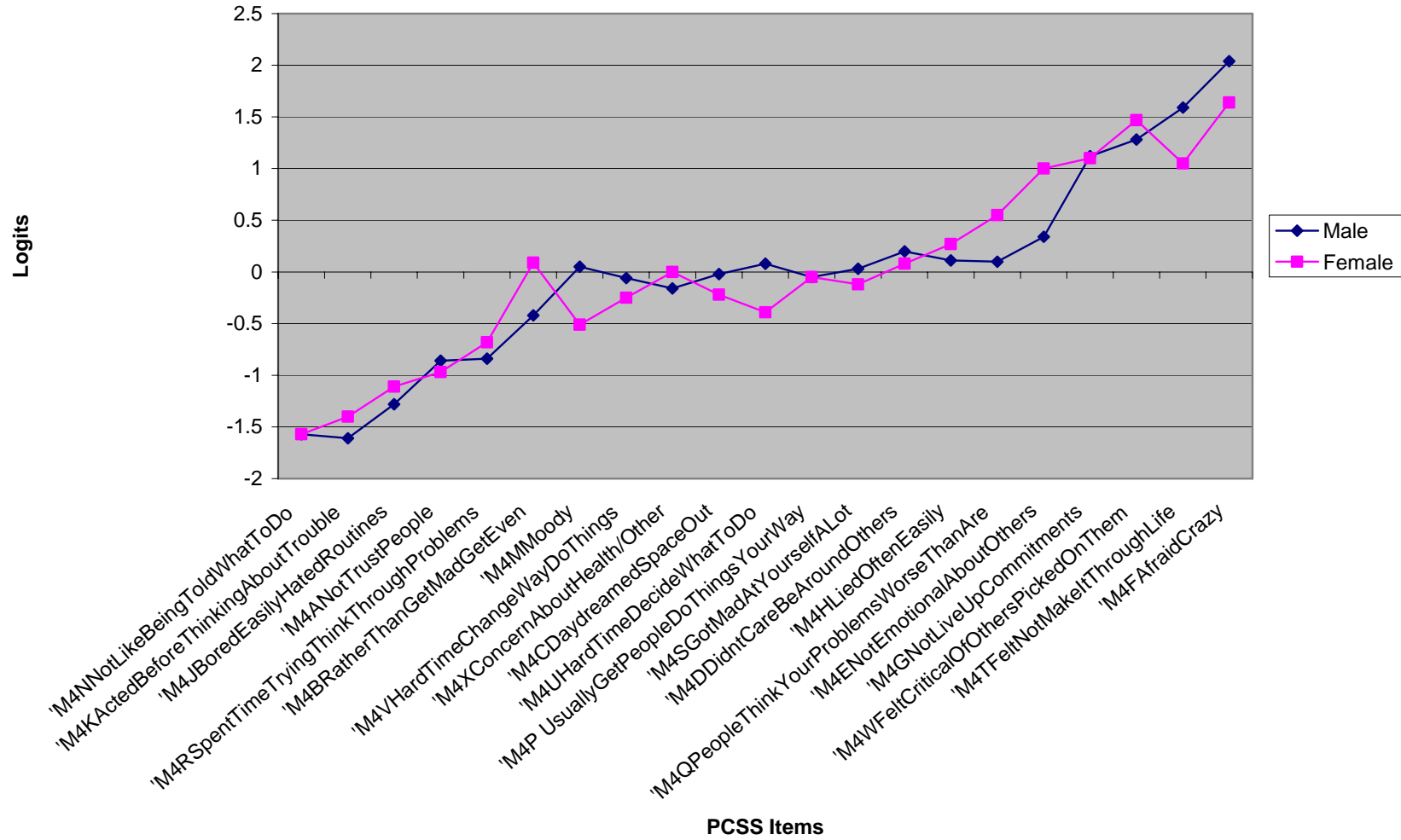


Figure 3. PCSS AGE DIF

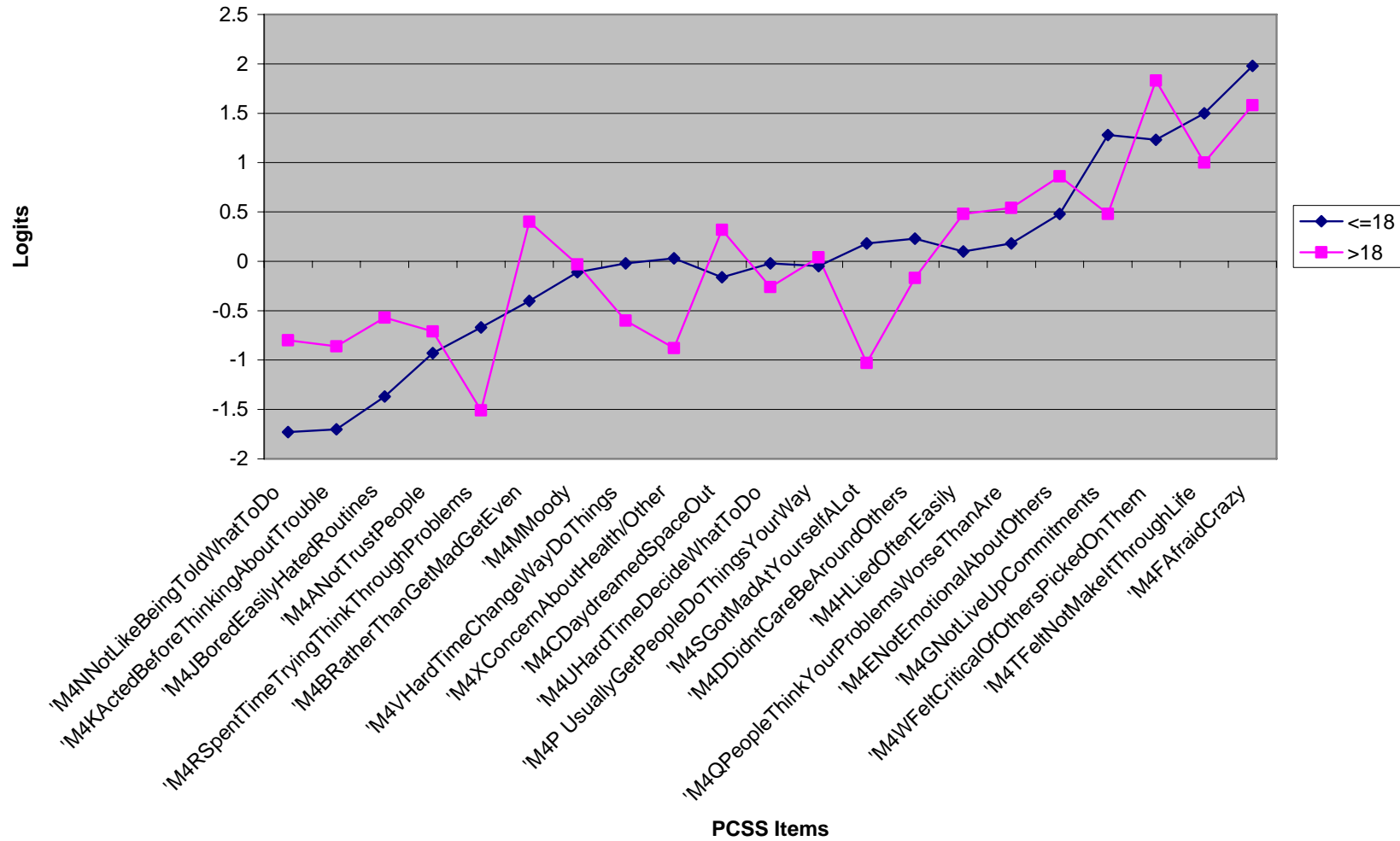


Figure 4. PCSS RACE DIF

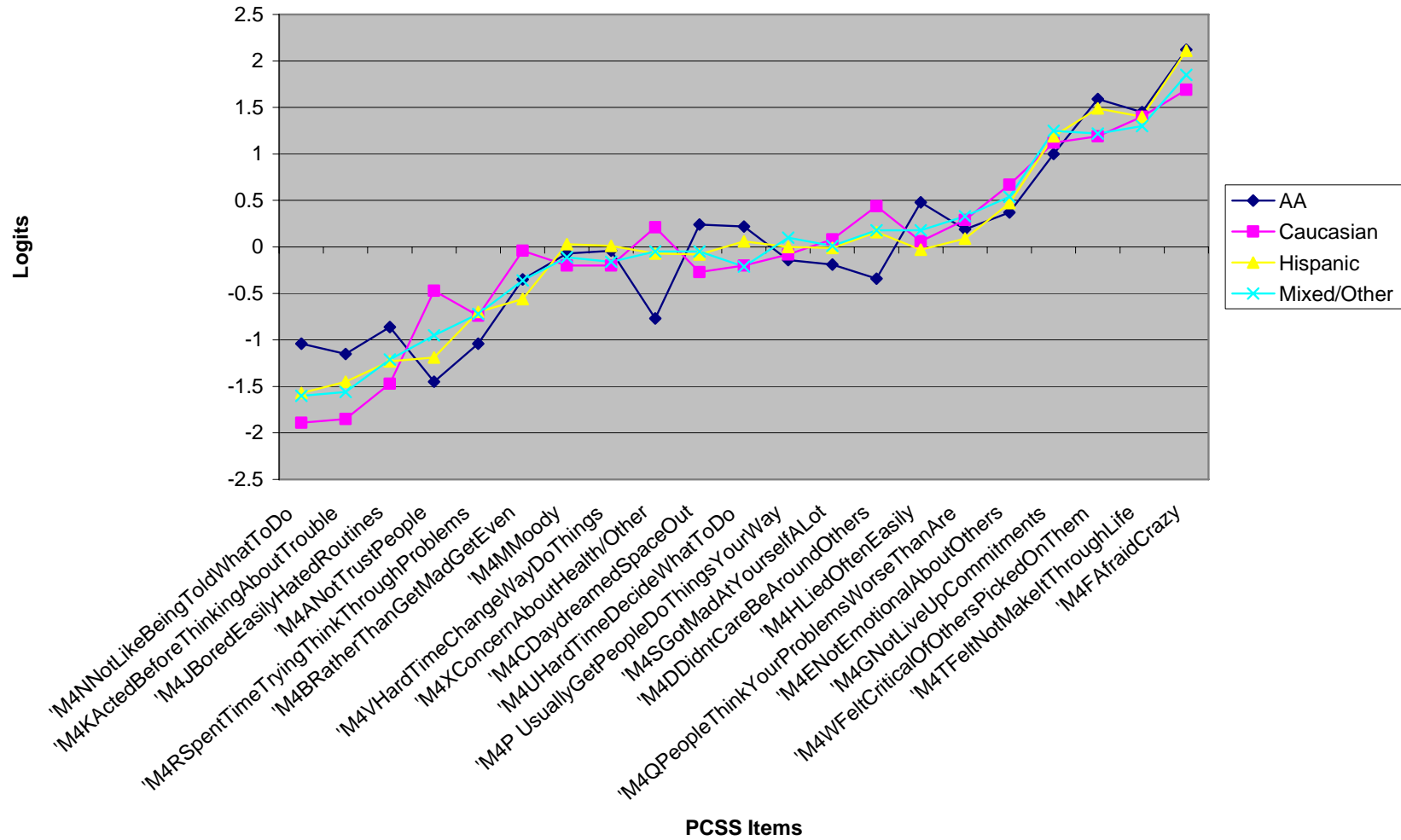
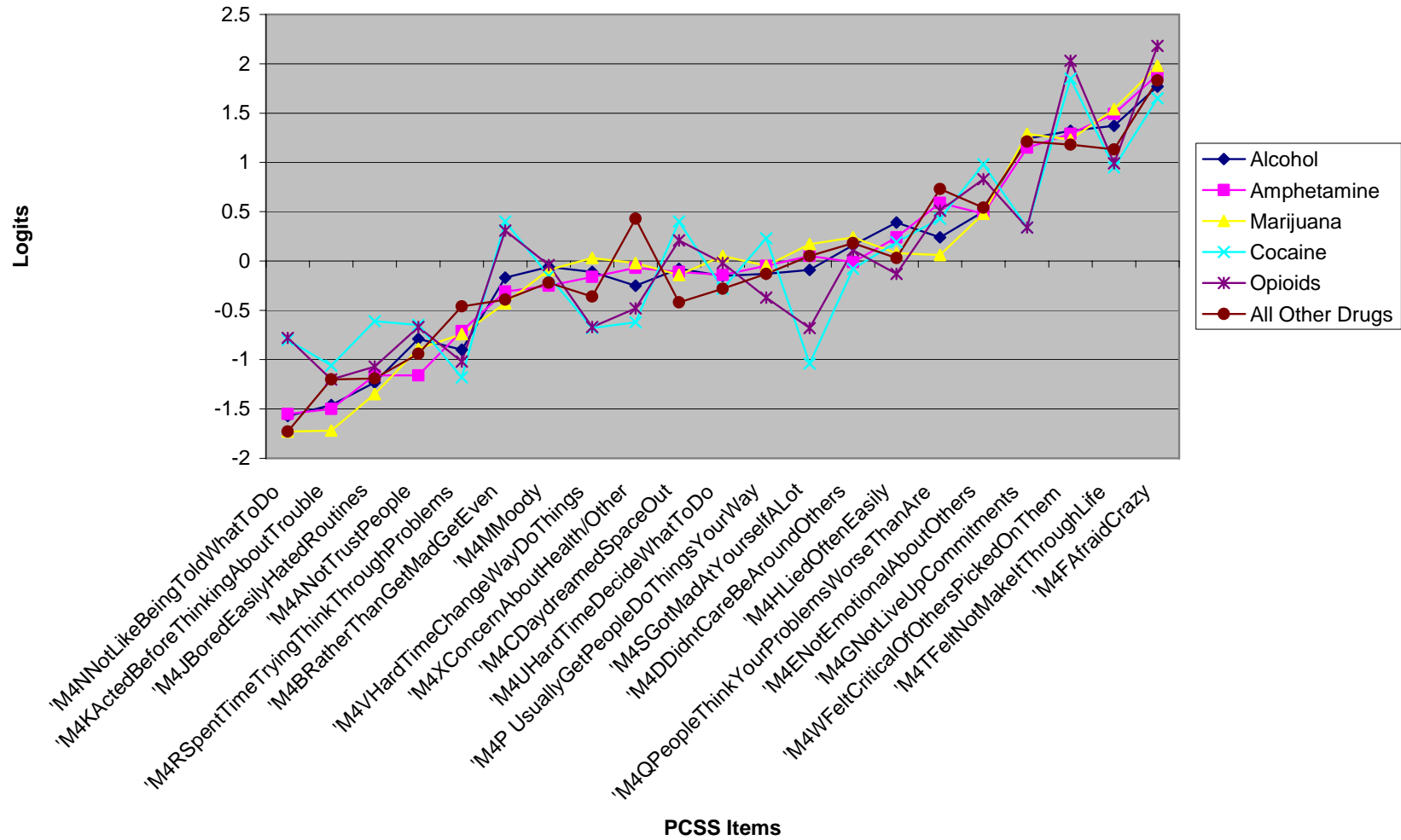


Figure 5. PCSS PRIMARY DRUG DIF



Person Fit Group Analysis for the PCSS

The purpose of the person fit group analysis is to illustrate and interpret the expected and unexpected patterns of raw scores in terms of the expectations of the Rasch model. The response patterns for each fit group are discussed relative to the response pattern for the overall group mean).

This fit group information should enable us to interpret certain unusual patterns of scores more appropriately, e.g., low scorers who endorse serious problems with their coping styles but not the less serious problems. This type of analysis should inform the interpretation of Rasch measures and enable better treatment decisions. We alert the reader that these charts present raw score p-values (higher proportions endorsing the items are higher on the charts) so they are upside down from the typical Rasch charts where more rare is higher. We use the words **lower, moderate and higher to express** where the fit group means fall relative to the overall group mean. The items in the charts are arranged first in severity order by subscale and then arranged by severity order within subscales.

Figure 6 displays the numbers and percentages of persons in each fit group in a pie chart. In Figures 7-10 below, we present the four possible person fit patterns using Rasch person fit statistics (Wright & Stone, 1979) where ≤ 1.33 mean square on both infit and outfit is low or moderate (L/M) fit (Wilson, 2005). We are regarding this as good fit from a clinical perspective, though we recognize that some would say that very low values, e.g., $< .75$ would be over-fitting. Infit or outfit values above 1.33 are regarded as high (H) or poor fitting patterns.

Therefore, in Figure 7, L/M on infit and L/M on outfit would be a pattern that is consistent with Rasch model expectations, i.e., good fit, and 10,007 persons (88%) were in this fit group. The solid lines represent the actual item (dichotomous 0/1 categories) response means for each fit group, and the dashed lines represent the item means over all persons. The red vertical lines indicate the difference between fit group mean and the overall group mean.

In Figure 8, the L/M infit and high (H) outfit group consists of 959 people (8%) (termed Atypical Type 1). Relative to the overall mean, Atypical Type 1 response patterns on the PCSS indicate that the persons in this fit group were less likely to endorse the items that were easiest for most people to endorse, i.e., *M4KActedBeforeThinkingAboutTrouble*, *M4NNotLikeBeingToldWhatTo*, *M4JBoredEasilyHatedRoutines*, which were all in the *Impulsivity Personality* subscale. However, the persons in this fit group were much more likely to endorse the items that were the hardest for other persons to endorse, i.e., *M4GNotLiveUpCommitments*, *M4WFeltCriticalOfOthersPickedonThem*, *M4TFeltNotMakeItThroughLife*, and *M4FAfraidCrazy*. These were the items that were the most difficult to endorse in each of the three subscales.

In Figure 9, the H infit and L/M outfit group consists of only 28 people (0.2%) (termed Atypical Type 2). Relative to the overall mean, Atypical Type 2 response patterns on the PCSS were very similar to Atypical Type 1 in the sense that they were much more likely to endorse the four items that most others, i.e., overall mean, were least likely to endorse. In addition, they were much more likely to endorse the fifth most difficult item, *M4ENotEmotionalAboutOthers*. This fit group tended to respond similarly to the overall mean on the easier to endorse items. Because of this similarity, this group could be merged with Atypical Type 1 for making clinical recommendations.

In Figure 10, the H infit and H outfit group consists of 402 people (4%) (termed Atypical Type 3). Relative to the overall mean, Atypical Type 3 response patterns on the PCSS tended to be even more extreme than Atypical Types 1 and 2. This group was least likely of all to endorse

the three easiest items. This group was even more likely to endorse the items that were hardest to endorse.

In summary, *PCSS* fit groups could be characterized as two types that differ by degree. The persons in Atypical Groups 1 and 2 will have overall measures that under-represent the severity of their coping style problems to a certain extent. The persons in Atypical Group 3 will have overall measures that under-represent the severity of their coping style problems to an even greater degree. To illustrate, a person in the Typical Group might endorse the five easiest items and have a raw score of 5 which corresponds to a Rasch measure of $-.9$. Since this response pattern fits the Rasch model, this would be interpretable as low severity. However, a person in the Atypical Group 3 might also have a raw score of 5 and a Rasch measure of $-.9$. However, we know that persons in this group are more likely to endorse the higher severity items. In fact, this person endorsed the five highest severity items. Therefore, the measure of the person in the Atypical Group 3 must be regarded as substantially different/atypical and the symptoms as more serious.

Figure 6. PCSS Fit Group Pie Chart

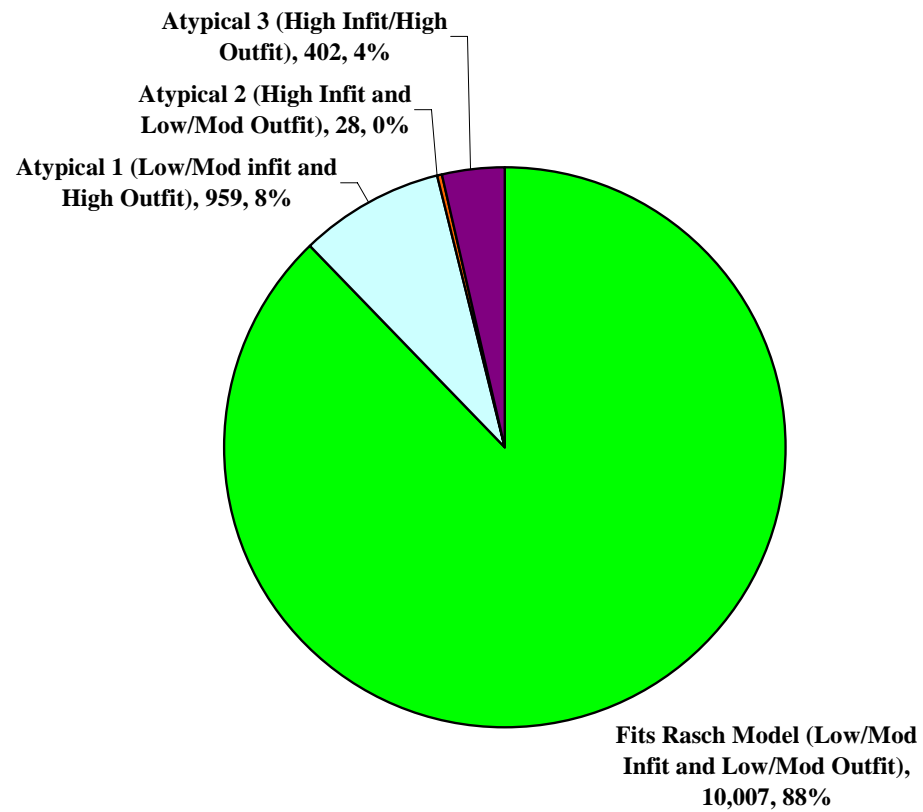


Figure 7. PCSS Overall Item Mean vs. Fit Group Item Mean
Fits Rasch Model N=10,007; 87.8%
Low/Moderate Infit and Low/Moderate Outfit

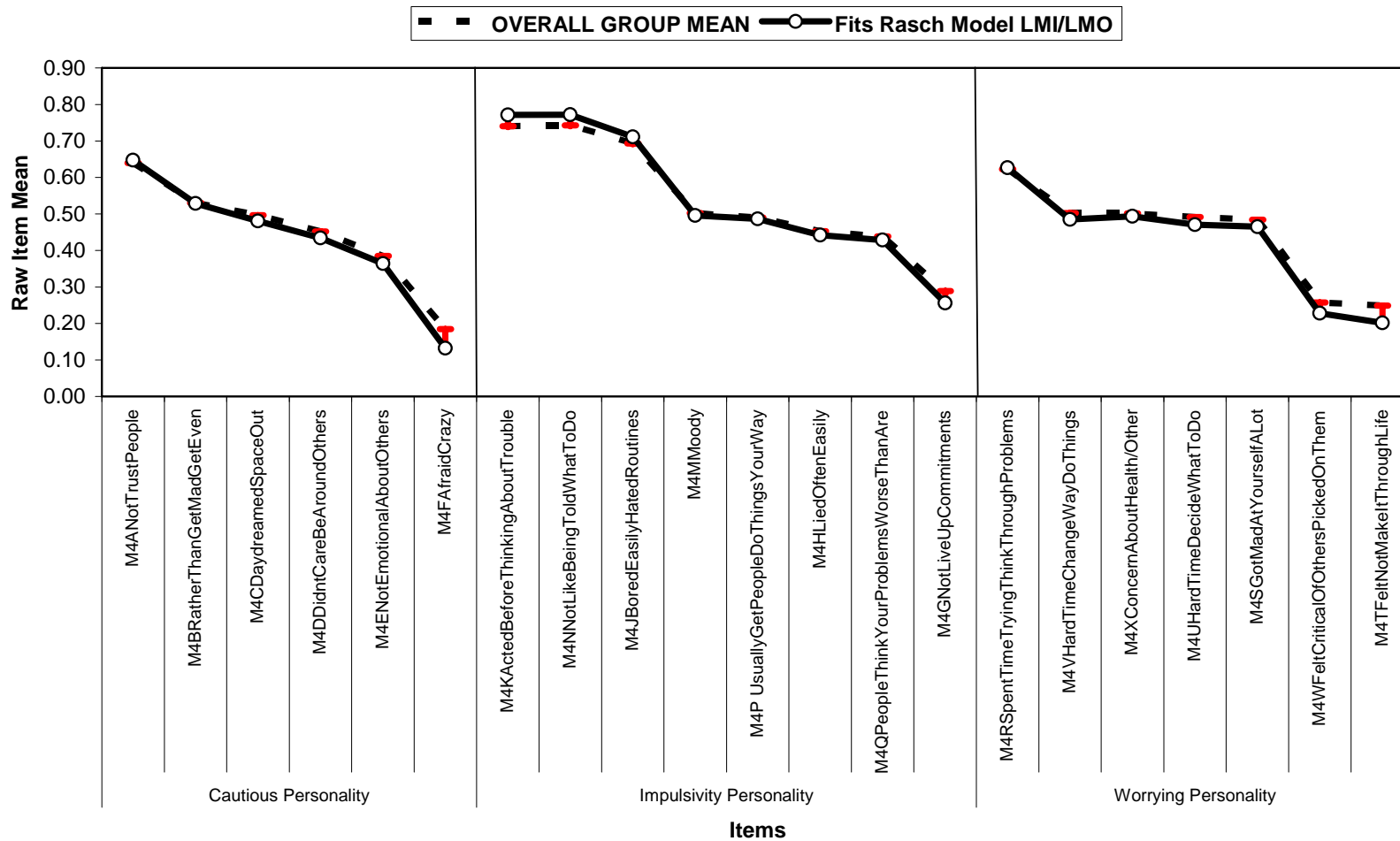


Figure 8. PCSS Overall Item Mean vs. Fit Group Item Mean
Atypical Type 1 N=959; 8.4%
Low/Moderate Infit and High Outfit

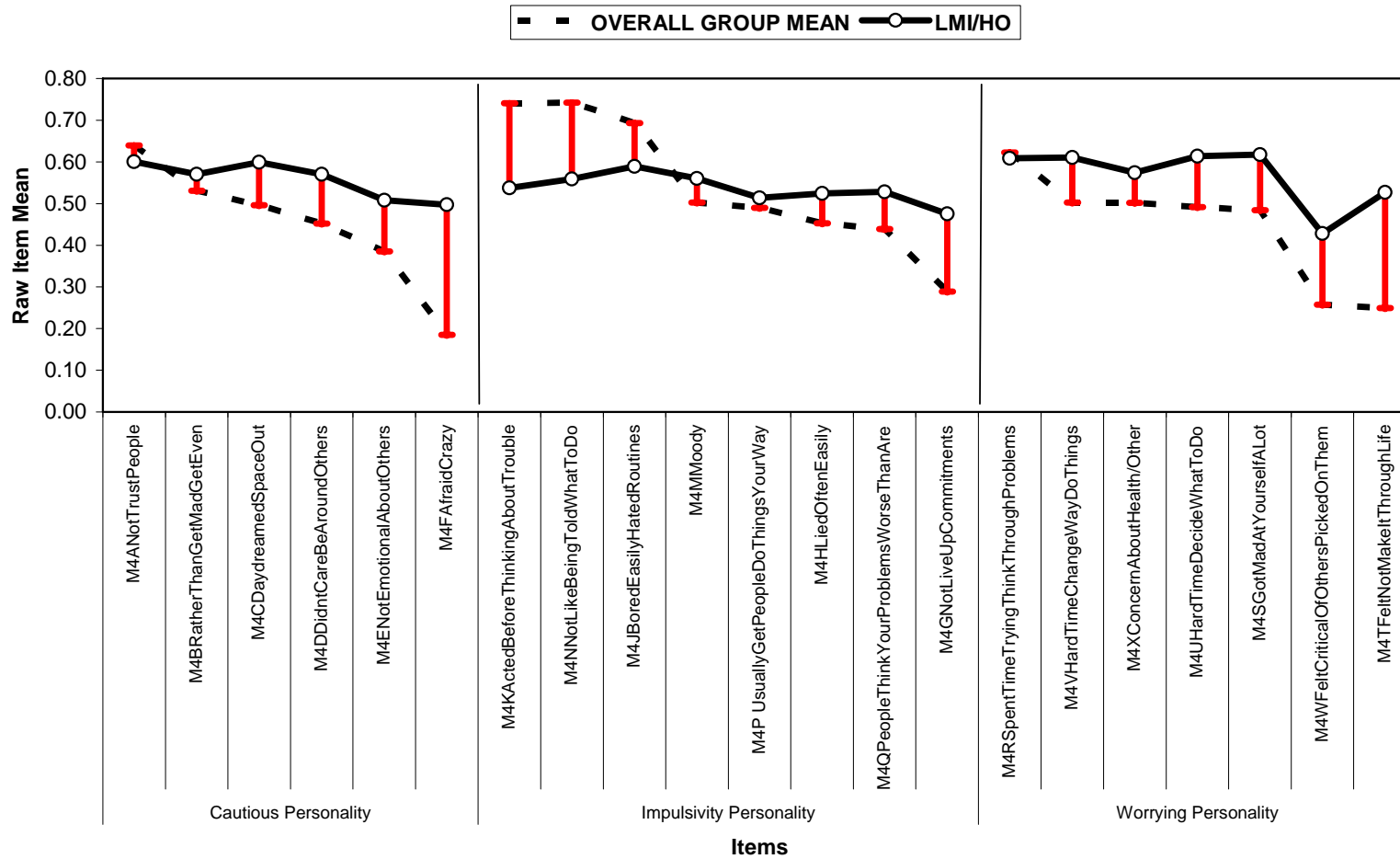


Figure 9. PCSS Overall Item Mean vs. Fit Group Item Mean
Atypical Type 2
N=28; 0.2% High Infit and Low/Moderate Outfit

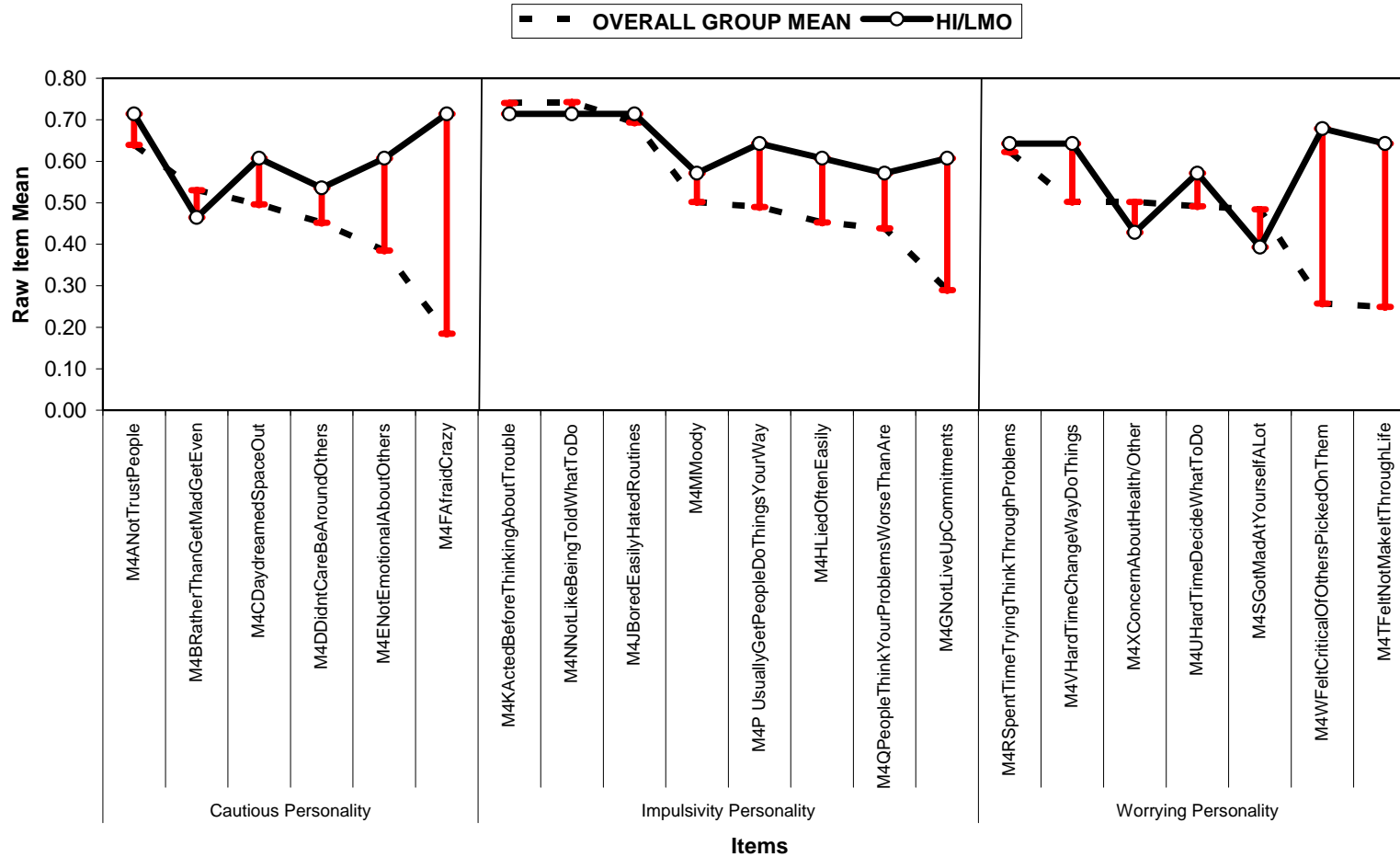
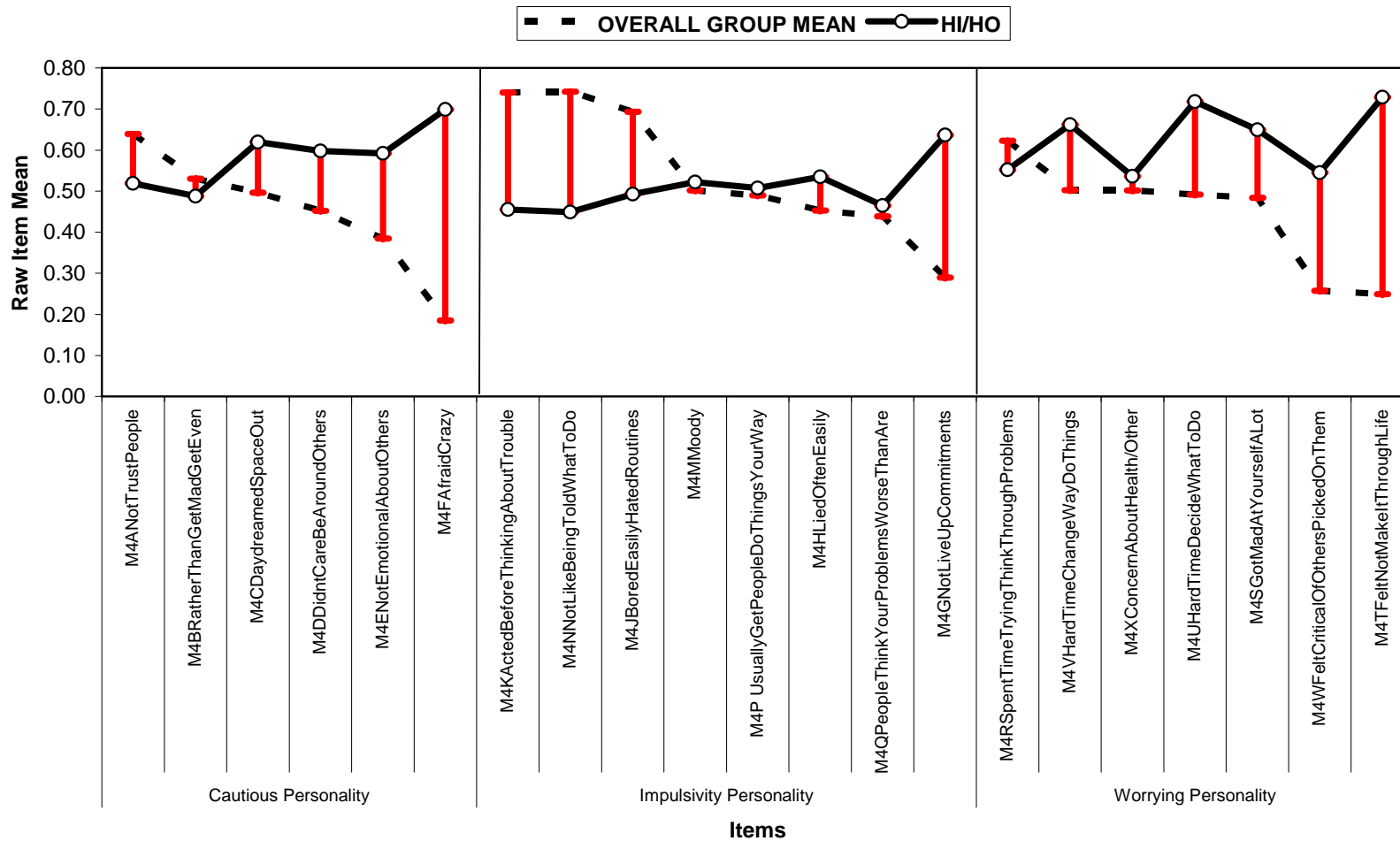


Figure 10. PCSS Overall Item Mean vs. Fit Group Item Mean
Atypical Type 3
N=402; 3.5% High Infit and High Outfit



Recommended Actions and Deliberations

The *PCSS* is useful in assessing its target construct, and it has strong psychometric properties (see abstract and text). The overall measure of *PCSS* is useful clinically for nearly 90% of the target population, i.e., except for atypicals discussed below. The subscales had low person reliability and are not suitable for clinical interpretation. There are several recommended actions and deliberations that might improve the scale.

- Significant differential item functioning (DIF) (i.e., $> .5$ SD = .60 logits) occurred in one item for gender, 9 items for youth vs. adults, 4 items for race when using African American as the reference group, and 5 items for primary substances when using opioids as the referent. Therefore age DIF was the most prominent. Since youth tended to endorse less serious symptoms more readily while adults endorsed more serious ones, this could result in estimates whereby adult measures would be somewhat underestimated.
- The DIF involving opioids is likely related to the age DIF finding since opioids users tend to be older.
- Other DIF analyses did not discern obvious imbalance that could result in differential test functioning, but they did reveal some issues that might be of theoretical interest. These items may be of interest in future research.
- No items misfit using the criterion of .75-1.33 MNSQ for both infit and outfit. This means that the items were “well-behaved” in terms of the expectations of the Rasch model.
- The three atypical groups, Atypical Groups 1, 2, and 3, tend to have scores that underestimate their personality coping style symptoms. This “atypicalness” affected about 12% of the sample. Since Atypical Group 2 had only 28 people who were very similar to those in Atypical Group 1, we recommend combining these two groups.
- *GAIN* Recommendation and Referral Summary (GRRS):
 - Persons in Atypical Type 1 and 2 groups probably have somewhat more serious personality coping style problems than their measures indicate. That is, Atypical Type 1 and 2 response patterns (relative to the group mean) were higher than expected on the more serious items within each subscale, e.g.,
 - *Cautious Personality Scale*: M4D_”didn’t care to be around others”; M4E_”not emotional about others”;M4F_”afraid you were crazy”;
 - *Impulsive Personality Scale*: M4Q_”people think your problems are worse than they are”; M4G_”not live up to commitments”; and
 - *Worrying Personality Scale*: M4W_”felt critical of others or picked on them”; M4T_”felt not make it through life.”
 - In addition, persons in the Atypical Type 1 group had a response pattern that was lower than expected on the three easiest items to endorse in the *Impulsivity Personality Scale*: M4K_”acted before thinking about trouble”; M4N_”not like being told what to do” and M4_”bored easily hated routines.”
 - Relative to the overall mean, Atypical Type 3 response patterns tended to be even more extreme than Atypical Types 1 and 2. This group was least likely of all to endorse the three easiest items. This group was even more likely to endorse the items that were hardest to endorse. Therefore, persons in this group will be those whose *PCSS* measures are the most underestimated.
- We recommend flagging all persons in the Atypical Groups for clinicians in the GRRS section of the *GAIN*.
- More work on construct validity would be helpful to understand these fit groups better and to insure proper interpretation of the measures.

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ACKNOWLEDGEMENT: This development of this paper was supported by the Center for Substance Abuse Treatment (CSAT), Substance Abuse and Mental Health Services Administration (SAMHSA) via Westat under contract 270-07-0191 to Dr. Dennis at Chestnut Health Systems in Bloomington, Illinois using data provided by the following grants and contracts from CSAT (TI-11320, TI-11317, TI-11321, TI-11323, TI-11324, TI-11422, TI-11424, TI-11423, TI-11894, TI-11874, TI-11888, TI-11892, TI-11871, TI-13309, TI-13356, TI-13305, TI-13340, TI-13344, TI-13322, TI-13323, TI-13345, TI-13308, TI-13354, TI-13313, TI-14254, TI-14376, TI-14311, TI-14196, TI-14214, TI-14261, TI-14090, TI-14189, TI-14252, TI-14283, TI-14355, TI-14272, TI-14103, TI-14267, TI-14315, TI-14188, TI-14271, TI-15686, TI-15671, TI-15486, TI-15545, TI-15672, TI-15475, TI-15678, TI-15447, TI-15461, TI-15433, TI-15481, TI-15514, TI-15478, TI-15413, TI-15483, TI-15670, TI-15674, TI-15479, TI-15682, TI-15467, TI-15511, TI-15562, TI-13601, TI-13190, TI-12541, TI-00567, TI-15415, TI-15421, TI-15438, TI-15446, TI-15458, TI-15466, TI-15469, TI-15485, TI-15489, TI-15524, TI-15527, TI-15577, TI-15584, TI-15586, TI-15677, TI-16386, TI-16400, TI-16414, TI-16904, TI-16915, TI-16928, TI-16939, TI-16961, TI-16984, TI-16992, TI-17046, TI-17055, TI-17070, TI-17071, TI-17334, TI-17433, TI-17434, TI-17446, TI-17475, TI-17476, TI-17484, TI-17490, TI-17517, TI-17523, TI-17530, TI-17604, TI-17605, TI-17638, TI-17728, TI-17755, TI-17761, TI-17763, TI-17765, TI-17769, TI-17779, TI-17786, TI-17788, TI-17812, TI-17825, TI-17830, TI-18406; Contract 207-98-7047, Contract 277-00-6500, Contract 270-2003-00006), the National Institute on Alcohol Abuse and Alcoholism (NIAAA) (R01 AA 10368), the National Institute on Drug Abuse (NIDA) (R37 DA11323; R01 DA 018183), the Illinois Criminal Justice Information Authority (95-DB-VX-0017), and the Illinois Office of Alcoholism and Substance Abuse (PI 00567). The opinions are those of the author and do not reflect official positions of the contributing project directors or government.