DOMINATING THE LIES IN THE IIP - DOMI SUB-SCALE

NIDA COCAINE DATA ANALYSIS FOR IMPROVED WEIGHTING AND PREDICTIONS OF IIP – DOMI SUB SCALE

Natalie LePera

STA513

Final Project

Due: 09 Dec 2025

UNDERSTANDING THE IIP – DOMI SUB-SCALE

Inventory of Interpersonal Problems

- 32 questions, 8 sub-scales 4 questions per scale
- Self reported
- Potentially high patient burden when paired with other assessments
- Potential for missed responses when used without eCOA
  - eCOA can be cost prohibitive

Current imputation processes[1]

- Mean score replacement for single value imputation, omitted if multiple values require imputation

Self reporting requires self awareness and honest assessment of close relationships

- Honest assessment may be impacted by underlying psychological comorbidities, antisocial behaviors, or other unknown factors

IIP – DOMI Sub-Scale Questions
It is hard for me to understand another person's point of view.
I argue with other people too much.
I try to control other people too much.
I am too aggressive toward other people.

Score	Response
0	Not at all
1	A little bit
2	Moderately
3	Quite a bit
4	Extremely

[1] https://jmgirard.com/wp-content/uploads/2018/02/IIP-C-IRTv1.0.pdf

MODEL AIMS

Model I:

- Analyze the potential relationship between DOMI score and treatment type with best fit covariates to determine if treatment type impacts patients' self reported DOMI scores

  H0: Mean DOMI score is equal across all 4 treatment groups

Model II:

- Analyze the potential relationship between DOMI score and the interaction of treatment type and type of cocaine used (cocaine or crack) to determine if the combination of treatment type and type of cocaine used impacts patients' self reported DOMI scores

  H0: Mean DOMI score is equal across all 8 combinations of treatment type and type of cocaine used

Model III

- Analyze the potential relationship between DOMI score and a selection of aggregate "home stability" variables, comprised of the interaction between marital status (married or single), employment status, and education status (HS diploma, GED, or lesser education vs greater than HS education) to determine if the combination of home stability variables impacts patients' self reported DOMI scores

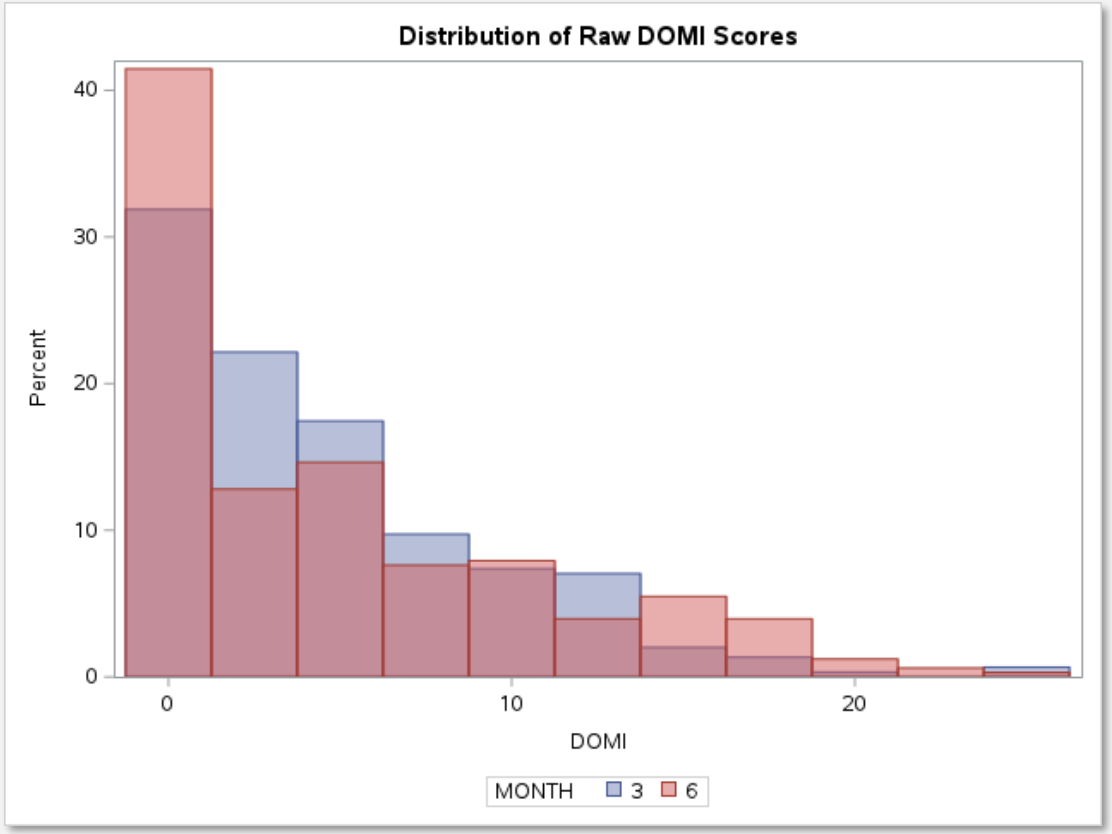
  H0: Mean DOMI score is equal across all 8 combinations of marital status, employment status, and education status

DOMI DETAILS: NIDA COCAINE STUDY

- Full data: 2697 observations
- Missing observations:
  - 3 months = 52 missing (14.86%)
  - 6 months = 50 missing (13.23%)
- DOMI scores skewed *and* potential poisson distribution
  - Requires shift
  - Requires BoxCox transformation

$$\hat{Y}\begin{cases}\dfrac{x^{\lambda}-1}{\lambda} & where\ \lambda \neq 0\\ \ln(x) & where\ \lambda = 0\end{cases}$$

- Outputs must be back transformed before utilization



GENDER	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Male	2062	76.46	2062	76.46
Female	635	23.54	2697	100.00

JOB	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Unemployed	1075	39.96	1075	39.96
Employed	1615	60.04	2690	100.00
Frequency Missing = 7				

CRACK	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Cocaine	497	18.48	497	18.48
Crack	2193	81.52	2690	100.00
Frequency Missing = 7				

MODEL 1 CREATION

- Prior to adding covariate, passed HOV (p = 0.0849 > 0.05)
- The main effect of treatment on DOMI score was analyzed with several covariates
- Model developed using stepwise deletion
- Treatment determined to be non-significant regardless of model construction
  - Treatment selected a priori and thus retained in reduced model
- Data transformations
  - Shift: DOMI + 0.1
  - BoxCox Transform: best $\lambda = 0.25$
  - SW Normality after shift/transform: p = 0.0409

$$\hat{Y} = Intercept + \beta_{txcond=IDC}X_{txcond=IDC} + \beta_{txcond=CT}X_{txcond=CT} + \beta_{txcond=SE}X_{txcond=SE} + \beta_{GSI}X_{GSI} + \beta_{SUIPR}X_{SUIPR} + \beta_{PS\_DOMI}X_{PS\_DOMI} + \beta_{PS\_COLD}X_{PS\_COLD} + \beta_{PS\_SOAV}X_{PS\_SOAV}$$

Measure/Scale Name	Variable
Treatment Condition 1 = IDC / 2 = CT / 3 = SE / 4 = GDC	TX_COND
Beck Global Severity Index	GSI
Self Understanding Interpersonal Problems – Recognition	SUIPR
Baseline Inventory of Interpersonal Problems – Dominance Subscale	PS_DOMI
Baseline Inventory of Interpersonal Problems – Cold Subscale	PS_COLD
Baseline Inventory of Interpersonal Problems – Socially Avoidant Subscale	PS_SOAV

NOTE: Residuals of model 1 for DOMI were unable to be normalized despite shifting and completing a box-cox transformation; any interpretations from this model should be considered with caution due to this violation of normality assumption

MODEL 2 CREATION

- The relationship between the interaction of treatment condition and type of cocaine used and patients' DOMI scores was analyzed
- Model developed from a priori hypothesis rather than data fit driven approach
- Data transformations
  - Shift: DOMI + 0.1
  - BoxCox Transform: best $\lambda = 0.25$
  - SW Normality after shift/transform: $p < 0.010$

$$\hat{Y} = Intercept - \beta_{txcond=IDC}X_{txcond=IDC} + \beta_{txcond=CT}X_{txcond=CT} + \beta_{txcond=SE}X_{txcond=SE} - \beta_{Crack=No}X_{crack=No} + \beta_{txcond=IDC\,|\,crack=0}X_{txcond=IDC}X_{crack=yes} + \beta_{txcond=IDC\,|\,crack=0}X_{txcond=CT}X_{crack=yes} + \beta_{txcond=IDC\,|\,crack=0}X_{txcond=SE}X_{crack=yes}$$

Measure/Scale Name	Variable
Treatment Condition 1 = IDC / 2 = CT / 3 = SE / 4 = GDC	TX_COND
Cocaine Use Type 0 = standard cocaine / 1 = crack	CRACK

NOTE: Residuals of model II for DOMI were unable to be normalized despite shifting and completing a box-cox transformation; any interpretations from this model should be considered with caution due to this violation of normality assumption

MODEL 3 CREATION

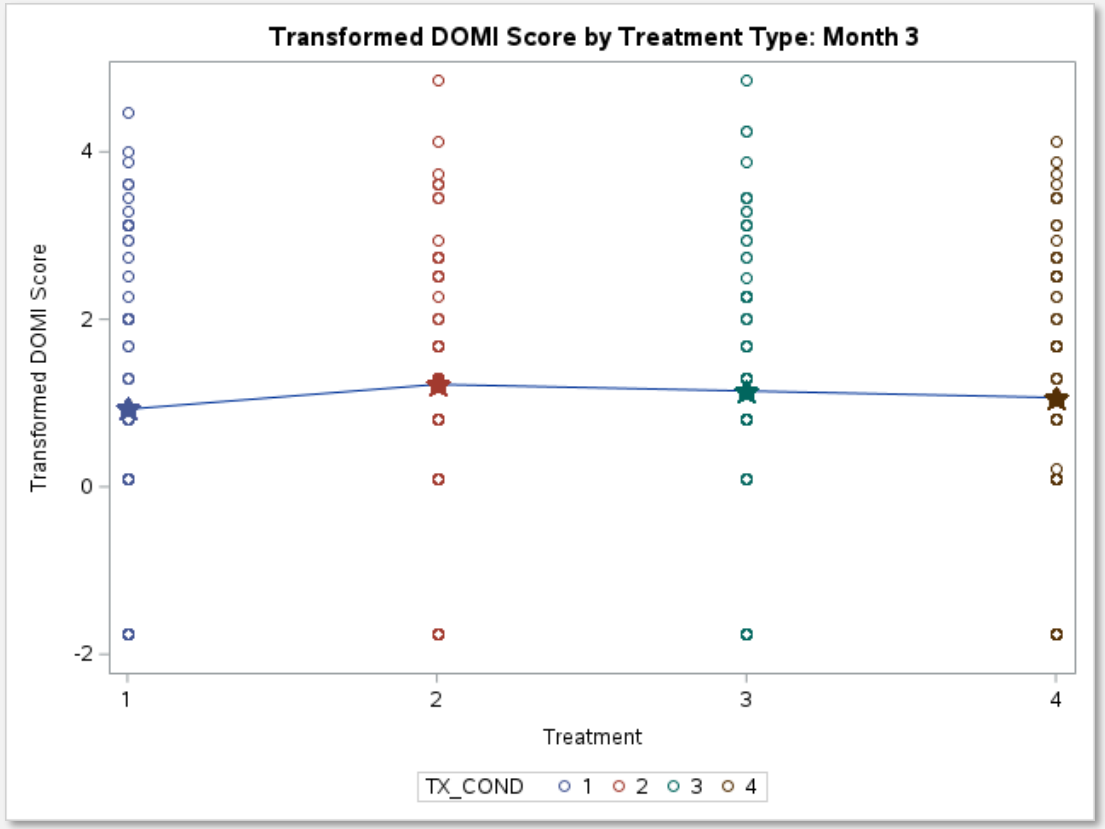
- The relationship between of "home stability" variables and DOMI score was analyzed
- Model developed from a priori hypothesis rather than through a data driven approach
- Data transformations
  - Shift: DOMI + 0.1
  - BoxCox Transform: best $\lambda = 0.25$
  - SW Normality after shift/transform: $p < 0.0001$

$$\hat{Y} = Inercept + \beta_{marstat=alone}X_{marstat=alone} - \beta_{job=unem}X_{job=unem} + \beta_{marstat=alone|job=unem}X_{marstat=alone}X_{job=unem} + \beta_{gths=no}X_{gths=no} + \beta_{marstat=alone|gths=no}X_{marstat=alone}X_{gths=no} + \beta_{job=no|gths=no}X_{job=no}X_{gths=no} + \beta_{marstat=alone|job=no|gths=no}X_{marstat=alone}X_{job=no}X_{gths=no}$$

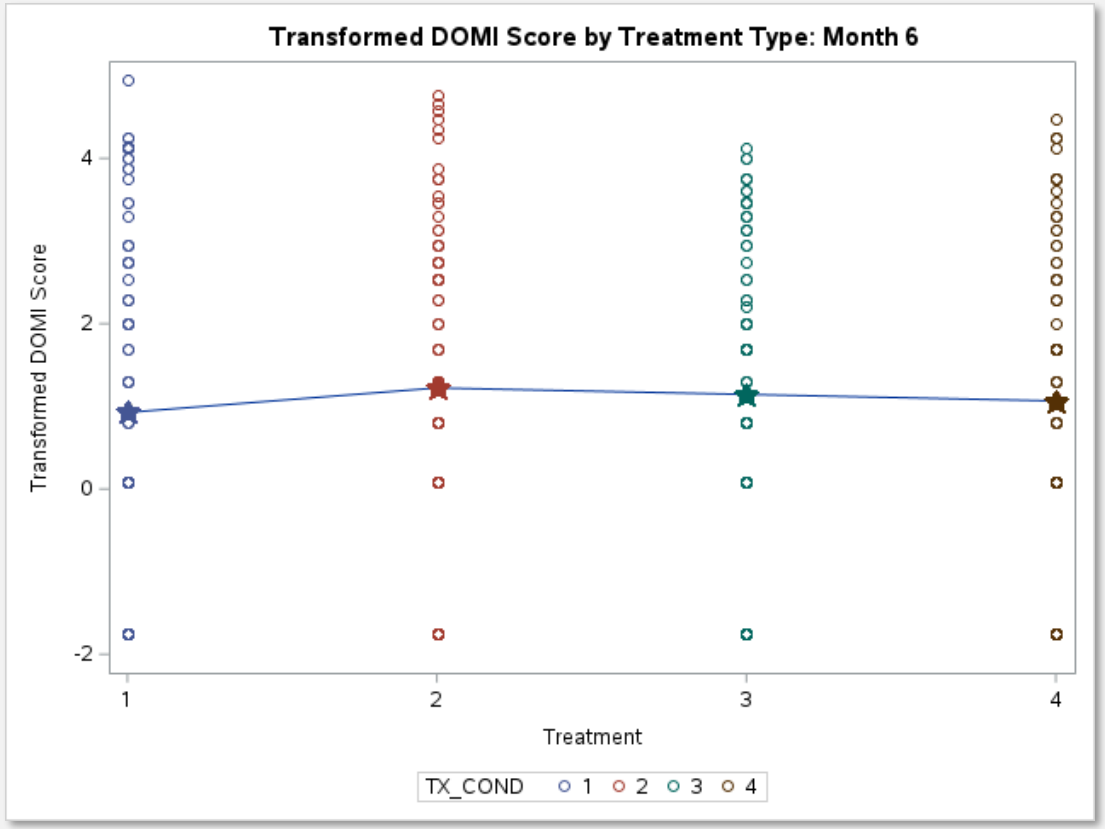
Measure/Scale Name	Variable
Marital Status 1 = Married or Cohabitating / 2 = Lives Alone	MAR_STAT
Job 1 = Employed / 0 = Unemployed	JOB
Greater Than High School Education 1 = Greater than HS education / 0 = HS Diploma, GED, or Lesser Education	GTHS

NOTE: Residuals of model III for DOMI were unable to be normalized despite shifting and completing a box-cox transformation; any interpretations from this model should be considered with caution due to this violation of normality assumption

MODEL 1 ANALYSIS (OVERALL)

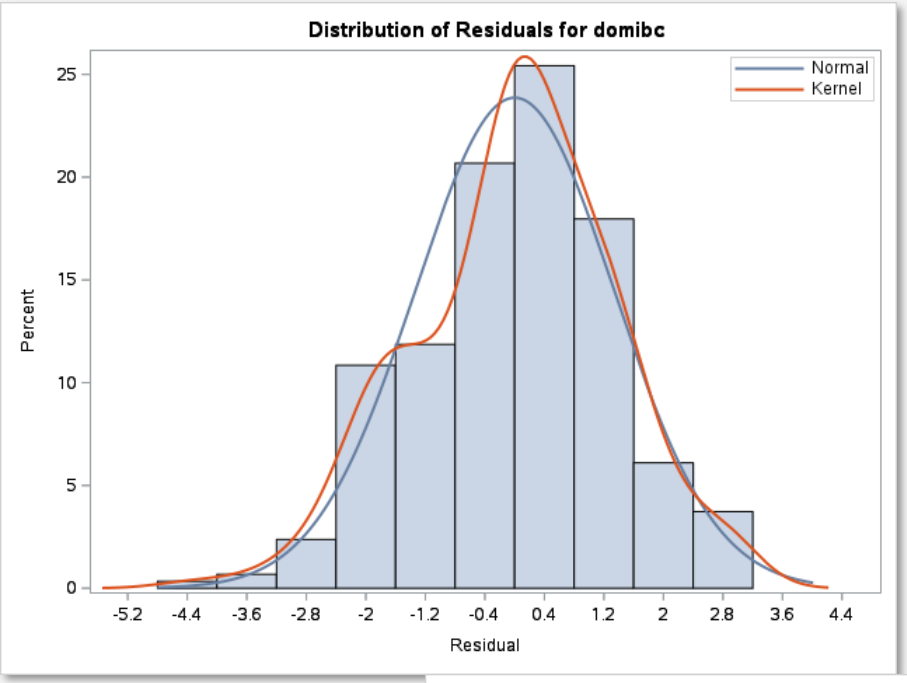


- Model explains approx. 65.0% of variance in DOMI scores ($R^2 = 0.422459$)
- No significant difference in average DOMI scores across the 4 treatment groups at the 3-month cut ($p = 0.9166 > 0.05$)
- Baseline Socially Avoidant score (PS_SOAV) found to be only marginally significant as a covariate at the 3-month cut ($p = 0.0683 > 0.05$)

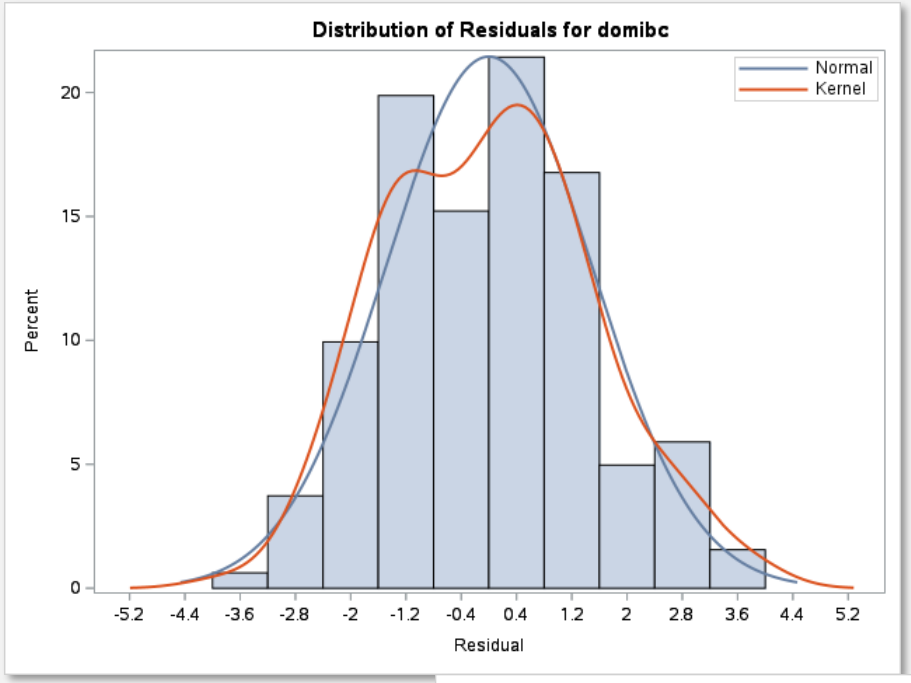


- Model explains approx. 69.1% of variance in DOMI scores ($R^2 = 0.477021$)
- No significant difference in average DOMI scores across the 4 treatment groups at the 6-month cut ($p = 0.5015 > 0.05$)
- Baseline Socially Avoidant score (PS_SOAV) found to be only marginally significant as a covariate at the 6-month cut ($p = 0.3305 > 0.05$)

MODEL 1 ANALYSIS (RESIDUALS)

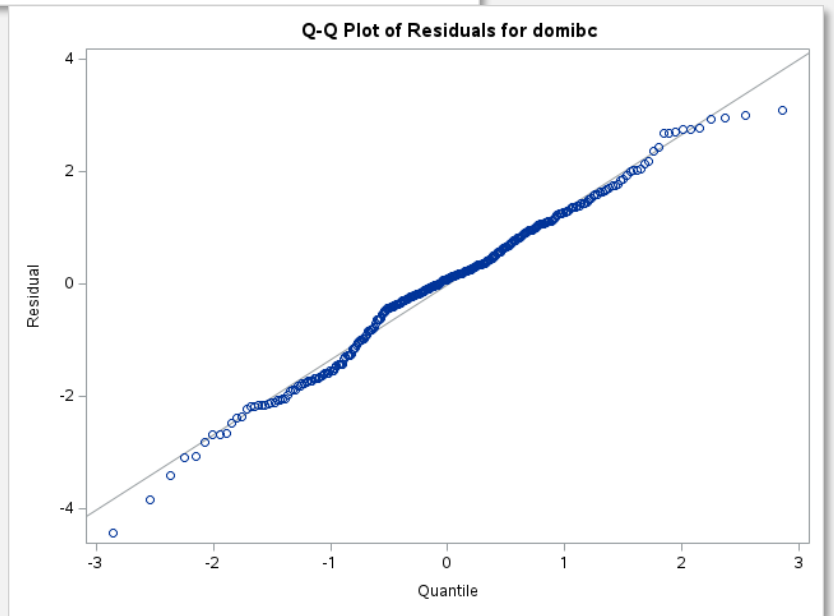


MONTH 3 DATA CUT

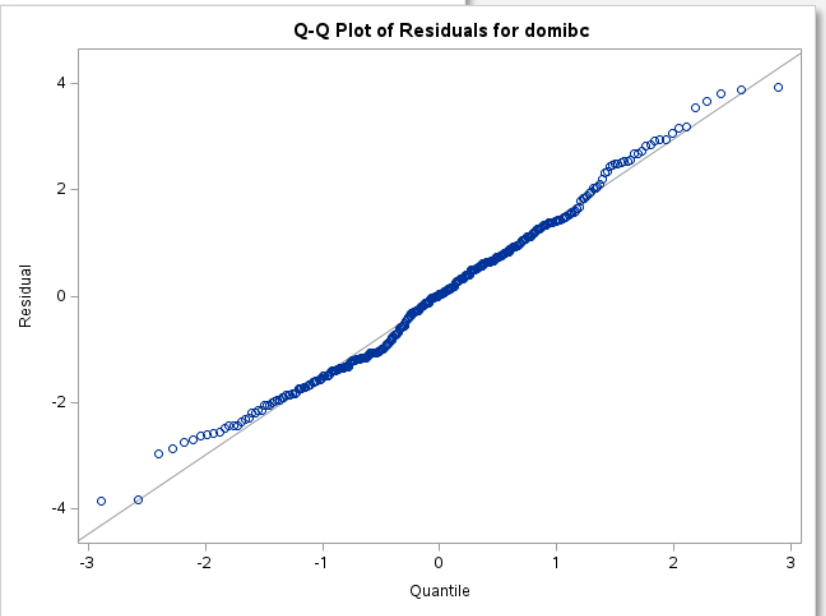


MONTH 6 DATA CUT

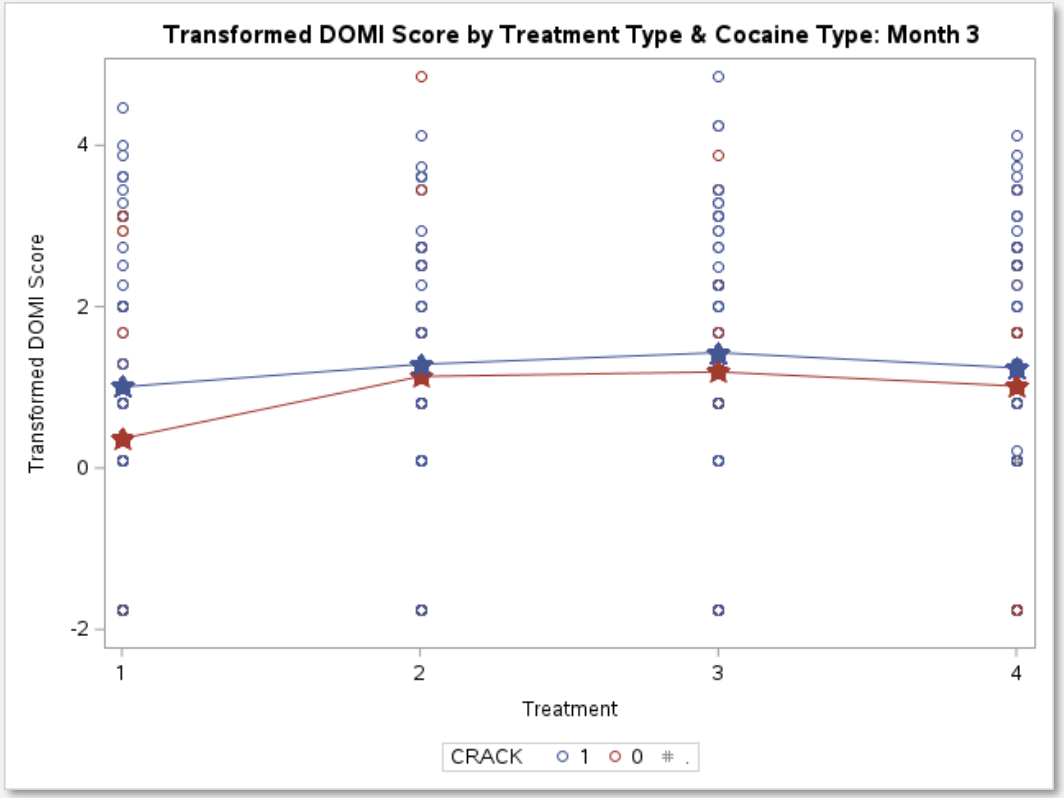
Residuals still fail Shapiro-Wilks test of normality ($p = 0.0271 < 0.05$)



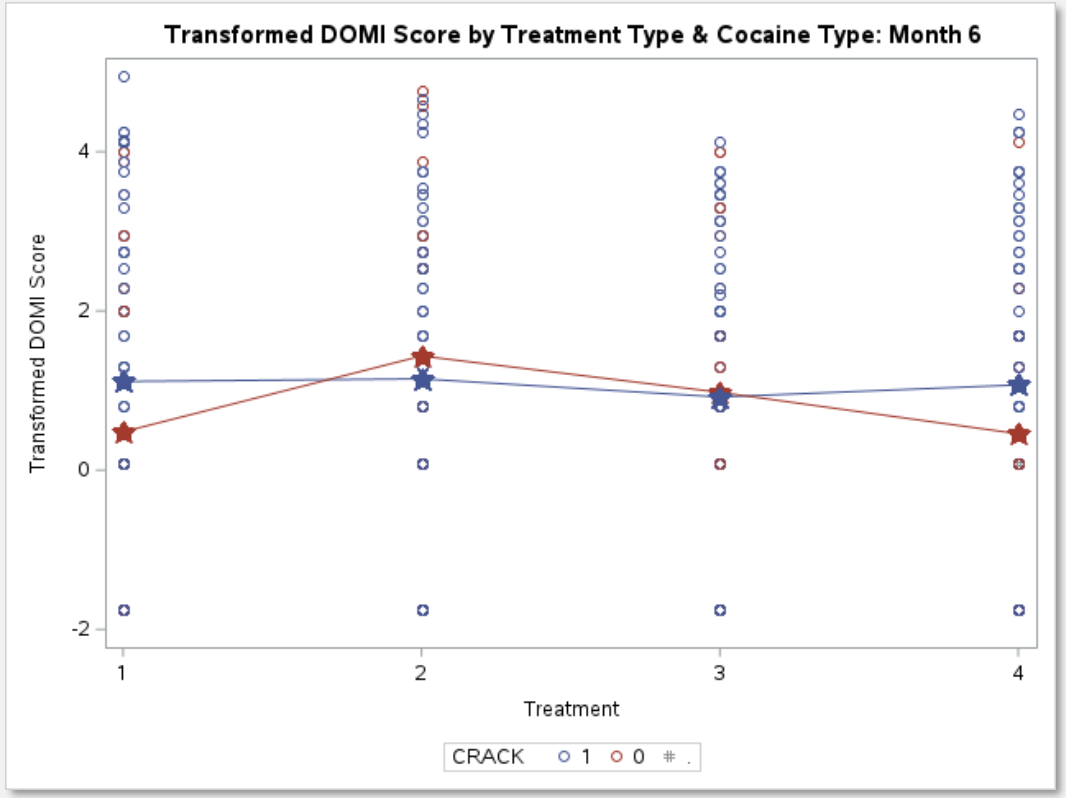
Residuals still fail Shapiro-Wilks test of normality ($p < 0.010 < 0.05$)



MODEL 11 ANALYSIS (OVERALL)



- Model explains approx. 13.75% of variance in DOMI scores ($R^2 = 0.018918$)
- Interaction between treatment type and type of cocaine used observed as **Ordinal** at the 3-month cut
- No significant **overall** interaction between treatment condition and cocaine type observed ($p = 0.9071 > 0.05$)
- No significant main effects of treatment type or cocaine type observed ($p_{tx} = 0.3262 > 0.05$ & $p_{crack} = 0.2146 > 0.05$)



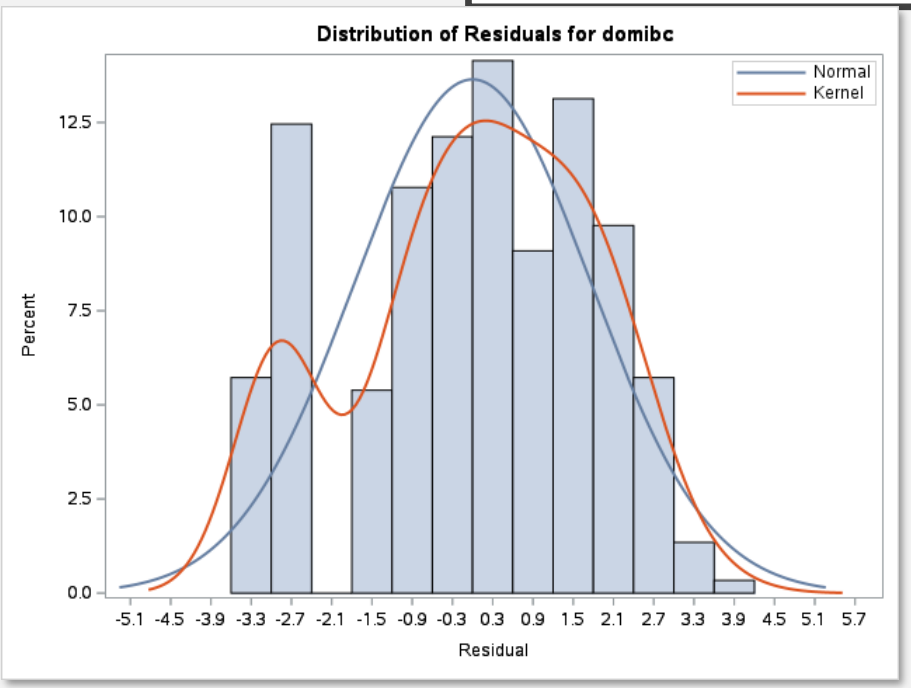
- Model explains approx. 9.87% of variance in DOMI scores ($R^2 = 0.009746$)
- Interaction between treatment type and type of cocaine used observed as **Disordinal** at the 6-month cut
- No significant **overall** interaction between treatment condition and cocaine type observed ($p = 0.6298 > 0.05$)
- No significant main effects of treatment type or cocaine type observed ($p_{tx} = 0.8518 > 0.05$ & $p_{crack} = 0.4334 > 0.05$)

MODEL II COMPARATIVE ANALYSIS

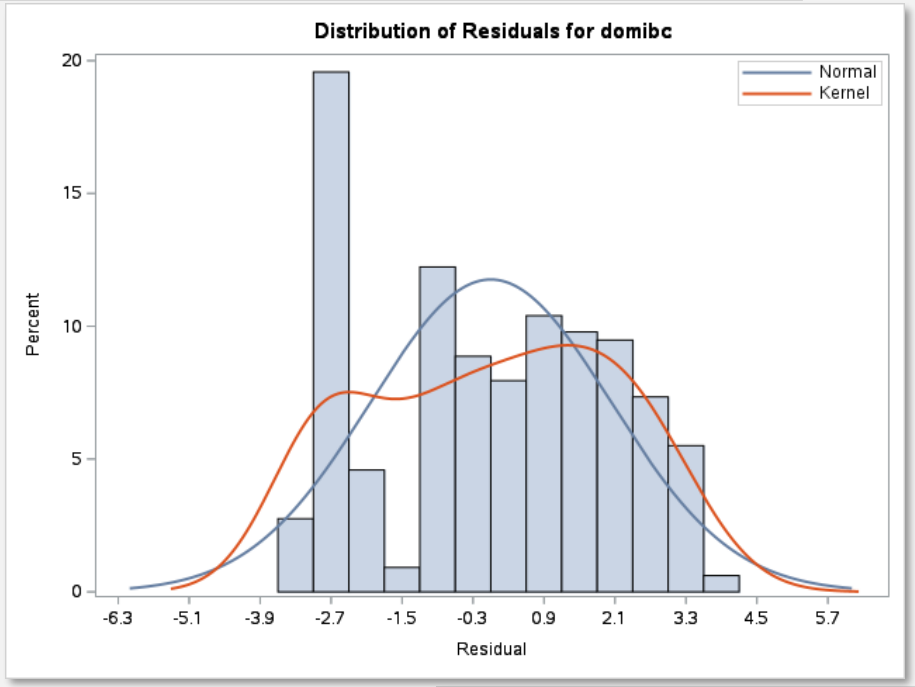
DOMI Scores back transformed to match true scale (0 – 16)

Comparative Analysis Aims	Month 3	Month 6
Comparison of average DOMI scores for **crack** users in the **Psychotherapy** (CT or SE) treatment groups to average DOMI scores for **crack** users in **Drug Counseling** (IDC or GDC) groups	PS group on average **1.564 more** than DC group (crack)	PS group on average **1.967 more** than DC group (crack)
Comparison of average DOMI scores for **cocaine** users in the **Psychotherapy** (CT or SE) treatment groups to average DOMI scores for **cocaine** users in **Drug Counseling** (IDC or GDC) groups	PS group on average **1.256 more** than DC group (cocaine)	PS group on average **0.942 more** than DC group (cocaine)
Comparison of the average difference in average DOMI scores between **Psychotherapy and Drug Counseling** for **crack** users to the average difference in average DOMI scores between **Psychotherapy and Drug Counseling** for **cocaine** users	Crack group on average **1.261 more** than cocaine group	Crack group on average **2.067 more** than cocaine group

MODEL II ANALYSIS (RESIDUALS)

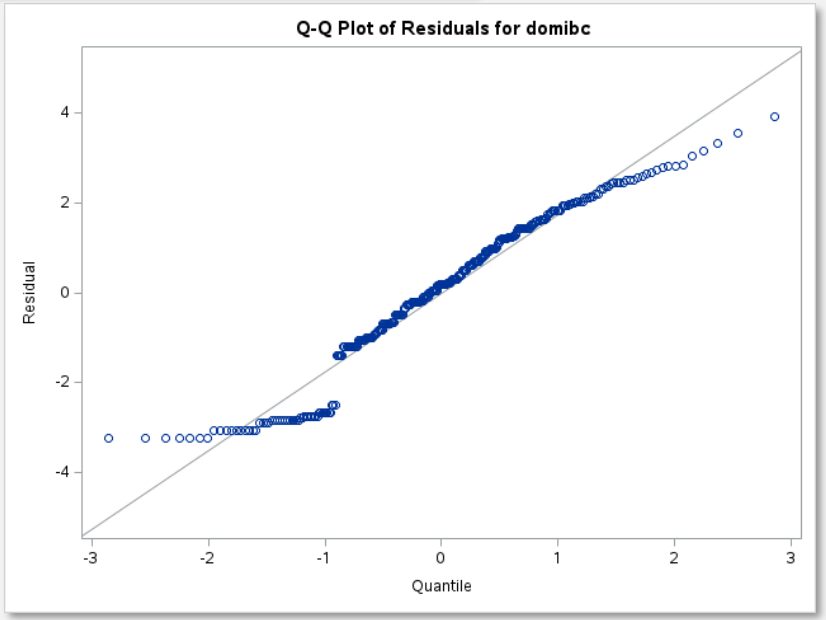


MONTH 3
DATA CUT

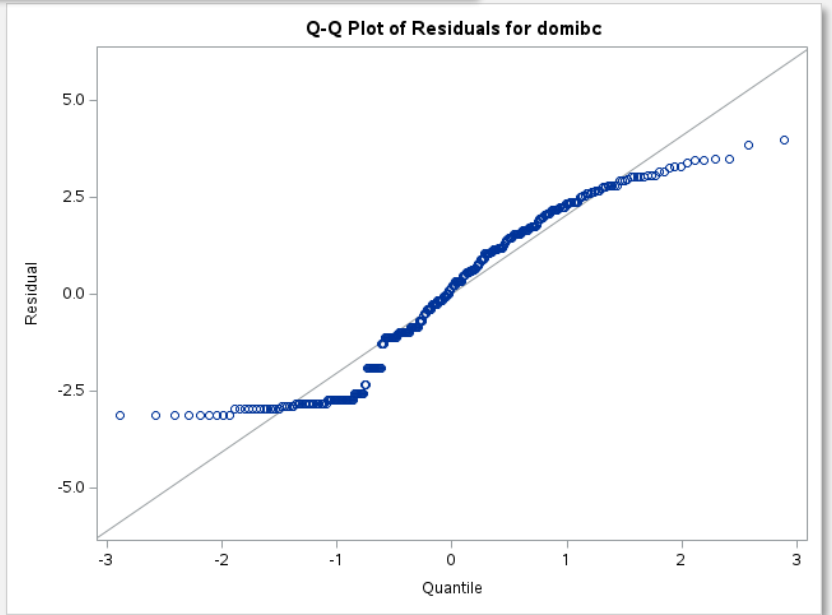


MONTH 6
DATA CUT

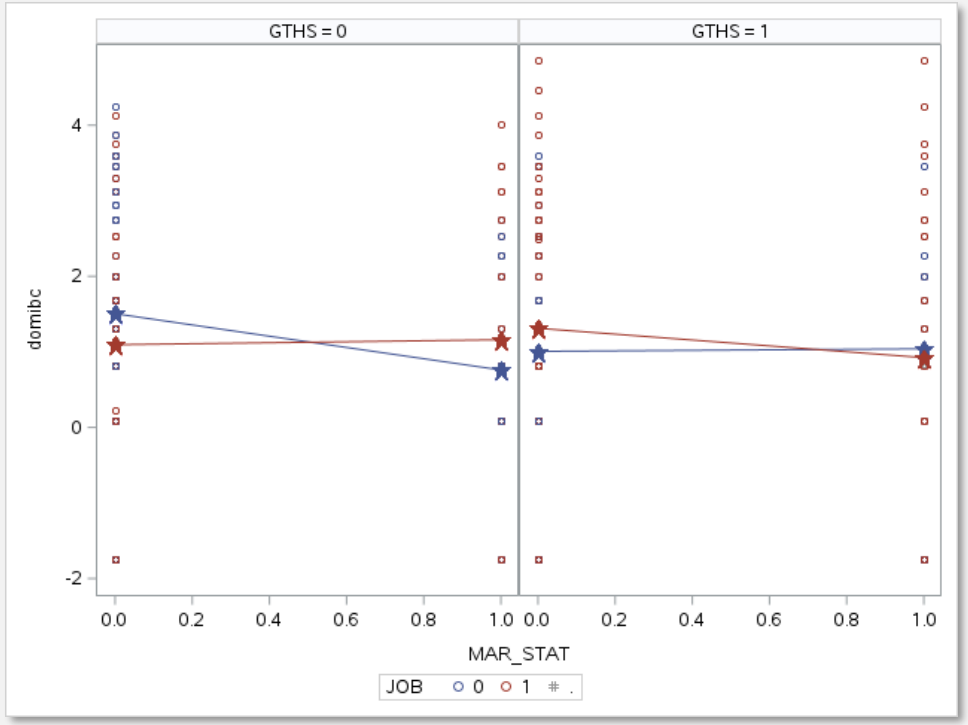
Residuals still fail Shapiro-Wilks test of normality ($p < 0.0001 < 0.05$)



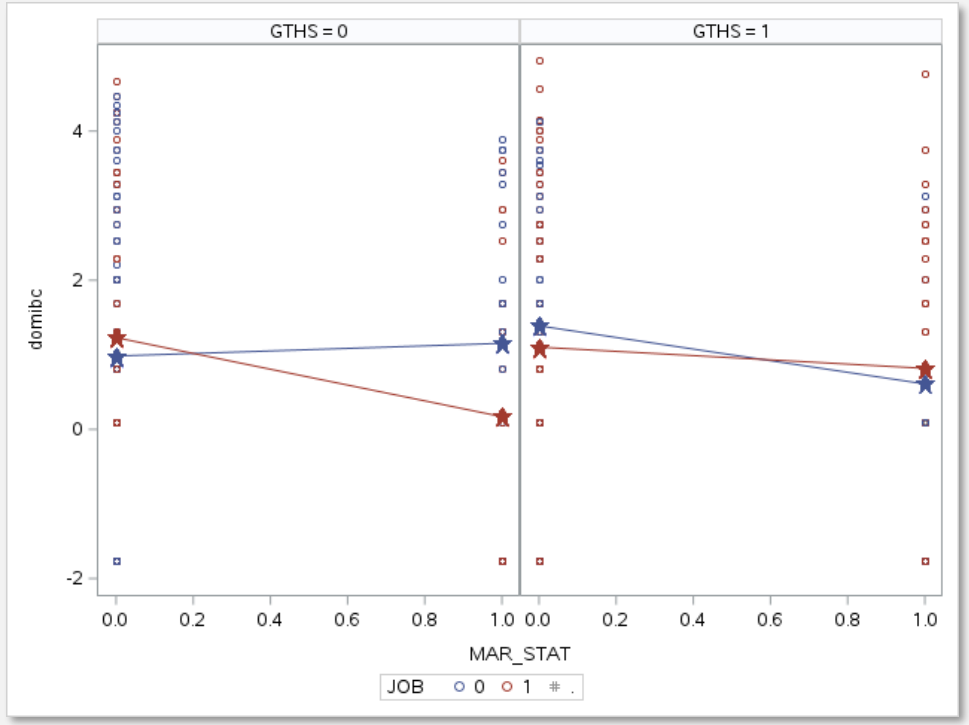
Residuals still fail Shapiro-Wilks test of normality ($p < 0.0001 < 0.05$)



MODEL III ANALYSIS (OVERALL)



- Model explains approx. 12.56% of variance in DOMI scores ($R^2 = 0.015768$)
- Interaction between marital status and employment status across both levels of education status observed as **Disordinal** at the 3-month cut
- No significant **overall** interaction between marital status, employment status, and education status observed ($p = 0.21531 > 0.05$)
- No significant main effects of marital status, employment status, or education status observed ($p_{mar\_stat} = 0.2983 > 0.05$, $p_{job} = 0.8579 > 0.05$, & $p_{education} = 0.8110 > 0.05$)



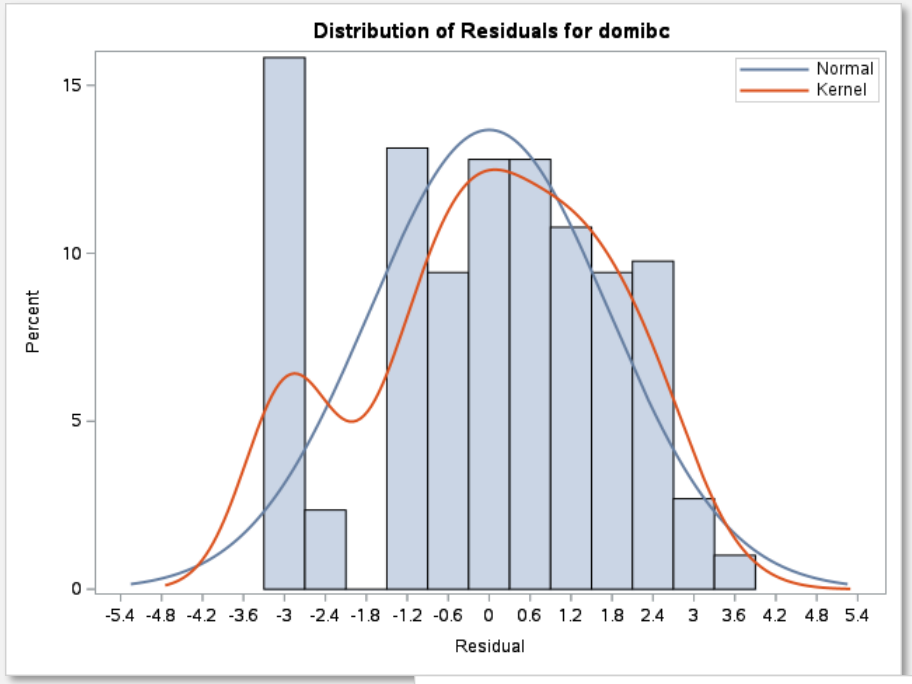
- Model explains approx. 15.20% of variance in DOMI scores ($R^2 = 0.023108$)
- Interaction between marital status and employment status across both levels of education status observed as **Disordinal** at the 6-month cut
- No significant **overall** interaction between marital status, employment status, and education status observed ($p = 0.1305 > 0.05$)
- No significant main effects of marital status, employment status, and education status observed **but** main effect of marital status marginal ($p_{mar\_stat} = 0.0680 > 0.05$, $p_{job} = 0.6352 > 0.05$, & $p_{education} = 0.4891 > 0.05$)

MODEL III COMPARATIVE ANALYSIS

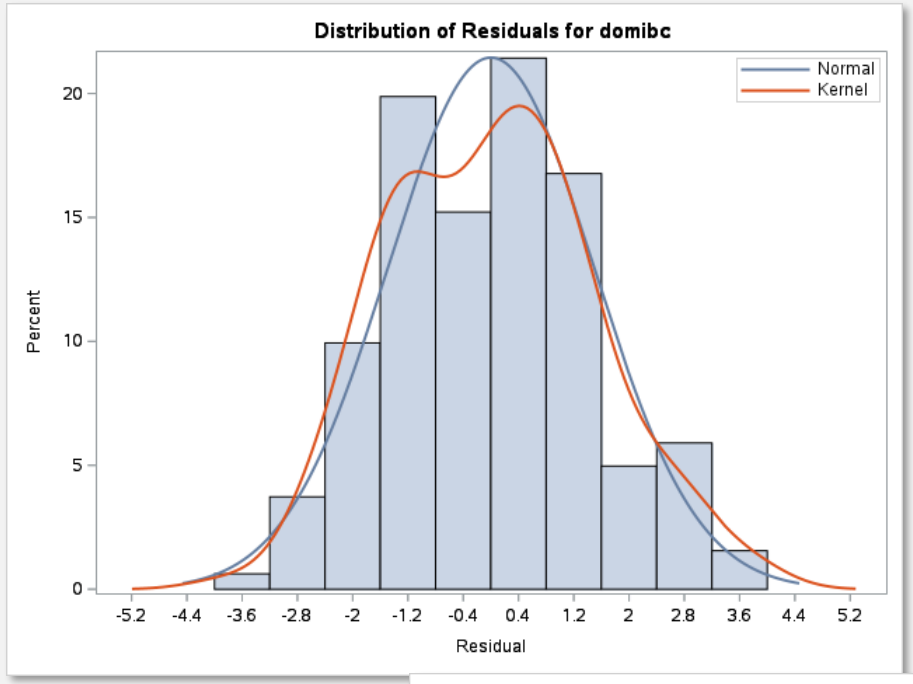
DOMI Scores back transformed to match true scale (0 – 16)

Comparative Analysis Aims	Month 3	Month 6
Difference in DOMI scores for patients meeting **full "household security"** (married, employed, above HS education) and patients meeting **no "household security"** (lives alone, unemployed, HS education or less)	Full household security group on average **1.722 more** than no household security group	Full household security group on average **1.176 more** than no household security group
Average difference in average DOMI scores between **married** and **unmarried** patients, controlling for *employment status* and *education status*	Married group on average **1.285 more** than unmarried group	Married group on average **1.585 more** than unmarried group
Average difference in average DOMI scores between **employed** and **unemployed** patients, controlling for *marital status* and *education status*	Employed group on average **0.956 more** than unemployed group	Employed group on average **1.219 more** than unemployed group
Average difference in average DOMI scores between patients with **more than a HS education** and patients with **a HS education or less**, controlling for *employment status* and *marital status*	More than HS education group on average **1.061 more** than HS education or less group	More than HS education group on average **0.908 more** than HS education or less group

MODEL III ANALYSIS (RESIDUALS)

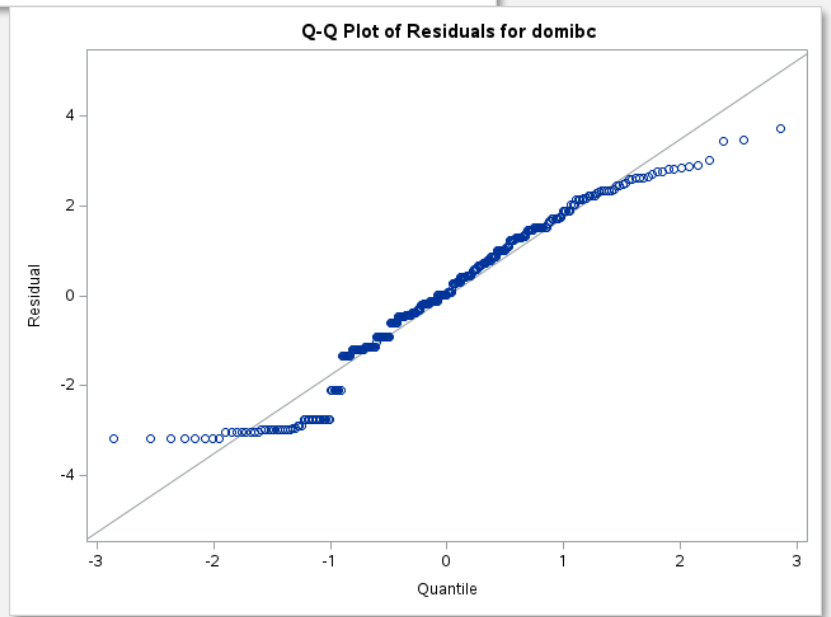


MONTH 3 DATA CUT



MONTH 6 DATA CUT

Residuals still fail Shapiro-Wilks test of normality ($p < 0.0001 < 0.05$)



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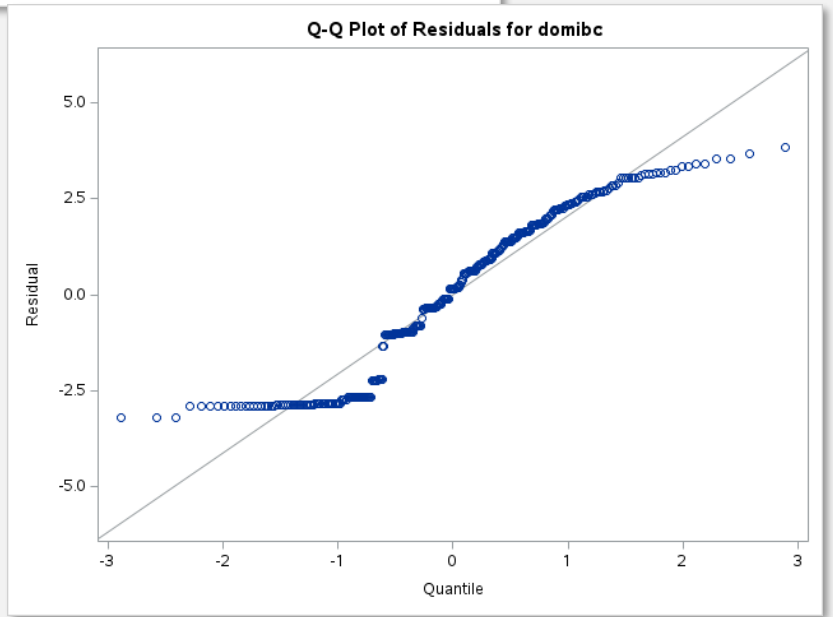

CONCLUSIONS

- The current recommended imputation processes for IIP-DOMI values results in a significant amount of missing data over the course of a study, resulting in poor modeling capabilities
- As the residuals would not normalize for any of the models, all comparative analyses should be interpreted with caution
- Overall there were several potential relationships that may exist in the data, but certain conclusions cannot be drawn to the violation of assumption of normality of residuals
  - Three way interaction of "household security" should be reexamined with additional, more complete data
- Unexpected outcome of higher DOMI scores with higher household securty
- Models should also be re-explored in a longitudinal fashion to see if additional trends and relationships were missed

REFERENCES

- IIP with grading instructions
  - https://jmgirard.com/wp-content/uploads/2018/02/IIP-C-IRTv1.0.pdf