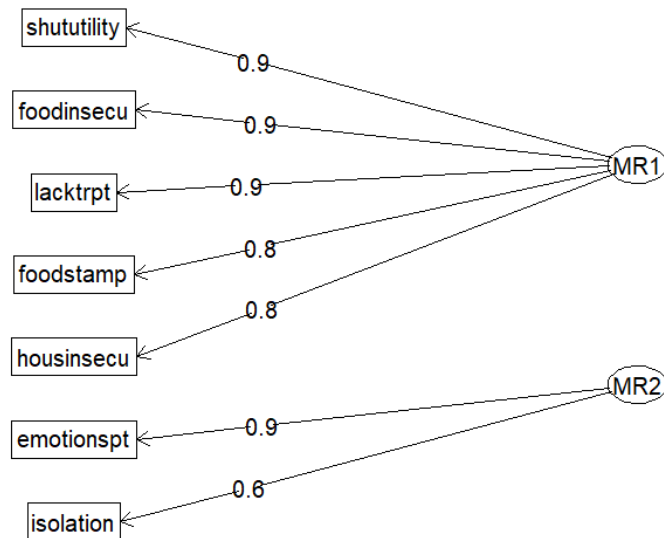
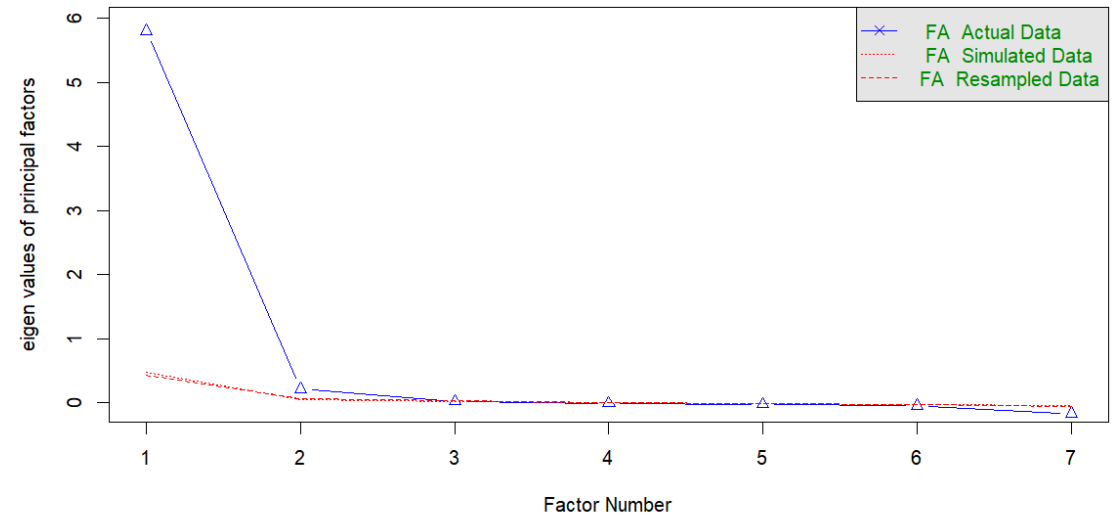


# Factor Analysis of HRSNs:

## Factor Analysis



Parallel Analysis Scree Plots



Two factors were identified across the 7 HRSNs. Next step, model on Frequent Mental Distress. Correlation between Factor 1 and Factor 2 = 0.0015 (almost nothing).

## Linear Model of Prevalence of Frequent Mental Distress (FMD) on Factored Health-related Social Needs, County Level, 2022

mean, Frequent Mental Distress				
Predictors	Estimates	std. Error	95% CI	p
<b>Factor 1: (Socio-economic related)</b>	1.29	0.03	1.22 – 1.36	<0.001
Food Insecurity, Receipt of Food Stamps, Housing Insecurity, Lack of				

Reliable Transportation, Utility  
Services Threat

<b>Factor 2: (Social/Emotional related)</b> Feeling Social Isolation, Lack of Social/Emotional Support	0.58	0.03	0.52 – 0.65	<0.001
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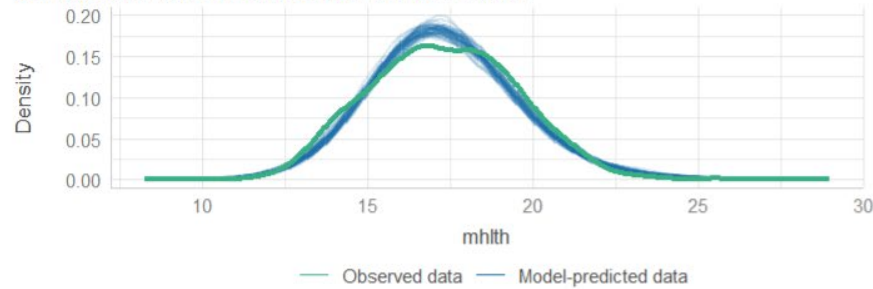
Observations	2417
R <sup>2</sup> / R <sup>2</sup> adjusted	0.406 / 0.405
AIC	9456.912

Estimate represents the change in the mean (FMD) associated with a 1-unit change in the factor, controlling for other parameters.

Linear model diagnostics:

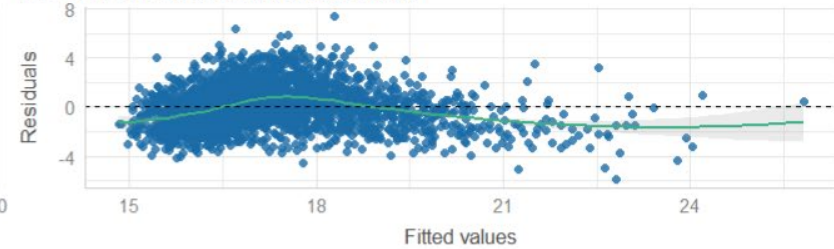
### Posterior Predictive Check

Model-predicted lines should resemble observed data line



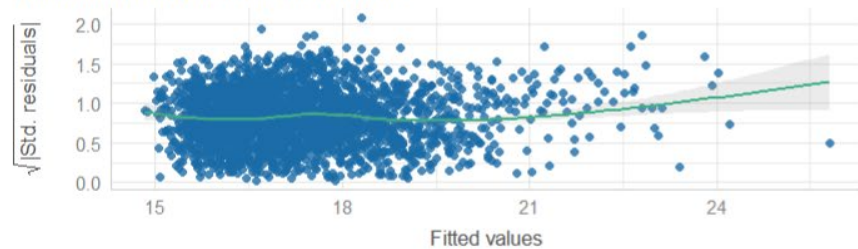
### Linearity

Reference line should be flat and horizontal



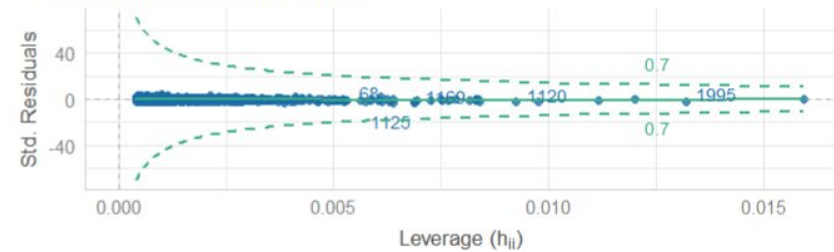
### Homogeneity of Variance

Reference line should be flat and horizontal



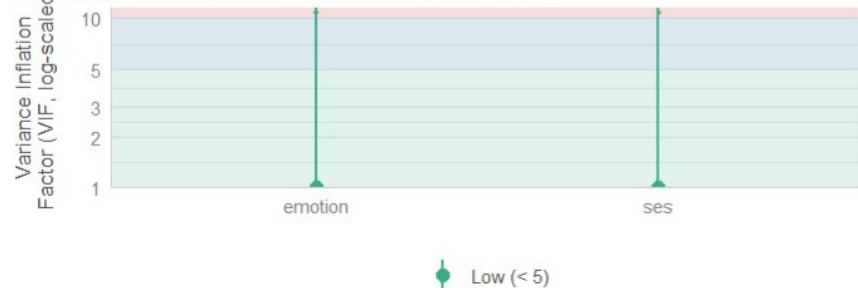
### Influential Observations

Points should be inside the contour lines



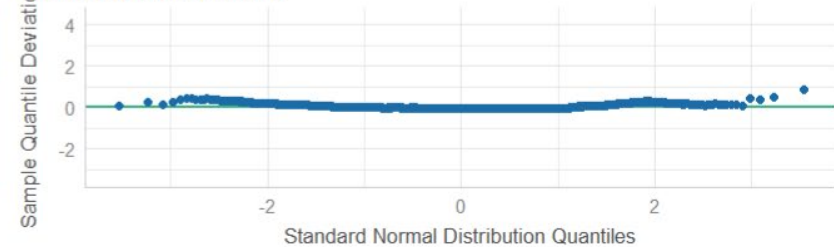
### Collinearity

High collinearity (VIF) may inflate parameter uncertainty



### Normality of Residuals

Dots should fall along the line



Correlation between factors is LOW! No collinearity. Now to address the random effects of state variation previously identified.

## Mixed Effects Model of Prevalence of Frequent Mental Distress (FMD) on Factored Health-related Social Needs, County Level, 2022

mean, Frequent Mental Distress

Predictors	Estimates	std. Error	95% CI	p
------------	-----------	------------	--------	---

<b>Factor 1: (Socio-economic related)</b> Food Insecurity, Receipt of Food Stamps, Housing Insecurity, Lack of Reliable Transportation, Utility Services Threat	1.22	0.03	1.16 – 1.28	<b>&lt;0.001</b>
<b>Factor 2: (Social/Emotional related)</b> Feeling Social Isolation, Lack of Social/Emotional Support	0.57	0.05	0.47 – 0.67	<b>&lt;0.001</b>

#### Random Effects

$\sigma^2$	1.22
$\tau_{00 \text{ full}}$	1.64
ICC	0.57
$N_{\text{full}}$	40
Observations	2417
Marginal $R^2$ / Conditional $R^2$	0.386 / 0.738
AIC	7524.080

**Inferential aspect:** Estimate represents the change in the mean (FMD) associated with a 1-unit change in the factor, controlling for other parameters (other factor and random effects (US State)). Both factors' estimates are positive suggesting a positive relationship with FMD (i.e., when Socioeconomic HRSN increases, FMD increases).

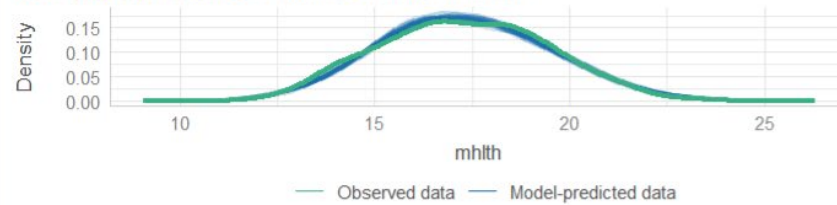
In mixed effects models, **marginal R-squared** measures the proportion of variance explained by fixed effects only (HRSN factors), while **conditional R-squared** measures the proportion of variance explained by both fixed and random effects.

R-squared is higher and AIC is lower in mixed effects model compared to linear suggesting a better model fit than the linear regression model. Additionally, the results from mixed effects model are relatively consistent with linear regression estimates.

#### Mixed Effects model diagnostics

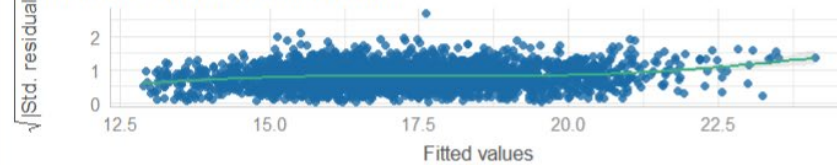
### Posterior Predictive Check

Model-predicted lines should resemble observed data line



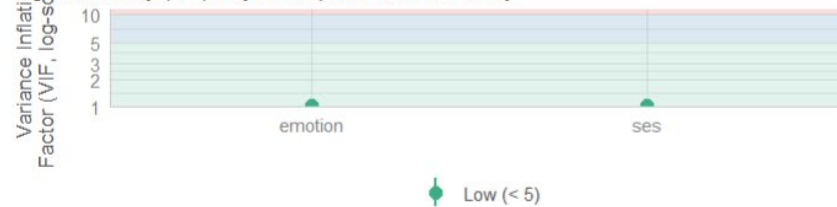
### Homogeneity of Variance

Reference line should be flat and horizontal



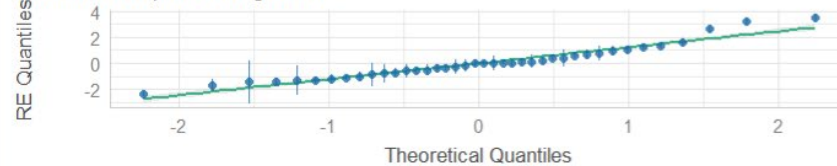
### Collinearity

High collinearity (VIF) may inflate parameter uncertainty



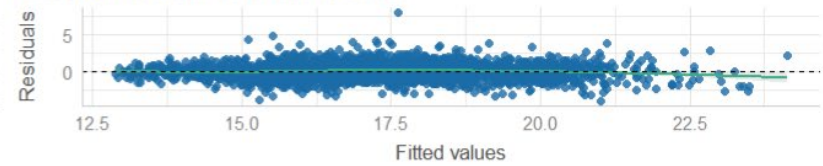
### Normality of Random Effects (full)

Dots should be plotted along the line



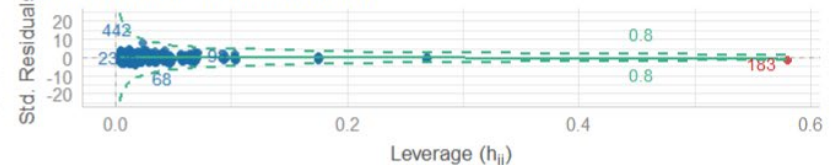
### Linearity

Reference line should be flat and horizontal



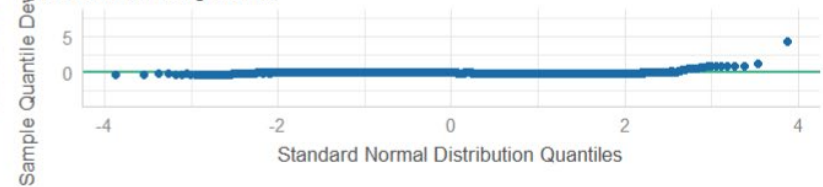
### Influential Observations

Points should be inside the contour lines



### Normality of Residuals

Dots should fall along the line



**Correlation between fixed effects is LOW! No collinearity. Confidence in the parameter estimates calculated.**

---

# [PREVIOUSLY DISCUSSED BELOW]

## Linear Regression Results of County level prevalence of Frequent Mental Distress on Health-related Social Needs, 2022

Variable	Unadjusted Results			Adjusted <sup>‡</sup> Results		
	R-squared	Parameter Estimate	p-value	Adjusted R-squared = 0.596	Parameter Estimate	p-value
Lack of Emotional Support	0.225	0.26	<0.001	-	0.11	<0.001
Social Isolation	0.256	0.22	<0.001	-	-0.19	<0.001
Food Insecurity (past 12 months)	0.359	0.24	<0.001	-	0.11	<0.001
Receipt of food stamps (past 12 months)	0.431	0.31	<0.001	-	-0.73	<0.001
Housing Insecurity (past 12 months)	0.322	0.41	<0.001	-	0.16	<0.001
Lack of reliable Transportation (past 12 months)	0.404	0.52	<0.001	-	0.38	<0.001
Utility Services threat (past 12 months)	0.444	0.52	<0.001	-	1.14	<0.001

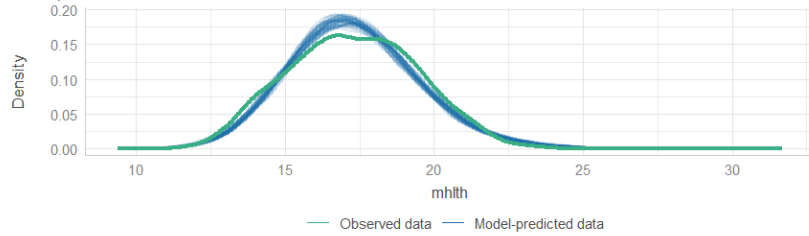
<sup>‡</sup>Adjusting for other health-related social needs.

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Adjusted Linear regression diagnostics (High collinearity is evident, lack of confidence in parameter estimates):

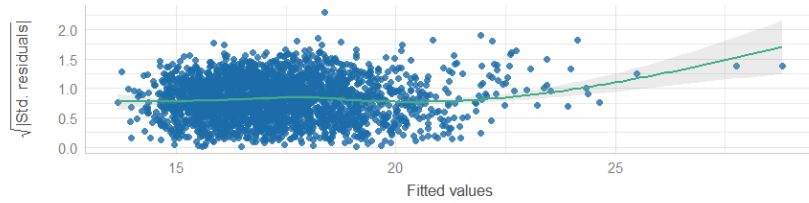
### Posterior Predictive Check

Model-predicted lines should resemble observed data line



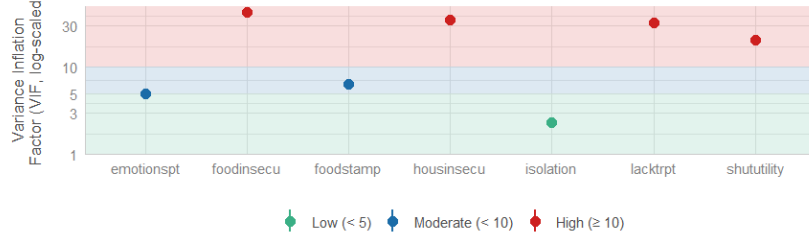
### Homogeneity of Variance

Reference line should be flat and horizontal



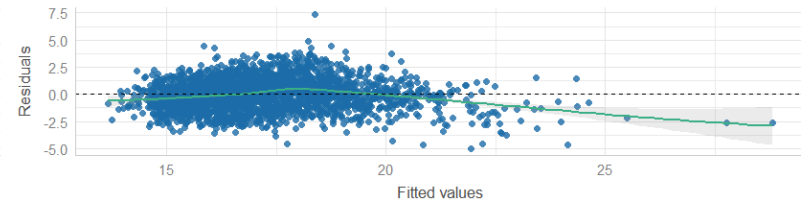
### Collinearity

High collinearity (VIF) may inflate parameter uncertainty



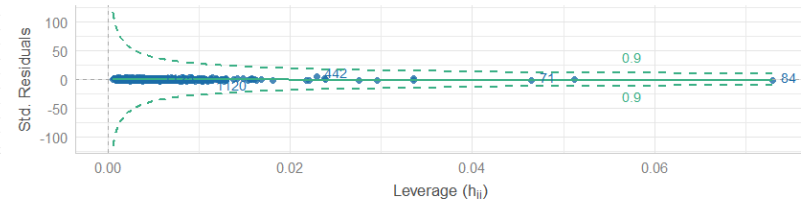
### Linearity

Reference line should be flat and horizontal



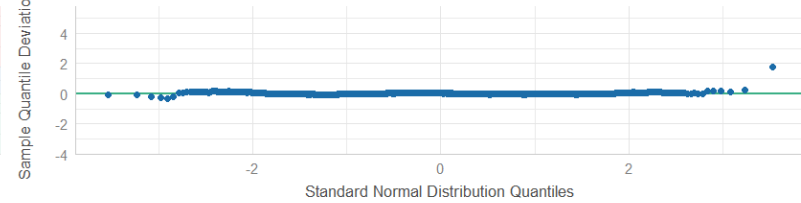
### Influential Observations

Points should be inside the contour lines



### Normality of Residuals

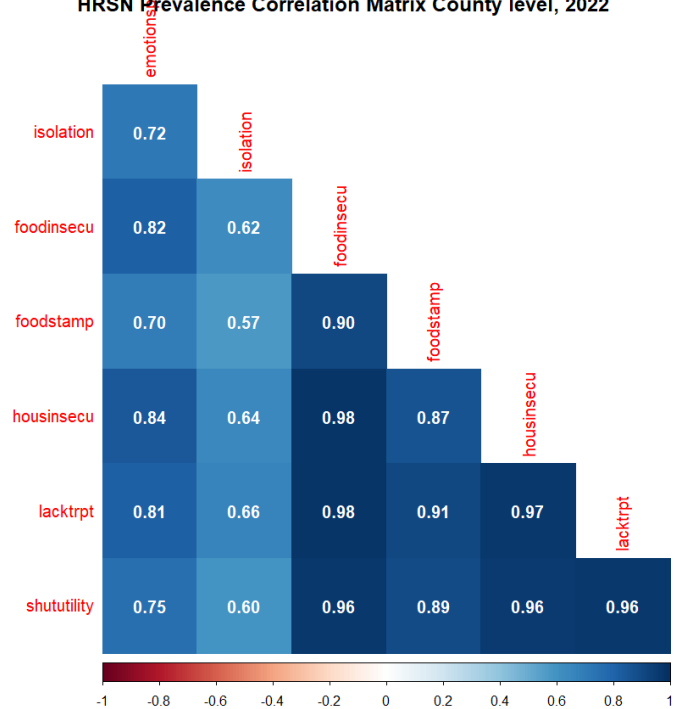
Dots should fall along the line



## Correlation Matrix of HRSNs

High collinearity is evident as predictors are highly correlated, inflating coefficients.

HRSN Prevalence Correlation Matrix County level, 2022





**Mixed Effects Regression Model Results of County level prevalence of Frequent Mental Distress on Health-related Social Needs, 2022 [ALL HRSN VARIABLES]**

Variable	Unadjusted Results				Adjusted <sup>‡</sup> Results			
	Random Effects <sup>♦</sup>	Estimate	95% CI	p-value	Random Effects <sup>♦</sup>	Estimate	95% CI	p-value
Lack of Emotional Support	$\sigma^2$ 1.56 $\tau_{00 \text{ full}}$ 2.48 ICC 0.61 N <sub>full</sub> 40	0.38	0.36-0.40	<0.001	$\sigma^2$ 0.83 $\tau_{00 \text{ full}}$ 2.73 ICC 0.77 N <sub>full</sub> 40	-0.18	-0.22 - -0.14	<0.001
Social Isolation	$\sigma^2$ 1.38 $\tau_{00 \text{ full}}$ 2.63 ICC 0.66 N <sub>full</sub> 40	0.52	0.50-0.55	<0.001		0.26	0.22-0.30	<0.001
Food Insecurity (past 12 months)	$\sigma^2$ 1.32 $\tau_{00 \text{ full}}$ 1.77 ICC 0.57 N <sub>full</sub> 40	0.22	0.21-0.23	<0.001		-0.62	-0.70- -0.53	<0.001
Receipt of food stamps (past 12 months)	$\sigma^2$ 1.27 $\tau_{00 \text{ full}}$ 1.54 ICC 0.55 N <sub>full</sub> 40	0.21	0.20-0.22	<0.001		0.25	0.20-0.30	<0.001
Housing Insecurity (past 12 months)	$\sigma^2$ 1.36 $\tau_{00 \text{ full}}$ 1.97 ICC 0.59 N <sub>full</sub> 40	0.32	0.30-0.33	<0.001		0.01	-0.09-0.12	0.822
Lack of reliable Transportation (past 12 months)	$\sigma^2$ 1.14 $\tau_{00 \text{ full}}$ 1.74 ICC 0.60 N <sub>full</sub> 40	0.50	0.48-0.52	<0.001		1.34	1.21-1.46	<0.001

Utility Services threat (past 12 months)	$\sigma^2$	1.28							
	$\tau_{00 \text{ full}}$	1.44							
	ICC	0.53							
	$N_{\text{full}}$	40	0.48	0.46-0.50	<0.001		-0.12	-0.26-0.02	0.099

‡ Adjusting for other health-related social needs.

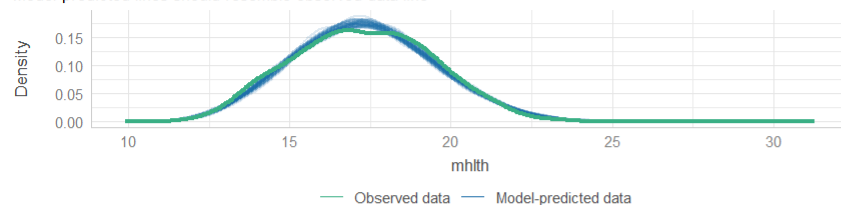
♦ Random effect = State.

**High collinearity, lack of confidence in parameter estimates.**

## Mixed Model Diagnostics (high collinearity still evident):

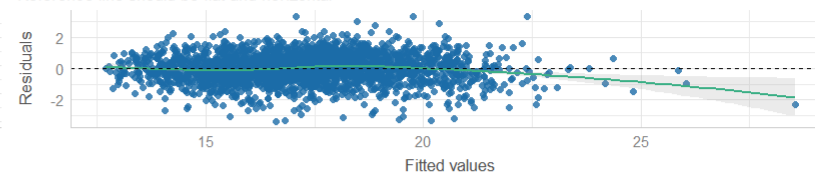
### Posterior Predictive Check

Model-predicted lines should resemble observed data line



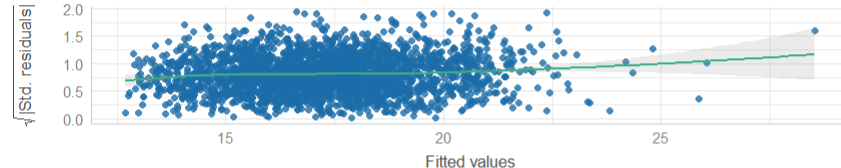
### Linearity

Reference line should be flat and horizontal



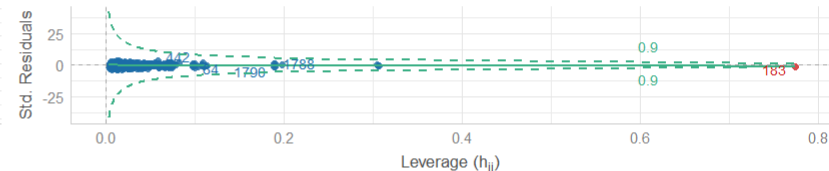
### Homogeneity of Variance

Reference line should be flat and horizontal



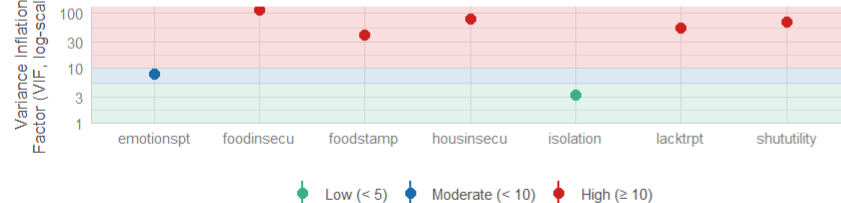
### Influential Observations

Points should be inside the contour lines



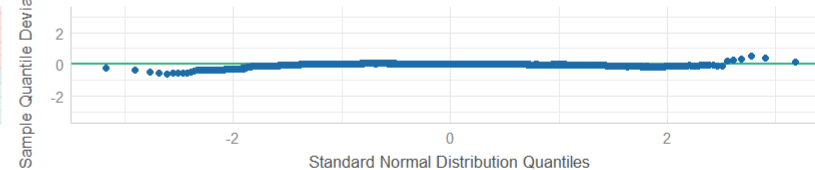
### Collinearity

High collinearity (VIF) may inflate parameter uncertainty



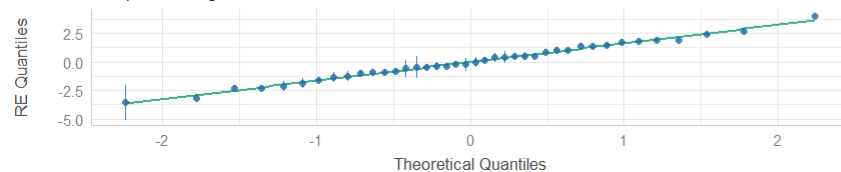
### Normality of Residuals

Dots should fall along the line



### Normality of Random Effects (full)

Dots should be plotted along the line



**Adjusted\* Mixed Effects Regression Model Results of County level prevalence of Frequent Mental Distress on Health-related Social Needs, 2022 [removing HOUSING INSECURITY & THREAT OF SHUTOFF UTILITY after stepwise regression]**

<i>Predictors</i>	<b>Frequent Mental Distress</b>		
	<i>Estimates</i>	<i>CI</i>	<i>p</i>
Lack of Emotion Support	-0.19	-0.23 – -0.15	<0.001
Social & Emotional Isolation	0.27	0.23 – 0.30	<0.001
Food Insecurity	-0.62	-0.68 – -0.55	<0.001
Receipt of Food Stamps	0.23	0.19 – 0.27	<0.001
Lack of Reliable Transportation	1.28	1.16 – 1.39	<0.001
<b>Random Effects♦</b>			
$\sigma^2$	0.83		
$\tau_{00 \text{ full}}$	2.58		
ICC	0.76		
$N_{\text{full}}$	40		
Observations	2417		
Marginal $R^2$ / Conditional $R^2$	0.416 / 0.858		

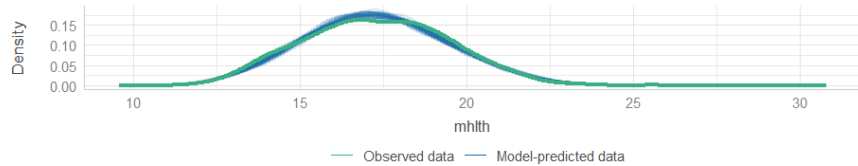
\*Adjusting for other HRSN's included in table.

♦Random effect = State.

Mixed Effects model diagnostics:

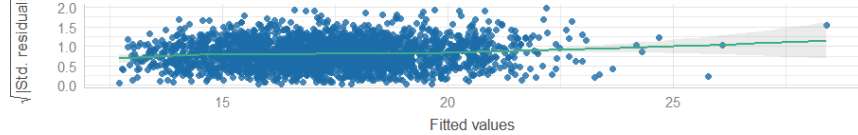
### Posterior Predictive Check

Model-predicted lines should resemble observed data line



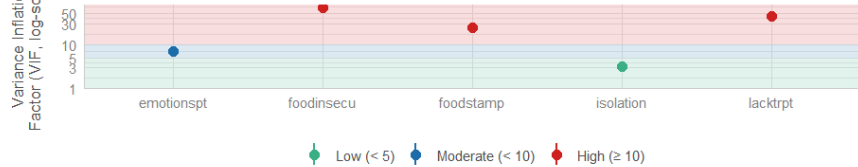
### Homogeneity of Variance

Reference line should be flat and horizontal



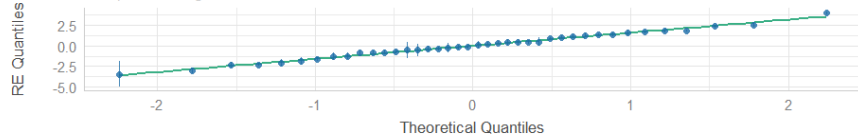
### Collinearity

High collinearity (VIF) may inflate parameter uncertainty



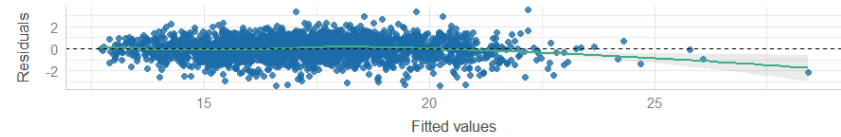
### Normality of Random Effects (full)

Dots should be plotted along the line



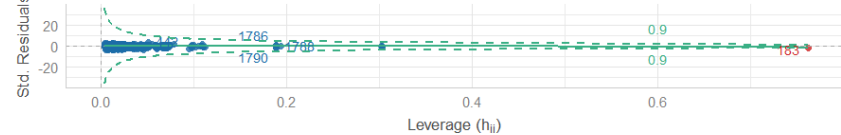
### Linearity

Reference line should be flat and horizontal



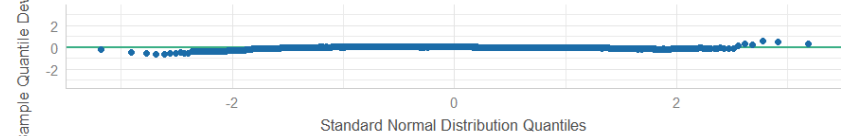
### Influential Observations

Points should be inside the contour lines



### Normality of Residuals

Dots should fall along the line



High collinearity, lack of confidence in parameter estimates.

## EXPLORATORY ANALYSIS

[Previously discussed below]

Correlations and scatterplots of County level prevalence of Frequent Mental Distress and Health-related Social Needs, 2022 [exploratory]

Frequent Mental Distress ( $\geq 14$ days) Correlations w/ Health Related Social Needs				
Variable	Pearson Estimate (linear relationship)	p-value	Spearman Estimate (non-linear relationship)	p-value
Lack of Emotional Support	0.474	<0.001	0.520	<0.001
Social Isolation	0.506	<0.001	0.501	<0.001

Food Insecurity (past 12 months)	0.599	<0.001	0.662	<0.001
Receipt of food stamps (past 12 months)	0.656	<0.001	0.687	<0.001
Housing Insecurity (past 12 months)	0.568	<0.001	0.639	<0.001
Lack of reliable Transportation (past 12 months)	0.636	<0.001	0.695	<0.001
Utility Services threat (past 12 months)	0.667	<0.001	0.728	<0.001

## Scatterplots of County level prevalence of frequent mental distress on health-related social needs (7), 2022 [exploratory]

