SCHOOL OF NATURAL SCIENCES AND PSYCHOLOGY

LEVEL 5 EXAMINATION

MODULE CODE: 5202PSYSCI

MODULE TITLE: RESEARCH METHODS AND STATISTICS IN PSYCHOLOGY 4

Date: July 2019 **Time Allowed: 2 Hours**

INSTRUCTIONS TO CANDIDATES

Answer **Questions 1 and 2**. Each is worth half of the marks

Additional permitted materials: 5202PSYSCI workbook

Banned materials: As specified by the University's Assessment Regulations.

Question 1

To identify the factors underlying posttraumatic stress disorder (PTSD), researchers contacted 234 victims of common assault immediately after their admission to an Accident and Emergency Department. Each was asked to indicate their age, gender and the severity of their assault along with their self-reported levels of anxiety and depression (scored from 1-9 with higher scores denoting greater anxiety and depression). Participants were interviewed six months later and asked to specify the extent of their PTSD symptoms (also scored from 1-9). The researchers hypothesised that:

- PTSD symptoms could be predicted from a combination of age, anxiety, assault severity and depression (H_1)
- Psychological variables would be stronger determinants of PTSD symptoms than background and demographic variables (H_2).

Please answer the following questions:

a) What is the design of the study? **[8 marks]**

Prospective **[4 marks]**, correlational design **[4 marks]**.

b) State the outcome and predictor variables.

[6 marks]

Assumptions

The assumptions were tenable **[2 marks]**. There was variability among predictors **[2 marks]**. The correlations and tolerance/VIF statistics revealed no issues of collinearity **[2 marks]**. There was also no issue of outliers: standardised residuals were less than three (and more than minus three) **[2 marks]**. In addition, the residuals were normally distributed with a mean of zero (see histogram) **[2 marks]** and random (see scatterplot) **[2 marks]**. Cook's distance was substantially less than one so there were no unduly influential cases **[2 marks]**.

c) Interpret the following analysis in terms of its implications for the hypotheses. Using the standard notation, report the analysis as you would in the Results section of a practical. Pay attention to the descriptive statistics, correlations, regression coefficients, *F* ratios and tests of assumptions.

[86 marks]

Respondents were aged 31.25 years (SD = 8.96) **[2 marks]**[1], reported severe PTSD symptoms (M = 7.68, SD = 2.84) **[2 marks]**, deemed their assaults to be severe (M = 6.47, SD = 2.37) **[2 marks]**. Further, self-reported depression was just above the scale mid-point (M = 5.43, SD = 3.14) **[2 marks]**, though anxiety was below (M = 3.70, SD = 1.92) **[2 marks]**.

Consistent with hypothesis 1 **[6 marks]**[2] PTSD symptoms could be predicted from the variables (R = .445, adjusted R^2 = .184, $F(4, 229) = 14.13$, $p<.001$)

[1] Award 1 mark for the mean and 1 for the *SD*. Same breakdown for the rest of the question.
[2] Award 6 marks each time the candidate correctly states the implications of the analyses for each hypothesis. This is awarded regardless of whether the corresponding inferential analysis is provided.

[10 marks][3]. The second hypothesis was also supported [**6 marks]** since psychological variables were stronger predictors of PTSD symptoms than background/demographic variables. This pattern of results was evident at bivariate and multivariate levels. In particular, Pearson correlations were stronger between PTSD symptoms and depression (r =.36, p<.001) **[4 marks]**[4] and anxiety (r =.30, p<.001) **[4 marks]** relative to assault severity (r =.23, p<.001) **[4 marks]** and age (r =–.11, p>.05, 2-tailed) **[4 marks]**. It is worth noting that these indicate that greater levels of depression and anxiety were associated with significantly worse PTSD symptoms **[4 marks]**. In addition, younger participants and respondents who suffered more severe assaults tended to report more PTSD symptoms **[4 marks]**. The same pattern of results was evident in the multiple regression analysis. The betas for depression (β = .26, p<.001) **[4 marks]**[5] and anxiety (β = .19, p<.01) **[4 marks]** were greater than the betas for age (β = –.15, p<.05) **[4 marks]** and assault severity (β = .13, p<.05) **[4 marks]**.

[3] 2 marks for R = .445, 2 marks for adjusted R^2 = .184, 2 marks for F(4, 229), 2 marks for 14.13 and 2 marks for p<.001 or p<.01 or p<.05. (Do not penalise students for failing to cite the 'highest' level of significance here or elsewhere. The exact value can also be listed providing the do not write p=.000.)

[4] Award 2 marks r=.23 and 2 marks p<.001 or p<.01 or p<.05. Same breakdown for the other correlations.

[5] Award 2 marks β = .26 and 2 marks p<.001 or p<.01 or p<.05. Same breakdown for the other betas.

Regression

Descriptive Statistics

	Mean	Std. Deviation	N
PTSD symptoms	7.6800	2.84000	234
Age	31.2500	8.96000	234
Anxiety	3.7000	1.92000	234
Assault severity	6.4700	2.37000	234
Depression	5.4300	3.14000	234

Correlations

		PTSD symptoms	Age	Anxiety	Assault severity	Depression
Pearson Correlation	PTSD symptoms	1.000	-.110	.300	.230	.360
	Age	-.110	1.000	.110	-.080	.120
	Anxiety	.300	.110	1.000	.090	.440
	Assault severity	.230	-.080	.090	1.000	.260
	Depression	.360	.120	.440	.260	1.000
Sig. (1-tailed)	PTSD symptoms	.	.047	.000	.000	.000
	Age	.047	.	.047	.111	.033
	Anxiety	.000	.047	.	.085	.000
	Assault severity	.000	.111	.085	.	.000
	Depression	.000	.033	.000	.000	.
N	PTSD symptoms	234	234	234	234	234
	Age	234	234	234	234	234
	Anxiety	234	234	234	234	234
	Assault severity	234	234	234	234	234
	Depression	234	234	234	234	234

, Pearson correlations were stronger between PTSD symptoms and depression (r =.36, p<.001) **[4 marks]**[6] and anxiety (r =.30, p<.001) **[4 marks]** relative to assault severity (r =.23, p<.001) **[4 marks]** and age (r =–.11, p>.05, 2-tailed)

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Depression, Age, Assault severity, Anxiety[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: PTSD symptoms

[6] Award 2 marks r=.23 and 2 marks p<.001 or p<.01 or p<.05. Same breakdown for the other correlations.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.445[a]	.198	.184	2.56558

a. Predictors: (Constant), Depression, Age, Assault severity, Anxiety

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	371.965	4	92.991	14.128	.000[a]
	Residual	1507.320	229	6.582		
	Total	1879.285	233			

a. Predictors: (Constant), Depression, Age, Assault severity, Anxiety

b. Dependent Variable: PTSD symptoms

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	5.830	.821		7.101	.000		
	Age	-.048	.019	-.151	-2.519	.012	.969	1.032
	Anxiety	.282	.098	.190	2.882	.004	.803	1.246
	Assault severity	.160	.074	.133	2.158	.032	.919	1.088
	Depression	.235	.062	.260	3.799	.000	.749	1.335

a. Dependent Variable: PTSD symptoms

Collinearity Diagnostics[a]

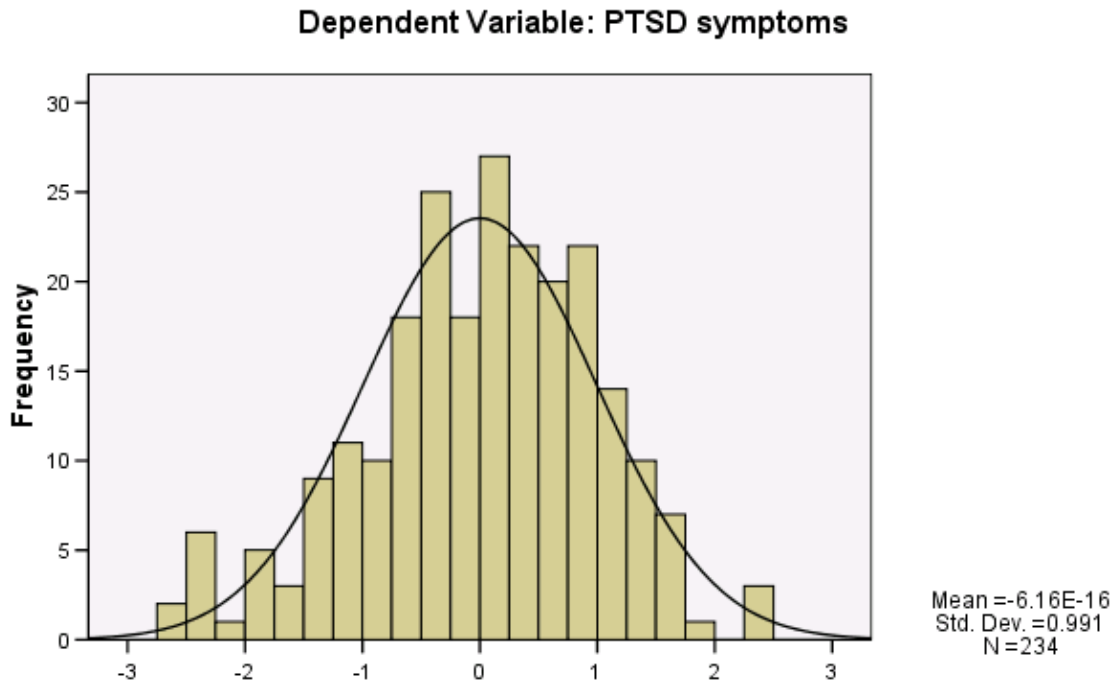
Model	Dimension	Eigenvalue	Condition Index	Variance Proportions				
				(Constant)	Age	Anxiety	Assault severity	Depression
1	1	4.539	1.000	.00	.00	.01	.00	.01
	2	.197	4.801	.03	.05	.19	.06	.38
	3	.137	5.753	.00	.02	.59	.13	.43
	4	.099	6.774	.00	.26	.19	.48	.17
	5	.028	12.670	.97	.66	.03	.32	.01

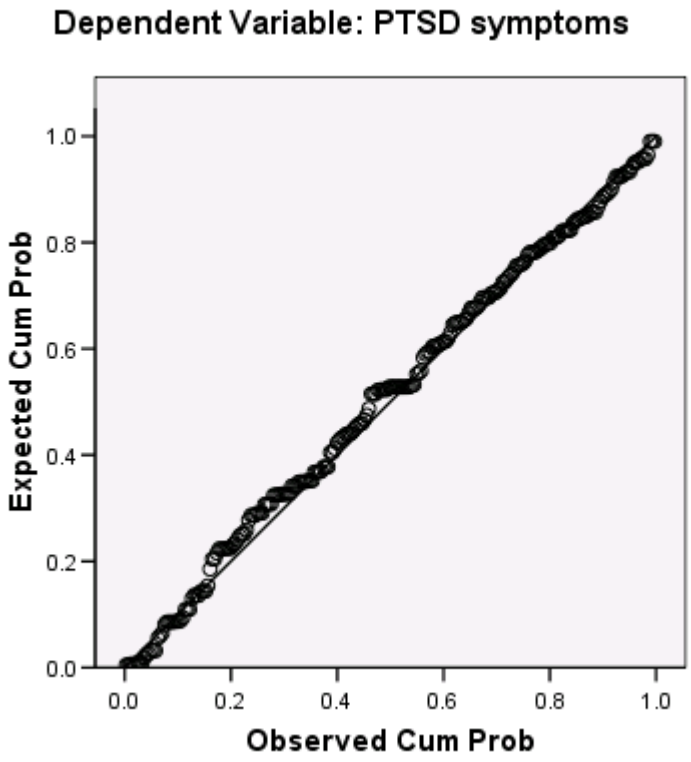
a. Dependent Variable: PTSD symptoms

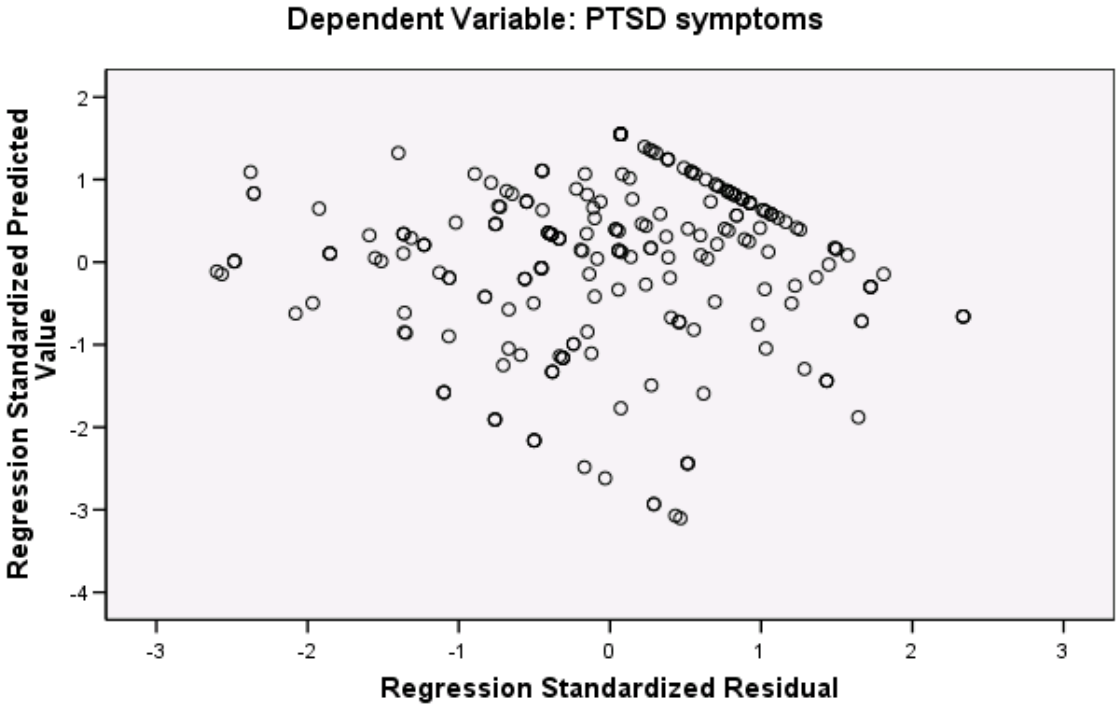
Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-3.6391	2.9039	.7244	1.40584	234
Std. Predicted Value	-3.104	1.550	.000	1.000	234
Standard Error of Predicted Value	.102	.509	.189	.065	234
Adjusted Predicted Value	-3.6972	2.9016	.7224	1.40858	234
Residual	-3.56318	3.20117	.00000	1.35862	234
Std. Residual	-2.600	2.336	.000	.991	234
Stud. Residual	-2.639	2.389	.001	1.003	234
Deleted Residual	-3.67004	3.34714	.00200	1.38955	234
Stud. Deleted Residual	-2.674	2.414	.000	1.007	234
Mahal. Distance	.285	31.180	3.983	3.817	234
Cook's Distance	.000	.052	.005	.009	234
Centered Leverage Value	.001	.134	.017	.016	234

a. Dependent Variable: PTSD symptoms




Dependent Variable: PTSD symptoms
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0


Dependent Variable: PTSD symptoms
Regression Standardized Predicted Value
Regression Standardized Residual
2
1
0
-1
-2
-3
-4
-3
-2
-1
0
1
2
3

Question 2

An experiment was conducted to compare two methods of determining *pain threshold* (the point at which one first reports pain) and *pain tolerance* (the point at which one can no longer endure pain). The *cold pressor method* required 30 participants to immerse their dominant hand in iced water. The time taken in seconds for them to report discomfort and to remove their hand from the water (i.e., withdrawal latencies) were used as the measures of pain threshold and pain tolerance respectively. For the *thermal method* the same participants had electrodes placed on the index finger of their dominant hand. The electrodes were then stimulated to induce heat. The time in seconds for participants to first report pain and the time at which they could no longer withstand the heat were used as the measures of pain threshold and pain tolerance respectively. The order of the conditions was counterbalanced. The researchers formulated the following hypotheses:

- Pain tolerance latencies would be greater than pain threshold latencies (H_1)
- The cold pressor method and thermal methods would produce different estimates of pain threshold and pain tolerance (H_2)
- The difference in pain tolerance and pain threshold latencies would be greater for the cold pressor method than for the thermal method (H_3).

Please answer the following questions:

a) What is the design of the study? **[8 marks]**

b) State the dependent and independent variables. State the number of levels for the independent variables and indicate whether they are within and/or between participant factors.

[6 marks]

c) Interpret the following analysis in terms of its implications for the hypotheses. Using the standard notation, report the analysis as you would in the Results section of a practical. Pay attention to the descriptive statistics, *F* ratios, effect sizes and tests of assumptions.

[86 marks]

General Linear Model

Within-Subjects Factors

Measure: MEASURE_1

Pain.type	Method	Dependent Variable
1	1	Thermal. threshold
	2	Cold. threshold
2	1	Thermal. tolerance
	2	Cold. tolerance

Descriptive Statistics

	Mean	Std. Deviation	N
Thermal threshold	10.07	3.051	30
Cold threshold	16.62	5.388	30
Thermal tolerance	21.63	4.382	30
Cold tolerance	33.37	7.266	30

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Pain.type	Pillai's Trace	.957	651.202[b]	1.000	29.000	.000	.957
	Wilks' Lambda	.043	651.202[b]	1.000	29.000	.000	.957
	Hotelling's Trace	22.455	651.202[b]	1.000	29.000	.000	.957
	Roy's Largest Root	22.455	651.202[b]	1.000	29.000	.000	.957
Method	Pillai's Trace	.828	139.294[b]	1.000	29.000	.000	.828
	Wilks' Lambda	.172	139.294[b]	1.000	29.000	.000	.828
	Hotelling's Trace	4.803	139.294[b]	1.000	29.000	.000	.828
	Roy's Largest Root	4.803	139.294[b]	1.000	29.000	.000	.828
Pain.type * Method	Pillai's Trace	.455	24.191[b]	1.000	29.000	.000	.455
	Wilks' Lambda	.545	24.191[b]	1.000	29.000	.000	.455
	Hotelling's Trace	.834	24.191[b]	1.000	29.000	.000	.455
	Roy's Largest Root	.834	24.191[b]	1.000	29.000	.000	.455

a. Design: Intercept
Within Subjects Design: Pain.type + Method + Pain.type * Method

b. Exact statistic

Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Pain.type	1.000	.000	0	.	1.000	1.000	1.000
Method	1.000	.000	0	.	1.000	1.000	1.000
Pain.type * Method	1.000	.000	0	.	1.000	1.000	1.000

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept
Within Subjects Design: Pain.type + Method + Pain.type * Method

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Pain.type	Sphericity Assumed	6013.752	1	6013.752	651.202	.000	.957
	Greenhouse-Geisser	6013.752	1.000	6013.752	651.202	.000	.957
	Huynh-Feldt	6013.752	1.000	6013.752	651.202	.000	.957
	Lower-bound	6013.752	1.000	6013.752	651.202	.000	.957
Error(Pain.type)	Sphericity Assumed	267.810	29	9.235			
	Greenhouse-Geisser	267.810	29.000	9.235			
	Huynh-Feldt	267.810	29.000	9.235			
	Lower-bound	267.810	29.000	9.235			
Method	Sphericity Assumed	2507.102	1	2507.102	139.294	.000	.828
	Greenhouse-Geisser	2507.102	1.000	2507.102	139.294	.000	.828
	Huynh-Feldt	2507.102	1.000	2507.102	139.294	.000	.828
	Lower-bound	2507.102	1.000	2507.102	139.294	.000	.828
Error(Method)	Sphericity Assumed	521.960	29	17.999			
	Greenhouse-Geisser	521.960	29.000	17.999			
	Huynh-Feldt	521.960	29.000	17.999			
	Lower-bound	521.960	29.000	17.999			
Pain.type * Method	Sphericity Assumed	201.502	1	201.502	24.191	.000	.455
	Greenhouse-Geisser	201.502	1.000	201.502	24.191	.000	.455
	Huynh-Feldt	201.502	1.000	201.502	24.191	.000	.455
	Lower-bound	201.502	1.000	201.502	24.191	.000	.455
Error(Pain.type*Method)	Sphericity Assumed	241.560	29	8.330			
	Greenhouse-Geisser	241.560	29.000	8.330			
	Huynh-Feldt	241.560	29.000	8.330			
	Lower-bound	241.560	29.000	8.330			

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	Pain.type	Method	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Pain.type	Linear		6013.752	1	6013.752	651.202	.000	.957
Error(Pain.type)	Linear		267.810	29	9.235			
Method		Linear	2507.102	1	2507.102	139.294	.000	.828
Error(Method)		Linear	521.960	29	17.999			
Pain.type * Method	Linear	Linear	201.502	1	201.502	24.191	.000	.455
Error(Pain.type*Method)	Linear	Linear	241.560	29	8.330			

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	50041.252	1	50041.252	669.275	.000	.958
Error	2168.310	29	74.769			

Estimated Marginal Means

1. Method

Estimates

Measure: MEASURE_1

Method	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	15.850	.640	14.541	17.159
2	24.992	1.066	22.812	27.172

2. Pain type

Estimates

Measure: MEASURE_1

Pain.type	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	13.342	.700	11.910	14.773
2	27.500	.954	25.549	29.451

Pairwise Comparisons

Measure: MEASURE_1

(I) Pain.type	(J) Pain.type	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-14.158*	.555	.000	-15.293	-13.024
2	1	14.158*	.555	.000	13.024	15.293

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Pillai's trace	.957	651.202[a]	1.000	29.000	.000	.957
Wilks' lambda	.043	651.202[a]	1.000	29.000	.000	.957
Hotelling's trace	22.455	651.202[a]	1.000	29.000	.000	.957
Roy's largest root	22.455	651.202[a]	1.000	29.000	.000	.957

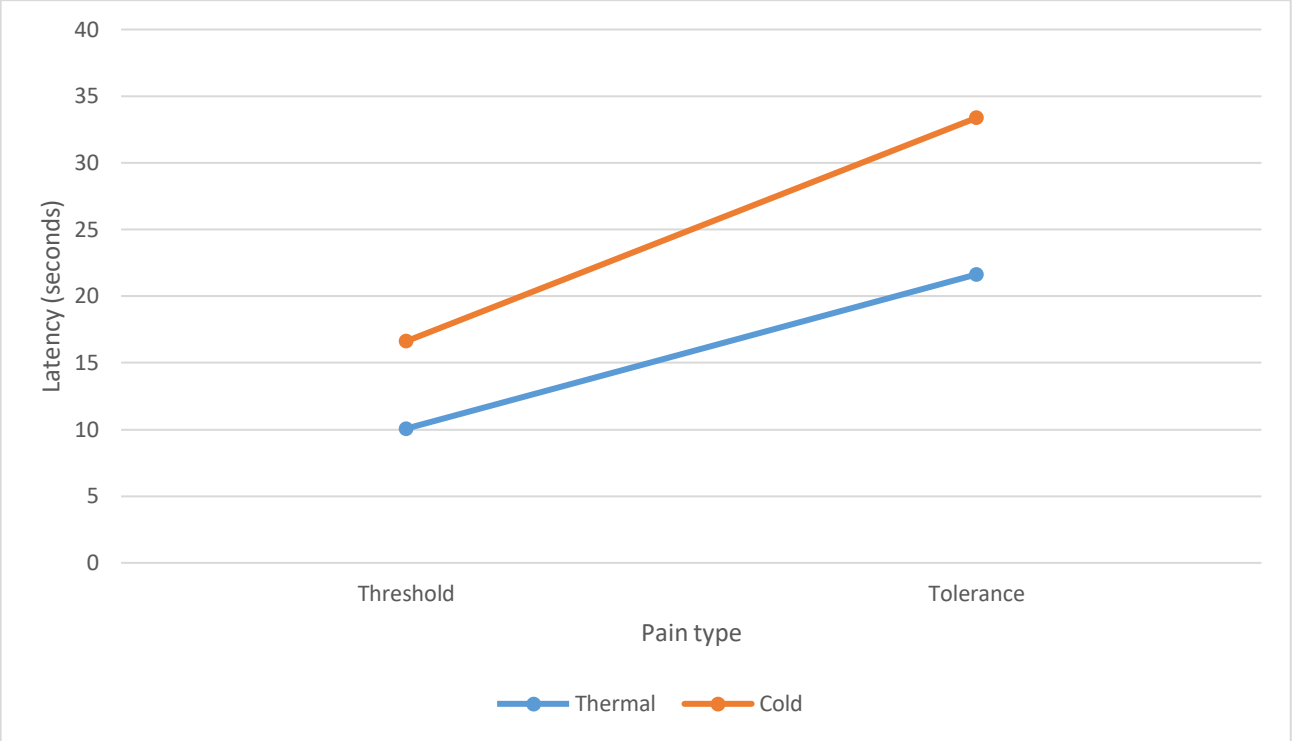
Each F tests the multivariate effect of Pain.type. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

3. Method * Pain.type

Measure: MEASURE_1

Method	Pain.type	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1	1	10.067	.557	8.928	11.206
	2	21.633	.800	19.997	23.270
2	1	16.617	.984	14.605	18.629
	2	33.367	1.327	30.654	36.080



Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Thermal threshold	.137	30	.158	.939	30	.088
Thermal tolerance	.121	30	.200*	.956	30	.242
Cold threshold	.112	30	.200*	.972	30	.582
Cold tolerance	.086	30	.200*	.966	30	.443

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction