Acceptability and Willingness to Use HIV Pre-Exposure Prophylaxis among Female Sex Workers in Lagos State, Nigeria: A Cross-Sectional Study

Appendix A: Measurement and Scale Reliability
This appendix provides the internal consistency estimates (Cronbach's alpha) for the composite scales used as the dependent variables in the multivariable linear regression models, validating their use in the analysis.

Table A.1: Internal Consistency of PrEP Scales (Cronbach's alpha)

Scale	Number of Items	Average Inter-Item Covariance	Cronbach's alpha Coefficient	Interpretation
PrEP Acceptability Score	6	0.4197	**0.8446**	Good
PrEP Willingness Score	8	0.1629	**0.6482**	Acceptable

Note on Interpretation
- The **PrEP Acceptability Score** (alpha = 0.8446) demonstrates **Good** internal consistency, exceeding the common threshold of 0.70.
- The **PrEP Willingness Score** (alpha = 0.6482) is slightly below the conventional 0.70 threshold, but is often deemed **Acceptable** for newly adapted or exploratory scales, particularly in early research stages. Its use in the MLR is justifiable, but the interpretation of its findings is acknowledged on this lower reliability.
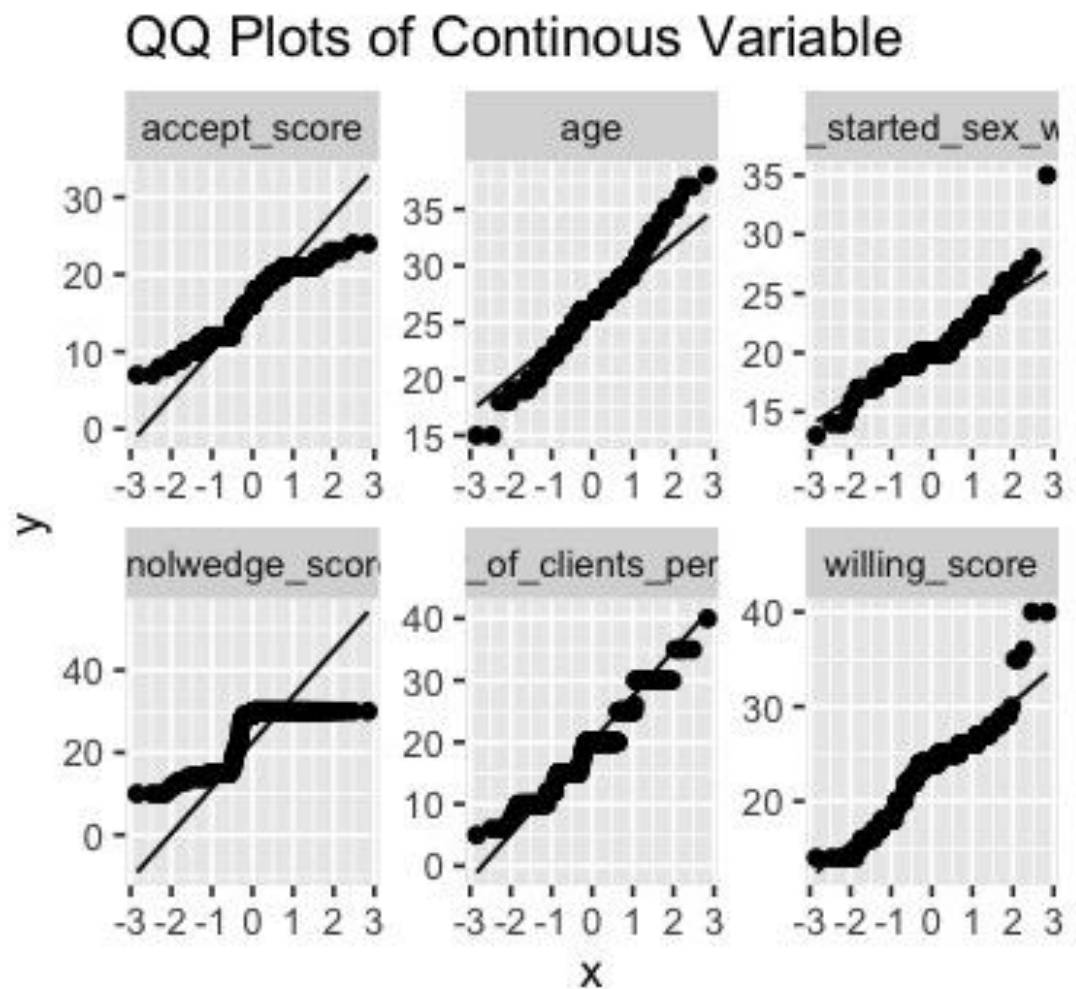
Acceptability and Willingness to Use HIV Pre-Exposure Prophylaxis among Female Sex Workers in Lagos State, Nigeria: A Cross-Sectional Study

Figure 1: QQ plots of variables

Table 1: Normality test of distribution of variables

Variable	Role in MLR	Skewness Value	Skewness Type	Shapiro-Wilk p-value	Normality Conclusion	Data Transformation	Modeling Strategy Justification
Age (Mean)	Predictor	≈0.00	None (Symmetric)	0.235	Normal	none	Retained as continuous. Preserves maximum statistical power and satisfies normality assumption for predictors.

This study has been approved by the Lagos University Teaching Hospital Human Research Ethics Committee (LUTH-HREC Approval No: ADM/DCST/HREC/APP/5093).

Acceptability and Willingness to Use HIV Pre-Exposure Prophylaxis among Female Sex Workers in Lagos State, Nigeria: A Cross-Sectional Study

Variable	Role in MLR	Skewness Value	Skewness Type	Shapiro-Wilk *p*-value	Normality Conclusion	Data Transformation	Modeling Strategy Justification
Age at Sex Work Initiation	Predictor	+1.12	Strong Positive (Right Skew)	<0.001	Severely non-normal	Root transformation =	Categorized by quartiles. Justified by strong right skew and significant non-normality. Quartiles represent a data-driven, non-arbitrary grouping method.
Number of Clients per Month	Predictor	+0.36	Minor Positive (Right Skew)	0.008	Technically non-normal		Retained as continuous for MLR. Minor skew permits reliance on Central Limit Theorem ($N = 221$). Low skewness (<0.5) and kurtosis near normal (2.74) support continuous treatment.
PrEP Knowledge Score	Predictor (Covariate)	−0.63	Moderate Negative (Left Skew)	<0.001	Severely non-normal		Categorized by tertiles. Justified by moderate left skew and Q-Q plot deviations. Tertiles provide balanced low/medium/high knowledge groups, addressing reviewer concerns about median splits.

Acceptability and Willingness to Use HIV Pre-Exposure Prophylaxis among Female Sex Workers in Lagos State, Nigeria: A Cross-Sectional Study

Variable	Role in MLR	Skewness Value	Skewness Type	Shapiro-Wilk p-value	Normality Conclusion	Data Transformation	Modeling Strategy Justification
PrEP Acceptance Score	Outcome	−0.22	Minor Negative (Left Skew)	<0.001	Technically non-normal		Retained as continuous for MLR. Minor skew permits reliance on Central Limit Theorem ($N = 223$). Normality of residuals assessed post-modeling.
PrEP Willingness Score	Outcome	+0.20	Minor Positive (Right Skew)	<0.001	Technically non-normal		Retained as continuous for MLR. Minor skew permits reliance on Central Limit Theorem ($N = 223$). Normality of residuals assessed post-modeling.

Table 2. Summary of Predictor Transformations and Final Status in MLR

Original Predictor	Final Predictor (Used in MLR)	Initial Skewness	Pre-Transformation Normality Test (W / p)	Post-Transformation Normality Test (W / p)	Final Status in MLR
Age Started Sex Work (continuous)	age_start_quartiles (categorical)	+1.116 (Severe)	0.93 / **<0.001** (Rejected)	0.80 / **<0.001** (Worsened)	Categorized into quartiles (transformation unsuccessful; categorization chosen for stability and interpretability).

This study has been approved by the Lagos University Teaching Hospital Human Research Ethics Committee (LUTH-HREC Approval No: ADM/DCST/HREC/APP/5093).

Acceptability and Willingness to Use HIV Pre-Exposure Prophylaxis among Female Sex Workers in Lagos State, Nigeria: A Cross-Sectional Study

Original Predictor	Final Predictor (Used in MLR)	Initial Skewness	Pre-Transformation Normality Test (W / p)	Post-Transformation Normality Test (W / p)	Final Status in MLR
Clients per Month (continuous)	*Excluded*	+0.36 (Mild)	**0.97 / 0.008**	Not Applicable (raw data used; mild skewness).	Excluded (not statistically significant in bivariate screening).
PrEP Knowledge Score (continuous)	knowledge_tertiles (categorical)	-0.630 (Moderate)	**0.92 / <0.001** (Rejected)	Log: 0.723 / **<0.001**; Root/Squared: 0.706 / **<0.001** (Both failed)	Categorized into tertiles (transformation unsuccessful; improved stability and model fit).

Appendix D: Final Multivariable Linear Regression Diagnostics
This appendix confirms that the final models met the key statistical assumptions required for **MLR**.
Assumption of Homoscedasticity
Both final models passed the Non-constant Variance Test ($p > 0.05$), confirming **constant error variance**. Accordingly, **standard OLS coefficients and standard errors** were retained in the final analyses, and **Heteroscedasticity-Consistent Standard Errors (HCSEs)** were not required.

Model 1: PrEP Acceptability Score (Final Predictors)
This model included only the predictors that were significant at the bivariate screening stage. All core MLR assumptions were met without the need for corrective adjustments.

Table 3: Multicollinearity (VIF Results)

Predictor	GVIF
Number of clients per month	1.13
Knowledge Score	1.12
Religion (collapsed)	1.43
Ethnicity	1.66
Regular paying job	1.16
Education (re-categorized)	1.24
Maximum	**VIF: 1.66**

Interpretation: All GVIF values are well below the threshold of 5, indicating no evidence of multicollinearity.

This study has been approved by the Lagos University Teaching Hospital Human Research Ethics Committee (LUTH-HREC Approval No: ADM/DCST/HREC/APP/5093).

Acceptability and Willingness to Use HIV Pre-Exposure Prophylaxis among Female Sex Workers in Lagos State, Nigeria: A Cross-Sectional Study
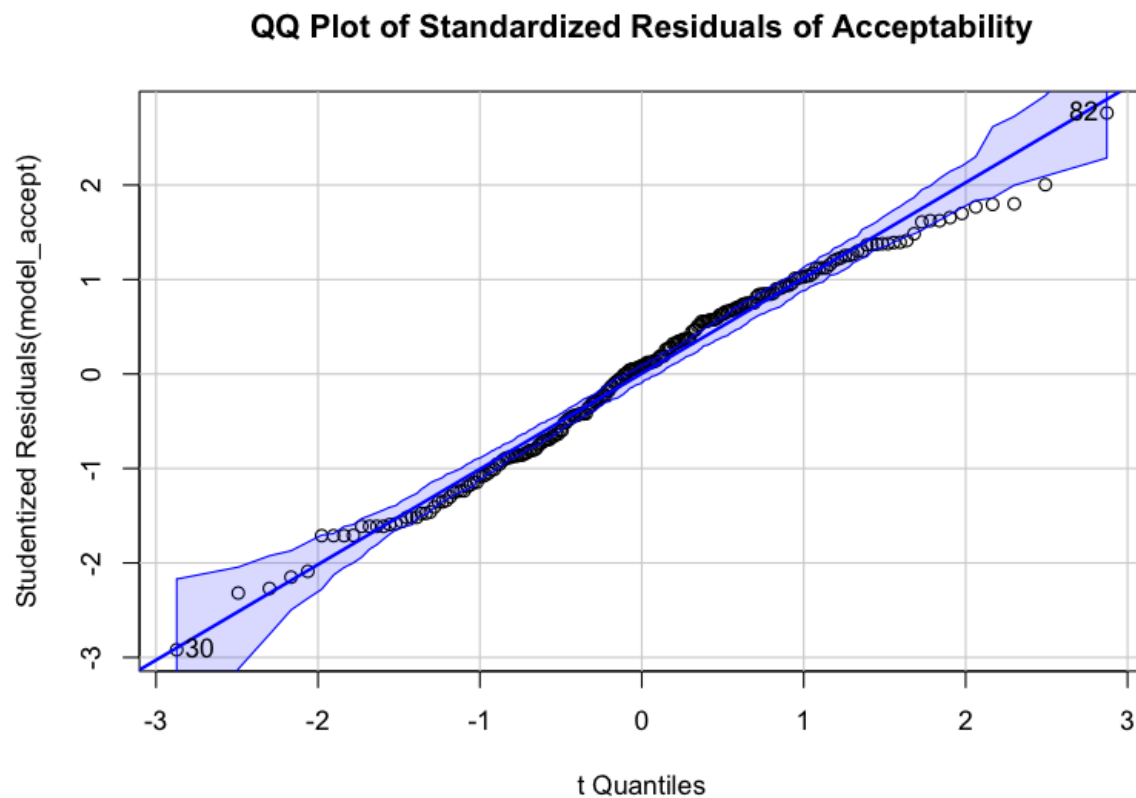

Figure 2. QQ plot of standardized residual of acceptability MLR model

Acceptability and Willingness to Use HIV Pre-Exposure Prophylaxis among Female Sex Workers in Lagos State, Nigeria: A Cross-Sectional Study
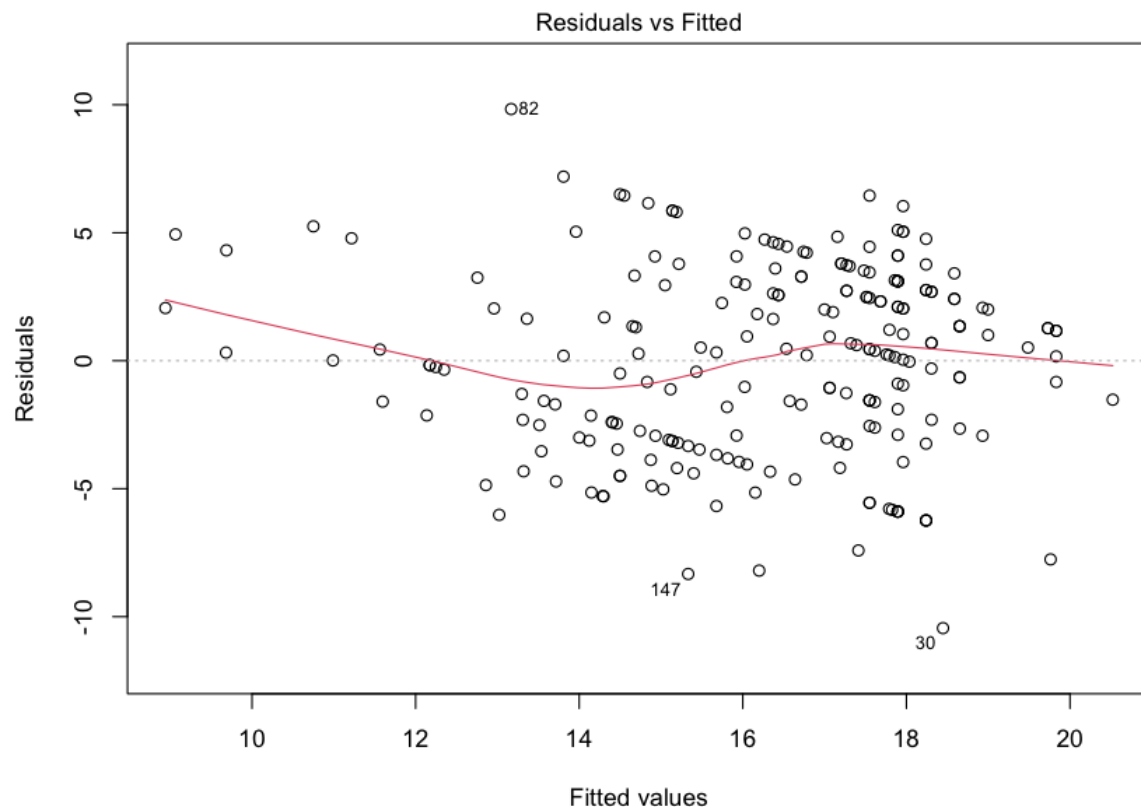

Figure 3. Residuals vs. Fitted plots (Homoscedasticity/Linearity) Acceptability

Table 4: Normality and Homoscedasticity of Residuals

Diagnostic Check	Value / Result	Interpretation
Shapiro–Wilk test	W = 0.987, p = 0.035	Minor statistical deviation from normality
Breusch–Pagan test	χ² = 6.36, p = 0.61	No heteroscedasticity
NCV test	χ² = 0.55, p = 0.46	Constant variance
Q–Q plot	Fig. 2	Visual approximation to normality
Residuals vs fitted	Fig. 3	No pattern; Clear curvature suggests a **violation of the linearity assumption**.

NCV= Non-Constant Variance

Acceptability and Willingness to Use HIV Pre-Exposure Prophylaxis among Female Sex Workers in Lagos State, Nigeria: A Cross-Sectional Study

Model 2: PrEP Willingness Score (Final Predictors)
This model satisfied the homoscedasticity assumption, but the residuals did not meet strict normality per statistical testing.

Table 5:. Multicollinearity (VIF Results)

Predictor	GVIF
Age	1.61
Age at start (quartiles)	1.79
Knowledge score	2.28
Offered PrEP	2.08
Religion (collapsed)	1.48
Ethnicity	1.73
Regular paying job	1.11
Number of clients per month	1.08
Maximum	**VIF: 2.28**

Interpretation: All GVIF values are below 5, indicating stable parameter estimates and no multicollinearity concerns.
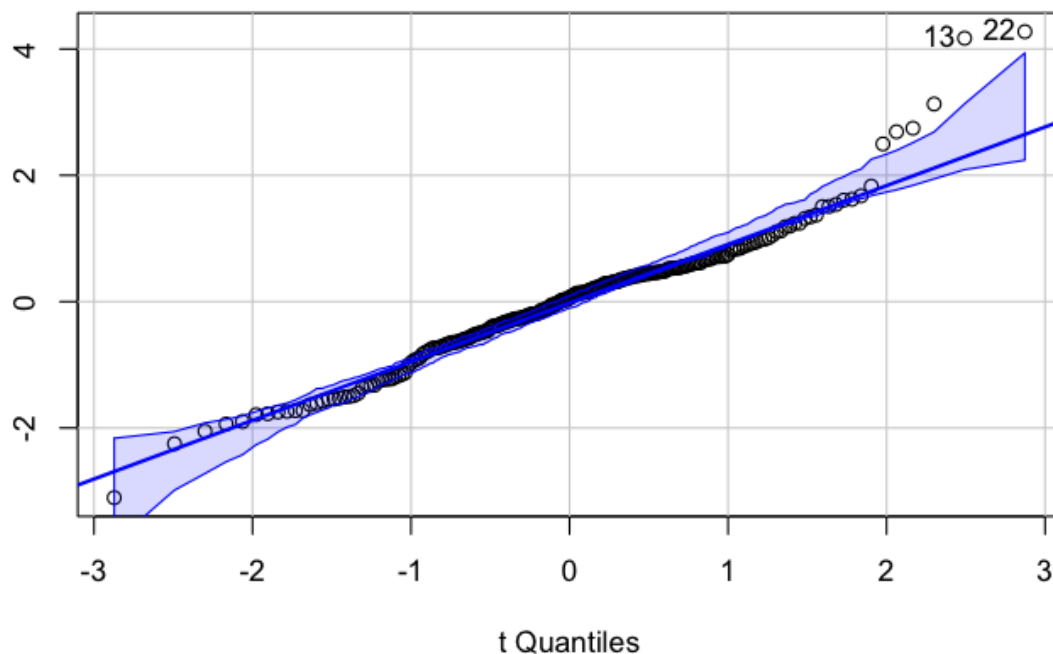

Figure 4: QQ plots of standardised residuals of willlingness

This study has been approved by the Lagos University Teaching Hospital Human Research Ethics Committee (LUTH-HREC Approval No: ADM/DCST/HREC/APP/5093).
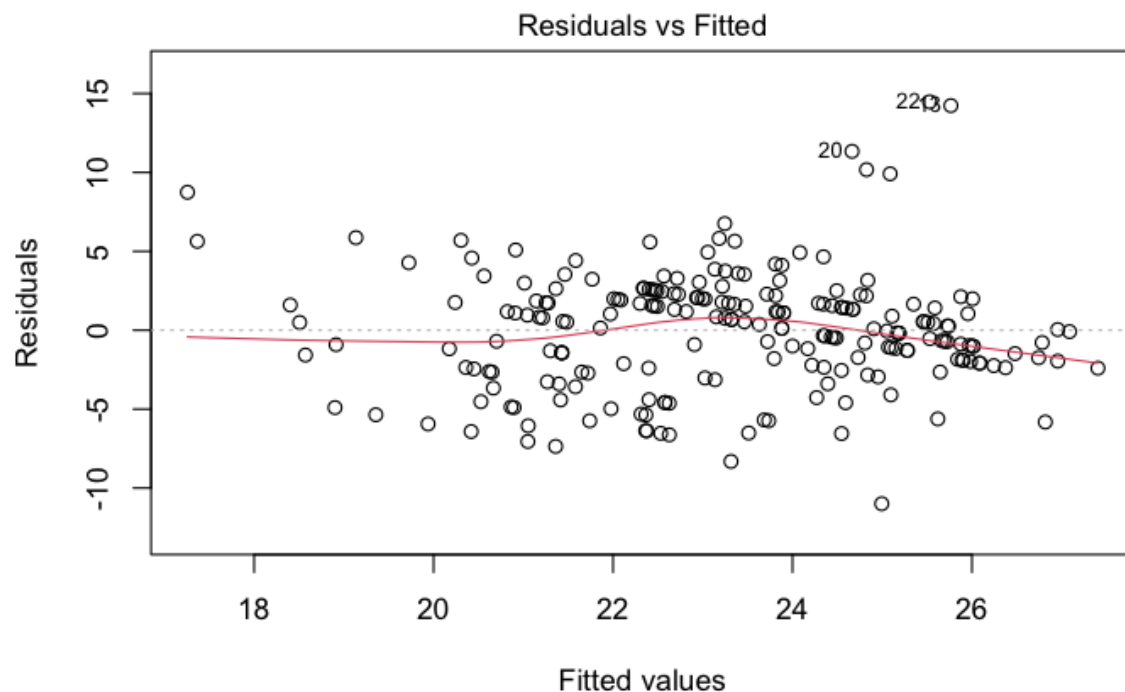
Acceptability and Willingness to Use HIV Pre-Exposure Prophylaxis among Female Sex Workers in Lagos State, Nigeria: A Cross-Sectional Study

Figure 5: Residuals vs. Fitted plots (Homoscedasticity/Linearity) Willingness

Table 6. Normality and Homoscedasticity of Residuals

Diagnostic Check	Value / Result	Conclusion
Shapiro–Wilk Test	W = 0.96777, p< 0.0001	**Fail (Statistical):** Normality rejected
Breusch–Pagan test	χ2= 61.11, p = 0.28	The model exhibits severe heteroskedasticity (non-constant variance of residuals).
NCV test	χ^2 = 0.509, p= 0.478	Contradictory to BP; The variance of the errors is constant.
Q–Q Plot	Fig 4	**Pass (Visual):** Residuals approximately normal (acceptable per Central Limit Theorem)
Residuals vs. Fitted Plot	Fig 5	Visual diagnostics confirm heteroskedasticity, while also showing a largely acceptable linearity with minor curvature.

NCV= Non-Constant Variance

This study has been approved by the Lagos University Teaching Hospital Human Research Ethics Committee (LUTH-HREC Approval No: ADM/DCST/HREC/APP/5093).

Acceptability and Willingness to Use HIV Pre-Exposure Prophylaxis among Female Sex Workers in Lagos State, Nigeria: A Cross-Sectional Study

Summary
Both adjusted multivariable linear regression models demonstrated overall acceptable adherence to key assumptions, with appropriate statistical and methodological corrections applied:

- Multicollinearity: No problematic multicollinearity was detected in either model (all VIFs were well below the common threshold of 5, with the highest VIF value being <3.0).

- Homoscedasticity: The assumption of constant variance was met in Model 1 (Acceptability scores, Breusch–Pagan test p=0.61), but rejected in Model 2 (Willingness scores, Breusch–Pagan test $p < 0.001$), indicating statistically significant heteroscedasticity in the latter. This violation was addressed by using HC3 heteroscedasticity-consistent standard errors across all final models to ensure reliable inference.

- Normality of Residuals: The assumption of normality was statistically rejected in both models (Shapiro–Wilk test $p < 0.05$ for both). However, given the composite nature of the Likert-scale outcomes and the moderate-to-large sample size, this deviation is considered acceptable due to the robustness of the linear model and the invocation of the Central Limit Theorem. The use of HC3 standard errors further mitigates this non-normality concern.

- Linearity: The linearity assumption was visually acceptable in Model 1 (Acceptability) but showed minor curvature in Model 2 (Willingness). Despite this minor visual deviation, the assumption was considered broadly confirmed through residual diagnostics.