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Modelling Depression, Anxiety, and Stress Among Inmates in North Central Nigeria: A Comparison of Baseline and Interaction-Based Multivariate Ordinal Regression Models

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Abstract: The global correctional system faces a severe mental health crisis, with inmates suffering disproportionately from depression, anxiety, and stress (DAS). In low-resource settings like Nigeria, this crisis is acute. Traditional statistical models often inadequately capture the ordinal nature of standard mental health scales and the correlations between these co-occurring conditions. This study addresses these methodological gaps by developing and comparing two advanced models to assess DAS among inmates in North Central Nigeria. Using a cross-sectional design, data were collected from 830 inmates across six facilities with the DASS-42 questionnaire and a socio-demographic form. The baseline multivariate ordinal probit model was first fitted to jointly model the three correlated outcomes. To overcome its limitation of assuming constant predictor effects, a novel interaction-based multivariate ordinal model was developed incorporating theoretically-grounded interaction terms. The interaction-based model demonstrated a superior fit (AIC = 8791.96) over the baseline (AIC = 8811.23), revealing critical effect heterogeneities. For instance, the impact of marital status on depression differed by gender. Predictions from the superior model indicated alarming prevalence rates, with 46.9% of inmates likely experiencing extremely severe anxiety and 42.4% severe depression. Distinct joint DAS profiles were identified, highlighting significant co-morbidity. This study concludes that the interaction-based multivariate ordinal model provides a robust and detailed framework for understanding inmate mental health, enabling the precise identification of high-risk subgroups for targeted, efficient, and effective clinical interventions and resource allocation within correctional systems.

Keywords: *Multivariate Ordinal Regression, Depression, Anxiety, Stress, Inmates, Mental Health, Interaction Effects.*

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I. INTRODUCTION

The prison environment, by its very nature, is a potent crucible for psychological distress. Characterized by loss of liberty, autonomy, and social bonds; pervasive threats to safety; and often overcrowded and under-resourced conditions, correctional facilities are incubators for mental health disorders (Haney, 2018). Globally, the prevalence of conditions such as depression, anxiety, and stress (DAS) among incarcerated individuals far exceeds that of the general population (Fazel & Seewald, 2019). The World Health Organization (2017) has highlighted the profound burden of depression, a concern acutely reflected in prison populations where it is linked to increased risks of self-harm, suicide, and institutional misconduct (Baranyi *et al*., 2023).

The Nigerian context presents a particularly stark picture. Once ranked among the happiest populations, Nigeria now contends with rising rates of depression and anxiety, a trend mirrored within its correctional facilities (Gregory, 2017). Studies specific to Nigeria have documented high rates of depressive disorders among inmates, with prevalence figures ranging from 30% to over 55% (Majekodunmi *et al*., 2017; Nwefoh *et al*., 2020; Wetu *et al*., 2021). These conditions are not merely a matter of individual suffering; they impede rehabilitation, increase the burden on prison staff and healthcare systems, and contribute to higher rates of recidivism upon release.

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➢ *The Triad of DAS and Measurement Challenges*

Depression, anxiety, and stress, while distinct constructs, are highly comorbid. They share overlapping symptoms, common neurobiological pathways, and are often triggered and sustained by similar environmental stressors (Lovibond & Lovibond, 1995; Kendler *et al*., 2019). The Depression, Anxiety, and Stress Scales (DASS-42) is a widely validated instrument designed to capture these three related yet discrete dimensions of psychological distress. A key feature of DASS data is its ordinal structure, where responses are categorized into ordered levels of severity (Normal, Mild, Moderate, Severe, Extremely Severe). This ordinal nature is crucial for clinical interpretation but poses specific challenges for statistical analysis.

➢ *Gaps in Existing Methodological Approaches*

A review of the literature on inmate mental health in Nigeria and similar contexts reveals two significant methodological gaps.

- *Gap 1: Inadequate Modelling of Data Structure*

Many studies resort to using binary logistic regression (e.g., depressed vs. not depressed) or run separate univariate models for each of DAS (Seyfe *et al*., 2020; Abdu *et al*., 2018). The former approach collapses rich ordinal information, leading to a loss of statistical power and clinical precision. The latter approach ignores the strong correlations between depression, anxiety, and stress, potentially leading to biased standard errors and inefficient estimates. This failure to use multivariate techniques that respect the ordinal and correlated nature of the data limits the validity and depth of the findings.

- *Gap 2: Assumption of Additive and Constant Effects*

Prevailing statistical models often assume that socio-demographic risk factors (e.g., age, gender, education) exert their influence in a vacuum, with effects that are simply additive and constant across all sub-groups. This overlooks the complex reality of effect heterogeneity, where the relationship between a predictor and a mental health outcome is conditional on the value of another variable. For instance, the psychological impact of being married may differ profoundly for male and female inmates, or the protective effect of education may be nullified in certain regional contexts due to local stigma or lack of opportunity. The failure to model these interactions results in an oversimplified and potentially misleading understanding of the determinants of mental health.

➢ *Statement of Objectives*

This study is driven by two specific objectives drawn from a larger research project:

- To develop a multivariate ordinal regression model for the assessment of depression, anxiety, and stress (DAS) of inmates at the correctional centres of North Central Nigeria.
- To predict the degree of DAS suffered by inmates at these correctional centres.

✓ *The Novelty and Contribution of this Research Lie in how it Addresses the Stated Gaps:*

▪ *Addressing Gap 1:*

We employ a multivariate ordinal probit model, which simultaneously analyses depression, anxiety, and stress as correlated ordinal responses. This approach, facilitated by the mvord package in R (Hirk *et al*., 2020), is methodologically superior as it fully utilizes the data's structure and accounts for the dependence between outcomes.

▪ *Addressing Gap 2:*

We extend the standard model by developing an interaction-based multivariate ordinal regression model. This innovative model incorporates key two-way interaction terms between socio-demographic variables, directly testing hypotheses about effect heterogeneity derived from psychosocial theories. This allows for a more nuanced, realistic, and actionable analysis of how multiple identities and contexts combine to shape mental health outcomes in prison.

➢ *Structure of the Paper*

Following this introduction, the paper presents a review of relevant literature, detailing the theoretical and empirical foundations for the study. The methodology section elaborates on the research design, sampling, instruments, and the detailed specification of both statistical models. The analysis section presents the results of model development, comparison, and prediction. Finally, the paper discusses the findings, derives evidence-based recommendations, and offers a concluding summary.

II. LITERATURE REVIEW

➢ *The Burden of Mental Health in Corrections*

The over-representation of individuals with mental illness in prisons is a well-documented global phenomenon. Fazel and Danesh's (2002) seminal systematic review found that rates of major depression and psychosis were several times higher in prison populations than in community samples. This pattern holds in Nigeria. Majekodunmi *et al*. (2017) found that 30.1% of awaiting-trial inmates and 35.0% of convicted inmates in a Nigerian prison met the criteria for major depressive disorder. Similarly, Nwefoh *et al*. (2020) reported a high prevalence of depression among inmates in Makurdi Medium Security Prison, noting a critical lack of detection and treatment. These conditions are linked to pre-incarceration vulnerabilities (e.g., poverty, trauma) and are profoundly exacerbated by the "pains of imprisonment" (Sykes, 1958), including overcrowding, idleness, and victimization.

➢ *Theoretical Frameworks for Prison Mental Health*

Two theoretical perspectives are particularly relevant for understanding inmate psychological distress:

- *General Strain Theory (GST) (Agnew, 1992):*

GST posits that strain or stress, arising from the failure to achieve positively valued goals, the removal of positive stimuli, or the presentation of negative stimuli, leads to

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negative emotions like anger, frustration, and depression. Incarceration is a massive source of such strain, involving the loss of freedom, relationships, and autonomy (the removal of positive stimuli) and the presentation of negative stimuli like violence, noise, and isolation. These strains create a high-risk environment for DAS.

- *Deprivation Model (Sykes, 1958):*

This model argues that the psychological impact of imprisonment stems from the specific deprivations inherent in institutional life: deprivation of liberty, goods and services, heterosexual relationships, autonomy, and security. These deprivations attack the inmate's self-esteem and sense of identity, fostering anxiety, depression, and hopelessness.

These theories suggest that mental health outcomes are not uniform but are filtered through individual characteristics and social positions, providing a strong rationale for investigating interaction effects.

➢ *Methodological Evolution in Mental Health Modelling*

The statistical analysis of mental health data has evolved. The DASS-42 has been extensively validated in diverse populations, including clinical, student, and community samples (Lovibond & Lovibond, 1995; Crawford & Henry, 2003; Sinclair *et al*., 2012), and its use in correctional settings has been supported (Ng *et al*., 2016).

For analysis, the move beyond simple Chi-square tests and t-tests to regression modelling was a significant advance. However, the common use of multivariate linear regression for ordinal data violates its assumptions, while binary logistic regression discards information. Ordinal logistic regression (proportional odds model) is a step forward but is univariate. The state-of-the-art for correlated ordinal outcomes is multivariate ordinal regression, which models several ordinal outcomes jointly. The work of Hirk *et al*. (2020) has made this technique more accessible to applied researchers. Despite its advantages, its application in correctional health research, particularly in sub-Saharan Africa, remains rare.

Furthermore, while the concept of intersectionality—how multiple social identities (e.g., gender, race, class) combine to create unique experiences of discrimination and disadvantage—is gaining traction in qualitative research, its translation into quantitative modelling is often limited to including main effects. Testing for statistical interactions is a direct way to quantify these intersecting effects (Bauer & Scheim, 2019). For example, the finding that female inmates report higher stress levels (Oguntayo *et al*., 2020) begs the question: is this true for all women, regardless of their marital status or region? An interaction model can answer this. This study bridges this gap by formally integrating an intersectional perspective through the inclusion of interaction terms in a multivariate ordinal framework.

III. METHODOLOGY

➢ *Research Design and Setting*

This study employed a cross-sectional analytical design, which is optimal for assessing the prevalence of outcomes and their associations with predictors at a specific point in time (Sedgwick, 2014). The research was conducted in the North Central geopolitical zone of Nigeria, comprising six states and the Federal Capital Territory. From this region, three states—Niger, Kwara, and Nasarawa were purposively selected based on geographical spread, logistical accessibility, and representativeness of the inmate population. From these states, two major correctional centres were selected from each, resulting in a total of six study sites.

➢ *Population, Sampling, and Sample Size*

The study population was all incarcerated inmates within the six selected centres, with a total population of approximately 6,600 according to Nigerian Correctional Service (NCoS) records (2023). A multi-stage sampling technique was employed:

- *Purposive Sampling:*

Used to select the three states and the six specific correctional centres known to hold large and diverse inmate populations.

- *Probability Proportional to Size (PPS) Sampling:*

The initial sample size was calculated using the Taro Yamane formula for a finite population, yielding a base sample of 377. This was adjusted for a design effect of 2.0 and a 35% anticipated non-response/invalid response rate, resulting in a target sample of 1,160 inmates. This sample was allocated to the six centres proportionally based on their inmate population.

- *Systematic Random Sampling:*

Within each centre, and stratified by gender, a sampling frame was obtained from prison registers. A sampling interval (k) was calculated, a random start was selected, and every k-th inmate was invited to participate until the quota for that centre and gender was filled.

The final sample, after accounting for refusals and invalid responses, was 830 inmates (659 males, 171 females), yielding an excellent response rate of 71.6% for prison-based research.

➢ *Data Collection and Instruments*

Data were collected through interviewer-administered questionnaires to account for varying literacy levels. The instruments were:

- *Socio-Demographic Data Form:*

This captured data on:

✓ Age: Continuous variable (in years).
✓ Gender: Categorized as Male or Female.
✓ Educational Qualification: Ordinal variable (None, Primary, Secondary, Tertiary).
✓ Marital Status: Categorized as Single, Married, Divorced, Widowed.
✓ Region: Categorized as North or South (of the study zone).
✓ Physical Disability: Binary variable (Yes or No).

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- *The Depression, Anxiety, and Stress Scales (DASS-42):*

This 42-item self-report scale has three 14-item subscales. Respondents indicate the extent to which each statement applied to them over the past week on a 4-point Likert scale (0 = Did not apply to me at all, to 3 = Applied to me very much, or most of the time). Scores for each subscale are summed and classified into five severity levels. The DASS-42 showed excellent reliability in this study (See Table 1).

Table 1 Reliability Statistics for the DASS-42 (N=830)

Scale	Cronbach's Alpha (α)	Standardized Alpha	Average Inter-Item Correlation
Depression	0.87	0.87	0.32
Anxiety	0.87	0.87	0.33
Stress	0.84	0.84	0.27
Combined DAS	0.94	0.94	0.29

➢ *Ethical Considerations*

Ethical approval was obtained from a relevant institutional review board. Permission was also secured from the Nigerian Correctional Service. Informed consent was obtained from all participants after the study's purpose, procedures, risks, and benefits were explained. Anonymity and confidentiality were assured, and participants were informed of their right to withdraw at any time without penalty.

➢ *Data Analysis and Model Specification*

Data analysis was performed using R software, primarily utilizing the mvord package for multivariate ordinal regression.

- *The Multivariate Ordinal Probit Framework*

The fundamental model is based on a latent variable formulation. For each inmate *i* and for each mental health outcome *j* (where *j*=1: Depression, *j*=2: Anxiety, *j*=3: Stress), we assume a continuous latent propensity Y_{ij}^* that represents the unobserved severity of the condition.

✓ The model is specified as:

$$Y_{ij}^* = \beta_{j0} + X_i^T \beta_j + \varepsilon_{ij} \quad (1)$$

Where:

Y_{ij}^* is the latent propensity for inmate *i* on outcome *j*.

β_{j0} is the intercept for outcome *j*.

X_i is the vector of observed covariates (socio-demographic factors) for inmate *i*.

β_j is the vector of regression coefficients for outcome *j*.

ε_{ij} is the error term for inmate *i* on outcome *j*.

The errors for the three outcomes for a given inmate, $\varepsilon_i = (\varepsilon_{i1}, \varepsilon_{i2}, \varepsilon_{i3})$, are assumed to follow a multivariate normal distribution with a mean of zero and a flexible correlation matrix R. This correlation matrix captures the dependence between the latent propensities for depression, anxiety, and stress.

The observed ordinal outcome Y_{ij} (taking categories k = 1: Normal, 2: Mild, 3: Moderate, 4: Severe, 5: Extremely Severe) is linked to the latent propensity through a threshold model:

$$Y_{ij} = k \text{ if } \tau_{j,k-1} < Y_{ij}^* \leq \tau_{j,k} \quad (2)$$

where τ_j is a set of strictly increasing threshold parameters for outcome j.

- *Model Development*

Two nested models were developed:

✓ *Model 1: Baseline Multivariate Ordinal Model*

This model included only the main effects of the six socio-demographic predictors: Age, Gender, Qualification, Marital Status, Region, and Disability. Its formula is as specified above.

✓ *Model 2: Interaction-Based Multivariate Ordinal Model*

This extended model incorporated the main effects plus theoretically selected two-way interaction terms. The selection was based on psychosocial theory and empirical plausibility:

✓ Gender × Marital Status: To test if the mental health impact of marital status differs for men and women.
✓ Qualification × Region: To test if the effect of education depends on the regional context (e.g., due to different economic opportunities or cultural values).
✓ Qualification × Disability: To test if education moderates the impact of disability on mental health.
✓ Age × Gender: To test for gendered aging effects in prison.
✓ Age × Marital Status: To test if the effect of marital status varies across the life course.

The model formula becomes:

$$Y_{ij}^* = \beta_{j0} + X_i^T \beta_j + Z_i^T \gamma_j + \varepsilon_{ij} \quad (3)$$

where Z_i is the vector of interaction terms and γ_j are their corresponding coefficients.

- *Prediction of the Fitted Model*

The fitted Model 2 (the superior model) was used for prediction. The predict function in mvord was used to:

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- ✓ Predict the most likely DAS severity category for all 830 inmates, providing a cross-sectional overview of the mental health burden.
- ✓ Calculate the predicted probabilities of falling into each severity level for each inmate.
- ✓ Identify common joint DAS profiles (combinations of D, A, and S categories) to understand patterns of co-morbidity.
- ✓ Perform a scenario analysis, predicting probabilities for a prototypical high-risk inmate profile.

Model performance and comparison were assessed using Log-Likelihood, Akaike Information Criterion (AIC), and Bayesian Information Criterion (BIC). Predictive accuracy was evaluated using classification accuracy and Cohen's Kappa from confusion matrices.

IV. ANALYSIS AND RESULTS

➢ *Descriptive Statistics of DAS*

The distribution of DAS levels among the 830 inmates revealed an alarming picture of psychological distress, as summarized in Table 2.

Table 2 Prevalence of Depression, Anxiety, and Stress Levels among Inmates (N=830)

Severity Level	Depression n (%)	Anxiety n (%)	Stress n (%)
Normal	95 (11.4%)	57 (6.9%)	300 (36.1%)
Mild	142 (17.1%)	37 (4.5%)	192 (23.1%)
Moderate	312 (37.6%)	230 (27.7%)	221 (26.6%)
Severe	188 (22.7%)	209 (25.2%)	85 (10.2%)
Extremely Severe	93 (11.2%)	307 (37.0%)	32 (3.9%)
Total	830 (100%)	830 (100%)	830 (100%)

The data shows that 88.6% of inmates had some degree of depressive symptomatology, with 71.5% in the Moderate to Extremely Severe range. Anxiety was even more pervasive and severe, with 93.1% of inmates experiencing symptoms and 62.2% in the Severe to Extremely Severe categories. Stress was comparatively less severe, though 63.9% of inmates still reported levels above normal.

➢ *Model Development and Comparison*

- *Baseline Model (Model 1)*

The baseline multivariate ordinal probit model was successfully fitted. The estimated correlations between the latent outcomes were all high and statistically significant ($p < 0.001$):

- ✓ Depression-Anxiety: $\rho = 0.809$
- ✓ Depression-Stress: $\rho = 0.808$
- ✓ Anxiety-Stress: $\rho = 0.754$

These strong correlations unequivocally justify the use of a multivariate model over separate univariate analyses, as they confirm the substantial shared variance among the three constructs.

- *Interaction-Based Model (Model 2)*

The refined model, incorporating the interaction terms, was fitted. Several interactions were found to be statistically significant, providing evidence of effect heterogeneity. The most notable were:

✓ *Gender × Marital Status (Female×Divorced):*

This interaction had a significant negative coefficient for Depression ($\beta = -1.37$, $SE = 0.69$, $p < 0.05$). This indicates that the effect of being divorced on depression is different for females compared to males. The negative sign suggests that divorced female inmates report *lower* levels of depression than divorced male inmates, after accounting for other factors. This counter-intuitive finding may point to unique coping mechanisms or differing social support structures for divorced women in the prison environment.

✓ *Qualification × Region (Secondary×South):*

This interaction was positive and significant for Anxiety ($\beta = 1.25$, $SE = 0.62$, $p < 0.05$). This reveals that the relationship between having a secondary education and anxiety is modified by region. Inmates with a secondary education in the southern part of the study zone experienced significantly higher anxiety than their counterparts with the same education level in the north. This could be due to higher expectations, greater awareness of lost opportunities, or different prison conditions in the south.

✓ *Qualification × Disability (Secondary×No):*

This interaction was negative and significant for Depression ($\beta = -1.59$, $SE = 0.75$, $p < 0.05$). This suggests that the combination of having a secondary education and no physical disability serves as a protective factor against depression. Education may provide cognitive resources that help non-disabled inmates cope more effectively with the prison environment.

- *Model Fit Comparison*

The two models were compared using standard fit statistics, as shown in Table 3.

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Table 3 Model Fit Statistics for Baseline and Interaction-Based Models

Criterion	Baseline Model (M1)	Interaction-Based Model (M2)	Interpretation
Log-Likelihood	-4315.69	-4254.59	A higher (less negative) value indicates a better fit. M2 is superior.
Akaike (AIC)	8811.23	8791.96	A lower value indicates a better fit, penalizing complexity. M2 is superior.
Bayesian (BIC)	9203.74	9409.10	A lower value is better, with a stronger penalty. M1 is preferred on this metric.

The interaction-based model (M2) demonstrates a better fit as per the Log-Likelihood and AIC, which are often prioritized for model selection when the goal is explanation and prediction. The higher BIC for M2 is expected due to the large penalty for the additional parameters; however, the substantial improvement in AIC supports the selection of M2 as the more appropriate model for understanding the complex data structure (Burnham & Anderson, 2019).

➢ *Prediction of DAS*

Using the superior Model 2, the predicted DAS levels for the inmate population were generated.

- *Overall Predicted Prevalence*

Table 4 shows the predicted categories based on the model.

Table 4 Predicted Severity Categories for DAS Among Inmates (N=830)

Severity Category	Depression n (%)	Anxiety n (%)	Stress n (%)
Normal	44 (5.3%)	33 (4.0%)	400 (48.2%)
Mild	240 (28.9%)	0 (0.0%)	0 (0.0%)
Moderate	178 (21.4%)	365 (44.0%)	407 (49.0%)
Severe	352 (42.4%)	43 (5.2%)	13 (1.6%)
Extremely Severe	16 (1.9%)	389 (46.9%)	10 (1.2%)
Total	830 (100%)	830 (100%)	830 (100%)

The predictions align with the descriptive statistics but provide a model-based smoothing of the data. They starkly highlight that the most likely outcome for a typical inmate is Severe Depression (42.4%) and Extremely Severe Anxiety (46.9%), while stress is most likely to be Moderate (49.0%) or Normal (48.2%).

- *Joint DAS Profiles*

A powerful feature of the multivariate model is its ability to predict combinations of outcomes. The inmates clustered into 12 distinct joint profiles. The most frequent profiles are shown in Table 5.

Table 5 Most Prevalent Joint DAS Profiles Among Inmates

Rank	Profile Description (DAS)	Frequency (n)	Percentage (%)
1	Severe, Extremely Severe, Moderate	343	41.3%
2	Mild, Moderate, Normal	240	28.9%
3	Moderate, Moderate, Normal	114	13.7%
4	Moderate, Severe, Moderate	43	5.2%
5	Normal, Normal, Normal	33	4.0%

Profile 1, affecting 41.3% of the population, represents the most critically distressed group, suffering from the worst levels of depression and anxiety concurrently. This profile is a clear target for urgent and intensive mental health intervention.

- *Predictive Scenario Analysis*

To illustrate the model's utility for risk assessment, we predicted probabilities for a prototypical inmate: a 30-year-old, married female from the northern region with a secondary education and no physical disability. The predicted probabilities for each severity level are in Table 6.

Table 6 Predictive Probabilities for a Prototypical High-Risk Inmate

Category	Depression	Anxiety	Stress
Normal	0.302	0.161	0.587
Mild	0.000	0.000	0.000
Moderate	0.264	0.084	0.209
Severe	0.316	0.364	0.159
Extremely Severe	0.096	0.219	0.038

This analysis shows that this inmate has a 41.2% chance of Severe or Extremely Severe depression and a 58.3% chance of Severe or Extremely Severe anxiety, but only a 19.7% chance of Severe or Extremely Severe stress. This nuanced profile can directly inform a tailored treatment plan,

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focusing primarily on her high risk for anxiety and depression.

V. FINDINGS, RECOMMENDATIONS AND CONCLUSION

➢ *Summary of Findings*

This study set out to develop and compare models for assessing DAS among inmates in North Central Nigeria. The key findings are:

- *High Prevalence of DAS:*

There is an alarming prevalence of depression and anxiety among the inmate population, with the majority experiencing moderate to extremely severe symptoms. Anxiety is the most severe of the three conditions.

- *Superiority of the Multivariate Interaction Model:*

The interaction-based multivariate ordinal regression model (Model 2) provided a significantly better fit to the data than the baseline model (Model 1), as evidenced by a superior AIC and Log-Likelihood.

- *Existence of Effect Heterogeneity:*

The analysis confirmed that the effects of socio-demographic factors are not constant. Significant interactions were found, demonstrating that the impact of marital status on depression is gendered, the effect of education on anxiety is regional, and the combination of education and disability status influences depression.

- *Utility for Risk Prediction:*

The model successfully identified distinct joint DAS profiles, with the largest group (41.3%) suffering from co-occurring Severe Depression and Extremely Severe Anxiety. Predictive scenarios can be used to identify high-risk individuals for proactive intervention.

➢ *Discussion of Findings*

The findings resonate strongly with theoretical frameworks. The high levels of DAS are a direct reflection of the strains and deprivations outlined by Agnew (1992) and Sykes (1958). The prison environment systematically strips away positive stimuli and imposes negative ones, creating a fertile ground for psychological distress.

The critical methodological finding is the value of modelling interaction effects. The significant Gender × Marital Status interaction underscores that the experience of incarceration is not monolithic; it is shaped by intersecting social identities. The finding that divorced women were less depressed than divorced men challenge simplistic assumptions and calls for qualitative research to uncover the underlying social dynamics. Similarly, the Qualification × Region interaction shows that the meaning and psychological impact of education are context-dependent, likely tied to local labour markets and cultural values. By capturing these specifics, the interaction-based model offers a more authentic representation of social reality.

➢ *Recommendations*

Based on the findings, the following recommendations are proposed:

- *For the Nigerian Correctional Service (NCoS):*

✓ *Implement Routine Mental Health Screening:*

The DASS-42 should be integrated into the intake process and administered periodically. The identified risk factors and interactions can be used to flag high-risk inmates automatically.

✓ *Develop Tiered Intervention Programs:*

Resources should be allocated based on the identified joint profiles. The 41.3% of inmates with the "Severe-Extremely Severe-Moderate" profile require immediate and intensive therapy (e.g., CBT, group therapy), while those with milder profiles may benefit from psychoeducational workshops and peer support.

✓ *Train Correctional Staff:*

Officers should receive training on recognizing signs of severe depression and anxiety, de-escalation techniques, and making appropriate referrals to healthcare staff.

- *For Mental Health Practitioners:*

✓ *Adopt an Intersectional Approach in Therapy:*

Clinical assessments and interventions should consider the interplay of an inmate's gender, marital status, education, and region. Therapy for a married male inmate from the south should be cognizant of the unique pressures these identities may create.

✓ *Focus on Anxiety Management:*

Given the extreme prevalence of anxiety, programs specifically targeting anxiety reduction (e.g., mindfulness, relaxation training, exposure therapy for specific fears) should be a top priority.

- *For Policy Makers:*

✓ *Increase Funding for Prison Mental Health:*

The results provide compelling evidence of a severe public health crisis within prisons, justifying increased budgetary allocations for mental health professionals, medications, and therapeutic facilities.

✓ *Promote Gender-Sensitive and Disability-Inclusive Policies:*

Policies and prison conditions must be adapted to address the specific vulnerabilities of female inmates and those with physical disabilities, as identified in the model.

- *For Researchers:*

✓ *Adopt Advanced Modelling Techniques:*

Future studies on correlated ordinal outcomes in public health should employ multivariate ordinal regression as a gold standard.

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✓ *Incorporate Interaction Effects:*

Researchers should routinely test for theoretically justified interactions to uncover the complex determinants of health outcomes.

✓ *Conduct Longitudinal Studies:*

Future research should track inmates over time to understand how DAS levels change throughout the incarceration period and how these trajectories are influenced by the factors identified here.

➢ *Conclusion*

This study has demonstrated that the mental health of inmates is a complex phenomenon driven by a web of interrelated personal and contextual factors. By developing and validating an interaction-based multivariate ordinal regression model, we have provided a sophisticated analytical tool that captures this complexity. The model moves beyond describing *what* factors are associated with DAS to illuminate *for whom* and *under what conditions* these associations are strongest. The findings reveal a profound and nuanced mental health crisis in Nigerian prisons, characterized by severe and co-morbid depression and anxiety. The application of this model offers a clear path forward for transforming correctional mental healthcare from a generic service to a targeted, efficient, and humane system capable of addressing the specific needs of its most vulnerable inhabitants. The methodology and findings are not only relevant for Nigeria but for any correctional system seeking to use data-driven insights to mitigate the profound psychological toll of incarceration.

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