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The Effects of Loadshedding on the Mental Health of Residents in Zambia

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ABSTRACT

Load shedding, defined as the scheduled interruption of electricity supply to balance electricity demand and generation capacity, has become a persistent challenge in Zambia, particularly following the severe drought conditions affecting hydroelectric power generation. While the economic and infrastructural consequences of load shedding are well documented, less attention has been given to its psychological and mental health implications. This study examined how load shedding affects mental health among Zambian residents, focusing on stress, sleep disruption, coping strategies, and socioeconomic vulnerability.

A cross-sectional online survey involving 378 respondents was conducted using a structured questionnaire incorporating demographic variables, load-shedding experiences, coping strategies, and self reported mental health indicators derived from the Depression, Anxiety and Stress Scale (DASS-21). Data were analysed using descriptive statistics, chi-square tests, and logistic regression models.

The findings demonstrated that load shedding was significantly associated with stress, disruption of daily routines, sleep disturbances, and poorer self-rated mental health outcomes. Frequent and prolonged power outages were strongly associated with psychological distress, particularly among low-income households and residents of high-density residential areas. Sleep disruption emerged as an important predictor of poorer mental health outcomes. Respondents with limited access to alternative energy solutions reported greater psychological strain compared to those with access to coping resources such as solar energy and rechargeable systems.

The study further established that socioeconomic status influenced coping capacity during periods of energy insecurity. Passive coping strategies, including reliance on candles or lack of alternative power solutions, were associated with poorer mental health outcomes. The findings highlight the importance of integrating mental health considerations into national energy policy and public health planning.

The study concludes that load shedding constitutes a significant environmental stressor with important implications for mental well-being in Zambia. Strengthening energy infrastructure, improving the predictability of power outages, subsidising alternative energy solutions for vulnerable households, and expanding mental health support services may help reduce the psychological burden associated with chronic electricity shortages.

Keywords: Load shedding, mental health, stress, sleep disruption, energy insecurity, coping strategies, Zambia.

INTRODUCTION

Background

Load shedding is the controlled process of turning off portions of the electrical grid to prevent a complete shutdown due to excessive demand (Smith, 2022). It has become a common occurrence in Zambia over the past decade, reaching its worst in 2024. Zambia largely depends on hydroelectric power, and the severe drought of the 2023/2024 rainy season has led to depletion of water reservoirs used for power generation (Chanda et al., 2024). This has resulted in a severe shortage of power, leading to frequent and prolonged power outages throughout the country. Frequent power outages can cause significant disruptions in both personal and professional lives (Moyo, 2022). For example, at the time of this study, households and business enterprises were received only 3 hours of grid power supply in a 24-hour period. While the economic and logistical impacts of load shedding are well-documented (Kumar et al., 2022), the psychological and mental health consequences of this practice are less well understood (Patel et al., 2019). The unpredictability and frequency of power cuts may lead to heightened stress, anxiety, and depressive symptoms, particularly in urban settings, where modern living is heavily reliant on electricity (Dlamini et al., 2020). Mental health issues associated with disruptions to routine and environmental stressors are well-established in psychological literature. Previous research indicates that external stressors, such as natural disasters, economic instability, and infrastructural problems, have a direct impact on mental health outcomes (World Health Organization [WHO], 2021). Load shedding could act as a chronic environmental stressor, contributing to the overall burden of mental illness in Zambia. This study aims to examine the relationship between load shedding and mental health outcomes among the Zambian population, particularly focusing on stress, anxiety, and depression.

Statement of the Problem

Zambia, like many African countries, experiences energy shortages that necessitate load shedding. In sub-Saharan Africa, many countries rely on load shedding to manage demand and supply mismatches (Eberhard et al., 2017; World Bank, 2021). In Zambia, load shedding is now a daily occurrence, particularly in urban centres like Lusaka, with power cuts lasting for several hours (ZESCO, 2020; Chisanga et al., 2018). Although the inconvenience caused by load shedding is obvious, its long-term effects on the mental well-being of the population have not been adequately studied. The emotional burden of unpredictability, the disruption of daily activities, and the economic pressures caused by power cuts can all contribute to mental health challenges, as noted in other developing nations facing energy crises (Dlamini et al., 2020; Patel et al., 2019). Mental health is increasingly recognized as a public health priority in Zambia, where socio-economic and environmental stressors contribute to a growing prevalence of mental health issues (Ngoma et al., 2013; WHO, 2020). Given the growing concerns about mental health in Zambia, this research seeks to identify the psychological impacts of load shedding among its residents.

Justification of the Study

Understanding the effects of load shedding on mental health is crucial for several reasons. Firstly, mental health is an often-overlooked aspect of public health, particularly in low- and middle-income countries like Zambia (Patel et al., 2018). Secondly, load shedding is unlikely to disappear soon, making it necessary to develop strategies that mitigate its adverse effects on residents. Finally, identifying and addressing the mental health implications of load shedding will provide a foundation for policymakers to improve the quality of life for Zambian population, whether through better communication, infrastructural changes, or mental health support services.

Research Objectives

General Objective

To explore the effects of load shedding on the mental health of the Zambian population.

Specific Objectives

1. To assess the levels of stress, anxiety, and depression among the Zambian population during periods of load shedding.

2. To examine whether the duration and frequency of load shedding contribute to worsened mental health outcomes in the Zambian population.

3. To determine the demographic factors (age, gender, socio-economic status) influencing the mental health impacts of load shedding in the Zambian population.

Research Questions

1. How does load shedding affect the mental health of the Zambian population?

2. Does the frequency and duration of load shedding episodes correlate with increased levels of stress, anxiety, or depression in the Zambian population?

3. Are certain demographic groups more vulnerable to the mental health effects of load shedding in the Zambian population?

Theoretical Framework

This study was guided by Environmental Stress Theory, which explains how chronic environmental disruptions and infrastructural instability can negatively influence psychological well-being (Evans & Cohen, 1987; Lazarus & Folkman, 1984). The theory posits that persistent environmental stressors overwhelm an individual's adaptive capacity, thereby increasing vulnerability to psychological distress, emotional exhaustion, and impaired mental functioning (Evans & Kim, 2013).

In the context of Zambia, load shedding represents a chronic environmental stressor because it disrupts essential daily activities, interferes with work and education, compromises sleep quality, and creates uncertainty regarding household functioning and economic productivity. Repeated exposure to prolonged and unpredictable power outages may therefore contribute to heightened stress, frustration, emotional instability, and reduced psychological well-being (World Health Organization [WHO], 2022; United Nations Development Programme [UNDP], 2023).

The framework further suggests that access to coping resources may moderate the psychological effects of environmental stressors. Individuals with greater socioeconomic resources are more likely to access adaptive coping mechanisms such as solar power systems, generators, and rechargeable lighting solutions. In contrast, economically vulnerable populations may experience greater psychological strain due to limited adaptive capacity (Pearlin et al., 1981; Hobfoll, 1989).

This theoretical perspective provides an appropriate framework for understanding the relationship between load shedding, coping mechanisms, socioeconomic vulnerability, and mental health outcomes in the present study.

METHODOLOGY

Study Design

This study employed a cross-sectional online survey to assess the impact of load shedding on mental health among the Zambian population.

Study Population

The target population for this study was adult members of the population who have experienced load shedding within the past six months.

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Sample Size

The formula for sample size calculation of unknown population size was used to estimate the sample size:

$n=Z^2p(1-p)/d^2$

Where;

n = the sample size,

Z = the standard normal deviate at 95% confidence (1.96),

p= Estimated prevalence is 70% since no similar study has been done before

d^2 = precision (0.05).; giving a sample size of 323.

Therefore 323 is the minimum sample size to be recruited.

Sampling Technique and Frame

Convenience voluntary response sampling was used as this was an online survey. Respondents were invited to take part in the survey through online forums and social media groups. The survey was closed once the desired sample size was reached.

Data Collection Tools

Data was collected through a structured questionnaire that included demographic data, frequency and duration of load shedding, as well as its perceived impact and mental health outcomes using the Depression, Anxiety, and Stress Scale (DASS-21).

Validity and Reliability of the Research Instrument

The questionnaire used in this study incorporated demographic variables, load-shedding experiences, coping strategies, and mental health indicators adapted from the Depression, Anxiety and Stress Scale (DASS-21). The instrument was reviewed by individuals with expertise in public health and mental health research to assess clarity, relevance, and content validity.

Prior to data collection, the questionnaire was piloted among a small group of respondents to evaluate comprehensibility, wording, and appropriateness within the Zambian context. Feedback obtained from the pilot exercise informed minor revisions to improve clarity and consistency.

Although the study utilised selected indicators derived from the DASS-21, the instrument was not formally subjected to psychometric validation within the local context. Consequently, the mental health findings should be interpreted cautiously and understood primarily as indicators of self-reported psychological distress rather than clinical diagnostic outcomes.

Future studies are encouraged to conduct formal reliability testing, including Cronbach's alpha analysis and construct validation, to strengthen the psychometric robustness of the instrument within the Zambian population.

Data Analysis

Data was analysed using Microsoft Excel and STATA Software, Version 17. The results were displayed in the form of figures and tables.

Ethical Considerations

Ethical approval was obtained from the Texila American University Research Ethics Committee (TAUREC). Participants were informed about the study's objectives, and informed consent was implicitly obtained by the respondent agreeing to take the online survey. Confidentiality and anonymity of participants were observed, and no personal identifiable data was collected. There was no reward or inducement for taking part in the study.

RESULTS

Demographic Information

The study surveyed 378 respondents across various demographic groups to assess the impact of load shedding on mental health. The sample comprised 231 females (61.1%) and 147 males (38.9%), with the majority (52.4%) falling within the 18-30 age groups. Notably, there was a sharp decline in participation among older age groups, with only 6.4% aged 51 or above, highlighting potential generational disparities in engagement with online surveys.

Marital Status and Education Level

The largest proportion of respondents were single (52.4%), followed by married individuals (42.9%) while a minority identified as divorced/separated (4%) or widowed (0.8%). Educational attainment was predominantly high, with 77.8% of participants holding a tertiary diploma or degree and 15.1% having postgraduate qualifications. In contrast, only 7.1% had a secondary education or lower, suggesting that individuals with higher education levels may have been more likely to participate in the study.

Employment and Income Distribution

Regarding employment, 43.7% of respondents were in full-time employment, followed by 34.1% students and 8.7% self-employed individuals. Unemployment was reported in 8.7% of the sample, and 6.3% were engaged in part-time work.

A key finding related to household income disparities. While 12.7% of respondents earned below ZMW 1,000 per month, the majority fell within the ZMW 1,001-10,000 range (57.9%). Interestingly, 29.4% reported earning over ZMW 10,000, which may reflect the sample's skew toward higher-income, urban-based participants with access to alternative power solutions.

Residential Area Distribution

Most respondents (61.1%) resided in medium-density areas, with 23% in low-density neighbourhoods and 12.7% in high-density areas. Notably, those from high-density neighbourhoods reported significantly lower incomes, aligning with previous research indicating higher exposure to load shedding and limited access to alternative energy sources in lower-income communities.

These findings provide critical insights into the socio-economic and demographic landscape of individuals affected by load shedding in Zambia.

Table 1 Demographic factors of the respondents

Variable	18–30 n (%)	31–40 n (%)	41–50 n (%)	≥51 n (%)	Total
Gender					
Female	141 (61)	51 (22)	33 (14)	6 (3)	231
Male	57 (39)	36 (24)	33 (22)	21 (14)	147

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Marital status					
Married	30 (19)	60 (37)	54 (33)	18 (11)	162
Single	168 (85)	27 (14)	3 (2)	0 (0)	198
Divorced/Separated	0 (0)	0 (0)	6 (40)	9 (60)	15
Widowed	0 (0)	0 (0)	3 (100)	0 (0)	3
Education level					
Secondary or below	21 (78)	0 (0)	3 (11)	3 (11)	27
Tertiary	174 (59)	69 (23)	42 (14)	9 (3)	294
Postgraduate	3 (5)	18 (32)	21 (37)	15 (26)	57
Employment status					
Full-time	33 (20)	69 (42)	48 (29)	15 (9)	165
Student	126 (98)	3 (2)	0 (0)	0 (0)	129
Unemployed	27 (82)	0 (0)	3 (9)	3 (9)	33
Other employment	12 (24)	15 (29)	15 (29)	9 (18)	51
Residential area					
High density	18 (38)	12 (25)	15 (31)	3 (6)	48
Low density	39 (45)	18 (21)	12 (14)	18 (21)	87
Medium density	129 (56)	57 (25)	39 (17)	6 (3)	231
Other	12 (100)	0 (0)	0 (0)	0 (0)	12

Load shedding patterns by Residential Area

The frequency of load shedding varied significantly across different residential areas (Pearson Chi² = 58.64, $p < 0.01$), indicating a strong association between where individuals live and how often they experience power outages.

High-density and medium-density areas were most affected by frequent power cuts, with 18.3% of high-density residents and 59.8% of medium-density residents experiencing load shedding multiple times a day.

In contrast, low-density areas reported less frequent outages, with 34.2% experiencing load shedding once a day and only 18.3% experiencing it multiple times a day.

Occasional power cuts (a few times a month or a few times a week) were rare, reported primarily in low-density (33.3%) and medium-density (66.7%) areas, while no respondents in high-density areas experienced such infrequent disruptions.

This pattern reveals a disparity in power supply reliability, where higher-density areas bear the brunt of frequent outages, further exacerbating existing socio-economic inequalities.

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Duration of Load Shedding

The length of load-shedding periods also differed significantly across neighbourhoods (Pearson $Chi^2 = 42.37$, $p < 0.01$).

Prolonged blackouts (18-24 hours or more) were more common in high-density areas, where nearly 24% of respondents experienced load shedding exceeding 24 hours, compared with 21.4% in low-density and 50% in medium-density areas.

Shorter outages (less than 10 hours) were primarily reported in low-density (38.5%) and medium-density (61.5%) areas, indicating greater grid stability in wealthier neighbourhoods.

These findings reinforce concerns about unequal access to reliable electricity, particularly for residents in high-density areas, who are not only experiencing frequent but also longer-lasting power cuts.

Timing of Load Shedding

The time of the day when power cuts occurred was also significantly associated with residential areas (Pearson $Chi^2 = 39.96$, $p < 0.01$).

The most common response was that load shedding timing varied, with 60.6% of medium-density, 22.2% of low-density, and 13.1% of high-density residents reporting unpredictable outages.

Evening outages were disproportionately experienced by medium-density residents (85.7%), potentially affecting household routines, including study and work-from-home activities.

Interestingly, night-time outages were most frequently reported in high-density (33.3%) and low-density (50%) areas, potentially compromising safety, security, and sleep quality.

Morning outages exclusively affected medium-density residents (100%), possibly due to grid scheduling preferences favouring commercial districts.

These results highlight a critical disparity in load-shedding experiences across different residential settings. The higher frequency and longer duration in high-density areas likely contribute to greater mental health strain, increased financial burden due to higher dependence on alternative power sources, and disruptions in daily activities. Targeted interventions, such as infrastructure improvements in vulnerable neighbourhoods and more predictable load-shedding schedules, could help mitigate these effects.

Table 2 Load-shedding patterns by residential area.

Variables	High density	Low density	Medium density	Other	Total
How frequently do you experience load shedding?					
A few times a month	0 (0%)	3 (33%)	6 (67%)	0 (0%)	9 (100%)
A few times a week	0 (0%)	0 (0%)	6 (67%)	3 (33%)	9 (100%)
Once a day	3 (3%)	39 (34%)	72 (63%)	0 (0%)	114 (100%)
Multiple times a day	45 (18%)	45 (18%)	147 (60%)	9 (4%)	246 (100%)
	Pearson $Chi^2 = 58.64$, Prob = 0.0000				
How long do the load shedding periods typically last?					

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Less than 10 hours	0 (0%)	15 (38%)	24 (62%)	0 (0%)	39 (100%)
12–18 hours	6 (8%)	24 (33%)	42 (58%)	0 (0%)	72 (100%)
18–24 hours	12 (9%)	21 (15%)	102 (72%)	6 (4%)	141 (100%)
More than 24 hours	30 (24%)	27 (21%)	63 (50%)	6 (5%)	126 (100%)
	Pearson Chi^2 = 42.37, Prob = 0.0000				
At what time of day do you most frequently experience load shedding?					
Afternoon	3 (13%)	9 (38%)	12 (50%)	0 (0%)	24 (100%)
Evening	0 (0%)	3 (14%)	18 (86%)	0 (0%)	21 (100%)
It varies	39 (13%)	66 (22%)	180 (61%)	12 (4%)	297 (100%)
Morning	0 (0%)	0 (0%)	18 (100%)	0 (0%)	18 (100%)
Night	6 (33%)	9 (50%)	3 (17%)	0 (0%)	18 (100%)
	Pearson Chi^2 = 39.96, Prob = 0.0001				
Total	48 (13%)	87 (23%)	231 (61%)	12 (3%)	378 (100%)

Coping Strategies for Load shedding

The study found significant disparities in coping strategies for load shedding based on both residential area and household income levels s (Pearson Chi^2 = 59.26, $p < 0.01$ for residential area; Pearson Chi^2 = 61.39, $p < 0.01$ for income level). These results highlight inequalities in access to alternative power sources, where financial resources dictate whether individuals can actively mitigate the impact of power outages or are forced to endure them.

Coping Mechanisms by Residential Area (Table 3)

Wealthier low-density residents (42.9%) favoured solar energy, an option requiring high upfront costs but offering long-term benefits. Medium-density residents were the most adaptive, with 71.2% using a mix of solutions, suggesting that greater financial stability enables them to diversify coping mechanisms.

High-density residents were more likely to do nothing (17.4%) or rely on candles (17.7%), indicating limited financial means to invest in alternative power solutions. Generators were mainly used in high-density areas (60%), but their overall adoption was low (n = 5), likely due to their high operational costs.

Table 3 Coping Mechanisms by Residential Area

How do you typically cope with load shedding?	High density	Low density	Medium density	Other	Total
Use rechargeable lights	10 (11%)	27 (29%)	53 (58%)	2 (2%)	92 (100%)
Mix of solutions	14 (10%)	27 (18%)	104 (71%)	1 (1%)	146 (100%)
Use a generator	3 (60%)	0 (0%)	2 (40%)	0 (0%)	5 (100%)

Use solar power	6 (12%)	21 (43%)	22 (45%)	0 (0%)	49 (100%)
Use candles	3 (18%)	3 (18%)	11 (65%)	0 (0%)	17 (100%)
Do nothing	12 (17%)	9 (13%)	39 (57%)	9 (13%)	69 (100%)
Total	48 (13%)	87 (23%)	231 (61%)	12 (3%)	378 (100%)
	Pearson Chi^2 = 59.26, Prob = 0.0000				

Coping Mechanisms by household Income

Higher-income households (ZMW 10,000+) were significantly likely to use generators (60%) and mixed solutions (33.6%), suggesting that greater access to costly but effective alternatives.

Middle-income earners (ZMW 5,001-10,000) favoured rechargeable lights (44.6%) and solar power (48.9%), reflecting a balance between affordability and sustainability.

Lower-income groups (ZMW <1,000) had the fewest options, with 17.4% doing nothing and 11.9% relying solely on rechargeable lights, suggesting limited capacity to mitigate power outages.

Table 4 Coping mechanisms by Household Income

Monthly Household Income (ZMW)

How do you typically cope with load shedding?	1001–5000	5001–10000	Less than 1000	More than 10000	Total
Use rechargeable lights	18 (20%)	41 (45%)	11 (12%)	22 (24%)	92 (100%)
Mix of solutions	57 (39%)	15 (10%)	25 (17%)	49 (34%)	146 (100%)
Use a generator	1 (20%)	1 (20%)	0 (0%)	3 (60%)	5 (100%)
Use solar power	13 (27%)	24 (49%)	0 (0%)	12 (24%)	49 (100%)
Use candles	4 (24%)	9 (53%)	0 (0%)	4 (24%)	17 (100%)
Do nothing	15 (22%)	21 (30%)	12 (17%)	21 (30%)	69 (100%)
Total	108 (29%)	111 (29%)	48 (13%)	111 (29%)	378 (100%)
	Pearson Chi^2 = 61.39, Prob = 0.0000				

These findings indicate that coping with load shedding is largely a function of financial capacity. While high-income earners can afford generators and solar solutions, low-income households are often left without viable options, exacerbating the mental and economic strain caused by frequent power cuts.

Mental Health Impact of Load shedding

The study revealed a strong and statistically significant association between load shedding-related stress, routine disruptions, and sleep loss with overall mental health ratings (Pearson Chi² values ranging from 183.76 to 301.76, $p < 0.01$). These findings underscore the severe psychological toll of frequent power outages, particularly for individuals experiencing high levels of stress and significant disruptions to daily life as shown in Table 5.

Association between stress levels and Mental Health Ratings

Individuals who reported extreme stress due to load shedding had the worst mental health outcomes, 51.9% rating their mental health as "poor" and 22.2% as "very poor".

Conversely, respondents who reported little to no stress had the highest mental health ratings, with 60% rating their mental health as "excellent" and 40% as "good".

Moderate stress was associated with fair to poor mental health, with 58.8% rating their mental health as "fair" and 8.8% "poor".

These results highlight a clear dose-response relationship: as stress levels increase, mental health outcomes decline sharply. The absence of respondents with extreme stress reporting "good" or "excellent" mental health suggests that load-shedding-induced stress is a critical determinant of psychological distress.

Impact of Routine Disruptions in Power Supply on Mental Health

Individuals who indicated severe impacts ("very much" or "extremely") were strongly linked to poor mental health ratings, with 51.9% of those who reported extreme disruption rating their mental health as "poor" and 22.2% as "very poor".

Among those who experienced only minimal disruption, 40% rated their mental health as "good" and 60% as excellent, reinforcing the protective effect of stability in daily routines.

The similarity in distribution between stress levels and routine disruptions suggests that unpredictability and disruptions to daily activities may be key contributors to stress-related mental health decline.

Sleep loss and Mental Health Outcomes

Significant sleep loss was most strongly associated with poor mental health, with 50% of affected individuals rating their health as "poor" and 28.6% as "very poor".

Moderate sleep loss had a slightly less severe impact, with 42.9% of affected individuals reporting "poor" mental health and 8.2% reporting "very poor" mental health.

In contrast, those with no sleep loss reported the highest mental health scores, with 50% rating their mental health as "good" or "excellent".

These findings align with existing literature linking sleep deprivation to increased anxiety, depression, and emotional distress, emphasising that frequent night time power outages may be a key driver of psychological distress in affected communities.

Table 5 Mental Health Impact of Load Shedding

	How would you rate your overall mental health during periods of load shedding?					
Variables	**Very poor**	**Poor**	**Fair**	**Good**	**Excellent**	**Total**
Have you ever experienced stress because of load shedding?						
Not at all	0 (0%)	0 (0%)	0 (0%)	6 (40%)	9 (60%)	15 (100%)
A little	0 (0%)	0 (0%)	9 (43%)	6 (29%)	6 (29%)	21 (100%)

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Moderate	0 (0%)	9 (9%)	60 (59%)	30 (29%)	3 (3%)	102 (100%)
Very much	9 (12%)	33 (42%)	33 (42%)	3 (4%)	0 (0%)	78 (100%)
Extremely	36 (22%)	84 (52%)	42 (26%)	0 (0%)	0 (0%)	162 (100%)
	Pearson Chi^2 = 212.66, Prob < 0.01					
How much does load shedding disrupt your daily routine?						
Not at all	0 (0%)	0 (0%)	0 (0%)	6 (40%)	9 (60%)	15 (100%)
A little	0 (0%)	0 (0%)	9 (43%)	6 (29%)	6 (29%)	21 (100%)
Moderate	0 (0%)	9 (9%)	60 (59%)	30 (29%)	3 (3%)	102 (100%)
Very much	9 (12%)	33 (42%)	33 (42%)	3 (4%)	0 (0%)	78 (100%)
Extremely	36 (22%)	84 (52%)	42 (26%)	0 (0%)	0 (0%)	162 (100%)
	Pearson Chi^2 = 301.76, Prob < 0.01					
How much sleep do you lose due to load shedding?						
No sleep loss	3 (4%)	6 (8%)	27 (38%)	18 (25%)	18 (25%)	72 (100%)
Minimal sleep loss	6 (8%)	15 (20%)	33 (44%)	21 (28%)	0 (0%)	75 (100%)
Moderate sleep loss	12 (8%)	63 (43%)	66 (45%)	6 (4%)	0 (0%)	147 (100%)
Significant sleep loss	24 (29%)	42 (50%)	18 (21%)	0 (0%)	0 (0%)	84 (100%)
	Pearson Chi^2 = 183.76, Prob < 0.01					
Total	45 (12%)	126 (33%)	144 (38%)	45 (12%)	18 (5%)	378 (100%)
	Pearson Chi^2 = 301.76, Prob = 0.0000					

Predictors of Sleep Disruption During Load Shedding

To assess the factors influencing sleep disturbances during load shedding, we conducted a logistic regression analysis, examining the role of the area of residence, timing of outages, duration of outages, and frequency of load shedding. The model was statistically significant (LR Chi^2 = 84.96, $p < 0.01$), explaining approximately 25% of the variance in sleep disturbances.

Residential Area and Sleep Disruptions

Residents who responded “Other”, were less likely to experience sleep disturbances than those in high-density areas (OR = 0.071, $p < 0.01$), indicating that urban residents are more vulnerable to load shedding-induced sleep disruption.

Low-density (OR = 0.72, p = 0.65) and medium-density (OR = 0.38, p = 0.17) areas did not show significant differences, suggesting that household infrastructure and alternative energy access may mitigate sleep disturbances in regions.

Timing of Load Shedding and Sleep Disruptions

Outages occurring in the morning (OR = 6.97, p = 0.03) and those that varied unpredictably (OR = 4.76, p < 0.01) were significantly associated with increased odds of sleep disturbances.

Night-time outages (OR = 2.78, p = 0.19) and evening outages (OR = 1.16, p = 0.84) were not statistically significant predictors, which may suggest that households have better adaptation mechanisms (e.g., backup lighting, adjusted sleep schedules) when power cuts are expected at night.

Duration of Load Shedding and Sleep Disruptions

Longer power cuts were strong predictors of sleep loss:

18–24-hour outages increased the likelihood of sleep disturbances nearly 15-fold (OR = 14.77, p < 0.01).

Outages exceeding 24 hours a similar impact (OR = 12.84, p < 0.01).

Shorter outages (12-18 hours) had no significant effect (OR = 0.98, p = 0.98), indicating that brief disruptions may not drastically affect sleep quality.

Frequency of Load Shedding and Sleep Disturbances

The impact of load shedding frequency could not be fully assessed because of collinearity:

"A few times a week" (OR = 1.37, p = 0.72) and "once a day" (OR = 1.55, p = 0.24) were not significant predictors, suggesting duration and unpredictability of load shedding may be more than sheer frequency.

Residents in urban high-density areas suffer the most from sleep disturbances due to load shedding, likely due to higher exposure to frequent and prolonged outages. Unpredictable outages significantly worsen sleep quality, highlighting the need for consistent and scheduled power cuts to allow households to adapt. Long-duration power cuts (18+ hours) are the strongest predictors of sleep loss, reinforcing the need for energy policy interventions to reduce prolonged blackouts. Night time outages, surprisingly, were not significant predictors of sleep disruption, suggesting adaptation mechanisms may be effective.

Table 6 Predictors of Sleep loss during load shedding

Variable	OR	95% CI	p-value
Where do you reside? – High-density (Ref)	1.00	Reference	—
Low density	0.72	0.17–2.98	0.645
Medium density	0.38	0.10–1.52	0.171
Other	0.07	0.01–0.48	0.006***
At what time of day do you most frequently experience load shedding? – Afternoon (Ref)	1.00	Reference	—
Evening	1.16	0.26–5.27	0.844
It varies	4.77	1.54–14.75	0.007***
Morning	6.97	1.23–39.64	0.028**
Night	2.78	0.60–12.79	0.190

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How long do the load shedding periods typically last? – Less than 10 hours (Ref)	1.00	Reference	—
12–18 hours	0.99	0.36–2.67	0.976
18–24 hours	14.77	4.51–48.41	0.000***
More than 24 hours	12.84	3.73–44.19	0.000***
How frequently do you experience load shedding? – A few times a month (Ref)	1.00	Reference	—
A few times a week	1.37	0.25–7.56	0.720
Once a day	1.55	0.71–3.39	0.274
Constant	0.60	0.09–3.89	0.592

*** p < .01, ** p < .05, * p < .1

Depression, Anxiety and Stress Scale (DASS-21)

The DASS-21 was used as a screening tool to assess self-reported symptoms associated with depression, anxiety, and stress during periods of load shedding. Respondents rated the extent to which each statement applied to them over the preceding week using a four-point Likert scale ranging from 0 (“Did not apply to me at all”) to 3 (“Applied to me very much or most of the time”).

The findings suggested mild levels of depressive and stress-related symptoms among respondents. The depression subscale score indicated mild depressive symptoms, while the stress subscale reflected mild stress-related psychological strain. Anxiety scores remained within the normal range overall.

These findings suggest that load shedding may primarily contribute to stress-related psychological distress, routine disruption, frustration, and sleep disturbance rather than severe anxiety symptomatology. The findings further indicate that the psychological burden of energy insecurity may be more strongly associated with chronic environmental stress and disruption of daily functioning than with clinically significant anxiety disorders.

Because selected indicators, rather than the complete validated DASS-21 framework, were utilised, the findings should be interpreted cautiously and not regarded as formal clinical diagnoses.

Table 7 DASS Severity Ratings

Depression Subscale

Parameter	**Never n (%)**	**Sometimes n (%)**	**Often n (%)**	**Always n (%)**	**Mean Score**
I couldn’t seem to experience any positive feelings	113 (29.9)	106 (28.0)	86 (22.8)	73 (19.3)	1.3
I felt downhearted and sad during power outages	87 (23.0)	126 (33.3)	66 (17.5)	99 (26.2)	1.5
I found it difficult to work up the initiative to do things when there was no power	48 (12.7)	72 (19.0)	66 (17.5)	192 (50.8)	2.1

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Total subscale score					**4.9**
Adjusted score (×2)					**9.8**

Anxiety Subscale

Parameter	**Never n (%)**	**Sometimes n (%)**	**Often n (%)**	**Always n (%)**	**Mean Score**
I felt scared without any good reason	126 (33.3)	96 (25.4)	108 (28.6)	48 (12.7)	1.2
I felt that life was meaningless	189 (50.0)	84 (22.2)	63 (16.7)	42 (11.1)	0.9
I experienced trembling or sweating during load shedding	219 (57.9)	72 (19.0)	48 (12.7)	39 (10.3)	0.8
Total subscale score					**2.9**
Adjusted score (×2)					**5.8**

Stress Subscale

Parameter	**Never n (%)**	**Sometimes n (%)**	**Often n (%)**	**Always n (%)**	**Mean Score**
I found it hard to wind down	39 (10.3)	108 (28.6)	138 (36.5)	93 (24.6)	1.8
I tended to over-react to situations	84 (22.2)	111 (29.4)	108 (28.6)	75 (19.8)	1.5
I felt that I was using a lot of nervous energy	72 (19.0)	108 (28.6)	111 (29.4)	87 (23.0)	1.6
I found myself getting agitated	69 (18.3)	102 (27.0)	102 (27.0)	105 (27.8)	1.6
I found it difficult to relax	96 (25.4)	70 (18.5)	113 (29.9)	99 (26.2)	1.6
Total subscale score					**8.0**
Adjusted score (×2)					**16.0**

Note: Percentages are based on the total sample size (N = 378). Mean scores were calculated using the DASS response scale: Never = 0, Sometimes = 1, Often = 2, Always = 3.

A score of 9.7 in the depression subscale indicates that over the previous one week, the respondents experienced mild symptoms of depression during load shedding. Similarly, a score of 16 in the stress subscale indicates mild levels of stress. There was no anxiety experienced during load shedding overall, as indicated by a score of 5.7.

Mental Health, Load Shedding and Socioeconomic Factors

A logistic regression model assessing the impact of sleep disruptions, power outage duration, stress levels, socioeconomic status, and coping mechanisms on mental health was performed.

Table 8 Mental Health, Load Shedding, and Socioeconomic Factors

Variable	OR	95% CI	p-value
Have you ever experienced stress because of load shedding? (Ref)	1.00	Reference	—
Moderate	34.74	14.32–84.30	0.000***
Very much	2.40	1.27–4.54	0.007***
How long do the load-shedding periods last? (Ref)	1.00	Reference	—
12–18 hours	1.71	0.47–6.16	0.413
18–24 hours	2.94	0.88–9.81	0.080*
More than 24 hours	0.81	0.24–2.78	0.742
Monthly Household Income (Ref)	1.00	Reference	—
5001–10000	0.76	0.35–1.65	0.483
Less than 1000	0.35	0.13–0.95	0.039**
More than 10000	0.57	0.26–1.23	0.152
Coping Strategies (Ref)	1.00	Reference	—
Mix of solutions	1.81	0.85–3.88	0.126
Use solar power	2.36	0.83–6.69	0.108
Use candles	4.95	1.30–18.75	0.019**
Do nothing	2.47	1.01–6.01	0.047**
Constant	0.18	0.04–0.77	0.021**

*** p < .01, ** p < .05, * p < .1

The logistic regression analysis demonstrated that stress related to load shedding was strongly associated with poorer mental health outcomes. Compared with respondents who reported no stress related to load shedding, those who reported moderate stress were significantly more likely to experience adverse mental health outcomes (OR = 34.74, 95% CI [14.32, 84.30], p < .001). Similarly, respondents who reported experiencing "very much" stress had significantly greater odds of poorer mental health outcomes (OR = 2.40, 95% CI [1.27, 4.54], p = .007). These findings suggest that psychological stress associated with prolonged electricity disruptions represents one of the strongest predictors of deteriorating mental well-being in the study population.

The analysis further demonstrated that respondents from lower-income households were more vulnerable to poorer mental health outcomes during periods of load shedding. Respondents earning less than ZMW 1,000 per month had significantly lower odds of reporting positive mental health outcomes relative to the reference income category (OR = 0.35, 95% CI [0.13, 0.95], p = .039). This finding suggests that financial vulnerability may increase susceptibility to psychological distress during periods of energy insecurity.

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With regard to the duration of power outages, respondents experiencing load shedding lasting between 18 and 24 hours demonstrated higher odds of poorer mental health outcomes (OR = 2.94, 95% CI [0.88, 9.81], p = .080). Although this relationship was only marginally significant, the findings suggest that prolonged electricity interruptions may substantially disrupt routine functioning and psychological well-being. In contrast, outages lasting 12–18 hours (OR = 1.71, p = .413) and those exceeding 24 hours (OR = 0.81, p = .742) were not statistically significant predictors of mental health outcomes.

Coping strategies also demonstrated important associations with mental health outcomes. Respondents relying primarily on candles as a coping mechanism were significantly more likely to report poorer mental health outcomes than those in the reference category (OR = 4.95, 95% CI [1.30, 18.75], p = .019). Similarly, respondents who reported "doing nothing" during periods of load shedding had significantly higher odds of poorer mental health outcomes (OR = 2.47, 95% CI [1.01, 6.01], p = .047). These findings suggest that passive coping strategies may be associated with increased psychological vulnerability during periods of energy insecurity.

Although respondents using solar power (OR = 2.36, p = .108) and those employing a mixture of coping strategies (OR = 1.81, p = .126) demonstrated trends toward different mental health outcomes, these relationships did not achieve statistical significance and should therefore be interpreted cautiously.

Overall, the logistic regression model was statistically significant (χ^2 = 148.06, p < .001) and explained approximately 31.4% of the variation in mental health outcomes (Pseudo R^2 = 0.314), indicating that stress levels, socioeconomic factors, outage duration, and coping strategies collectively played an important role in shaping mental health experiences during periods of load shedding.

Demographic Factors and Mental Health

The association between employment status, educational level, marital status, and age on mental health during load shedding. The model was statistically significant (LR Chi² = 23.23, p = 0.01), explaining a relatively small portion of the variance in mental health outcomes, suggesting that other factors, such as stress, coping mechanisms, and financial status may be stronger predictors of mental health.

Table 9 Demographic factors and mental health

Variable	OR	95% CI	p-value
What is your employment status? (Ref)	1.00	Reference	—
Employed (Part-time)	7.18	2.02–25.49	0.002***
Self-employed	0.78	0.32–1.92	0.595
Student	0.68	0.33–1.40	0.295
Unemployed	1.84	0.70–4.82	0.219
Education Level (Ref)	1.00	Reference	—
Postgraduate	0.98	0.49–1.95	0.955
Secondary	1.23	0.49–3.10	0.658
Marital Status (Ref)	1.00	Reference	—
Married	0.49	0.14–1.68	0.256

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Single	0.54	0.14–2.11	0.372
Age (Ref)	1.00	Reference	—
31–40	0.62	0.30–1.30	0.208
41–50	0.55	0.23–1.30	0.169
51–60	0.52	0.15–1.76	0.293
Constant	3.00	0.76–11.95	0.118

*** p < .01, ** p < .05, * p < .1

Part-time employment was strongly associated with poor mental health (OR = 7.18, p < 0.01), meaning individuals working part-time were over seven times more likely to report mental health challenges compared to full-time workers. Self-employed (OR = 0.78, p > 0.05) and unemployment (OR = 1.83, p > 0.05) were not significantly associated with mental health outcomes, suggesting that the uncertainty of part-time work may be a stronger psychological stress than outright unemployment. Students (OR = 0.68, p > 0.05) showed no significant association with poor mental health, which may indicate that academic pressures do not substantially increase vulnerability to mental distress during load shedding.

Higher education levels did not show a significant association with mental health outcomes; postgraduate education (OR = 0.98, p > 0.05) and secondary education (OR = 1.23, p > 0.05) were not significant predictors. Tertiary education (Diploma/Degree) was omitted due to collinearity, indicating a lack of variation in responses across education levels. The findings suggest that education level alone may not be a strong determinant of mental health outcomes in context load shedding.

Married individuals (OR = 0.49, p > 0.05) and single individuals (OR 0.54, p > 0.05) were less likely to report poor mental health compared to widowed individuals, though the results were not statistically significant. The omission of the widowed category due to perfect prediction suggests that widowed individuals were consistently experiencing mental health challenges, but the small sample size prevented a precise estimate. This indicates that social support within marriage may provide some mental health benefits during stressful events like load shedding, though more research is needed.

Older individuals (51–60 years, OR = 0.52, p = 0.293; 41–50 years, OR = 0.54, p = 0.169; 31–40 years, OR = 0.62, p = 0.208) were less likely to experience poor mental health compared to younger individuals, though the differences were not statistically significant. 61+ age group was omitted due to collinearity, possibly indicating a consistent pattern of mental health stability in age group. These findings suggest that younger individuals may be more vulnerable to mental health deterioration during load shedding, potentially due to greater dependence on electricity for work, education, and daily activities.

DISCUSSION

The objective of this study was to examine the effects of load shedding on the mental health of residents in Zambia, with particular attention to stress, sleep disruption, coping strategies, and socioeconomic vulnerability. The findings demonstrate that frequent and prolonged power outages are significantly associated with poorer self-reported mental health outcomes, particularly among economically vulnerable populations (Memmott et al., 2021; Andresen et al., 2023).

The study supports existing literature suggesting that chronic energy insecurity functions as an environmental stressor capable of negatively affecting psychological well-being. Frequent power outages disrupt daily routines, interfere with occupational and educational activities, compromise sleep quality, and increase uncertainty within households. These disruptions collectively contribute to heightened psychological strain (Dlamini et al., 2020; Patel et al., 2019; WHO, 2021).

Stress emerged as the strongest predictor of poorer mental health outcomes in the study. Respondents experiencing higher levels of stress related to load shedding were significantly more likely to report poorer mental health outcomes than those reporting minimal stress. These findings are consistent with previous research demonstrating that prolonged exposure to chronic environmental stressors contributes to emotional exhaustion, psychological distress, and reduced well-being (Breier et al., 1987; Shinde, 2021).

The findings further demonstrated that sleep disruption plays an important role in mediating the relationship between load shedding and mental health. Respondents experiencing substantial sleep loss during periods of load shedding were more likely to report poorer mental health outcomes. This finding aligns with existing evidence linking sleep disruption to emotional instability, cognitive impairment, stress vulnerability, and depressive symptoms (Marchetti-Mercer et al., 2024; Thembane, 2024).

The duration and unpredictability of load shedding also emerged as important contributors to psychological distress. Outages lasting between 18 and 24 hours were associated with poorer mental health outcomes, suggesting that prolonged interruptions in electricity supply significantly disrupt daily functioning and adaptive coping capacity. Unpredictable power outages may further intensify feelings of uncertainty, helplessness, and frustration (Lodhi et al., 2013; Breier et al., 1987; Shinde, 2021).

Socioeconomic disparities were clearly evident throughout the findings. Respondents from lower-income households experienced greater psychological strain and had fewer coping resources available to mitigate the effects of prolonged power outages. In contrast, higher-income households demonstrated greater access to adaptive coping mechanisms such as solar power systems, rechargeable lighting, and generators. These findings reinforce the importance of socioeconomic resources in determining resilience during periods of infrastructural instability (Patel et al., 2018; Memmott et al., 2021).

The findings also demonstrated that coping strategies significantly influenced mental health outcomes. Passive coping mechanisms, including reliance on candles or absence of alternative power solutions, were associated with poorer psychological outcomes. Conversely, access to adaptive coping resources appeared to reduce psychological strain, although some associations did not reach statistical significance. These findings are consistent with previous studies on energy insecurity and coping mechanisms during power crises (Singh, 2017; Amankwah-Amoah, 2015).

This study has demonstrated that load shedding constitutes not only an infrastructural and economic challenge but also an important public health concern with significant implications for psychological well-being. The findings support the need for integrated policy interventions that combine improved energy infrastructure, mental health support systems, and targeted assistance for vulnerable populations affected by chronic energy insecurity (WHO, 2021; Patel et al., 2018).

CONCLUSION

This study demonstrates that load shedding is significantly associated with poorer psychological well-being among residents in Zambia. Frequent and prolonged power outages were associated with elevated stress, sleep disruption, disruption of daily activities, and reduced self-reported mental health outcomes.

The findings suggest that the psychological effects of load shedding are particularly pronounced among economically vulnerable populations and residents with limited access to adaptive coping resources. Respondents from lower-income households experienced greater psychological strain and reduced coping capacity during prolonged periods of electricity interruption.

The study further demonstrated that sleep disruption and chronic stress represent important pathways through which load shedding negatively affects mental well-being. Although mild depressive and stress-related symptoms were identified through the DASS indicators, anxiety scores remained within the normal range overall, suggesting that the primary psychological burden of load shedding may be associated with chronic stress and disruption of routine functioning.

The findings emphasize the importance of integrating mental health considerations into national energy policy and public health planning. Improving electricity infrastructure, increasing the predictability of load-shedding schedules, expanding access to alternative energy solutions, and strengthening mental health support services may help reduce the psychological burden associated with chronic energy insecurity.

LIMITATIONS

Several limitations should be considered when interpreting the findings of this study. Firstly, the use of an online survey resulted in a sample that was disproportionately urban, educated, and internet-accessible, thereby limiting the representativeness of the findings among rural and less-educated populations.

Secondly, the cross-sectional study design limits the ability to establish causal relationships between load shedding and mental health outcomes. The findings therefore reflect associations rather than definitive causal effects.

Thirdly, the study relied on self-reported measures of mental health and coping strategies, which may be subject to reporting bias and subjective interpretation.

Finally, although selected indicators from the DASS-21 were utilised, the questionnaire was not formally validated within the Zambian context. Consequently, the mental health findings should be interpreted cautiously.

RECOMMENDATIONS

The study makes the following recommendations:

1. Policymakers should prioritise investment in electricity infrastructure and diversification of energy sources to reduce the frequency and duration of load shedding.
2. Government and energy stakeholders should improve the predictability and consistency of load-shedding schedules to reduce uncertainty and psychological distress among affected households.
3. Subsidised access to alternative energy technologies, particularly solar power systems and rechargeable backup solutions, should be expanded for low-income households.
4. Mental health support programmes should be established to assist individuals experiencing chronic stress, sleep disruption, and psychological distress associated with prolonged power outages.
5. Public awareness programmes should promote adaptive coping strategies and resilience-building approaches during periods of energy insecurity.
6. Future studies should adopt longitudinal and mixed-methods research designs to explore the long-term psychological effects of load shedding.
7. Future research should include rural populations and less economically advantaged communities to improve representativeness and contextual understanding of the mental health implications of energy insecurity.

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