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Exploring Operational Copying Strategies of Private Hospitals amid Loadshedding in Zambia

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Abstract

This study explored the operational coping strategies employed by private hospitals in the Lusaka district amid persistent loadshedding. The research aimed to identify the strategies adopted, evaluate their effectiveness in maintaining healthcare service delivery, and assess their impact on operational costs and patient care. This particular study focused on private health care service delivery amid loadshedding and did not consider public facilities. Both quantitative and qualitative data were collected for this study. Quantitative data was collected using structured questionnaires, which were administered to hospital personnel, including hospital administrators, technical staff, and medical staff. Qualitative data was collected using an interview guide to collect qualitative insights from 21 hospital administrators across various private hospitals. A total of 120 respondents were targeted using stratified purposive sampling across 30 registered private hospitals in the Lusaka district, from which 110 responded, achieving a response rate of 87%. Both quantitative and qualitative data analysis methods were employed. For quantitative analysis, SPSS (Statistical Package for the Social Sciences) was used, while qualitative data was analyzed thematically. The findings reveal that private hospitals primarily rely on a mixture of strategies, including backup generators, solar equipment, staff shift adjustments, and water storage/management strategies to cope with power outages. While these strategies were found to be moderately effective in promoting continuity of services, they significantly increase operational costs. Additionally, the strategies were found to have no impact on patient care. The study highlights the need for sustainable energy solutions, improved infrastructure, and improved solar technical skills.

1. Introduction

Loadshedding is a common phenomenon that affects economic development of both developed and developing countries of the world. It is caused by the high demand of power for economic activities, coupled with climate change and low substantive investment in electricity generation capacity (C Lombe, 2023). Developing countries, Zambia included tend to be more affected by insufficient provision of electrical power than developed countries. Load management poses numerous challenges to the smooth running of many enterprises, as a result, small businesses face more problems compared to large firms. Even when loadshedding is not much felt as compared to developing countries, electricity production and distribution are undergoing significant restructuring to keep up with the increased demands for electricity (ERB, 2015).

Electricity supply is a critical component of healthcare delivery. In Zambia, particularly Lusaka, frequent loadshedding has posed significant challenges to private hospitals. These institutions rely heavily on uninterrupted power for surgical procedures, diagnostic equipment, patient monitoring systems, and overall hospital operations. Loadshedding disrupts service delivery, increases operational costs, and threatens patient safety. In the recent past, Zambia has faced significant energy challenges, with loadshedding becoming a common feature of daily life. Tembe and Hlengwa 2022, define loadshedding as, a deliberate temporary shutdown of electricity in certain areas. Loadshedding in Zambia is now a serious issue since its consequences are felt by a wide range of businesses. Loadshedding has profound impact on various sectors of the economy such as SME's, Hospitality, Education and health (H Temba, 2022)

The problem addressed in this study is the extent to which private hospitals are able to cope with loadshedding and the effectiveness of the strategies they employ. The main objective of the study is to investigate operational coping strategies used by private hospitals in Lusaka. The study is guided by the following research questions: What strategies are used by private hospitals to cope with loadshedding? How effective are these strategies? What is the impact of these strategies on patient care?

1.1 Background of the study

Loadshedding is a controlled process used to manage electricity demand and prevent overloading the power grid (B Bwalya, 2019). It typically involves temporarily interrupting the electricity supply to certain areas to prevent the overall system from a total blackout. Loadshedding is often implemented during peak demand periods or when the utility company seems to have a power generation problem. While loadshedding is not considered a universal problem for every country in the world, many countries and regions are facing situations where power outages are necessary due to varying factors. One such country is Australia. Australia's power utility company AEMO manages the national grid, balancing supply and demand (JICA, 2022).

In countries like South Africa, loadshedding can result in scheduled power outages lasting several hours. The importance of constant power supply especially in hospitals cannot be over-emphasized. Lack of continuous power supply to hospitals may result in delayed medical procedures. Most of these procedures that are carried out in hospitals require the use of medical equipment that require power supply in order to work, including life support machines, sterilization units as well as diagnostic tools. Therefore, a lack of power supply from the national grid distributed by Zesco unfortunately demands that the hospitals either have to do away with the procedures or simply find an alternative source of power, which in most cases is more expensive. The Zambian Government has in the recent past committed to installing solar solutions in health institutions to provide a more reliable power supply. As much as this may be helpful for lighting and other small appliances, it may not be sufficient to power certain medical equipment. In a press statement issued by the Ministry of Energy (MOE, 2024), it was stated that the current average generation as dictated by water availability in the reservoirs is about 900Mega watts (MW) against the average demand of 2400MW resulting in a power deficit of 750MW as at May 2024.

1.2 Statement of the problem

Loadshedding, characterized by scheduled power outages, remains a persistent challenge in many developing countries. Zambia, being highly dependent on hydro power, is also affected due to the effects of climate change. While some business owners have resorted to using alternative energy sources such as solar and generators as a way of facilitating the integration of renewable energy sources and building resilience due to loadshedding, the acquisition and maintenance of such alternative sources, the huge costs incurred by the use of such alternative sources, cannot be compared to the costs that are incurred by the use of national grid (ZESCO power). This is in line with research done by (Banda, et al., 2020) who highlighted that, most businesses are forced to compromise on efficiency and effectiveness in production due to the high cost of production resulting from load shedding. Prolonged power outages could also, force firms to reduce staff or temporarily shut down operations, further compounding financial losses (Bizimana, 2024). In the field of health care provision, Hospitals, Clinics and Pharmacies rely on power to store medicines at recommended temperatures, conduct certain tests such as scans, x-rays as well as preserve the bodies of our dear departed loved ones. Therefore, power outages in health care facilities especially those that are privately owned puts the business under pressure.

1.3 Significance of the study

This study may provide evidence on how electricity shortages that are currently being experienced in the country can disrupt hospital operations and potentially affect patient safety and service delivery. The findings can help to inform national energy and policy, helping government bodies plan better for energy resilience in health care settings. Understanding the operational impacts of loadshedding and strategies being implemented may also enable the private hospital managers and owners to make data-driven decisions about backup systems and emergency protocols. This may help in justifying why some private hospitals need to consider investing in certain alternative energy sources such as fuel-efficient generators. On the other hand, private hospitals can utilize the findings of this research to document their vulnerabilities and explore shared solutions like private-public partnerships for energy resilience. The findings may also provide a basis for advocacy or engagement with the power utility company (ZESCO). All in all, private hospitals which often operate independently of public sector support, may benefit from understanding the extent to which loadshedding affects their service delivery. The study may also serve as a reference for lobbying efforts or partnerships aimed at improving energy reliability in the private health sector.

2 Literature Review

2.1 Theoretical framework

In trying to better understand the research that was carried out, three theories were used. These are systems theory, Resource Dependance Theory (RDT) and Organization theory. According to (Khuzwayo, 2020), systems theory is a way of understanding the world by looking at things as a group of interconnected parts that work together as a whole. It focusses largely on the organization's relationships and interactions among its components. The systems theory suggests that, when there is an interruption in one part of a functional system, the entire system suffers from that interruption. This is because every organization exists in a particular environment and is expected to balance with internal and external components of the system. With regards to this research, that would entail that when the supply of power is interrupted, the entire operation of the hospitals gets interrupted. This theory helps to understand how one external output such as electricity will affect the entire hospital operation and how that can cause a ripple effect. On the other hand, Resource Dependance Theory suggests that an organization depends on external resources to operate effectively (Adam Cobb, 2014). This theory will be used because private hospitals rely on electricity to power equipment, refrigeration for medicine and electronic health systems. Because of this reliance, hospitals are forced to seek alternative power resources such as generators to curb loadshedding. Another theory is the organizational theory. (Termitope Mark, 2023). This theory is the study of how organizations are structured, managed, and how people behave within them (Daft, 2026). It stipulates how organizations work, why they are designed in certain ways and how they can be improved. This theory helped in designing the research design. It ensured that the right respondents in various departments of the hospital are targeted. Organizational theory is essential in understanding how private hospitals respond to the challenges posed by load shedding. It provides insights into organizational structure, interdependence, staff behavior, management strategies, and environmental influences. By applying this theory, researchers can develop a comprehensive understanding of how healthcare institutions adapt to disruptions and maintain service delivery.

2.2 Loadshedding and the global economy

While electricity shortages and rationing have recently emerged as pressing concerns across the developed world, inconsistent access to reliable power has been a perpetual reality for large swaths of the global population, particularly in emerging economies. From Asia and Africa to South America, hundreds of millions have spent decades adapting their daily lives to frequent planned and unplanned outages (James Lapperman, 2025).

In India, where as much as 20% of the population still lacks access to electricity, scheduled power cuts lasting 6–8 h per day have been common across rural areas and major cities such as Mumbai and Delhi (James Lapperman, 2025). While pockets of affluence enjoy backup generators and inverter systems, the vast majority have been forced to adjust their work schedules, business hours, and household routines around these planned outages.

Over the past decade and a half, no middle-income country has been as impacted by systematic, nationwide electricity rationing as South Africa (Anelle,

2022). What began in 2008 as a temporary program of scheduled power cuts by the state utility Eskom to prevent total grid collapse has persisted into an intractable crisis impacting many facets of society (Anelle, 2022). South Africa is at the vanguard of the energy crisis. The country's electricity woes can be traced back to the late 1990s, when the apartheid regime fell and the democratically elected government inherited Eskom. Subsequently, the national utility has underinvested in maintenance and new power plants (Anelle, 2022). A surge in household electrification programs and industrial demand quickly outstripped supplies. Around 2008, South Africa experienced its first round of scheduled "load-shedding", a rotational program of planned outages implemented by Eskom to prevent total grid failure (James Lapperman, 2025). What was initially portrayed as a temporary solution to managing electricity shortages has persisted for over 15 years. Power cuts have become an inescapable part of daily life for South African residents and businesses.

On the other hand, the Electricity Supply Industry in Zambia is dominated by hydro generation which in 2015 accounted for 94.1% of national installed capacity. The balance of 5.9% was from alternative sources such as Diesel, Heavy Fuel Oil (HFO) and Solar Photovoltaic (PV) generation plants. In 2015, Zambia experienced a drastic reduction in electricity supply which was attributed to the reduced generation by ZESCO Limited due to the low water levels in the reserves caused by poor rainfall in the 2014/15 rainy season. The power deficit in 2015 ranged from 560 to 1000 MW. By July 2015, ZESCO had increased the extent of load shedding to at least eight (8) hours a day for the majority of its household, commercial and industrial consumers. One of the measures of load management undertaken by ZESCO was load shedding. The load shedding affected the most business operations and financial viability. From literature, it has been investigated those small enterprises are the most likely to be adversely affected by measures such as load shedding. This is because, small enterprises are less resilient and most of them are not insured or have limited capacity to invest in alternative energy sources (Bizimana, 2024). Given the importance of small enterprises in the economy, it is critical that the impact of load shedding is studied and understood. For example, according to (Emmanuel Chris, 2024), considering the data on Small and Medium Sized Enterprises (SMEs) for the period 1993-2006, SMEs had created total employment of 214,527 in different sectors of the economy. Agriculture sector provided 36.7 percent followed by manufacturing with 34.3 percent (B Bwalya, 2019).

2.3 Loadshedding on the African continent

Energy insecurity remains a major challenge in Africa due to inadequate infrastructure, low generation capacity, and poor energy management systems (Karekezi and Kimani, 2002). Frequent power outages have been shown to negatively affect economic productivity and social well-being. In the healthcare sector, unreliable electricity supply compromises service delivery and increases operational risks (Adair-Rohani et al., 2013). Loadshedding is a persistent problem in many African countries, including Zambia. Healthcare facilities frequently experience power outages, and many lack reliable backup power systems (WHO, 2014).

In a 2022 study, the audit company PriceWaterhouseCoopers (PWC) projected that loadshedding was going to cost South Africa 350 000 jobs. When PWC made this projection, loadshedding was only up to stage 4. Its predictions were therefore conservative. The worst of loadshedding was yet to come. The situation has since escalated and stage 6 loadshedding became the order of the day. This is equivalent to six to eight hours of loadshedding in a single day, making hours spent without electricity almost the same as hours of work in South Africa. This means that the impact has doubled, if not quadrupled. It should follow suit that the loss of jobs, too, should have worsened (Lotz, 2023). On the other hand, Loadshedding is stifling and killing small medium enterprises. Whilst big companies with financial muscle can find alternative energy such as diesel generators and solar systems, most small medium enterprises cannot afford such costs. They are forced to stop operations and wait for electricity to return, suffering great loss of income in the process. Some have struggled to survive the loss of income and have downscaled or completely closed shop. Many who depended on these enterprises have been left without jobs. However, the truth is that even for big business that may afford the installation of alternative sources of energy, such expense could be avoided if there was reliable electricity. Investments in alternative energy are eating away profit margins and resources for further expansion, which could have been beneficial for more jobs.

Zambia in the recent past witnessed an increase in economic activities, which has led to an increased demand for energy. The increased demand for energy has exceeded the hydroelectric power generating capacity for ZESCO, which has since reduced the supply of power to the various sectors of the economy (ERB, 2015). This has prompted ZESCO to institute a national world load shedding schedules which last up to eight (8) hours daily. This development has a potentially far-reaching economic effect on the operations of the national economy, which also includes the private hospitals.

2.4 Loadshedding in the health sector

Healthcare facilities are among the most electricity-dependent institutions. Electricity powers life-saving equipment such as ventilators, incubators, and diagnostic machines, as well as essential services like lighting, sterilization, and communication systems (WHO, 2014). Reliable electricity is therefore fundamental for quality healthcare delivery, and its absence can significantly compromise patient outcomes (WHO, 2014). Loadshedding disrupts clinical services by interrupting surgeries, laboratory diagnostics, and emergency care. Studies show that power outages lead to delays and cancellations of medical procedures, which negatively affect patient outcomes (Moyo, 2020). In extreme cases, prolonged outages can render hospitals unable to provide essential services. There is a strong relationship between power outages and increased mortality rates. Andersen and Dalgaard (2013) found that unreliable electricity supply contributes to higher mortality rates in developing countries. Patients who depend on electrically powered life-support systems are particularly vulnerable.

Loadshedding significantly affects patient safety by disrupting medical procedures and compromising the storage of vaccines and medicines. Unreliable electricity increases the likelihood of medical errors and reduces the overall quality of care (Adair-Rohani et al., 2013).

Power outages also disrupt hospital administration, including electronic health records, billing systems, and communication networks. Hospitals often revert to manual systems, which increases inefficiencies and the risk of errors (Moyo, 2020).

The financial strain is exacerbated by increased fuel consumption for generators, adding to operational expenses. Loadshedding has also posed a challenge when it comes to proper storage of certain medications, these power losses can compromise their temperature control rendering them ineffective (Fredrick Kabwe, 2024). Hospitals adopt operational strategies such as rescheduling non-emergency procedures, prioritizing critical services, and managing energy consumption to reduce the impact of loadshedding (Moyo, 2020). Healthcare workers play a key role in adapting to power outages by modifying workflows and implementing innovative solutions to maintain service delivery (Moyo, 2020).

Existing studies have highlighted those hospitals in sub-Saharan Africa often rely on diesel generators as a primary backup during power outages.

However, generators are costly, environmentally unfriendly, and prone to breakdowns. Emerging literature suggests solar energy and hybrid systems as sustainable alternatives. In Zambia, limited research has focused on private hospitals' adaptive strategies, creating a gap that this study aims to fill.

3 Methodology

This research adopted an embedded mixed method approach. The considered area for this research was Lusaka district. Lusaka is not only the capital city of Zambia but is also considered the largest city in Zambia, with a lot of economic activities (JICA, 2022). It is considered to have the highest number of private hospitals in the country. This made it a good study area for the research. The population that was considered was 923 employees across 30 private hospitals. The private hospitals were stratified into three categories namely; small hospitals (0-50 beds), medium (50-100 beds), and big hospitals (more than 100 bed spaces). The sample size was determined using Cochran's formula for finite populations assuming a 95% confidence level and maximum variability (p= 0.5). A sample of 120 personnel was arrived at corresponding to an approximate margin of error of 8%, which was considered acceptable given the time and resource constraints. The target respondents were; hospital administrators, technical as well as medical staff. In selecting a research sample, proportional stratified sampling was used. This was because the population was spread across 30 hospitals. This technique ensured that large hospitals contribute more respondents to ensure that all employees that are directly linked to the operations of the hospital are sampled. A structured homogenous questionnaire and an interview guide were used to collect data. The questionnaire was structured in such a way that the questions asked were relevant to the research questions listed. For the collection of qualitative data, interviews were conducted with 21 hospital administrators. These administrators represented their various hospitals.

The data collected from the various hospitals using the structured questionnaires and interviews were analyzed using a software called SPSS (Statistical Package for Social Sciences). Quantitative data was analyzed using statistical software (SPSS/Excel) to generate descriptive statistics such as frequencies and means. Qualitative data was analyzed thematically to identify patterns and insights. Inferential statistics were also calculated to test the study hypotheses.

4 Results and Discussions

4.1 Results

The findings of the research indicated that hospitals had adopted a mixture of copying strategies during loadshedding. The adopted strategies were, solar equipment, constant equipment maintenance, staff adjustments, water storage and generators. Among these strategies, the use of gensets accounted for 45.45 %, solar accounted for 27.27 %, water storage accounted for 4.545 %, and cost cutting measures accounting for 2.727 %. Frequency tables and bar charts were used to compare responses. Solar was found to be the most used strategy with most hospitals using it for lighting. These results are presented in Figure 1.

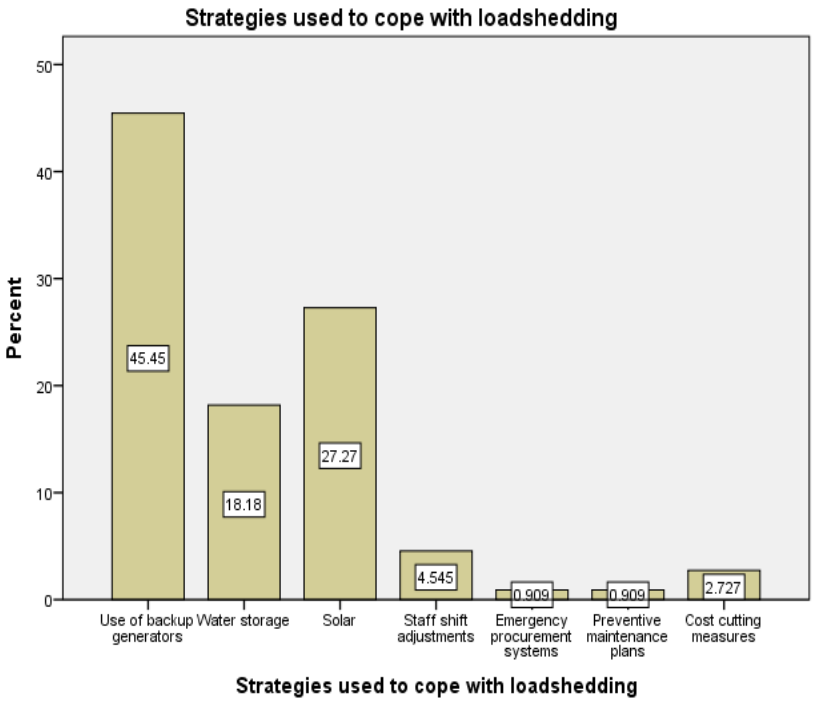

Figure 1: Copying strategies by private hospitals

Table 1: Hospital size and strategies used.

Size of the hospital * Strategies used to cope with loadshedding Crosstabulation

Count

		Strategies used to cope with loadshedding							Total
		Use of backup generators	Water storage	Solar	Staff shift adjustments	Emergency procurement systems	Preventive maintenance plans	Cost cutting measures	
Size of the hospital	Less than 50 beds	35	0	0	0	0	0	0	35
	50-100 beds	15	20	15	0	0	0	0	50
	More than 100 beds	0	0	15	5	1	1	3	25
Total		50	20	30	5	1	1	3	110

As shown in table 1, the findings indicate that different hospitals based on size have adopted different strategies. Small hospitals with less than 50 bed spaces were found to use backup generators as their alternative energy source during loadshedding. On the other hand, hospitals with 50-100 bed spaces use a mixture of water storage (40%), solar (30%) and use of backup generators at 30%. Large hospitals were found to use solar as their main copying strategy during loadshedding with staff shift adjustments, cost cutting measures, preventive maintenance plans as well as emergency procurement accounting for 20%, 12%,4% and another 4% respectively.

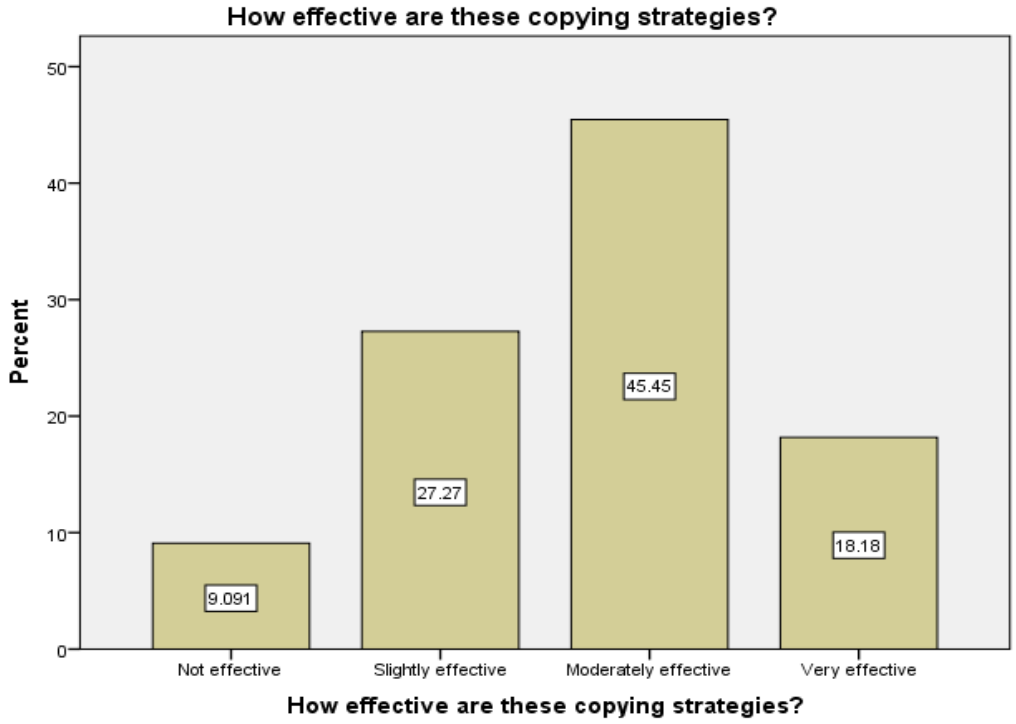

Figure 2: effectiveness of copying strategies

The findings indicated that the strategies being implemented are moderately effective. In analyzing the effectiveness of the copying strategies, the responses were measured and mean measured was ranging from 3.71 to 4.06 which was close to 4, meaning the respondents strongly agreed that the copying strategies are moderately effective representing a 45.5 %. On the other hand, 27.3% of the respondents felt that the strategies were very effective with the least accounting for 9.1% stating that the strategies are not effective.

The findings of the study also indicated that, the copying strategies being implemented by private hospitals have no impact on the patient care that is given to the patients. This was according to 45% of the respondents who indicated that there was no impact on the patient care provided to the patients. 28% indicated that the strategies had a negative impact on the patient care provided with 27% stating that there was a positive impact on patient care. The research investigated the impact of strategies on patient care focusing on how efficiently the hospitals are operating during loadshedding. The researcher used bar charts and frequency analysis and found that most hospitals still offer quality service to patients with no direct impact on patient care.

Table 2: Descriptive statistics

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Back-up power systems effectively support hospital operations during loadshedding	110	1	5	3.95	1.237
Copying strategies help to maintain continuity of patient care	110	1	5	4.07	.936
Copying strategies reduce operational disruptions caused by loadshedding	110	1	5	4.24	.985
Copying strategies improve staff efficiency during power outages	110	1	5	4.16	1.063
Valid N (listwise)	110				

4.2 Discussion

The findings of this study (Table 3) indicate that private hospitals have implemented effective coping strategies to mitigate the effects of loadshedding. This is supported by the high mean scores across all variables, particularly continuity of patient care, effectiveness of backup power systems in supporting hospital operations, operational disruptions during loadshedding and improved staff efficiency during power outages (Mean = 4.105), and the statistically significant results from the one-sample t-test ($p < 0.05$).

These findings are consistent with existing literature. For instance, Adair-Rohani et al. (2013) emphasize that healthcare facilities in Sub-Saharan Africa rely heavily on backup power systems and adaptive strategies to maintain service delivery during power outages. Similarly, WHO (2014) highlights that reliable access to alternative energy sources is essential for ensuring uninterrupted healthcare services.

The ANOVA results further revealed that coping strategies are not equally effective ($F = 3.96$, $p = 0.009$), suggesting variation in how different strategies impact hospital operations. This aligns with Moyo (2020), who argues that while coping strategies improve resilience, their effectiveness varies depending on implementation and available resources.

5 Conclusion and Recommendations

5.1 Conclusion

The study concludes that private hospitals have not been spared from the effects of loadshedding. However, they have adopted several copying strategies that have enabled them to continue offering health services with no direct impact on the quality of patient care that is provided. The strategies that were discovered by this research include; solar use, use of generators, water storage, staff shift adjustments as well as constant maintenance of equipment. The research found that hospitals had adopted a mixture of copying strategies during loadshedding. The adopted strategies were, solar equipment, constant equipment maintenance, staff adjustments, water storage and generators. Among these strategies, the use of gensets accounted for 45.45 %, solar accounted for 27.27 %, water storage accounted for 4.545 %, and cost cutting measures accounting for 2.727 %. Frequency tables and bar charts were used to compare responses. Solar was found to be the most used strategy with most hospitals using it for lighting.

The research also found that different hospitals based on size have adopted different strategies. Small hospitals with less than 50 bed spaces were found to use backup generators as their main alternative energy source during loadshedding. On the other hand, hospitals with 50-100 bed spaces use a mixture of water storage (40%), solar (30%) and use of backup generators at 30%. Large hospitals were found to use solar as their main copying strategy during loadshedding with staff shift adjustments, cost cutting measures, preventive maintenance plans as well as emergency procurement accounting for 20%, 12%,4% and another 4% respectively.

The effectiveness of these strategies was also measured using a likert scale and it was discovered that the strategies are moderately effective with a challenge of high operational costs incurred in the use of these strategies. High fuel prices were specifically mentioned as a factor that has led to an increase in operational costs. Questions were asked to determine the impact of these copying strategies on patient care and the findings indicated that there was no impact on the quality of patient care that is offered to the patients.

5.2 Recommendations

Private hospitals need to move beyond short-term, reactive measures such as heavy reliance on diesel generators and instead prioritize long-term investment in sustainable energy solutions, particularly solar and hybrid systems. While generators provide immediate relief, their high fuel and maintenance costs make them economically unsustainable, thereby undermining financial stability. At the same time, there is a pressing need for targeted government intervention through subsidies, tax incentives, or public-private partnerships to support private healthcare providers in transitioning to reliable and affordable energy sources, as their role is critical to national healthcare delivery.

Furthermore, hospital management must adopt more strategic and cost-efficient operational approaches, including energy management systems, demand-side optimization, and better resource planning to minimize waste and control escalating costs.

Equally important is the institutionalization of continuous monitoring and evaluation mechanisms to constantly assess the effectiveness of copying strategies. Without systematic evaluation, hospitals risk persisting with inefficient practices that drain resources without delivering optimal outcomes. Overall, a shift from reactive copying mechanisms to proactive, sustainable and policy supported strategies is necessary to enhance both operational

efficiency and the quality of healthcare delivery under persistent load shedding conditions.

Declaration of Competing Interests

The authors declare that they not aware of any competing financial interests or personal relationships that may have influenced the work described in this document.

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Ethical considerations

The article followed all ethical standards appropriate for this kind of research.

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