

Luminodeficit: The Paradox of High Rent and Abandoned Interiors

Ohochuku Chinwennwo Phillips^{1,*}, Dimkpa Kelechukwu², Abraham Pyamene³

Abstract

The paradox of high rent and poor daylighting in residential buildings is a pressing issue in urban areas like Port Harcourt, Rivers State, Nigeria. Despite paying premium rents, many residents experience inadequate daylighting, leading to unexpected behavioral outcomes. This study aims to explore the effects of daylight deprivation on residents of high-rent residential buildings in Port Harcourt. It investigates how poor daylighting influences indoor time spent and overall occupant satisfaction, despite favorable indoor thermal conditions. A purposive sampling technique was employed to select participants residing within Port Harcourt who have lived in their current residential buildings for more than six months. A sample size of 400 respondents (200 males and 200 females) was determined using the Cochran sample size formula, ensuring a 95% confidence level, a 5% margin of error, and 50% maximum variability. Data analysis revealed that male respondents had a mean score for daylighting conditions ranging from 3.60 to 3.82, with a standard deviation of 0.921 to 0.988. Female respondents reported a mean score ranging from 3.60 to 3.90, with a standard deviation of 0.831 to 0.945. The close standard deviations indicate homogeneity in opinions about daylight conditions. Significant findings include: 72% of male respondents and 65% of female respondents indicated that daylighting was a critical factor in their choice of residence. 67% of respondents spent more than 5 hours outdoors during daytime on weekends, despite having good indoor thermal conditions. Another 13% spent 4 to 5 hours, while 20% spent less than 4 hours outdoors. The findings underscore the importance of adequate daylighting in residential design for enhancing occupant well-being and satisfaction. They have implications for architects, estate managers, developers, and policymakers, emphasizing the need for improved daylighting standards in residential buildings.

Keywords: Luminodeficit, daylighting, housing, rent, interiors

INTRODUCTION

In the built environment, lighting quality is a critical component that affects both the physical and psychological well-being of occupants. Good lighting conditions create environments that support task performance, foster desirable interactions, and contribute to a pleasant ambiance. However, inadequate lighting can lead to discomfort and reduced productivity, exacerbating issues such as sick building syndrome. Despite the advancements in building design, many residential spaces, particularly in urban areas, still suffer from poor daylighting conditions. This is especially true in high-rent areas, where occupants pay a premium for spaces that do not provide adequate natural light.

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This study examines the paradox of daylight deprivation in high-rent residential buildings in Port

Harcourt, Rivers State, Nigeria. Despite favorable thermal conditions indoors, many residents spend considerable time outdoors, indicating a disconnect between the cost of housing and the quality of the indoor environment. This research aims to explore the effects of daylight deprivation on indoor occupancy and the overall well-being of residents, with a focus on identifying the key factors influencing this phenomenon.

LITERATURE REVIEW

Lighting Quality and Human Well-Being

Lighting quality is a multifaceted concept that encompasses both physical and psychological parameters. According to Moscoso and Matusiak, (2018) [1], good lighting quality is achieved when a lighting system creates optimal conditions for visibility, supports task performance, and contributes to the aesthetic and mood of a space. Poor lighting can lead to discomfort and impair visual performance through phenomena such as glare, where unsuitable luminance distribution reduces the ability to see details.

Historical Context and Modern Challenges

Historically, humans have evolved to depend on natural daylight for health and survival. However, modern architectural practices have often prioritized artificial lighting, leading to issues like sick building syndrome [2]. The challenge for architects and engineers lies in managing fluctuations in natural light levels and integrating daylighting strategies effectively [3–6].

The Benefits of Daylighting

Daylighting is not merely about providing light; it involves optimizing heat gains, glare control, and light distribution to enhance productivity and reduce energy consumption [7, 8]. Lighting accounts for 20–25% of total energy consumption, and up to 30–40% in commercial sectors [9]. Effective daylighting can significantly reduce CO₂ emissions and energy costs [10].

Natural Light in Architecture

Natural light, or daylight, enters buildings in several forms, including direct sunlight, skylight, and reflected light. Each type of light has unique properties and contributes to the overall lighting environment within a building [11–13]. Efficient use of natural light can improve the psycho-physical balance of occupants by regulating circadian rhythms and promoting well-being [14].

The Importance of Daylight in Nigerian Architecture

In Nigeria, (Figure 1) housing is a significant determinant of social status and plays a vital role in health, social well-being, and economic welfare [15]. Despite the availability of technical expertise and architectural education, many residential buildings in urban areas like Port Harcourt suffer from inadequate daylighting. This study aims to highlight the need for improved lighting design in high-rent residential spaces to enhance occupant well-being.

METHODOLOGY

This study employs a mixed-methods approach, including surveys and interviews with residents of public housing in Port Harcourt, to assess perceptions of housing affordability and daylighting conditions. The analysis focuses on understanding the behavioral and psychological impacts of poor daylight access.

Study Area

Port Harcourt, the capital of Rivers State, is a hub for technical and service industries and hosts four tertiary institutions offering courses in architecture and building technology. The city's residential housing projects provide a valuable context for examining the interplay between housing design, occupant well-being, and economic factors.

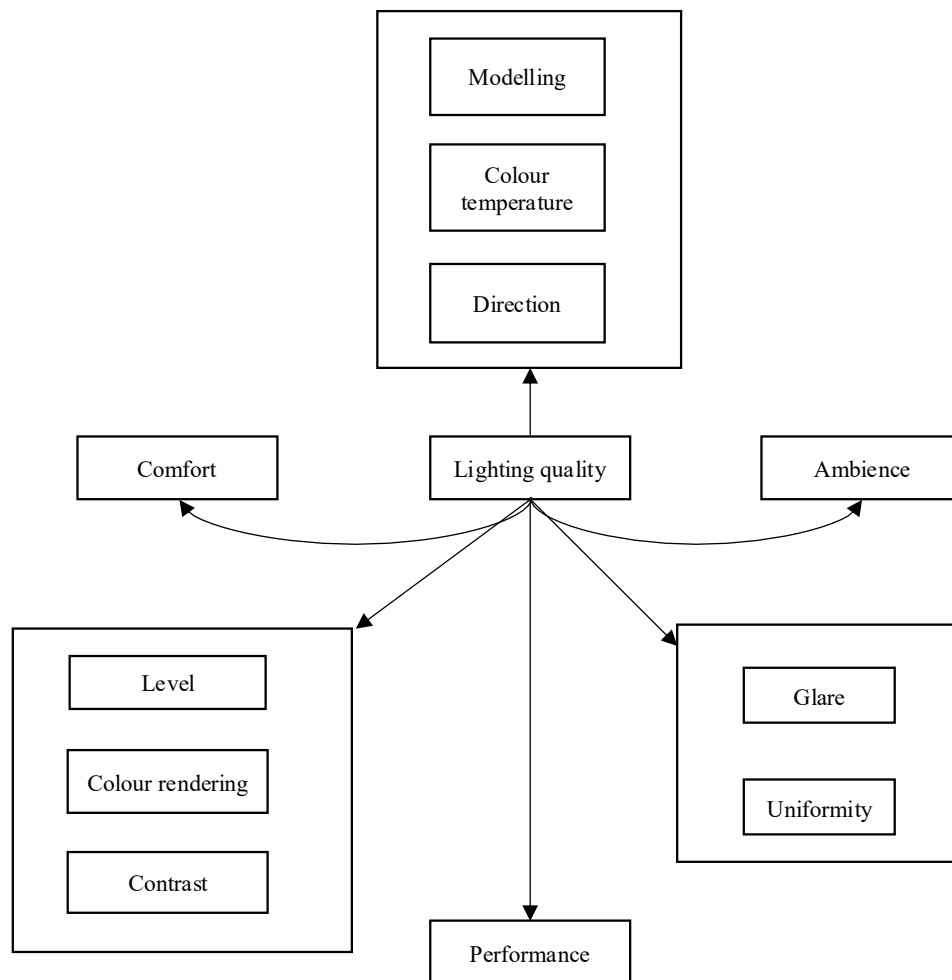


Figure 1. Factors affecting lighting quality.

Population and Sampling

The population for this study comprises residents of residential buildings in Port Harcourt, Rivers State, Nigeria. A purposive sampling technique was employed to select participants who meet specific criteria: they must reside within Port Harcourt and have been living in their current residential building for more than six months. This approach ensures that the sample is relevant to the study's focus on established residents' experiences with daylight conditions in their living spaces.

Sample Size Calculation

Given an estimated population of 3,480,000, the sample size was calculated using the Cochran formula, appropriate for determining sample sizes for proportion studies. The parameters used for calculation were:

- *Confidence level:* 95% ($Z = 1.96$)
- *Margin of error:* 5% ($e = 0.05$)
- *Maximum variability:* 50% ($p = 0.5$)

The Cochran formula is:

$$n_0 = \frac{Z^2 \cdot p \cdot (1-p)}{e^2}$$

Substituting the values:

$$n_0 = \frac{(1.96)^2 \cdot 0.5 \cdot (1-0.5)}{(0.05)^2} \approx 384$$

This calculation provides a sample size of approximately 384 respondents to ensure statistical reliability. A total sample size of 400 was used for the study, with equal proportions for males and females.

FINDINGS

Demographic Characteristics

The study's demographic analysis focused on the perceptions and behaviors of 400 male and female residents regarding daylight conditions in their homes:

- *Male residents:* The mean score for daylighting conditions was in the range of 3.60–3.82, with a standard deviation ranging from 0.921 to 0.988.
- *Female residents:* The mean score for daylighting conditions was in the range of 3.60–3.90, with a standard deviation ranging from 0.831 to 0.945.

The closeness of the standard deviations for both genders indicates a high level of consensus among respondents about the impact of daylighting conditions.

Impact of Daylighting on Residence Selection and Behavior

Daylighting as a Selection Criterion

A substantial proportion of respondents considered daylighting an important factor when selecting their residences. Specifically, 72% of male respondents and 65% of female respondents reported that daylighting played a significant role in their decision-making process (Figure 2).

Time Spent Outdoors

The study revealed notable insights into how daylight conditions influence outdoor behavior. A significant 67% of respondents reported spending more than 5 hours outdoors during daylight hours on weekends. Additionally, 13% of respondents spent 4 to 5 hours outdoors (Figure 3) and 20% of respondents spent less than 4 hours outdoors during the daytime on weekends.

These findings suggest that despite favorable indoor thermal conditions, poor daylighting in residences leads to increased outdoor activity, highlighting the critical role of daylighting in overall residential satisfaction.

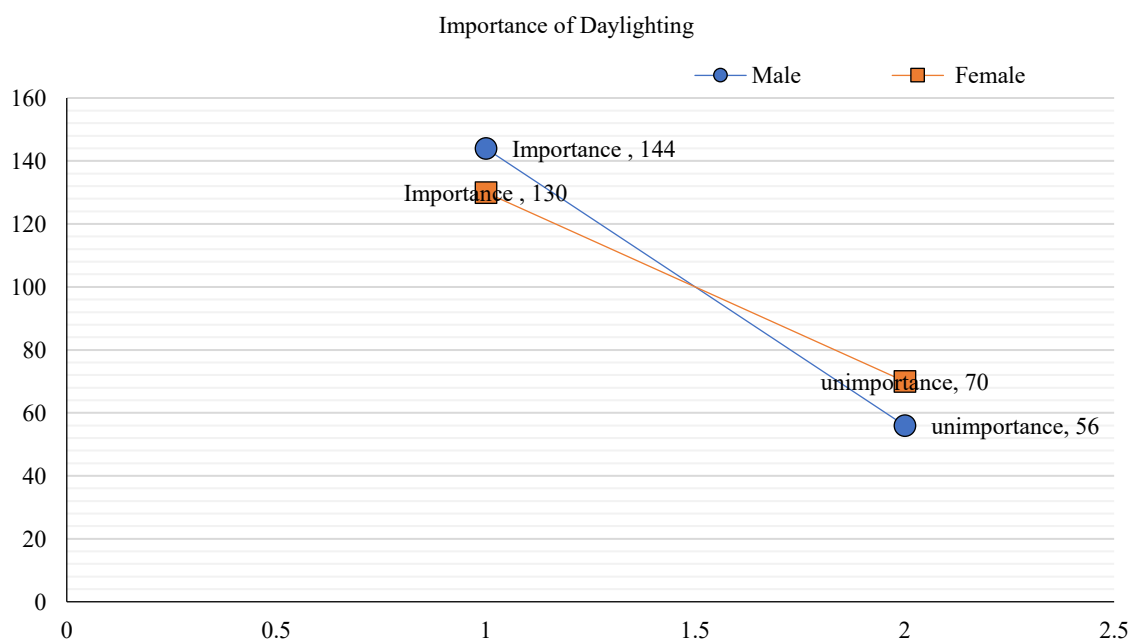


Figure 2. Importance of daylighting for home selection.

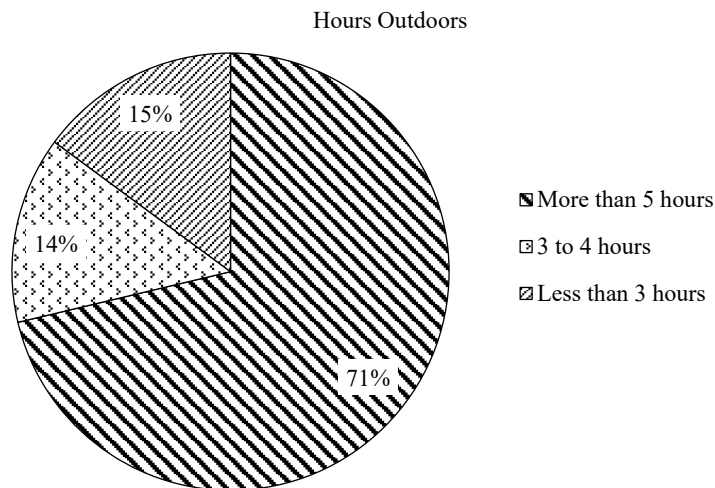


Figure 3. Hours spent outdoors.

DISCUSSION

The Paradox of High Rent and Poor Daylighting

The study reveals a striking paradox: despite high rental costs, many residential buildings in Port Harcourt suffer from inadequate daylighting. This discrepancy highlights a critical issue in residential design where cost does not always correlate with optimal living conditions. The findings demonstrate that daylighting quality significantly influences resident satisfaction and behavior, even in high-rent environments where one might expect better design standards.

Technical Implications of Daylighting Deficiencies

Daylighting, defined as the utilization of natural light to illuminate indoor spaces, encompasses several critical aspects including light levels, glare control, and uniformity [7, 12]. The inadequate daylighting conditions identified in this study suggest a failure in meeting basic standards of lighting quality, which includes:

1. *Illumination levels:* Effective daylighting should ensure sufficient light intensity to support visual tasks and comfort. The study's findings that residents spend substantial time outdoors may be attributed to insufficient indoor illumination levels that fail to meet occupants' visual and psychological needs.
2. *Glare control:* Poorly designed daylighting can lead to excessive glare, which not only causes discomfort but also reduces the overall usability of indoor spaces. The absence of appropriate shading or light diffusion strategies likely contributes to the observed dissatisfaction among residents.
3. *Light uniformity:* Uneven distribution of natural light can create zones of discomfort and reduces the overall effectiveness of daylighting. This may force occupants to seek more evenly illuminated outdoor spaces, as indicated by their increased outdoor activity.

Behavioral Response to Inadequate Daylighting

The significant time residents spend outdoors during weekends, despite good indoor thermal conditions, underscores a behavioral response to inadequate daylighting. This behavior aligns with existing research that links natural light exposure to improved mood, productivity, and overall well-being [16]. The lack of adequate daylighting may thus not only impact residents' comfort but also their psychological and physiological health.

The preference for outdoor environments despite favorable thermal conditions suggests that daylighting influences not only the aesthetic and functional quality of indoor spaces but also the psychological well-being of residents. The findings align with studies indicating that natural light is integral to circadian rhythms and mental health [14]. This behavioral shift towards outdoor

spaces highlights the necessity for a paradigm shift in residential design to address daylighting as a fundamental element.

Gender-Based Sensitivities to Daylighting

The analysis reveals a nuanced understanding of gender-based sensitivities to daylighting conditions. The slightly higher mean score among female respondents may suggest a heightened sensitivity to daylighting or a greater emphasis on natural light in residential choices. This insight could be indicative of broader trends in daylighting preferences across different demographic groups, suggesting that personalized design considerations could further enhance residential satisfaction.

Contextual Implications for Port Harcourt

Port Harcourt, as a rapidly growing urban centre in Nigeria's South-South geopolitical zone, presents unique challenges for residential design. The city's tropical climate demands a careful balance between thermal comfort and daylighting. The findings suggest that current residential design practices may be insufficient in addressing this balance, leading to compromised living conditions. This situation is compounded by the city's high rental rates [17], which exacerbate the perceived value of residential properties without corresponding improvements in daylighting quality.

The study's results call for a re-evaluation of design standards and practices in Port Harcourt. There is a pressing need for residential developments that integrate effective daylighting strategies to enhance both functional and psychological aspects of living environments.

CONCLUSION

The study highlights a critical gap in the residential design of high-rent buildings in Port Harcourt. Despite favourable indoor thermal conditions, inadequate daylighting leads to significant time spent outdoors, revealing a profound impact of daylighting on resident behavior and satisfaction. This paradox underscores the need for a comprehensive reassessment of residential design priorities, with a focus on integrating daylighting as a core element.

The findings suggest that improving daylighting in residential buildings is essential for enhancing occupant well-being and aligning housing designs with the needs of modern residents. As urban areas like Port Harcourt continue to develop, addressing daylighting deficiencies will be crucial for creating healthier and more satisfactory living environments.

Recommendations

1. *Advanced daylighting design strategies*: Architects and designers should adopt advanced daylighting strategies such as light shelves, high-performance glazing, and dynamic shading systems. These solutions can enhance light distribution and reduce glare, improving overall indoor lighting quality.
2. *Incorporation of daylighting standards*: Building codes and design guidelines should include specific requirements for daylighting in residential buildings. This could involve setting minimum light levels, glare control measures, and guidelines for light distribution.
3. *Customized design solutions*: Consideration of demographic-specific needs in daylighting design can enhance user satisfaction. For example, incorporating adjustable lighting features or personalized light control options can address varying preferences among different demographic groups.
4. *Integrated building systems*: Promoting the integration of daylighting with other building systems, such as passive solar heating and natural ventilation, can enhance overall energy efficiency and occupant comfort.
5. *Ongoing research and feedback mechanisms*: Establishing feedback mechanisms for residents to report on daylighting conditions can provide valuable insights for continuous improvement. Further research into daylighting's impact on various demographic groups and building types can inform more effective design practices.

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