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A Study on Daylight Conditions of Dementia Care Facilities in Malaysia
(Kajian Mengenai Tahap Pencahayaan Siang di Pusat Jagaan Demensia di Malaysia)

Siti Munirah Zazarin , Zalena Abdul Aziz* & Christopher Heng Yii Sern

School of Housing, Building & Planning, Universiti Sains Malaysia, Malaysia

**Corresponding author: zalena@usm.my*

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ABSTRACT

Thoughtful design can provide a therapeutic solution for people with dementia in both assisted and independent living facilities. Considerations that create a dementia-inclusive environment include layout design, incorporation of sensory cues, signage system, levels of visibility, and lighting systems. As those with dementia are prone to wandering, design which facilitates wayfinding is crucial in their daily lives. Hence, visibility and lighting are essential to support wayfinding and promote independence amongst those with dementia besides reducing the risk of falls. Indoor daylight settings and adequate levels of illumination are vital as they compensate for the cognitive deterioration that people with dementia experience. Therefore, this paper aims to study the existing conditions of daylight in dementia care facilities. The outcome of this paper summarizes the current state of daylighting implementation in the Malaysian context through first-hand experiments at three different dementia centres, located in different parts of Malaysia. At each centre, daylight levels are recorded hourly throughout daylit hours within a period of one day. The data recorded is cross-referenced with daylight requirements outlined in Malaysian Standards 1525:2019. The findings of this paper suggest that on the whole, communal spaces, namely dining areas and activity spaces receive sufficient or excessive daylight, while private spaces, such as the bedroom receives either adequate or insufficient daylight levels.

Keywords: Daylighting; illumination levels; dementia-inclusive; daylight factor; elderly care facility

ABSTRAK

Reka bentuk yang bijak menyumbang kepada penyelesaian terapeutik untuk penghidap demensia di pusat jagaan warga emas dan golongan berkeperluan khas. Ciri-ciri reka bentuk yang mewujudkan persekitaran inklusif demensia termasuk reka bentuk susun atur dalaman, penggabungan isyarat deria, sistem papan tanda, tahap keterlihatan, dan juga sistem pencahayaan. Memandangkan penghidap demensia biasa dengan sikap 'merayau', reka bentuk yang memudahkan laluan penting dalam kehidupan seharian mereka. Oleh itu, keterlihatan dan pencahayaan adalah penting untuk menyokong pencarian laluan dan menggalakkan kebebasan dalam kalangan peghidap demensia selain mengurangkan risiko jatuh. Pencahayaan siang dalam setiap ruangan dan tetapan tahap pencahayaan yang mencukupi adalah penting untuk mengimbangi kemerosotan kognitif yang dialami penghidap demensia. Oleh itu, kertas kerja ini bertujuan untuk mengkaji keadaan pencahayaan siang sedia ada di kemudahan penjagaan demensia. Hasil kertas kerja ini merumuskan keadaan semasa tahap pencahayaan siang dalam konteks Malaysia melalui kajian di tiga pusat demensia di lokasi yang berbeza. Di setiap pusat jagaan yang dikaji, tahap penchayaan siang direkodkan setiap satu jam pada waktu siang, dalam tempoh satu hari. Data yang direkodkan dibandingkan dengan keperluan tahap penchayaan siang yang digariskan dalam Piawaian Malaysia 1525:2019. Kajian ini mendapati bahawa ruang komunal, iaitu ruang makan dan ruang aktiviti menerima cahaya siang yang mencukupi atau berlebihan, manakala ruang peribadi, seperti bilik tidur menerima tahap cahaya siang yang mencukupi dan juga tidak mencukupi.

Kata kunci: Pencahayaan siang; tahap penchayaan; inklusif demensia; faktor pencahayaan siang; pusat jagaan warga emas

INTRODUCTION

Indoor daylight and illumination are critical components of an ideal setting to compensate for sensory changes caused by ageing and dementia (Goudriaan et al. 2021). Nevertheless, currently, there are no minimum daylight access requirements in dementia-care facilities. In general, assisted living facilities lack a detailed set of criteria for optimal daylight consumption to improve the health and well-being of dementia patients through design. Furthermore, lighting rules for buildings are primarily concerned with enhancing circumstances for performing visual activities and conserving energy, rather than biological requirements (Konis, 2014). In recent studies, lighting requirements have become an increasingly prevalent area of study, namely to facilitate activities of everyday life that dementia patients struggle with, such as wayfinding, besides helping to reduce the negative behavioural symptoms related to dementia.

This research paper focuses on evaluating existing lighting conditions of dementia care centres in Malaysia against the building requirements and recommendations outlined in the literature review. Konis et al. (2018) suggest that increasing light exposure can potentially treat dementia patients with major depression. With this in mind, this research paper aims to study in what scenario and space daylight exposure can enter a space most effectively. This paper emphasizes the following aspects: 1) current daylight conditions of dementia care facilities, 2) location with the most optimum daylight levels, and 3) types of spaces and their relationship with daylight levels.

LITERATURE REVIEW

To understand the requirements of daylight study in a dementia care facility, different research areas are studied including lighting issues, daylight recommendations and lighting requirements. With these findings, the current state of daylight design performance in the Malaysian context is analysed through dementia care centres as case studies.

CURRENT LIGHTING ISSUES IN DEMENTIA CARE FACILITIES

The amount of light supplied in most nursing facilities is insufficient to meet the visual needs of the elderly. As a result, low lighting levels are a persistent source of concern for persons living in long-term care facilities, as the levels offered are inappropriate for their age and disease-related changes. Low lighting in nursing homes has also been related to an increased risk of falls among the elderly (MAREP 2018). In a study by De Lepeleire et al. (2007), eight nursing homes in the United States were investigated, whereby light levels were recorded at 16 different locations throughout the respective homes. The results showed that illumination levels did not meet the minimum standards in even less than half of the 16 spaces. On the other hand, a field study by Sinoo (2016) documents that daylight in common rooms and corridors in seven of the nursing homes recorded a correlated colour temperature (CCT) of significantly less than 5000K, which is lower than the recommended value. These conditions, therefore, limit social engagement and hinder daily tasks in the respective care homes.

According to a series of studies, insufficient lighting was responsible for 18% of the elderly's fall accidents, which accounted for 43% of all falls (Hignett and Masud 2006). Furthermore, a previous review study found that environmental hazards at home, such as poor illumination, were responsible for 35% to 45% of falls among the elderly (Fong et al. 2015).

LIGHTING RECOMMENDATIONS FOR THE ELDERLY

Lighting is a significant component in creating a healing environment. Improving the lighting in the living areas of the elderly increases their self-reported quality of life significantly (Brunnström et al. 2004). In the design of a care facility, proper quantity and quality of illumination are key to a visually- friendly elderly care home. Quantity refers to task performance. Quality, on the other hand, refers to the distribution of illumination within a space; with a focus on issues such as glare and visual comfort (Sinoo 2016).

Different authorities establish lighting recommendations and regulations to serve as a guideline in the construction of aged care facilities. These lighting guidelines outline requirements for both natural light as well as artificial lighting environments. This paper looks at recommendations from selected literature and regulations from different bodies to analyze the extent of daylight application in the case studies observed.

In a guideline produced by Bell et al. (2018), there are three main design approaches to lighting design for the elderly. These considerations are 1) lighting for emotional balance, 2) lighting for performance, and 3) lighting for fall prevention. Daylight, specifically, plays a significant role in regulating emotional balance amongst nursing home residents. Bell et al. further emphasize that design professionals are now able to construct a dynamic artificial lighting system which simulates the properties of daylight, including the flux of daylight levels. Daylight is also addressed by the Illumination Engineering Society of North America, as seen in the recommended illumination levels for the elderly in Table 1.

TABLE 1. Recommended illumination values for the elderly (IESNA, 2007).

Area	Light Setting	Illumination Intensity [E(lx)]
Corridors	• Daylighting • Close to floor (10cm above floor) • Eye-level (140-160 cm above floor)	• 200-300 Lux • 500 Lux
	• Night lighting, close to floor	• 20-50 Lux
Recreational Spaces	• Daylighting • Close to floor • Table height (75 cm above floor)	• 200-500 Lux
Residents' Rooms	• Care light • Bed level (85cm above floor)	• 300-500 Lux
	• Reading light, work light • Bed level/reading level (Separate additional lighting if required)	• 300-1000 Lux
	• Living area light, close to floor	• 100-500 Lux
	• Night light, close to floor • Monitoring lights for care staff at night, close to floor	• 50-100 Lux • Approx. 5 Lux
Bathrooms	• For residents: Basic lighting close to floor, mirror lighting, accent lighting at face level	• 200-500 Lux

Of the different areas, daylight recommendation is addressed in only two spaces, which are the corridors and recreational spaces (Table 1). On this note, it is important to consider that the interplay between daylight, artificial light, use of colours and materials constitute a whole in facilitating effective architecture for people with dementia (Derungs 2016).

LIGHTING RECOMMENDATIONS FOR DEMENTIA

Although ample data is readily available regarding general lighting requirements for the elderly, lighting guidelines for dementia are limited. Moreover, lighting guidelines for the elderly are precise and quantitative, outlining specific illumination intensities, light colours (warm or cool) and required type of light (direct or indirect) in relation to the designated areas such as recreational areas, residents' rooms or circulation areas, as seen in Table 1. No such guideline exists for those with dementia. Hence, this review paper works towards filling this research gap.

For people suffering from dementia, lighting should perform three main purposes (Derungs, 2016). Firstly, there must be sufficient provision and should be of low-shadow basic lighting. Secondly, the lighting should be biologically effective, and, thirdly, lighting conditions should cater to medical care and examination requirements. The purpose of these functions is to prevent falls and promote accessibility, to help regulate the body's internal clock, as well as to achieve morning stimulation and calming effect in the evening.

LIGHTING AND DAYLIGHT REQUIREMENTS

If a space relies solely on daylight, dementia-friendly recommendations propose a daylight factor (DF) greater than 5% (McNair et al. 2013). Other than reviewing recommendations based on findings from selected literature, lighting and daylight requirements and guidelines are studied to determine the ideal environment for dementia patients. As a reference, healthcare lighting requirements for healthcare facilities and elderly facilities are observed, both internationally and in the Malaysian setting.

Based on De Lepeleire's et al.'s study (2007) on lighting for the elderly, the data in Table 2 acts as a guideline based on two sets of standards, which are the European Standard (ES) and the Adapted Standard (AS).

TABLE 2. Recommended lighting for the elderly care facility according to the European Standard and Adapted Standard

Area	European Standard (lux)	Adapted Standard (lux)
Entrance hall	200	310
Sitting area and reading room	500	775
Corridors:		
At day time	200	310
At night	50	77.5
Patients' bathroom	200	310
Dining area, cafeteria	200	310
Escalators, staircase	150	232.5
General lighting in rooms	100	155
Lighting for tables and chairs	500	775

Source: De Lepeleire et al. 2007

Table 3 illustrates the comparative values of three sets of standards (Lim, 2010) on room illumination levels which comprise the IES Standard of Illumination, the Malaysian Standard 1525: 2019 and the Malaysian Public Works Department Lux Level Requirements (Panduan Teknik JKR).

TABLE 3. Comparative values of three sets of lighting standards according to different spaces

Area	IES Illumination Standards (lux)	MS 1525:2019 (lux)	JKR Illumination Requirements (lux)
Circulation Spaces			
Corridors and Walkways	100	50	100
Elevators	150	100	100
Staircase	150	100	100
Escalator	150	150	100
Outdoor Walkways	30	50	30
Entrances	150	100	100
Lobbies, Waiting rooms	500	300	300
Information Counter	300	200	200
Guardhouse			
Outdoor Areas	150	100	150
Controlled entrances, exit gate	30	50	30
Entrance and exit car parks	30	50	30
Storage			
MEDICAL CENTRES			
Consultation rooms, treatment areas	500	-	400
Medical storage	100	-	100
Rest rooms	150	150	100

Hospital	30-50	-	50
Ward units	150	-	Local lighting
General spaces	300	-	300
Nurse station (evening)	500	-	300
Pharmacies	300	-	200
Reception	500	-	300
Information Counter	500	-	300
Laboratories	400	-	500
Operating theatres ICU	30-50	-	-
Recovery Rooms	500	-	500
X-ray department			

Source: Lim (2010)

The comparative standards in Table 3 demonstrate that there are similarities and slight variations in recommended lux levels in the different areas. In addition, the Malaysian Standards 1525:2019 does not have as comprehensive a set of requirements for areas in a hospital as compared to the other two sets of standards. It is observed that the lux values of the IES standards and JKR standards are quite similar. In this study, the JKR standards of illumination will be prioritized as it is a Malaysian standard of illumination, suited to the context of the case studies conducted. According to Asl and Safari (2020), it is concluded that very few studies have assessed daylight functions, consumption of energy and internal layout of medical areas. Asl and Safari further state that recommended daylight levels for human activity is of daylight factor (DF) 2% to 6%. A DF value below 2% is insufficient. In this paper, the daylight levels of the case studies recorded are compared to Tables 1, 2 and 3 to determine adequacy, with Table 3 being the priority.

METHODOLOGY

This research is mainly carried out through fieldwork and is mostly quantitative. The data is obtained by recording illumination levels at the respective care centres. Based on the lighting levels recorded at the different centres, the floor plans of the respective centres are drawn up while the data collected is tabulated and compared. The research method is summarized in Figure 1.

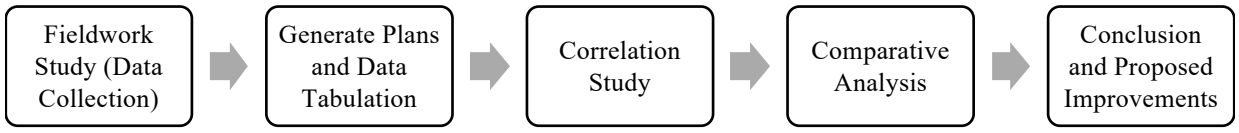


FIGURE 1. Flow of research

FIELDWORK STUDY: DEMENTIA CARE CENTRES

The nature of this study is a comparative investigation done on the results of three different dementia care centres. All three centres, C1, C2 and C3 are located in different states of Malaysia, which are Penang, Perak, and Selangor respectively. The names of these centres are withheld due to confidentiality. C1 and C2 are both private-owned care centres, while C3 is run by a non-governmental organization. C2 and C3 are both daycare dementia centres, while C1 is a fully stay-in facility. All three centres have a similar capacity of a maximum of around 25 residents. C1 and C3 are bungalows repurposed into dementia care centres, while C2 is a purpose-built dementia care centre.

RESEARCH ASPECTS: PERIOD OF STUDY, MEASUREMENT PARAMETERS AND LIMITATIONS

The study is carried out throughout most of the daylit-hours in a day, from 10 am to 4 pm. One full day is dedicated to each centre where lux levels in different spaces are recorded by the hour. The fieldwork study at C1 was conducted at the end of April 2022, while C2 and C3 were conducted in early May 2022. All three recordings were taken one week apart from each other.

Lux levels are recorded using a digital lux meter with a maximum measuring range of 200000 lux. Recordings are taken at hip level; about 1m from ground level, as instructed by the standard operating procedure of the lux

meter used. In each space, daylight readings are taken at several equidistant interval points, depending on the size of the respective room. The method for recording daylight data is illustrated in Figure 2.

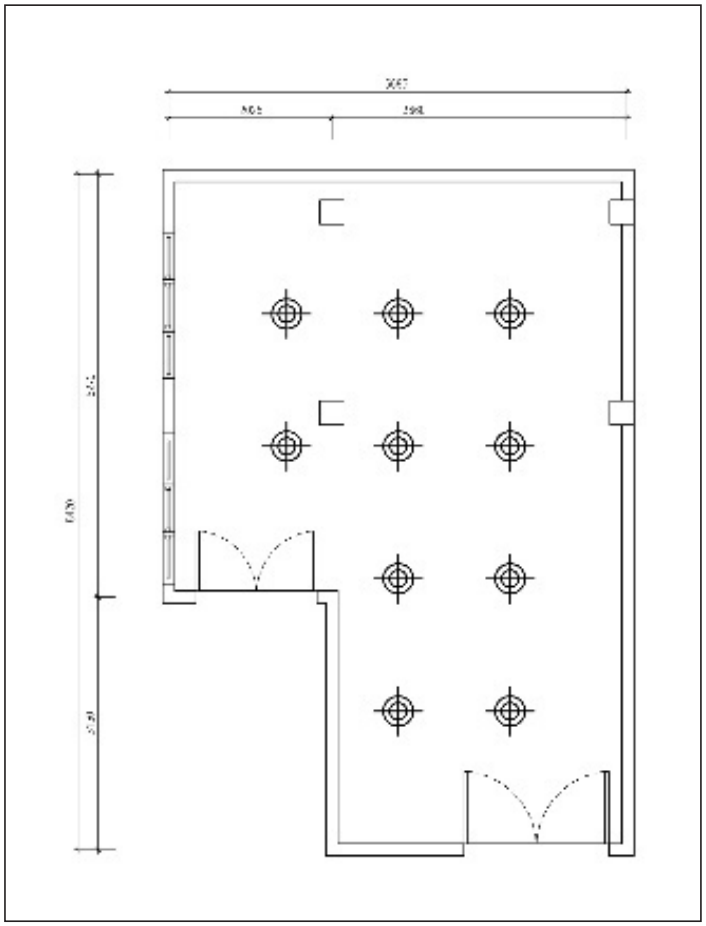


FIGURE 2. Method of illuminance reading in plan

Several methodological limitations are present in the execution of this research. Firstly, due to the different locations which affect the direction and amount of daylight received, it may be difficult to come up with a fair and conclusive comparison. In addition, as the recordings are taken on the same day by the same person, readings in the different spaces are not recorded at the exact same time but in intervals within an hour. Furthermore, the use of the lux meter may result in slight variations from one point to another, resulting in the possibility of inaccuracies. Nevertheless, correlation studies are conducted to assist in analyzing the relationship between the different factors studied.

RESULTS AND DISCUSSION

At each centre, illumination levels are recorded in all relevant spaces. As mentioned earlier, daylight levels are taken hourly from 10 am to 4 pm. For comparison, the average lux level in each space at every hour is considered.

RECORDED ILLUMINATION LEVELS

The different spaces studied at the three centres visited are documented in Table 4. The spaces are categorized into areas with similar functions for ease of analysis. Average lux levels are also recorded and cross-referenced with daylight requirements as outlined in Tables 1, 2 and 3. The MS1525:2019 recommended lux levels are referred to as the primary source of comparison due to its suitability to the local context. Table 1 is referred to as the secondary set of lux recommendations.

TABLE 4. Activity spaces and average lux level recorded

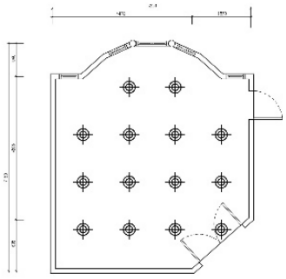
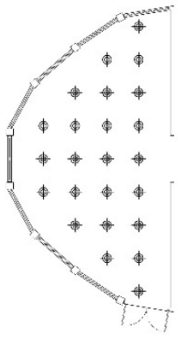
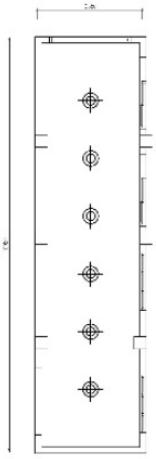
Name of Space & Location	Avg. Lux Reading						Avg. Lux/ hour	Recommended Lux
	(10 am – 11 am)	(11 am – 12 pm)	(12 pm – 1 pm)	(1 pm – 2 pm)	(2 pm – 3 pm)	(3 pm – 4 pm)		
Physiotherapy Room, C1 	568.7	600	824.7	834	764	689	713.4	400-500 (Overly Lit)
Gym Room, C2 	1098	1295	1602	1713	1402	1559	1444.83	200-500 (Overly Lit)
Sensory Corner, C3 	312.2	404.3	436	537	542.5	348.2	430.03	200-500 (Compliant)

TABLE 5. Living and lounge areas and average lux level recorded

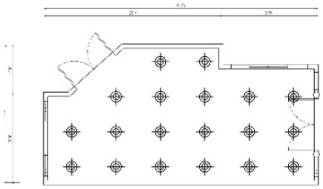
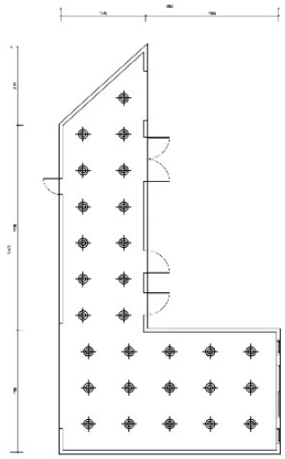
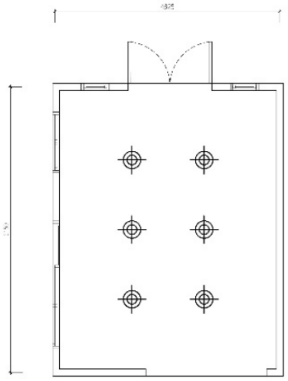
Name of Space & Location	Avg. Lux Reading						Avg. Lux/ hour	Recommended Lux
	(10 am –11 am)	(11 am – 12 pm)	(12 pm – 1 pm)	(1 pm – 2 pm)	(2 pm – 3 pm)	(3 pm – 4 pm)		
Living Room, C1 	145	161.2	202	262.4	228	269	211.27	150-500 (Compliant)
Entrance Foyer and Walkway, C2 	125.6	158.7	169.5	187	183	179	167.13	150-500 (Compliant)
Lounge, C3 	191.5	211.6	263.8	266.4	267	280	246.72	150-500 (Compliant)

TABLE 6. Dining areas and average lux level recorded

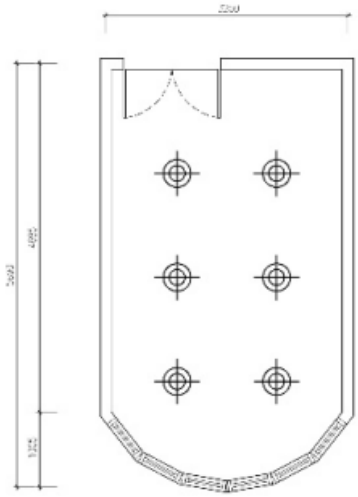
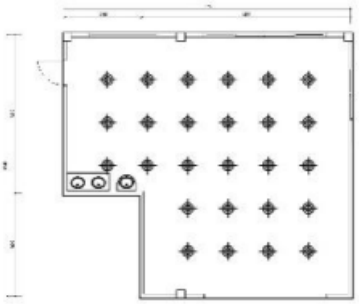
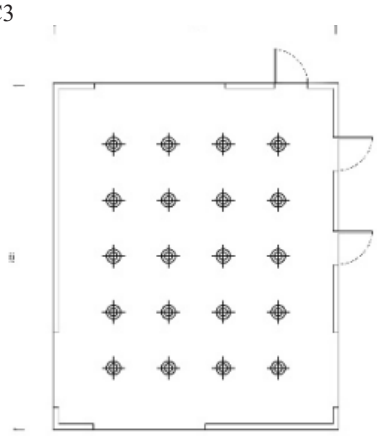
Name of Space & Location	Avg. Lux Reading						Avg. Lux/ hour	Recommended Lux
	(10 am –11 am)	(11 am – 12 pm)	(12 pm – 1 pm)	(1 pm – 2 pm)	(2 pm – 3 pm)	(3 pm – 4 pm)		
Dining Room, C1 	187	195.2	189	193.4	221	227	202.1	200-310 (Compliant)
Dining Room, C2 	402	422	520	512	527	436	469.83	200-310 (Overly Lit)
Dining Room & Activity Area, C3 	287	292	315.15	344	322	297	309.53	200-310 (Compliant)

TABLE 7. Bathrooms and average lux level recorded

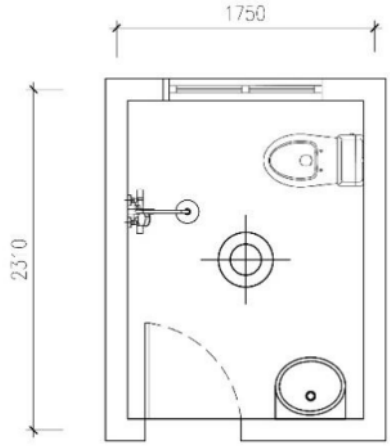
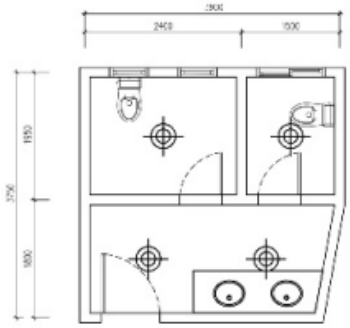
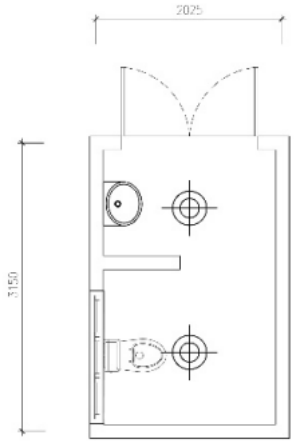
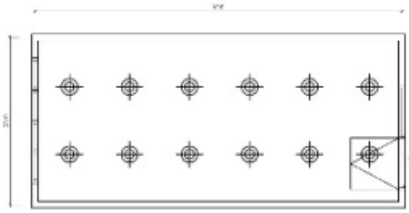
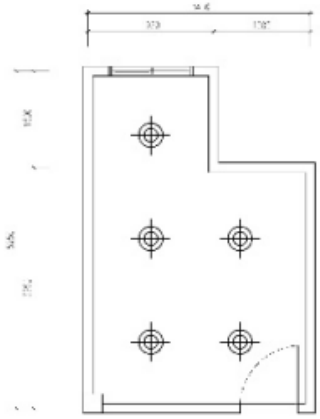
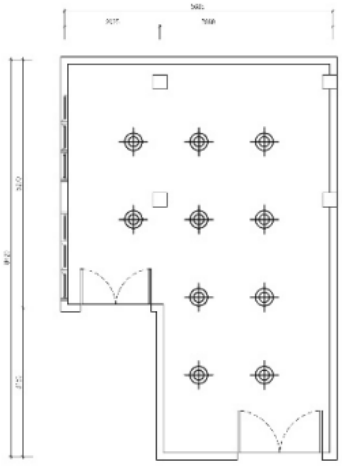
Name of Space & Location	Avg. Lux Reading (10 am – 11 am)	(11 am – 12 pm)	(12 pm – 1 pm)	(1 pm – 2 pm)	(2 pm – 3 pm)	(3 pm – 4 pm)	Avg. Lux/ hour	Recommended Lux
Bathroom, C1 	165.8	165.7	185.5	199.6	201	189	184.43	150-300 (Compliant)
Bathroom, C2 	102.2	249	584	601	495	350	396.87	150-300 (Overly Lit)
Bathroom, C3 	99.5	104.9	185.4	200.4	170.3	154.4	152.48	150-300 (Compliant)

TABLE 8. Bedrooms & resting rooms and average lux level recorded

Name of Space & Location	Avg. Lux Reading						Avg. Lux/ hour	Recommended Lux
	(10 am – 11 am)	(11 am – 12 pm)	(12 pm – 1 pm)	(1 pm – 2 pm)	(2 pm – 3 pm)	(3 pm – 4 pm)		
4-Bed Shared Room, C1 	64.3	69.1	95.9	102.4	110.4	104.5	91.1	100-200 (Non-Compliant)
Quiet Room, C2 	81.4	95.2	99.5	126.95	102.8	101.3	101.19	100-200 (Compliant)
Ladies' Resting Room, C3 	98.6	101.2	113.5	112.3	112.7	105.5	107.3	100-200 (Compliant)

Based on Tables 4 to 8, the different spaces are grouped based on the activities carried out in the designated area. For instance, the Physiotherapy Room, Gym Room and Sensory Corner are all activity spaces. However, the recommended lux level referred to is that of the specified function of the individual space. This comparative table summarizes that of the three centres, the centre which complies most with daylight requirements and recommendations is C3. As a matter of fact, C3 complied with daylight requirements in all the space categories. Out of all spaces studied, only one room did not comply with daylight requirements, which was the 4-bed shared room of C1. Nevertheless, the average lux level/hour recorded (91.1lux) is not far from the recommended minimum of 100 lux for a bedroom space. Looking at the lux levels of C2, it is observed that two out of the five spaces have sufficient daylight levels, while three of the spaces exceed the recommended levels of daylight. Looking at the Gym Room of C2, for instance, the average illumination level of 1444.83 lux is more than double the maximum recommended level of 500 lux. In fact, the room is made up of almost 100% window, with the exception of columns placed in between the fenestrations. Having observed the spaces around noon, despite the space being extremely well-lit, user comfort is jeopardized as the room has too much glare, and is even more significant since no forms of internal (blinds) or external shading (façade or overhang) are present.

Reading the results by category, the only spatial typology whereby all the centres comply with the recommended illumination levels is the 'living and lounge' category. Even from observation, these areas have an optimum window-to-wall ratio, hence being a contributing factor to the high levels of daylight entering the respective spaces. The location of these, areas, too, affects daylight levels as the living areas are found near the main entrance; the most public area of the home. On the other hand, it is seen that the dining areas in two of the centres, C1 and C3, complied with daylight requirements, while the dining room of C2 is overly lit. Referring to the 'bedroom' category of the centres, two out of three centres complied while the 4-bed shared room did not, as earlier mentioned.

To further analyse the relationship between different factors and Lux level, Bivariate analyses are conducted to test the correlation between different sets of variables. The output of the mentioned tests is seen in Figure 3 and Table 9.

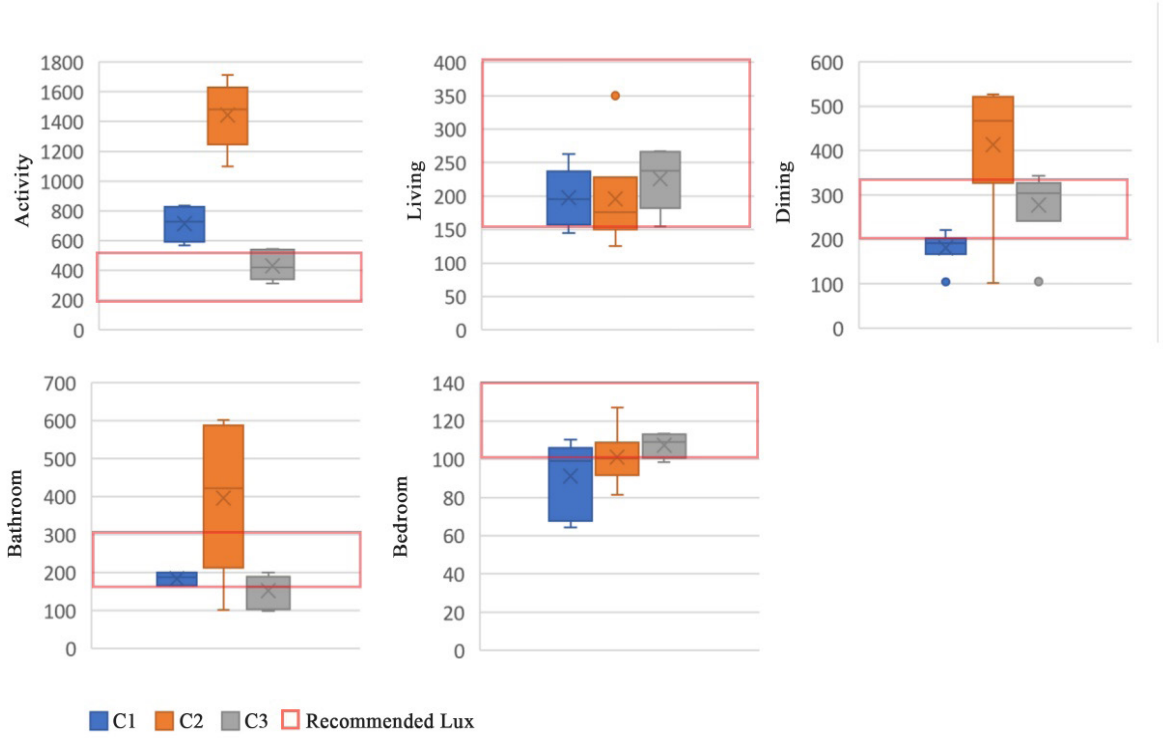


FIGURE 3. Box plot graph showing the relationship between use of space and

TABLE 9. Correlation between different times of the day in common category of spaces

	Correlation between Different Times of the Day					
Category of Space	10 am and 1 pm	12 pm and 3 pm	11 am and 2 pm	10 am and 2 pm	11 am and 1 pm	Average
Activity Space	0.997	0.998	0.999	0.997	0.999	0.998
Living	0.757	0.824	0.866	0.963	0.573	0.797
Dining	0.999	0.998	0.994	0.988	0.998	0.996
Bathroom	-0.470	0.986	0.940	-0.391	0.907	0.394
Bedroom	0.399	0.530	-0.123	0.224	0.688	0.344

The results in Figure 3 show that of all three centres, C3 has the strongest correlation between the different spaces at the centre, while C1 has the lowest. This indicates that C3 has the highest consistency throughout the whole building in terms of daylight levels. As observed earlier in the individual spaces of the centres in Tables 4 to 8, the results support the earlier data as C2 had the least spaces which complied with daylight requirements. Out of the three centres, C2 also had the most number of spaces which were overly lit.

Table 9, on the other hand, studies the relationship in the different spaces at different times of the day between the three different centres. Of all the designated functions, the activity spaces showed the highest correlation, while the bedrooms showed the least. From this observation, compared to the earlier data on daylight compliance, the activity spaces are seen to be either overly lit or have sufficient daylight levels. The bedrooms in two centres are observed to have complied with daylight requirements, while one did not. The weak correlation in different times of the day in these spaces is caused by inconsistent daylight recording throughout the day. Referring to the bedroom correlation between 11 am and 2 pm of -0.123, this value is affected by the significant difference in the daylight levels of C1 at 11 am and 2 pm which were 69.1 lux and 110.4 lux respectively. Looking at specific time intervals and space, the bathroom category recorded the lowest correlation of -0.470 at 10 am and 1 pm. This can conclude that daylight levels in the bathrooms of different dementia centres vary greatly throughout the day, from being compliant to overly lit. Dining areas in all three centres at all time intervals show strong positive correlations, of 0.994 to 0.999. This signifies that the dining areas in all centres have an almost perfect positive correlation, which means that daylight distribution in this space is consistent throughout the day. A contributing factor may be the suitability of the location of the dining space in the respective centres.

CONCLUSION

Revisiting the earlier statement that the amount of light in most nursing facilities is insufficient to meet the needs of the elderly (De Lepeleire et al. 2007), it is seen that the case studies do not fully associate with this stand. Of all fifteen spaces studied in three different dementia care homes, it is recorded that 10 out of 15 spaces (66.7%) comply with daylight requirements and recommendations. Meanwhile, 4 of the 15 spaces (26.7%) are overly lit, which indicates that the levels of daylight are still sufficient but are not within the recommended range. Only 1 (6.67%) out of 15 spaces did not comply with the requirements.

The findings of this research indicate that daylight conditions are quite well considered, yet still have room for improvement in Malaysian dementia care facilities. However, it is discovered that some categories of space are better lit compared to others. Based on the data in this study, activity spaces, dining areas and bathroom spaces generally receive sufficient or too much daylight, while in bedrooms, it is sufficient in two centres and did not comply in one centre. It is evident through the fieldwork that these centres are focused on improving the living environment for residents as they are constantly expanding and experimenting to create the ideal home for dementia.

An aspect that is difficult to analyze is the direct effect of daylight on the behaviour of dementia residents. Such a study cannot be done in one day and requires detailed observations and one-on-one interaction with people with dementia. This area of research poses the potential for continued study within the same topic of daylighting but is a more user-centred approach and addresses the person using the space directly. Another possible area to expand this research is to compare current conditions with proposed improvements. This can be done through design interventions such as light shelves or window size and configuration.

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