ORIGINAL ARTICLE

Time to Inquire Workspace of the Eye Examination Room in Optical Outlets in Malaysia for Post-Covid-19 New Norms

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ABSTRACT

Introduction: Careful consideration of what is necessary for the workspace is inevitable to curb the spreading of COVID-19. Work from home is a logistic challenge for the health, retail, and manufacturing sectors. Hence, a workspace probe is imperative to obtain elementary evidence to fine-tune implementation strategy in pandemic crisis management. Sparse information concerning the workspace of the eye examination rooms inducted this investigation to gather the footing data towards impending preparation of post-COVID-19 new norms for optical outlets in Malaysia. **Methods:** Nine optical outlets with a combination of commercial chains, individual practices, suburban and urban areas were selected to represent assorted types of retail settings. The on-site workspaces' data were measured and recorded in a logbook with a laser meter and measurement tape. Self-assessments of workspaces were gathered through structured interviews. **Results:** The on-site data revealed that all-optical outlets did not comply with the minimum requirement for an optimal eye examination in terms of space area and illuminance. None of the eye examination rooms had a built-in air filtering system and handwash infrastructure. Paradoxically, the functionality of the workspace was self-graded as 'above average'. **Conclusion:** Variation in the eye examination room designs and deviance from the standard requirement may just be a noticeable part of a larger problem about the service quality of optical outlets. Lack of basic hygiene facilities requires action for preventive measures. The incongruity between the self-assessment and the on-site data might indicate a conjectural challenge to efficiently self-implement the post-COVID-19 workspace new norm in optical outlets.

Keywords: workspace, optical outlets, vision, eye care services, COVID-19

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INTRODUCTION

The COVID-19 pandemic is an unprecedented global crisis that upset the economy, politics, education, health and social structures (1). Most countries opt for lockdowns and social distancing to curb the spreading of COVID-19. Work from home has been advocated worldwide, but it is not logistically possible for health, retail and manufacturing sectors. Deliberations about the new norms in those workspaces are on-going. Careful consideration of what is necessary in the workspace is inevitable to deal with the COVID-19 pandemic crisis. Implications, issues, and insights on how COVID-19 alters work practices have been actively debated by researchers and scholars around the world (2). Workspace can affect productivity and efficiency (3-5). Appropriate planning of instruments and furniture positioning in workspace is essential in space management, circulation, and accessibility as well as to avoid workspace related adverse health consequences (6-9). The COVID-19 physical distancing requirement that compromises the functionality of space has been reassessed to address proximity challenges in the workspace (10-12).

Due to an unprecedented pandemic outbreak, most of us are caught unprepared and vulnerable. As the COVID-19 pandemic sweeps through the world, we are forced to make rapid and decisive responses. Most of the COVID-19 guidelines for eye care services are assembled hastily and made accessible in social media platforms in countering the pandemic. A handful of scientific article publications with proper peer-reviewed pertaining to COVID-19 guidelines for community eye-

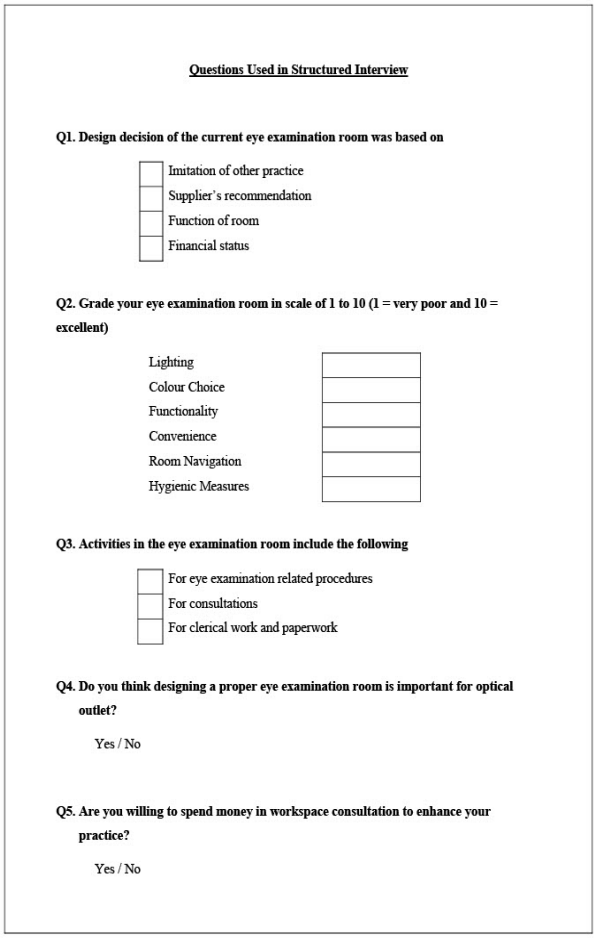
health, ophthalmology, optometry, and optical services is available (13-15). There are primarily guidelines on how to manage community eye health and vision centres, and steps to declutter the optical stores and optometry clinic and COVID screening protocol for staff, customers, and visitors, also specific guideline where and how to sanitize and disinfect different sections of work space like frames, trays, examination tools and so on. Nevertheless, research study and publication about the workspace of optical outlets in Malaysia are limited to initiate and support the strategic provision for post-COVID-19 new norm. With limited footing data on workspace in optical retail outlets, the best practice of post-COVID-19 new norms remain uncertain. Basic information on the workspace of the eye examination room is essential to regulate implementation strategy in pandemic crisis management. Due to the scarce information concerning the workspace of the eye examination rooms, this study served to offer the groundwork information towards imminent preparation of post-COVID-19 new norms for optical outlets in Malaysia. The workspace was investigated from visual ergonomic standpoints to examine the functionality and adherence to minimum standard requirement. It was also inspected from the viewpoint of COVID-19 new norm to safeguard the welfare of space occupants.

MATERIALS AND METHODS

This cross-sectional study adhered to the Declaration of Helsinki. Ethical approval was obtained from the UITM Research Ethic Committee (600-IRMI (5/1/6) REC/193/17). Nine optical outlets were selected using convenient sampling. They encompassed diverse settings of optical outlets with regards to the modus operandi of commercial chain and individual practice; and the residential environment covering both suburban and urban regions.

Objective physical measurements were collected on-site about space and interior furnishing (equipment, colour, lighting, air ventilation and hand wash infrastructure). The eye examination room was quantified using laser meter and measurement tape to record the lengths, widths, and heights in meters for the total space area calculation. Illumination was measured in multiple points at 0.75 meter height using the zig-zag approach (16). Sizes, types, and positioning of interior furnishings such as light source, furniture, instruments, air filtering system, hand-washing basin and loose items were documented if available.

Self-assessment data on the workspace usage was collected from the nine respondents from the respective optical outlets using a structured interview approach. The scopes of the structured interview (Fig. 1) included the deciding factors of eye examination room design (Question 1); self-assessment in term of lighting, colour choice, functionality, convenience, room navigation and hygienic measures (Question 2); activities in the eye examination room (Question 3); self-perceived importance of having a proper eye examination room (Question 4); and willingness to invest for workspace consultation (Question 5).



Questions Used in Structured Interview

Q1. Design decision of the current eye examination room was based on

- ☐ Imitation of other practice
- ☐ Supplier's recommendation
- ☐ Function of room
- ☐ Financial status

Q2. Grade your eye examination room in scale of 1 to 10 (1 = very poor and 10 = excellent)

Lighting	
Colour Choice	
Functionality	
Convenience	
Room Navigation	
Hygienic Measures	

Q3. Activities in the eye examination room include the following

- ☐ For eye examination related procedures
- ☐ For consultations
- ☐ For clerical work and paperwork

Q4. Do you think designing a proper eye examination room is important for optical outlet?

Yes / No

Q5. Are you willing to spend money in workspace consultation to enhance your practice?

Yes / No

Fig 1: The scopes of the structured interview

RESULTS

On-site Data on Workspace

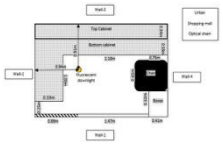
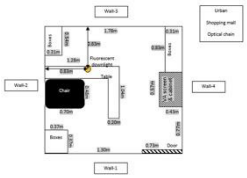
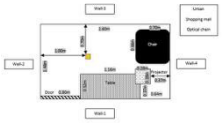
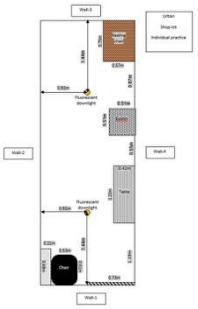
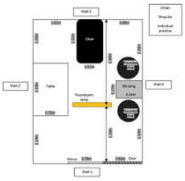
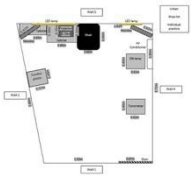
The on-site physical measurement data were summarized in Table I with the schematic layout. The layout incorporated the space area, the location of the objects and furniture, and the positions of the fixed light source.

There were generally three types of room shapes: rectangular (ECP3, ECP4, ECP5, ECP9), square (ECP1, ECP2, ECP7, ECP8), and trapezoid (ECP6). Variations in space areas were apparent. The room size was found to range from as small as 3.49 m2 to as big as 10.80 m2. The room length, which was crucial for proper eye test chart positioning, ranged from 1.48 meters to 5.09 meters. Fitting room length that could accommodate the minimum viewing distance for the vision chart was not

observed. Proximity effect was more apparent in smaller room sizes. The availability of space for navigation was derived from the layouts after subtracting all the built-in furniture and instruments. Some outlets used a part of the eye examination room as storage area. The space for navigation was approximately 60% and above for all eye examination rooms.

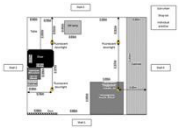
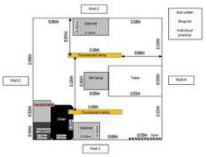
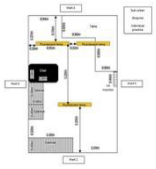
All optical outlets had a neutral pressure type of ventilation system. None of the optical outlets were installed with either positive or negative pressure type. Air conditioners were available in all eye examination

Table I: Objective on-site measurements of the working space of the eye examination rooms

Code	Outlet Types*	Schematic Layout Scale to 1:31.58cm	Room Area in square meters (width x length x height in meters)	Available navigation space (%)	Color of wall, ceiling, and floor	Light type	Illumination (in lux)	Ventilation Type**
ECP1	**UCC**		5.10 (1.84 X 2.77 X 2.92)	65%	Ceiling: white Wall: white Floor: light grey	Fluorescent downlight	147	Neutral
ECP2	**UCC**		5.21 (2.40 X 2.17 X 3.28)	70%	Ceiling: white Wall: grey Floor: grey	Fluorescent downlight	63	Neutral
ECP3	**UCC**		3.49 (2.36 X 1.48 X 3.90)	66%	Ceiling: white Wall: white Floor: white	LED luminaire and Fluorescent downlight	174	Neutral
ECP4	**UIP**		9.06 (1.78 X 5.09 X 3.03)	80%	Ceiling: white Wall: white Floor: white	Fluorescent downlight	92	Neutral
ECP5	**UIP**		8.23 (2.47 X 3.33 X 2.41)	77%	Ceiling: white Wall: white Floor: dark brown	Fluorescent downlight	160	Neutral
ECP6	**UIP**		8.88 (2.40 / 3.86 x 3.57/ 3.71 x 2.83)	83%	Ceiling: white Wall: grey, white Floor: brown	Fluorescent downlight	62	Neutral
ECP7	**SUIP**		10.80 (3.60 X 3.00 X 2.85)	63%	Ceiling: white Wall: white Floor: white	Fluorescent downlight	170	Neutral

CONTINUED

Table I: Objective on-site measurements of the working space of the eye examination rooms (cont.)

Code	Outlet Types*	Schematic Layout Scale to 1:31.58cm	Room Area in square meters (width x length x height in meters)	Available navigation space (%)	Color of wall, ceiling, and floor	Light type	Illumination (in lux)	Ventilation Type**
ECP7	**SUIP**		10.80 (3.60 X 3.00 X 2.85)	63%	Ceiling: white Wall: white Floor: white	Fluorescent downlight	170	Neutral
ECP8	**SUIP**		8.53 (2.93 X 2.91 X 2.39)	72%	Ceiling: white Wall: white, grey Floor: dark grey	Fluorescent downlight	209	Neutral
ECP9	**SUIP**		9.03 (2.44 X 3.70 X 3.46)	70%	Ceiling: white Wall: white Floor: white	Fluorescent downlight	310	Neutral

*Type of Outlet: ECP - Eye Care Practice; UCC - urban commercial chain; SUIP - sub-urban individual practice; UIP - urban individual practice
**Type of Ventilation: negative pressure - more air is exhausted out; positive pressure - more air is supplied in; neutral pressure - same air is exhausted out and supplied in

rooms. However, the ventilation system and hand-washing infrastructure were not accessible within the eye examination room space. Some optical outlets positioned those in the ophthalmic dispensing rooms.

Fluorescent light remained as the preferred light source. Only one optical outlet (ECP3) incorporated Light Emitting Diode (LED) luminaires with fluorescent as downlight. The room illumination in this study ranged from 62 to 310 lux. The effect of room illumination on visual acuity measurement had been testified (17). A shift of room illumination from 90 lux to 1300 lux caused the visual acuity to drop by more than one line. Visual acuity estimates were less affected by the levels of ambient room illumination if the charts were self-illuminated (18). An investigation on visual acuity testing under 15 different illuminance levels (50–8000 lux) further confirmed that the changes in illuminance had a significant effect on visual acuity that could contribute to test/retest variability (19). Unless examination room lighting conditions follow certain minimum lighting requirements, otherwise the comparison of measurements from different clinical settings become meaningless (20). In addition, our study also revealed that light dimmer was not commonly installed to adjust the brightness of the room light for different procedures in eye examination.

Neutral colour (white and grey) for walls and ceilings was the favourite colour in optical outlets. All optical outlets used white colour for the ceilings. Grey and white were the preferred choice for the walls. Floor had a mixture of white, grey or brown colour.

There are three types of visual acuity charts used in optical outlets: chart projector, TV monitor chart and Snellen chart with the aid of a mirror. Six optical outlets engaged in chart projector. TV monitors and Snellen charts were employed in two and one optical outlets respectively. Six optical outlets only had a basic refraction kit (visual acuity chart, trial lens set, trial frame, reading chart) in their eye examination rooms.

Slit lamp biomicroscope was available in three optical outlets (ECP5, ECP6, ECP 7). A functional slit lamp biomicroscope is a device that can be used to examine the anterior and posterior segment of the eye (21).

Keratometer was available in one optical outlet (ECP5). A keratometer is a device that can be used to measure the cornea curvature (22). It can estimate the cornea contribution in the power and axis of astigmatism in the prescription (22).

ECP6 had additional tools such as a tonometer and fundus camera in its eye examination room. Tonometer measures the internal pressure of the eye, as one of the principal tests for glaucoma. A fundus camera is a tool used to photograph the interior surface of the eye. It is commonly used as an ocular health screening tool to detect any abnormality at the fundus. It is also useful for monitoring the progression of eye diseases such as diabetic retinopathy, hypertensive retinopathy, age-macular degeneration, glaucoma etc.

The total staff number of each outlet usually consisted of an optometrist with one or two sales assistants. The

number of visitors at one period of time varied but usually below five. Occasionally could be higher.

Self-Assessment on Workspace Usage

The structured interview was carried out using closed-ended questions to probe on the deciding factors for the design of eye examination room (Question 1); the space usage in term of navigation and functionality (Questions 2 & 3); the perception about the importance of proper eye examination room design (Question 4); and the willingness to invest on workspace consultation (Question 5).

Based on the structured interview, the deciding factors for the design of respective optical outlets were mainly based on the basic function of the room (4 out of 9 optical outlets) and the recommendation from equipment suppliers (3 out of 9 optical outlets). The designs of the two remaining outlets were tied to financial status in decision making. Imitation of other practice was not one of the deciding factors in all responses.

On the other hand, two-third of respondents self-perceived above the average on space usage in terms of navigation and functionality. All self-grading scores on lighting, colour choice, functionality, convenience, navigation and hygiene measures were above average (score of 6 and above). Only four outlets used the allocated space for the eye examination purpose alone; others incorporated multiple utilities into the same space such as consultation and clerical paperwork. All responses advocated the importance of proper eye examination room design in providing good eye care service. Unfortunately, only less than half were willing to invest in professional workspace consultation (four out of nine optical outlets).

DISCUSSION

Our on-site findings revealed a similar tendency concerning lack of space and small navigation areas in eye care practices as reported in previous studies (6-7). The space area for optical outlets varied in our study. Only four out of nine optical outlets fulfilled the minimum requirement room length of at least 3.50 meters to position the eye test chart with a mirror to efficiently control the eye focusing and eye alignment mechanism during eye examination especially for active accommodators like children and adolescents (19, 23-24). A distance of fewer than three meters to position a testing chart could induce accommodation that led to errors in refractive correction (19, 23-24).

The COVID-19 pandemic forced optical outlets out of their comfort zones and posed a challenge to change the normal practice. COVID-19 experience unveils a close link between the physical environment and wellness in the workspaces. Mental health associated with the COVID-19 pandemic are unprecedented. (25) The short-term and long-term mental and physical health impacts remain inconclusive. Promoting good hand hygiene has been advocated to save lives and reduce the spread of COVID-19 (26). Ventilation and indoor air quality issues have been indicated in fighting the spread COVID-19 as part of the strategy besides social distancing, and face masks (27-29). Neutral pressure type of ventilation system was commonly found in optical outlets. None of the optical outlets were installed with positive or negative pressure type of airflow. Apparently, none of the optical outlets in our study placed ventilation and hand-washing infrastructure within the eye examination room space. With the COVID-19 pandemic experience, consumers may be prone to inquire if the air in the eye examination room is filtered and safe.

Consumers might impose additional demands on preventive measures. Those changes might stretch the current roles and incur extra operating cost. The close distance requirement between eye care practitioners and clients in confined space areas of the examination room is a challenge. Optical outlets need to be reassessed to safeguard the welfare of space occupants. Occupational Safety and Health Administration recommends 2 to 3 feet (approximately 60 cm to 90 cm) of physical distancing in a confined workspace to avoid the coronavirus spread through respiratory droplets (30).The need for personal protective equipment (PPE) among healthcare staff remain debatable due to low- to very low-certainty evidence that covering more parts of the body leads to better protection (31). Additional operating cost in absorbing PPE expenses and the practicality to perform procedures under PPE remain challenging for eye care practitioners.

The confined space areas of 3.49 m^2 to 10.80 m^2, in an eye examination room, may benefit from a few preventive measures. One of the measures is to integrate continuous monitoring of the indoor air quality in the eye examination room. Well-designed and monitoring systems are vital for post-COVID-19 workplace design to ensure healthy indoor air quality where pathogens are filtered, diluted, and removed (30). Hand wash infrastructure should be strategically positioned to lessen pathogen transmission. The lesson from the COVID-19 pandemic moves us beyond the scope of just providing sufficient space to enhance the functionality of the room, but also the quality and safety of the confined space due to close physical distance required by eye examination procedures. Workspace hygiene assessment, indoor air quality monitoring, and handwash infrastructure may be adopted as the new requirements in optical outlets.

Self-assessment of the workspace was graded as 'above average'. Self-assessment on lighting, colour choice, functionality, convenience, navigation and hygiene measures did not seem to share the same sentiment as the on-site findings. They were all self-graded as above average. This might reflect the discrepancy between

perception and real scenario that should be taken into consideration in designing data collection approach in future investigation.

Another important component in designing the eye examination room for optical outlets is the room lighting. The luminance of the visual acuity chart and the ambient illumination of the eye examination room interfered with the luminance profile of the fixation target and produced a lower resolution limit (18, 32). When there was a reduction in chart luminance, there was a rapid fall off of the letter contrast which in turn resulted in decreased visual resolution (32). The room illumination in our study ranged from 62 to 310 lux. They were far below the recommended illuminance for an eye examination room of 400 to 600 lux (19). The light source also plays an important role in colour discrimination ability, performance, and comfort (33). Different light types are required for different visual tasks (33). The different light spectrum has been reported to result in different colour discrimination ability (34). Fluorescent light was found to be the preferred light source despite the emergence of energy-saving and cost-effective light emitting diode (LED) light (35). Eye examination room requires different illuminance for different test functions, therefore a specific light source for designated vision testing and dimming control should be added into the lighting designs and setup (6, 33- 35). The designs of eye examination rooms have a direct impact on the accuracy of vision measurements that can affect clinical findings, diagnosis, and management as a whole. In addition, light spectrum in the eye examination room can be affected by wall, ceiling and floor colour selection (34). Neutral interior colour within the eye examination room is preferable to ensure light spectrum stability for more accurate clinical findings. Adhering to the minimum requirement of the eye examination room is also crucial to safeguard the wellness of workspace occupants. This information on the discrepancy should be well-regarded to design-out a visual ergonomics potential problem before it is built into any optical outlets in providing better public vision care services (6-7, 36).

Variation in the eye examination room designs and noncompliance to the minimum standard requirement are apparent in our findings. Both may indicate a noticeable part of a much larger challenge in enhancing optical services in Malaysia. Nonetheless, the capability in making the right choice for workspace new norm in optical outlets remains optimistic. The divergence between the self-assessment and the on-site data on workspace may benefit from teamwork tactics instead of solo approach to improve workplace hygiene, the existing room performance, and continuous room condition assessments. Proactive strategic moves are necessary to pave for the post-COVID-19 new norm in optical outlets. Understanding the risk and safety associated with an eye examination room is crucial. Continuous COVID-19 risk assessment at the workplace supports the implementation of preventive measures (30).

CONCLUSION

Variation in the eye examination room designs, the minimum standard compliance issues, limited hygiene preventive measures as well as the disparity between the self-assessment and the on-site data may be just the tip of the iceberg of a larger challenge in the optical service industry. There is a need for more investigation before making any conclusive decision about optical services in Malaysia. Although the nine optical outlets in our study might cover a range of geographic and business combinations, the small sample remains as the limitation to push for policy changes. Future research to include larger samples that encompasses eye examination rooms in hospital settings and teaching institutions is recommended. Proactive continuous improvement and preventive measures style of adaptation in optical outlets is vital to uplift vision care services.

ACKNOWLEDGMENTS

This study was financially supported by Fundamental Research Grant Scheme (FRGS) [FRGS/1/2015/SKK06/ UiTM/03/3/ 600-RMI/FRGS 5/3 (5/2015)] and Geran Inisiatif Penyeliaan (GIP) [Project Number: 600-IRMI 5/3/GIP (079/2019)]. Special thanks to Nureen Afrina Binti Mohd Latif, Ethan Hoe Tzong Shuen, Saiful Azlan Rosli, and Azmir Ahmad for technical support.

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