Original Article

EFFECTIVENESS OF COMPUTERIZED VISUAL SCREENING TOOL USED IN DRIVING SCHOOLS IN MALAYSIA

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ABSTRACT

Purpose: A survey on new Malaysian drivers was conducted in Malaysia between year 2006-2009. The objective of this study was to look at the effectiveness of the present computerized visual screening tool and to compare it with the conventional testing method.

Methods: A total of 3717 drivers aged 19±6 years, who had passed in the computerized visual screening, participated in this study.

Results: 250 subjects achieved less than 0.3 LogMAR with their best eye and 83 subjects failed the Ishihara Test after retested using the conventional tool.

Conclusion: These finding showed the computerized visual screening test failed to filter some subjects according to the standards set.

Keywords: Visual acuity, driving, colour vision, vision.

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INTRODUCTION

Road accidents in Malaysia have increased in recent years.[1] Jacobs & Aeron-Thomas noted that fatality risk (i.e. deaths per 100,000 populations) was highest in a disparate group of countries including Malaysia, Korea, Latvia, Saudi Arabia and Colombia.[2] Many factors has been put forward as the main cause of road accidents such as the roads, traffic lights, drivers' factor, vehicle condition, speeding, road lighting and others. Another important factor that should be emphasized is the driver's visual competency. The visual screening tools used in different countries are different and there is a need to test their effectiveness in meeting visual standards.

Vision requirement for driving

In Malaysia, the Road Transport Department (RTD) had adopted a guideline of Snellen Visual Acuity at minimum of 6/60 in each eye without glasses and 6/12 in the best eye with corrective glasses. A pass in the Ishihara Test for private vehicle licensing is also necessary. Although many other countries have eliminated the criteria of passing the colour vision test for private vehicles, Malaysia RTD however retained it. A recent study among new Malaysian drivers has noted that the visual status needs to be taken seriously to ensure safe driving.[3]

Computerized visual screening tool

Driving schools in Malaysia which the RTD had recognized it to conduct computerized visual screening tool to screen applicants were randomly selected in this study. Only two schools from each zone were selected to represent the general population of Malaysia. The RTD's visual test comprise of a series of images shown on computer screen which tested on vision and colour perception. There was no standard specification for the computer screen or standard setting for the screen. However, there was no evidence that this software (name given as JPJ Computerized Vision Test, no other information was given regarding the origin of the software) used by the RTD has been tested for its effectiveness since it was fully implement to driving schools' candidates.

Applicants are required to pass the computerized screening test before they are allowed to sit in for their practical driving test. This colour vision software comprised 30 number plates, four picture plates, and three traffic light colour plates, which

are all being shown in random on the computer screen. However, eight different plates (five plates with numbers and three traffic light colour plates) will be shown at each test and time given was three minutes for each candidate. Each plate will be supplied with four objective answers and applicants were expected to choose only one correct answer. A second chance was given if the applicant failed to answer all plates correctly during the first try.

The visual acuity screening comprised of five plates of car registration number (size 2 mm height X 1 mm width). The time allocated was two minutes and the applicant's distance from the monitor was recommended at 75 cm. All plates need to be answered correctly. Similar to the first test, objective answers were given for each plate shown. A second chance was allowed if applicant failed the first time. However, on failing the tests for a second time, applicants will be referred to general practitioners for further visual assessment.

The objective of this study was to look at the effectiveness of the computerized visual screening tool and to compare it with the conventional visual screening method. The computerized method is hypothesized as inaccurate as it was not following the gold standard in screening visual functions.

METHODS

A total of 3717 new drivers had passed their computerized visual screening earlier in their respective driving schools and volunteered to undergo the conventional visual screening test.

This study measured the parameters of visual acuity using the LogMAR EDTRS Chart and the colour vision test was assessed using the manual Ishihara 24-Plate Test. This cross-sectional descriptive study was conducted at four different zones in Malaysia. The zones were north, south, east and west which comprised of several states in Malaysia (Table 1). A large number of subjects were used in these studies as to get a sample of population to represent the urban and rural area drivers. This study was carried out in a large room allocated by the driving schools. All schools were appointed by the RTD office. Lighting was measured at a minimum of 600 lux. An examiner was placed at each station where visual acuity (VA) and colour vision test was conducted consecutively.

The VA was tested monocularly and then binocularly. A 3 m LogMAR Chart was placed in a closed room to minimize the possibility of other subjects memorizing the chart while queuing in line for their turn. All subjects wear their present habitual correction; spectacles or contact lenses. All data were recorded accordingly for right eye, left eye and both eyes.

Meanwhile, the manual colour vision test was done using the Ishihara 24-Plate Test. This was conducted binocularly.

Number of errors was noted and failure in recognizing a minimum of four plates was regard as fail. As this was just a screening test to distinguish between subjects with normal and defective colour vision, it was not necessary to recognize the type or severity of the colour defect. All descriptive data of this study was presented for further interpretation.

This study had been granted with Ethics Approval by the Medical Research Ethical Approval Committee, Medical Faculty, Universiti Kebangsaan Malaysia (FF-071-2007). All data collected were analysed and presented in descriptive form.

RESULTS

A total of 3717 new drivers (50.2% males and 49.8% females), age range from 16 to 74 years (mean 19±6 years), were recruited in this study. There were 250 (6.7%) new drivers with VA of less than 0.3 LogMAR (Snellen equivalent 6/12) with their best eye. The southern and the northern zones held the highest percentage of drivers with reduced visual acuity.

Table I: Visual acuity of new drivers tested using the logMAR Chart

Zones	No	VA less than 0.30 LogMAR in best eye, N (%)
Central	1164	58 (5)
East	809	45 (5.6)
South	836	65 (7.8)
North	908	82 (9.0)
TOTAL	3717	250 (6.7)

Only 83 (2.2%; 2.1% males and 0.1% females) new drivers in Malaysia failed the manual Ishihara test. These subjects were not traced earlier of their defects by the computerized colour vision screening. All the 83 subjects failed to read more than four plates out of the 24 plates shown to them. The zones that showed highest in percentage was the southern zone (3.00%) followed by the eastern zone (2.81%).

Table 2: Colour vision of new drivers tested using the manual Ishihara Plates (24 plates)

Zones	No	Fail Ishihara Test, N (%)
Central	1164	18 (1.62)
East	809	23 (2.81)
South	836	25 (3.00)
North	908	16 (1.76)
TOTAL	3717	82 (2.21)

DISCUSSION

In this study, the author found 6.7% new drivers with substandard VA for driving. The standard requirement for driving in Malaysia is VA 6/12 with best corrected eye. This is equivalent to 0.3 LogMAR. Although all these subjects passed in the computerized visual screening, they failed in the conventional screening test. Thus, there is a 6.7% difference in the abilities of the two methods in screening for visual compromise.

According to figures given by RTD official portal, there were 11, 697, 306 licensed vehicle drivers as at December 2009. A 6.7% difference would translate into a figure of 780,000 Malaysian drivers not meeting the VA standards for driving.

Visual acuity

In many other advanced countries, stringent criteria for commercial drivers are practiced.[4-6] In Malaysia, the visual criteria are set lower than other countries regardless the type of driving license. If all the drivers were to be tested against higher standard criteria, then more obviously more drivers will fail to achieve the higher standard requirement.

The difference of these two screening methods is caused by testing distance,[7] subject's monitoring, subject's accommodation,[8] letter and figures used on the chart, contrast and luminance.

The computerized visual screening test is done on a monitor screen at a recommended viewing distance of 75 cm. An early presbyope subject will need an accommodation power of 1.33D to view the monitor from this distance.[7] Failing to accommodate to this required amount, the visual acuity will decreased and subjects have tendency to position themselves further away to view the plates clearly. On the other hand, subjects with uncorrected myope or hyperope will move their position closer to the monitor in order to focus clearly on the plates. Since the computerized screening test is not being monitored by anyone, subjects could adjust themselves to a comfortable position, thus this contributes to false results. By calculation, the computerized screening is actually meant for testing near visual acuity instead. Meanwhile, the LogMar test was done at the appropriate distance which was at 3 meters.

The computerized visual screening used the car registration numbers, such as WJC 8705, QM 1676, etc. Meanwhile, the optotypes format used in the conventional screening is different. The letters used in this study was the Sloan's letters with grid size of 5 X 5 such as letter C, D, H, K, N, O, R, S, V, Z.[9] These letters contain the same seeing difficulties unlike the car registration numbers. Moreover, during driving, the ability of seeing signboards, sharp corners and car signals are far more important hence good visual acuity is needed for quick response and reaction.

Computer screens can also be altered to vary the background contrast and screen luminance. The computerized visual screening uses white letters with black background unlike the logMAR chart uses black letters on white background. Just by changing the luminance twice, the VA score can be altered by 0.92 logMAR,[10] since the computer screen can be freely adjusted; it is not possible to keep the contrast and luminance standardized. The driving schools were not summon to have a standard computer screen or were advised on the standard luminance setting for the screens. Therefore, the setting of luminance and the size of the computer screen could vary from one school to another.

Colour vision

It was found that 2.2% of Malaysian new drivers have congenital colour defect when tested using the manual Ishihara plates. This however was not detected earlier in the computerized colour vision test. The computerized colour test took the concept of Ishihara Plates using the principles of Pseudoisochromatic but was not in accordance with clinical standards. The arrangements and the colour combination used were different from the original standard. The colours chosen were not confusion hues so it did not serve as an appropriate testing plate as subjects with colour defects could still appreciate and differentiate the colours shown using some colour clues. In addition, the plates has no design for transformation, vanish, hidden or diagnostic plates to diagnose types of defect. Colour assessment done using the manual Ishihara Plates were found more reliable compared to the computerized software adopted by the driving schools. Moreover, the monitor screen can once again be adjusted in contrast and brightness and it can be tempered with when used without strict supervision. Lack of standardization will also cause variability in colour assessment on subjects.[11]

It is well known that the two important parameters in visual screening are essential for safe driving. The visual acuity coupled with the ability to discriminate colours served as important factors needed for competent driving.

Since the statistics showed that accidents are always on the rise despite having many preventive measures like good roads, lightings, better driving conditions and vehicle safety upgrading, it might be worthwhile to have a stringent vision test to allow only visually capable drivers to be on the road. If most of the ametropia participated are believed to be able to obtain good visual acuity after correcting them with prescriptive lenses, it will be of utmost important to have them repeat the vision test with their corrections on. Failed candidates should be made mandatory to have the eyes examined for refractive status

and colour test by qualified eye care practitioners before a re-sitting is allowed.

Candidates with colour vision defect should be strongly advice to have their severity and type of defect to be assessed in a more comprehensive technique. Being a deuteramalous or deutan will not posed as much danger as a protanomalous or protanope.[11] However, this finding contradicted to Atchison *et al*., where it was shown that deutans performed much worse than protons of similar severity. It is generally accepted that colour vision deficient adults can drive safely if only they discriminate colours by using cues and this ability depends on the type and severity of the colour defect.[11]

CONCLUSION

This study confirms that the current visual screening method used for Malaysian drivers failed to filter out the visually incompetent candidates to some extent. An effective tool for visual screening is necessary to ensure only visually competent drivers are allowed on the road.

ACKNOWLEDGEMENT

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Family Medicine is not a preferred career choice of medical students in a private university

Chew YW, Rajakrishnan S, Low CA, *et al.* Medical students' choice of specialty and factors determining their choice: A cross-sectional questionnaire survey in Melaka-Manipal Medical College, Malaysia. *Biosci Trends*. 2011;5(2):69-76.
http://www.biosciencetrends.com/action/downloaddoc.php?docid=418
Affiliation of primary author: Melaka-Manipal Medical College, Melaka, Malaysia.

This is a cross-sectional survey of 425 fourth and fifth year medical students at Melaka-Manipal Medical College. Family Medicine is not mentioned as one of the 12 first choices. More than three-quarters of students preferred one of these five discplines: Medicine, Surgery, Paediatrics, Obstetrics & Gynaecology, and Orthopaedics.