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Evaluation of the Vision Screening in School Children, Hamadan Province, West of Iran

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Abstract

Background: Despite the fact that school nurses perform visual screening of pupils in Iranian primary schools; very few studies have been done to determine the validity of the screening test. This study was conducted to assess the validity of visual screening test by school nurse compare to optometrist diagnosis.

Methods: A total of 878 pupils aged 6-15 year were studied. A school nurse performed screening for visual ability using E-chart. Also all the pupils referred to an optometrist for definite diagnosis. Then the results obtained by the school nurse were compared to the optometrist diagnosis. In comparison, the sensitivity and specificity of the test were calculated to show the value of the screening test.

Results: From all the pupils, who were screened by the school nurse, 64 screened out positively. These pupils were referred to the optometrist, 87.5% were diagnosed as having vision disorders. 91.5% of the other pupils, who were screened out negative and referred to the optometrist, were healthy. Comparison of the results of the vision screening with the outcome of a full eye examination, gave a sensitivity and specificity of 44.8% and 98.9% respectively.

Conclusion: The use of E-chart by school nurse to determine visual "defects" of school children, is low sensitive but highly specific. To improve the present system of visual screening in the schools, training of the school nurses is recommended.

Keywords: *vision screening, E-chart, school nurse*

Introduction

Screening is defined as, the presumptive identification of unrecognized disease or defect by the application of tests, examination or other procedures which can be applied rapidly (1). The vision screening of children aged 6-15 was established in the 1990s in response to a need perceived by health professionals. Traditionally, using E-chart a test is carried out by school nurses as part of pupils' health surveillance (2). In the recent years, using advanced instruments, excess to use E-chart; optometrists have established programs specifically for vision screening in some surgeries (3). There is considerable variety in the types of vision screening and their efficacy in the populations (4-8). The validity of a test is defined as the ability of the test to distinguish between infected and uninfected people (9). The aim of the pupils' vision screening test is prevention or reduction of disability due to ametropia that cannot be detected without vision screening (10- 12). In Iran, the vision screening test is performed by schools' nurses. The future of vision screening is presently receiving heated debate. Recent governmental legislative activity of comprehensive health planning has caused renewed interest in vision screening. To make appropriate recommendation for the development of standards for comprehensive vision screening of school children, attention to the efficacy of present system is needed. This study compares the results of testing vision of school children by school nurse and an optometrist.

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Materials and Methods

Totally 878 pupils aged 6-15 year, were screened for visual ability. The sampling method was simple random one. The children were studied in Hamadan city, west of Iran. Visual ability was measured at 3 meters, using the E-chart (Snellen test). A school nurse performed measurement for each pupil. Children with a test result in visual acuity of 6/9 or worse were screened as positive. The result of the test for each person was coded as negative or positive. Then, an optometrist in the clinic examined these pupils. All pupils were first instructed as for E-chart at classrooms. Visual ability was measured for each eye separately. Then, the school nurse completed the questioners related to the screening results and also demographic characteristics of the children. To evaluate the validity of pupils' visual screening by school nurse, the results were compared with the optometrist diagnosis. For comparison, the sensitivity, specificity, positive and negative predictive value and negative predictive value were calculated. Sensitivity is the ability of the screening test to give a positive finding when the person tested truly has the disorders, a/ (a+c). Specificity is the ability of the test to give a negative finding when the subjects tested are truly free of the disorder under study, d/ (b+d). The proportion of positive tests that are truly positive a/ (a+b), is called the predictive value of a positive test. The proportion of negative tests that are truly negative d/(c+d), is called the predictive value of a negative test (13). The general representation of the screening evaluation is shown in table 1.

Table 1: The general representation of the screening matrix

		Diagnosis by optometrics		
		Disorder	**Not disorder**	**Total**
Screening by the school nurse	**Positive**	True positive (a)	False positive (b)	(a+b)
	Negative	False negative (c)	True negative (d)	(c+d)
	Total	(a+c)	(b+d)	(a+b+c+d)

Results

Eight-hundred seventy eight children were screened by the school nurse. Table 2 shows the results of screening test for visual "defects" of school children. Totally, 125 (14.2%) were diagnosed as eye disorder. Sixty four pupils (7.3%) failed the vision screening and were examined by the optometrist, 56 of whom failed the ophthalmic examination, named as true positive. Of the failed pupils by the screening test, eight were not diagnosed as having vision disorder by the optometrist, named as false positive. Besides, all the pupils who were not failed by the screening tests were referred to the optometrist, of whom 69 were diagnosed as having vision disorder, named false negative. The others were named as true negative. The estimated values of the visual screening test were: sensitivity 44.8%; specificity, 98.9%; positive predictive value, 87.5%; and negative predictive value, 91.5%. Results of screening test for visual "defects" of school children, after removing of negatives due to myopia by optometrist, are shown in table 3. All the pupils who were not failed by the screening tests (814) were referred to the optometrist, when ignoring myopia by the optometrist, of whom only 9 had vision disorder, named false negative. The others were named as true negative. According to the later data, sensitivity

was increased to 86.2%. In this case, specificity and negative predictive value were 99% and 98.9% respectively. An attempt was made to determine the pupils who used medical spectacles, during the study. From fifty-two pupils who had medical spectacles; 30 (57.7%) used an appropriate one. The spectacles of 22(42.3%) pupils were not appropriate (Table 4). It was known that 73 children did not use any spectacles glasses.

Table 2: Results of screening test for visual "defects" of school children.

		Diagnosis by optometrist		
		Disorder	Not Disorder	Total
Screening Test	Positive	56	8	64
	Negative	69	745	814
	Total	125	753	878

Table 3: Results of screening test for visual "defects" of school children, after removing of negatives due to Myopia.

		Diagnosis by optometrist		
		Disorder	Not Disorder	Total
Screening Test	Positive	56	8	64
	Negative	9	805	814
	Total	65	813	878

Table 4: Status of the school children, due to appropriate spectacle

Diagnosis by optometrist		
Status of Spectacles	No.	Percent
Appropriate to use	30	58
Should be changed or removed	22	42
Total	52	100

Discussion

The prevalence of visual morbidity was 14.2%. Eye disorders were found in relatively high frequencies for this population. Also, in a study, 4759 school children aged 11 years were screened over a 3-year period, the annually calculated prevalence of vision problems ranged between 10.5% and 13.8% (6). The findings in the present study underscore the necessity of comprehensive vision-screening programs that integrate follow-up care. Children with limited access to specialized eye care must be provided with a mechanism for obtaining these services. There are two probabilities used to measure the efficacy of a screening test to discriminate between individuals who have the disease and those who do not. These components are determined by comparing the results obtained by the screening test with those derived from some definitive diagnostic procedure. The extent, to which the screening results agree with those derived by the more definitive tests, provides a measure of sensitivity and specificity. For simplicity, it is assumed that there is no error in the final diagnosis reached by the more definitive procedure. An ideal screening test would be 100% sensitive and 100% specific. In practice these do not occur; sensitivity and specificity are usually inversely related (14). Lennerstrand et al, in a study of school children highly recommended visual screening of the children by school nurses (15). Comparison of the results of the vision screening by the school nurse, with the outcome of a full eye examination by the optometrist, gave a low sensitivity of 44.8% but a high sensitivity of 98.9%. The results of vision screening of 5 year old children in schools by school nurses and an optometrist gave a sensitivity of 95% and the specificity 83% (16). Six-hundred eighty children were screened, about eleven percent (76 persons) failed the vision screening and was examined, 68 of whom failed the ophthalmic examination (4). Eight hundred and twenty one primary school children in South Auckland were screened, of whom 1.8% new visual defects were detected (6). Robinson et al, have investigated the validity (sensitivity and specificity) of school vision screening program (17). The yield indicated that a very high

percentage of children with vision problems were identified for the first time.

Of 878 children screened, 125 (14.2%) had a failing results. Of this group, 52 had glasses. The yield indicated that a very high percentage of children with vision problems were identified for the first time. Given that only 41.6% of children who needed glasses had them, indicated a huge need to provide glasses in this age group in Iran (2). In a study on students 9 to 15 years of age in four middle schools in Northern Manhattan, only ten percent of the group that required glasses already had them (11).

According to the results, use of E-chart to determine visual "defects" is insensitive and highly specific. Sixty of the false negatives which were diagnosed as having Myopia by optometrist, transferred to true negative cell in table 3. When we transferred 60 Myopia from false negative cell to true negative cell in table 3, sensitivity increased to 86.2%. This finding shows that the visual screening test will be valuable if we only want to measure distance vision. Thomson and Evans have stated that E-chart vision screener provides an inefficient method for screening in schools (8). A new method suggested by them to vision screening in schools, demonstrated a sensity and specificity of 93.8% and 96.1% respectively. Lim et al suggested the referral criteria for abnormal visual acuity should be set at 6/12 (7). From the results it can be concluded that only using E-chart is suitable for distance vision test and is not valid for myopia which has been emphasized by Vaughan et al (18). There is, therefore, a need to make more universally available, more sophisticated tests of vision; where they are not available, further emphasis should be placed on increasing accuracy of the present system as a comprehensive vision screening system for Iranian school children. To implement a comprehensive vision screening, according to the standards, preparing adequate school nurse practitioners for the country is recommended. Moreover, vision screening workshops are recommended for the present occupant school nurses. It can be concluded that eye disorders are found in relatively high frequencies within this population. This finding underscores the necessity of comprehensive vision screening programs that integrate follow-up care. Children with limited access to specialized eye care must be provided with a mechanism for obtaining these services.

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