

# Vision testing in schools: an evaluation of personnel, tests, and premises

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## Abstract

**This study compared the results of vision screening of 5 year olds in schools by school nurses and an orthoptist, compared two tests, and examined testing conditions. The specificity of nurse testing was 95% and the sensitivity 83%. No conclusions about the tests could be made owing to the small numbers in this part of the study, but some children, after nearly one year at school, could not match a line of four letters required for the more accurate test. Only 13 of 22 schools had suitable testing conditions.**

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School vision testing has been an established part of the school health service since 1907 and remains universally recommended.<sup>1</sup> Despite this, little analysis of accuracy and outcome has been performed. Screening at age 5 years is primarily aimed at detecting amblyopia and refractive errors, but debate continues about the effectiveness of treatment of amblyopia at this age and its significance as a cause of morbidity.<sup>2</sup> All primary 1 children in Glasgow schools, regardless of history, currently have their visual acuity tested, by a single letter matching test, the Stycar 5, in which a child is

shown letters of decreasing size and is required to match them from a choice of five on a card. Because a single letter is presented at a time there is a tendency to overestimate acuity compared with a standard Snellen chart,<sup>3</sup> therefore the referral criteria have to be lower. In this study we compared the results of screening by school nurses with those of an orthoptist, compared results using two different tests—one the test currently used and the other a technically more accurate test—and examined the suitability of testing conditions.

## Subjects and methods

During the 1995-96 school session 10 000 primary 1 pupils had their visual acuity tested in the 315 schools in Glasgow. Twenty two schools, with 766 pupils, were selected at random from the 120 in one sector of the city, and these children were retested in the same location with the same single optotype test as used by the nurse. One hundred and six children were also tested using a 3 metre linear test, the Glasgow acuity cards.<sup>4</sup> In this test the child again matches letters but is shown a line of four letters at a time to identify, thus increasing the accuracy because of the presence of a crowding effect. These children were not randomly selected for testing with this additional test, but the testing was performed only in schools where there was time available. Assessment of the lighting conditions and the presence or absence of distractions was made at the 6 metre test location and where a 3 metre test area was available.

## Results

Figure 1 shows the results obtained. The prevalence of decreased visual acuity on nurse screening was 8.6%, but 4.2% on orthoptist testing. The specificity of nurse testing was 95% and sensitivity 83%. The positive predictive value was only 40%, but the negative predictive value was 99%.

Owing to time constraints, linear testing was attempted with some pupils only in 10 schools, but the pupils in two schools were unable to perform the test because they could not identify each letter individually in the correct order and match it to their card. The examiner could not simplify the test by pointing to each letter in turn as this would have negated the crowding effect. A total of 106 children was tested—four had reduced acuity and all were also detected by the single optotype test. No children identified as having reduced acuity using the single letter test were subsequently found to have normal acuity with the linear test.

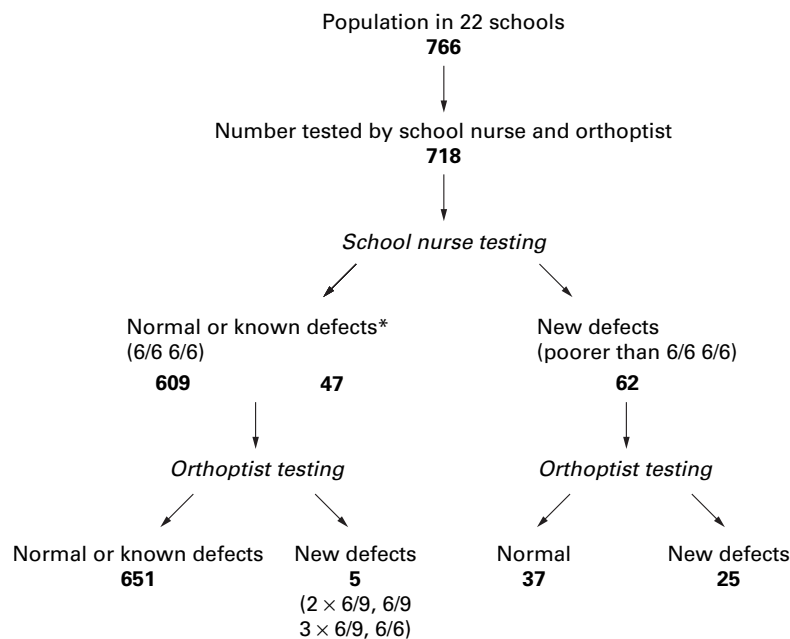


Figure 1 Results of visual acuity testing by school nurses and an orthoptist using a single optotype test. \*A defect is defined as a visual acuity of 6/9 or poorer by single optotype testing.

All 22 schools had a location with 3 metres available but one did not have 6 metres. Appropriate lighting (at least 480 lux) was available in 17 schools at 6 metres and in 21 at 3 metres. Only 13 schools were free from distractions at 6 metres but 21 were at 3 metres. Conditions were suitable overall in 20 schools at 3 metres but in only 13 at 6 metres.

### Discussion

Orthoptists are more accurate visual screeners than others,<sup>5</sup> but the principal findings of this study suggest that all children with significant visual defects are detected by the current screening system. None of those children detected by the orthoptist, but not the nurse, had a serious visual defect, although single optotype testing may have overestimated their acuity. If school vision screening is to continue to be thought of as being of positive benefit, nurses should continue to be the primary screeners. This is not only because of these results, and despite the high false positive rate, but because vision screening is an integral part of monitoring children's health, is vital for their education, and provides a unique opportunity for a trained school nurse to have direct contact with each child in his or her school. Concerns have been expressed previously<sup>6</sup> about the standard of nurse vision screening, but this study shows that children with a significant defect should not remain undetected. A reduction in the false positive rate should be sought, however, thus reducing the referral rates both to optometrists and ophthalmology clinics and the personal and parental anxiety induced by screening positive. Anxiety might be reduced by instituting community orthoptic clinics where children screening positive could be seen rapidly and more fully assessed.

No firm conclusions can be drawn from the comparison of the two tests because of the small number of defects, but other studies<sup>4</sup> have shown that the linear Glasgow acuity cards are better than single optotype tests. Of more importance was that some children after almost one full year of formal education could not match letters from a line. This indicates that for primary 1 children in an inner city population like that of Glasgow a simple single letter test is more universally appropriate than a linear test. A larger study comparing sensitivity, specificity, and performance of the two testing strategies is required.

Conditions for school vision testing often do not accord with the British Standards,<sup>7</sup> and this study confirms that optimum conditions are not available everywhere. Adoption of vision testing at 3 metres as opposed to the current 6 metres would greatly increase the availability of acceptable conditions, though specificity and sensitivity would need to be maintained.

This study suggests that screeners are competent and that the tests require further study and adjustment, but does not address the issue of children's attendance at follow up or compliance with treatment; this work is continuing. Neither does it consider whether the number of visual defects detected and the outcome of their treatment is justified. This issue was recently considered for preschool screening,<sup>8</sup> but the effect of treatment remains unclear. If no screening programme existed it is likely that fewer unilateral defects and amblyopia would present, but the results of treatment may not justify the input, and it is unclear whether unilateral visual loss is truly an appreciable impairment in adult life. Evidence of treatment outcomes and long term implications is required.

Ideally, testing should be performed at 3 metres with an accurate test, with good sensitivity and specificity, which primary 1 children can, in general, perform. This would maximise testing conditions and, therefore, reduce the false referral rate.

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Conflict of Interest: None.

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