Incidence and awareness of visual problems in children

Anthony J Hanks and Ian D Chapman
Port Macquarie, New South Wales

A study of 151 Year 5 school children was conducted to determine the incidence of significant visual problems. The incidence of problems was 30 per cent, but we were especially concerned by the high proportion which were not previously recognised. Surprisingly, almost half those with a vision problem were unaware that such a problem existed. Comparison of this data to earlier unpublished preschool results is included, and the implications for school screening programmes are discussed.

Keywords: Screening, children, visual problems, incidence, awareness.

Vision problems among school-age children are generally reported at an overall incidence of between 20 and 30 per cent.[1-5] The observation that these problems can have far reaching effects on an individual's learning potential is also well accepted.[5-9] A child who was previously thought to be learning-disabled may later be found to have a fundamental visual problem which has retarded the learning process.

Whether the vision problem results in 'strain' or 'blur', the net result can be the same. Children will typically not recognise their own visual problems since they assume that everybody else sees the same way as they do. It becomes the responsibility of caring adults to ensure that these problems are recognised as early as possible, in order to minimise the interference with learning.

The school screening program

The NSW Health Department currently provides Community Health Centre staff to conduct regular sight and hearing tests in all schools. These tests, conducted by nurses, are a sincere attempt to detect these limiting conditions by means of a screening regimen and appropriate referral.

While being well-conducted, the screening for vision problems is unfortunately limited in the areas it is able to test. Hyperopia cannot be detected by the current battery of tests, except in very high degrees. This one condition has the highest incidence among the vision problems affecting children.[10] It is also acknowledged as being associated with below average readers,[1] and yet hyperopia is not checked in most screening programs,[5] including those in NSW. The reason for this probably relates to the difficulties of detecting the condition during a brief screening examination. We believe that its omission goes some of the way to explaining the relatively low incidence (10 per cent) of vision problems quoted for the school health services.[1]

The real concern with this type of school vision screening program is the false sense of security which parents of a significantly hyperopic child can receive. Even if they had suspicions about their child's vision and strain associated with close work, parents could be falsely reassured by the results of a screening program which did not check for hyperopia.

If the incidence of significant visual problems is generally recorded at 20 per cent the question is raised as to what proportion of these are recognised and receiving appropriate treatment. Given that children will not recognise their own visual limitations, and that the current school program is only a screening (and then only for some problems), it is reasonable to expect that there will be a significant number of children with undetected problems.

Comparative data

In 1985, 1986 and 1987, we conducted a comprehensive vision screening of 671 children aged approximately 4.5 years. These studies included the same clinical evaluations, equivalent to those conducted in the study of Year 5 children reported here.

We found an incidence of visual problems in pre-school children of 18.9 per cent; probably the most significant finding was that, of these children, less than one quarter were already recognised and receiving treatment. More than three quarters of those with visual problems were not recognised.

The data for both the incidence of visual problems and the proportion of these which were already recognised, will be compared and contrasted with the equivalent data now collected on an older age group. The community and socio-economic backgrounds of the children in the samples remained similar, so that comparisons are relevant for the change in age group.

The Year 5 study

A sample of 151 Year 5 students was included in this study of children's vision problems and their awareness of them.

After obtaining the approval of the NSW Department of Education and the Department of Health, the study was implemented during November, 1986. Written parental permission was obtained for all prospective participants in the study. From these the sample was then selected by random numbers from a controlled cross-section of both public and private schools, including relatively

Accepted for publication: September 9, 1988.

Sample Size:	151
Schools:	
Public	60.8 %
Private	39.2 %
East Port Primary	20.5 %
West Port Primary	27.1 %
Hastings Primary	13.2 %
St Joseph's Primary	24.7 %
St Agnes Primary	14.6 %

Table 1. The sample of Year 5 children

depressed and affluent economic areas, all within the Port Macquarie district. The final breakdown of the sample is summarised in Table 1.

In order to determine the proportion of vision problems in the older, school age children, a comprehensive vision screening program was conducted. All screening examinations were conducted by the same optometrist.

Since this study was to be a straightforward measurement of the incidence of specific conditions in a given sample population, there were no controls required.

The complete screening was based on a modified clinical technique and included the tests for visual skills as listed in Table 2. This table also includes the criteria used to classify those requiring 'further evaluation'

1. Push up convergence	Near point at more than 8 cm
2. Cover test for ocular muscle balance	Any esophoria Large exophoria ($>10^{\Delta}$) associated with poor convergence
3. Ocular motility for muscle actions and co-ordinations	Any restrictions
4. Visual acuity R & L (unaided or habitual) — Snellen letter chart	6/7 or less
5. Stereopsis for depth perception & binocularity — Titmus Stereo Fly	No response better than 400 seconds of arc
6. Colour vision — Ishihara number plates	More than one error, repeated twice
7. Retinoscopy to determine significant refractive errors	Hyperopia $\geq +1.50$D Myopia ≥ -0.50D Astigmatism ≥ 1.00D
8. Ophthalmoscopy for ocular health, internal and external	Any abnormality

Table 2. Screening tests and criteria for 'further evaluation'

Advice to parents

At the conclusion of the study, all parents of participating children received a written report advising the results for their child (see Appendix A). This explained the limited screening nature of testing, classified the child's result, and recommended further evaluation with the family's own eye-care practitioner if appropriate, or if future symptoms ever warranted it. In accordance with the Department of Education approval, there was no acknowledgement of either the authors or the study sponsors.

Results

Visual problems

For the 151 Year 5 children evaluated, 48 were found to have specific visual problems indicated by the screening tests. These are summarised in Table 3. Results from our studies of pre-school children are also included, for comparison.

Proportions recognised

The 48 children detected to have visual problems were further recorded as those already recognised and under treatment versus those previously undetected. This type of breakdown, in each of the age groups evaluated, is shown in Table 4. Those subjects for whom the only problem was a colour vision defect are not included, since treatment of this condition is not applicable.

Visual problems previously undetected

A total of 21 children had visual problems, detected during the screening procedures, which were previously not recognised. This result has a significance which varies depending upon the specific problem involved. For example, colour vision defects generally cannot be corrected, but the appropriate treatment is really one of recognition. Once identified, any educational techniques which are dependent on colour coding can then be avoided and appropriate vocational advice can be provided.

For vision problems such as reduced visual acuity, specific treat-

	Year 5		Pre-School	
Sample size	151	100.0 %	671	100.0 %
Passed	103	68.2 %	544	81.1 %
Passed except colour vision	2	1.3 %	28	4.2 %
Failed	46	30.5 %	99	14.7 %

Table 3. Incidence of visual problems

	Year 5		Pre-School	
Visual problem indicated by screening	46	100.0 %	99	100.0 %
Already under treatment	25	54.4 %	20	20.2 %
Previously undetected	21	45.6 %	79	79.8 %

Table 4. Proportions of previously detected visual problems

	Year 5	
Sample size	151	100 %
Visual problem indicated by the screening, but previously undetected	21	13.9 %
Binocular inco-ordinations	6	4.0 %
Strabismus	0	0.0 %
Convergence insufficiency	3	2.0 %
Poor depth perception	1	0.6 %
Colour vision defective	2	1.3 %
Reduced visual acuity	5	3.3 %
Refractive error	10	6.6 %
Longsighted	6	4.0 %
Shortsighted	3	2.0 %
Astigmatism	3	2.0 %
Eye health	2	1.3 %

* Some children categorised under multiple problems

Table 5. Visual problems that were previously undetected*

	Year 5		Pre-school	
Sample size	151	100.0 %	671	100.0 %
Passed except colour vision	2	1.3 %	28	4.2 %
Failed including colour vision	5	3.3 %	2	0.3 %
Total Incidence	7	4.6 %	30	4.5 %

Table 6. Incidence of color vision abnormalities

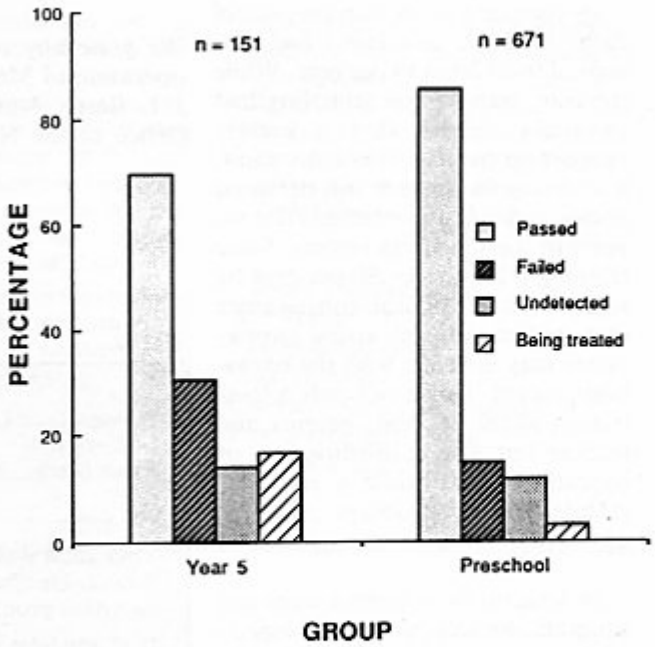

Figure 1: Visual problems and proportions of problems recognised in two surveys. The categories 'Undetected' and 'Being treated' add to make up the 'Failed' category.

ment is indicated to overcome the handicap. The specific visual problems for those children who were not already under treatment, are shown in Table 5.

Colour vision

Colour vision abnormalities are generally expected to affect seven per cent of boys and one per cent of girls, for an overall incidence of approximately four per cent.[5] In the evaluation of Year 5 subjects, seven children with colour vision problems were detected. These included some who failed for other reasons, some already under treatment, and some who would otherwise have passed. The full breakdown is shown in Table 6.

Discussion

The significant proportion of school-age children with visual problems was again confirmed in this study. The incidence of 30 per cent is certainly enough to warrant a more complete approach to the testing of children's vision in the regular school screening programs.

The increase in the incidence of visual problems from pre-school to Year 5 age children was from 15 to 30 per cent. This increasing pattern is consistent as the young eyes mature and develop approaching adolescence, together with the growing visual demands of each passing grade.

It should certainly be agreed that 30 per cent visual problems in this age group is a significant level. As such, it is one which requires an accurate assessment and a procedure whereby correctly interpreted information can be confidently reported back to parents.

Colour vision defects affected 4.6 per cent of the Year 5 sample. Both this and the similar level for the pre-school sample are consistent with the levels expected.

While the incidence of visual problems recorded is at a significant level, perhaps the most important and specific finding in this study was the awareness of these visual problems. It would always be hoped that any youngsters with impairments to their learning ability should be detected when they are as young as possible. Then corrective action could be taken before that child's progress was handicapped.

Unfortunately, this desired 100 per cent awareness of visual problems was not found in this study. Instead, almost half of those children with a significant visual problem were unaware that such a problem existed. Never having had a 'normal' visual situation with which to compare, they had not recognised their own visual handicap. Neither had it been detected by the observations of parents and teachers, nor by the limited nature of the current school vision screening program.

In comparison to our pre-school data, problem awareness had improved from 20 to 54 per cent. While the entry into formal schooling had obviously helped alert a greater proportion to their visual situation, a worrying 46 per cent still persisted undetected and uncorrected after six years in the schooling system. Since learning is held to be 80 per cent by sight[4], it is a natural consequence that such significant visual impairments may interfere with the education process. This is not only a frustration to the student, parents and teacher but also a misdirection of education funds while a relatively simple visual problem remains unsolved.

In structuring a school screening program, we feel that several aspects of the current system need to be addressed. The screening program should be more comprehensive. This is especially important given the confidence which parents place in the system. A simple test for hyperopia, such as the 'plus lens test' could be routinely included in all screenings. Assessment of hyperopia, the biggest single visual problem in children, is still not included in the official battery of tests.

The use of a test for stereopsis is a further efficient evaluation of several visual skills. By confirmation of the intended three dimensional appearance, binocularity can be quickly confirmed, a strabismus diagnosis eliminated and depth perception verified.

Reports need to be supplied for all children, both those who pass as well as those needing a referral. The absence of a note to parents is all too willingly accepted as being good news. Instead it may actually indicate a careless delivery by the child involved. If reports were expected by all parents this problem would be largely overcome. Finally, the frequency of vision screenings needs to be increased rather than reduced. As a minimum, the current schedule of Kindergarten, Year 5 and Year 8 should continue with the addition of stereopsis and hyperopia screening.

Acknowledgements

We gratefully acknowledge the co-operation of Messrs L E Phelps and J L Beers, North Coast Regional Office of the NSW Department of Education. CIBA Vision Australi has met all costs associated with thi project by providing a communit services grant.

APPENDIX A

PASS:

YEAR 5 VISION STUDY
(Approved by the NSW Education Department)

Dear Mr/s_____ Date: _____

Re: _____ Study ref P5.11.86

Your child was included in the Vision Screenings recently conducted at the School. He/She performed the required 8 tasks to a satisfactory level, thus no vision problem was apparent.

If at any time you are concerned that a vision difficulty may exist, it is still advisable to have a full examination with your family's Eye Care Practitioner. Clinical measurements passed at a screening are sometimes more significant when considered together with other detailed tests and symptoms.

_____
Optometrist

FURTHER EVALUATION:

YEAR 5 VISION STUDY
(Approved by the NSW Education Department)

Dear Mr/s _____ Date: _____

Re: _____ Study ref: F5.11.86

Your child was included in the Vision Screenings recently conducted at the School. He/She did not perform all of the required tasks to a satisfactory level. It is therefore suggested that he/she have a full examination with your family's Eye Care Practitioner.

_____
Optometrist

UNDER TREATMENT:

YEAR 5 VISION STUDY
(Approved by the NSW Education Department)

Dear Mr/s _____ Date: _____

Re: _____ Study ref: T5.11.86

Your child was included in the Vision Screenings recently conducted at the School. It was noted that he/she is currently receiving treatment for a vision problem.

Please continue to follow the advice of your family's Eye Care Practitioner.

_____
Optometrist

References

1. O'Grady J. The relationship between vision and educational performance: A study of Year 2 children in Tasmania. *Aust J Optom* 1984; **67:** 126-140.
2. Behrens, GR. Integration or segregation: An investigation of the most suitable methods of educating partially sighted children. Hobart, December, 1979. Unpublished thesis available from the author.
3. Australian Optometrical Association. Submission to the Education Department's Committee on Special Education. Melbourne, 1980.
4. Walters J. Portsea modified clinical technique: Results from an expanded optometric screening protocol for children. *Aust J Optom* 1984; **67:** 176-186.
5. Australian Optometrical Association. A teacher's guide to vision problems in children. Melbourne, 1979.
6. Dreby C. Vision problems and reading disability: A dilemma for the reading specialist. *The Reading Teacher* 1979; April: 787-795.
7. Suchoff IB. Research on the relationship between reading and vision — What does it mean? *J Learning Disabil* 1981; **14:** 573-576.
8. Grosvenor T. Are visual anomalies related to reading ability? *J Am Optom Assoc* 1977; **48:** 510-517.
9. Simons HD, Grisham JD. Binocular anomalies and reading problems. *J Am Optom Assoc* 1987; **58:** 578-587.
10. MacFarlane DJ, Fitzgerald WJ and Stark, DJ. The prevalence of ocular disorders in 1000 Queensland primary schoolchildren. *Aust NZ J Ophthalmol* 1987; **15:** 161-174.

Author's address:
A J Hanks OD
Professional Suite
'The Heritage'
Clarence Street Headland
Port Macquarie 2444
AUSTRALIA