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Spectacle prescribing among 10-year-old children

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SUMMARY Between 10 and 12% of the 10-year-old children in the 1970 national birth cohort were prescribed a pair of spectacles. One-fifth of these childen had no impairment of visual acuity and a further 15-20% had only minimal visual defects. Only two-thirds of children with spectacles could produce them when asked to do so at the survey school medical examination; this was particularly common among those in the lower social classes and among children who had no detectable impairment. The information presented in this paper combined with that from earlier national birth cohort studies suggests that overprescribing of spectacles to school children is very common. The financial implications of this overprescribing are discussed.

Since Roger Bacon discovered spectacles in the thirteenth century they have provided such unequivocal benefit to so many people with very poor vision that therapeutic trials to test their value would seem to be inappropriate. However, in recent years spectacles have been widely prescribed to people with relatively slight visual impairments; this is particularly so among children. The benefit to the latter from wearing spectacles is far from striking, but trials to test their value have not been proposed.

A recent publication from the 1958 birth cohort[1] presented data showing that as many as 18% of adolescents had been prescribed spectacles but that up to a quarter of this group had perfect or nearly perfect visual acuity. The paper called for further investigation into the criteria on which spectacles are prescribed.

In this study spectacle prescribing has been investigated among the children of the 1970 birth cohort. The aim was to establish how many 10-year-old children had been prescribed spectacles, to estimate the degree of visual impairment among children with spectacles, and to investigate whether factors other than impairment of vision influenced which children received spectacles.

Materials and methods

The data from this study were collected in the most recent survey of the 1970 birth cohort, which took place in 1980, when the children were 10 years old. The study began with a survey of all infants born during the week 7–11 April 1970 throughout the United Kingdom. Children living in Northern Ireland were excluded from the 1980 study. The 1980 survey included a parental interview conducted by a health visitor, a questionnaire which was completed by the child's school doctor after a thorough medical examination, and a self-administered questionnaire completed by the child's mother or the person who was mainly responsible for the child's care.

During the parental interview the parent(s) were asked whether the child wore glasses. The father's occupation and the child's home address was recorded. The former was classified according to the Registrar-General's Classification of Occupations[2] and the latter was grouped by standard region.[3]

The self-administered questionnaire included a question on whether the child experienced headaches. The responses were grouped into three categories: more often than once a week, less often than once a week but more often than once a month, and less often than once a month.

During the medical examination the doctor inquired whether glasses or contact lenses had been prescribed for current use and tested the child's distant and near visual acuity without glasses. Responses to the inquiry and results from the tests were recorded together with many other items of information. In the medical examination visual acuity tests were carried out under conditions similar to those in

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Table 1 *Categories of visual defect*

Description of defect	*Visual acuity*				*Predominant diagnostic category*
	Distant		*Near*		
No defect	6/6	6/6	6	6	Perfect vision
Bilateral minimal distant defect	6/9	≤6/9*	6	6	Bilateral myopia of increasing severity
Bilateral mild distant defect	≤6/12≥6/18	≤6/12*	6	6	
Bilateral marked distant defect	≤6/24	≤6/24*	6	6	
Unilateral distant defect	≤6/9	6/6	6	6	Unilateral myopia
Bilateral near defect	6/6	6/6	≤9	≤9	Mild and moderate hypermetropia
Unilateral near defect	6/6	6/6	≤9	6	Unilateral hypermetropia
Unilateral mild mixed defect†	≤6/9≥6/18	6/6	≤9	6	Amylyopia of increasing severity
Unilateral marked mixed defect†	≤6/24	≥6/9	≤9	≥9	
Bilateral mild mixed defect†	≤6/9≥6/18	≤6/9*	≤9	≤6	No predominant diagnostic category
Bilateral marked mixed defect†	≤6/24	≤6/24*	≤9	≤6	
	(≤worse than/≥better than)				

*Where visual acuity differs between the two eyes, defects have been classified to the level of distant visual acuity in the better eye.
†Mixed defects are those in which both near and far visual acuity is affected.

which children are routinely screened in clinics and schools. Instructions were given with the questionnaire to test the child's distant vision with a Snellen chart, if available, by standing the child in a good light 20 ft (6 m) from the chart and covering first one eye and then the other. If no Snellen chart was available and an alternative was used, the type of chart was recorded. Near vision was tested with a Sheridan-Gardiner near vision chart which was provided with the questionnaire.[4] Instructions were given to hold this chart at a comfortable distance not more than 10 inches (25 cm) from the eye in a good light, and to test each eye separately. Gradations on the Sheridan-Gardiner chart range from 6 (perfect near visual acuity) to worse than 60.

Children with less than perfect visual acuity (6/6, 6/6 on distant vision, and 6,6 on near) were classified into 10 different categories. These are set out in Table 1. The categories were chosen, first, in order to be able to identify the large number of children with very minor or unilateral visual defects and, secondly, to be able to categorise children with defects to whom it was possible to attach a probable diagnosis.

The statistical significance of the findings was tested by the χ^2 test.

RESPONSE RATE

Parental interviews were completed for 13 782 children and medical questionnaires on 13 723; 13 681 self-administered questionnaires were completed by the mother. A total of 13 871 children participated in one or other aspect of the health survey. This represents an estimated 86·7% of the original birth cohort. Satisfactory visual acuity data were obtained on 12 853 children. For the remainder tests were either inadequately conducted or not carried out at all. There is a slight social class bias among the children for whom adequate tests were obtained, namely, 94·0% of social class I children as opposed to 90·5% of social class V. 91% of the moderately educationally subnormal ESN(M) children in the cohort completed the acuity tests but only 19·5% of those classified severely educationally subnormal ESN(S). Information on spectacle prescribing was obtained from either parent or doctor or both for all but 115 children.

Each series of analyses was carried out with the full complement of children for whom data were available.

Results

Doctors reported that 10·7% of the cohort children had been prescribed glasses or contact lenses. But the parents of 107 of these 1475 children responded negatively to the question, does your child wear glasses? Parents reported that 10·9% of children wore glasses, but for 135 of these children doctors said that no spectacles or lenses had been prescribed (Table 2).

The use of contact lenses, about which only doctors were asked, could not have been responsible for this discrepancy, since only 11 children in the cohort had been prescribed lenses by this age. The wording of the two questions about glasses may have accounted for some of the difference; not all children who had been prescribed spectacles would be expected to wear them. The medical examination and the parental interview were not completed at exactly the same time, so it is also possible that some children received a prescription for spectacles in the period between these two parts of the survey.

Whatever the cause, some degree of uncertainty must be taken into account in describing the data.

Table 2 *Spectacle prescribing in the 1970 birth cohort (n=13 756)*

	Children with spectacles	
	%	Number
Spectacles brought to medical examination*	7·1	980
Spectacles not brought to medical examination	4·6	630
Parents and doctor agree child has spectacles*	2·8	388
Only parents say child has spectacles†	1·0	135
Only doctor says child has spectacles†	0·8	107
Total: all children who may have been prescribed spectacles	11·7	1610

*These two groups are together referred to as definite spectacle prescriptions.
†These groups are together referred to as possible spectacle prescriptions.

The group of children about whom there is disagreement between parents and doctors have therefore been included in all tables as having possible spectacle prescriptions.

Of all the children who may have been prescribed glasses only 60·9% had their glasses with them when they attended their medical examination.

The proportion and number of children who had been prescribed spectacles in each of the 10 visual impairment categories is shown in Table 3. The most striking feature of this table is the number of children with perfect vision who had spectacles. Although the proportion with spectacles in this group was small (2–3%), it represented between 200 and 300 pairs of glasses. Nearly one-third of children with minimal bilateral distant defects had a pair of spectacles, as did one-fifth of those with a vision defect in one eye only. The latter constituted a large group of children, 80% of whom had a defect of 6/9; in most of the remainder the defect was 6/12.[5]

Children who had a near vision defect with perfect distant vision were less likely to have been prescribed spectacles than were children with isolated distant vision defects. Approximately half of the children with near and far defects in only one eye had been prescribed spectacles, as had all but eight of those with marked impairments of both near and distant vision in both eyes.

The prevalence of spectacle prescribing according to sex, social class, and region of residence is presented in Table 4. The value tabulated is the proportion of children said by either parent or the examining doctor to have spectacles (definite and possible spectacle groups combined). Conclusions which could be drawn from a table showing the proportion of children who definitely had spectacles were exactly the same, and therefore only one set of values is tabulated here.

More girls (12·6%) than boys (10·8%) had spectacles ($p<0·01$). The difference for both social class and region do not reach statistical significance.

The prevalence of visual defects is shown in Table 4 alongside the prevalence of spectacles prescriptions. It is clear that the excess of spectacles in girls is exactly what we should expect from the excess of defects. Similarly the slight variation in prevalence of spectacles by social class closely mirrors variation in the prevalence of defects. That there is close correlation between these two values is illustrated by calculating the ratio of 'spectacle prevalence' to 'defect prevalence.' This ratio remains remarkably constant in the two sexes and across the different social classes. The number of spectacle prescriptions is approximately half the number of children with visual defects in all groups.

Although the difference in prevalence of spectacle prescriptions across the regions is not statistically significant, it can be seen from Table 3 that the prevalence does not vary in the same way as defect prevalence. This is illustrated by the fluctuating spectacle-defect ratio. The fluctuation suggests that, after allowance is made for variation in the

Table 3 *Proportion of children prescribed spectacles in different visual acuity categories (n=12 840)*

Category of defect	Definite spectacles		Possible spectacles		Total	
	%	No.	%	No.	%	No.
0 Perfect vision	2·1	206	1·0	96	3·0	302
1 Bilateral minimal distant defect	29·3	139	2·5	12	31·8	151
2 Bilateral mild distant defect	65·7	113	4·1	7	69·8	120
3 Bilateral marked distant defect	88·9	96	0·9	1	89·8	97
4 Unilateral distant defect	19·8	117	2·9	17	22·7	134
5 Bilateral near defect	16·8	32	1·6	3	18·4	35
6 Unilateral near defect	10·8	29	0·4	1	11·2	30
7 Unilateral mild mixed defect	44·7	96	5·6	12	50·2	108
8 Unilateral marked mixed defect	49·0	73	6·7	10	55·7	83
9 Bilateral mild mixed defect	59·6	328	2·0	11	61·6	339
10 Bilateral marked mixed defect	91·3	105	1·2	2	93·0	107

Table 4 *Prevalence of spectacle prescribing*

		Number of children in group	*Proportion said by parents or doctor to have been prescribed spectacles* %	*Proportion of children with less than perfect vision (6/6 6)* %	*Spectacle defect ratio (column 1/column 2)* %
Sex	Girl	6652	12·6	24·7	0·51
	Boy	7104	10·8	20·8	0·52
Social class	I	759	12·6	23·7	0·53
	II	2896	11·0	20·6	0·53
	IIIN	1111	11·5	21·8	0·53
	IIIM	5379	11·5	21·4	0·54
	IV	1496	11·5	23·6	0·49
	V	481	14·3	25·7	0·56
Standard region	Scotland	1369	10·7	23·3	0·46
	North	860	10·9	20·1	0·54
	York and Humberside	1375	11·8	21·7	0·54
	North-west	1703	11·3	22·2	0·51
	East Midlands	906	11·1	25·0	0·44
	West Midlands	1444	12·5	19·9	0·63
	Wales	799	12·4	22·8	0·54
	East Anglia	485	11·5	22·5	0·51
	South-east	3763	12·4	21·7	0·57
	South-west	1018	10·4	22·6	0·46

prevalence of defects, children are less likely to be prescribed spectacles in Scotland and the South-west and more likely to be prescribed them in the West Midlands.

Disagreement between parents and doctors about whether the child had spectacles was more common among children with perfect vision (Table 5). This group and those with only a minor defect were less likely to have brought their prescribed spectacles to the medical examination. Children in the lower social classes were also less likely to be carrying their spectacles with them when they were seen by the doctor (Table 6). Indeed a trend in this phenomenon could be observed across the different classes; 69·8% of those in class I and 47·8% of those in class V brought their spectacles with them. In contrast spectacle usage did not appear to be influenced by sex or region of residence.

Tables 7, 8, and 9 present data relating headache to spectacle prescribing. Spectacles were prescribed more frequently to children whose mothers reported that they experiencd headaches (more often than once a month); 15·4% compared with 11·2%. The prevalence of defects was also slightly raised among this group, but spectacle prescribing remained increased even when this was taken into account.

Headaches were more common among the group of children who failed to bring their spectacles to the medical examination and among the 'possible spectacle' group. They were also common among children who had spectacles but had no visual defect. These findings fit the hypothesis that children with

Table 5 *Use of spectacles by severity of vision defect (n=12 840)*

Category of defect		*Number of children who may have been prescribed spectacles*	*% of those in column 1 who brought their spectacles to the medical examination*	*% of those in column 1 who did not bring their spectacles to medical examination*	
				Parents and doctor agree that child has spectacles	*Either parent or doctor but not both say child has spectacles*
0	Perfect vision	302	36·8	31·5	31·8
1,4	Minor defects	285	60·0	29·8	10·2
2,3,5, 6–10	Other defects	919	73·4	21·4	5·1

x^2_4 $p<0·0001$

Table 6 *Provision and use of spectacles: social class, region, sex (n=12 840)*

	Number of children who may have been prescribed spectacles	*% of those in column 1 who brought their spectacles to the medical examination*	*% of those in column 1 who did not bring their spectacles to medical*	
			Parents and doctor agree that child has spectacles	*Either parent or doctor but not both say child has spectacles*
Social class (n=12 122)				
I	96	69·8	19·8	10·4
II	320	70·1	19·4	10·5
IIIN	128	65·6	14·8	19·5
IIIM	618	60·2	23·9	15·9
IV	172	57·6	29·1	13·4
V	69	47·8	42·0	10·1
χ^2_{10} p<0·01				
Standard Region (n=13 722)				
Scotland	146	68·5	21·9	9·6
North York & Humberside	94	60·6	25·5	13·8
North West	162	60·5	26·5	13·0
East Midlands	193	60·6	22·3	17·1
West Midlands	101	59·4	24·8	15·8
Wales	181	57·5	26·0	16·6
East Anglia	99	59·6	29·3	11·1
South East	56	67·9	16·1	16·1
South West	466	62·6	22·2	15·2
	106	59·4	17·9	22·6
χ^2_{18} p=NS				
Sex (n=13 756)				
Boys	770	60·0	24·4	15·6
Girls	840	61·7	23·8	14·5
χ^2_2 p=NS				

perfect vision and those with minor visual defects are more likely to be prescribed spectacles if they also complain of headaches.

Discussion

Between 10% and 12% of the 10-year-old children in this cohort had been prescribed spectacles. But one in five of the children with spectacles had normal visual acuity, and between 15% and 10% had only minimal defects. Over a third of children who had spectacles came to their medical examination without them, which might suggest that many children who had been prescribed spectacles rarely wore them. Thus the overprescribing of spectacles identified among the 16-year-olds of the 1958 cohort is apparently occurring among younger children also.

Table 7 *Prevalence of spectacle prescribing among children who experience headaches more often than once a month (n=12 316)*

	% with spectacles	*% with visual defects*	*Ratio of spectacles to defect*
Children with headaches	15·4	24·3	0·63
Other children	11·2	21·7	0·53
Statistical significance	p<0·001	p<0·05	

The suggestion has been raised[6,7] that unnecessary spectacles can cause a deterioration in visual function. This hypothesis has not been rigorously tested and a more substantive criticism of overprescribing can be made on the grounds of wastage of scarce resources. The price of a single pair of spectacles is not great. The average cost to the National Health Service for a prescription, including lenses, frames, and optician's professional fee, is £15·00 (1984 prices). However, if we accept that 35% of prescriptions to 10-year-olds are unnecessary, and we assume that this level of overprescribing is equally common at all ages in school children, we can calculate that at any one point in time the sum which has been spent on spectacles which are unlikely to benefit children

Table 8 *Provision and use of spectacles: headaches (N=13 109)*

	Number of children	*Proportion of children experiencing headaches at least once a month*	
		%	*No.*
No spectacles	11 574	10·7	1237
Spectacles available for medical examination	954	12·9	123
Spectacles not brought to medical examination			
Definite spectacles	364	17·0	62
Possible spectacles	217	18·4	40

χ^2_3=p<0·001.

Table 9 *Proportion of children experiencing a headache at least once a month (n=12 316)*

	Children with spectacles		*Children without spectacles*		*Statistical significance*
	%	*No.*	%	*No.*	
Visual defect present	13·4	140	11·4	185	NS
No defect	18·2	36	10·6	997	p<0·001

is about £5·4 million (nearly £30,000 per health district).

Were these spectacle prescriptions really necessary? The principal weakness of this study lies in the measurement of visual acuity. VA charts used as they have been in this study by a series of medical officers with variable training in a multitude of schools and clinics constitute a very blunt instrument for measuring visual function.

Thus it is likely that a proportion of the children who appeared to have perfect visual acuity but who nevertheless had been prescribed spectacles were inadequately tested. Some of them may have had a lower visual acuity than that recorded, but it is unlikely that the acuity was seriously impaired. Others may have had mild degrees of astigmatism or hypermetropia, which may be present without a defect of acuity. Some of the latter children may have been prescribed spectacles to treat latent or overt squint. 18% of the group of children with apparently perfect visual acuity and spectacles were reported to have a squint or to have had one in the past.

Children with 6/9 vision constitute another large proportion of all children with spectacles; and if, as suggested above, some of the group with perfect acuity actually had a minor defect which had not been detected, the true proportion could be even larger. However, evidence that children with 6/9 vision benefit from spectacles is anecdotal. It could be argued that 6/9 vision is due to normal variation in the refractive power of the 10-year-old child's eye. Correcting refraction with spectacles to the arbitrary level of 6/6 imposed by the Snellen chart may be inappropriate. However, many of those working in the children's eye clinics do treat these defects because they believe that minor degrees of visual impairment can interfere with learning. There is little evidence to support this idea, and a recent study[8] has presented evidence which suggests that minor visual impairment does not interfere with learning.

There is no reason why the value of spectacles should not be tested in randomised controlled clinical trials. Such trials should be able to establish which type of children with which type of impairment benefit from spectacles and in what way. Although lack of interest on the part of the ophthalmologists managing children's eye clinics, attitudes and beliefs among parents, and financial interests among those who prescribe spectacles may present as obstacles to such trials, none of these should prove insurmountable.

Trials of treatment will not be conducted overnight, and it will be some time before definitive answers are available. However, this study would suggest that there is considerable room for rationalisation of prescribing in the meanwhile. For example regional variation in spectacle prescribing could be examined. There may be good reasons why such variation exists, but equally the differences may simply be a matter of habit. Further information on geographical variation should be available from family practitioner committees, which handle fees for all spectacles prescribed to children in many parts of the country.

Follow-up visits by children who have been prescribed spectacles might lead to a greater awareness of which children benefit. Such visits could be used to assess whether symptoms such as headaches or poor academic progression improve after spectacles are prescribed. Questions could be asked to assess the extent to which spectacles are actually worn. Simple self-auditing procedures such as these might on their own lead to a reduction in prescribing or at least to a halt of the current tendency to prescribe spectacles to children with milder and milder visual defects.

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