



BIOS Vision Screening Audit

Academic Year 2015-2016

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BIOS Vision Screening SIG

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BIOS Vision Screening Audit: Academic Year 2015-2016

Abstract

Aim: This audit utilises data submitted by Head Orthoptists to the British and Irish Orthoptic Society (BIOS). The aim is to provide insights into vision screening practices across the United Kingdom (UK) for the academic year 2015-2016, compare the findings to the previous vision screening audit for academic year 2014-2015 and provide evidence for future decision making regarding best practice.

Method: Fifty-nine sites provided data with four instances of site amalgamation. Site representatives were contacted to confirm new area details, duplicated submissions were identified and one submission in each case was used in the analysis. Fifty-two sites remained (number of children screened (n) = 168,239). Thirty-eight sites (n=148,159) provided further screening outcome data. Of these, twenty sites (n=6,101) provided further diagnostic test data on the number of true positives (+ve). The method of calculating True +ve scores was explored and the implications discussed.

Results: The number of sites participating in the current BIOS vision screening audit for academic year 2015-2016 increased from the previous academic year (2014-2015) from 56 to 59. This number of 59 reduces to 52 when combined data and duplicated submissions were accounted for. The mean coverage decreased from 91% in the academic year 2014-2015 to 89% in the current audit of academic year 2015-2016.

Calculation of mean true +ve for the sites was conducted using three separate methods. Whilst noting methods 1 and 2, this audit focuses on method 3 for interpretation. Sites providing Orthoptic delivered screening (n=3123) showed a mean true +ve of 79%, Vision Screener trained by an Orthoptist using the BIOS package (n=889) showed a mean True +ve of 66%, Vision Screener trained by an Orthoptist using a local package (n= 1452) showed a mean True +ve of 66%, and Vision Screener not trained by an Orthoptist (n=637) showed mean True +ve of 41%.

Conclusions: This audit concludes that there is a need for further investigation into the effects of training received on True +ve scores. It suggests that the level of training received/professional administering the test affects the number of True +ve. The implications are discussed.

Background

The British and Irish Orthoptic Society (BIOS) is concerned with inequity in the commissioning process for Vision Screening in England. In some areas no service is commissioned whereas in other areas commissioned services are variable regarding personnel screening, consent procedures used, tests used, referral criteria and referral pathway. There is a lack of adherence to UK National Screening Committee (NSC) guidelines on Vision Screening services.

BIOS has utilised current literature to develop evidence-based recommendations to promote standardised delivery of vision screening practices across the UK and endorses the standardising approach to national vision screening recommended by the NSC. It is acknowledged that the guidance does not provide explicit specification and standards. A Public Health England (PHE) Vision Screening Advisory Group set-up in April 2016 is expected to produce more detailed guidance for commissioners of services by the end of 2017.

A recent literature review found that age-appropriate vision screening is a cost efficient and clinically effective practice (Tailor et al, 2016). Screening in school is associated with reduced prevalence of amblyopia (Solebo, Cumberland & Rahi, 2014). Early screening has the potential to allow for better outcomes and orthoptist-led screening is suggested to be more accurate, in this age group, than non-specialist or lay screening (Hu et al, 2012). There is a body of research (e.g. Toufeeq & Oram, 2014; Hall and Elliman, 2003) recommending that vision screening for reduced vision be performed by orthoptists, or led by orthoptists between the ages of 4 and 5 years; a recommendation supported by the NSC and BIOS. There is no robust research to support any other vision screening in childhood.

BIOS is working to ensure that the specification and commissioning of Vision Screening contracts occur in a consistent way and deliver on NSC recommendations. Orthoptists are also working with the Governments in Scotland, Wales and Northern Ireland to achieve this standardisation.

The current 2015-16 audit seeks to identify the current vision screening practice across the UK and Ireland, identify any changes from the previous year and provide evidence to allow decisions to be made regarding best practice for future commissioning.

Methods

Data from local vision screening programmes were requested from Orthoptic Heads of Service for the academic year 2015-2016. An Excel spreadsheet was circulated which included requests for data on two specific categories; site information and screening outcome data. The full list of data requested is provided in Appendix 1.

Two hundred and four sites were identified across the UK and Ireland, fifty-nine of those sites provided data. Of those fifty-nine sites, there were four instances whereby two or more sites had merged services and provided combined data with duplicate submissions. Site representatives were contacted about this issue and duplicated submissions were identified. One site in each case was used in the analysis. Fifty-two sites remained and were eligible for analysis of site information.

A further fourteen sites were removed from the screening outcome data analysis for not providing data pertaining to the number of children screened. This left 38 site data sets to analyse further, of these, 21 sites provided accurate data to allow the number of True +ve to be calculated. Sites that had not accounted for all children seen were removed from this analysis. Further removals of sites occurred on an individual basis, the reasons were due to missing data and the inconsistent number of children documented in the results at each point of analysis.

Previous BIOS audits for the academic years 2013-14 and 2014-15 calculated True +ve taking true positive to be all children referred whom, following diagnostic testing, were not discharged. This included children who were found to have no abnormality on orthoptic assessment, normal fundus and media examination, but either visual acuity or refractive error that was considered border-line. This method has been repeated for the current audit. Many children are therefore being identified as True +ves although they have not been diagnosed with an eye condition or received any treatment. The purpose of vision screening is to detect cases of reduced vision due to amblyopia, usually related to refractive error and hence the need for glasses or presence of strabismus (squint). On that premise, a second method was used to calculate an alternative True +ve using outcome categories 1 (glasses prescribed) and 4 (occlusion) only; i.e. reporting only those who have received treatment. The third method used for analysis considered all children referred who were identified with reduced vision at the diagnostic test, even if treatment wasn't given.

Method 1

- True +ve was calculated by obtaining the sum of those children who failed screening and were documented in categories 1,2,3,4,5,6,8 in the 'initial outcome' section, out of the total number of children seen (see Appendix 1 for categories).
- False +ve was calculated by obtaining the sum of children who failed screening and were documented in the 'initial outcome' category as 7 out of the total number of children seen.

Method 2

- True +ve was calculated by obtaining the sum of those children who failed screening and were documented in categories 1 or 4 in the 'initial outcome' section out of the total number of children seen.
- False +ve was calculated by obtaining the sum of children who failed screening and were documented in the 'initial outcome' category as either 2, 3, 5, 6, 7, or 8 out of the total number of children seen.

Method 3

- True +ve was calculated by obtaining the sum of those children who failed screening and were documented in categories 1,3 & 4 in the 'initial outcome' section out of the total number of children seen.
- False +ve was calculated by obtaining the sum of children who failed screening and were documented in the 'initial outcome' category as either 2, 5, 6, 7, or 8 out of the total number of children seen.

Individual discrepancies in data were evident in some instances across sites. For example:

- Some sites were unable to provide information on both the number of children eligible and the number screened; this meant it was not possible to calculate a coverage percentage for these sites and they were excluded from screening outcome results.
- Some sites were unable to provide complete data pertaining to referral reasons; unless the reasons for referral were equivalent to the number seen, sites were excluded from this analysis.

Screening outcome data was analysed for each site and mean site data was subsequently calculated with ranges shown. The number of children included in each analysis is detailed to allow for

interpretation of data to be in context of the sample size. Total mean values based on all children combined from all sites was also analysed. Statistical analysis was not possible due to limited data.

Results of Site Data

Fifty-two sites provided site data; of those fifty-two sites, eleven provided no data on the number of children screened. Therefore, in the following tables, although the number of sites that carried out screening is accurately depicted, the value shown for number of children screened is not the true total but gives an indication of the scale of numbers involved in each process. The number of children in each category of requested site data was calculated:

The area specific consent policy:

<i>Table 1</i>	Opt-out	Opt-in	Overall
<i>Number of Sites</i>	42	10	52
<i>Number of Children</i>	151,167	17,072	168,239

The age at which screening was delivered:

<i>Table 2</i>	4-5 years	Other	Overall
<i>Number of Sites</i>	51	1	52
<i>Number of Children</i>	167,568	671	168,239

The professional by whom screening was delivered:

<i>Table 3</i>	Orthoptist	VS trained by Orthoptist BIOS package	VS trained by Orthoptist local package	VS not trained by Orthoptist	Overall
<i>Number of Sites</i>	18	15	10	9	52
<i>Number of Children</i>	64,458	45,883	36,797	21,101	168,239

- VS = Vision Screener

The test/s used in the screening process:

One site was removed from analysis of test used for submitting data detailing the use of both 'Keeler Crowded logMAR vision test only' and 'Other VA test'.

Table 4

	KCLT only	KCLT & OA	Other VA test	Other VA test & OA	Overall
<i>Number of Sites</i>	27	9	12	3	51
<i>Number of Children</i>	84,383	35,256	38,616	3,933	162,188

- KCLT = Keeler crowded logMAR test
- OA = Orthoptic Assessment
- VA = visual acuity

The pass criteria adopted:

Table 5

	0.200 each eye	0.200 each eye & orthoptic test(s)	Other	Overall
<i>Number of Sites</i>	32	8	12	52
<i>Number of Children</i>	101,304	34,924	32,011	168,239

The referral pathway for children who fail the screening:

Table 6

	HES service	HS Optometrist	HES or HS Optometrist based on criteria	Overall
<i>Number of Sites</i>	35	5	12	52
<i>Number of Children</i>	115,874	14,487	37,878	168,239

- HES = Hospital Eye Service
- HS = High Street

The eye examination used for children who have failed:

Table 7 VA, CT, OM, BV, Testing determined Other Overall
 cycloplegic by eye care
 refraction, fundus & professional
 media exam

Number of Sites	26	25	1	52
Number of Children	82,671	82,065	3,503	168,239

- VA = visual acuity
- CT = Cover test
- OM = ocular movements
- BV = Assessment of binocular vision

The criteria used to determine the treatment / management of the child:

Three sites were removed for providing information detailing the use of both evidence based and opinion/clinical judgement based management criteria.

Table 8 Evidence-based Based on opinion / Overall
 clinical judgement

Number of Sites	27	22	49
Number of Children screened	70,441	87,858	158,299

Results of Screening Data

Data was requested on the coverage and initial referral outcome of vision screening for the academic year 2015- 2016.

Coverage of the screening

Data was requested on the number of children eligible to be screened and the number of those children actually screened. 38 sites provided data on the number of eligible children (n=166,089); this allowed for a calculation of the mean coverage and range (%) across these 38 sites. Table 9 represents the mean of calculated site means and the range of coverage across the 38 sites.

<i>Table 9</i>	Number Eligible	Number Screened	Total Coverage (%)	Site Coverage (%)	Mean Site (%)	Range
<i>Number of Sites</i>	38					
<i>Number of Children</i>	166,089	148,159	89	89		33-100

- Mean site coverage for academic year 2014/15: 91% - Range 65% to 98%.

Two areas that presented with the lowest capture scores were identified as follows:

Table 10 **Mean Coverage (%)** **Consent Strategy**

<i>Site A</i>	33	Opt-in
<i>Site B</i>	39	Opt-in

The Opt-out method provides no values for coverage as low as the ones shown in Table 10. This was however, not an issue for all opt-in sites; as shown again in Table 11.

<i>Table 11</i>	Opt-out	Opt-in
<i>Mean Coverage (%)</i>	92	65
<i>Range (%)</i>	62-100	33-95

Referral Rate

Data was requested on the number of children who passed and failed the screening.

Referral rate was calculated by the percentage of children who failed screening out of the number screened. Data was available from 41 sites (162,419 children screened, of which 19,302 failed).

Table 12 **Orthoptist** **VS trained by** **VS trained by** **VS** **not** **Overall**
 Orthoptist **Orthoptist** **Orthoptist** **trained** **by**
 BIOS package **Local package** **Orthoptist**

	Orthoptist	VS trained by BIOS package	VS trained by Local package	VS trained by Orthoptist	Overall
<i>Number of Sites</i>	16	12	9	3	41
<i>Number Screened</i>	64,458	45,883	40,077	12,001	162,419
<i>Number referred</i>	7,685	5,926	4,559	1,132	19,302
<i>Total %</i>	12	13	11	9	12
<i>Site Mean (%)</i>	12	12	11	11	12
<i>Site Range (%)</i>	4-23	6-24	6-15	9-12	4-24

- Mean site referral rate in 2014/15 academic year was 14% range 8% to 21%.

Reason for the referral / fail

Data was available from 20 sites including 84,737 children screened, of which 9,519 failed.

Table 13 **Failed VA** **Failed VA &** **Failed OA** **Referred poor** **Overall**
 test **OA** **cooperation**

	Failed VA test	Failed VA & OA	Failed OA	Referred poor cooperation	Overall
<i>Number of Children Failed</i>	8,456	375	375	313	9,519
<i>Total (%)</i>	89	4	4	3	100
<i>Site Mean (%)</i>	91	4	3	2	100
<i>Site Range (%)</i>	67-100	0-24	0-16	0-15	

Mean Age at Diagnostic Test

Data was available from 34 sites (n=9,779 children seen)

- Mean age 59 months (4 years 11 months), range from 48 (4 years) to 68 months (5 years 8 months)

Table 14 **Screened at 4-5 years** **Screened at 'Other'**

<i>Number of sites</i>	33	1
<i>Number seen</i>	9,684	95
<i>Mean age</i>	59 months	48 months
<i>Range (%)</i>	52-68	n/a

Waiting time from Screen fail to diagnostic appointment

Data was available from 30 sites (n=13,754 children seen)

- Mean wait 7 weeks, range 2 to 12 weeks.

Table 15 **HES service** **HS Optometrist** **HES or HS
Optometrist based
on criteria**

<i>Number of sites</i>	22	1	7
<i>Number seen</i>	6,437	480	6,837
<i>Mean wait (in weeks)</i>	7	3	7
<i>Range (in weeks)</i>	2-12	n/a	4-11

- *HES = Hospital Eye Service*
- *HS = High Street*

Attendance for eye examination

Data was requested on the number of children referred from screening that attended the full diagnostic eye examination. Data was available from 37 sites (n=16,333 children seen):

- Mean attendance was 78%, range 36% to 100%
- Sites were contacted to determine any specific reasons for low attendance; external factors were described such as home-schooling, setting/location where diagnostic testing was offered (e.g. in a school, clinic, hospital) with difficult access affecting the ease for parents and children to attend the appointment.

To determine whether the consent policy used had an effect on diagnostic eye examination attendance further analysis was undertaken and shown in Table 16.

<i>Table 16</i>	Opt-out	Opt-in	Overall
<i>Number of Sites</i>	42	10	52
<i>Number of Children referred</i>	151,167	17,072	168,239
<i>Site Mean Attendance (%)</i>	92	65	
<i>Site Range (%)</i>	62-100	33-95	

Initial Outcome of the eye examination: Data was available from 18 sites (n=5,245):

Table 17a **Initial Outcome of eye examination**

	1	2	3	4	5	6	7	8
<i>Number of children</i>	3,127	173	537	19	17	47	1,145	180
<i>Mean (%)</i>	58	4	8	0.8	0.2	1	25	3
<i>Range (%)</i>	35 - 83	0 - 11	1- 23	0- 5	0- 3	0- 3	0- 60	0- 25

Outcome categories: 1) Glasses prescribed; 2) Borderline prescription, no glasses given yet, review; 3) Borderline VA, no glasses required, review; 4) Occlusion given¹; 5) Orthoptic exercises; 6) Ophthalmic pathology; 7) Discharged as no defect; 8) Other

¹ May rarely be given at initial visit as no glasses required, fundus exam normal and monocular sub-normal acuity due to manifest squint.

Number of children with borderline vision, no treatment, review (Initial outcome 3)

Data was available from 18 sites (n=5,245)

Table 17b Orthoptist VS trained by Orthoptist VS trained by Orthoptist VS not trained by Overall
BIOS package Local package Orthoptist

	Orthoptist	VS trained by Orthoptist BIOS package	VS trained by Orthoptist Local package	VS not trained by Orthoptist	Overall
<i>Number of sites</i>	8	4	3	3	18
<i>Number of children seen</i>	2,875	889	963	518	5,245
<i>Number of children borderline vision</i>	342	97	40	58	554
<i>Mean (%)</i>	12	11	5	11	11
<i>Site Mean (%)</i>	7	11	5	10	10
<i>Site Range (%)</i>	0.5 - 24	6 - 15	2 - 8	6 - 13	0.5 - 24

Number of children with Borderline prescription, no glasses given, review (Initial outcome 2)

Table 17c Orthoptist VS trained by Orthoptist VS trained by Orthoptist VS not trained by Overall
BIOS package Local package Orthoptist

	Orthoptist	VS trained by Orthoptist BIOS package	VS trained by Orthoptist Local package	VS not trained by Orthoptist	Overall
<i>Number of sites</i>	8	4	3	3	18
<i>Number of children seen</i>	2,875	889	963	518	5,245
<i>Number with borderline prescription</i>	68	27	52	26	173
<i>Mean (%)</i>	2	3	5	5	3
<i>Site Mean (%)</i>	2	4	7	5	4
<i>Site Range (%)</i>	0-7	0-11	3-11	0-10	0-11

Number seen by an Ophthalmologist

Data was requested on the number of children who required an ophthalmic opinion.

Data was available from 36 sites. Of 1,540 children attending for diagnostic testing, 573 received an ophthalmic opinion.

- Mean 10%, site range 0% to 64%.

5 sites reported referral for Ophthalmologist opinion of 20% or more, all 5 of these sites used referral pathway 1 (all fails referred to Orthoptic led HES service).

Number of true positives (Initial Outcome categories 1-6 & 8: Method 1)

Data was available from 20 sites (n=5,982), whereby full representation of children who had failed screening was evident and accounted for in the initial outcome section.

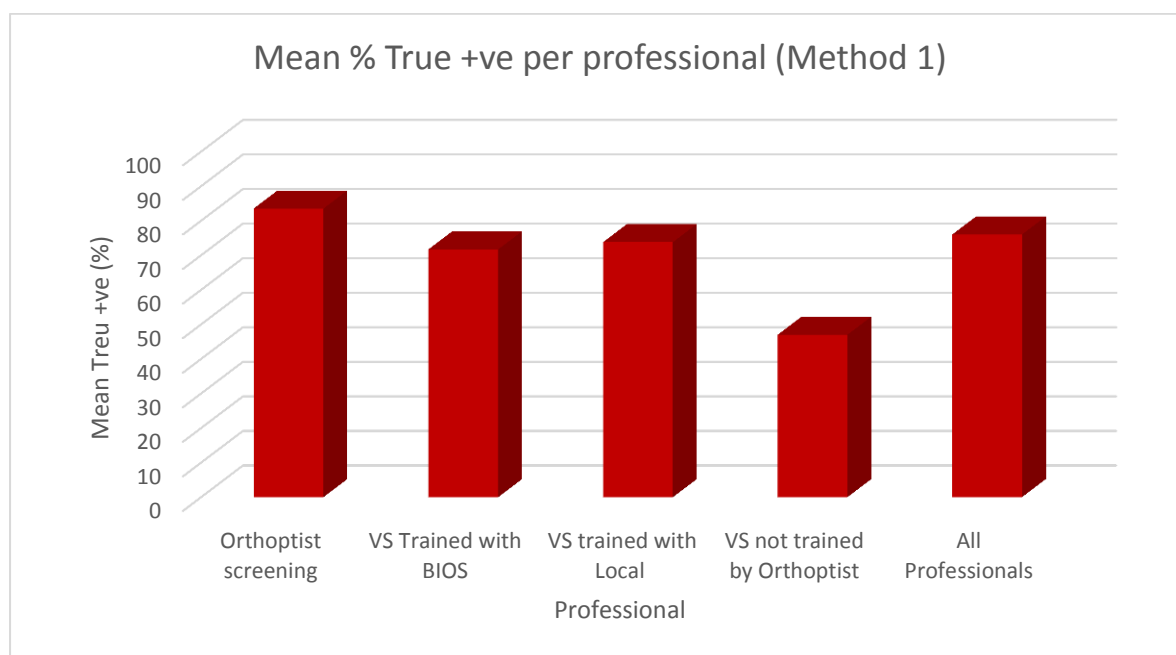
Data was requested on the number of children confirmed as having a visual defect, this was calculated using Initial Outcomes categories 1-6 & 8:

Table 19 **1: True +ve Orthoptist screening** **2: True +ve VS Trained with BIOS** **3: True +ve VS trained with Local** **4: True +ve VS not trained by Orthoptist** **Overall**

	1: True +ve Orthoptist screening	2: True +ve VS Trained with BIOS	3: True +ve VS trained with Local	4: True +ve VS not trained by Orthoptist	Overall
<i>Number of Sites</i>	9	4	4	3	20
<i>Number of Children seen</i>	3,123	889	1,452	518	5,982
<i>Number of True Positives</i>	2,633	632	1,035	265	4,565
<i>Mean (%)</i>	84	72	74	47	76
<i>Range (%)</i>	58 - 93	66 - 74	59 - 74	40 - 54	40 - 93

Data in Table 19 is also shown in Figure 1 for clarity

Figure 1:



Number of true positives (1. Glasses Prescribed + 2. Occlusion given: Method 2)

Data was requested on the number of children confirmed as having a visual defect related to the target condition – this is the total number of children in the **initial** outcome categories 1 & 4.

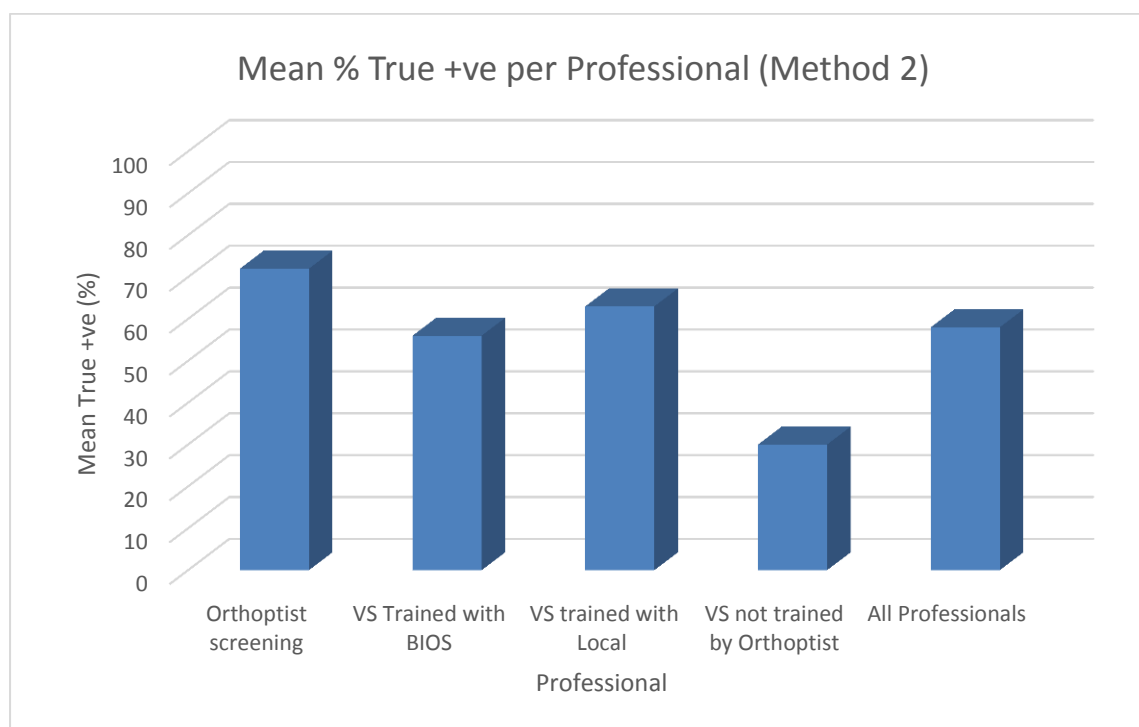
Table 20

	True +ve Orthoptist screening	True +ve VS Trained with BIOS	True +ve VS trained with Local	True +ve VS not trained by Orthoptist	Overall
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<i>Number of Sites</i>	9	4	4	3	20
<i>Number of Children seen</i>	3,123	889	1,452	518	5,982
<i>Number of True Positives</i>	2,172	494	914	165	3,745
<i>Mean (%)</i>	72	56	63	30	58
<i>Range (%)</i>	54-83	47-61	49-81	22-35	22-83

Data from Table 20 is also shown in Figure 2 for clarity.

Figure 2:



Number of true positives (1. Glasses Prescribed + 3. No glasses but reduced vision +4. Occlusion given: Method 3)

Data was used for determination of True +ve with just the number of children confirmed as having a reduced vision on diagnostic testing, this is the total number of children in the **initial** outcome categories 1,3 &4.

Table 21	True +ve Orthoptist screening	True +ve VS Trained with BIOS	True +ve VS trained with Local	True +ve VS not trained by Orthoptist	Overall
Number of Sites	9	4	4	3	20
Number of Children seen	3,123	889	1,452	518	5,982
Number of True Positives	2527	591	958	223	4,405
Mean (%)	79	66	66	41	68
Range (%)	56-93	62-71	54-82	28-48	28 - 93

Data from Table 21 is also shown in Figure 3 for clarity.

Figure 3

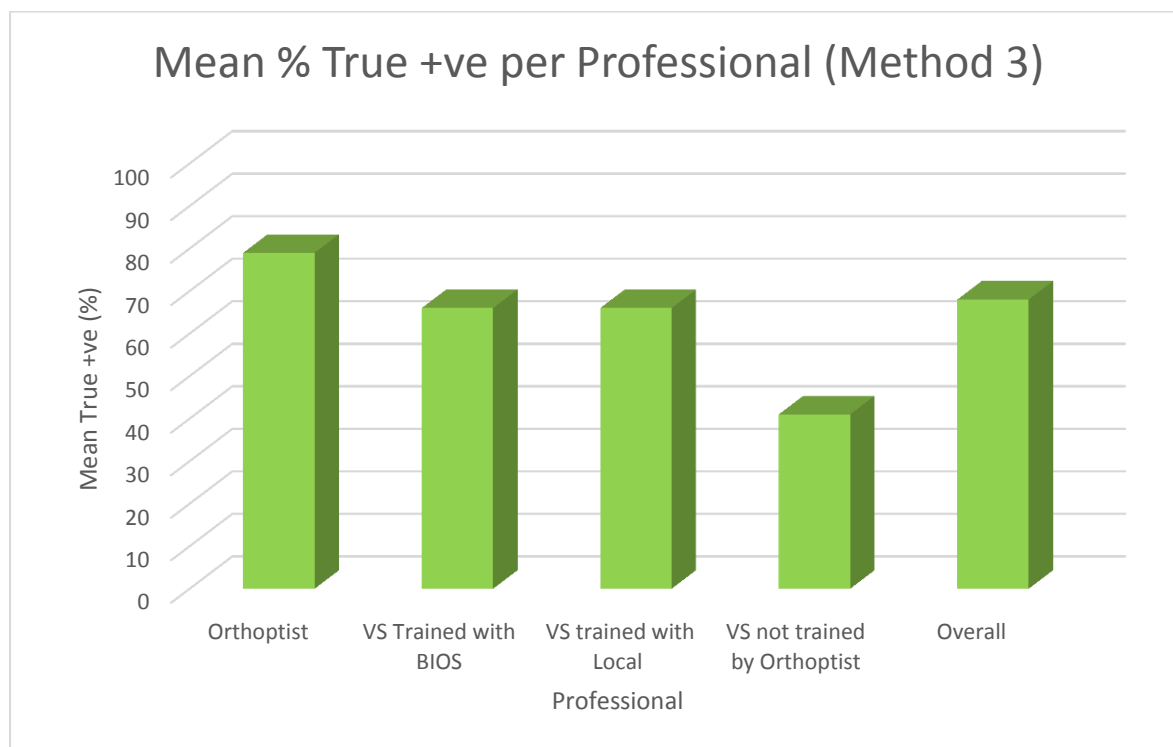


Table 22 compares the overall mean True +ve for each professional category based on True +ve calculation methods 1 or 2.

Table 22

	Mean True +ve Method 1 (70%)	Mean True +ve Method 2 (58%)	Mean True +ve Method 3 (68%)
<i>Orthoptist screening</i>	84	72	79
<i>VS Trained with BIOS</i>	72	56	66
<i>VS trained with Local</i>	74	63	66
<i>VS not trained by Orthoptist</i>	47	30	41

Data in Table 22 is also shown in Figure 4 for clarity.

Figure 4:

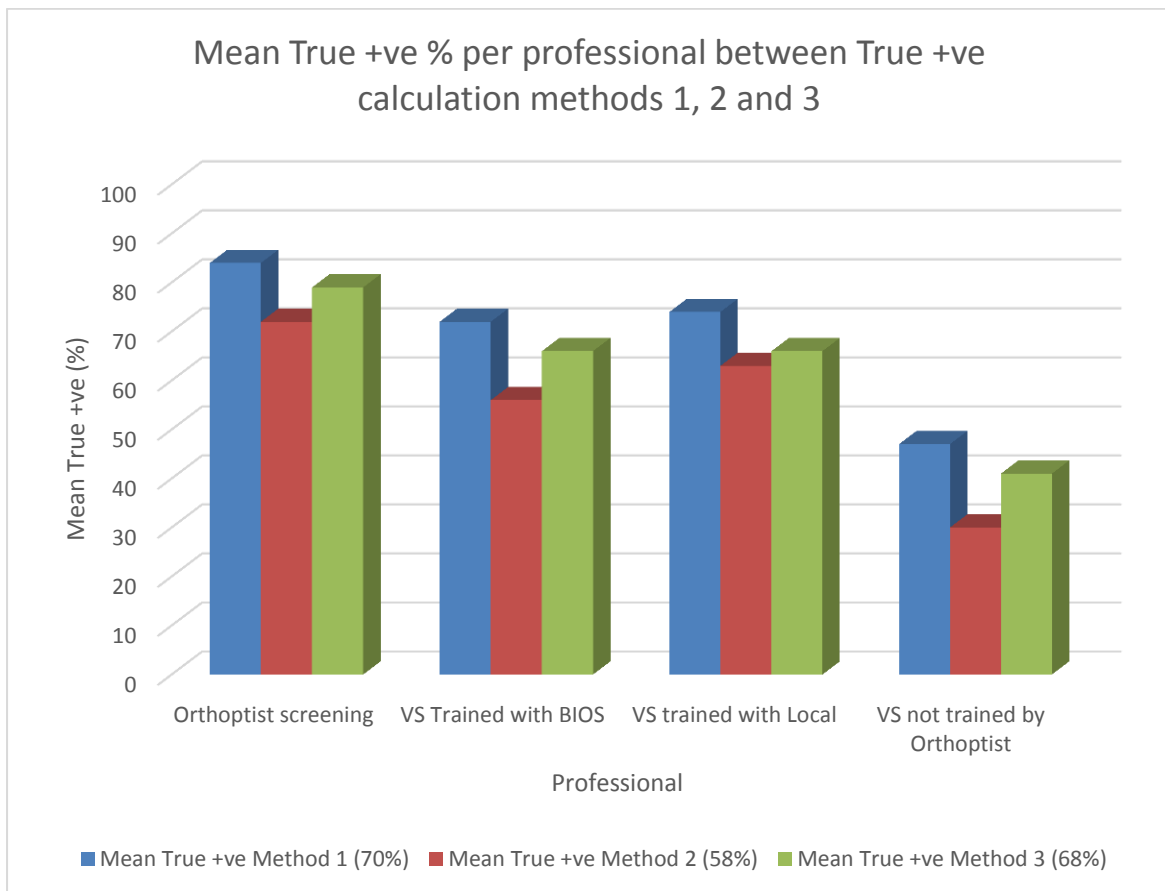


Table 23 shows the differences between academic year 2014-2015 and academic year 2015-2016 when using method 1 to calculate True +ve.

	Academic year 2014-2015			Academic year 2015-2016		
	Number of sites	Mean True +ve (%)	Range (%)	Number of sites	Mean True +ve (%)	Range (%)
<i>Orthoptist screening</i>	6	80	69-94	9	84	58-93
<i>VS Trained with BIOS</i>	See footnote	See footnote	See footnote	4	78	74-91
<i>VS trained with Local</i>	See footnote	See footnote	See footnote	4	77	68-84
<i>VS not trained by Orthoptist</i>	0	n/a	n/a	3	47	40-54

Footnote:

- *Academic year 2014-2015: True +ve calculated for VS as one group. Number of sites (6); Mean True +ve (74%); Range (59% - 89%)*

Effect of test on True +ve (n=5,675 children): Based on True +ve calculation Method 3

Table 24	KCLT only	KCLT and OA	Other VA test	Other VA test and OA	Overall
<i>Number of sites</i>	13	3	2	1	19
<i>Number of children seen</i>	3,579	1,671	385	40	5,675
<i>Mean (%) True Positives</i>	62	89	75	78	68
<i>Range (%) True Positives</i>	28-85	86-93	68-81	n/a	28-93

Table 24 does not take into account a potential confounding variable, i.e. professional administering the test. Data in Table 25 considers these results in relation to the professional administering the test.

Table 25

	Orthoptist	VS trained BIOS	VS trained Local	VS not trained by Orthoptist	Overall	
<i>KCLT only</i>	4	3	3	3	13	68%
<i>KCLT OA</i>	2	0	0	0	2	11%
<i>Other VA test</i>	2	0	1	0	3	16%
<i>Other VA test & OA</i>	1	0	0	0	1	5%
<i>Overall</i>	9	3	4	3	19	100%

VS not trained by an Orthoptist were removed from Table 24 to investigate a potential relationship between personnel administering the test and subsequent True +ve scores. The results are show in Table 26 below:

Table 26

	KCLT only	KCLT and OA	Other VA test	Other VA test and OA	Overall
<i>Number of sites</i>	10	3	2	1	19
<i>Number of children seen</i>	3,061	1,671	385	40	5,156
<i>Mean (%) True Positives</i>	68	89	75	78	74
<i>Range (%) True Positives</i>	54-85	86-93	68-81	n/a	54-95

<i>Table 27</i>	0.200 each eye	0.200 & OA	Other	Overall
<i>Number of sites</i>	12	4	3	19
<i>Number seen</i>	3,242	1,711	722	5,675
<i>Mean True +ve (%)</i>	64	86	65	68
<i>Range True +ve (%)</i>	28-85	78-93	46-81	28-93

Effect of pass criteria on True +ve (n=5675 children seen)

Table 27 does not take into account a potential confounding variable, i.e. professional administering the test. Therefore, the above table was broken down to show information regarding professional administering the test. The results are shown in Table 28.

<i>Table 28</i>	Orthoptist	VS trained BIOS	VS trained Local	VS not trained by Orthoptist	Overall
<i>0.200 each eye</i>	4	2	4	3	13
<i>0.200 & other OA</i>	3	0	0	0	3
<i>Other</i>	1	1	0	1	3
<i>Overall</i>	9	3	4	4	19

VS not trained by an Orthoptist were removed from Table 27 to investigate a potential relationship between personnel administering the test and subsequent True +ve scores. The results are shown in Table 29 below:

Table 29 **0.200 each eye** **0.200 & OA** **Other** **Overall**

<i>Number of sites</i>	10	4	2	16
<i>Number seen</i>	3,137	1,711	309	5,675
<i>Mean True +ve (%)</i>	69	86	74	74
<i>Range True +ve (%)</i>	54-85	78-93	66-81	54-93

Initial diagnosis

Data was requested on the number of children in each of the following diagnostic categories based on the **initial outcome**. Data was available from 2 sites (n=633).

Table 30

	1	2	3	4	5	6	7	8	9
<i>Number Children</i>	445	23	25	7	6	67	2	58	0
<i>Total %</i>	70	3.5	3.6	1	1	11	0.3	9	0
<i>Site Mean %</i>	54	2	5	1	1	12	1	24	n/a
<i>Site Range %</i>	29 - 80	0 - 4	4 - 5	1 - 2	0 - 1	10 - 15	0.2 - 1	0 - 49	n/a

- 1) *Refractive error only*; 2) *Manifest strabismus only*²; 3) *Manifest strabismus and refractive error*; 4) *Ocular motility defect only*; 5) *Poor convergence only*; 6) *No confirmed abnormality, review as borderline/ poor coop*; 7) *Ophthalmic pathology only*; 8) *Ophthalmic pathology with refractive error &/or strabismus*; 9) *Other*

² Includes constant, intermittent and microtropia, eso and exo.

Discussion

Site Information

In previous academic years, the BIOS vision screening audit has examined the results of site information and screening data based on the number of sites that have returned data sets. In the current BIOS vision screening audit for academic year 2015-2016, the number of sites was noted and further analysis was undertaken based upon the number of children screened and referred. This aims to provide further interpretation of data as sites vary greatly in the size of eligible population (min= 420 to max= 10,214). Specific differences in key performance indicators and further audit data between academic year 2014-2015 and 2015-2016 are detailed in Appendix 2.

The number of site data sets received for academic year 2015-2016 (52 sites) appears to have fallen from the academic year 2014-2015 (56 sites). However, if merged sites from academic year 2015-2016 are considered individually, the number of returns has increased (59 sites).

In academic year 2014-2015, 53 (95%) sites screened children at ages 4-5 years old and 3 sites screened children at an unspecified 'other' age. Whereas, in academic year 2015-2016, 51 (98%) sites screened children at ages 4-5 years old and 1 site screened children at an unspecified 'other' age. The number of sites utilising a vision screener trained by an orthoptist using the BIOS package has increased from 2014-2015 (n=7) to 2015-2016 (n=15). Moreover, the number of sites using KCLT only, has increased from academic year 2014-2015 (n=16) to academic year 2015-2016 (n=27). The number of sites submitting data using a KCLT & OA has decreased from academic year 2014-2015 (n=21) to 2015-2016 (n=8). The number of sites using the recommended pass criteria of 0.200 in each eye has increased from academic year 2014-2015 (n=17) to academic year 2015-2016 (n=32) and the number of sites using the pass criteria of 0.200 in each eye and other orthoptic test(s) has decreased from academic year 2014-2015 (n=20) to academic year 2015-2016 (n=8).

Screening Data

In total, 148,159 of an eligible population of 166,089 children were screened, this is a total mean coverage of 89%. The mean site coverage was 89% with a range of 33% to 100%. The two lowest means (33% and 39%) were sites that adopted the opt-in (n=17,072) method of consent. This cohort elicited a lower mean attendance (65%) than those sites which endorsed the opt-out method (n=151,167; Mean= 92%). Counterintuitively, there seems to be a relationship between method of consent and attendance to diagnostic appointment, whereby those children who are consented via

opt-in are less likely to attend for a visual acuity assessment compared to those children who are consented via the opt-out method.

In the current BIOS vision screening audit for academic year 2015-2016, the number of children seen by an Ophthalmologist had a range of 0%-64%. This raises questions about the differences in the diagnostic pathways across sites. It could indicate a disparity of resources across sites and emphasises the need for a national guideline approach to vision screening practices.

Follow-up of children within the diagnostic pathway was also variable, for instance, Table 17b (page 12) shows the number of children that are considered to have sub-normal vision but are offered no treatment. Table 17c (page 12) shows the number of children categorised as borderline prescription, no glasses given, and kept on for review. This appears to be a large number of children who have not been treated and continue within the HES or monitoring in other community services. The clinical argument may be that it is important to detect and check these children as treatment may be required at a later date and they would otherwise be missed. A subsequent follow-up of the outcomes at the next visit would be important for this group, in order to determine the outcome.

Data from academic year 2014-2015 combined outcome categories 1-6 & 8 as a measure of True +ve scores (Method 1). The current audit has proposed two alternative methods of calculating True +ve scores; that is, by calculating those children who were offered treatment, hence in outcome categories 1 & 4 only (Method 2) and by calculating those children who had reduced vision at diagnostic testing, in outcome categories 1, 3 & 4 (Method 3). It could be considered that as the children in categories 2, 3, 5 and 6 have essentially passed the VA test, have no other refractive findings, or abnormality relating to the target conditions, that they should be discharged. Children who reside in category 8 are a further omission from the True +ve calculation proposed; they have not been prescribed glasses, occlusion has not been given and there is no explanation for what 'other' entails. The results highlight the need for national guidelines into what constitutes a True +ve and what the most effective practice is when considering children for review. It is suggested that Method 3 is the most accurate calculation of True +ve, consequently, the True +ve scores discussed will be using Method 3.

True +ve

The professional subgroup that presented with the highest mean True +ve were Orthoptists (79%). VS trained by an Orthoptist using the BIOS package and VS trained by an Orthoptist using a local

package both elicited mean True +ve scores of 66%. VS not trained by an Orthoptist presented with the lowest Mean True +ve (41%). It should be noted however that some sites delivering vision screening by VS trained by Orthoptists achieved up to 82% True +ve rate. Regardless of method used to determine True +ve, the pattern of mean True +ve scores remains constant (see figure 4 – page 17). The comparison is difficult to make however as some areas with Orthoptic delivered screening operate a system of retesting children with borderline vision on a second visit to school reducing the number of referrals but increasing costs of the screening service.

Vision screeners trained by an Orthoptist using the BIOS package (n=889 children seen) showed a mean True +ve of 66% (Range= 62% to 71%), Vision Screener trained by an Orthoptist using a local package (n= 1452 children seen) showed a mean True +ve of 66% (Range= 54% to 82%). It is important to note the difference between the sample sizes of these two groups, but the indication is that there is no difference between these two groups on True +ve scores. The benefit of receiving training from an Orthoptist is evident when comparing either of these Orthoptist trained professional groups with VS not trained by an Orthoptist (Mean True +ve = 41%; Range= 28% to 48%).

Although the data is limited, urging the need for further investigation with a larger sample, this initial analysis suggests that there is not likely to be a difference between True +ve scores between these training methods. These findings, although not comprehensive, tend to support the notion of applying a uniform approach to vision screening training across the UK. There does not seem to be a difference between training packages, and the development and use of trust-specific/local training packages instead of a national package may prove to be counter-productive; creating potential issues with varied practices, responses and reporting of evidence.

The effect of Test used on True +ve

KCLT & OA showed the highest mean True +ve score (89%). Other VA test & OA (78%) followed by, other VA test (75%) and KCLT only (62%). However, data is suggested as being skewed by confounding variables, i.e. personnel administering the test.

The analysis of Other VA tests and Other VA tests & OA indicated that there is little difference in the number of True +ve that are seen between these two groups; indicating that the use of these additional tests might not be a cost effective or efficient way to conduct vision screening practices.

The lack of difference between practices highlights the need and the importance of setting out and adhering to a national guideline for vision screening.

The results indicate that the KCLT only is not the test that elicits the highest number of True +ve. The professional administering the test presented an interesting effect on True +ve scores within these groups. It should be noted that further investigation with a more comprehensive data set is needed to fully understand these effects, however, Orthoptists were the only professional subgroup that utilised both the KCLT/OA and other VA test/OA. Orthoptists presented with the highest mean True +ve (79%). This may provide an insight into the higher than expected mean True +ve seen in both test groups for KCLT/OA (89%) and other VA test/OA (78%). Furthermore, orthoptists and vision screeners trained by an orthoptist using a local package accounted for the entire 'other VA test' sample. This may explain the higher than expected mean True +ve (75%) for this test. Every vision screener not trained by an Orthoptist utilised the KCLT only and accounted for 20% of this test population; KCLT only showed a mean True +ve of 62% and a range of 28%-85%. The VS administering the test is suggested as being a factor in the lower than expected True +ve scores. This suggestion was explored in Table 26 (page 19); when the vision screeners not trained by an orthoptist were removed from the test sample, mean True +ve scores increased from 62% (Range= 28% to 85%) to 68% (Range= 54% to 85%).

The effect of pass criteria on True +ve

The data suggests that the use of 0.200 & OA provides the greatest number of True +ve (86%), followed by 'other' (65%) and 0.200 in each eye (64%). This however, is complicated by other factors; the professional administering the test can be seen to effect the overall means (%) of True +ve scores. Orthoptists (*Mean True +ve=79%*) accounted for all professionals who adhered to 0.200 in each eye & other orthoptic assessment (number of sites= 4); possibly providing insight into why this pass criteria elicited a high True +ve score. Furthermore, vision screeners not trained by an Orthoptist (*Mean True +ve =41%*) accounted for 23% of the population (number of sites=3) that utilised the recommended pass criteria category of 0.200 in each eye. When vision screeners not trained by an orthoptist were removed from the sample, mean True +ve scores for pass criteria of 0.200 in each eye increased from 64% (Range= 28%-85%) to 69% (Range= to 54%-85%). Furthermore, the exclusion of VS not trained by an Orthoptist resulted in an increase of 'Other' pass criteria from 65% (Range= 46% to 81%) to 74% (Range 66% to 81%). This provides a clear indication of the effect of VS on True +ve scores, regardless of pass criteria used.

Conclusion

The number of sites participating in the current BIOS vision screening audit for academic year 2015-2016 has increased from the previous academic year (2014-2015) from 56 to 59. This number of 59 reduces to 52 when combined data and duplicated submissions were accounted for. The mean coverage has decreased from 91% in the academic year 2014-2015 to 89% in the current audit of academic year 2015-2016.

On analysis of True +ve, available data sets increased from 12 in 2014-2015 to 21 in 2015-2016. The reported True +ve means compared using Method 1, as used in 2014-2015, have not shown any changes. With the larger data set available, this study was able to analyse the mean True +ve scores of all professional subgroups; this was not possible in the 2014-2015 audit. With a further increase in response and completed data submissions, the upcoming BIOS Audit for academic year 2016-2017 has potential to analyse this further.

Further investigation with a larger dataset is needed to clearly identify the role of the vision screener on True +ve scores. The possible effects of training received have been highlighted in this report, with orthoptic training being essential to produce satisfactory outcomes. Professional administering the test appears to have an effect on True +ve scores possibly related to other fundamental aspects such as which test is used and the pass criteria adopted. The effects of carrying out a further report with a more comprehensive data set, or indeed not doing so, could have a significant impact on national screening recommendations. There is an urgent need for a more comprehensive data set in order to identify trends and make informed suggestions regarding vision screening practices.

References

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Appendix 1

Site Information was requested to provide the basic information about the screening provided in each area. This included:

Area ID – the area’s ID from BIOS interactive maps

Area name - the area’s ID name from BIOS interactive maps

Contact email – the email address of the person submitting the data

Consent - the area’s consent policy:

- 1 = opt-out
- 2 = opt in

Age – the age at which children are screened in each area:

- 1 = age 4 – 5 years
- 2 = other

Professional – the professional who undertakes the screening:

- 1 = Orthoptist
- 2 = vision screener trained by Orthoptist with BIOS training package
- 3 = vision screener trained by Orthoptist with local training package
- 4 = vision screener not trained by Orthoptist

Test/s – the test/s are used in the screening:

- 1 = Keeler crowded logMAR vision test only
- 2 = Keeler crowded logMAR vision and Orthoptic assessment
- 3 = other VA test
- 4 = other VA test and orthoptic assessment

Pass criteria - the pass criteria used in each area:

- 1 = 0.200 each eye
- 2 = 0.200 each eye and other orthoptic test(s)
- 3 = other

Referral pathway - the area's care pathway for children who fail the screening:

- 1 = all fails referred to Orthoptic led HES service
- 2 = all fails referred to high street Optician
- 3 = referral to HES and own Optician based on set criteria

Eye exam - the type of eye exam the child receives having failed the screening:

- 1 = Assessment of vision (R+L) Keeler Crowded LogMAR, Assessment of Binocular vision and motility Cycloplegic (if required) refraction & fundus / media exam for every child referred
- 2 = testing required determined by eye care professional
- 3 = other

Management criteria - the criteria used to determine the treatment / management of the child:

- 1 = evidence-based criteria used to determine if visual deficit present i.e level of vision and refractive guidelines used.
- 2 = based on opinion / clinical judgement of individual professional

Screening data was requested from each area, this included:

- Number eligible – the number of children in the target age group to be screened in each area.
- Number tested - the number of eligible children actually screened.
- Passed – the number of children who passed the screening.
- Failed – the number of children who failed the screening and were referred.

Referral reason – the reason for the referral / fail and details about the number of children in each category:

- 1 = failed vision test
- 2 = failed vision test and orthoptic assessment
- 3 = failed orthoptic assessment only (i.e. any or all of the following CT, OM, BV test)
- 4 = referred as poor cooperation

Number seen – the number of children referred who attended for the eye exam

Mean age – the mean age in months of the children seen

Age range - the age range in months of these children

Mean Wait - the mean waiting time (in weeks) to be seen for the eye exam

Outcome - the number of children in each category for the *initial* outcome of the eye exam - the outcome of the first eye exam having failed the school screening:

- 1 = Glasses prescribed
- 2 = Borderline prescription, no glasses given yet, but review
- 3 = No glasses required but review as borderline / sub-normal vision
- 4 = Occlusion given (*i.e. may rarely be given at initial visit as no glasses required, fundus exam normal and monocular sub-normal acuity due to manifest squint*)
- 5 = Orthoptic exercises
- 6 = Ophthalmic pathology
- 7 = Discharged as no defect
- 8 = Other

Ophthalmologist – the number of children who required an ophthalmic opinion

Number of true positives – this is the number of children confirmed as having a visual defect – this is the total number of children in the *initial* outcome categories 1 and 4 described above.

Number of false positives – this is the number of children confirmed as having no clear visual defect – this is the total number of children in the *initial* outcome categories 2, 3, 5 and 6 described above.

Diagnosis - the number of children in each of the following diagnostic categories based on the *initial outcome* - this is the diagnosis based on the outcome of the first eye exam having failed the school screening:

- 1 = refractive error only
- 2 = manifest strabismus only (includes constant, intermittent and microtropia, eso and exo)
- 3 = manifest strabismus and refractive error
- 4 = ocular motility defect only
- 5 = poor convergence only
- 6 = no confirmed abnormality but review as poor cooperation, or borderline results
- 7 = ophthalmic pathology only
- 8 = Ophthalmic pathology with refractive error &/or strabismus
- 9 = other

Appendix 2

BIOS Recommended Vision Screening Monitoring

On the basis of the data presented:

BIOS Key Performance Indicators

KPI 1: % of children who were screened

KPI 2: % of children screened who were referred for an eye examination

KPI 3: % of children referred who attended for an eye examination

KPI 4: % true-positive referral rate

	Academic Year 2014-2015	Academic Year 2015-2016
KPI 1	91%	89%
KPI 2	14%	12%
KPI 3	75%	77%
KPI 4	78%	76% (Method 1) 58% (Method 2) 68% (Method 3)

BIOS Further Audit Data

AD 1: Number of children aged 4 – 5 years to be screened (eligible population)

AD 2: Number of children aged 4 – 5 years who were screened

AD 3: Mean age (and range) of the children referred

AD 4: Mean waiting time (and range) for the full eye examination

AD 5: % prevalence of prescription of glasses

AD 6: % prevalence of manifest strabismus (constant, intermittent or micro)

AD 7: % of children who required an ophthalmic opinion

	Academic Year 2014-2015	Academic Year 2015-2016
AD 1	Local	165,283
AD 2	KPI 1	147,488 (89%)
AD 3	58 months	58 months
AD 4	Local	7 weeks (HES service) 3 weeks (HS optometrist) 7 weeks (HES or HS optometrist)
AD 5	63%	56%
AD 6	13%	7%
AD 7	9%	10%