BIOS VISION SCREENING AUDIT:
Academic Year 2016-2017

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Dr Helen Griffiths
Senior Lecturer in Orthoptics
Academic Unit of Ophthalmology & Orthoptics
University of Sheffield

Dr Jill Carlton
Senior Research Fellow
Health Economics and Decision Science
ScHARR
University of Sheffield

Paolo Mazzone
Research Assistant
Health Economics and Decision Science
ScHARR
University of Sheffield

Glossary of Terms

True Positive (True +ve): This is the number of children confirmed at diagnostic testing as having a visual defect (but see Figure 1)

False Positive (False +ve): This is the number of children confirmed at diagnostic testing as having no clear visual defect

Professional: The professional who undertakes the screening

Test/s: The test/s used in the screening

Pass criteria: The pass criteria used in each area to determine that no referral is required

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

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

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

Referral reason: The reason for failing the screening test and referral to the diagnostic pathway

Mean age: The mean age in months

Age range: The age range of these children in months

Mean wait: The mean waiting time (in weeks) to be seen for the diagnostic eye examination

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

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 screening

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BIOS Vision Screening Audit: Academic Year 2016-2017

Abstract

Aim: This audit utilises data submitted by Head Orthoptists to the British and Irish Orthoptic Society (BIOS). The aim is to attempt to describe vision screening practices across the United Kingdom (UK) for the academic year 2016-2017, compare the findings to the previous vision screening audit for academic year 2015-2016 and provide evidence for future decision-making.

Method: Submitted data was integrated into an Excel spreadsheet and the information was analysed to identify the differences between screening programmes across sites. The method of calculating True +ve scores was explored using three methods (as explained in 2015-2016 audit) and the effects of training on True +ve are discussed. Data was deemed 'accurate', such as at the analysis of initial outcomes, only if all children seen after referral were accounted for in the initial outcomes section.

Results: Fifty sites provided basic data including consent policy and age at which tests are performed; a decrease from the previous academic year 2015-2016 (n=52 sites). Forty-three sites provided data on which professional administered the tests, the test(s) used and the pass criteria adopted. Forty-one sites provided data regarding the referral pathway and forty-three sites provided data on eye exam and management criteria. Forty-two sites provided data regarding the number of children screened (n=162,868), of which thirty sites provided 'accurate' data on the number of children who failed screening (n=15,383). Thirty-eight sites provided 'accurate' data on the number of children who attended their follow-up (n=10,748). Eighteen sites (n=4,645 children seen) provided data on initial outcomes of the eye examination and sixteen sites (n=4,060 children seen) provided diagnostic test data on the number of True positives (+ve). The mean coverage increased to 93% (2016-2016=89%). Using Method 1 of calculating True +ve: Orthoptic delivered screening (n=1,790) showed a mean True +ve of 89%; Vision Screener (VS) trained by an Orthoptist using the BIOS package (n=608) showed a mean True +ve of 81%; VS trained by an Orthoptist using a local package (n=804) showed a mean True +ve of 71%; and VS not trained by an Orthoptist (n=126) showed a mean True +ve of 59%.

Conclusions: This audit concludes that many screening services do not have methods to collect data to assess the effectiveness of the programme. Clarity is needed regarding the meaning of certain terms to achieve consistency in reporting and allow comparison and benchmarking of services, for example, in recording True+ve. Without this, it is not possible to definitively conclude whether professional delivering screening and type of vision screener training does influence True +ve rates or not. The current limited data suggests that the 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 across the UK and Ireland. 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 the referral diagnostic pathway.

Literature has shown that 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 UK National Screening Committee (NSC) and BIOS. There is no robust research to support any other vision screening in childhood.

There is a lack of adherence to NSC recommendations by Vision Screening services. In October 2017 new Public Health England (PHE) guidance was published to aid Local Authorities in the commissioning and delivery of services. PHE utilised current literature to develop these evidence-based recommendations to promote standardised delivery of vision screening practices across the UK. The guidance provides explicit specification and pathway guidance but standards are still awaiting final approval and publication. The effect of this guidance will need to be evaluated but will take at least another two years before any changes in data outcomes can be expected.

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 2016-17 audit seeks to identify the current vision screening practice across the UK and Ireland, identify any changes from the previous year, allow benchmarking of services 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 via the BIOS email account for the academic year 2016-2017. The email was sent on 10th October 2017 for submission by 31st December 2017. The email request included an Excel spreadsheet and guidance to complete the data submission process. It 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. A reminder email to Orthoptic Heads of Service, for completion and submission of data with an extended deadline of 31st January 2018 was sent on 21st December 2017.

Two hundred and four sites were identified across the UK and Ireland, fifty (24.5%) of those sites provided initial data. Data was analysed for inclusion in 'screening outcome data' reporting by assessing 'accuracy' using four criteria, namely:

- Pass/Fail: The number of children who passed and failed screening must equate to the number of children who were actually screened.
- Referral Reasons: The number of referral reasons must equate to the number of children who failed screening.
- Initial Outcomes: The number of initial outcomes must equate to the number of children seen, after referral from diagnostic testing.
- True +ve /False +ve: The sum of True +ve and False +ve must equate to the number of children seen, after referral from diagnostic testing.

Sites were excluded on an individual basis, only if they provided inaccurate data at each point. For example, a site could be excluded for not providing 'accurate' referral reasons data, but could still be included in the initial outcomes and True +ve/False +ve analysis – if the data at these points was deemed 'accurate'. In total eight sites were removed from the screening outcome data analysis for not providing information pertaining to the number of children screened. Forty-two sites remained for further 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 was repeated in the 2015-2016 audit (BIOS, 2016), along with two new methods, which have also been included in this 2016-2017 report. The alternative True +ve analysis has been completed based on the notion that many children are being identified as True +ve 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, in most cases due to amblyopia related to uncorrected refractive error and hence the need for glasses or presence of strabismus. 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 was not given.

Figure A.

Method 1

- True +ve was calculated by obtaining the sum of those children who failed screening and were documented in categories 1,2,3,4,5,6,7 and 9 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 8 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, 4, or 7 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, 8, or 9 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 & 7 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, 8, or 9 out of the total number of children seen.

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

Not all data complete for all site questions, this is reflected by number of sites reported in the totals for each point/question. Fifty sites provided site data, of which, 39 sites provided data on the number of children screened. Therefore, in the following tables, although the number of sites that carried out screening is accurate, 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 area specific consent policy:

Table 1	Opt-out	Opt-in	Overall
Number of Sites	40	10	50
Number of Children	138,735	14,008	152,743

The age at which screening was delivered:

Other was detailed as aged 40-44 months of age.

Table 2	4-5 years	Other	Overall
Number of Sites	49	1	50
Number of Children	152,236	507	152,743

The professional by whom screening was delivered:

Seven sites were excluded for not providing information on professional who delivered the screening.

Table 3	1	2	3	4	Overall
Number of Sites	15	9	17	2	43
Number of Children	58,655	36,029	54,273	3,776	152,743

1: Orthoptist; 2: Vision Screener (VS) trained by Orthoptist BIOS package; 3: VS trained by Orthoptist local package; 4: VS not trained by Orthoptist

The test/s used in the screening process:

Forty-four sites submitted information in response to this question. One site was removed from reporting 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**
Number of Sites	24	7	9	3	43
Number of Children	84,706	24,221	33,497	10,319	152,743

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**
Number of Sites	27	5	11	43
Number of Children	90,115	16,139	46,489	152,743

Second screening offered if unable to test:

Table 6	**Yes**	**No**	**Other**	**Overall**
Number of Sites	17	19	4	40
Number of Children	58,204	72,930	8,403	139,537

Second screening offered if borderline VA:

Table 7	**Yes**	**No**	**Other**	**Overall**
Number of Sites	12	26	1	39
Number of Children	37,389	108,746	Unknown	146,135

The referral pathway for children who fail the screening:

Table 8	**HES service**	**HSO**	**HES or HSO**	**Overall**
Number of Sites	25	3	13	41
Number of Children	97,543	14,451	40,749	152,743

HES = Hospital Eye Service only, HS = High Street Optometrist, HES or HS = Hospital Eye Service or High Street Optometrist based on criteria

The eye examination used for children who have failed:

Table 9	**VA, CT, OM, BV, cyclo refraction, F&M (1)**	**Testing determined by eye-care professional (2)**	**1 & 2**	**Other***	**Overall**
Number of Sites	13	19	2	9	43
Number of Children	51,111	57,341	6,925	37,366	152,743

VA = visual acuity, CT = Cover test, OM = ocular movements, BV = Assessment of binocular vision, cyclo refraction = cycloplegic refraction, F & M = fundus and media examination

**'Other' included the use of SLT; VA is 0.2 or above, then no refraction &fundus; Sonksen; Thomson or Sonksen; those with VA less than 0.5 in either eye reviewed at secondary orthoptic screening and referred into HES for full orthoptic assessment and cylopegic refraction and fundus check if they fail.*

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

Table 10	**Evidence-based**	**Opinion / clinical judgement**	**Other***	**Overall**
Number of Sites	21	11	11	43
Number of Children screened	88,241	35,197	29,305	152,743

**11 sites provided information detailing the use of 'other' treatment/management criteria. These were explained as a combination of evidence-based and opinion/clinical judgement; i.e. evidence based but if borderline clinical judgement*

Results of Screening Data

Coverage of the screening

Data was requested on the number of children eligible to be screened and the number of those children actually screened. Forty-two sites provided data on the number of eligible and screened children (n=175,407); this allowed for a calculation of the mean coverage and range (%) across these 42 sites, shown in Table 11

Table 11	**Number Eligible**	**Number Screened**	**Total Coverage (%)**	**Site Mean Coverage (%)**	**Site Range (%)**
Number of Sites	42				
Number of Children	175,407	162,868	93	92	69.7 - 99.8

- Mean site coverage for academic year 2015/16: 89% - Range 33% to 100%.

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 28 sites (111,295 children screened, of which 14,508 failed) and categorised based on professional delivering the screening.

Table 12	1	2	3	4	A*	B*	Overall
Number of Sites	8	6	13	1	1	1	28
Number screened	30,582	30,761	46,136	3,776	1,391	5,774	111,295
Number referred	3,964	3,173	6,731	640	313	1,440	14,508
Total % children	13	10	15	17	23	25	13
Site Mean (%)	15	12	13	17	23	25	14
Site Range (%)	3 - 24	4 - 30	5 - 28	n/a	n/a	n/a	3 - 30

1= Orthoptist; 2= VS trained by Orthoptist BIOS package; 3= VS trained by Orthoptist local package; 4=VS not trained by Orthoptist; A= 1 and 2 - "Undertaken by both"; B* - "Part of BIOS package used: lectures delivered, but competencies not assessed"*

- Mean overall site referral rate in 2015/16 academic year was 12% range 4% - 24%

Reason for the referral / fail

Data was available from 32 sites including 113,610 children screened, of which 14,530 failed.

Table 13	**Failed VA test**	**Failed VA & OA**	**Failed OA**	**Referred poor cooperation**	**Overall**
Number of Children Failed	13,441	281	214	594	14,530
Total (%)	93	2	1.5	4	100
Site Mean (%)	91	3	2	4	100
Site Range (%)	*60 – 100*	*0 – 19*	*0 – 28*	*0 – 22*	

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 40 sites (n=11,147 children), two sites were removed for the calculation of mean attendance for failing to supply an 'accurate' complete number of children who failed screening. Of the 38 remaining sites (n=10,974 children seen):

- Mean attendance was 71%, range 27% to 95%
- Sites were contacted to determine any specific reasons for low attendance; external factors were described such as 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.

Mean Age at Diagnostic Test

Data was available from 36 sites (n=9,779 children).

Table 14	**Screened at 4-5 years**	**Screened at 'Other'**
Number of sites	32	1
Number seen	8,959	87
Mean age	61.33 months	40-44 months
Range (%)	52-68	n/a

- Mean age 61 months, range from 42 to 70 months.

Waiting time from Screen fail to diagnostic appointment

Data was available from 32 sites (n=8,700 children). There is no data concerning waiting times for those children referred to high-street opticians; only for those referred to orthoptic led HES and HES & own optician based on set criteria.

- Mean wait 7.7 weeks, range 2.9 to 14.0 weeks.

Initial Outcome of the eye examination: Data was available from 18 sites (n=4,645 children):

Table 15 **Initial Outcome of eye examination**

	1	2	3	4	5	6	7	8	9
Number of children	3,008	177	307	24	13	9	18	794	295
Mean (%)	64.8	3.8	6.6	0.5	0.3	0.2	0.4	17.1	6.3

1) Glasses prescribed; 2) Borderline prescription, no glasses given yet, but review; 3) Borderline VA, no glasses required but review; 4) Occlusion given[1]; 5) Orthoptic exercises; 6) Ophthalmic pathology with normal VA; 7) Ophthalmic pathology with reduced VA; 8) Discharged as no defect; 9) Other

Number seen by an Ophthalmologist

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

Data was available from 32 sites. Of 7,937 children attending for diagnostic testing within Hospital Eye services, 885 (Mean: 11%; Range: 0% - 85%) received an ophthalmic opinion.

Number of True positives (*Method 1 - Figure A)*

Data was available from 16 sites (n=4,060 children), whereby full representation of children who had failed screening was evident and accounted for in the initial outcome section.

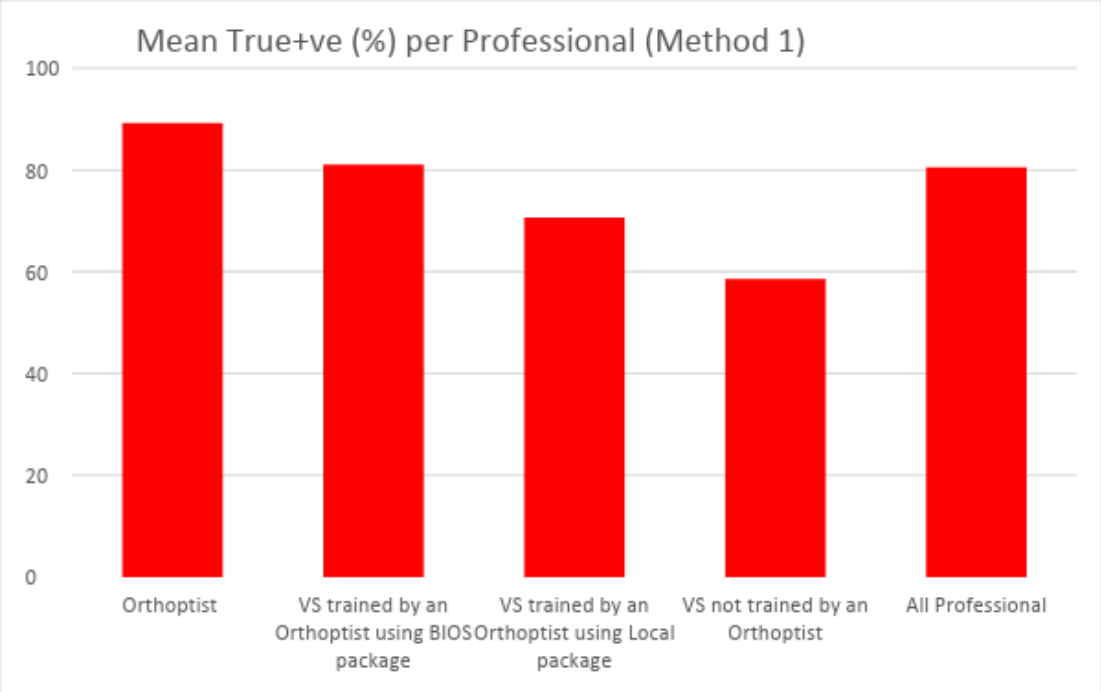
Data was requested on the number of children confirmed as having a visual defect, this was calculated using Initial Outcomes categories 1-6 & 8 and categorised based on professional:

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

Table 16	**Orthoptist screening**	**VS trained with BIOS**	**VS trained with Local**	**VS not trained by Orthoptist**	**Overall**
Number of Sites	8	2	5	1	16
Number of Children seen	1,989	753	1,103	215	4,060
Number of True Positives	1,790	608	804	126	3,328
Mean (%)	89	81	71	59	81
Range (%)	78 – 100	75 – 87	49 – 91	n/a	49 - 100

It should be noted here that True positives from services using VS trained with BIOS package contains only two sites in the analysis, one performing better than some of the orthoptic delivered services. Data in Table 16 is also shown in Figure 1 for clarity.

Figure 1:



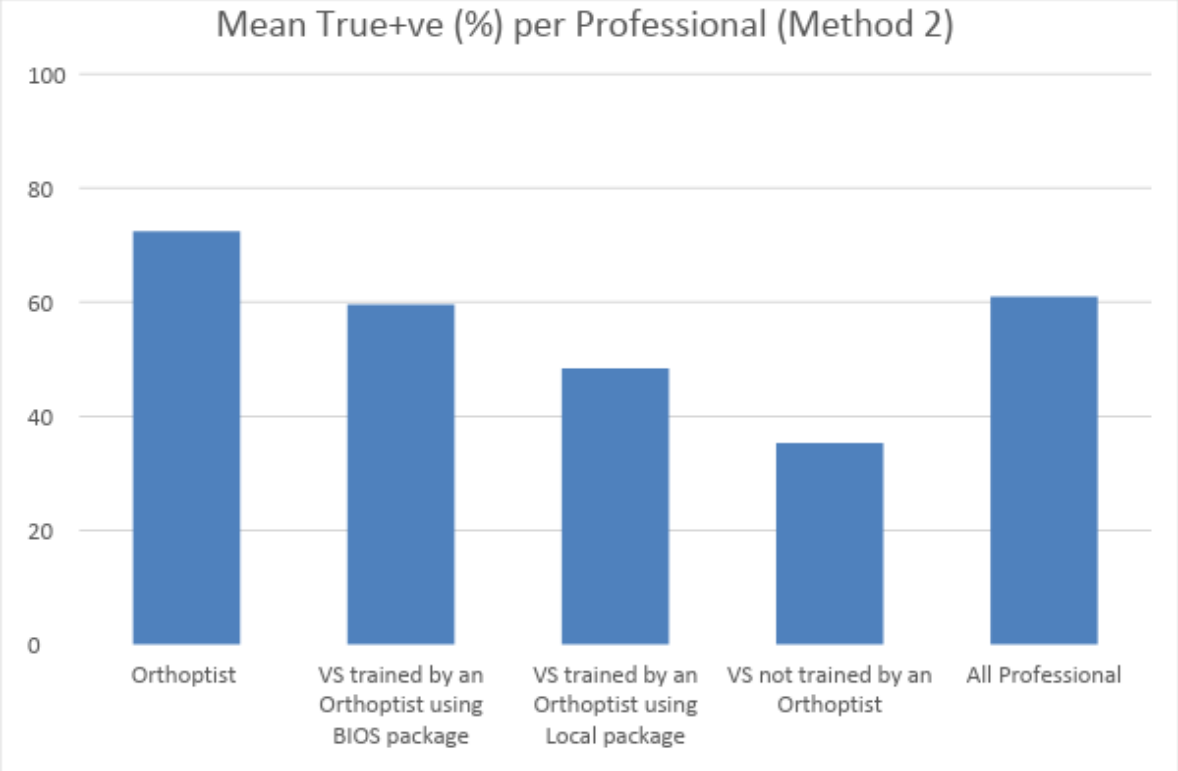
Number of True positives (*Method 2 – Figure A)*

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 17	**Orthoptist screening**	**VS Trained with BIOS**	**VS trained with Local**	**VS not trained by Orthoptist**	**Overall**
Number of Sites	8	2	5	1	16
Number of Children seen	1,989	753	1,103	215	4,060
Number of True Positives	1,511	444	556	76	2,587
Mean (%)	72	60	48	36	61
Range (%)	29 – 88	48 - 71	0 – 81	n/a	0 – 88

Data from Table 17 is also shown in Figure 2 for clarity.

Figure 2:



Number of True positives (*Method 3 – Figure A)*

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 18	**Orthoptist screening**	**VS Trained with BIOS**	**VS trained with Local**	**VS not trained by Orthoptist**	**Overall**
Number of Sites	8	2	5	1	16
Number of Children seen	1,989	753	1,103	215	4,060
Number of True Positives	1,672	487	608	79	2,846
Mean (%)	81	65	52	37	67
Range (%)	59 – 94	59 – 71	0 – 85	n/a	=5

Data from Table 18 is also shown in Figure 3 for clarity.

Figure 3:

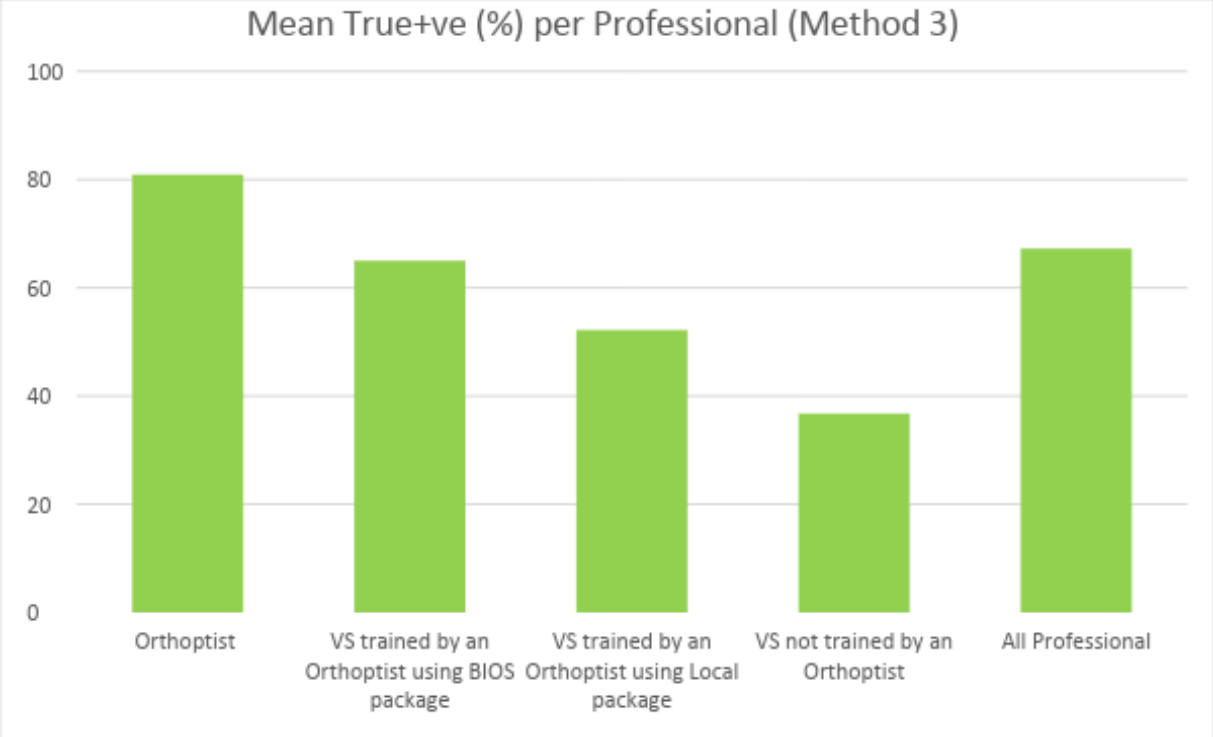


Table 19 compares the overall mean True +ve for each professional category based on True +ve calculation methods 1, 2, or 3.

Table 19	**Mean True +ve Method 1 (75%*)**	**Mean True +ve Method 2 (54%*)**	**Mean True +ve Method 3 (60%*)**
Orthoptist screening	89	72	81
VS Trained with BIOS	81	60	70
VS trained with Local	71	48	52
VS not trained by Orthoptist	59	35	37

**Percentages in brackets refer to mean True +ve for all professionals.*

Data in Table 19 is also shown in Figure 4 for clarity.

Figure 4:

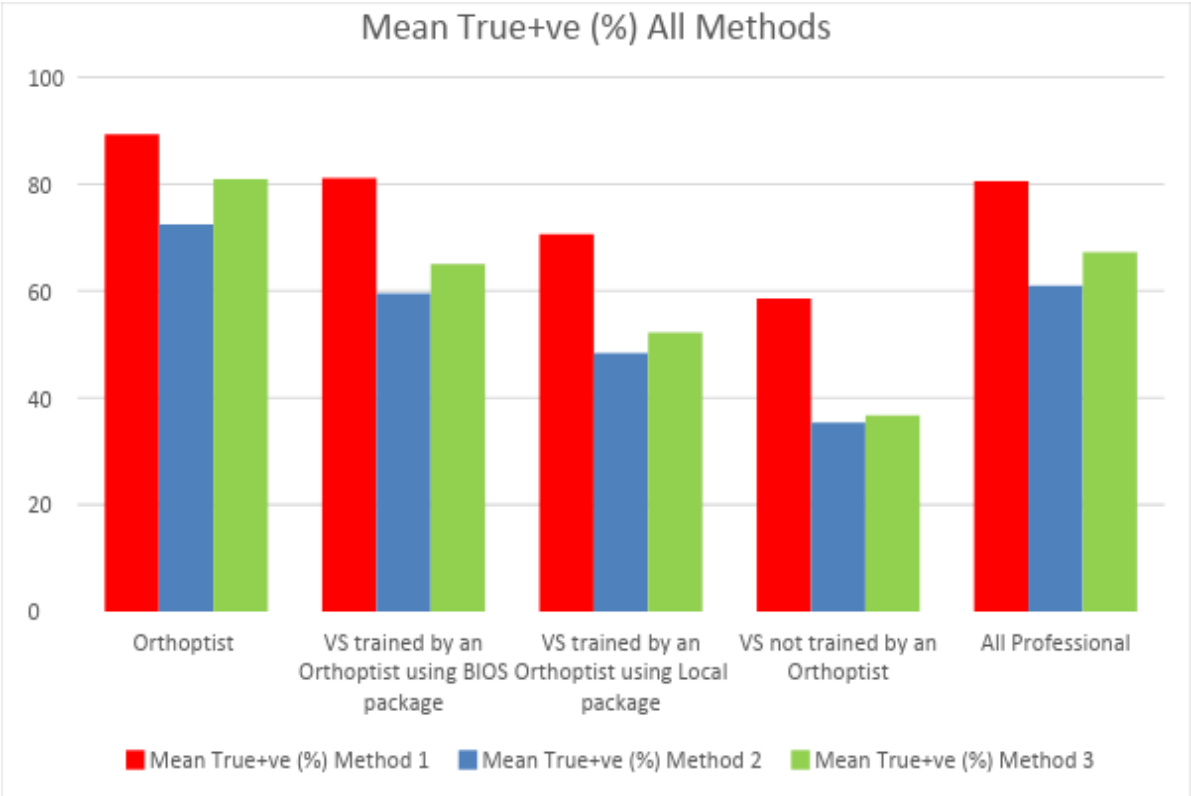


Table 20 shows the differences between academic year 2015-2016 and academic year 2016-2017 when using method 1 to calculate True +ve.

Table 20 Academic year 2015-2016 Academic year 2015-2016

	Number of sites	**Mean True +ve (%)**	**Range (%)**		**Number of sites**	**Mean True +ve (%)**	**Range (%)**
Orthoptist screening	9	84	58-93		8	89	78 – 100
VS Trained with BIOS	4	78	74-91		2	81	75 – 87
VS trained with Local	4	77	68-84		5	71	49 – 91
VS not trained by Orthoptist	3	47	40-54		1	59	n/a

Effect of test on True +ve (n=4,060 children): *Based on True +ve calculation Method 1.*

Table 21	**KCLT only**	**KCLT and OA**	**Other VA test**	**Other VA test and OA**	**Overall**
Number of sites	8	2	5	1	16
Number of children seen	1,756	842	1,375	87	4,060
Mean (%) True Positives	76	94	79	98	81
Range (%) True Positives	49 – 91	89 - 100	59 – 91	n/a	49 – 100

Table 21 does not take into account a potential confounding variable, i.e. professional administering the test. Data in Table 22 considers these results in relation to the professional administering the test.

Table 22	**Orthoptist**	**VS trained BIOS**	**VS trained Local**	**VS not trained by Orthoptist**	**Overall**
KCLT only	4	1	3	0	8
KCLT OA	2	0	0	0	2
Other VA test	1	1	2	1	5
Other VA test & OA	1	0	0	0	1
Overall	8	2	5	1	16

True+ve regarding test used was explored based on professional administering the test. This is documented in tables 23-26.

Orthoptist

Table 23	**KCLT only**	**KCLT and OA**	**Other VA test**	**Other VA test and OA**
Number of sites	4	2	1	1
Number of children seen	881	842	179	87
Mean (%) True Positives	85	94	87	98
Range (%) True Positives	78 – 92	89 – 100	n/a	n/a

VS Trained by an Orthoptist using BIOS package

Table 24	**KCLT only**	**KCLT and OA**	**Other VA test**	**Other VA test and OA**
Number of sites	1	0	1	0
Number of children seen	357	n/a	396	n/a
Mean (%) True Positives	87	n/a	75	n/a
Range (%) True Positives	n/a	n/a	n/a	n/a

VS Trained by an Orthoptist using Local package

Table 25	KCLT only	KCLT and OA	Other VA test	Other VA test and OA
Number of sites	3	0	2	0
Number of children seen	518	n/a	585	n/a
Mean (%) True Positives	61	n/a	86	n/a
Range (%) True Positives	49 – 68	n/a	81 – 91	n/a

VS not trained by an Orthoptist

Table 26	KCLT only	KCLT and OA	Other VA test	Other VA test and OA
Number of sites	0	0	1	0
Number of children seen	n/a	n/a	215	n/a
Mean (%) True Positives	n/a	n/a	59	n/a
Range (%) True Positives	n/a	n/a	n/a	n/a

Effect of pass criteria on True +ve (n=4,060 children seen)

Table 27	0.200 each eye	0.200 & OA	Other	Overall
Number of sites	9	2	5	16
Number seen	1,913	623	1,524	4,060
Mean True +ve (%)	77	99	79	81
Range True +ve (%)	49 – 91	98 – 100	59 – 89	49 – 100

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 Tables 28.

Table 28	Orthoptist	VS trained BIOS	VS trained Local	VS not trained by Orthoptist	Overall	
0.200 each eye	3	1	5	0	9	56.3%
0.200 & other OA	2	0	0	0	2	12.5%
Other	3	1	0	1	5	31.3%
Overall	8	2	5	1	16	100%

True +ve regarding pass criteria was explored based on professional administering the test. This is documented in tables 29-32.

Orthoptist

Table 29	0.200 each eye	0.200 & OA	Other
Number of sites	3	2	3
Number of children seen	453	623	913
Mean (%) True Positives	85.4	98.9	86.8
Range (%) True Positives	78 – 91	98 – 100	85 – 89

VS Trained by an Orthoptist using BIOS package

Table 30	0.200 each eye	0.200 & OA	Other
Number of sites	1	0	1
Number of children seen	357	n/a	396
Mean (%) True Positives	87	n/a	74.8
Range (%) True Positives	n/a	n/a	n/a

VS Trained by an Orthoptist using Local package

Table 31	**0.200 each eye**	**0.200 & OA**	**Other**
Number of sites	5	0	0
Number of children seen	1,103	n/a	n/a
Mean (%) True Positives	71	n/a	n/a
Range (%) True Positives	49 – 91	n/a	n/a

VS not trained by an Orthoptist

Table 32	**0.200 each eye**	**0.200 & OA**	**Other**
Number of sites	0	0	1
Number of children seen	n/a	n/a	215
Mean (%) True Positives	n/a	n/a	59
Range (%) True Positives	n/a	n/a	n/a

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=995 children seen). All other sites were excluded for not providing complete data; i.e. the total number of Initial Diagnoses did not equate to the number of children seen.

Table 33

	1	2	3	4	5	6	7	8	9
Number Children	707	53	50	21	22	59	4	74	5
Mean %	71	5	5	2	2	6	0.45	7	0.55
Range %	58 – 82	4 – 7	5 – 5.5	1 – 4	0.4 – 4	4 – 7	0.3 – 0.4	0.2 – 16	0

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 reduced vision; 9) Other

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

Discussion

Site Information

In the previous BIOS report (2015-2016), vision screening audit examined the results of site information and screening data based primarily on the number of children screened and referred with the number of sites included also given. The same method has been continued for this academic year (2016-2017). Specific differences in key performance indicators and further audit data between academic year 2015-2016 and 2016-2017 are detailed in appendix 3. The number of site data sets received for academic year 2016-2017 (50 sites) has fallen slightly from the academic year 2015-2016 (52 sites).

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. Similarly, in academic year 2016-2017, 49 (98%) sites screened children at ages 4-5 years old and 1 site screened children at an 'other' age, detailed at 40-44 months. The number of sites submitting data who utilise a vision screener (VS) trained by an orthoptist using the BIOS package has decreased from 2015-2016 (n=15) to 2016-2017 (n=9). However, one site has stated the use of both an Orthoptist and VS trained by an Orthoptist in the current academic year. Further changes were seen in two other sites, whereby one adopted parts of the BIOS package (lectures delivered, but competencies not assessed) and one adopted most of the BIOS package, but with a "few tweaks". This reduction in sites using the BIOS training or using it fully may indicate that the package is too time consuming to complete in its entirety, suggesting that a review of content may be required.

The number of sites submitting data who use Keeler Crowded logMAR test (KCLT) only, has decreased slightly from academic year 2015-2016 (n=27) to 2016-2017 (n=24). The number of sites submitting data using a KCLT & orthoptic assessment (OA) has decreased from academic year 2015-2016 (n=8) to 2016-2017 (n=7). The number of sites using the recommended pass criteria of 0.200 in each eye has decreased from academic year 2015-2016 (n=32) to 2016-2017 (n=27) and the number of sites using the pass criteria of 0.200 in each eye and other orthoptic test(s) has decreased in submissions from academic year 2015-2016 (n=8) to 2016-2017 (n=5).

Screening Data

In total, for academic year 2016-2017, out of a pool of 175,407 eligible children, 162,868 (total mean=93%; Range=69.7%-99.8%) were screened. This is an increase from academic year 2015-2016 (total mean=89%; Range=33%-100%). In the current BIOS vision screening audit for academic year 2016-2017, the number of children seen by an ophthalmologist was recorded as 876 (11%) out of 7,830 referred with a range of 0.3%-85.2%. This compared to 0%-64% in the 2015-2016 academic year. 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 in relation to the diagnostic pathway. This has recently been clarified in the Public Health England (PHE) guidance published in October 2017 (PHE, 2017).

Follow-up of children within the diagnostic pathway was also variable, for instance, Table 15 shows the number of children that are considered to have subnormal vision but are offered no treatment (n=307) and the number of children categorised as borderline prescription, no glasses given, and kept on for review (n=177). This appears to be a large number of children who have not been treated and continue within the Hospital Eye Service (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. This may then allow more specific criteria to be defined for those requiring follow-up and those that could be discharged earlier.

Data for this academic year (2016-2017) followed on from academic year 2015-2016, where by three methods for comparing True+ve percentages is utilised: Method 1, Method 2 and Method 3 (Figure A). 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 and therefore are not True+ve. Children who reside in category 9 are a further omission from the True +ve calculation proposed. 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 understood that Method 1 is the currently preferred and as such, the True +ve scores discussed will be using Method 1, however, Method 3 is suggested as the technique that should be used by trusts going forward.

True +ve

The professional subgroup delivering the screening that presented with the highest True +ve (Method 1) were Orthoptists (Mean=89.3%; Range=77.7%-100%). This was followed by VS trained by an Orthoptist using the BIOS package (Mean=81.1%; Range=74.8%-87.4%) and VS trained by an Orthoptist using a local package (Mean=70.6%; Range=48.7%-91.3%). VS not trained by an Orthoptist presented with the lowest True +ve (Mean=58.6%; 1 site). 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 12 sites 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. A cost and outcome analysis of the two-screen model compared to diagnostic testing earlier for this group would be warranted. However, the benefit of receiving training from an Orthoptist is evident when comparing either Orthoptist trained professional groups with VS not trained by an Orthoptist. 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 local and BIOS training packages. These findings, although not comprehensive, tend to support the notion of applying a uniform approach to vision screening training across the UK. The development and use of trust-specific/local training packages instead of a national package may prove to be counterproductive; creating potential issues with varied practices, responses and reporting of evidence.

The effect of Test used on True +ve

Other VA test & OA (Mean=97.7%; Range=n/a) showed the highest mean True +ve score but this was from just one site. Use of KCLT & OA achieved similar outcome data (Mean=94.3%; Range=88.6%-100%). Other VA test produced a lower mean True positive rate and a concerning range in the data sets (Mean=78.5%; 58.6%-91.3%). Screening with KCLT only gave a mean True +ve of 76.2%. It should be noted however that the range was larger with the best outcome using this test being 91.4% True +ve (Range=48.7%-91.4). However, data may also be skewed by confounding variables, i.e. professional administering the test. The small differences seen between Other VA tests & OA and KCLT & OA, as well as KCLT only and other VA test, indicates 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. Whilst the results suggest that KCLT only is not the test that elicits the highest number of True +ve care should be taken in interpretation. 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 (89.3%). This may provide an insight into the higher than expected mean True +ve seen in both test groups for KCLT & OA (94.3%) and other VA test & OA (97.7%). The VS administering the test is suggested as being a factor in the outcome of True +ve scores.

When accounting for the type of test used, there are varying True+ve scores between professionals. This indicates that the training provided has an impact on the competency of administering each test. For example, VS trained by an Orthoptist using the BIOS package will be trained specifically using BIOS recommendations of KCLT only. Perhaps consequently, this could explain why True +ve scores for this test (Mean=87.4%) outscore that of Other VA test (Mean=74.8%) and when compared to VS trained by an Orthoptist using a Local package, the scores for KCLT only decrease (Mean=60.5%) and the scores for Other VA test increase (85.9%).

The effect of pass criteria on True +ve

The effect of pass criteria on True+ve scores was explored in the same way as the effect of test used. The data suggests that the use of 0.200 & OA provides the greatest number of True +ve (Mean=98.9%; Range=97.7%-100%), followed by 'other' (Mean=78.7%; Range=58.6%-88.6%) and 0.200 in each eye (Mean=77.4%; Range=48.7%-91.4%). This however, is complicated by other factors; the professional administering the test can be seen to affect the overall means (%) of True +ve scores. Orthoptists (Mean True +ve=89.3%) accounted for all professionals who adhered to 0.200 in each eye & other orthoptic assessment and 60% of the sites that utilised 'Other' test; possibly providing insight into why these pass criterion elicited a higher True +ve score. The VS is suggested as being a factor in the outcome of pass criteria effect on True +ve scores. When accounting for the type of pass criteria used, there are varying True+ve scores between professionals. This indicates that the training provided has an impact on the competency of utilising each pass criteria. For example, VS trained by an Orthoptist using the BIOS package will be trained specifically using BIOS recommendations of 0.200 in each eye. Perhaps consequently, this could explain why True+ve scores for this pass criteria (Mean=87.4%) outscore that of 'Other' (Mean=74.8%) and when compared to VS trained by an Orthoptist using a Local package, the scores for 0.200 in each only decrease (Mean=70.6%), as does 'Other' (Mean=58.6%). This provides an 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 2016-2017 (50 sites) has decreased slightly from the previous academic year 2015-2016 (52 sites). The mean coverage has increased from 89% in the academic year 2015-2016 to 93% in the current data submitted for the audit of academic year 2016-2017.

On analysis of True +ve, available data sets decreased from twenty-one in 2015-2016 to sixteen in 2016-2017. The reported True +ve means compared using Method 1 have not shown any real changes. With an increase in response and accuracy of completed data submissions, the upcoming BIOS Audit for academic year 2017-2018 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. Professional administering the test appears to have an effect on True +ve scores possibly related to training. The possible effects of training received have been highlighted in this report, with standardised orthoptic training being essential to produce satisfactory outcomes. 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. There is also a need for individuals to have consistent definitions, methods of data collection and data submission. This is likely to bring consistency, for example, in recording True+ve. Without this, it is not possible to definitively conclude whether training of the vision screener does influence True +ve or not, however the data does suggest that the training received/professional administering the test affects the number of True +ve.

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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 / subnormal vision

4 = Occlusion only, no glasses 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 with normal VA

7 = Ophthalmic pathology with reduced VA

8 = Discharged as no defect

9 = 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

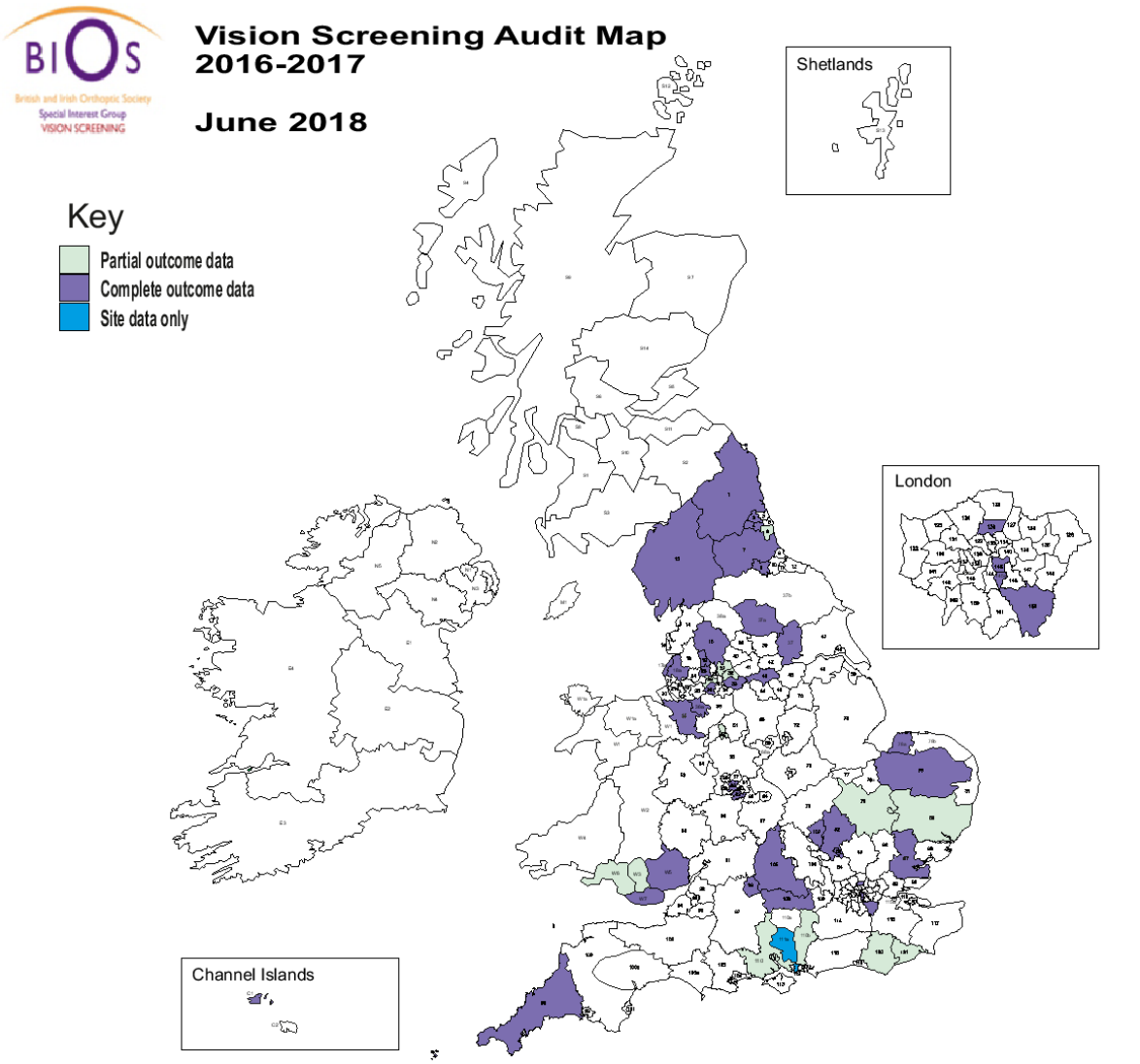
6 = no confirmed abnormality but review as poor cooperation, or borderline results

7 = ophthalmic pathology only

8 = Ophthalmic pathology with refractive error &/or strabismus

9 = other

Appendix 2



Wales

W1	Betsi Cadwalader University Health Board
W1a	Betsi Cadwalader University West
W2	Powys Teaching Health Board
W3	Cwm Taf Health Board
W4	Hywel Dda Health Board
W5	Aneurin Bevan Health Board
W6	Abertawe Bro Morgannwg University Health Board
W7	Cardiff and Vale University Health Board

Scotland

S1	NHS Ayrshire and Arran
S2	NHS Borders
S3	NHS Dumfries and Galloway
S4	NHS Western Isles
S5	NHS Fife
S6	NHS Forth Valley
S7	NHS Grampian
S8	NHS Greater Glasgow and Clyde
S9	NHS Highland
S10	NHS Lanarkshire
S11	NHS Lothian
S12	NHS Orkney
S13	NHS Shetland
S14	NHS Tayside

Northern Ireland

N1	Belfast Trust
N2	Northern Trust
N3	South Eastern Health and Social Care Trust
N4	Southern Trust
N5	Western Trust

Eire

E1	HSE Dublin North East
E2	HSE Dublin Mid Leinster
E3	HSE South
E4	HSE West

England

1	Northumberland Care Trust
2	Newcastle
3	North Tyneside
4	Gateshead
5	South Tyneside
6	Sunderland
7	County Durham
8	Hartlepool
9	Darlington
10	Stockton on Tees
11	Middlesbrough
12	Redcar and Cleveland
13	Cumbria
14	North Lancashire
15	Blackpool
16	East Lancashire
17	Sefton South
17a	Sefton North
18	Central Lancashire
18a	West Lancashire
19	Blackburn & Darwen
20	Wirral
21	Liverpool
22	Knowsley
23	Halton & St Helens
24	Ashton, Leigh & Wigan
25	Bolton
26	Bury
27	Rochdale Haywood & Middleton
28	Warrington
29	Salford
30	Trafford
31	Manchester
32	Oldham
33	Tameside & Glossop
34	Stockport
35	West Cheshire
36	East Cheshire
36a	Mid Cheshire
37	York & Selby
37a	Harrogate & Rural CCG
37b	North Allerton
38	Bradford & Airedale
38a	Craven
39	Leeds
40	Calderdale
41	Kirklees
42	Wakefield
43	Barnsley
44	Sheffield
45	Rotherham
46	Doncaster
47	East Riding of Yorkshire
48	Hull
49	North Lincolnshire
50	North East Lincolnshire
51	North Staffordshire
52	Stoke-on-Trent
53	Shropshire
54	Telford & Wrekin
55	South Staffordshire
56	Wolverhampton
57	Walsall
58	Dudley
59	Sandwell and West Birmingham
60	Birmingham Central and Cross City
61	Birmingham East and North
62	South Birmingham
63	Solihull
64	Coventry & North Warwickshire
65	Herefordshire
66	Worcestershire
67	Warwickshire (South)
68	North Derbyshire County
68a	South Derbyshire County
69	Derby City
70	Bassetlaw
71	Nottingham City
72	Nottinghamshire County
73	Lincolnshire County
74	Leicester City
75	Leicestershire County & Rutland
76	Northamptonshire
77	Peterborough
78	Norfolk (South, East, West)
78a	Norfolk (North-West)
78b	Norfolk (North-East)
79	Cambridgeshire
79a	Cambridgeshire Fenland
80	Suffolk
81	Great Yarmouth & Waveney
82	Bedfordshire
83	Luton
84	West Hertfordshire
85	East and West Hertfordshire
86	West Essex
87	Mid Essex
88	North East Essex
89	South West Essex
90	South East Essex
91	Gloucestershire
92	South Gloucestershire
93	Bristol
94	North Somerset
95	Bath and North East Somerset
96	Swindon
97	Wiltshire
98	Cornwall and Isles of Scilly
99	Plymouth
100	North Devon
101	Torbay and South Devon
101a	Exeter, East & Mid Devon
102	Somerset
103	Dorset
103a	West Dorset
104	Bournemouth & Poole
105	Oxfordshire
106	Buckinghamshire
107	Milton Keynes
108	Berkshire West
109	Berkshire East
110	New Forrest & Test Valley
110a	Basingstoke
110b	Hampshire (South)
111	Southampton City
111a	Winchester
112	Portsmouth City
113	Isle of Wight
114	Surrey
115	West Kent
115a	Gravesend
116	Medway
117	Eastern and Coastal Kent
118	West Sussex
119	Brighton and Hove City
120	East Sussex
121	Hastings and Rother
122	Hillingdon
123	Harrow
124	Barnet
125	Enfield
126	Haringey
127	Waltham Forest
128	Redbridge
129	Havering
130	Ealing
131	Brent
132	Camden
133	Islington
134	City and Hackney
135	Newham
136	Barking and Dagenham
137	Hammersmith and Fulham
138	Kensington and Chelsea
139	Westminster
140	Tower Hamlets
141	Hounslow
142	Richmond and Twickenham
143	Wandsworth
143a	Putney
144	Lambeth
145	Southwark North
145a	Southwark South
146	Lewisham
147	Greenwich
148	Bexley
149	Kingston
150	Sutton and Merton
151	Croydon
152	Bromley

Channel Islands

C1	Guernsey
C2	Jersey

Isle of Man

M1	Isle of Man

Appendix 3

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 2015-2016	Academic Year 2016-2017
KPI 1	89.0%	93.0%
KPI 2	12.0%	13.0%
KPI 3	77.0%	71.4%
KPI 4	76% (Method 1) 58% (Method 2) 68% (Method 3)	81% (Method 1) 61% (Method 2) 67% (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 2015-2016	Academic Year 2016-2017
AD 1	165,283	175,407
AD 2	147,488 (89%)	162,868 (93%)
AD 3	58 months	60 months
AD 4	5.7 weeks	7.7 weeks
AD 5	56%	35%
AD 6	7%	13%
AD 7	10%	11%