



**THE DEVELOPMENT OF A NEEDS BASED  
RESOURCE ALLOCATION FORMULA FOR  
GENERAL OPHTHALMIC SERVICES IN SCOTLAND**

**Final Report to the Scottish Executive Health Department**

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## 1. Executive Summary

### Background

This report describes the results of research commissioned by the Scottish Executive Health Department (SEHD) into the development of a needs based formula for the allocation of General Ophthalmic Services (GOS) expenditure. This is one of three reports outlining the methods for allocating Family Health Services (FHS) expenditure in Scotland.

The Scottish Executive Health Department currently spends approximately £36m on General Ophthalmic Services (GOS) in Scotland. GOS, at present, comprise a number of elements carried out by either optometrists or Ophthalmic Medical Practitioners (OMPs). Ophthalmic services are in the most part private, with only those people in eligible groups able to benefit from GOS. In this report, we identify a new method for allocating this expenditure to NHS Boards based on the relative needs of different population groups. The aim is to ensure that resources are distributed equitably across Scotland reflecting the population's relative need for resources rather than reflecting the current pattern and location of eye care professionals.

### Legislative Environment

The legislative environment for ophthalmic services has changed substantially over the past ten to fifteen years, with a gradual widening of the definition of people entitled to free or subsidised NHS services. The Smoking, Health and Social Care (Scotland) Bill (2004) proposed that free eye examinations, including, where clinically necessary, testing of sight, will be available for all. This will have a substantial effect on the GOS programme and associated expenditure as everyone in Scotland will be eligible for a free eye examination. The legislation does not influence the eligibility criteria for GOS3 and GOS4.

### Data Sources

We used a number of data sources to compile this report, including:

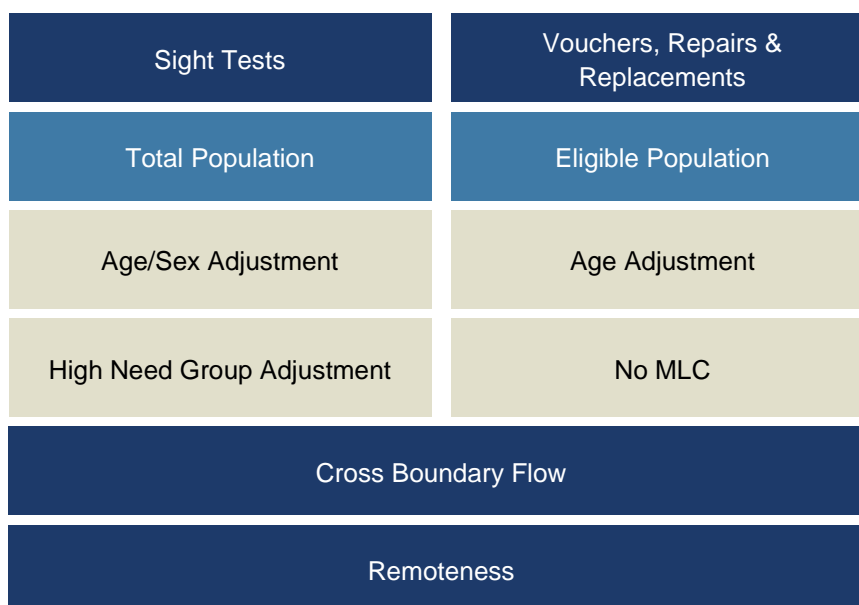
- population counts for each area in Scotland based on the June 2003 Community Health Index (CHI) register;
- a list of all fees and treatment data undertaken within GOS from the OPTIX database;
- a link file enabling the matching of patient locations to NHS Board of treatment;
- benefits/credit data from various sources to estimate the size of the eligible population;
- epidemiological data to estimate the prevalence of diabetes and glaucoma; and
- information on current expenditure by NHS Board from the Scottish Cost book.

### Methodology

Where possible we adopted a similar conceptual approach for determining the need for GOS resources across Scotland to that outlined in *Fair Shares for All*. However, due to data constraints and the tightly defined eligibility criteria for NHS ophthalmic services we adapted

this approach as appropriate. Figure 1.1 illustrates the conceptual framework used to construct the formula.

**Figure 1.1 Formula Sub-Programme Approach**



We developed two sub-programmes, one addressing need for sight tests (GOS1&5) and the second the need for vouchers, repairs and replacements (GOS3&4).

*Eligible Population*

In order to estimate the size of the eligible population in Scotland we combined data from various sources to estimate the number of people in each age/benefit/credit category. Based on these data we estimated that 1.92m (38%) of the Scottish population are eligible for NHS support under GOS3 and GOS4.

*Age and Sex Adjustment*

The need for ophthalmic resources is strongly related to the age profile of the population, as sight generally deteriorates with age. Age is also strongly related to the prevalence of other eye conditions, most notably cataract and macular degeneration (which is the leading cause of sight loss). It is therefore reasonable to assume that a population with a high proportion of elderly will need more GOS resources than a population with a younger profile.

The pattern of resource use across age and sex reasonably reflects the expected profile of need by age and sex despite concerns that they would simply reflect eligibility. Given these findings, we used an age and sex cost curve derived from GOS1 data to reflect the relative need for resources by different age and sex groups in the sight test sub-programme. We applied an age adjustment to the voucher and repair sub-programme, reflecting the higher need of the elderly population who are eligible for NHS support. Therefore, an area with a

high proportion of elderly in the eligible population group would be expected to need relatively more resources than an area with a younger eligible population profile. We have no gender profile for the eligible population so we adjust for age only.

#### *High Need Adjustment*

Individuals with various clinical conditions require additional eye care resources because they have a high risk of developing more serious eye conditions. A number of these groups are already offered more frequent free sight tests. The two largest groups of individuals are diabetic patients and patients with glaucoma and their close relatives.

In order to adjust for these high need population groups we estimated the distribution of diabetes and glaucoma across Scotland:

- we used the PBS Diabetes Prevalence Phase 2 Model to estimate the prevalence of diabetes in Scotland. The model applies age, sex, socio-economic and ethnic group specific estimates of diabetes prevalence derived from epidemiological studies to determine the total prevalence of diagnosed and undiagnosed diabetes;
- we used predictive equations developed from epidemiological survey data sources to estimate the prevalence of glaucoma.

High need groups, as the name suggests, require additional ophthalmic resources because of the potential effect of their condition on the health of their eye. To reflect this additional need we applied a 'high need' weight to the glaucoma and diabetic patients based on current guidance. This guidance implies they need twice the level of resources of other population groups.

#### *Unavoidable Cost Adjustment*

An unavoidable cost adjustment was not applied to the GOS formula. There was no strong rationale to suggest that ophthalmic contractors in remote and rural areas face significant unavoidable costs of service provision. It also seemed reasonable to argue, given the nature of ophthalmic demand, that there is relatively less need for very accessible ophthalmic services in remote and rural areas compared to other FHS services.

#### *Cross Boundary Flow Adjustment*

We developed an explicit adjustment for the effect of cross boundary flow on an NHS Board's need for resources. This allows an NHS Board's need for resources to be based on the services provided in the Board area regardless of the patient's Board of residence. In developing this adjustment we used data linking actual patient locations to the NHS Board they attend. These data illustrate a substantial degree of cross boundary flow.

This adjustment assumes that cross boundary flow represents a patient's preference for their optician's location. It could be argued that patients may need to travel to an optician because of the lack of a local service so this adjustment may reinforce current provision patterns. However, contractor locations are also more likely to be related to the size of the retail market as opticians generate a high proportion of income from non-NHS retail services.

## Results

The variation in population needs by NHS Board was illustrated by a series of graphs for each separate formula adjustment. In summary:

- the relative size of the eligible population was much higher in Boards with relatively deprived populations such as Greater Glasgow, Lanarkshire, Ayrshire and Arran and Argyll and Clyde;
- the size of the age and sex adjustment was relatively large in each sub-programme, reflecting the strong association between ophthalmic need and age;
- the size of the high need adjustment was relatively small because of the low prevalence of diabetes (4.3%) and glaucoma (2.7%). Overall the high need adjustment targets additional resources at Boards with more deprived, ethnic and elderly populations;
- the proportion of items flowing across Board boundaries is relatively high, with large net gains in Greater Glasgow and Tayside;
- the combined results illustrate a range of results, with the most deprived areas predicted to have the highest need for vouchers, repairs and replacements. This effect is exaggerated further in Greater Glasgow because of the large cross boundary flow. Within the sight test programme, NHS Boards with a more elderly population are predicted to have relatively high needs. The cross boundary flow adjustment has a large effect on the need characteristics of Greater Glasgow and Tayside.

## Financial Implications

The results illustrate that few NHS Boards are at parity when we compare the pattern of current expenditure to estimated need. The most notable gainers in percentage terms under the formula are Orkney (+67.9%), the Western Isles (+30.2%), Borders (+40.1%) and Highland (+29.1%). The gains in monetary terms are relatively low. However, there are two large net losers in Greater Glasgow (-21.2%) and Lanarkshire (-13.9%).

At a sub-programme level the results are slightly different, with less variation in actual and expected resource shares within the sight test sub-programme. Most of the variance relates to the voucher, repair and replacement sub-programme. In particular, it appears that Greater Glasgow has a very high number of claims under GOS3 and GOS4 compared to expectations. We understand that this is the first time such an exercise has been undertaken so the divergences in need and expenditure should not be entirely unexpected.

## Conclusions and Recommendations

A number of conclusions and recommendations were drawn from the analysis in relation to the inclusion or exclusion of certain adjustments. Areas for further research were highlighted and the need to update the formula was discussed.

## 2. Introduction

This report describes the results of research commissioned by the Scottish Executive Health Department (SEHD) into the development of a needs based formula for the allocation of General Ophthalmic Services (GOS) expenditure. This is one of three reports outlining the methods for allocating Family Health Services (FHS) expenditure in Scotland. The other two reports present similar research into the allocation of expenditure on primary and community dental services and pharmaceutical care services<sup>1 2</sup>.

The methods and results outlined in this report are presented on behalf of the FHS Advisory Group for discussion with interested partner organisations.

### 2.1. Background

The Scottish Executive Health Department currently spends approximately £36m on General Ophthalmic Services (GOS) in Scotland. GOS, at present, comprise a number of elements carried out by either optometrists or Ophthalmic Medical Practitioners (OMPs) including:

- the testing of sight of eligible people;
- informing GPs of the results of certain tests;
- the completion and issuing of prescriptions (a written order giving details of lenses intended to be made up into glasses or contact lenses); and
- the issuing of NHS optical vouchers to eligible people.

Ophthalmic services are, in the most part, private with only those in eligible groups able to benefit from GOS. For an optometrist or OMP to be able to provide GOS, they must be on the relevant NHS Board's ophthalmic list. The optometrists and OMPs that are on these lists are usually referred to as 'principals'. To join a list a principal has to satisfy rules on suitability, including registration with the General Optical Council and demonstrate they have suitable experience. To remain on a list the optometrist or OMP must undertake at least one NHS sight test every six months.

There are no restrictions as to where an optometrist or OMP can locate, and it is likely that the distribution of current expenditure on GOS will reflect the current distribution of eye care professionals in Scotland. The use of GOS is largely demand led and depends upon the degree to which eligible populations attend their optician for a sight test. Given the potential fluctuations in demand, the budget is currently non-cash limited.

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<sup>1</sup> The Development of a Needs Based Formula for Pharmaceutical Care Services in Scotland. Deloitte MCS Limited, 2005.

<sup>2</sup> The Development of a Needs Based Formula for Primary and Community Dental Services in Scotland. Deloitte MCS Limited, 2005.



The original *Fair Shares for All* (2000) review of resource allocation did not consider the development of a formula for allocating GOS and other FHS programmes because it was considered impractical within the original timescales:

*'there was consensus that these smaller elements... should be examined at a later date in the medium term future, once the methods for distributing larger budgets had been decided'. p5.*

In the absence of a formula specifically for allocating GOS expenditure, this budget is allocated to NHS Boards based on current expenditure.

In this report, we identify a new method for allocating this expenditure to NHS Boards based on the relative needs of different population groups. The aim is to ensure that resources are distributed equitably across Scotland reflecting the population's relative need for resources rather than reflecting the current pattern and location of eye care professionals. However, not all people are currently entitled to receive NHS services, or help with costs towards the provision of glasses/contact lenses. Therefore when we refer to equity of access to services for the population, it is important to distinguish between the eligible and whole population of the Board area.

## 2.2. Terms of Reference

The terms of reference for this research are to identify a method of allocating resources for ophthalmic services provided in the community which will ensure equity of access to services for the eligible population living in each Board area<sup>3</sup>.

The tender documentation highlighted a number of key issues for the research to address:

- the methods of estimating the relative need for ophthalmic services between the population living in different areas of Scotland;
- the influence of deprivation on the relative need for ophthalmic services;
- the effects of remote and rural areas (and other relevant supply-side factors) on the costs of providing ophthalmic services and the implications for equity of access;
- the implications of differences between Board areas in the age and sex structure of the population;
- the implications of cross boundary flow, i.e. patients resident in one Board area may use ophthalmic services in a different Board area; and
- the effects of ethnicity on the relative need for ophthalmic services.

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<sup>3</sup> based on the tender documentation issued in September 2002.

No constraints were placed on the methods proposed, however, it was stated that the research should explore alternative methods for assessing needs, including the scope for using analytical methods similar to those used in the *Fair Shares for All* report.

Ophthalmic services provided in hospital are funded separately and are not included in this research proposal.

### 2.3. Project Management Arrangements

An Advisory Group was established to review and advise on the research methods used. This Group consisted of members of the Analytical Services Division and Primary Care Division of the SEHD as well as representatives from the Information and Statistics Division (ISD) and an independent academic. In addition, the methods were presented to Optometry Scotland to ensure relevant parties were able to comment on the research as appropriate.

Full membership of the Advisory Group is outlined in Appendix 1.

### 2.4. Structure of Report

The report is structured into seven sections, set out as follows:

**Section 3 *Ophthalmic Services Market*:** this section outlines the characteristics of the ophthalmic market and provides an overview of its size and recent policy initiatives influencing this research;

**Section 4 *Data Sources*:** this section describes the main sources of data used for this research and describes the limitations and constraints placed on the research;

**Section 5 *Methodological Issues*:** this section discusses in more detail the methodological approach undertaken by the research and highlights some of the issues raised by the use of various data sources;

**Section 6 *Results*:** in this section we present the results of the needs assessment exercise;

**Section 7 *Financial Implications*:** this section discusses the financial implications of applying the new formula to current budgets; and

**Section 8 *Conclusions and Recommendations*:** this section provides an overview of the research, highlighting its strengths and weaknesses, and identifies areas for further work.

A series of appendices provide additional technical details and results. An Excel spreadsheet model has also been prepared for use in conjunction with this report. It presents details of the analysis and can be used for budget setting purposes.

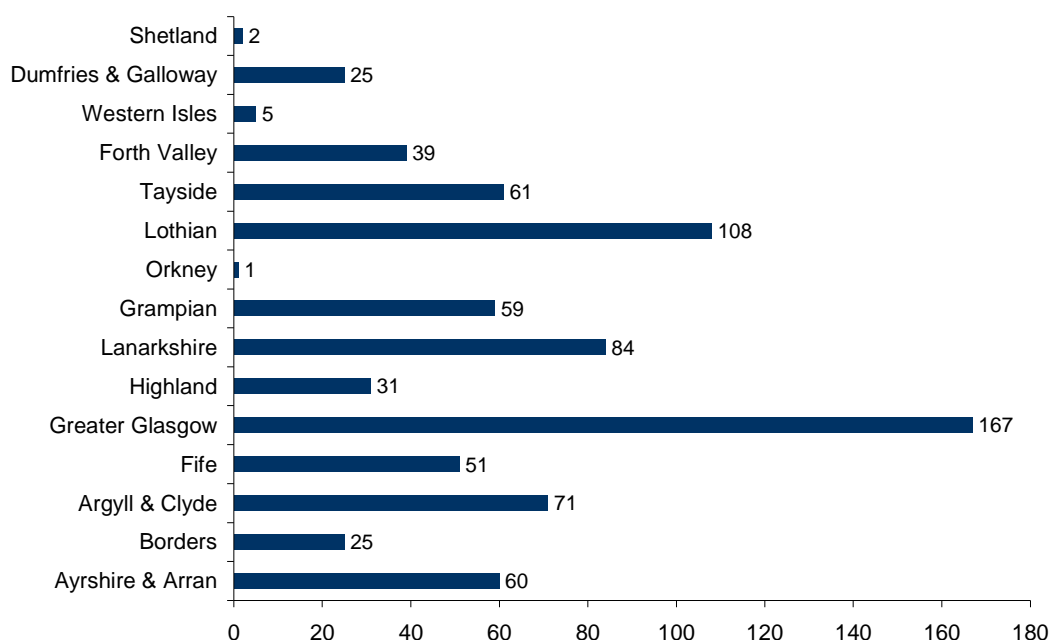
### 3. Ophthalmic Services Market

In this section we describe the characteristics of the ophthalmic services market in Scotland. Firstly, we outline the number and range of suppliers and current expenditure on the service. We then provide a brief synopsis of the policy environment, including reference to the legislation covering the eligibility for free NHS services.

#### 3.1. Supply Characteristics

Ophthalmic services are provided by a range of eye care professionals including optometrists (historically referred to as ophthalmic opticians), ophthalmic medical practitioners (OMPs) and dispensing opticians. Ophthalmic services are provided by high street opticians. Figure 3.1 illustrates the total number of GOS contractor premises in Scotland by NHS Board area.

**Figure 3.1 Number of GOS Contractor Premises by NHS Board (2003/04)**



Source: ISD Scotland

There were 791 GOS contractor premises registered with NHS Boards during 2003/04<sup>4</sup>. The vast majority of contractor premises are located within the central belt in Greater Glasgow, Lothian and Lanarkshire. Shetland and Orkney contain only three GOS contractor premises between them. Contractor premises numbers were based on fee claims during the 2003/04 financial year, therefore, contractors open part of the year due to openings or closures are included.

<sup>4</sup> defined as having a NHS fee greater than zero (note we could not match addresses to two list numbers)

### 3.2. Current Expenditure

Opticians are reimbursed for their services based on the submission of three main types of form for different service categories:

- GOS(S)1 and GOS(S)5 forms are used for sight tests and domiciliary visits. Domiciliary visits are for those who require a sight test but are unable to visit an optician due to illness or disability and are visited in their home by an optician<sup>5</sup>;
- GOS(S)3 forms are referred to as vouchers and are used to provide glasses or contact lenses;
- GOS(S)4 forms are used for repairs and replacements of glasses or contact lenses.

Table 3.1 illustrates the expenditure on each claim type during 2003/04. The majority of claims relate to sight tests which include just over 33,000 domiciliary visits. The highest proportion of expenditure relates to the cost of vouchers issued towards the cost of glasses/contact lenses (also see section 4.11).

**Table 3.1 General Ophthalmic Service Activity and Expenditure 2003/04**

Claim Form	Total Number of Items	Total Fees (£000s)
Sight Tests (GOS1/GOS5)	919,806	15,993
Vouchers (GOS3)	449,922	17,465
Repairs & Replacements (GOS4)	68,238	2,021
<b>Total</b>	<b>1,437,966</b>	<b>35,479</b>

Source: ISD Scotland

The fees for each element are set by the Scottish Executive Health Department each year, as below:

- the fee (on or after April 2005) for an NHS sight test was £18.39;
- the fee for a domiciliary visit was £32.38 for the first and second patient seen at one visit and £8.11 thereafter (NHS: HDL 2005 14);
- the value of optical vouchers for the supply, replacement and repair of lenses or frames varies depending upon the patient's prescription (NHS: HDL 2005 14).

<sup>5</sup> in the remainder of this report we combine GOS1 and GOS5 data as they both relate to sight tests.

### 3.3. Legislative Environment

The legislative environment for ophthalmic services has changed substantially over the past ten to fifteen years with a gradual widening of the definition of eligible people entitled to free or subsidised NHS services, for example:

- on 1st July 1986 the NHS spectacle voucher scheme came into effect. Entitlement to a voucher is, with the exception of children and those who require complex lenses, based on income;
- on 1st April 1989, the provision of free sight testing under the NHS was restricted to certain eligible groups of people including children, students, and low-income adults;
- further legislative changes in 1999 created further categories for the provision of free sight tests including 'Aged 60 and over' and 'At risk of glaucoma';
- in April 2003 a new 'Working Family Tax Credit' and 'Disabled Persons Tax Credit' were replaced by new tax credits. Those named on, or entitled to, a NHS Tax Credit Exemption Certificate are entitled to a free NHS sight test and voucher towards the cost of glasses or contact lenses;
- in October 2003 a new category of 'Pension Credit guarantee credit' was introduced.

The Smoking, Health and Social Care (Scotland) Bill (2004) proposed that free eye examinations, including where clinically necessary, testing of sight, will be available for all. This will have a substantial effect on the GOS programme and associated expenditure as everyone in Scotland will be eligible for a free eye examination. The legislation does not influence the eligibility criteria for GOS3 and GOS4. Further details on the current size and composition of eligible categories is provided in section 4.2.

## 4. Data Sources

In this section we outline the main data sources used in this research report. We describe each data source in turn, outlining the limitations of each data set and the implications for the analysis.

### 4.1. Population Data

The study used population counts based on 717 small areas (areas) constructed at a postcode sector level (Fair Shares for All, 2000). The populations are minimised by age, sex and council district to the 2003 Mid Year Estimates (General Register Office). The populations were provided by ISD Scotland and are currently used for allocating resources to NHS Boards.

Table 4.1 illustrates the total size of the Scottish population at June 2003 by age and gender.

**Table 4.1 CHI Population Data for Scotland (June 2003)**

Age Band	Male	Female	Total
0-4	134,878	128,947	263,825
5-14	314,292	299,560	613,852
15-24	329,353	318,391	647,744
25-44	698,299	741,916	1,440,216
45-64	622,205	650,455	1,272,660
65-74	204,449	247,813	452,262
75-84	108,235	172,659	280,894
85+	22,831	63,070	85,901
<b>Total</b>	<b>2,434,542</b>	<b>2,622,811</b>	<b>5,057,353</b>

*Source: ISD Scotland*

### 4.2. Fees and Activity Data

ISD Scotland provided information on the number of items and fees claimed by each ophthalmic contractor premise for the 2003/04 financial year. Each contractor premise has a registered principal and in some cases more than one principal can be in the same location. For each contractor premise we had information on the number of items claimed, the associated fees, GOS form type, eligibility category and the number of domiciliary visits.

Table 4.2 overleaf provides a number of summary statistics for the fee and item data for the 791 contractor premises which claimed an NHS fee during 2003/04.

**Table 4.2 Fee and Item Data Descriptive Statistics by List**

	Mean	Percentile			
		5th	25th	75th	95th
<b>Items</b>					
GOS1	1,213	4	445	1,565	3,382
GOS3	607	1	161	766	1,967
GOS4	147	0	14	180	581
<b>Total</b>	<b>1,967</b>	<b>13</b>	<b>683</b>	<b>2,532</b>	<b>5,848</b>
<b>Fees</b>					
GOS1	20,915	69	7,672	27,404	58,729
GOS3	23,102	55	5,993	29,148	75,523
GOS4	2,621	0	251	3,339	11,058
<b>Total</b>	<b>46,637</b>	<b>462</b>	<b>15,095</b>	<b>60,968</b>	<b>147,104</b>

Source: ISD Scotland, Deloitte

The average contractor claimed 1,967 items with associated fees of £46,637 during 2003/04. Some of the larger high street chains claimed in excess of three times this amount. Table 4.3 illustrates the number of claims made by each eligibility category.

**Table 4.3 Number of Claims by Exemption Category (2003/04)**

Exemption Category	Number of Claims		
	GOS1	GOS3	GOS4
Over 60 years old	376,738		
Under 16 years old	189,490	106,205	110,595
Income Support	97,069	187,722	3,159
Over 40 & relative with Glaucoma	84,407		
Diabetic	69,333		
Tax Credit	52,539	54,779	144
Full Time Student 16-18	30,477	21,716	431
Job Seekers Allowance	19,096	20,146	101
HC2 Certificate	15,943	39,587	192
Glaucoma	11,329		
Complex Lens	4,943	2,432	
Pension Credit	4,679	38,978	1,268
Registered Blind or Partially Sighted	2,354		
At risk of Glaucoma	1,191		
HC3 Certificate		8,367	18
<b>Total</b>	<b>959,588</b>	<b>479,932</b>	<b>115,908</b>

Source: ISD Scotland

Table 4.3 illustrates that a greater number of people are currently eligible for free sight tests (GOS1) than NHS vouchers or repairs (GOS3/4). The main difference in

eligibility is that over 60 year olds are not eligible for GOS3/4 claims. In the future all people in Scotland will be eligible for a free eye examination, whilst eligibility for NHS vouchers and repairs/replacements will apply only to children, full time students under 19, those who require complex lenses and those on low incomes or receiving benefits/credits.

### 4.3. Contractor Geography

We were able to identify the name and full address of 789 ophthalmic contractor premises (two premises were not identifiable although they claimed only 2 items). A full postcode for each contractor premise was also supplied by ISD Scotland. A number of the postcodes were either invalid or included errors. Using information from the GRO and from manual searching we were able to identify full and valid postcodes for each contractor premise. The availability of postcode data enabled us to match each contractor to a grid reference which identifies the postcode centroid to the nearest metre (small and large user postcode lookup file supplied by ISD Scotland). However, we could match only 758 contractor premises to a Scottish postcode mainly due to some opticians having an English postcode (Luton and Swindon). These contractor premises were assigned a Board but we could not match the location to a Scottish Census Output Area.

### 4.4. CHI Matching to OPTIX

ISD Scotland matched an extract of the 2003/04 OPTIX dataset to the CHI register to enable the linking of patient postcodes to the NHS Board in which the GOS contractor was registered. These data would enable us to investigate the extent of cross boundary flow within the GOS. Table 4.4 illustrates the proportion of observations that were matched.

**Table 4.4 Proportion of Matched Observations**

Variable	Number	Percentage
Total claims available for matching	2,102,758	
Total claims matched to CHI register & patient postcodes	1,848,989	87.9%
Total claims matched to a NHS Board	882,087	41.9%
Total claims matched to an area	877,225	41.7%

*Source: ISD Scotland*

The matching process was reasonably successful. ISD Scotland was able to link 88% of all OPTIX claims to the CHI register and subsequently assign a patient postcode. We were able to successfully link each claim to a contractor, however, these contractors related to a payment location rather than a geographic location of premises. We therefore linked each claim to the NHS Board of treatment, which enabled us to match 42% of claims from a patient postcode to the Board of treatment. Although a substantial number of claims remained unmatched, we were still left with a very large database of just under 880,000 observations.



#### 4.5. Rurality and Remoteness

Two main measures of remoteness or rurality were used in this study:

- population density statistics from the 2001 Census available at a Census Output Area (OA); and
- the Scottish Executive Urban Rural Classification (SEURC) which classifies each Census OA based on the size and type of settlement.

The remoteness characteristics for each contractor were assigned based on the output area of the contractor postcode. This measures remoteness based on contractor location and not necessarily the characteristics of the contractor's 'catchment' population. However, the remoteness characteristics of a contractor location provide a reasonable proxy, especially once aggregated to a Board level. Table 4.5 classifies each dispensing contractor into one of six urban rural categories based on the SEURC of the contractor's output area.

**Table 4.5 Urban Rural Classification of Optician Contractor Locations**

Type	Total	Percentage
Large Urban Areas	343	43.4%
Other Urban Areas	262	33.1%
Accessible Small Towns	80	10.1%
Remote Small Towns	38	4.8%
Accessible Rural	14	1.8%
Remote Rural	21	2.7%
Unassigned	33	4.2%
<b>Total</b>	<b>791</b>	<b>100.0%</b>

Source: Deloitte

Table 4.4 illustrates that the vast majority of contractors are located in urban areas (76.5%).

#### 4.6. Age and Gender Profiles

The OPTIX system includes data on the age and gender of each claimant. This makes it possible to link items and fees to age and gender bands to examine the effect of age on the use of ophthalmic resources.

#### 4.7. Benefits and Credit Data

We obtained data from a number of sources on various benefits/credits to establish the number of individuals eligible for NHS vouchers or repairs/replacements, including:

- the number of applicants and partners claiming tax credits and issued with an NHS Tax Credit Exemption Certificate by age band and postcode sector in Scotland for the 2003/04 financial year (Prescription Pricing Authority, NHS exemptions database);
- the number of Job Seeker Allowance claimants by postcode sector (717 areas) and age band at August 2004 (Department for Work and Pensions Information Directorate);
- the number of Income Support claimants by postcode sector (717 areas) and age band at August 2004 (Department for Work and Pensions Information Directorate);
- the number of Pension Credit claimants by postcode sector (717 areas) and age band at August 2004 (Department for Work and Pensions Information Directorate);
- the number of HC2 and HC3 claimants by age band and postcode sector in Scotland for the 2004/05 financial year (Prescription Pricing Authority, CRS database). These are means tested certificates primarily for low earners not eligible for other benefits/credits.

These data were provided under the Freedom of Information Act. To ensure data confidentiality figures were either rounded to the nearest five or not stated. We specified seven age bands (0-15, 16-24, 25-44, 45-64, 65-74, 75-84, 85+) and did not include a gender split because at a small area level the numbers in each cell would have been too small, raising confidentiality issues.

Benefit/credit categories are not necessarily mutually exclusive, for example, an individual can claim a tax credit whilst on income support. The Department of Work and Pensions provided information on multiple benefit/credit claims based on a sample of 5% of claimants on either job seekers allowance, income support or the pension credit across the UK and separately for Scotland (November 2004). The sample was then matched to tax credit information from the Inland Revenue to provide an estimate of those claiming tax credits in addition to other benefits.

#### **4.8. Census Data**

We used data from the 2001 Census to estimate:

- the number of full time students aged between 16 and 18 in Scotland by Output Area (Table KS13); and
- the size of ethnic population groups by NHS Board (Table S201). The Table outlined the number of people in each of five ethnic groupings (White, Indian, Pakistani and other South Asian, Chinese and Other<sup>6</sup>) by age and sex.

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<sup>6</sup> we assume the Other category includes data on the Black population

#### 4.9. Prevalence Data

We used a number of data sources to estimate the prevalence of two high need conditions:

- we used the Public Health Observatory-Brent-ScHARR (PBS) Diabetes Prevalence Model Phase 2 to estimate the prevalence of diabetes in Scotland ([www.yhpho.org.uk](http://www.yhpho.org.uk)); and
- we used a number of publications from the clinical literature to estimate the prevalence of glaucoma.

#### 4.10. Current Expenditure Statistics

We used data from ISD Scotland to provide information on current expenditure at an NHS Board level (2003/04). Current expenditure data was provided by GOS form type. Table 4.6 illustrates total expenditure on General Ophthalmic Services by NHS Board.

**Table 4.6 Current Expenditure by NHS Board (2003/04)**

NHS Board	Expenditure (£000s)				Per Capita (£)
	GOS1/5	GOS3	GOS4	Total	
Ayr & Arran Health Board	1,240	1,392	178	2,810	7.65
Borders Health Board	255	201	19	474	4.88
Argyll & Clyde Health Board	1,287	1,518	178	2,982	7.10
Fife Health Board	1,108	1,045	115	2,267	6.18
Greater Glasgow Health Board	3,216	4,599	605	8,420	10.01
Highland Health Board	630	501	46	1,177	5.70
Lanarkshire Health Board	1,759	2,421	312	4,492	7.76
Grampian Health Board	1,497	1,157	102	2,756	5.22
Orkney Health Board	42	28	6	77	3.99
Lothian Health Board	2,235	2,067	186	4,488	5.68
Tayside Health Board	1,285	1,132	100	2,517	6.74
Forth Valley Health Board	776	862	122	1,760	6.37
Western Isles Health Board	62	70	4	137	5.25
Dumfries & Gally Health Board	536	411	40	987	6.83
Shetland Health Board	66	62	8	135	6.17
<b>Scotland</b>	<b>15,993</b>	<b>17,465</b>	<b>2,021</b>	<b>35,479</b>	<b>7.02</b>

Source: ISD Scotland

Domiciliary visits accounted for just £590,000 of GOS1/5 expenditure.

## 5. Methodological Issues

In this section we discuss and describe the key methods and issues associated with the construction of a needs based formula for allocating GOS expenditure. We provide a conceptual overview of the approach taken and then describe in turn each adjustment in the formula to reflect a population's need for resources. A number of issues and options for developing the formula are identified and described.

### 5.1. Conceptual Framework

Using the principles outlined in *Fair Shares for All* the majority of NHS expenditure in Scotland is now allocated using a series of weighted capitation formulae which allocate resources to Boards based on four factors:

- the population share of the Board;
- the age and sex characteristics of the population;
- the morbidity and life circumstances (MLC) of the population; and
- an adjustment for remoteness to reflect the additional cost of providing services in remote areas.

Where possible we have attempted to adopt a similar conceptual approach for determining the need for GOS resources across Scotland. However, due to data constraints and the tightly defined eligibility criteria for NHS ophthalmic services we intend to use a different approach to the construction of a weighted capitation formula.

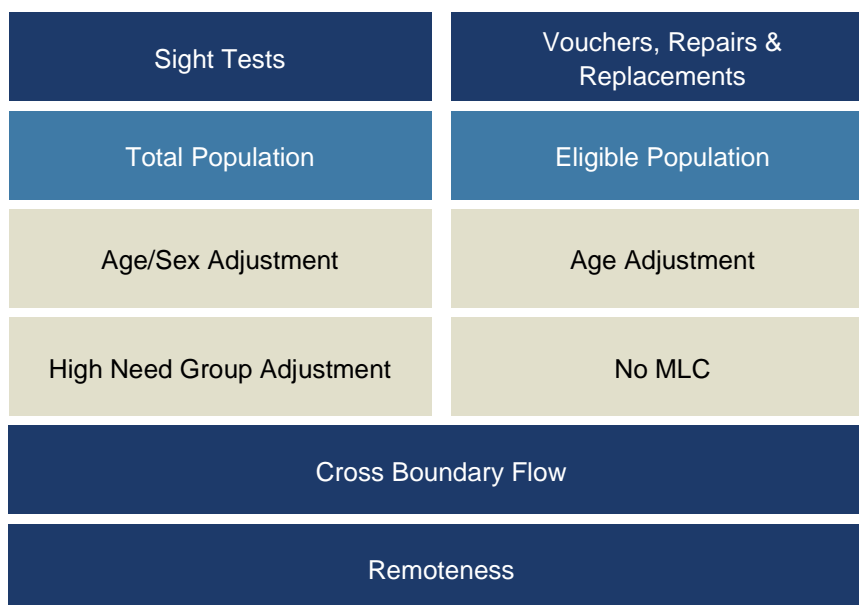
Figure 5.1 overleaf illustrates our overall conceptual approach to developing the GOS formula, including:

- the development of two sub-programmes, one addressing need for sight tests (GOS1&5) and the second the need for vouchers, repairs and replacements (GOS3&4);
- the use of total population shares in the sight test sub-programme, and eligible population shares in the vouchers and repairs/replacement sub-programme. Whilst meeting criteria for eligibility does not equate to need for ophthalmic services (i.e. non-exempt adults will still need glasses) it will reflect need for NHS resources;
- the identification of the effect of age and sex on the need for resources;
- within the sight test sub-programme we will take into account high need groups such as each Board's share of the population with glaucoma and diabetes;
- we will not develop a specific morbidity and life circumstances adjustment for either sub-programme. The voucher and repair/replacement sub-

programme already targets resources at socially deprived communities because eligibility is related to low income and benefit/credit status. We understand that those in more socially deprived areas would not need more frequent sight tests, and therefore we do not apply an MLC adjustment to the sight test sub-programme (personal communication: Optometry Scotland). There is no literature specifically examining this issue to our knowledge<sup>7</sup>, however, there is some evidence that serious eye disease and visual impairment is more prevalent in people living in relatively underprivileged areas (Reidy et al 1998);

- we investigated whether there is a case for adjusting the formula to take into account the unavoidable cost of provision in remote areas. The current reimbursement structure does not include any such adjustment;
- we developed an adjustment to account for the cross boundary flow of individuals from one Board to another.

**Figure 5.1 General Ophthalmic Services Formula Framework**



Source: Deloitte

In the following sections we describe our proposed method for empirically measuring these factors.

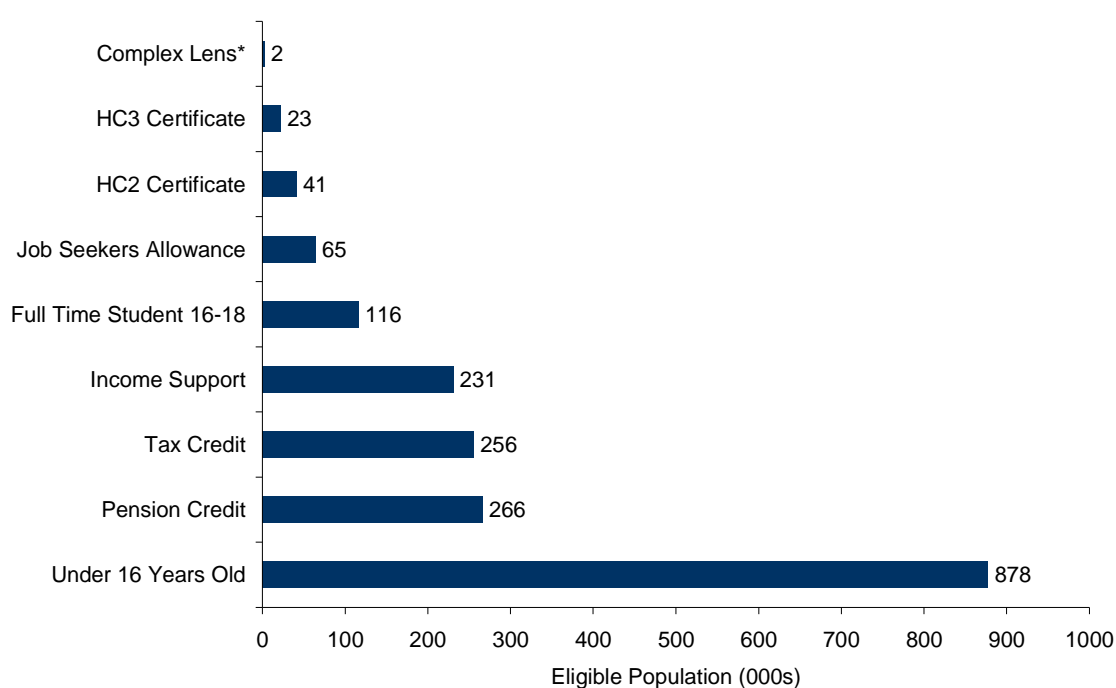
<sup>7</sup> As discussed in our initial inception report.

## 5.2. Eligible Population Size

The provision and availability of NHS vouchers, repairs and replacements (GOS3/4) has been heavily shaped by recent changes in legislation which have gradually increased the coverage and size of the eligible population. As illustrated in Table 4.3, eligibility is determined by a series of factors including age and various means tested benefits/credits. A Board's need for resources will therefore depend upon the size of the eligible population (although it is likely that take-up rates will continue to drive actual expenditure).

In order to estimate the size of the eligible population in Scotland and to estimate the number of people in each category we combined data from various sources. Figure 5.2 illustrates the total number of people in Scotland within each eligibility category for GOS3 and GOS4.

**Figure 5.2 Total Number of People by GOS3&4 Exemption Category**



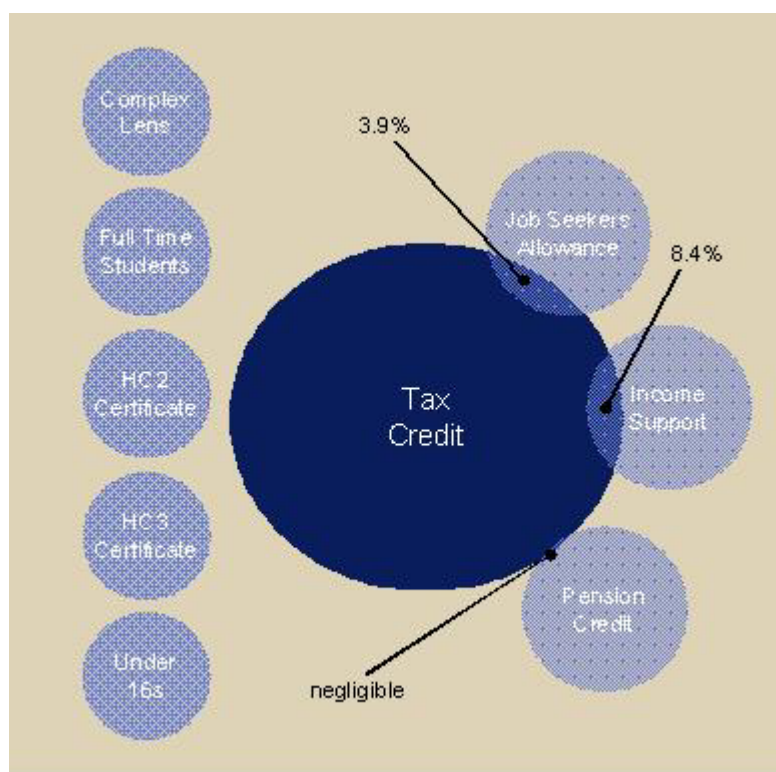
Sources: 2001 Census, DWP Aug 2004, PPA 2003/4, \*current GOS3 claims

Figure 5.2 illustrates that children under 16 account for the highest proportion of the eligible population, with only a small percentage of the population accounting for HC2 or HC3 certificates and complex lenses. However, simply summing the total number of people in each category will overstate the number of people eligible for NHS vouchers, repairs and replacements because each category is not necessarily mutually exclusive. We have assumed in estimating the size of the eligible population that:

- claimants of Job Seekers Allowance, Income Support and the Pension Credit are mutually exclusive, however claimants of these benefits are also able to claim Tax Credits (personal communication, DWP). We therefore reduced each claimant count by the extent of this overlap based on data provided by the DWP;
- we have assumed that claimants of HC2 and HC3 are not on other forms of benefit, as these means tested certificates are primarily for low earners not eligible under other categories;
- full time students aged between 16 and 18 years old are separately identifiable to the under 16 year olds;
- we assume that individuals with a complex lens prescription are also a mutually exclusive category and we estimate its size based on current claims (the numbers are very small).

Figure 5.3 illustrates the assumed relationship between each eligible population group.

**Figure 5.3 Assumed Relationship between Eligible Population Groups**



Sources: DWP, Deloitte

It illustrates that most eligible population groups are mutually exclusive, although there is a small overlap between Job Seekers Allowance (3.9%) and Income Support

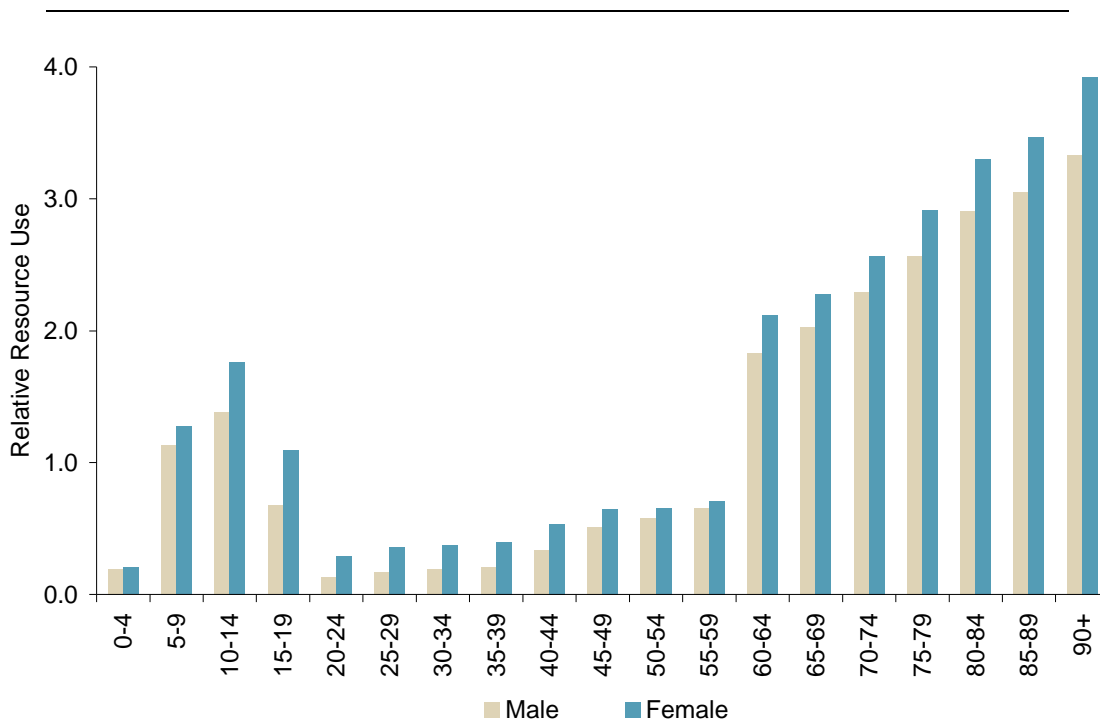
(8.4%) and the Tax Credit. Based on these data we estimate that 1.92m (38%) of the Scottish population are eligible for NHS support under GOS3 and GOS4.

### 5.3. Age and Sex Adjustment

The need for ophthalmic resources is strongly related to the age profile of the population as sight generally deteriorates with age. Age is also strongly related to the prevalence of other eye conditions, most notably cataract and macular degeneration (which is the leading cause of sight loss). It is therefore reasonable to assume that a population with a high proportion of elderly will need more GOS resources than a population with a younger profile. This can be illustrated by examining data on the current claimants of GOS.

Figure 5.4 illustrates the relative use of GOS1 resources by age and sex, where relative resource use is calculated as the average fee per capita in each age band, divided by the average fee across all age bands (a relative weight of 1.0 equates to the Scottish average).

**Figure 5.4 GOS1 Relative Per Capita Fees by Age and Sex**



Sources: OPTIX ISDSScotland

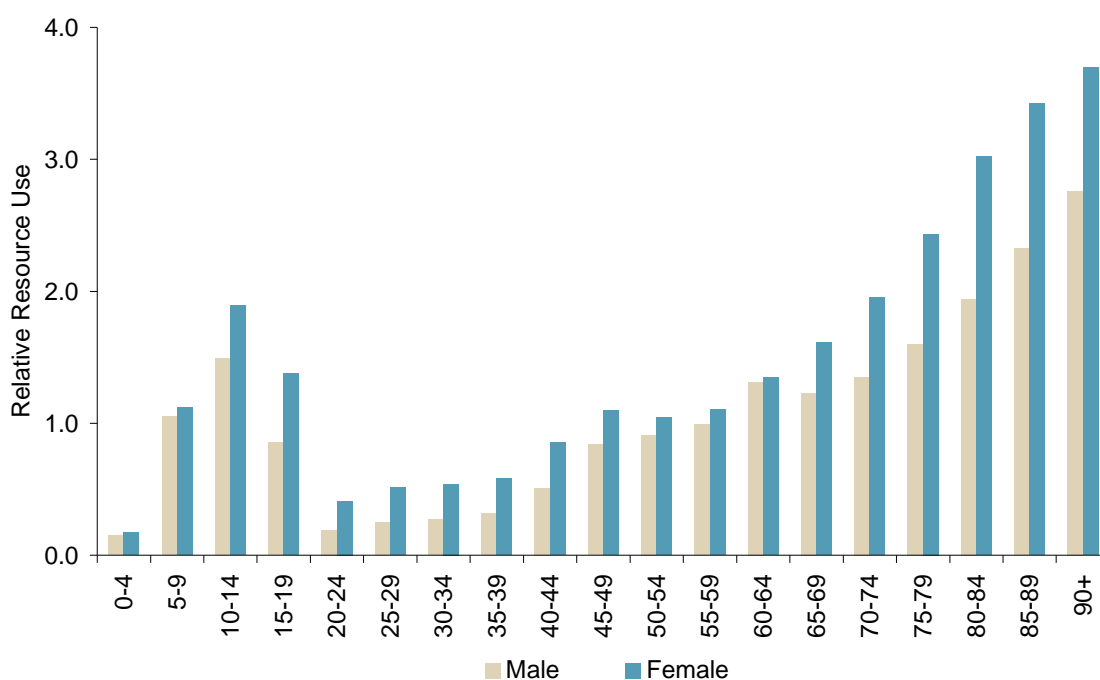
Figure 5.4 illustrates a stepped pattern of resource use across age (i.e. the value of claims per capita), with a peak in the teenage population (who need eye tests frequently, as prescriptions change during adolescence) and the elderly population (who have a high need due to the general deterioration of sight with age). Females are more likely to claim for a free sight test than males.



This pattern is heavily influenced by eligibility for GOS1, for example, there is a large jump in GOS1 claims in the over 60s who are exempt from paying sight test fees. Despite this one off jump, the use of GOS1 resources continues to increase in more elderly populations, with those over 80 years old using nearly four times the Scottish average level of resources. Some of this dramatic increase in resource use is likely to be due to the higher level of domiciliary visits in the very elderly (domiciliary visits also attract a slightly higher fee than a standard sight test). Domiciliary fees per capita are 20 to 30 times higher in those over 80 years old than the Scottish average (see Figure A1 in Appendix 3).

Figure 5.5 illustrates a similar pattern of resource use in GOS3 claims.

**Figure 5.5 GOS3 Relative Per Capita Fees by Age and Sex**



Sources: OPTIX ISDSScotland

The pattern of resource use across age within GOS3 is very similar to GOS1, with those in teenage and older age groups using a relatively higher proportion of resources. The elderly are not eligible for GOS3, however, they still use substantially more resources illustrating the strong association between the need for glasses and age. We understand that there is a very stable relationship between sight test volumes and subsequent voucher claims (personal communication, Optometry Scotland).

The use of GOS4 resources (repairs and replacements) exhibits a very different pattern across age, with children, and in particular boys, between 5 to 14 years old requiring repairs. Figure A2 in Appendix 3 illustrates the distribution of GOS4 claims by age and sex.

The patterns of resource use across age and sex reasonably reflect the expected profile of need by age and sex despite concerns that they would simply reflect eligibility (personal communication: Optometry Scotland). The only slight area of concern was the relative under-use of resources in the very young. The strong association between age and ophthalmic need was also reflected in a memorandum of understanding between the SEHD and a number of professional groups in relation to the frequency of NHS sight tests. This memorandum sets out minimum intervals between sight tests and recommends more frequent sight tests in the elderly and young as set out in Table 5.1.

**Table 5.1 Minimum Interval between Sight Tests**

Patient Group	Interval
Under 7 years of age, with binocular vision anomaly or corrected refractive error	6 months
7 years of age and over and under year of age with binocular vision anomaly or rapidly progressing myopia	6 months
Under 16 year of age unless in one of the categories above	1 year
16 years of age and over and under 70 years of age	2 years
70 years of age and over	1 year
Those with glaucoma	1 year
Those 40 years of age and over with a close family history of glaucoma	1 year
Those with ocular hypertension	1 year
Diabetic patients	1 year

*Source: Memorandum of Understanding between SEHD and Association of Optometrists, Federation of Ophthalmic and Dispensing Opticians and the Scottish Committee of Optometrists on Frequency of NHS Sight Tests*

Given these findings, we intend to use the GOS1 age and sex cost curve to reflect the relative need for resources by different age and sex groups in the sight test sub-programme. We also intend to apply an age adjustment to the voucher and repair sub-programme, reflecting the higher need of the elderly population who are eligible for NHS support. Therefore, an area with a high proportion of elderly in the eligible population group would be expected to need relatively more resources than an area with a younger eligible population profile. We have no gender profile for the eligible population so we adjust for age only (the cost curve is illustrated in Appendix 4).

**5.4. High Need Groups**

Individuals with various clinical conditions require additional eye care resources because they have a high risk of developing more serious eye conditions. A number of these groups are already offered more frequent free sight tests. The two largest groups of individuals are:

- diabetic patients; and

- patients with glaucoma and their close relatives.

In order to adjust for these high need population groups we estimated the distribution of diabetes and glaucoma across Scotland.

#### 5.4.1. Prevalence of Diabetes

There are various approaches available for estimating the prevalence of diabetes in Scotland, including the use of population registers. However, registers only include diagnosed diabetics, whereas various studies illustrate a high degree of undiagnosed diabetes (Harris et al 1998).

We therefore used the PBS Diabetes Prevalence Phase 2 Model to estimate the prevalence of diabetes in Scotland. The model applies age, sex, socio-economic and ethnic group specific estimates of diabetes prevalence derived from epidemiological studies to determine the total prevalence of diagnosed and undiagnosed diabetes. We used the ‘user defined population’ function to estimate the prevalence of diabetes at an NHS Board level in Scotland. This involved inputting data on each Board’s age, sex and ethnic profile. The Phase 2 model also incorporated a socio-economic adjustment based on the proportion of the population in deprivation quintiles (which we defined using the Scottish Index of Multiple Deprivation).

Table 5.2 illustrates the estimated prevalence of diabetes by NHS Board in Scotland using the PBS model.

**Table 5.2 Diabetes Prevalence by Board**

NHS Board	Number of Cases	Prevalence	Share of Cases	Index <sup>1</sup>
Ayrshire & Arran	17,460	4.76%	8.08%	1.113
Borders	3,874	3.99%	1.79%	0.934
Argyll & Clyde	19,250	4.59%	8.91%	1.073
Fife	15,122	4.12%	7.00%	0.965
Greater Glasgow	39,968	4.75%	18.49%	1.112
Highland	8,713	4.22%	4.03%	0.988
Lanarkshire	25,763	4.45%	11.92%	1.042
Grampian	18,914	3.58%	8.75%	0.838
Orkney	714	3.70%	0.33%	0.865
Lothian	29,467	3.73%	13.64%	0.873
Tayside	16,713	4.48%	7.73%	1.047
Forth Valley	11,513	4.17%	5.33%	0.975
Western Isles	1,319	5.05%	0.61%	1.183
Dumfries & Galloway	6,594	4.56%	3.05%	1.067
Shetland	722	3.30%	0.33%	0.773
	216,105	4.27%	100.00%	1.000

Source: PBS Model Phase 2, <sup>1</sup> share of cases/population share

Table 5.2 illustrates that the Western Isles has the highest expected prevalence of diabetes in Scotland, followed by Greater Glasgow and Ayrshire and Arran. The prevalence rates are largely determined by the age distribution of the population, ethnic mix and socio-economic characteristics of the population.

The model is based on diabetes prevalence in England and, given Scotland's slightly worse health and socio-economic profile, it probably slightly underestimates prevalence rates. However, in relative terms the differences between NHS Boards are likely to be reasonably consistent.

#### 5.4.2. Prevalence of Glaucoma

We identified two potential methodologies for estimating the prevalence of glaucoma in Scotland:

- the use of GOS1 data on the number of individuals claiming a free sight test within the glaucoma category;
- the use of predictive equations developed from epidemiological survey data sources. We identified two studies which developed methods of predicting glaucoma prevalence in large populations both of which used regression models to estimate prevalence rates from a wide range of survey data (Tuck-Crick, 1998, Quigley-Vitale, 1997). The predicted equations apply to the over 65 population with primary open angle glaucoma<sup>8</sup>.

Our preferred approach was the use of epidemiological based estimates because of concerns regarding the accuracy of utilisation data which could be affected by variations in access to ophthalmic services or differences in the categorisation of eligible groups.

The equations estimated prevalence rates based on an age adjustment only. The prevalence of glaucoma (particularly of closed angle glaucoma) is higher in some ethnic groups, including Asian and Chinese populations. However, we did not make any further adjustments to our approach because of the difficulty of integrating these data into published predictive equations and we considered that it would be unlikely to make any material difference at a Board level. The ethnic population in Scotland is small and the prevalence of glaucoma is relatively low.

Table 5.3 illustrates the estimated age specific prevalence rates of glaucoma across Scotland using the epidemiological based equations.

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<sup>8</sup> Primary Open Angle Glaucoma (POAG) is by far the most common type of glaucoma in Europe.

**Table 5.3 Glaucoma Prevalence in Scotland**

Age Band	Scottish Population	Tuck-Crick Equation		Quigley-Vitale equation	
		Number	%	Number	%
65-69	242,007	3,656	1.5%	5,039	2.1%
70-74	210,255	4,716	2.2%	6,031	2.9%
75-79	164,691	5,122	3.1%	6,297	3.8%
80-84	116,203	4,649	4.0%	5,751	4.9%
85-89	55,381	2,653	4.8%	3,458	6.2%
90+	30,520	1,649	5.4%	2,352	7.7%
<b>Total</b>	<b>819,057</b>	<b>22,446</b>	<b>2.7%</b>	<b>28,927</b>	<b>3.5%</b>

Source: Tuck-Crick 1998, Quigley Vitale 1997

As illustrated above there are estimated to be between 22,000 and 29,000 people in Scotland with glaucoma. A comparative study of both estimation approaches in London by Minassian et al (2000) found that the Tuck-Crick predictive equation performed well, and therefore we used these estimates in our analysis. Note that there were only 11,300 GOS1 claims by patients with glaucoma during 2003/04.

Close relatives of patients with glaucoma who are over 40 years old also have an elevated risk of developing glaucoma and are recommended to have more frequent sight tests. To take this population group into account we assumed that there are approximately 4 close relatives over 40 years old per glaucoma patient. This ratio is similar to the ratio of the current number of claims by relatives of glaucoma patients (84,400) to the total estimated prevalence of glaucoma in Scotland (22,000).

#### **5.4.3. Relative Resource Needs**

High need groups, as the name suggests, require additional ophthalmic resources because of the potential effect of their condition on the health of their eye. Current guidance states that these patient groups should have sight tests conducted once a year rather than the usual once every two years (see Table 5.1). This guidance implies that these high need groups need twice the level of sight test resources compared to other population groups.

To reflect this additional need we applied a 'high need' weight to the glaucoma and diabetic patients reflecting their higher than average resource need. This was applied in addition to the age and sex adjustment, the assumption being that there is a basic age effect for everyone and then an added effect of diabetes or glaucoma.

## 5.5. Unavoidable Cost Adjustment

Boards that provide services to populations living in remote and rural areas may face unavoidable costs because of the difficulties associated with the delivery of services on a relatively small scale to small and isolated communities. In this section, we discuss the case for adjusting the capitation formula for remoteness.

The average GOS contractor site is substantially smaller in remote and rural areas relative to urban areas in Scotland. The average number of NHS claims is approximately 50% lower in very rural areas compared to urban areas. In other areas of the health service, such as the provision of GP services or community pharmacy services we would expect that smaller contractor sites would incur additional costs because of the limited scope to spread fixed costs such as shop overheads given the volume constraints.

However, it is not clear whether the ophthalmic market faces similar unavoidable costs of provision in remote and rural areas for three main reasons:

- a high proportion of income comes from non-NHS sources such as the sale of glasses, contact lenses and other services and therefore contractors are less reliant on NHS activity<sup>9</sup>;
- small contractors may still be viable because they can restrict their opening hours (there are no contractual obligations relating to opening hours). An optician shop can be open without an optometrist or OMP on site and frequently optometrists or OMPs travel between more than one site;
- the characteristics of ophthalmic demand is very different compared to other health services. For example, demand for services is more predictable and ophthalmic attendance is relatively infrequent (between one and two years between appointments). Contrast this with the pattern of demand within a community pharmacy or GP practice, which can be unpredictable and thus requires full on-site staffing. Even if there is an urgent requirement to repair or replace glasses, these repairs do not need to be undertaken by an optometrist and replacements are usually manufactured off site in any case.

These factors indicate that there is no strong rationale to suggest that ophthalmic contractors in remote and rural areas face significant unavoidable costs of service provision. It also seems reasonable to argue, given the nature of ophthalmic demand, that there is relatively less need for very accessible ophthalmic services in remote and rural areas compared to other FHS services.

Whilst the additional cost of providing ophthalmic services in remote and rural areas is relatively low, additional costs are currently incurred by optometrists travelling to remote areas. The SEHD currently funds these excess travel and subsistence costs, which totalled £10,000 in 2004/05. Given the small sums involved we have not applied an unavoidable cost adjustment to the GOS programme.

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<sup>9</sup> this balance of provision may change with the introduction of free sight tests

## 5.6. Cross Boundary Flow

Opticians, unlike other hospital and community health services, do not currently have a defined or registered resident population. Patients are free to visit any contractor they choose, and Boards reimburse opticians based on the volume of activity regardless of where the patient is from. There are also no entry and exit regulations covering the establishment of an ophthalmic premises in Scotland. Contractors are private agents and following registration with the relevant authorities can provide NHS services at a location of their choice.

This freedom of movement makes it difficult to assess whether an area is relatively under- or over- provided with General Ophthalmic Services relative to need because patients may 'commute' across boundaries to visit an optician. For example, a contractor in a city centre shopping centre may dispense NHS prescriptions for glasses from all over the country. Whilst the immediate geographical area may seem over provided with ophthalmic services it actually provides a service to people from out with the area.

In order to develop an adjustment for the cross boundary flow of 'need' we calculated the net inflow and outflow of patients between Boards<sup>10</sup>. Table 5.4 illustrates the inflow and outflow of patients from each Board. The net change is presented in both actual numbers and in percentage terms.

**Table 5.4 Net Inflow and Outflow of Patients by NHS Board**

Board	Board Total	Outflow	Inflow	Net Change	% Change
Argyll & Clyde	77,761	11,874	5,735	-6,139	-7.89%
Ayr & Arran	69,018	4,463	2,611	-1,852	-2.68%
Borders	14,117	1,319	962	-357	-2.53%
Dumfries & Galloway	28,614	1,162	1,484	322	1.13%
Fife Health	66,025	7,934	2,461	-5,473	-8.29%
Forth Valley	44,689	4,630	4,906	276	0.62%
Grampian	85,592	4,728	2,519	-2,209	-2.58%
Greater Glasgow	158,196	8,695	25,129	16,434	10.39%
Highland	33,913	1,564	2,396	832	2.45%
Lanarkshire	103,598	14,765	6,959	-7,806	-7.53%
Lothian	119,594	7,207	8,345	1,138	0.95%
Orkney	2,534	174	76	-98	-3.87%
Shetland	3,529	446	95	-351	-9.95%
Tayside	65,814	2,806	8,658	5,852	8.89%
Western Isles	4,231	702	133	-569	-13.45%
<b>Total</b>	<b>877,225</b>	<b>72,469</b>	<b>72,469</b>	<b>0</b>	

Source: Deloitte

<sup>10</sup> these data were only available at an area to NHS Board level so we could not investigate the geographical dispersion of claimants at individual GOS contractor sites

Table 9.2 illustrates that the proportion of patients flowing across Board boundaries is relatively high<sup>11</sup>. The main points to note are the large net inflow of patients into Greater Glasgow (10.4%) and Tayside (8.9%), and the large net outflow of patients in Fife (-8.3%), Lanarkshire (-7.5%), Argyll and Clyde (-7.9%) and the Islands.

We have therefore adjusted for cross boundary flow taking into account patient flows from areas to GOS contractors in other NHS Boards. The adjustment takes into account the net effect of the outflow of patients who visit contractors in a different Board and the inflow of patients from other Boards. This fourth adjustment to the GOS formula sums across resource shares taking into account location of patients' treatment rather than location of contractor. For example, if in area X, 5% of claimants are in Board A and 95% in Board B, we allocate 5% of the areas estimated need to Board A and 95% to Board B.

This adjustment assumes that cross boundary flow represents a patient's preference for their optician's location. However, it could be argued that patients may need to travel to an optician because of the lack of a local service so this adjustment may reinforce current provision patterns. Opticians' locations are also heavily influenced by the size of the retail market because a high proportion of income is generated from non-NHS sources.

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<sup>11</sup> these figures should be treated with some caution because only 42% of OPTIX records could be included in the analysis (see section 4.4)



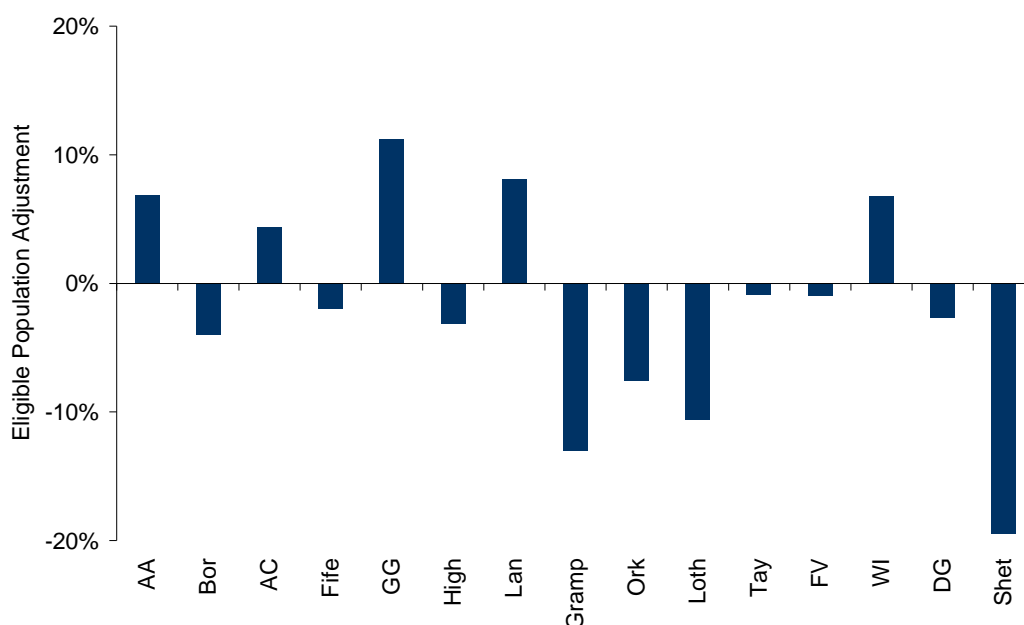
## 6. Results

In this section we present the results of the preceding analysis and illustrate the need characteristics of each Board’s population. We illustrate the impact of each adjustment in turn, and then combine all of the adjustments.

### 6.1. Eligible Population

We estimated that 1.92m (38%) of the Scottish population are eligible for NHS support under GOS3 and GOS4. Figure 6.1 illustrates the relative size of the eligible population by NHS Board. The adjustments are presented as an index with zero representing the Scottish average and values above zero indicating greater need and vice versa.

**Figure 6.1 Relative Size of the Eligible Population (GOS3/4)**



Source: Deloitte

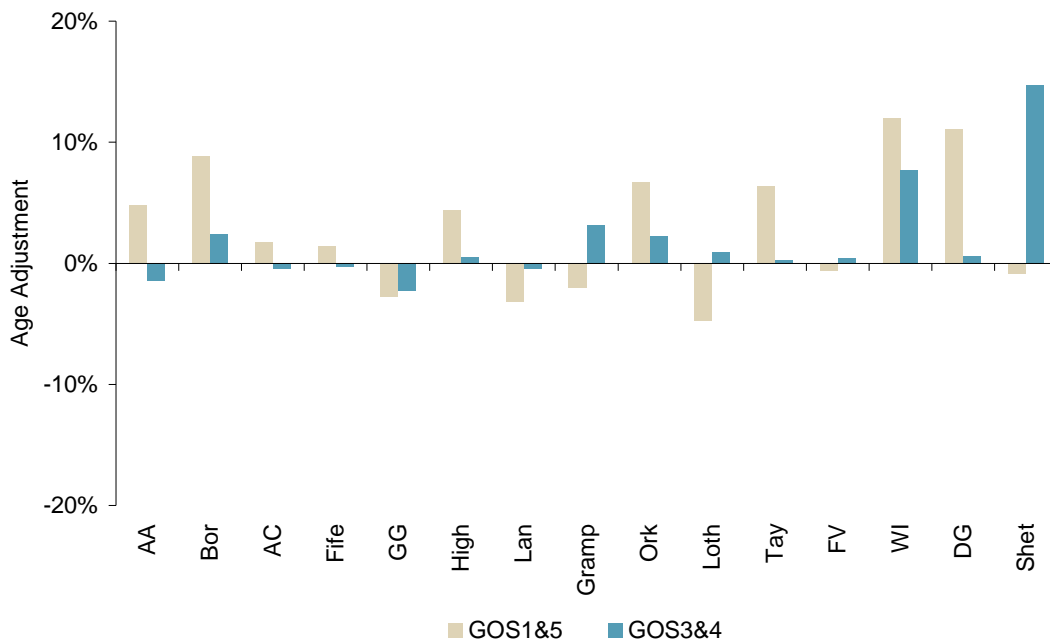
These data illustrate the size of the eligible population relative to the Board’s total population. It indicates that Boards with relatively deprived populations such as Greater Glasgow, Lanarkshire, Ayrshire and Arran, and Argyll and Clyde are all estimated to have an above average share of people eligible for NHS support under GOS3 and GOS4.

### 6.2. Age and Sex Adjustment

Board populations differ in their age and sex characteristics and this has an effect on their relative need for ophthalmic services. To address this we developed a weighting to allow for age and sex differences within the sight test sub-programme (GOS1/5)

and age differences in the voucher, repairs and replacement sub-programmes (GOS3/4). Figure 6.2 illustrates the effect of these weightings on the relative need for resources in each Board.

**Figure 6.2 Relative Need for Resources: Age/Sex Adjustment**



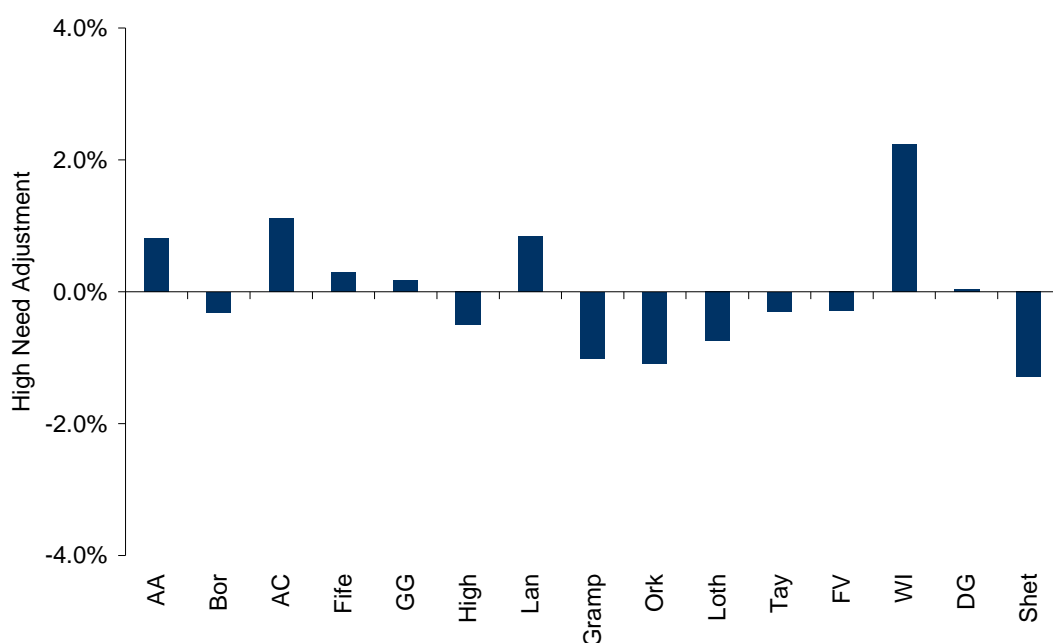
Source: Deloitte

The adjustments highlight that NHS Boards with relatively elderly populations require additional resources whilst Boards with young populations such as Greater Glasgow, Lanarkshire and Lothian have lower resource requirements. The size of the adjustment is slightly larger in the sight test sub-programme.

**6.3. High Need Adjustment**

Within the sight test sub-programme we developed a separate adjustment to reflect the relative size of high need populations such as diabetics and those with glaucoma. Based on normative guidance these population groups should have a sight test twice as frequently as the rest of the population. Figure 6.3 overleaf illustrates the relative size of these high need populations by NHS Board.

The size of this adjustment is relatively small because of the relatively low prevalence of diabetes (4.3%) and glaucoma (2.7%). Overall the high need adjustment targets additional resources at Boards with more deprived and ethnic populations (a higher prevalence of diabetes) and also Boards with an elderly population (a higher prevalence of glaucoma). The Western Isles has the highest estimated prevalence of high need groups because it has an elderly and relatively deprived population.

**Figure 6.3 Relative Need for GOS1/5 Resources: High Need Adjustment**

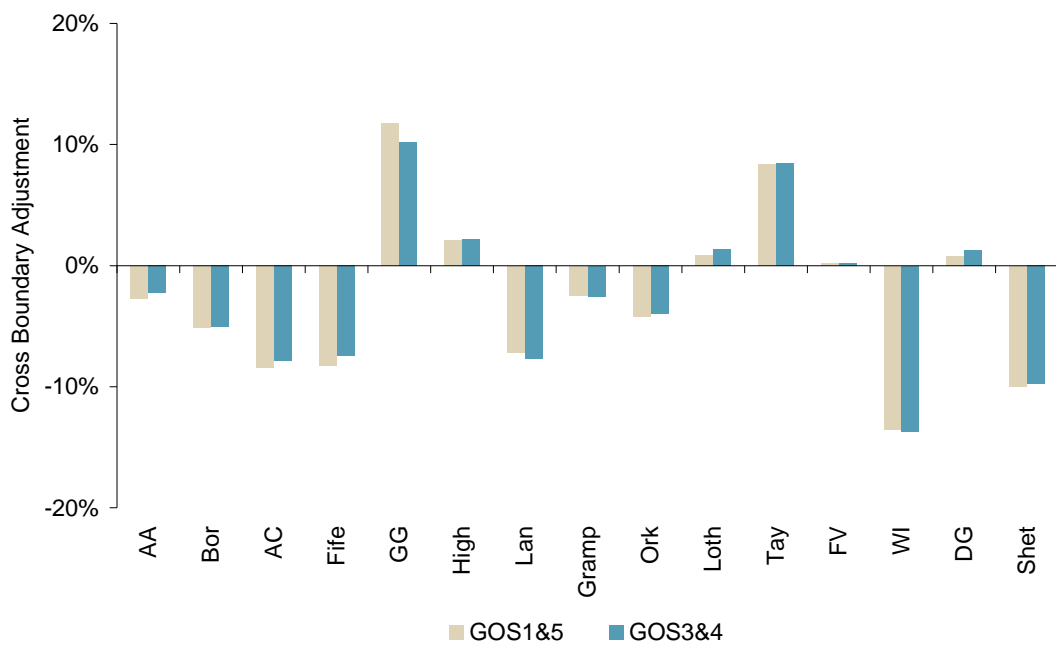
Source: Deloitte

#### 6.4. Cross Boundary Flow Adjustment

In order to account for the cross boundary flow of 'need' we developed an adjustment based on the net inflow and outflow of patients from each Board. The rationale is that if a large number of residents of a Board choose to visit an optician in another Board then funding should follow the patient. Figure 6.4 overleaf illustrates the size of the cross boundary flow adjustment in each NHS Board based on the sample of OPTIX data.

The proportion of patients flowing across Board boundaries is relatively high and has a substantial impact on Board allocations. The main points to note are the large net inflow of patients into Tayside and Greater Glasgow.

**Figure 6.4 Relative Need for Resources: Cross Boundary Flow Adjustment**

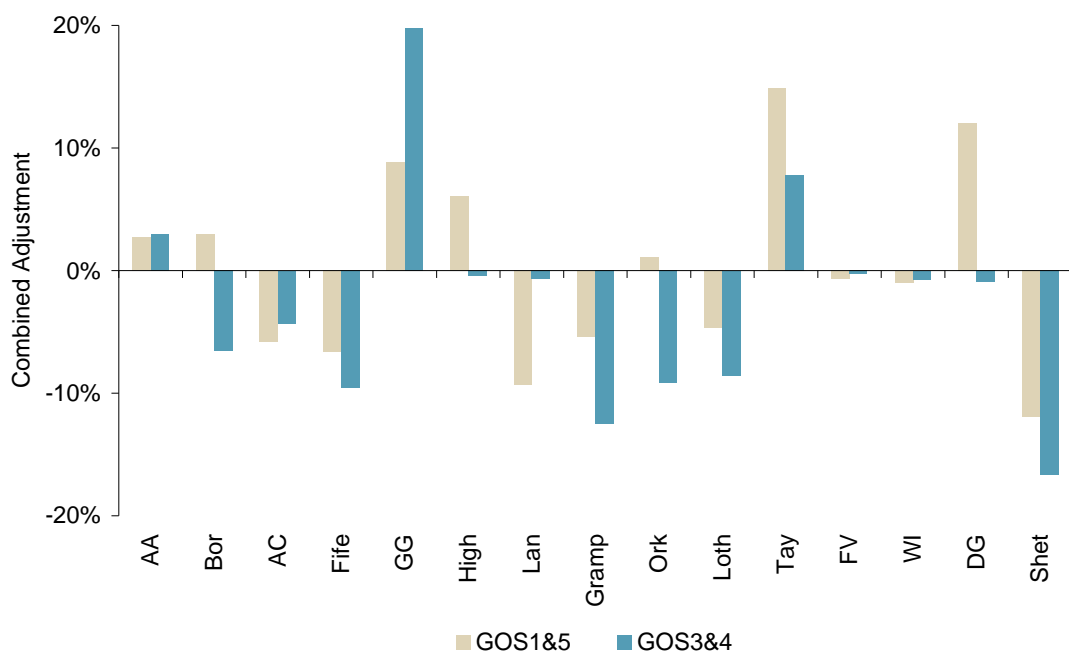


Source: Deloitte

**6.5. Combined Adjustments**

Figure 6.4 illustrates the combined effects of each of the four adjustments.

**Figure 6.4 Relative Need for GOS Resources: Combined Adjustments**



Source: Deloitte

The results illustrate a range of results, with the most deprived areas predicted to have the highest need for voucher, repairs and replacements. This effect is exaggerated further in Greater Glasgow because of the large cross boundary flow. Within the sight test programme NHS Boards with a more elderly population are predicted to have relatively high needs. Again, the cross boundary flow adjustment has a large effect on the need characteristics of Greater Glasgow and Tayside.

A breakdown of all of the adjustments by each sub-programme is presented in Appendix 5.

## 7. Financial Implications

In this section we present the results of the analysis, comparing the current share of the GOS budget with the estimated resource shares by NHS Board.

Table 7.1 illustrates the financial consequences applying the formula at an NHS Board level.

**Table 7.1 Financial Consequences (2003/04 Budget)**

Board	Expenditure (£000s)	Resource Share	Formula Share	Change in Share	Change (£000s)
Ayrshire & Arran	2,821	7.85%	7.47%	-4.9%	-138
Borders	481	1.34%	1.88%	40.1%	193
Argyll & Clyde	2,956	8.23%	7.89%	-4.1%	-122
Fife	2,275	6.33%	6.65%	5.1%	116
Greater Glasgow	8,711	24.24%	19.11%	-21.2%	-1,844
Highland	1,164	3.24%	4.18%	29.1%	338
Lanarkshire	4,555	12.68%	10.91%	-13.9%	-633
Grampian	2,758	7.68%	9.47%	23.4%	645
Orkney	78	0.22%	0.36%	67.9%	53
Lothian	4,558	12.69%	14.56%	14.8%	673
Tayside	2,551	7.10%	8.19%	15.4%	393
Forth Valley	1,754	4.88%	5.44%	11.4%	201
Western Isles	141	0.39%	0.51%	30.2%	43
Dumfries & Galloway	993	2.76%	3.00%	8.5%	85
Shetland	135	0.38%	0.37%	-1.8%	-2
<b>Total</b>	<b>35,931</b>	<b>100.00%</b>	<b>100.00%</b>	<b>0.0%</b>	<b>0</b>

Source: Deloitte

Table 7.1 illustrates that few NHS Boards are at parity when we compare the pattern of current expenditure to estimated need. The most notable gainers in percentage terms under the formula are Orkney (+67.9%), the Western Isles (+30.2%), Borders (+40.1%) and Highland (+29.1%). The gains in monetary terms are relatively low. However, there are two large net losers, Greater Glasgow (-21.2%) and Lanarkshire (-13.9%).

At a sub-programme level the results are slightly different, with less variation in actual and expected resource shares within the sight test sub-programme. Most of the variance relates to the voucher, repair and replacement sub-programme. In particular, it appears that Greater Glasgow has a very high number of claims under GOS3 and GOS4 compared to expectations (see Appendix 6).

We understand that this is the first time such an exercise has been undertaken so the divergences in need and expenditure should not be entirely unexpected.

## 8. Conclusions and Recommendations

The preceding analysis has outlined our approach to developing a needs based capitation formula for General Ophthalmic Services in Scotland. The approach reflects the framework adopted by the original *Fair Shares for All* report. In this section we highlight a number of areas which require further research and outline a series of recommendations.

### 8.1. Eligible Population Adjustment

We calculated the size of the population eligible for free NHS support under GOS3 and GOS4 using various data sources. We estimated that 1.92m (38%) of the Scottish population would be eligible for support. We recognise that take up rates will drive actual expenditure on vouchers, repairs and replacements at a Board level. **However, these data provide a useful benchmark to identify variations in claims relative to expectations.**

### 8.2. Age and Sex Adjustment

In order to reflect the association between the age profile of the population and the need for GOS resources we used data on the utilisation of services:

- we used data on the age and sex profile of GOS1/5 claimants from the OPTIX database to reflect the influence of age and sex on the need for sight tests. This adjustment gave a significantly higher weight to the more elderly population, reflecting their greater ophthalmic need;
- we used data on the age profile of GOS3/4 claimants from the OPTIX database to reflect the influence of age on the need for vouchers, repairs and replacements. This adjustment gave a higher weight to more elderly eligible population groups, reflecting their greater ophthalmic need. No gender profile for the eligible population was available.

**The relative pattern of resource use reasonably matched the expected age profile of need** despite initial concerns that the data would be too strongly influenced by eligibility criteria.

### 8.3. Morbidity and Life Circumstance Adjustment

We made no explicit adjustment to the GOS formula for the morbidity and life circumstances of each Board's population, although:

- the voucher and repair/replacement sub-programme already targets resources at socially deprived communities because eligibility, in a number of cases, is related to low income and benefit/credit status;
- in general social deprivation was not considered a key driver of sight test need, especially after the introduction of free eye examinations. However, it was considered in relation to the prevalence of diabetes (see 8.4 below).

Within the constraints of our research we did not identify any literature specifically addressing the need for sight tests and social deprivation. This issue could be revisited if further research evidence becomes available.

#### 8.4. High Need Adjustment

We estimated the prevalence of diabetes and glaucoma in the general population and adjusted the sight test sub-programme accordingly. The prevalence estimates were based on a number of factors:

- we used the PBS model for estimating the prevalence of diabetes. This model took into account four key factors when estimating prevalence: ethnicity, age, gender and social deprivation;
- we used the Tuck-Crick equation for estimating the prevalence of glaucoma. This equation took only age into account.

There are a number of limitations to these approaches, for example, the PBS model was developed specifically for England and the Tuck-Crick equation did not account for ethnicity. **Overall, we consider that both approaches provide a robust method for estimating the prevalence of high need groups. It is not clear how either approach could be improved upon without further extensive or original research.**

#### 8.5. Unavoidable Cost Adjustment

An unavoidable cost adjustment was not applied to the GOS formula. This was due to three main factors:

- the current reimbursement structure does not include any remoteness adjustment (with exception of some travel expenses);
- data are limited for empirically examining the influence of remoteness on the costs of provision; and
- demand for GOS is more predictable and less immediate/urgent and therefore small practices do not always require on site support from an optometrist or OMP. This improves the viability of smaller locations.

#### 8.6. Cross Boundary Flow Adjustment

We developed an explicit adjustment for the effect of cross boundary flow on an NHS Board's need for resources. This allows an NHS Board's need for resources to be based on the services provided in the Board area, regardless of the patient's Board of residence.

In developing this adjustment we used data linking actual patient locations to the NHS Board in which the GOS contractor is registered. These data illustrate a substantial degree of cross boundary flow. **We have presented the results with the cross boundary flow adjustment included. This may highlight the undersupply of GOS in an area rather than a patient's preference for location of treatment.**



**Contractor locations are also more likely to be related to the size of the retail market as opticians generate a high proportion of income from non-NHS retail services.**

## **8.7. Interpretation of the Results**

We presented the results of the analysis relative to the current GOS budget. The results illustrate that few NHS Boards are at parity when we compare the pattern of current expenditure to estimated need. The most notable gainers in percentage terms under the formula are Orkney (+67.9%), the Western Isles (+30.2%), Borders (+40.1%) and Highland (+29.1%). These gains in monetary terms are relatively low. However, there are two large net losers, including Greater Glasgow (-21.2%) and Lanarkshire (-13.9%).

**At a sub-programme level the results are slightly different, with less variation in actual and expected resource shares within the sight test sub-programme, most of the variance relates to the voucher, repair and replacement sub-programme.** In particular, it appears that Greater Glasgow has a very high number of claims under GOS3 and GOS4 compared to expectations.

We understand that this is the first time such an exercise has been undertaken so the divergences in need and expenditure should not be entirely unexpected.

## **8.8. Formula Update and Review**

We recommend that certain aspects of the formula are updated annually depending upon its application. Four elements in particular should be updated annually:

- the population data;
- the expenditure weights for each sub-programme;
- the age and sex resource use curves; and
- the cross-boundary flow adjustment, ensuring it is possible to match as many linked cases to a GOS contractor location as possible.

We would recommend that the methods used to calculate the high need adjustment are reviewed if more accurate or sophisticated approaches become available. We would also welcome a review of the formula by the newly established National Resource Allocation Committee (NRAC). This work has been conducted within the *Fair Shares for All* framework and may benefit from the more recent perspectives of NRAC.

## 9. Appendix 1 – Advisory Group Membership

[Hamish Wilson](#), Head of Primary Care Division, SEHD

[Chris Naldrett](#), Service Policy & Planning Manager , Primary Care Division, SEHD

[Eric Gray](#), Primary Care Division, SEHD

[Lynne Morrison](#), Primary Care Division, SEHD

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[Uzma Khan](#), Economic Adviser, Analytical Services Division, SEHD

[Joan Forrest](#), Information Services, NHS National Services Scotland

[Jim Waldron](#), Assistant Head of Healthcare Information Group, Information Services, NHS National Services Scotland

[Stephen Goold](#), Dental and Ophthalmic Information Manager, Information Services, NHS National Services Scotland

[Matt Sutton](#), Professor of Health Economics, Health Economics Research Unit, University of Aberdeen

[Peter Lock](#), Project Manager, Deloitte

[Stewart Robertson](#), Project Director, Deloitte

## 10. Appendix 2 – Bibliography

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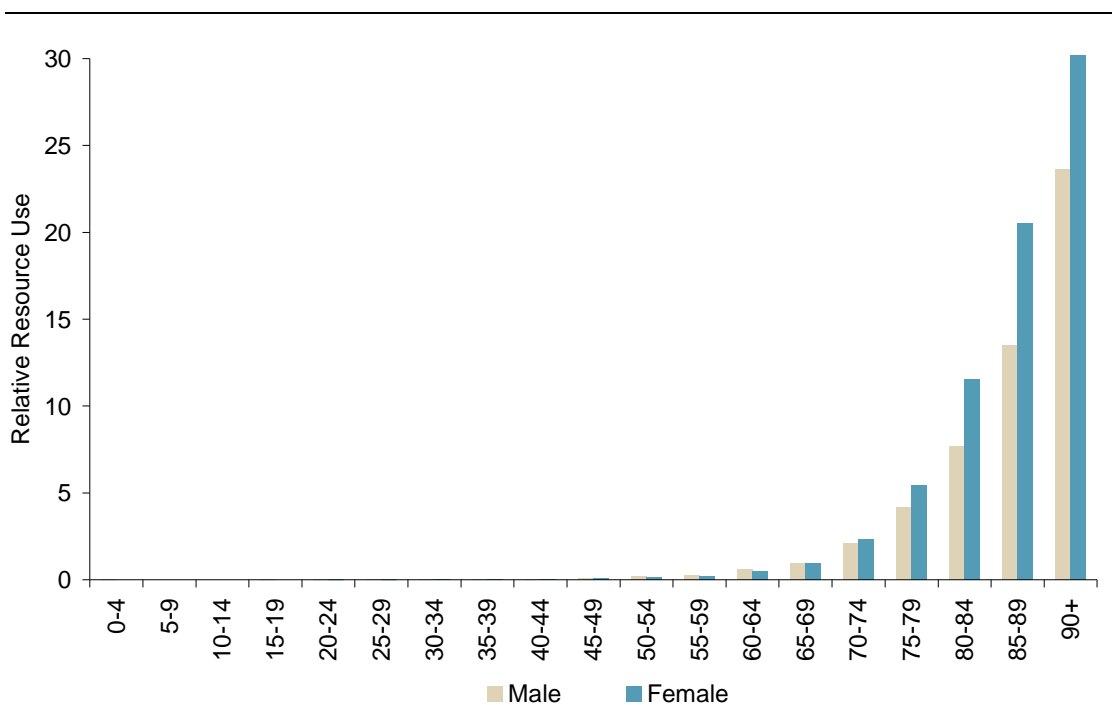
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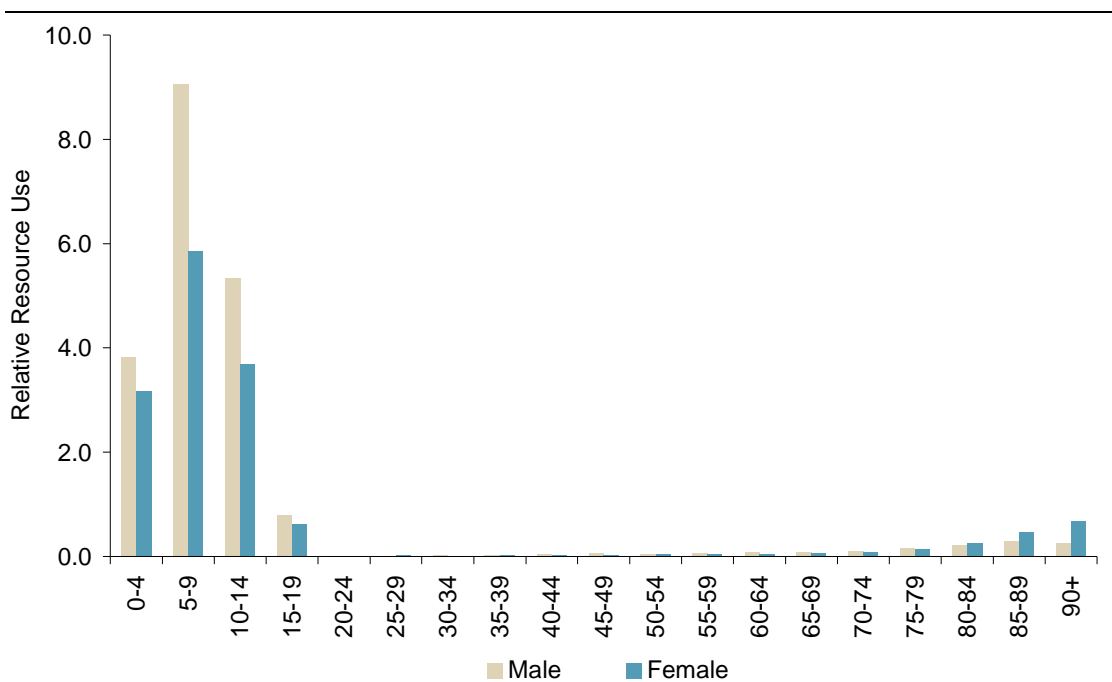
## 11. Appendix 3 – Age and Sex Relative Weights

Figure A3 Domiciliary Visit Relative Per Capita Fees by Age and Sex



Source: OPTIX, ISD Scotland

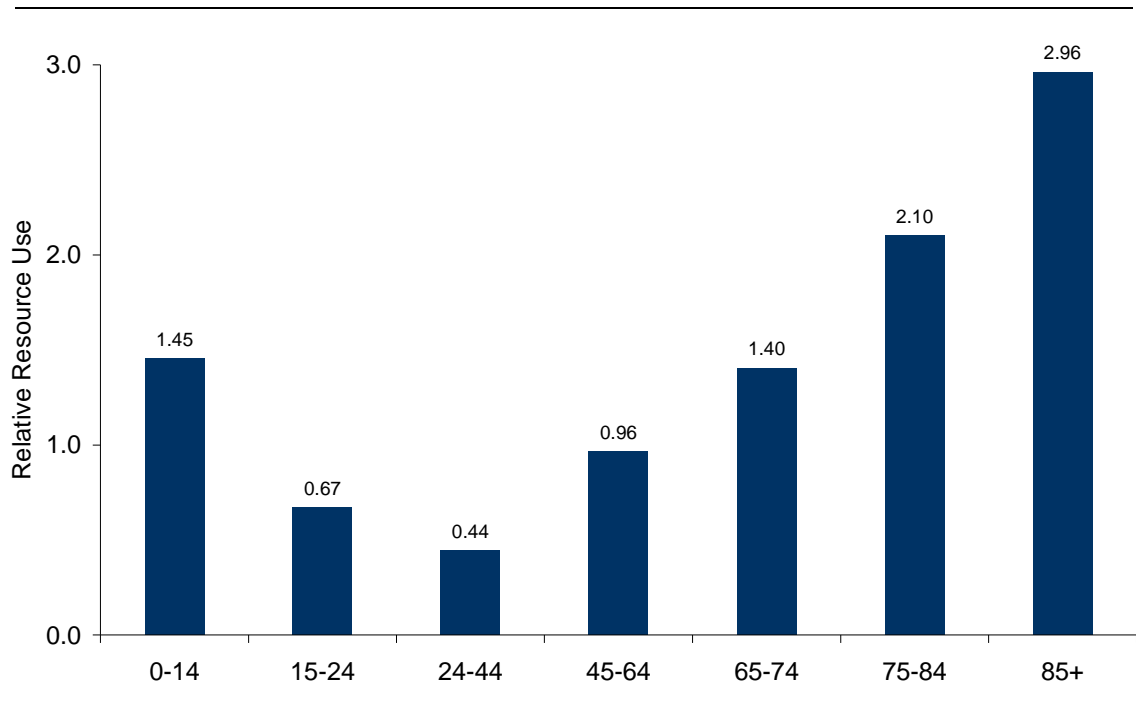
Figure A3 GOS4 Relative Per Capita Fees by Age and Sex



Source: OPTIX, ISD Scotland

## 12. Appendix 4 – Voucher and Repair/Replacement Age Adjustment

Figure A4 GOS3&4 Relative Per Capita Fees by Age Group



Source: OPTIX, ISD Scotland

### 13. Appendix 5 – Resource Shares

**Table A5.1 Sub-Programme Formulae Indices**

Board	Population	Population Share	Age/Sex Index	Sight Test Sub-Programme			Voucher, Repair & Replacement Sub-Programme			
				High Need Index	Cross Boundary Index	Combined Index	Eligible Population	Age Index	Cross Boundary Index	Combined Index
Ayrshire & Arran	367,106	0.0726	1.048	1.008	0.973	1.028	1.069	0.985	0.978	1.030
Borders	97,090	0.0192	1.089	0.997	0.949	1.029	0.960	1.025	0.949	0.934
Argyll & Clyde	419,796	0.0830	1.018	1.011	0.915	0.942	1.044	0.995	0.921	0.957
Fife	366,854	0.0725	1.015	1.003	0.917	0.933	0.980	0.997	0.925	0.904
Greater Glasgow	841,329	0.1664	0.972	1.002	1.118	1.089	1.112	0.977	1.102	1.198
Highland	206,349	0.0408	1.044	0.995	1.021	1.061	0.969	1.006	1.022	0.995
Lanarkshire	578,565	0.1144	0.968	1.008	0.928	0.907	1.081	0.996	0.923	0.993
Grampian	528,355	0.1045	0.980	0.990	0.975	0.946	0.870	1.031	0.975	0.874
Orkney	19,310	0.0038	1.067	0.989	0.958	1.011	0.924	1.023	0.960	0.908
Lothian	790,244	0.1563	0.952	0.993	1.009	0.953	0.894	1.010	1.014	0.914
Tayside	373,402	0.0738	1.064	0.997	1.084	1.149	0.991	1.003	1.085	1.078
Forth Valley	276,417	0.0547	0.994	0.997	1.002	0.993	0.990	1.005	1.002	0.997
Western Isles	26,100	0.0052	1.120	1.022	0.865	0.990	1.068	1.077	0.863	0.993
Dumfries & Galloway	144,567	0.0286	1.111	1.000	1.008	1.120	0.973	1.006	1.012	0.991
Shetland	21,870	0.0043	0.991	0.987	0.900	0.881	0.805	1.147	0.902	0.833
<b>Total</b>	<b>5,057,353</b>	<b>1.0000</b>	<b>1.000</b>	<b>1.000</b>	<b>1.000</b>	<b>1.000</b>	<b>1.000</b>	<b>1.000</b>	<b>1.000</b>	<b>1.000</b>

Source: Deloitte

## 14. Appendix 6 – Sub-Programme Financial Results

Figure A6.1 Sight Test Sub-Programme Financial Consequences (2003/04)

Board	Expenditure (£000s)	Resource Share	Formula Share	Change in Share	Change (£000s)
Ayrshire & Arran	1,240	7.75%	7.46%	-3.8%	-47
Borders	255	1.59%	1.98%	24.0%	61
Argyll & Clyde	1,287	8.04%	7.82%	-2.8%	-36
Fife	1,108	6.93%	6.77%	-2.2%	-25
Greater Glasgow	3,216	20.11%	18.11%	-9.9%	-320
Highland	630	3.94%	4.33%	9.9%	62
Lanarkshire	1,759	11.00%	10.37%	-5.7%	-100
Grampian	1,497	9.36%	9.88%	5.6%	84
Orkney	42	0.26%	0.39%	45.8%	19
Lothian	2,235	13.98%	14.89%	6.6%	147
Tayside	1,285	8.03%	8.48%	5.6%	72
Forth Valley	776	4.85%	5.43%	11.8%	92
Western Isles	62	0.39%	0.51%	31.5%	20
Dumfries & Galloway	536	3.35%	3.20%	-4.4%	-23
Shetland	66	0.41%	0.38%	-7.9%	-5
<b>Total</b>	<b>15,993</b>	<b>100.00%</b>	<b>100.00%</b>	<b>0.0%</b>	<b>0</b>

Figure A6.2 Voucher/Repair/Replacement Financial Consequences (2003/04)

Board	Expenditure (£000s)	Resource Share	Formula Share	Change in Share	Change (£000s)
Ayrshire & Arran	1,570	8.06%	7.47%	-7.3%	-114
Borders	219	1.13%	1.79%	59.3%	130
Argyll & Clyde	1,696	8.70%	7.94%	-8.7%	-148
Fife	1,160	5.95%	6.56%	10.2%	118
Greater Glasgow	5,204	26.71%	19.93%	-25.4%	-1,321
Highland	547	2.81%	4.06%	44.7%	245
Lanarkshire	2,733	14.02%	11.36%	-19.0%	-519
Grampian	1,259	6.46%	9.14%	41.4%	521
Orkney	34	0.18%	0.35%	96.4%	33
Lothian	2,252	11.56%	14.29%	23.6%	532
Tayside	1,232	6.32%	7.96%	25.8%	318
Forth Valley	984	5.05%	5.45%	7.9%	78
Western Isles	75	0.38%	0.51%	33.9%	25
Dumfries & Galloway	452	2.32%	2.83%	22.2%	100
Shetland	69	0.36%	0.36%	1.3%	1
<b>Total</b>	<b>19,485</b>	<b>100.00%</b>	<b>100.00%</b>	<b>0.0%</b>	<b>0</b>

Source: Deloitte