1 Title: **Failing to plan and planning to fail. Can we predict the future growth of demand on UK Eye**
2 **Care Services?**

3 Running Title: **2015-35: failing to plan, planning to fail**

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29   The major ophthalmic diseases of public health concern in the UK are cataract, glaucoma, diabetic

30   retinopathy (DR) and age-related macular degeneration (AMD).[1]

31   Older age is a major risk factor for each of these conditions, and expansion of treatment options has

32   increased the resource allocation necessary per case. Hence with the number of UK residents aged

33   over 75 set to rise from 4.9 million (2010) to 8.9 million (2035), whilst the ratio of working age to

34   retirement age populations drops from 3.16 (2010) to 2.87 (2035),[2] there is a pressing national need

35   for proactive service provision planning to avoid a serious and progressive under-provision which

36   cannot be ethically dealt with by continued recruitment of medical staff from nations with greater

37   human resource problems than the UK.[3,4]

38   Planning expansion of services cannot occur without estimation of future demands. We attempted

39   epidemiological modelling, therefore, to quantify the proportional disease burden growth 2015-35

40   in so far as that growth is driven by prevalence. In doing so, however, the constraints were as

41   apparent as the possibilities.

42   **Epidemiological modelling – more caveat than confidence?**

43   Projections of UK population growth by Office for National Statistics (ONS) are stratified by age and

44   gender. However, with significant variation in disease prevalence between different ethnicities[5,6] and

45   major UK ethnographic changes expected,[7] modelling must incorporate ethnicity. 'ETHPOP'

46   population projections for 12 ethnic groups by age and gender, constrained to ONS projections to

47   2051, have been produced using a cohort-component model.[8,9] For example, ETHPOP predicts

48   Asian/British Asian population aged >80 to quadruple from ~60 000 in 2015 to 231 000 in 2035.

49   Difficulties then arise, starting with the absence of contemporary UK population-based survey data

50   to provide prevalence estimates. Increasingly historic survey data from geographically and

51   genetically disparate contexts was, of necessity, therefore utilised. Furthermore, modelling should

52   take into account age-specific incidence and the effects of becoming a "case" on life expectancy.

53   Lack of data to permit quantification of the current impact of diagnosis on life expectancy prevents

54   serious consideration of such an approach.

55   Other known risk factors such as smoking, hypertension, socio-economic status and obesity are not

56   static within the UK population – but modelling to include the expected changes in these factors and

57   their interactions with disease burden is fraught with difficulties; changes in efficacy of treatment

58   modalities for diseases or their risk factors is impossible to predict.

59   The undeniable size of these obstacles to the generation of academically robust projections of

60   disease burden, does not diminish the equally undeniable need for long term service delivery

61   planning – which cannot occur in the absence of some attempt to quantify the future needs.

62   With this in mind, we searched for the most relevant survey data and applied them to the ETHPOP

63   population projections via the National Eye Health Epidemiological Model (NEHEM) which facilitates

64   application of disease prevalence to populations (www.eyehealthmodel.org).

65   <u>Glaucoma</u> – Published UK Asian population studies[10] cannot be considered widely representative of

66   UK Asian/British Asian populations so meta-analysis of large studies from both India and Bangladesh

67   was selected.[6] No relevant UK Black population data is available, so meta-analysis was again used

68   with the largest contributing studies utilising West Indies,[11] USA[12] and African data.[13] The largest

69   White UK population data were felt to be too old, coming from a survey undertaken in 1995/96,[14] so

70   large American, European and Australian surveys were accessed.[6] Using these data, a 49% rise in

71   glaucoma cases from 2015-35 is predicted.

72   <u>AMD</u> – Prevalence data for AMD could be taken from UK sources,[15] however, case definition

73   limitations and restriction to age >75 made multicentre EUREYE data appear most representative.[16]

74   The lower prevalence of blinding AMD seen in black populations was accommodated by application

75   of data from the American Eye Diseases Prevalence Research Group.[17] Using these data, a 64% rise

76   in nAMD cases from 2015-35 is predicted.

77 <u>Cataract</u> - Absence of internationally agreed case definition, to which prevalence estimates are

78 extremely sensitive, makes estimation of case numbers of limited value. Proportional increase in

79 those numbers, however, is potentially very useful. Estimates from two surveys were taken,[18,19] and

80 using these data, a 52% rise in cataract cases is expected from 2015-35.

81 <u>Diabetic Retinopathy</u> - The global diabetic population by 2030 has been variously predicted to rise by

82 three separate academic groups to; 366 million,[20] 439 million,[21] and 552 million[22]. Similarly, two

83 1997 estimates of growth rate of UK diabetic population were 4.1% annually[23] and 1.0% annually.[24]

84 The general scarcity and need for data and future projections to inform ophthalmic public health

85 planning for DR is acknowledged.[25] Despite this need, we concluded that the data did not exist to

86 permit us to attempt this, as the variation in existing projections demonstrates.

87 However, if the best indicator of future behaviour is past behaviour, then we should note that UK

88 diabetes prevalence increased from 2.8% (1996) to 4.3% (2005), >50% rise in 10 years, hence it

89 would seem prudent to anticipate a substantial increase in demand from DR.[26] The scale of this may

90 be similar to the predicted 86% rise in the diabetic population projected for the USA (2009-2034)[27]

91 or for Germany of a 64% rise in diagnosed type 2 diabetics.[28]

92 **Of what value are these estimates?**

93 If a large, unquantified and changing proportion of glaucoma is undiagnosed, and visual thresholds

94 for cataract surgery alter surgical numbers far more than prevalence, then it would be reasonable to

95 assert that predicting numbers of "cases" in a population has little to offer to service planning and

96 that the case numbers in table 1 can be discounted. However, there must be a substantial

97 proportion of demand that is driven by prevalence, and in so far as the conversion rate between

98 prevalence and demand remains relatively stable, epidemiological modelling gives the best chance

99 of estimating by what proportion demand will rise.

100

101   The historic lack of prospective planning for rising demand has allowed a capacity shortfall with well-

102   documented national level evidence of harm to patients.[29,30] Short term financial targets make it

103   unattractive for managers to configure services with any excess capacity to accommodate expected

104   growth, hence utilisation of inefficient short term fixes such as waiting list initiatives, until the

105   system decompensates with serious untoward incidents at which point investment to increase

106   routine capacity becomes unavoidable. This situation must change.

107

108   Better source data for planning would require a UK national population-based survey, but until this

109   becomes available, these estimates of proportional increase in case numbers offer some guidance

110   on the size of the growth in service delivery that UK eye care services will be expected to deliver

111   over the next 20 years – and as such should be useful to those taking the long view nationally or

112   locally on resource allocation and workforce planning. Amongst the uncertainties, one thing can be

113   said for sure: if we fail to plan for growth, we are consciously planning to fail our patients in the

114   years to come.

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117 **Table 1: Estimated and projected numbers of cases of Glaucoma, Cataract and nAMD in the UK**

118 **2015-2035**

	Glaucoma Cases (% increase cf 2015)		Cataract Cases (% increase cf 2015)		nAMD Cases (% increase cf 2015)	
2015	659 000	-	1 450 000	-	411 000	-
2025	807 000	23%	1 790 000	23%	521 000	27%
2035	983 000	49%	2 210 000	52%	672 000	64%

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