

Diabetic retinopathy equity profile in a multi-ethnic, deprived population in Northern England

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CLINICAL STUDY

Abstract

Purpose Equity profiles are an established public health tool used to systematically identify and address inequity within health and health services. Our aim was to conduct an equity profile to identify inequity in eye health across Leeds and Bradford. This paper presents results of findings for diabetic retinopathy in Bradford and Airedale.

Methods A variety of routine health data were included and sub-analysed by measures of equity, including age, sex, ethnicity, and deprivation to identify inequity in eye health and healthcare. The Spearman Rank Correlation Coefficient was used to determine the association between variables.

Results The prevalence of diagnosed diabetes in Bradford and Airedale district is 6.6% compared to 4.3% in nearby Leeds and 5.1% nationally. The age-standardised prevalence of diagnosed diabetic retinopathy within Bradford and Airedale is 2.21% (95% CI 1.54–2.26%), with a disproportionately high prevalence of disease in the Pakistani population and the most deprived parts of the population. There was a poorer uptake of diabetic retinopathy screening in more deprived parts of the district and the proportions with a higher rate of referral to ophthalmology following the screening in Black and Minority Ethnic populations compared with the white population (13.2% *vs* 6.9%). Uptake of secondary care outpatient appointments is much lower in more deprived populations.

Conclusion Inequalities are inherent in diabetic retinopathy prevalence, diagnosis, and treatment. The reasons for these inequities are multi-factorial and further investigation of reasons for poor uptake of services is required. Addressing the

inequalities in eye health and healthcare requires cross-organisational collaboration.

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Introduction

Diabetic retinopathy is the leading cause of blindness in the working population in the developed world.¹ Diabetes and its complications, including diabetic retinopathy, are more common in people in lower socioeconomic groups and from ethnic minority populations,² leading to inequalities in eye health. Traditionally, ophthalmology has been viewed as a secondary care service. However, more recently there has been a move towards a population approach to eye health, prioritising health promotion and prevention of eye disease and associated sight loss. The UK Vision Strategy was developed in line with the World Health Assembly VISION 2020 resolution to reduce avoidable blindness by the year 2020, and improve support and services for the blind and partially sighted people.³

In keeping with the UK Vision Strategy, we conducted an eye health equity profile across two districts in West Yorkshire, Leeds, and Bradford and Airedale, to identify the key eye health issues that need to be addressed locally. Equity profiles are an established public health tool used to systematically assess inequity within health and health services.⁴ They aim to embed the reduction of inequalities explicitly the commissioning and delivery of health services, and therefore encourage prioritisation of a population approach to health care. This is one of the most comprehensive eye

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health equity profiles that has been conducted in the UK and can be used as a model for further audit.

This profile considered the prevalence of the four main eye conditions (cataracts, diabetic retinopathy, glaucoma, and age-related macular degeneration), and the availability and equity of access to primary and secondary care services. A full copy of the equity profile is available from the Bradford Observatory.⁵

Although the overall audit considered the four main eye conditions across Leeds and Bradford, this paper outlines the main issues surrounding diabetic retinopathy in Bradford and Airedale district as this was found to have the highest disease burden. Bradford and Airedale is a region with a population of 506 800. The 2001 census data show that 24% of the population is of Black and Ethnic Minority (BME) population, with a large proportion (16%) from Pakistani origin and this proportion is continuing to grow. The district is within the most deprived 10% of local authorities nationally, with some of the most deprived parts of the country in Bradford City and some of the most affluent parts of the country in Airedale. The district has a young population, with people <25 years of age accounting for 36% of the district's population, compared with 31% nationally. Only 16% of the local population are of pensionable age, compared with 19% for the UK as a whole.⁶

Materials and methods

No new data were collected for this profile and there was no single data source available that provided a comprehensive assessment. A variety of routine health data were included (outlined below) and sub-analysed by measures of equity, including age, sex, ethnicity, and deprivation. The denominator used for the population was GP capitation for Bradford and Airedale district. The indicator for deprivation used throughout the equity audit was the Index of Multiple Deprivation 2007 (IMD 2007), which is based on small geographical areas known as LSOAs (lower super output areas) and provides a relative ranking of areas by postcode according to their levels of deprivation using various indicators such as income and employment. Deprivation indices have also been allocated to each GP practice based on the postcodes of registered patients and the IMD score in those postcodes, therefore giving a measure of the proportion of registered patients living in different categories of deprivation.

In order to assess the equity of eye services, a variety of measures were considered: current community and hospital services; location of current services, including optometry; prevalence and management of reversible risk factors such as diabetes, hypertension, and smoking; prevalence of visual impairment; prevalence of the four

main eye conditions (cataracts, diabetic retinopathy, glaucoma, and age-related macular degeneration); uptake of sight testing; uptake of diabetic retinopathy screening (DRS); uptake of secondary care services; and spend. A full outline of the methods and limitations of the data is included within the full equity profile.

In order to assess the equity in diabetic retinopathy, a number of data sources were used:

- (a) *Prevalence of diabetes*: Data on diabetes prevalence were extrapolated from the Department of Health Information Centre from Quality Outcomes Framework (QOF) by PCT and by GP practice for 2009/10. QOF is a voluntary annual reward and incentive programme for all GP surgeries in England, detailing practice achievement results. The prevalence of diabetes was calculated from the number of cases of the diabetes register and the GP capitation of above-17-year-olds for the district for the same time period.⁷ The prevalence of diagnosed diabetes by practice was also calculated in order to provide an insight into the distribution of diabetes across the district. This was calculated using the number of people on the diabetic register per practice, compared with the list size per practice of above-17-year-olds.
- (b) *Management of diabetes*: Data on diabetes management were also extrapolated from the Department of Health Information Centre from QOF by PCT and by GP practice for 2009/10. There are 17 indicators used to determine diabetes management. These include HbA1c control, attendance at DRS, presence of hypertension, and treatment of hypercholesterolaemia. A composite of these 17 indicators was used to give an indication of the overall management of diabetes and the risk of developing diabetic retinopathy. This composite was calculated by dividing the total number of QOF points collected by the total number of QOF points available.
- (c) *Prevalence of diabetic retinopathy*: Information on prevalence of diabetic retinopathy was collected from auditing the GP databases. This includes any patient given a diagnosis of diabetic retinopathy, usually through screening services or secondary care ophthalmology services, which are recorded within their GP records. In Bradford and Airedale, 97% of GP practices use the computer system SystemOne (TPP, Horsforth, UK), and therefore a relatively complete audit of prevalence could be conducted by searching GP records for a set list of diagnostic codes correlating to the four main eye diseases for 2009/10. However, this method of identifying prevalence will only provide information on diagnosed diabetic retinopathy and relies on accurate coding of data in the practices.

- (d) *Uptake of DRS*: The local DRS database was manipulated for both uptake and outcome of screening for 2009/10.
- (e) *Uptake of secondary care*: Hospital Episode Statistics (HES) data were used to identify the uptake of services within secondary care between 2008 and 2010. However, limited demographic and clinical data can be extrapolated from HES data, particularly on outpatient information.

Information was mapped against deprivation to visually illustrate inequity within the district. Confidence intervals were calculated around rates to illustrate the statistical significance of any differences. Non-parametric variables such as diabetes prevalence and management, diabetic retinopathy prevalence and screening outcomes were compared with GP practice deprivation using Spearman Rank Correlation Coefficients. Ethical approval was not required for this audit.

Results

Diabetes mellitus

The prevalence of diagnosed diabetes in Bradford and Airedale district is 6.57% (95% CI 6.49–6.65%) compared to 4.34% (95% CI 4.29–4.39%) in nearby Leeds and 5.1% nationally, a significantly higher prevalence of diabetes than nearby Leeds and the national average. In addition, it is estimated that there are a further 7400 people in Bradford and Airedale with undiagnosed diabetes,⁸ which would increase the prevalence of diabetes to 8.5%.

There is a moderate statistically significant correlation between practice prevalence of diagnosed diabetes and practice deprivation, implying that the prevalence of diabetes increases in areas of deprivation ($r = 0.663$, $P < 0.0001$). In addition, GP practices were divided into deprivation quintiles and prevalence of disease was compared for the least deprived and most deprived quintiles. The prevalence of diabetes in the least deprived quintile was 4.55% (95% CI 3.87–5.23%) compared with 8.31% (95% CI 6.50–10.11%) in the most deprived quintile, illustrating the significantly higher burden of disease in the most deprived populations.

The overall average management of diabetes for England is 95.2%, with Bradford and Airedale markedly below at 89.0% (95% CI 88.8–89.2%). This significantly higher prevalence and significantly poorer management of diabetes illustrates the difficulty within Bradford and Airedale in managing diabetes and the increased risk to patients of developing diabetic retinopathy.

Although the district-wide figure gives an indication of overall management within Bradford and Airedale, it masks significant variation at a practice level. When comparing management at individual practice level

compared with practice deprivation, there was a moderate statistically significant correlation between poor management of diabetes and higher levels of deprivation by practice ($r = -0.586$, $P < 0.0001$). In addition, GP practices were divided into deprivation quintiles and management of diabetes compared for the least deprived and most deprived quintiles. The overall management of diabetes in the least deprived quintile was 99.8% (95% CI 99.4–100%) compared with 91.3% (95% CI 85.2–97.4%) in the most deprived quintile. This suggests that practices in areas of deprivation will have poorer management of diabetes, and therefore, patients are at a higher risk of developing complications from diabetes.

Prevalence of diabetic retinopathy

The directly age-standardised prevalence of diagnosed diabetic retinopathy within Bradford and Airedale is significantly higher than Leeds; 2.21% (95% CI 1.54–2.26%) and 0.87% (95% CI 0.66–0.89%), respectively. Among those with diabetic retinopathy, 55% are men. The prevalence of diabetic retinopathy is highest in 70–79-year-olds (prevalence 7.1%), but there is a significant burden of disease in younger working populations with prevalence of diabetic retinopathy at 3.2% in 50–59-year-olds. Ethnicity data are poorly recorded on GP databases and only 55% of diabetic retinopathy patients have ethnicity coded. Among the patients with ethnicity coded, 50% of those with diabetic retinopathy are from Pakistani Asian ethnic groups and 10% from Indian Asian ethnic groups, compared with 27% from White British backgrounds. These data suggest that the prevalence in South Asian ethnic groups is likely to be markedly higher than other populations, in keeping with current literature,⁹ and illustrating an inequity in the burden of disease in this population.

In order to assess the equity in prevalence of diabetic retinopathy by deprivation, the practice prevalence of diagnosed diabetic retinopathy was mapped onto deprivation by LSOA (Figure 1). Areas in red are the most deprived and areas in green are the least deprived. Each blue dot represents a GP practice and the size of the dot represents the prevalence of diagnosed diabetic retinopathy at each practice; the bigger the dot, the higher the prevalence. Practice prevalence has been standardised for age to minimise the bias when comparing practices with different age structure.

The large red area is Bradford City, which has a high population density and therefore a concentration of GP practices. The affluent green areas illustrate more rural settings with lower population densities and therefore a lower concentration of GP practices. Practices within areas of deprivation are generally represented by larger

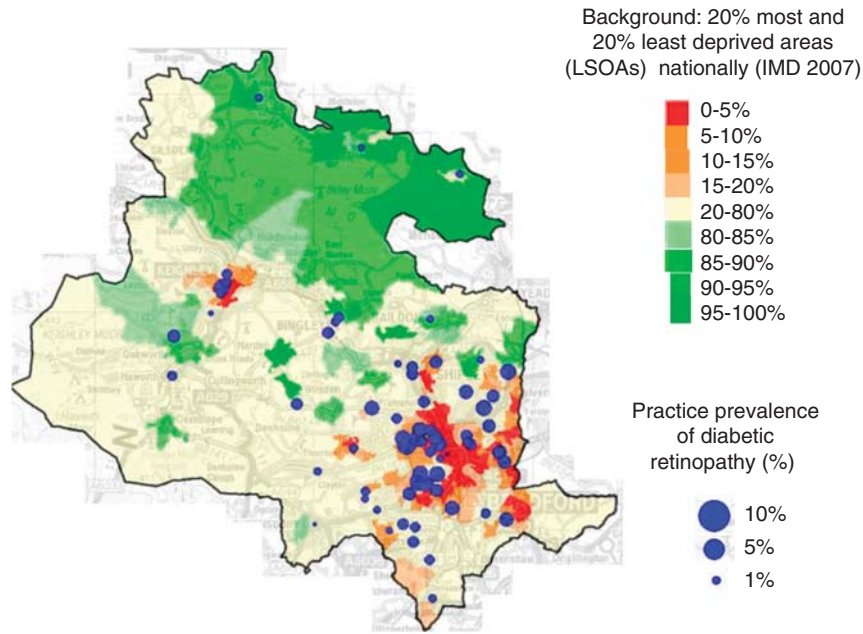


Figure 1 Age-standardised practice prevalence of diabetic retinopathy in Bradford and Airedale mapped onto deprivation (by LSOAs).

dots, therefore, illustrating that these practices have higher practice prevalence of diabetic retinopathy, and illustrating inequity in burden of eye disease. This relationship was also investigated using Spearman Rank Correlation, and a moderate statistically significant correlation was identified between increasing practice prevalence of diabetic retinopathy and increasing deprivation ($r = 0.634, P < 0.0001$).

Diabetic retinopathy screening

In Bradford and Airedale, there are 25 789 diabetics eligible for DRS. In addition to areas of deprivation in Bradford City having a high prevalence of diabetic retinopathy, mapping of uptake of DRS shows that these areas also have low rates of uptake, illustrated by darker areas on the Figure 2. Mapping of uptake also identified an area in affluent rural Airedale that has a low uptake rate for screening. This has been identified as being a long distance away from screening sites and so a new screening centre has been opened in order to address this gap in services.

In order to investigate the outcomes from DRS, results were divided into those requiring referral to ophthalmology and those not. People who require referral to ophthalmology after screening are those with pre-proliferative retinopathy (R2) or worse and/or maculopathy (M1), suggestive of diabetic retinopathy. Therefore, referral to ophthalmology suggests more advanced disease. Patients from the white populations have a far lower rate of referral from DRS to ophthalmology as compared with the BME populations

(Table 1), although again ethnicity is only recorded in 55% of people screened. This implies that the BME population more frequently requires referral to ophthalmology, possibly because of less well-controlled diabetes or later presentation for screening.

When comparing the rate of persons screened who require a referral to ophthalmology at GP practice level compared with practice deprivation, there was a strong statistically significant correlation between those requiring referral to ophthalmology and higher levels of deprivation by practice ($r = 0.728, P < 0.0001$). Therefore, this suggests that practices in areas of deprivation will have worse outcomes from screening, requiring referral to an ophthalmologist.

Access to ophthalmology for diabetic retinopathy

HES outpatient data cannot be split by disease and so only the total rate of outpatient appointments for ophthalmology is available. The population can be split into five groups (or quintiles) by deprivation, the quintile five being the most deprived. Figure 3 illustrates that quintile five has a much lower rate of outpatient consultation than the other quintiles, although it has clearly been shown that the most deprived populations have the highest burden of disease. Therefore, this illustrates a large inequity in access and provision of healthcare.

Discussion

There is a much higher prevalence of diagnosed diabetes and therefore diabetic retinopathy in Bradford compared

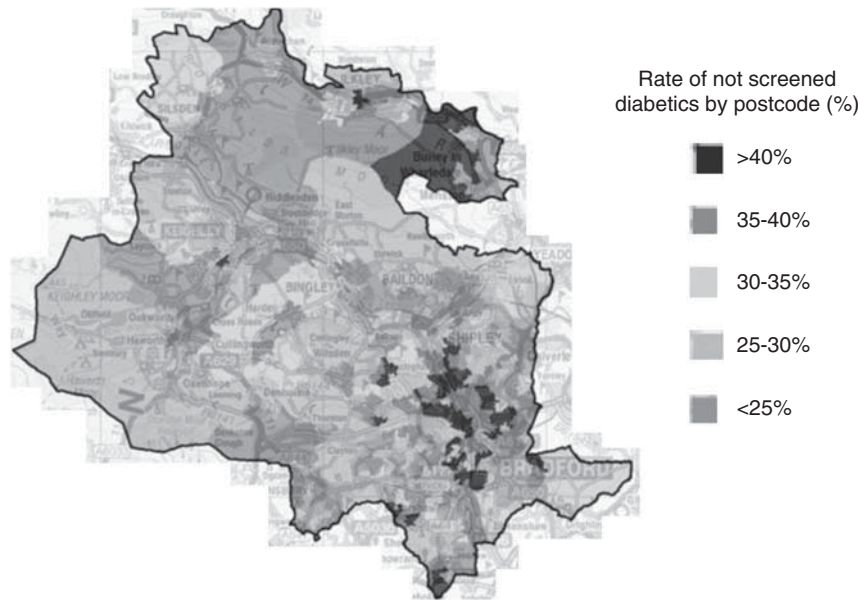


Figure 2 Rate of not-screened individuals by postcode as a percentage of those on the DRS register in 2010.

Table 1 Proportion of persons who have been screened who require a referral to ophthalmology by ethnicity (1 April 2009–31 March 2010)^a

	Number of persons requiring referral	Total population by ethnicity	Proportion requiring referral (%)	95% confidence intervals
White population	423	6101	6.9	6.3–7.6
BME population	554	4205	13.2	12.2–14.2

^aOf the 55% of patients with ethnicity recorded.

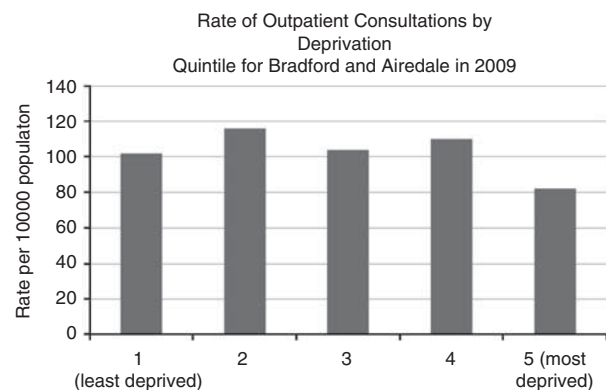


Figure 3 Rate of outpatient ophthalmology consultations by deprivation quintiles (based on patient postcodes) for Bradford and Airedale in 2009.

with Leeds and national averages. The reason for the difference in prevalence rates is likely to be multi-factorial. Bradford and Airedale have a large South Asian population and high levels of deprivation, likely to lead

to higher prevalence of diabetes. Another explanation for the higher prevalence of diagnosed diabetes in Bradford could be because over recent years, Bradford and Airedale PCT have worked with local GPs to actively case hunt for diabetic patients and have encouraged early diagnosis; this may partially contribute to the higher prevalence of disease.

There is substantial variation in practice prevalence and management of diabetes and the prevalence of diabetic retinopathy, with the majority of the burden of disease falling on those living in the most deprived areas of the district. In addition, the uptake of screening services is lower in those living in areas of deprivation and the outcomes from screening are worse for deprived populations and those from ethnic minority groups. Access to secondary care is also more limited in more deprived populations. Therefore, this equity profile shows that there are large inequities within provision of and access to services for diabetic retinopathy.

The results of this equity profile have been used to inform the local eye health strategy and commissioning of services. Healthcare professionals both in primary and secondary care must take a population health approach to the prevention and treatment of eye disease if they are to address inequities in eye health. Patients with diabetes must be identified and treated early to reduce complications. It is the responsibility of all healthcare professionals who are in contact with patients to promote health through dietary, exercise, and smoking cessation advice. In addition, commissioners must see eye health as a priority within more deprived populations to reduce inequity.

The equity profile illustrates that it is vital that good quality data are available in order to monitor and audit services to ensure quality and equity. Hospital-based databases can provide invaluable information about health outcomes, which is not available from routine data sources. This may help to reinforce messages about the importance of eye health services. With the move to clinical commissioning groups, it is vital that strong relationships are maintained between commissioners, the voluntary sector, and primary and secondary eye care throughout this process to ensure that eye health remains a priority. The local eye health strategy will be used to promote population health within the district. It also will hopefully be a driver to improve data collection and to promote partnership working within eye health.

In association with RNIB, the equity profile is being used to guide the development of a community eye health programme aiming to increase the uptake of sight testing and DRS in the most deprived populations in Bradford and Airedale. RNIB are currently in the process of conducting a qualitative study in Bradford investigating the barriers to diagnosis and treatment of diabetic retinopathy in various vulnerable groups within the population. This will hopefully lead to the development of an informed community engagement programme that will promote eye health and healthcare within the local community.

Strengths and limitations

This is not a formal epidemiological study and instead uses routinely collected data sources that may have inherent problems and biases, described throughout this paper. Therefore, interpretation of data from these sources must be undertaken with a degree of caution. There is limited information on ethnicity recorded within the routinely collected data, which is disappointing, particular owing to the large proportion of BME populations living within the district.

However, the use of routinely collected data allows this process to be repeated in a cycle of equity audit, without additional funding or technical expertise. In Bradford and Airedale, access to GP database information was readily available to audit as all but one GP practices use the same information technology system. In Leeds, this process was less simple and required interrogation of multiple databases. However, access to GP databases provides invaluable information on prevalence of the disease.

The information that has been collected through the equity profile can be used to develop local projects that are based on need and evidence, which can be of great benefit to communities and the public health. This

process involved engagement from a variety of healthcare professionals, voluntary services, commissioners, and public health professionals throughout the entire process, which promotes multi-agency commitment and cooperation that can lead to implementation of recommendations in local eye health strategies and services.

Conclusion

Inequities are inherent in diabetic retinopathy diagnosis and treatment, and in many other areas of eye health, in Bradford and Airedale. The reason for this inequity is likely to be multi-factorial such as deprivation, cultural differences, and service provision. However, there is limited understanding of why there are such inequities. Therefore, a qualitative study is currently being undertaken to further understand the barriers to eye health and healthcare, and will hopefully be used to further develop eye health services locally that may start to address these inequities. This work requires commitment from a variety of staff and organisations, such as primary and secondary eye healthcare workers, commissioners, voluntary sector workers, and public health.

Summary

What was known before

- Diabetic retinopathy is a cause and a consequence of inequalities in health. Equity profiles are systematic tools used to measure the inequalities in a population, and are invaluable to help guide the commissioning of health-promoting services.

What this study adds

- Inequalities in eye health are present in the four main eye conditions. Those in the most deprived populations have the greatest burden of diabetic retinopathy and have worse outcomes than more affluent populations. Further investigations into the reasons for this inequality must be carried out.
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Conflict of interest

The authors declare no conflict of interest.

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