



The effect of geodemographic factors on the attendance rates at a regional diabetic retinopathy treatment centre

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Abstract

Aim To determine whether geodemographic factors, specifically age, gender or commuting distance, affect the attendance rates of patients referred to a Diabetic Retinopathy Treatment (DRT) Centre from the Irish National Diabetic Retinal Screening (DRS) Programme.

Methods A retrospective analysis of the first 1200 patients who were referred for ophthalmic assessment between November 2013 and June 2015 to Cork University Hospital's (CUH) DRT clinic from the DRS was completed.

Results A total of 972 (81%) patients attended all their scheduled DRT appointments. The attendance rates for those living in counties Cork and Kerry were 83.9% and 72.5%, respectively. Fifty-seven (4.75%) patients failed to attend any of their clinic appointments (2.2% of Cork and 11.8% of Kerry referrals). Patients living within 60 km of the treatment centre were more likely to attend ($p = 0.013$). Both age and gender were also shown to have a statistically significant impact on attendance, with those under 40 years of age ($p < 0.001$) and male patients ($p = 0.02$) less likely to attend their scheduled appointments.

Conclusion This study suggests a correlation between geodemographic factors (age, gender and commuting distance) and attendance at a DRT Centre. The longer commuting distance for Kerry patients contributes to their higher non-attendance rates indicating a need to provide a Kerry-based satellite treatment centre to improve accessibility.

Keywords Diabetic retinopathy · Non-attendance · Patient compliance · Screening

Diabetes is one of the most common metabolic disorders worldwide and is a leading cause of morbidity and mortality [1, 2]. The World Health Organisation has estimated that, between 2000 and 2030, the number of people with diabetes will have more than doubled [3]. The prevalence rate of diabetes in the adult Irish population for 2015 was estimated to be 5.6% [4]. Diabetes is a chronic disease and is associated with the development of serious microvascular and macrovascular complications. In particular, diabetic retinopathy (DR) can cause irreparable changes within the vasculature of the eye, leading to subsequent retinal ischaemia, neovascularisation and visual impairment.

The incidence of blindness in Europe secondary to diabetes is reported to be in the range of 53–65 per 100,000 diabetic population per year [5, 6], and it is the leading cause of blindness amongst those of working age [7]. In Ireland in 2003, an increase of 120% in blind registration secondary to DR was recorded over a 7-year period [8]. Over the subsequent decade, the incidence rate of visual impairment due to diabetic retinopathy for adults aged 18–69 years in Ireland increased from 6.4 per 100,000 in 2004 to 11.7 per 100,000 in 2013 [9]. On an economic level, DR contributes towards a loss of productivity as well as a reduction in patients' quality of life and number of healthy life years [10, 11]. The direct cost of visual loss and blindness to the Irish healthcare system was estimated to be €117 million in 2010 and €269 million indirectly to the state and society [12].

Screening for DR fulfils the Wilson and Jungner principles of early disease detection [13], and is an accepted standard of care internationally [14, 15]. Screening allows for the early detection of disease at a stage more likely to respond to treatment, with 34% of those treated prevented from going blind within the subsequent 10 years [16]. International studies have estimated that screening for DR and subsequent treatment of

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diabetic eye disease is one of the least costly interventions when compared to the most common interventions for advanced DR, as laser treatment can significantly reduce the risk of blindness [17].

In Ireland, the National Diabetic Retinal Screening (DRS) Programme was introduced in 2013. It offers annual screening and treatment where necessary to all patients with diabetes aged 12 years and older currently living in Ireland. In line with The St. Vincent Declaration [3], the programme aims to reduce blindness secondary to diabetes by at least a third over the subsequent 5 years [18]. As such, the programme is structured to facilitate the screening of over 190,000 patients with a target for successful attendance and DR grading of over 80%. As the number of patients with diabetes is set to increase over the coming years, it is vital that the programme continues to operate as efficiently as possible.

Non-attendance is a marker of patient compliance with screening programmes and forms a major obstacle in the efficiency of the DRS programme, resulting in longer waiting lists and treatment delays. Furthermore, non-attendance is a risk factor for sight-threatening retinopathy and there has been a proven link between the number of missed appointments and the severity of DR at presentation [19, 20]. This study aims to identify the factors that are affecting patient attendance at a DRT clinic and suggests compensatory measures to address this.

Methods

Ethical approval was obtained from the Clinical Research Ethics Committee (CREC). A retrospective analysis of the first 1200 diabetic patients who were referred for ophthalmic assessment to the Cork University Hospital (CUH) Diabetic Retinopathy Treatment (DRT) Centre from the DRS between November 2013 and June 2015 was completed. There were no exclusion criteria within this cohort of patients. The data were collected from the CUH DRT clinic database, supplemented by the CUH Patient Administration System, and kept on a password-protected Microsoft Excel file. Following pseudonymization, the database was organised to include demographic information (age, gender, area of residence), clinic attendance and non-attendance dates, retinopathy grade and screening outcomes.

The attendance rate for the CUH DRT was derived from the proportion of those referred from the DRS who attended all their clinic screening and treatment appointments over the timeframe of the study. We allowed for cancellations ahead of the booked appointment as long as they attended their rescheduled appointment. Patients who did not attend (DNA) were defined according to one of the following four categories:

1. Single DNA: did not attend on one occasion.
2. Multiple DNAs: did not attend on two or more occasions.

3. Attended only once then declined further appointments.
4. Never attended.

The subdivision was done in order to identify the number of patients who never attended any screening clinic appointment. This figure was important as this group of patients' eye condition remained unknown and may pose a greater risk of complications going undetected until they become advanced.

The retinopathy grading classification adopted by the DRS was used where patients are given a retinopathy (R0-3) grade [4]. If there was a disparity in the grades between the right and left eyes, the higher grade was recorded. Patients with pre-proliferative (R2) or proliferative (R3) grades were classed as having sight-threatening DR.

The commuting distance to the CUH DRT was derived using an online geographical-related web resource (Google Maps, 2017). Statistical analysis was conducted using IBM SPSS Statistic Data Editor, version 22. The geodemographic factors of patients were initially described using frequencies and percentages. The statistical methods utilised in this study were divided into univariate and multivariate analyses to evaluate the difference between patients who attend and did not attend their clinic appointments. The univariate analysis was performed via chi-square test and Fisher Exact test to assess the relationship of each factor independently with the attendance rate. In order to avoid over-adjustment, only factors that were identified to be statistically significant ($p < 0.05$) were retained and included in the multivariate analysis. The latter was constructed using multiple logistic regression utilising all four variables that reached statistical significance in univariate analysis with $p < 0.05$.

Results

A summary of the patient demographic and retinal grading with respect to attendance rates is shown in Table 1. Of the first 1200 patients referred for ophthalmic assessment at the CUH DRT, 883 were from Cork, 305 from Kerry and 12 from outside these two counties. The male-to-female ratio was 2:1 (801 males and 399 females). The average age (\pm SD) of participants was 64 ± 14 years.

There were a total of 228 (19%) referrals who did not attend their appointments on at least one occasion. Of these, 43.9% ($n = 100$) failed to attend on a single occasion, 25.8% ($n = 58$) on two or more occasions and 25% ($n = 57$) failed to attend any scheduled appointments, while 5.3% ($n = 12$) of patients declined further follow-up after their initial assessment.

There was also shown to be a relationship between the gender and age of patients and their attendance rates. Patients under the age of 40 years were less likely to attend, with a DNA rate of 32.2% compared with 18% for those over 40 ($p < 0.001$, Fig. 1). Males had a statistically significant

Table 1 Patient demographics and retinopathy grade vs attendance rates

	Total		Attended screening		Did not attend		<i>p</i> values*
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	
Total	1200	100	972	81	228	19	
Age							
< 40	87	7.2	59	67.8	28	32.2	< 0.001
40–59	308	25.7	257	83.4	51	16.6	0.205
60–79	624	52.0	516	82.7	108	17.3	0.120
≥ 80	181	15.1	140	77.3	41	22.7	0.174
Gender							
Male	801	66.7	634	79.2	167	20.8	0.02
Female	399	33.3	338	84.7	61	15.3	
Distance travelled (km)							
≤ 60	796	66.3	675	84.8	121	15.2	< 0.001
> 60	404	33.7	297	73.5	107	26.5	
Retinopathy grade							
R0	199	16.6	169	84.9	30	15.1	0.122
R1	575	47.9	485	84.3	90	15.6	0.046
R2	210	17.5	154	73.3	56	26.7	0.002
R3	216	18.0	164	75.9	52	24	0.358

R0 no retinopathy, R1 background retinopathy, R2 pre-proliferative retinopathy, R3 proliferative retinopathy

**p* value for differences between the groups within each of the categories: age, gender, distance travelled, and retinopathy grade

higher rate of non-attendance compared with females (20.8% vs. 15.3%, *p* = 0.02, Table 1).

There was also a trend towards poorer attendance in those with worse retinopathy grades (see Table 1). Patients with sight-threatening retinopathy (R2 and R3) had statistically significant higher rates of non-attendance when compared

with those with less severe retinopathy grades (26.35% vs. 15.5%, *p* < 0.0001).

There was a statistically significant difference in the DNA rates between those who lived within 60 km of the CUH DRT Centre and those who lived further away (15.2% versus 26.5%, respectively, *p* < 0.001, Fig. 1). With respect to patients residing in the county of Cork, 90% (*n* = 670) of whom lived within 60 km of the DRT Centre, the attendance rate was 83.9% (*n* = 741). The rate for Kerry patients, all of whom lived further than 60 km from the DRT Centre, was lower at 72.5% (*n* = 221), a difference which was statistically significant (*p* < 0.001). Nineteen (2.2%) patients from Cork never attended the DRT Centre, compared with 36 (11.8%) referrals from Kerry. Patients within 60 km of the treatment centre were more likely to attend screening (*p* = 0.013); of the 57 (4.75%) patients who failed to attend any of their DRT clinic appointments, 38 (66.7%) resided over 60 km from the centre.

Results from multivariate analysis conducted using multiple logistic regression showed that patient age under 40 years (odds ratio (OR) of attendance = 0.48) and male patients (OR of attendance = 0.60) were less likely to attend screening. In contrast, patients who resided within 60 km of the DRT clinic (OR of attendance = 1.54) and patients with retinopathy grade R1 (OR of attendance = 1.60) were more likely to attend screening. The findings are illustrated in Table 2.

Discussion

To our knowledge, this is the first study to establish an association between geodemographic factors and attendance rates at a treatment centre for the DRS programme in Ireland. What sets this programme apart from other similarly themed screening services in other countries is the way the screening,

Fig. 1 Patient attendance rates (percentage) versus age (years)

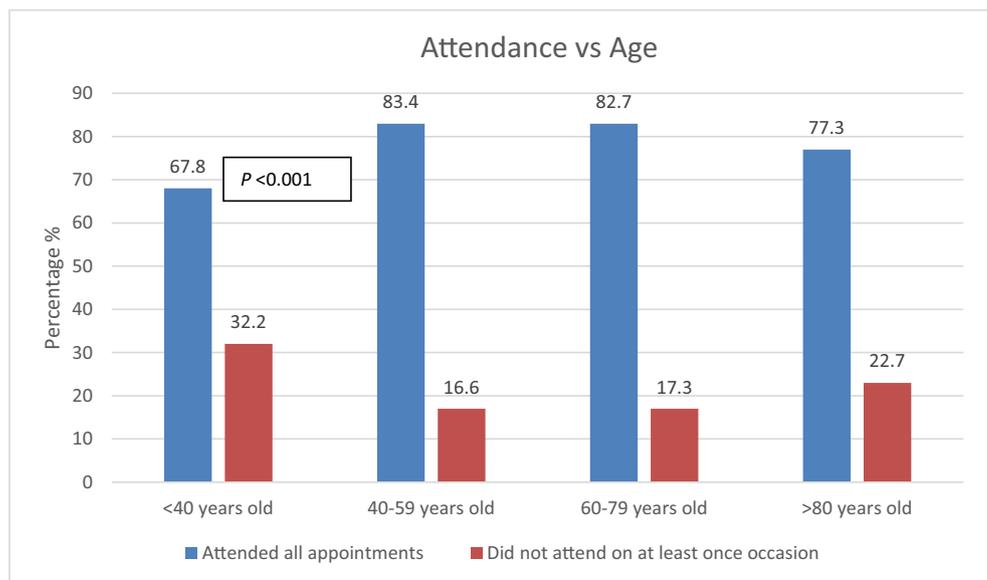


Table 2 Factors associated with adherence to Diabetic Retinopathy Treatment Centre appointments

Categorical variables*	Odds ratio (OR)	Confidence interval (CI)	<i>p</i> values
Age < 40 years old	0.48	0.24–0.95	0.03
Male gender	0.60	0.41–0.87	0.008
Distance travelled ≤ 60 km	1.54	1.10–2.17	0.013
Retinopathy grade R1	1.60	1.02–2.49	0.04

*In multivariate analysis, these categorical variables were associated with being statistically significantly less likely (OR < 1) or more likely (OR > 1) to attend screening

grading and treatment centres are intrinsically linked through the same electronic medical records system (Optomize). This system allows for complete visibility throughout the patient care pathway. Studies published prior to this, both nationally and internationally have predominantly reported on attendance rates at screening centres and not treatment centres. As a result, while the data is unique, it makes it difficult to compare the 19% non-attendance rate of our treatment clinic to the 9–12% non-attendance rates reported in the literature for U.K.-based screening clinics [21–23].

DR screening engages patients with a predefined chronic illness who have many other health demands and as such have regular contact with healthcare services. Their attitudes to screening may differ from those of other similar programmes. Caution should also be taken as our data represents patients who have passed through the screening service and already know that they have DR or non-diabetic eye disease which may require treatment. This is in contrast to other screening programmes which generally deal with healthy individuals who are asymptomatic and unaware of any problems. This remains true when comparisons are made to other Irish screening programmes. For example, the non-attendance rate of 11.5% reported for the ‘CervicalCheck’ programme was related to screening appointments for otherwise ‘healthy’ patients, as opposed to attendance at treatment centres [24]. Unfortunately, as there are no comparable studies, it is uncertain whether patient awareness that ocular pathology has been detected by the DRS influences their attendance at a treatment centre.

Our study found that patient age plays a significant role in attendance rates. Thirty-two percent of patients under the age of 40 years failed to attend, nearly twice the rate of non-attendance rate for those over the age of 40. These findings are consistent with that of a similar study [25]. It has been theorised that younger patients are less likely to be affected by visually significant ocular pathology, and the absence of symptoms may negatively impact on their motivation to attend treatment centre appointments. As such, the doctor-patient relationship is a key factor in facilitating increased awareness through patient education of the importance of attendance even in the absence of symptoms [26]. This may be especially important for male patients, who demonstrated a statistically significant poorer attendance rate compared to females.

Patients with mild background diabetic retinopathy (R1) were better at attending compared with patients with more advanced retinopathy. This is a source of concern as early detection of retinopathy is critical for timely intervention and reducing the risk of visual loss. A worrying trend was that those with severe proliferative diabetic retinopathy (R3) and hence the highest risk of blindness, had the second highest rate of non-attendance at 24%. Possible reasons for this include poor motivation as their vision fails and the patients feel there is little to be salvaged. Alternatively, they may have already received extensive laser treatment for their proliferative disease and are thus already under the care of existing ophthalmology services and considered stable. A limitation of our study is that it was retrospective and as such there was no way to confirm if any of the non-attendees were patients of other ophthalmic institutions and receiving treatment without the knowledge of the DRS. Another possible explanation for poor attendance is that this patient cohort face greater barriers getting to the treatment clinic. They generally have higher rates of comorbidities including diabetic-related renal, cardiovascular and foot complications and frequently rely on carers to transport them to appointments as their level of vision and general health deteriorates. This trend of those with more severe retinopathy having poorer adherence rates was also noted in an American study involving a largely uninsured and African American population [27].

Unsurprisingly, distance from the DRT Centre had a significant impact on attendance rates, with 83.9% of Cork patients attending all their appointments as scheduled versus 72.5% of those from Kerry. Patients over the age of 60 who were living more than 60 km from the treatment centre comprised the cohort with the highest rate of non-attendance in terms of those who never attended any of their treatment centre appointments. This inverse relationship between the travel distance to a screening appointment and likelihood of attending has been found in other screening programmes, for example screening for breast cancer [28]. Studies carried out on programmes that facilitated mobile screening centres have suggested that they provide improved accessibility and thus may mitigate the negative effects of travel distance on attendance rates [22]. As such, a provision to allow for a more local assessment by an ophthalmologist may be of benefit to the patients residing in Kerry who face long commutes to the

CUH DRT Centre. A recent study surveying Irish patient preference regarding DR screening location showed that a majority of patients preferred community-based appointments rather than hospital-located retinal screening appointments [29]. Interestingly, overall commuting distance may not have a significant impact on attendance rates when DR screening appointments are scheduled to coincide with other hospital-based diabetes-related clinics [22]. However, the practicality of arranging combined appointments from an administrative perspective makes it uncertain whether this approach is a viable option in improving attendance rates.

At present, once a patient is referred from the DRS to the CUH DRT clinic, they are initially sent out a written reminder. If they fail to attend the appointment, it is rescheduled and a reminder letter is resent. If the patient does not attend for a second time, their GP is informed to follow up as a matter of urgency. This method of recruitment has been shown to be a cost-effective strategy in improving patient compliance with their appointments. DNA rates improved from 4.9 to 2.2% in deprived areas of west London by sending out written reminders to patients [21]. The use of text-based electronic notifications has also been used to improve clinic attendance, and has been shown to improve attendance and reduce no shows across healthcare settings in systematic reviews [30].

In summary, this study demonstrated a correlation between geodemographic factors such as age, gender and commuting distance and attendance rates at a DRT Centre. The longer distances patients from Kerry are required to travel likely contributes to their higher DNA rates, with older patients being disproportionately affected. This indicates a possible need to provide a satellite diabetic retinopathy treatment centre in Kerry to improve patients' accessibility. Increased awareness amongst younger male patients regarding the importance of attending clinic appointments in the pre-symptomatic stage through increased contact with local health care providers is also desirable. It is important that steps are taken to maintain and improve attendance figures at treatment centres if the screening programme is to reach its key objective of reducing rates of blindness from diabetic retinopathy. Overall, there is a need for regular and systematic auditing of the programme to continue to evaluate patient compliance and if interventions are improving attendance.

Compliance with ethical standards

Ethical approval was obtained from the Clinical Research Ethics Committee (CREC).

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