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# Trends in blindness due to diabetic retinopathy among adults aged 18–69 years over a decade in Ireland

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## ABSTRACT

**Aims:** To describe trends in the incidence of visual impairment and blindness due to diabetic retinopathy among adults aged 18–69 years in Ireland between 2004 and 2013.

**Methods:** Data on visual impairment due to diabetic retinopathy in adults aged 18–69 years or over who are registered with the National Council for the Blind of Ireland, (2004–2013) were analysed. Annual incidence rates were calculated for the adult population and the population with diagnosed diabetes. Poisson regression was used to test for changes in rates over time. The relative, attributable and population risk of blindness and visual impairment due to diabetic retinopathy were calculated for 2013.

**Results:** Over the decade, the prevalence of diagnosed diabetes increased from 2.1% to 3.6%. Among people with diagnosed diabetes, the incidence of visual impairment due to diabetic retinopathy increased from 6.4 (95% CI 2.4–13.9) per 100,000 in 2004 to 11.7 (95% CI 5.9–21.0) per 100,000 in 2013. The incidence of blindness due to diabetic retinopathy varied from 31.9 per 100,000 (95% CI 21.6–45.7) in 2004 to 14.9 per 100,000 (95% CI 8.2–25.1) in 2013.

**Conclusions:** Our findings indicate the need for increased attention to preventive measures for microvascular complications among adults with diabetes in Ireland. Retinopathy screening has been standardised in Ireland, these findings provide useful baseline statistics to monitor the impact of this population-based screening programme.

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## 1. Introduction

Vision impairment is a major public health problem worldwide [1]. In 2010, it was estimated that 0.5% of the global population were blind [1]. In Ireland, the prevalence of blindness increased from 0.2% in 2003 [2] to 0.3% in 2010 [3]. Worldwide

approximately 80% of visual impairment cases can be prevented or cured [4]. In order to reduce the global burden of visual impairment, nine preventable causes of visual impairment have been prioritised on the global public health agenda including diabetic retinopathy [4]. Compared to the general population, individuals with diabetes are at an increased risk

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of losing their eyesight [5]. Genz et al. found that the risk of blindness in an individual with diabetes was 2.4 times that of an individual without diabetes [6]. In Ireland there is no diabetes register or national data-capture system to observe diabetes trends in diabetes incidence or prevalence over time. However, findings from a recent systematic review [7] suggest that the prevalence of diagnosed diabetes increased from 2.2% in 1998 to 5.2% in 2015. The review was unable to distinguish between the various types of diabetes [7]; however it can be assumed that type 2 diabetes is driving the increase in prevalence as it accounts for 90% of all diabetes cases [8]. As the prevalence of diabetes rises, visual impairment due to diabetic retinopathy represents a growing global public health challenge [9].

Diabetic retinopathy is a leading cause of preventable vision loss in countries such as the UK [10] and the USA [11]. In Ireland, it was the second most common cause of blindness among adults aged 16–64 years in 2003, with an incidence rate of 0.7 per 100,000 adults [2]. Retinitis pigmentosa was the most common cause of blindness among adults aged 16–64 years in 2003; with an incidence rate of 0.9 per 100,000 adults [2]. The individual and societal costs of visual impairment due to diabetic retinopathy are significant [12,13], and include increased healthcare costs [14,15], loss of productivity [15], and a severe reduction in healthy life years [16] and quality of life [17].

It is now widely accepted that systematic screening for diabetic retinopathy has the potential to reduce the incidence of sight-threatening visual impairment [18]. A reduction of rates of blindness due to diabetic retinopathy have been noted in countries that have established population-based retinal screening programmes as part of their national diabetes strategy [6,19–23]. Up until recently, there was no national population-based screening programme for diabetic retinopathy in Ireland; screening was delivered on a limited basis by local services using different models of service provision [24]. In 2013, a national retinal screening programme (Diabetic RetinaScreen) was introduced in Ireland [25] with the objective of reducing blindness by 40% through the implementation of a standardised screening and treatment service [26]. The service was introduced on a phased basis, patient registration began in 2013 and full implementation was achieved in late 2014.

In 2010, the World Health Organisation highlighted the importance of within-country data on visual impairment to facilitate global efforts aimed at monitoring and eliminating avoidable blindness [4]. Given that the national programme has only been recently introduced, there is limited national data on rates of visual impairment due to diabetic retinopathy in Ireland [7]. Therefore, this study used national blind registry data to establish current rates of visual impairment and blindness due to diabetic retinopathy. Data from blind registers allow the absolute burden of visual impairment attributed to diabetic retinopathy to be quantified [27]. In Ireland, blind registry data have been previously used to describe trends in all-causes of blindness in 1996 [28] and 2003 [2]. The aims of this study were to (1) estimate the incidence of visual impairment and blindness due to diabetic retinopathy among (a) the total adult population and (b) population with diagnosed diabetes in Ireland over a ten year period (2004–2013); (2) explore whether these rates have changed over time and

(3) estimate the relative, attributable and population attributable risk of visual impairment and blindness due to diabetic retinopathy in Ireland in 2013.

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## 2. Subjects materials and methods

### 2.1. Data source

Data from the National Council for the Blind of Ireland (NCBI) were analysed. The NCBI is a charitable organisation which provides support and services to people experiencing sight loss [29]. Anyone who is having significant difficulty with their eyesight can be referred to the NCBI by a health care professional or family member; self-referral is also possible [29]. Once referred, the individual's information is added to the NCBI database; however, an ophthalmic assessment report (OAR), to confirm the level of visual impairment, is necessary to officially register with the service [29]. Registration with the NCBI is not compulsory, however those who register can access a range of NCBI support services and registration is also required to qualify for the state-provided Blind Welfare Allowance [30]. The NCBI registry comprises data on approximately 15 causes of visual impairment and blindness, including macular degeneration, glaucoma, cataract, optic atrophy, retinitis pigmentosa and diabetic retinopathy [2,3]. Information such as service-user demographics (gender and date of birth), date of registration, visual acuity score and cause of visual impairment are recorded on a centralised national database. Information on type of diabetes, the stage of diabetic retinopathy, or risk factors for diabetic retinopathy is not recorded. In this study, anonymised data on visual impairment due to diabetic retinopathy in adults aged 18–69 years, (January 2004–December 2013) were obtained for analysis.

### 2.2. Numerator data

The number of new cases of visual impairment due to diabetic retinopathy was extracted from the NCBI database for each calendar year. The number of new cases due to all other causes of visual impairment was extracted for 2013. Cases were excluded if visual acuity score was not recorded. In Ireland, visual impairment is categorised into three levels: mild visual impairment (visual acuity between 6/12 and 6/18 inclusive), moderate visual impairment (best-corrected acuity of less than 6/18 but better than or equal to 6/60 in the better-seeing eye) and blindness (visual acuity of 6/60 or less in the better eye or a visual field restricted to 20 degrees or less) [31]. These criteria are commonly used in North America, Australia, and most of Europe [31]. For the purpose of this study, individuals who met the national criteria for mild and moderate visual impairment were defined as 'visually impaired' and those who met the criteria for blindness were defined as 'blind'.

### 2.3. Denominator data

Annual population estimates were obtained from the Central Statistics Office (CSO), Ireland [32]. A census took place in Ireland in 2006 and 2011; data for other study years were CSO

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