





Prevalence of refractive error, visual impairment and access to eyecare for the homeless in Wales, United Kingdom

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Abstract

Background/aims To investigate visual impairment and disability, refractive error, and barriers to eye care in the homeless in Cardiff, United Kingdom.

Methods Prospective cross-sectional study carried out on participants in homeless shelters in Cardiff. We collected participants socio-demographic profile, ocular history and access to eyecare services. Quantitative data included near and distance visual acuity and a non-cycloplegic refraction.

Results A total of 100 participants were studied in this study. Prevalence of myopia was 19% and hyperopia 17%. Mean SE (Spherical Equivalent) for myopia -2.42D (95% CI: -1.65 to -3.19D), for hyperopia this was $+2.22\text{D}$ (95% CI: $+1.66$ to $+2.79$). The prevalence of astigmatism was 36% (mean: 1.67D , 95% CI: -0.88 to 0.94 , $n = 100$). The number of participants with visual acuity (VA) worse than 6/12 was 11% in comparison to 0.89% and 1.1% in the general Cardiff and Welsh population respectively ($p < 0.05$). Additionally, 1% of the homeless subjects were registerable as blind (visual acuity worse than 3/60 in the better eye). Barriers to eyecare services were high, with 50% not seen by an optometrist within the last 5 years.

Conclusions These findings indicate a significant disparity in ocular health, visual acuity and refractive error amongst the homeless in comparison with the general population.

Introduction

In England, 61,410 households were threatened with, or rendered statutorily homeless in the fourth quarter of 2018. Statutorily homeless was defined in accordance to the definition outlined in the Housing Act 1996 by the British Government. A household is considered statutorily homeless if a local authority decides that they do not have a legal right to occupy accommodation that is accessible,

physically available and which would be reasonable for the household to continue to live in [1]. In addition, 83,700 households were living in temporary accommodation, a 5% increase from the previous year [2]. In Wales, 10,737 households were threatened with statutory homelessness in 2018–2019, an increase of 18% from the same period in 2017–2018 [3]. In 2017 the number of rough sleepers had increased by 8.6% in Cardiff [4]. Homelessness is an increasing social and political issue.

While there is substantial information on systemic morbidity, relatively little is known about the impact of ocular comorbidity [5, 6]. Studies in Europe and North America have shown a correlation between increased ocular morbidity and homelessness [7, 8]. An analysis by the Homelessness Link in 2014 reported that 14.2% of 2500 homeless individuals in England had long standing eye conditions, compared to 1.4% in the general population [9].

Although previous studies in the United States have investigated ocular health in the homeless, the results are not directly applicable to the homeless population living under a universal healthcare system such as the National Health Service (NHS). To our knowledge, this is the first

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Table 1 Knowledge and access to healthcare in the sample population ($n = 100$).

Questions	Number of participants
When was the last time your eyes were examined by an eye doctor?	
<1 year	0 (0%)
1–5 years	4 (4%)
5+ years	10 (10%)
Never	86 (86%)
Have you ever visited the optometrist? If yes, when was your last visit?	
<1 year	4 (4%)
1–5 years	25 (25%)
5+ years	50 (50%)
Never	21 (21%)
Have you ever had corrected vision (wear glasses or contacts)?	
Yes	25 (25%)
No	75 (75%)
Do you wear/own glasses or contacts currently?	
Yes	11 (11%)
No (never owned/lost)	89 (89%)
If you had problems with your vision, where would you go for help?	
Opticians/GP	96 (96%)
Don't know	4 (4%)
Where would you go to get a pair of glasses or contacts if needed?	
Opticians/specific clinic	97 (97%)
Don't know	3 (3%)
Are you aware of any governmental schemes/support currently in place?	
No	100 (100%)

prospective cross-sectional study of refractive error and visual acuity and access to eyecare services in the homeless in the UK.

Materials and methods

The study recruited participants from three homeless centres across Cardiff, namely the Sir Julian Hodge Centre (The Wallich), the Trinity Centre and the Huggard Centre. For the purposes of this study homelessness is defined according to the British legal definition as a lack of secure or permanent accommodation [2]. As reported by member of staff, the average duration of homelessness varied from 3 to 5 years depending on the shelter we visited.

Convenience sampling technique via a standardised protocol in which staff in the shelters could individually notify residents of the study. Exclusion criteria included participants aged 16 years and below, those who are were incompetent to consent or deemed to have incapacity to

participate (as outlined by the Mental Capacity Act 2005) and any participants who would place the researchers or others at risk such as inebriation or incapacitation due to drug use.

Sociodemographic data collected included age, gender and ethnicity. A structured and validated questionnaire was completed on subjective visual impairment, past ocular history and accessibility to ocular healthcare services. This questionnaire was obtained from a previous study on the ocular morbidity in the homeless population in Hawaii [10].

Informed consent was obtained on every occasion. All tests were carried out by qualified Ophthalmologists experienced in refraction. Binocular and monocular vision was recorded using a LogMAR chart and near vision using a Rosenbaum chart (uncorrected and best corrected if corrective lenses worn). Objective and subjective non-cycloplegic retinoscopy was carried out. LogMAR visual acuity notation was converted to Snellen to stratify participants by the degree of visual impairment, as per the International Classification of Diseases 11th Revision (ICD-11) [11]. Near vision impairment was defined as a corrected near visual acuity at presentation of less than N6 as per the ICD-11 [12].

Hyperopia was defined as $\geq +1.0$ D and myopia as ≤ -1.0 D. Emmetropia was defined as a refractive error between -1.0 and $+1.0$ D and high refractive error as $\geq +6.0$ D for hypermetropia, or ≤ -6.0 D for myopia. Astigmatism was defined as cylindrical error $\geq +1.0$ D or ≤ -1.0 D.

A validated questionnaire obtained from Barnes et al. (Table 1) was used to investigate subjective visual acuity (patient's verbal report on the level of visual impairment) [10]. Participants were classified on this basis into the following groups: no visual problems, sight corrected by lenses, difficulties seeing distance, difficulties seeing near and difficulties seeing both near and distance. The questionnaire also examined participant's access and perceived barriers to obtaining eye care.

Statistical analysis was performed using R statistical package (3.6.1, 2019-07-5, University of Auckland, New Zealand). Wilson's method has been used to generate the confidence interval. A p value of < 0.05 was deemed statistically significant. Age-adjustment was performed to compare sight loss (defined as $VA \leq 6/12$) in Wales and Cardiff population to that of the homeless participants in two specific age brackets: 18–64 years and 65–74 years, over the total sample size of those respective age groups. This was analysed using the Fisher's exact test. Kolmogorov–Smirnov testing was used to evaluate for distribution of data. Spearman correlation was used to evaluate the correlation between presenting visual acuity and absolute spherical equivalence. Cohen's kappa correlation coefficient was used to evaluate the correlation between subjective and measured (objective) visual acuity

Table 2 Demographic profile of 100 participants in the study with comparisons to 2011 National Census [12–14].

Characteristics	Study population (Percentage) (n = 100)	Cardiff population 2011 census (percentage)	Wales population census 2011 (percentage)	England and Wales population 2011 census (percentage)
Sex				
Male	82%	49.60%	49.30%	49.40%
Female	8%	50.40%	50.70%	50.60%
Age (years)				
16–29	18%	27.20%	18.70%	18.70%
30–44	57%	19.50%	17.20%	20.50%
45–64	22%	21.70%	26.40%	25.40%
65–74	3%	7.60%	11.50%	8.70%
>75	0%	6.50%	9.30%	7.90%
Ethnicity				
White	89%	88.80%	96%	86%
Asian	1%	5.60%	2.30%	7.50%
Black	8%	1.70%	0.60%	3.30%
Other	2%	1.80%	0.50%	1%
Mixed	0%	2.10%	1.00%	2.20%

Table 3 Ocular history of the participants surveyed.

Ocular history	Number of participants
Trauma to orbit, globe or skull	4 (4%)
Strabismus	4 (4%)
Colour-blindness	2 (2%)
Cataract	1 (1%)
Keratoconjunctivitis sicca	3 (3%)
Family history of ocular disease (n = 2)	
Retinitis pigmentosa	1 (1%)
Glaucoma	1 (1%)
Previous eye surgery (n = 4)	
Strabismus surgery	2 (2%)
Cataract surgery	1 (1%)
Glaucoma surgery	1 (1%)

to determine if the subject's reported visual outcome aligned with their measured presenting visual acuity.

Results

Data was collected from 100 eligible homeless participants (Table 2). The study sample comprised 82 (82%) males and 18 (18%) females. Female mean age was 36.8 ± 10.7 years and 38.5 ± 11 years for males ($p = 0.51$). The participants' ocular history is summarised in Table 3. Five participants reported a preexisting ocular condition and 2 reported a family history of ocular disease.

The visual acuity questionnaire showed that 64% of participants reported problems with their vision. The

majority (66%) reported visual concerns, with 53% reporting difficulties discriminating distant objects and 12% reporting difficulties with both near and distance vision.

Data regarding visual acuity is demonstrated in Table 4. Based on the presenting distance visual acuity of the better eye, 4% of the participants had VA worse than 6/18. The prevalence of near-visual impairment (defined as worse than n6) was 37%. The number of participants with visual acuity worse than 6/12 binocular was 11%. In addition, 1% of the homeless subjects were registerable as blind. All participants with a presenting visual acuity worse than 6/12, all had improvement in visual acuity after refraction.

The mean absolute spherical equivalent was 0.83 (95% CI 0.61–1.04) and 0.87 (95% CI 0.65–1.10) for right and left eye respectively ($n = 200$). The total prevalence of myopia was 8% (mean = -2.78 , 95% CI -1.71 to -3.85) and 16% (mean = -2.32 , 95% CI -3.14 to -1.49) for the right and left eyes respectively. The total prevalence of hyperopia was 18% for right eye (mean SE = 2.07, 95% CI 1.61–2.52) and 14% for left eye (mean SE = 1.97, 95% CI 1.34–2.61). The total prevalence of myopia and hyperopia was 17% (mean SE = -2.42 , 95% CI -3.19 to -1.65) and 19% (mean = 2.22, 95% CI 1.66–2.79) ($n = 100$) respectively. The prevalence of astigmatism was 36% (mean = 1.67 95% CI -0.88 to 0.94), $n = 100$. Distribution of refractive error for right and left eye is shown in Fig. 1. There was a positive correlation between presenting visual acuity and absolute spherical equivalence (Spearman's rank, $r_s = 0.54$, $p < 0.05$).

Data regarding knowledge and access to healthcare from the questionnaire is shown in Table 1. For the participants who had received a previous eye test from an opticians/

Table 4 Degree of visual impairment based on presenting visual acuity of the better seeing eye in 100 participants, according to the International Statistical Classification of Diseases and Related Health Problems 11th Revision (ICD-11) [11].

Level of vision impairment	Worse than	Equal or better than	logMAR equivalent	Number of participants
No visual impairment		6/12		89 (89%)
Mild visual impairment	6/12	6/18	0.3	7 (7%)
Moderate visual impairment	6/18	6/60	0.5	2 (2%)
Severe visual impairment	6/60	3/60	1	1 (1%)
Blindness	3/60	1/60	1.3	1 (1%)
Blindness	1/60	Light perception	Light perception	0 (0%)
Blindness	No light perception	No light perception	No light perception	0 (0%)

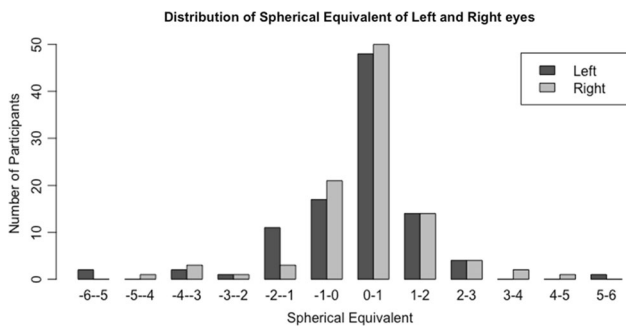


Fig. 1 Distribution of Spherical Equivalent in our participants in terms of left and right eyes.

optometrist, one received the examination while incarcerated in prison while the remaining respondents self-funded the examination. Of the 25 (25%) participants who previously wore prescription glasses, 11 (44%) no longer possessed their glasses, reporting that they had either been lost, stolen or destroyed following assault.

Discussion

The age and ethnicity of our sample was similar to those from previous reports of visual concerns in the homeless [13, 14]. The mean age of our sample was 39.6 ± 10.8 years, which was similar to that of the Hawaii and East London Study (35 and 47.9 years, respectively) [10, 15]. The median age at 40 years was also similar to the UK and Welsh population, at 40.1 and 42.5 years, respectively [13, 14].

Our findings suggested a disparity in ocular health between the homeless and the general population. Our sample subjects were more likely than the general Wales and Cardiff population to suffer from VA that is $\leq 6/12$ ($p < 0.05$, OR = 14.5 and OR = 58.8, respectively) for the age groups between 18–64 years and 65–74 years [16]. Further, the standardised rate ratio (SRR) for VA of $\leq 6/12$ in the

homeless in comparison to the general Welsh population was 7.65. In addition, 1% of our homeless subjects were eligible for blind registration compared to 0.47% from the Sight Loss Data Tool created by the Royal National Institute of Blind People [16].

The prevalence of visual impairment (defined as VA worse than 6/18) for those aged 16–39 years was higher, at 2%, than the global prevalence as reported by the WHO of 1.1% [17]. While a direct comparison should be made with caution, the majority of our participants fall within a similar age range suggesting that homeless people have greater ocular morbidity than the global average, even though they reside in a developed country with universal healthcare.

There was a positive correlation between presenting visual acuity and absolute spherical equivalence was in line with prior literature findings which showed that poorer visual acuity was associated with a higher refractive error [6, 7, 10, 15].

NHS guidelines recommend a sight test once every 2 years [18]. Despite this, only 25% of the participants saw an optometrist in the past five years. In comparison, 73% of the Cardiff population had their eyes tested at least once every 2 years [16]. Several factors could explain this low uptake. Existing sight testing, NHS travel cost or prescription glasses claimant forms require a fixed address as an eligibility criterion. Even though almost all of our participants were qualified otherwise for compensation, they were unable to access the necessary health services due to a lack of a permanent address (fixed abode). Homeless shelters or “no fixed address” were not accepted as valid alternative addresses in these claimant forms. Even if our participants could qualify for certification of visual impairment and subsequent additional support, these forms would require a fixed address as well as seeing an ophthalmologist [19–22].

The main limitation of this study is the lack of a full ophthalmic examination including fundoscopy, as ocular pathology could result in poor vision. Spherical equivalence is a good indicator of overall refractive error in most

instances, and the absence of a full ophthalmic examination was partially addressed with qualitative data surveys. This can be seen from a strong correlation coefficient between absolute spherical equivalent and visual acuity. Most patients with poor vision improved after refraction, therefore a majority of these could be explained by the refractive error. In addition, convenience sampling and selection bias could potentially lead to an overrepresentation of a relatively health-conscious subset of the homeless, yielding better visual acuity and refractive error readings, or better access to spectacles or contact lenses. Further, there might be an aspect of non-respondent bias as the proportion of those refused were not documented. However, the general participation rate remains relatively high and homogenous throughout the three homeless shelters. Ideally, true random sampling techniques would be employed. Further, recruitment was restricted to three shelters which limits generalisability. However, these three sites were the major homeless shelters with an extensive catchment area. While participants with preexisting sight loss might actively seek for an ocular examination, from the questionnaire, we identified that a significant number of participants denied any preexisting ocular morbidities or had urgent concerns over their vision to motivate their need for partaking in the study.

In this study we focused on one simple and treatable aspect of visual impairment, refractive error. In addressing the prevalence of refractive error of the homeless in Cardiff, we can effectively target and improve their physical and mental health, future employability (attaining driving standard vision), rehabilitation where necessary and increase standards of living and overall quality of life. Government policies could also be advised based on our research findings, benefitting the homeless population throughout Wales, the UK and beyond. On a larger scale, documentation of visual impairment in the homeless could influence global initiatives such as the VISION 2020 (World Health Organization) which aims to eliminate avoidable blindness [23].

Summary

What was known before

- The homeless are well known to be a vulnerable group within society, with poorer access to healthcare.
- Previous research has shown a higher prevalence of ocular morbidity, in particular, refractive error and visual impairment in the homeless.
- Governmental policies, particularly in healthcare, should be implemented to support this group of population.

What this study adds

- There is a lack of published literature on the ocular morbidities and visual needs of the homeless worldwide. This is the first prospective cross-sectional study investigating the prevalence of uncorrected refractive error, visual acuity and barriers to healthcare access in the homeless population in the United Kingdom.
- This study obtained baseline information on visual acuity and refractive error, perceptions of ocular health and knowledge of access to service provisions Cardiff's homeless population.
- The study compares the ocular morbidities in the homeless population to the general Cardiff population (age-adjusted), giving insight on prevalence data which was not previously established.

Disclaimer

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Author contributions PP, TY, JEM conceived and designed the study. PP, TP, TY and DA collected data. PP and WW performed statistical analyses. PP and WW drafted the initial manuscript. PP, TP, TY, DA, JEM and WW all reviewed the draft, provided suggestions and improvements.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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