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Delivering eye care to homeless and marginally housed populations during the COVID-19 pandemic: a pilot study

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Objective: Homeless and marginally housed populations experience a higher prevalence of visual impairment relative to the general population. The aim of this pilot study is to present a novel model for conducting ocular screening clinics for homeless individuals during a pandemic and to describe the status of ocular health in this population during this time.

Methods: In this cross-sectional study, 3 outdoor tent-based ocular screening clinics were held in a park in Toronto. Most participants were recruited from local shelters, but additional spots were allocated for homeless individuals on a drop-in basis. Prior to enrolment, each participant underwent COVID-19 screening via a questionnaire and temperature measurement. Those who screened negative received a comprehensive eye examination, including vision testing, dilated fundus examination, and autorefration.

Results: Eleven individuals completed all assessments. The mean age of participants was 54.5 years, and 11 of the participants were male. Visual impairment was found in 5 individuals. Refractive error via pinhole testing was found in 1 patient. Ocular pathology in this sample was found in 4 participants. Two patients required a referral to an ophthalmologist. From a psychosocial perspective, 4 participants reported significant difficulties.

Conclusions: This novel tent-based ocular screening program provides a viable option for screening in a pandemic.

Objectif: Comparativment à la population générale, les personnes sans abri et celles qui sont logées de façon précaire présentent un taux plus élevé de troubles oculaires. Notre étude pilote avait pour objectif de présenter un modèle innovateur en vue de tenir des cliniques de dépistage des troubles oculaires destinées à des sans-abris dans un contexte de pandémie et de décrire la santé oculaire actuelle au sein de cette population.

Méthodes: Dans le cadre de cette étude transversale, 3 cliniques de dépistage des troubles oculaires ont été érigées à l’extérieur dans des tentes installées dans un parc à Toronto. La plupart des participants ont été recrutés dans des refuges locaux, mais quelques places ont été réservées à des sans-abris qui se sont présentés spontanément. Avant l’inscription, chaque participant a subi un dépistage de la COVID-19 (questionnaire et prise de température). Les sujets dont le test de dépistage était négatif ont fait l’objet d’un examen oculaire complet, qui comprenait un examen de la vue, un examen dilaté et une autorefration.

Résultats: Onze personnes, tous des hommes, ont pris part à l’ensemble des examens. L’âge moyen des participants était de 54,5 ans. On a noté un trouble de la vue chez 5 de ces sujets. On a observé une erreur de réfraction lors du trou sténotique chez 1 patient. Une pathologie oculaire a été recensée chez 4 participants. Deux patients ont dû être adressés à un ophtalmologiste. Par ailleurs, 4 participants ont signalé avoir des difficultés importantes du point de vue psychosocial.

Conclusions: Cette méthode innovatrice consiste à installer une clinique de dépistage oculaire à l’intérieur d’une tente représentant une option viable pour réaliser des dépistages dans un contexte de pandémie.

The homeless and marginally housed (HMH) population represents a vulnerable group in society that is subject to an increased burden of illness relative to the general population. In addition to a multitude of general comorbidities, lower income has been shown to be associated with poor ocular health, including an increased incidence of glaucoma, cataracts, and dissatisfaction with vision [1–4]. At baseline, this group faces a number of structural barriers to accessing ophthalmic care. The introduction of COVID-19 clinical guidelines has resulted in a significant reduction in in-person clinical activity, and widespread lockdowns have forced some clinics to cease operations entirely [5]. Furthermore, patients are reluctant to seek care because of fear of COVID-19 exposure. Consequently, patients are now presenting with more serious sequelae of ocular disease [6,7].

Since the onset of the pandemic, there has been a rise in tent encampments in Canadian urban centres because of fear of contracting COVID-19 in shelters, which may affect access to ocular care owing to a lack of support typically provided by shelters [8,9]. The aim of this pilot study was to describe a novel tent-based ocular screening clinic model that constitutes a cost-effective method for screening and conforms to the current best practice guidelines outlined by Public Health Ontario. We also provide insight into the ocular health of this population during the pandemic.
Methods

Three outdoor mobile ocular screening clinics were held in a downtown park in Toronto between September and October 2020. The location was selected based on the proximity to the Sherbourne Health Bus, a mobile medical facility serving downtown Toronto’s HMH population. Clinics were held between 4:00 and 8:00 PM. Ethics approval was obtained from the St. Michael’s Hospital Ethics Review Board (#20-214). The study was conducted in accordance with the Declaration of Helsinki, and all participants provided written informed consent to participate. Funding for the mobile clinic tent structure, medical equipment, personal protective equipment, and prescription spectacles was obtained from the St. Michael’s Hospital Foundation.

Our group has previously described the nature and implementation of ocular screening programs for vulnerable populations [10–13]. The clinics took place outdoors using a portable tent as a central storage space for equipment. All providers underwent COVID-19 testing and screening prior to each clinic (Supplementary Table 1, available online). All providers wore scrubs as well as appropriate personal protective equipment including an N95 mask, face shield, gloves, gown, and a disposable cap at all times.

Procedure

The inclusion criteria for study participation were as follows: (i) homeless or marginally housed, (ii) able and willing to participate, (iii) must pass a screening questionnaire for symptoms of COVID-19, (iv) temperature lower than 38°C, (v) understands the risks and benefits of participating and signs a consent form, (vi) >18 years of age, and (vii) able to communicate in English. The exclusion criteria included (i) failure to pass a screening questionnaire for symptoms of COVID-19, (ii) refusal to have temperature taken or temperature ≥38°C, (iii) refusal to provide informed consent, or (iv) unable to participate in the assessment. The benefits for participants enrolled in this study included a free eye examination, free reading glasses, prescription for ocular medications, and referrals for care when indicated.

Participants were recruited through announcements and registration at local homeless shelters. Additional slots were allocated for individuals residing in nearby encampments to attend on a drop-in basis; these patients were recruited based on their proximity to the screening location. All potential participants underwent COVID-19 screening. Participants who screened negative were provided with a medical-grade mask and were required to conduct hand hygiene before entering the clinic. Participants then completed a verbal questionnaire that included general demographic information, place of residence, level of education, monthly income, and medical and ocular history (Supplementary Table 2, available online). These questions were derived from previously validated questionnaires or previously published studies [10,13]. Participants also were asked about how the pandemic has affected their general health, quality of life, and access to eye care (Table 1).

Visual acuity was assessed using a Snellen chart for both near and distance vision, with pinhole occlusion to eliminate refractive error. Visual impairment was defined as visual acuity of 20/50 or worse in the eye with better vision. Confrontation visual fields, pupils, and extraocular movements were assessed by a trained examiner. Intraocular pressure was measured using a portable tonometer (Tono-Pen AVIA; Reichert, Buffalo, NY). Each participant was examined using a portable slit lamp and underwent a dilated fundus examination using an indirect ophthalmoscope. An autorefractor was used to measure the participant’s refractive error.

Statistical analysis

Demographic data, clinical characteristics, and outcomes were summarized by standard descriptive statistics. Continuous variables were described in terms of medians and interquartile ranges, whereas percentages were used for categorical variables.
Twelve participants across 3 clinics were recruited. One participant was unable to participate because of intoxication. Eleven participants ultimately underwent all assessments. Six were recruited through shelter announcements, and 5 were allocated to drop-in spots. Figure 1 presents the patient recruitment flowchart. Participants had a median age of 54.5 years (interquartile range [IQR], 51.8–59.3), had been homeless for a median of 5 years (IQR, 1.5–7.0 years), and were unemployed at the time of screening. Demographic information is presented in Table 2. The majority of participants were male (n = 11), Caucasian (n = 11), and had at least some high school education (n = 5).
Two participants reported alcohol use disorder as well as 1 each of nonintravenous and intravenous drug use. Six participants reported mental health disorders including depression, posttraumatic stress disorder, and anxiety. One participant had a previous diagnosis of diabetes, and 1 participant had a diagnosis of hepatitis C. Six of the study participants reported that their health was negatively affected by the pandemic, with 4 endorsing substantial difficulty due to COVID-19.

Only 1 participant reported satisfaction with his vision. The ocular conditions reported by study participants are presented in Table 3. Two participants reported a history of ocular surgery, including 1 case of strabismus repair and 1 case of retinal detachment repair. Ten participants self-reported an active ocular condition, and none had accessed eye care within the preceding year. Ten participants reported wearing prescription glasses currently or in the past. Of these, participants reported that their glasses had either been lost (n = 3), stolen (n = 2), or broken (n = 2) or were not available at the time of visual assessment (n = 3). The median intraocular pressure was 9.5 mm Hg (IQR, 7.3–11.0 mm Hg).

Five participants had a visual acuity worse than 20/50 (Table 4), 1 of which was due to correctable refractive error and 4 due to ocular pathology (Table 5), including nuclear sclerotic cataracts (n = 1), moderate nonproliferative diabetic retinopathy (n = 1), chalazion (n = 1), and pterygia (n = 1). Two patients required a referral to an ophthalmologist for further management, as detailed later. Patient 4 was a 59-year-old African-Canadian male with hypertension and hypercholesterolemia. On examination, his visual acuity was hand motion OU, and the reminder of the examination was unremarkable except for dense nuclear sclerotic cataracts. His most recent ophthalmic examination of record included a visual acuity of 20/100 with correction and was marked with vision.

Table 2—Demographic characteristics

| Characteristic                        | Number of Participants (%) |
|--------------------------------------|----------------------------|
| Sex                                  |                            |
| Male                                 | 11 (91.7)                  |
| Female                               | 1 (8.3)                    |
| Age (y)                              |                            |
| 40–49                                | 3 (25.0)                   |
| 50–59                                | 6 (50.0)                   |
| > 60                                 | 3 (25.0)                   |
| Total years spent homeless*          |                            |
| <1                                   | 2 (18.1)                   |
| 1-5                                  | 4 (36.4)                   |
| >5                                   | 5 (45.5)                   |
| Ethnicity                            |                            |
| Caucasian                            | 7 (58.3)                   |
| African Canadian                     | 3 (25.0)                   |
| Indigenous                           | 2 (16.7)                   |
| Marital status                       |                            |
| Married                              | 0                          |
| Divorced                             | 4 (33.3)                   |
| Separated                            | 2 (16.7)                   |
| Single                               | 6 (50.0)                   |
| Highest level of education achieved  |                            |
| Some high school                     | 5 (41.7)                   |
| Completed high school                | 4 (33.3)                   |
| Some postsecondary                   | 1 (8.3)                    |
| Completed postsecondary              | 2 (16.7)                   |
| Monthly income (CAD)                 |                            |
| $500                                 | 6 (50.0)                   |
| $500–$1000                           | 0                          |
| >$1000                               | 6 (50.0)                   |
| Income support                       |                            |
| Ontario Works                        | 6 (50.0)                   |
| Ontario Disability Support Program   | 6 (50.0)                   |

*Only 11 patients responded with the number of years they had been homeless.

Table 3—Questionnaire results

| Questionnaire Item (item number if applicable) | Number of Participants (%) or Scale (median [interquartile range]) |
|------------------------------------------------|---------------------------------------------------------------|
| Owned prescription or contact lenses           | 10 (83.3)                                                     |
| Previous ocular diagnosis                      |                                                              |
| Cataract                                        | 1 (8.3)                                                       |
| Retinal detachment                              | 1 (8.3)                                                       |
| Previous eye surgery or procedure               |                                                              |
| Strabismus repair                               | 1 (8.3)                                                       |
| Retinal detachment repair                       | 1 (8.3)                                                       |
| Most recent ocular examination [1]              |                                                              |
| <2                                              | 2 (16.7)                                                      |
| 2–4                                             | 6 (50.0)                                                      |
| 5–10                                            | 2 (16.7)                                                      |
| >10                                             | 2 (16.7)                                                      |
| Satisfied with vision [2]                       |                                                              |
| Yes                                             | 1 (8.3)                                                       |
| No                                              | 11 (91.7)                                                     |
| Difficulty accessing eye care prior to pandemic [3] |                                                  |
| Yes                                             | 1 (8.3)                                                       |
| No                                              | 11 (91.7)                                                     |
| Pandemic affected ability to seek eye care [4]  |                                                              |
| Yes                                             | 5 (41.7)                                                      |
| No                                              | 7 (58.3)                                                      |
| Quality of life affected by eye health (1–10) [5] | 6.0 (4.5–7.0)                                      |
| Concern for eye health (1–10) [6]              |                                                              |
| Yes                                             | 9.0 (7.0–10.0)                                                |
| No                                              |                                                              |
| Preferred eye care environment [7]              |                                                              |
| Emergency room                                  | 2 (16.7)                                                      |
| Walk-in clinic                                   | 3 (25.0)                                                      |
| Shelter eye clinic                               | 1 (8.3)                                                       |
| Mobile tent clinic                               | 4 (33.3)                                                      |
| Other                                           | 2 (16.7)                                                      |
| Pandemic affected general health [8]            |                                                              |
| Yes                                             | 6 (50.0)                                                      |
| No                                              | 6 (50.0)                                                      |
| Impact of COVID-19 on daily living (1–10) [9]   | 4.0 (3.0–4.25)                                                |
| Can barely get through the day                  | 4 (33.3)                                                      |
| Can get through the day with difficulty         | 0                                                            |
| I can manage                                     | 2 (16.7)                                                      |
| Some problems, not too big a deal               | 5 (41.7)                                                      |
| I don’t notice much of a difference from my days before COVID-19 | 1 (8.3) |

Table 4—Visual acuity according to the North American standard classification

| Visual acuity                  | Presenting Visual Acuity (number of participants, %) | After Pinhole Correction (number of participants, %) |
|-------------------------------|--------------------------------------------------------|-------------------------------------------------------|
| Not impaired                  | 1 (9.1)                                                | 2 (18.2)                                              |
| 20/20 or better               | 5 (4.5)                                                | 4 (36.4)                                              |
| 20/25–20/30                   | 0                                                      | 1 (9.1)                                               |
| Low vision                    | 1 (8.3)                                                | 3 (27.3)                                              |
| Blind                         | 3 (27.3)                                               | 1 (9.1)                                               |
| 20/200 or worse               | 3 (27.3)                                               | 1 (9.1)                                               |
recent ocular examination was by an optometrist in 2019, though he had not been able to follow up with his referral for cataract surgery because of lack of travel support. Prior to developing cataracts, he reported no ocular diseases and had not undergone any ocular surgeries. He completed postsecondary education, lives in subsidized housing, and is currently supported by the provincial disability support program. On referral, he successfully underwent cataract removal in October 2020, and his postoperative vision was 20/40 OD and 20/70 OS, which improved to 20/20 with appropriate spectacles.

Patient 12 was a 53-year-old Caucasian male with long-standing diabetes and a previous pulmonary embolism. On examination, his visual acuity was 20/63 OU on pinhole refraction. Both pupils were equal and reactive to light without a relative afferent papillary defect, and his intraocular pressure was 6 mm Hg in his right eye and 8 mm Hg in his left. His dilated fundus examination was significant for several retinal hemorrhages and hard exudates in both eyes as well as macular edema in his left eye indicating worsening diabetic retinopathy. He had difficulty accessing primary care for management of his diabetes, which he reports was exacerbated by the pandemic. His last ocular examination was in 2019, at which point he was diagnosed with mild diabetic retinopathy. He had no other ocular conditions and no ocular surgical history. He earned a college diploma, is currently supported by a provincial disability support program, and lives in subsidized housing. A referral was made to a retina specialist for further follow-up.

### Discussion

The HMH population is known to experience a higher prevalence of visual impairment than the general population, with previous studies reporting an incidence of 25.2% (95% CI, 16.7%-33.7%) and 5.7% (95% CI, 5.4-6.0), respectively, before the onset of the COVID-19 pandemic [4,10,11,14,15]. Our study found five individuals experiencing visual impairment. Due to the limited sample size, it is not possible to make a definitive conclusion regarding the effects of the pandemic on the prevalence of visual impairment in this population.

The social determinants of health (SDH) refer to the financial and social factors contributing to the inequalities shaping an individual’s health status [16]. Previous research suggests that these factors interact in complex ways to negatively affect the health outcomes in HMH populations [4,10,17,18]. In particular, studies have shown a bidirectional relationship between socioeconomic status and visual impairment and have established that visual impairment is associated with reduced educational attainment and income level [10,11,14]. Identifying and mitigating the etiologies of visual impairment therefore may represent an effective and low-cost intervention to improve overall health and quality of life in this vulnerable population.

Our study found that 3 participants with visual impairment had either completed or partially completed high school without pursuing further education. Limited education is associated with poor health literacy, which directly affects an individual’s understanding of his or her own health and ability to navigate the healthcare system [17]. Existing research also suggests that homeless individuals may experience reduced levels of health literacy, and this, in turn, may act as a barrier to accessing care [19]. These factors may help account for the study population’s low utilization of health care services. Despite the Canadian universal health coverage system and access to emergency ophthalmic care via public insurance, only 2 participants reported receiving an eye examination in the previous 1-year period compared with 41.0% in the general population [20]. Of note, only 1 participant in this study reported satisfaction with their vision. In part, this may be explained by the fact that routine eye examinations for individuals without an ocular condition diagnosed between the ages of 20 and 64 are not covered by provincial health insurance, unless they are covered by the Ontario Disability Support Program [21]. Furthermore, some HMH individuals may not have access to Ontario Health Insurance Program coverage, as is the case for refugees who are no longer covered by the refugee health program. Ultimately, this limitation may contribute to further ocular health disparities between those who are able to afford care and those who cannot. Screening clinics such as ours represent an important step toward addressing this disparity, given that follow-up ophthalmic care is covered by provincial health insurance after initial diagnosis.

Evolving research also suggests that the COVID-19 pandemic may be contributing to an increased prevalence of mental illness in the general population, which is concerning in that the HMH populations already reported higher rates of mental health conditions prior to the pandemic, and the harsh conditions associated with homelessness are known to exacerbate poor mental health [22–25]. Within this study, 4 participants reported that they could “barely get through the day” due to the COVID-19 pandemic. The most commonly reported emotions included sadness and worry.

COVID-19 clinical guidelines reduced in-person clinical activity, which may contribute to underutilization of ocular care services in this population. Online innovations such as telehealth have emerged as a means to provide physically distanced medical care, but HMH individuals often lack access to the digital devices and private space necessary for online medical appointments. The outdoor tent-based ocular screening model

### Table 5—Ocular pathology of 11 homeless participants sampled

| Ocular Pathology                                      | Number of Participants (%) |
|--------------------------------------------------------|-----------------------------|
| Cataracts (bilateral)*                                  | 1 (9.1)                     |
| Chalazion                                              | 1 (9.1)                     |
| Nonproliferative diabetic retinopathy (moderate, bilateral) | 1 (9.1)               |
| Pterygia (bilateral)                                   | 1 (9.1)                     |

*World Health Organization Grade NUC-3.

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presented in this study represents a safe and effective means of addressing this disparity while complying with COVID-19 safety regulations. All study personnel received personal protective equipment training prior to participation and used proper donning and doffing techniques that were supervised by the study administrator. None of the study personnel contracted COVID-19 during the study period. All patients complied with study precautions, and those who did not pass screening were offered to reschedule their appointment at the clinic after they had completed their isolation and were symptom free. The mobile tent-based model was easily implemented because the researchers were able to erect and deconstruct the tent for each clinic and transport the tent and supplies in a taxicab.

This pilot study helps to lay the groundwork for future research. Future research should focus on evaluating the viability of this targeted intervention in a larger sample of HMH individuals and exploring further solutions to help reduce barriers to care in this population. Such solutions may include investing in technology for the HMH population to receive telemedicine and close collaboration with social workers and shelter staff. Further research also should include an emphasis on mental health outreach because of the high levels of psychological distress reported by participants, as well as assessment and promotion of health literacy. Once regular clinical activities resume, this model for ocular screening clinics will have continued salience as a method for providing care in low-resource settings.

The primary limitation of this pilot study was its sample size, which limits the direct comparability of the results to the broader population. This was largely affected by inclement weather, which is common to the geographic location and timing of this study and affected our ability to conduct expansive outdoor clinics. Another limitation was the lack of a control group, which may have contributed to selection bias. The equipment used in this study also introduces some limitations because a portable slit lamp is less reliable than a traditional slit lamp, and autorefration was used as opposed to manual refraction. Finally, because the study was conducted early in the course of the COVID-19 pandemic, the prevalence reported may not fully represent the status of ocular health among the HMH population throughout the second and third waves of the pandemic.

Conclusion

This pilot study represents the first proposed model for successfully conducting ocular screening clinics safely during the COVID-19 pandemic. To the best of our knowledge, it also constitutes the first assessment of the ocular health of HMH populations during the pandemic. Our results suggest that community-based mobile clinics such as ours may present an effective method for providing care to this vulnerable population during COVID-19. As the pandemic continues to shape the health-care landscape, it is essential that the current standard of ocular health-care provision evolves to meet the needs of this population and overcome barriers to accessing care.

CRediT Author Statement

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Supplementary Materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.jcjo.2021.08.018.

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Footnotes and Disclosure

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