Original Investigation

Accuracy and Utility of Self-report of Refractive Error

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IMPORTANCE Large-scale generic studies offer detailed information on potential risk factors for refractive error across the life course, but ophthalmic examination in such cases to determine the refractive error phenotype is challenging and costly. Thus, refractive status is commonly assigned using questionnaires. In a population survey, often only a few condition-specific self-reported questions can be included, so the questions used must be effective in ruling in those who have the trait of interest and ruling out those who do not.

OBJECTIVE To determine the accuracy of identification of refractive status using self-reported age at and/or reason for first use of glasses or contact lenses (optical correction).

DESIGN, SETTING, AND PARTICIPANTS The UK Biobank study, a cross-sectional epidemiologic study, included 117 278 participants aged 40 to 69 years in 6 regional centers in England and Wales. Data for the present study were assessed from June 2009 to July 2010. Patients underwent autorefraction measurement. Spherical equivalent in the more extreme eye was used to categorize myopia (−1.00 diopter [D] or more extreme) and hypermetropia (+1.00 D or more extreme).

MAIN OUTCOMES AND MEASURES Sensitivity and specificity of the reason for optical correction were assessed using autorefraction as the gold standard. Receiver operating characteristic curves assessed the accuracy of self-reported age at first use of optical correction and incremental improvement with addition of the reason.

RESULTS Of the 95 240 participants who reported using optical correction (55.6% female; mean [SD] age, 57.7 [7.5] years), 92 121 (96.7%) provided their age at first use and 93 156 (97.8%) provided the reason. For myopia, sensitivity of the reason for optical correction was 89.1% (95% CI, 88.7%-89.4%), specificity was 83.7% (95% CI, 83.4%-84.0%), and positive and negative predictive values were 72.7% (95% CI, 72.2%-73.1%) and 94.0% (95% CI, 93.8%-94.2%), respectively. The area under the curve was 0.829 (95% CI, 0.826-0.831) and improved to 0.928 (95% CI, 0.926-0.930) with combined information. By contrast, self-report of the reason for optical correction of hypermetropia had low sensitivity (38.1%; 95% CI, 37.6%-38.6%), and the area under the curve with combined information was 0.713 (95% CI, 0.709-0.716).

CONCLUSIONS AND RELEVANCE In combination, self-report of the reason for and age at first use of optical correction are accurate in identifying myopia. These findings indicate an agreed set of questions could be implemented effectively in large-scale generic population-based studies to increase opportunities for integrated research on refractive error leading to development of novel prevention or treatment strategies.

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Refractive error, particularly myopia, is an important public health concern worldwide, because it is the most common cause of impaired vision and because of the associated risk for complications causing blindness.[1] The costs of correction (optical or surgical) are high.[2] Striking temporal changes in whole-population distribution of refraction have resulted in increased frequency and severity of myopia in particular. Half of the adult population in the United States and Western Europe[3-5] now has refractive error, and an even greater proportion of Asian populations has myopia.[6]

The challenge for prevention and disease modification now lies in combining genetic, classic, and life-course epidemiologic research to elucidate how genetic and environmental risk factors combine to influence risk and severity.[7,8] Such research requires very large general population-based surveys and/or cohort studies with detailed information on potential risk factors across the life course, information that is often lacking in disorder-specific ophthalmic studies. Undertaking a detailed ophthalmic assessment in this context, usually using nonspecialist examiners, to determine refractive status with accuracy is methodologically challenging, time consuming, and costly. An alternative approach has been to elicit refractive status using questionnaires. Although limited research has investigated the validity of self-reported questionnaire data on refraction, investigators recognize that accuracy depends on the specific questions asked and whether responses are used singly or in combination.[9,10] We herein report on the utility of self-report of the reason for and age at first use of glasses or contact lenses (optical correction), separately or in combination, for categorization of myopia and hypermetropia in the UK Biobank Study, a contemporary population-based study unparalleled for its scale and scope.

Key Points

Question Is self-reported age at, or the reason for, first ever use of optical correction accurate in identifying refractive status?

Findings In this UK adult population, self-report of the reason for and age at first use of optical correction were found to have good accuracy for identification of myopia when compared with spherical equivalent in the more extreme eye, and the accuracy improved if the information was combined. However, the prediction of hypermetropia was poor overall.

Meaning Questions relating to age at or reason for first use of optical correction could be implemented effectively in large-scale generic population-based studies on refractive error.

Methods

Study Population

The UK Biobank Study is a prospective investigation of health and disease in more than 500 000 adults recruited from February 2006 to July 2010 (http://www.ukbiobank.ac.uk/). From June 2009, the protocol included an ophthalmic examination consisting of noncycloplegic autorefraction (RC-5000 Auto Refkeratometer; Tomey Corp) on a subsample of 117 278 participants (23.3% of the entire sample) aged 40 to 69 years in 6 regional centers in England and Wales, as reported elsewhere.[11] The UK Biobank Study has been approved by the North West Multicentre Research Ethics Committee, which covers the United Kingdom. The study also obtained approval in England and Wales from the Patient Information Advisory Group, which has since been replaced by the National Information Governance Board for Health and Social Care, which allows access to information for inviting individuals to participate. Participants recruited into the UK Biobank Study provided written informed consent.

Classification of Refractive Errors

Spherical equivalent (SE) measurements (algebraic sum in diopters [D] of the sphere + 0.5 cylinder) were used to categorize refractive error in each eye, with a threshold of −1.00 D or more extreme for myopia. We defined the following categories: mild myopia (−1.00 to −2.99 D), moderate myopia (−3.00 to −5.99 D), high myopia (−6.00 D or worse), emmetropia (−0.99 to 0.99 D), mild hypermetropia (+1.00 to +2.99 D), and moderate to high hypermetropia (+3.00 D or more extreme).

Participants answered the following questions with the given response options about optical correction:

1. Do you wear glasses or contact lenses to correct your vision?
(1) Yes; (2) no; or (3) prefer not to answer.

2. If yes, what age did you first start to wear glasses or contact lenses?
(1) Age in years; (2) do not know; or (3) prefer not to answer.

3. If yes, why were you prescribed glasses or contact lenses?
(1) For short-sightedness (ie, only or mainly for distance viewing such as driving, cinema, etc) (called *myopia*); (2) for long-sightedness (ie, for distance and near tasks like reading) (called *hypermetropia*); (3) for just reading/near work as you are getting older (called *presbyopia*); (4) for astigmatism; (5) for a “squint” or “turn” in an eye since childhood (called *strabismus*); (6) for a “lazy” eye or an eye with poor vision since childhood (called *amblyopia*); (7) other eye condition; (8) do not know; or (9) prefer not to answer.

Statistical Analysis

Data were assessed from June 2009 to July 2010. Assignment of myopia and hypermetropia by self-reported use of corrective lenses, the reason for their use, and age at first use were validated using SE measurement on the more extreme eye (the larger absolute SE difference from zero) as the gold standard. Sensitivity and specificity were calculated for participants who reported myopia as the reason for their optical correction using the cutoff of SE −1D (ie, the proportion of those with SE −1.00 D or more extreme [true-positive myopia]) and for participants who did not report myopia as the reason for optical correction (ie, the proportion of those with SE −0.99 D or greater [true-negative myopia]). The proportion of participants who self-reported myopia as the reason for use of optical correction and who had myopic refraction (positive predictive value) and the proportion of those who did not give myopia as the reason for use of optical correction and did not have myopic refraction (negative predictive value) were used to estimate the utility of self-report of myopia. Estimates were similarly calculated for hypermetropia. We

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Table 1. Categorization of Refractive Error Status by Self-report vs Autorefraction Measure[a]

Self-reported Refractive Error	No. (%) of Participants	Refractive Error Category by SE, No. (%) of Participants		
		Myopia	Emmetropia	Hypermetropia
Myopia only	30 855 (82.6)	24 266 (78.6)	4550 (14.7)	2039 (6.6)
Myopia and presbyopia	6292 (16.8)	2746 (43.6)	1978 (31.4)	1568 (24.9)
Myopia and other[b]	221 (0.6)	138 (62.4)	45 (20.4)	38 (17.2)
Myopia (overall)	37 368 (40.1)	27 150 (72.7)	6573 (17.6)	3645 (9.8)
Hypermetropia only	14 196 (72.2)	1224 (8.6)	4398 (31.0)	8574 (60.4)
Hypermetropia and presbyopia	232 (1.2)	19 (8.2)	72 (31.0)	141 (60.8)
Hypermetropia, presbyopia, and astigmatism	2447 (12.5)	97 (4.0)	843 (34.4)	1507 (61.6)
Hypermetropia and astigmatism	1400 (7.1)	223 (15.9)	344 (24.6)	833 (59.5)
Hyperopia and other[c]	1371 (7.0)	86 (6.3)	146 (10.6)	1139 (83.1)
Hyperopia (overall)	19 646 (21.1)	1649 (8.4)	5803 (29.5)	12 194 (62.1)
Other reasons[d]	36 142 (38.8)	1676 (4.6)	18 309 (50.7)	16 157 (44.7)
All	93 156 (100)	30 475 (32.7)	30 685 (32.9)	31 996 (34.3)

Abbreviations: D, diopter; SE, spherical equivalent.

[a] Myopia was defined as −1.00 D or more extreme; emmetropia, −0.99 to 0.99 D; and hypermetropia, 1.00 D or more extreme. Percentages have been rounded and might not total 100.

[b] Includes astigmatism, strabismus, amblyopia, or other.

[c] Includes strabismus, amblyopia, or other.

[d] Indicates other than myopia or hypermetropia.

Table 2. Sensitivity and Specificity of Myopia or Hypermetropia in Self-reported Use of Optical Correction

	Sensitivity, % (95% CI)	Specificity, % (95% CI)	PPV, % (95% CI)	NPV, % (95% CI)
Reason for use of optical correction (n = 93 156)				
Myopia	89.1 (88.7-89.4)	83.7 (83.4-84.0)	72.7 (72.2-73.1)	94.0 (93.8-94.2)
Hypermetropia	38.1 (37.6-38.6)	87.8 (87.6-88.1)	62.1 (61.4-62.7)	73.1 (72.7-73.4)
Reason for use of optical correction and no reported use of optical correction (n = 104 899)				
Myopia	85.7 (85.3-86.1)	86.0 (85.8-86.3)	72.7 (72.2-73.1)	93.3 (93.1-93.5)
Hypermetropia	37.0 (36.5-37.5)	89.6 (89.4-89.9)	62.1 (61.4-62.7)	75.7 (75.4-75.9)

Abbreviations: NPV, negative predictive value; PPV, positive predictive value.

generated receiver operating characteristic curves for the age at first use of optical correction (continuous variable) and for the combined variables of the reasons for and age at first use of optical correction. We used the area under the curve (AUC) to compare the predictive models. The nonparametric Spearman correlation coefficient was used for self-reported age at first use of optical correction and refractive error measurements. Analyses were performed using Stata software (version 13; StataCorp LP).

Results

Participation and Study Sample

Autorefraction data were available for 107 409 participants (91.6% of those invited). Those participants who did not meet the protocol requirements, including those who did not undergo testing or had no measurement available owing to equipment failure (n = 4079), who had prior eye treatment or a condition that could affect current refraction (eg, cataract, cataract surgery, or myopia secondary to other ocular condition [n = 5058]), and who had highly discordant refraction measures for the 2 eyes (n = 732), were excluded as described elsewhere.[11] Four hundred twenty-six participants had no information on the use of optical correction (eFigure 1 in the Supplement).

Of those 107 409 participants with refraction data, 54.4% were female. The mean (SD) age of female participants was 56.4 (8.0) years; of male participants, 56.9 (8.2) years (overall, 56.6 [8.1] years). Thirty-two thousand one hundred sixty-five individuals (29.9%) had myopia; 34 064 (31.7%), hypermetropia; and 41 180 (38.3%), emmetropia (eTable in the Supplement).

Accuracy of Self-report of Reason for Optical Correction

Of 107 409 participants, 95 240 (88.7%) reported wearing glasses or contact lenses (55.6% female; mean [SD] age, 57.7 [7.5] years). Of these, 93 156 (97.8%) reported the reason for wearing glasses, including myopia in 37 368 (40.1%), hypermetropia in 19 646 (21.1%), or other reasons (eg, astigmatism or presbyopia) in 36 142 (38.8%) (**Table 1**).

Myopia

The sensitivity for myopia was 89.1% (95% CI, 88.7%-89.4%), whereas the specificity was 83.7% (95% CI, 83.4%-84.0%) (**Table 2**). The positive and negative predictive values for myopia were 72.7% (95% CI, 72.2%-73.1%) and 94.0% (95% CI, 93.8%-94.2%), respectively. Of those participants who self-reported having myopia, 6573 (17.6%) were actually emmetropic, with a median SE of −0.50 (interquarile range [IQR], −0.76 to 0.16) D, and 3645 (9.8%) were hypermetropic, with a median SE of 2.13 (IQR, 1.53 to 3.09) D (Table 1). The median age of those reporting myopia who in fact had emmetropia was 58 (IQR, 50-63) years, with a median age at first use of optical correction of 30 (IQR, 18-45) years, and 1991

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(30.3%) reported wearing glasses for presbyopia as well as myopia. Of those who reported myopia but actually had hypermetropia, the median age was 63 (IQR, 59-66) years with a median age at first use of optical correction of 40 (IQR, 18-48) years, and 1577 (43.3%) reported wearing glasses for presbyopia as well.

Hypermetropia

In the group of 19 646 participants self-reporting hypermetropia, the sensitivity of the question on reason for wearing optical correction was 38.1% (95% CI, 37.6%-38.6%), with a higher specificity of 87.8% (95% CI, 87.6%-88.1%) (Table 2). Of those participants who self-reported hypermetropia, 5803 (29.5%) actually had emmetropia, with a median SE of 0.38 (IQR, −0.28 to 0.70) D, and 1649 (8.4%) had myopia, with a median SE of −2.44 (IQR, −4.49 to −1.42) D (Table 1). Thus, the positive predictive value was 62.1% (95% CI, 61.4%-62.7%), and the negative predictive value was 73.1% (95% CI, 72.7%-73.4%) (Table 2). The median age of those who reported having hypermetropia and actually had emmetropia was 58 (IQR, 51-63) years, with a median age at first use of optical correction of 42 (IQR, 25-48) years, and 940 (16.2%) reported wearing glasses for presbyopia and hypermetropia. Those who self-reported hypermetropia and actually had myopia had a median age of 58 (IQR, 52-63) years and reported the median age at first use of optical correction as 18 (IQR, 12-32) years. Of this group, 125 (7.6%) reported wearing glasses for presbyopia. Overall, 92 121 study participants (96.7%) reported the age at first use of optical correction, with 90 307 (94.8%) reporting first age at and reason for use of optical correction.

Myopia

The median age at first use of optical correction for those with myopia was 15 (IQR, 11-22) years (**Figure 1**A). The median SE in participants with myopia varied by age at first use from −5.63 (IQR, −7.98 to −3.72) D in those younger than 10 years to −1.49 (−2.07 to −1.20) D in those 40 years or older (**Table 3**). We found an association between the age at first use of optical correction and severity of myopia; 95.1% of those with high myopia, 80.9% of those with moderate myopia, and 46.7% of those with mild myopia used optical correction at younger than 20 years (Table 3). Most participants with first use of optical correction at 40 years or older had mild myopia.

Hypermetropia

Although the overall median age reported at first use of optical correction for participants with hypermetropia was 42 (IQR, 26-49) years, most reported use at younger than 20 years (20.4%) or from 40 to younger than 60 years (64.0%), which reflected childhood hypermetropia or the onset of presbyopia in midlife with the associated age-related hyperopic shift in refractive error, with or without preexisting mild hypermetropia (Figure 1B). In participants with hypermetropia, median SE varied by first age at use of optical correction from 4.16 (IQR, 2.56-5.88) D in those younger than 10 years to 1.75 (IQR, 1.33-2.43) D in those 40 years or older. Among participants with high or moderate hypermetropia, 45.6% started to wear glasses at younger than 20 years, whereas 76.2% of those with mild hypermetropia started wearing glasses at 40 years or older (Table 3). The correlation coefficients between the age at first use of optical correction and mean SE were 0.55 ($P < .001$) and −0.38 ($P < .001$) for myopia or hypermetropia, respectively.

The receiver operating characteristic curves were plotted separately for myopia and hypermetropia (**Figure 2**A and C). The AUC for myopia was 0.829 (95% CI, 0.826-0.831), with a threshold of age at first use of optical correction at 28 years giving the best sensitivity (83.9%; 95% CI, 83.5%-84.3%) and specificity (77.3%; 95% CI, 77.0%-77.7%) for myopia.

The AUC for hypermetropia was 0.612 (95% CI, 0.607-0.615), which indicated poor prediction of hypermetropia with the age at first use of optical correction. Similar poor predictive value was obtained by plotting receiver operating characteristic curves by selecting the participants' age at first use of optical correction use at younger than 30 years or 30 years or older, which is the threshold indicated by the age distribution in those with hypermetropia (eFigure 2A-C in the Supplement).

Accuracy of Self-reported Age at First Use and Reason for Use of Optical Correction

The AUC for myopia was improved to 0.928 (95% CI, 0.926-0.930) with the addition of information on the reason for the use of optical correction (Figure 2B). Overall, the AUC for hypermetropia was 0.713 (95% CI, 0.709-0.716) with the additional information (Figure 2D); however, in the subsample of participants with the age at first use of optical correction at 30 years or younger, the AUC was 0.781 (95% CI, 0.774-0.788) (eFigure 2B in the Supplement).

Discussion

In this UK adult population, self-report of the reason for and age at first use of optical correction was found to have good accuracy for identification of myopia (threshold, −1.00 D or more extreme) compared with SE (autorefraction) in the more extreme eye as the gold standard, with the accuracy being improved if this information was combined. Overall prediction of hypermetropia was poor; however, the accuracy improved when only those 30 years or younger at first use of optical correction were included.

We found an association between age at first use of optical correction, used as a proxy for age of onset, and severity of myopia and hypermetropia, which is consistent with prior research.[12] Further direct comparison with other studies is not straightforward because of the use of different direct or indirect questions to elicit reasons for the use of optical correction or the use of examination of prescribed distance glasses to identify those with refractive error and because of the use of prescription data or autorefraction measures as the gold standard. In addition, no consensus in epidemiologic studies on optimal definitions of myopia or hypermetropia exists, which affects the prevalence and sensitivity and specificity estimations.[6,9,10,13,14]

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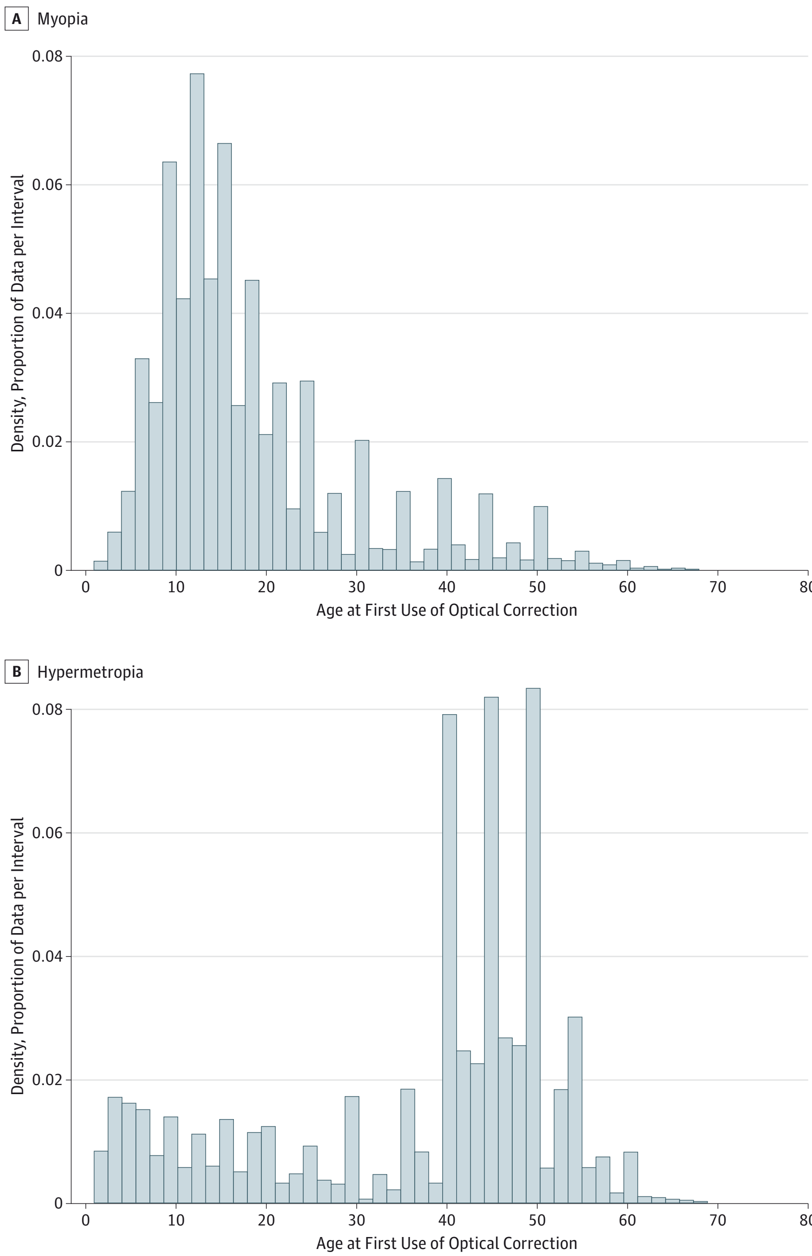
Figure 1. Distribution of Age at First Use of Optical Correction by Refractive Error



For this study, myopia is defined as a spherical equivalent (SE) of −1.00 diopters (D) or more extreme; hypermetropia, SE of 1.00 D or more extreme.

Despite the scale and size of the UK Biobank Study, some limitations should be noted. Identification of refractive error based on self-report of prescribed optical correction meant that participants with undiagnosed (and therefore untreated) refractive error would be misclassified. However, in the United Kingdom, those with undiagnosed refractive error in this age group are likely to have mild late-onset myopia, as are those who wore glasses previously but no longer required them. Thus, most individuals with a primary refractive error will have been identified by the lead question on the use of glasses or contact lenses. Refractive error status in individuals was assigned based on the more extreme eye to avoid misclassification of those with anisometropia, which occurs when using the mean SE of 2 eyes. Finally, the self-report questions used in the UK Biobank Study were intended to categorize refractive status as a categorical variable, in keeping with norms in classic and life-course epidemiology. Separate questions about the reasons for the first use and current use of optical correction are needed to account for refractive shift (hypermetropic or myopic) in later adult life. In genetic epidemiology, analyzing refraction as a continuous quantitative trait has an advantage, but self-report could nevertheless be useful as a means of identifying individuals eligible for further detailed assessment.

Of those who reported use of optical correction for myopia, 9.8% actually had hypermetropia; conversely, 8.4% of

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Table 3. Distribution of Refractive Error by Severity and Age of First Use of Optical Correction

Age Group, y	No. (%) of Participants	SE, Median (IQR), D[a]	No. (%) of Participants		
			High[b]	Moderate	Mild
Myopia					
<10	4607 (15.2)	−5.63 (−7.98 to −3.72)	2124 (40.3)	1700 (15.4)	783 (5.6)
10 to <20	15 819 (52.4)	−3.74 (−5.38 to −2.41)	2883 (54.7)	7211 (65.4)	5725 (41.1)
20 to <30	5043 (16.7)	−2.40 (−3.48 to −1.65)	209 (4.0)	1525 (13.8)	3309 (23.8)
30 to <40	1998 (6.6)	−1.85 (−2.65 to −1.38)	29 (0.6)	328 (3.0)	1641 (11.8)
40 to <50	1815 (6.0)	−1.51 (−2.15 to −1.22)	18 (0.3)	173 (1.6)	1624 (11.7)
50 to <60	839 (2.8)	−1.43 (−1.91 to −1.18)	2 (0.04)	71 (0.6)	766 (5.5)
60 to <70	96 (0.3)	−1.58 (−2.14 to −1.14)	2 (0.04)	11 (0.1)	83 (0.6)
All	30 217 (100)	−3.23 (−5.13 to −1.91)	5267 (100)	11 019 (100)	13 931 (100)
Missing	1948	−1.63 (−2.48 to −1.22)	88	289	1571
Hypermetropia					
<10	3376 (10.7)	4.16 (2.56 to 5.88)	NA	2318 (29.0)	1058 (4.5)
10 to <20	3060 (9.7)	2.67 (1.60 to 4.35)	NA	1325 (16.6)	1735 (7.3)
20 to <30	1823 (5.8)	2.40 (1.55 to 3.86)	NA	690 (8.6)	1133 (4.8)
30 to <40	2597 (8.2)	2.30 (1.56 to 3.49)	NA	896 (11.2)	1701 (7.2)
40 to <50	13 173 (41.7)	1.82 (1.36 to 2.56)	NA	2063 (25.8)	11 110 (47.0)
50 to <60	7049 (22.3)	1.66 (1.30 to 2.24)	NA	658 (8.2)	6391 (27.0)
60 to <70	541 (1.7)	1.59 (1.27 to 2.11)	NA	35 (0.4)	506 (2.1)
All	31 619 (100)	1.97 (1.41 to 3.02)	NA	7985 (100)	23 634 (100)
Missing	2445	1.77 (1.29 to 2.68)	NA	477	1968

Abbreviations: D, diopter; IQR, interequartile range; NA, not applicable; SE, spherical equivalent.

[a] Indicates refractive error in worse eye.

[b] For participants with hypermetropia, high and moderate were combined into a single category.

those who reported use of optical correction for hypermetropia had myopia. More than 20% of participants with misclassified myopia and hypermetropia were older adults who also reported use of optical correction for presbyopia, which could have led to some confusion in their reports of the reason for their current prescription. In addition, a small number of individuals may have reported their refractive error status incorrectly. Most participants with misclassified diagnoses had a mild refractive error and reported first use of optical correction as young adults rather than during childhood. Thus, the wording of questions in this survey, with an explanation of terms, identified most of those with primary myopia and more severe hypermetropia.

Sensitivity and specificity of self-report for the identification of myopia in the present study were comparable with those reported in 2 prior studies using similar questions.[13,15] Those studies included younger adults, had lower thresholds for definition of myopia (−0.5 D or worse[13] and <0 D[15]), and used the participant's worn spectacle prescription as the gold standard rather than measuring actual refraction.[3] Sensitivity and specificity were 89% and 83%, respectively, for Ip et al[13] and 83% and 93%, respectively, for Breslin et al.[15] Accuracy of self-report for identification of hypermetropia has consistently been found to be poor,[10,13,15] with specificity of self-report of the reason for optical correction generally higher than sensitivity. However, high specificity does not compensate for low sensitivities when self-report is used as a screening tool in population studies to identify participants for further assessment.

A previous study[10] reported that physical examination of glasses by nonexpert examiners to assign lenses as magnifying or minimizing is effective in categorizing (but not quantifying) refractive status. However, the method is limited by the need for additional data collection time and training of nonspecialist assessors and by failure to capture undiagnosed refractive error or sole contact lens use. Spectacle prescription data have also been used to validate self-report of refractive status[13] but are susceptible to bias in those with available data, the time lag between testing and reporting of the prescription, and the clinical scenario in which a prescription is intentionally different from the actual refraction. Sensitivity of self-report is lowest for questions using lay rather than technical terms (ie, short- and long-sightedness); respondents appear to find this confusing, leading to high misclassification rates.[9,10] However, parental report of eye problems and diagnosed eye disorders in their children can include accurate medical terminology and lead to prevalence estimates directly comparable with those of clinical studies.[16] Use of the internet by parents or patients to research suspected or diagnosed conditions has led to more widespread use of medical terminology.[17]

This study and those by other investigators[12] have found the age at first use of optical correction—a proxy for age at onset—to be associated with severity of myopia and hypermetropia. Thus, using self-report of age at first use of optical correction combined with self-report of refractive error status is likely to be the most effective method for identifying myopia and hypermetropia (although less effective for hypermetropia) in the new generation of large-scale general population studies in health care settings similar to the UK Biobank Study in which refractive correction is avalable.[18] The questions selected must be effective in ruling in those with the trait of interest and ruling out those without it so that self-report defines phenotype sufficiently well to harness the power of scale.[19,20] The next step is to improve the predictive value of self-report by considering variations by potential predictors of the refractive error phenotypes. We are tak-

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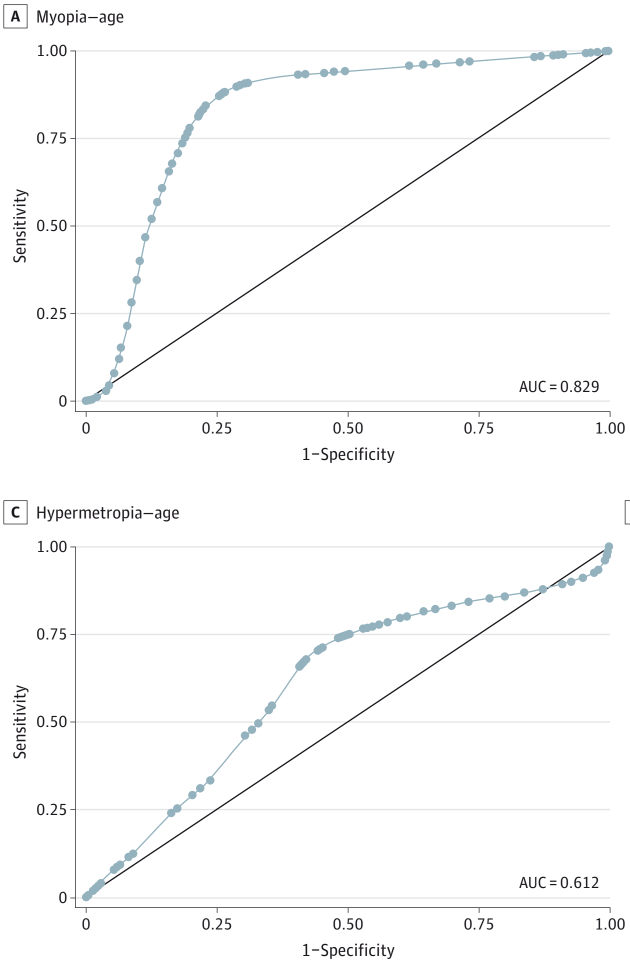
Figure 2. Receiver Operating Characteristic (ROC) Curve for Sensitivity and Specificity of Myopia and Hypermetropia



The ROC curves assess the accuracy of self-reported age at first use of optical correction (age) and incremental improvement with the addition of the reason for optical correction (age and reason).

ing this step forward within our program on eyes and vision within the UK CLOSER (Cohort and Longitudinal Studies Enhancement Resources) initiative (http://www.closer.ac.uk/).

Conclusions

Using self-report questions on the reason for use and the age at first use of optical correction and, ideally, a combination of the two, is a feasible and accurate way to identify individuals with myopia in an adult population. This approach is less accurate for hypermetropia. The utility of self-report of refractive error relates to the nature of the research and the degree to which any misclassification would affect and is dependent on the precise wording of the questions. The scope to develop concensus for a set of questions that could be implemented effectively in large-scale generic population-based studies exists; doing so would increase the opportunities for integrated research on refractive error that are necessary to develop novel prevention or treatment strategies.

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Study concept and design: All authors.
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