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Epidemiological factors associated with health knowledge of three common eye diseases: A community-based pilot survey in Hong Kong

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Abstract

Objectives: To assess the proportions of respondents in the general community having heard or awareness, and their knowledge level, of three common eye diseases: age-related macular degeneration, cataract, and glaucoma. We also attempted to assess for risk factors that may be associated with any variations, which will help identify the areas of inadequate knowledge and demographics of potential audiences for focused health education.

Methods: We conducted a community-based pilot survey for the residents from a southern suburb of Hong Kong in early 2016, by inviting all aged 50 or above to complete a standardized questionnaire in the local community hall.

Results: Most of the 222 respondents have heard, or awareness, of cataract (92.79% or 81.98%, respectively), followed by glaucoma (86.94% or 52.70%, respectively), and age-related macular degeneration (51.35% or 29.28%, respectively). The results of Cronbach's alpha ($\alpha > 0.7$) and Spearman's correlation coefficient ($p < 0.01$) suggested that the internal consistency, convergent and discriminant validities of the questionnaire were acceptable for the study population. Compared to a previous Hong Kong survey in 2002, the proportions of having heard of the three eye diseases were greater, but the overall knowledge remained limited. From a maximum knowledge score of 29, the median scores for age-related macular degeneration, cataract, and glaucoma were 9, 13, and 14, respectively. Except for the treatment of cataract, the knowledge level in most areas was low. Sociodemographic factors and medical history, rather than behavioral factors, were more likely to be associated with having a higher knowledge level. Subjects with family or friends with a history of glaucoma or age-related macular degeneration were more aware and knowledgeable, but not for subjects who were current and past smokers or alcohol drinkers. For age-related macular degeneration, gender modified the effect between age and knowledge level, while age was a confounder of having medical history, and having heard or awareness, of the disease.

Conclusion: Despite a larger proportion of the community having heard or awareness since 15 years ago, much effort remains for improving health knowledge of these three eye diseases in Hong Kong. We recommend targeting respondents with higher lifestyle risks, such as current and past smokers or alcohol drinkers, as a focused audience, and utilizing family members, relatives, or friends as another way of distributing health information.

Keywords

Awareness, knowledge, age-related macular degeneration, cataract, glaucoma, Hong Kong

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Introduction

Background

Visual impairment (VI) is associated with poor physical health and disability.[1,2] Previous studies have shown a correlation between the severity of VI and the incidence of falls, fractures, chronic diseases, and mortality in the elderly.[3–8] Visually impaired people are more likely to have poorer social network, employment status, and mental health problems.[9–11] Various reports have noted the inverse correlation between VI severity and quality-of-life (QoL) scores.[12–17] Increasing VI is also associated with substantial health burden,[18] and elderly people with VI are more likely to need community support services and nursing home care.[19,20] The US annual economic burden and governmental budget of visual disorders were estimated to be $35.4 billion and $13.7 billion, respectively.[21] A systematic review has reported that economic burden was positively correlated to the severity of VI and blindness.[22] Besides patients, their care providers and community will also have to bear the medical cost and productivity loss associated with VI.[21,22]

Epidemiology

A meta-analysis showed an ongoing reduction in the age-standardized prevalence of VI and blindness globally but a substantial increase in the number of cases from 1990 to 2015.[23] Global estimates in 2010 reported that 285 million people had VI, with 80% being avoidable and curable. The second to fourth leading causes of VI were cataract (33%), glaucoma (2%), and age-related macular degeneration (AMD, 1%), while the three most common causes of blindness were cataract (51%), glaucoma (8%), and AMD (5%).[24] In 2015, the second to fourth global causes of VI were cataract (25%), AMD (4%), and glaucoma (2%), while the first and third global causes of blindness were cataract (35%) and glaucoma (8%).[23] In Hong Kong, besides refractive error, the leading causes of impaired vision or blindness were cataract (28.1%), macular degeneration (7.6%), and glaucoma (3.0%).[25] Thus, cataract, glaucoma, and AMD are major causes of VI and blindness, both globally and locally.

Public health significance

Health awareness and knowledge are important for reducing VI from cataract, glaucoma, and AMD, which are treatable and sometimes avoidable through early detection and timely treatment.[26–28] Self-detection in the early stage may be difficult due to a lack of symptoms awareness, resulting in late presentation, diagnosis, and treatment.[29–31] Raising awareness can facilitate early treatment and encourage those at risk to seek regular eye examination.[32–34] Health education also contributes to changing behaviors, including modifying lifestyle and knowing when to seek medical attention.[35,36] It is usually less costly to prevent visual loss by treating early diseases than to manage the burden of blindness from advanced diseases.[33,37,38]

Rationale and objectives

To our knowledge, only one similar eye disease survey has been conducted in Hong Kong previously, in the Shatin District in 2002,[39] which had analyzed the sociodemographic characteristics of the respondents but no other potential variables such as behavioral factors or medical history. No survey has since been conducted in Hong Kong to assess the awareness and knowledge of AMD, cataract, and glaucoma for the past 15 years, despite increasing access to medical knowledge brought on by the ubiquitous use of smartphones in recent years. To determine whether medical knowledge has improved in the past 15 years, the primary objective of this pilot survey was to measure the proportions of respondents having heard or awareness, and their knowledge level, of three common eye diseases (AMD, cataract, and glaucoma). The secondary objective was to assess for risk factors associated with any variations. Our findings would assist in evaluating the feasibility of a forthcoming 5-year eye screening program, designing future large-scale eye research surveys, and facilitating the planning of further health education by identifying the areas of knowledge deficiency and demographic features of potential target audience.

Methods

Ethics approval and informed consent

Ethics approval was granted by the Institutional Review Board (IRB) and Ethics Committees (EC) of the Hong Kong University/Hospital Authority Hong Kong West Cluster (reference no. UW 15-160) on 16 March 2015. Written informed consent was obtained from all subjects before they were enrolled in the study and given the questionnaire.

Study area and sampling

This community-based, cross-sectional pilot survey was conducted at Chi Fu, a southern suburb on Hong Kong Island, which was randomly selected from the 17 District Council Constituency Areas (DCCAs) that compose the Southern District of Hong Kong. According to the 2016 Population By-census, Chi Fu had an estimated population of 15,784, with 6427 being aged 50 and above (46.52% males and 53.48% females).[40] On average, its residents had higher levels of education, household income, and proportion living in private housing than the mean for the entire Southern District and Hong Kong (Supplementary Material 1).

The previous survey in the Shatin District of Hong Kong in 2002 showed that 78.4% and 9.2% of respondents have heard of glaucoma and AMD, respectively.[39] Assuming there was a 10% increase in proportions due to better access to medical knowledge since 2002, we hypothesized that the

corresponding proportions in our survey would be 88.4% and 19.2%. Using a power of 0.8 and a significant level of 0.05, the required sample size should be 216.

We sent invitation letters (in Chinese) to all households within the study area to ensure that all residents would have the same opportunity to get the information and participate in our survey. On a first-come-first-served basis (convenience sampling), residents who were interested to participate responded by phone to make an appointment at a designated time for a free eye examination by an ophthalmologist in the local community hall, during which the study questionnaire was completed. The targeted study population was local Chinese residents aged 50 or above, without extra inclusion and exclusion criteria. The survey fieldwork was carried out from 11 to 28 January 2016.

Measurements

A structured and self-administered questionnaire in Chinese was used to collect data on the respondents' sociodemographic information, medical history, awareness, and knowledge of eye diseases. Only "yes-no" and "multiple-choice" questions were included. Sociodemographic information covered age, gender, type of housing, level of education, marital status, employment status, monthly household income, smoking, and alcohol-drinking habit. Respondents reported their own, family, or friends' medical history of chronic medical conditions: diabetes mellitus (DM), hypertension, hyperlipidemia, and three common eye diseases: AMD, cataract, and glaucoma. The outcomes were the proportions and determinants of respondents having (1) heard of, (2) being aware of, and (3) their knowledge level (with regard to symptoms, pathophysiology, and treatments) of the three eye diseases.

Operational definitions

Respondents were defined as having "awareness" of a disease if they have heard of it and reported knowing at least one fact regarding its symptoms, pathophysiology, or treatments. For those with disease awareness, we would ask the remaining questions to assess their individual knowledge level (29 items in total for each disease). A score of 1 was given for each correct response, and a 0 if there was no response or the response was incorrect to give a possible score of 0 to 29. For analyzing the factors associated with knowledge level, those scoring the median or above were defined as having "good knowledge," while those scoring below the median were considered as having "poor knowledge" of that eye disease.

Statistical analysis

Internal consistency of 29 items measuring the knowledge level of the three eye diseases was assessed using Cronbach's alpha coefficient, while convergent and discriminant validities were tested using the correlation between item and subscale (symptoms, pathophysiology, and treatments) or total score with Spearman's correlation coefficient. For descriptive statistics, the median with interquartile range (IQR) was used to summarize continuous variables, while frequencies and percentages were used to summarize categorical variables. Univariate logistic regression analysis was conducted to examine the association between various explanatory variables and output variables. Explanatory variables with p-value less than 0.1 were fitted into multivariate logistic regression analysis for further prediction. Crude and adjusted odds ratios (CORs and AORs) with a 95% confidence interval (CI) were calculated to show the strength of associations between exposures and outcomes. A p-value less than 0.05 was considered statistically significant.

We calculated the relative change in ORs to measure the magnitude of confounding effect and examine the confounding effect of age on the association between having a medical history and having heard or awareness of the three eye diseases. We also performed the stratification and multiplicate interaction model to measure the effect modification. We included respondents with incomplete data in the analyses and used multiple imputation method to handle missing data by creating 2000 multiple datasets and combining estimates from imputed datasets to obtain the overall estimate, based on the assumption of missing at random.[41,42] The database was maintained and managed using Microsoft Excel 2016 (Microsoft Corporation, Redmond, WA, USA). All statistical analyses were performed using the R package version 3.4.3 (R Development Core Team, 2017).[43]

Results

Characteristics of respondents

A total of 222 respondents, median age 67 years (IQR = 61–72) participated in the survey, including 87 males (39.19%) and 135 females (60.81%). Most were aged 60–69 years (49.55%). The majority had completed secondary education (51.35%), lived in private housing (94.14%), married (85.14%), not working (89.64%), and had a monthly household income below $25,000 (75.22%). The self-reported prevalences of DM, hypertension, hyperlipidemia, AMD, cataract, and glaucoma were 12.61%, 39.64%, 15.32%, 4.05%, 22.97%, and 2.70%, respectively. The proportion of current and past smokers was 4.95%, and that of alcohol drinkers was 18.92% (Supplementary Material 2).

Descriptive and univariate logistic analysis

Cronbach's alpha results of 29 items measuring the knowledge level of AMD, cataract, or glaucoma were 0.78, 0.89, or 0.89, respectively. Score of each item was significantly correlated with its corresponding subscale and total score ($p < 0.01$). The correlation coefficient between the item and its corresponding subscale was higher than between the item and its

noncorresponding subscale. These results suggested that the internal consistency, convergent, and discriminant validities of the questionnaire were acceptable for the study population.

Of the 222 respondents (subjects), 51.35% (114) and 29.28% (65) have heard and awareness of AMD, respectively; 92.79% (206) and 81.98% (182) have heard and awareness of cataract, respectively; and 86.94% (193) and 52.7% (117) have heard and awareness of glaucoma, respectively. The median scores for the 29 knowledge questions of AMD, cataract, and glaucoma were 9 (IQR = 5–13), 13 (IQR = 10–21), and 14 (IQR = 7–20), respectively (Supplementary Material 3). Except for the treatment of cataract, the respondents' feedbacks showed that the knowledge level in most areas was low (Supplementary Material 4). Univariate logistic regression results noted that sociodemographic factors and medical history, rather than behavioral factors, were more likely to be associated with having heard, awareness, and higher knowledge level of the three eye diseases (Supplementary Materials 5–7).

Multivariate logistic analysis

Table 1 (heard of the disease) showed that those with education of secondary level (AOR = 2.93; 95% CI = 1.40–6.33), non-degree level (AOR = 3.88; 95% CI = 1.45–10.88), or degree level (AOR = 4.84; 95% CI = 1.71–14.59) were more likely of having heard of AMD than those with primary level or below. Similarly, females (AOR = 2.15; 95% CI = 1.17–4.02), subjects with a history of AMD (AOR = 11.24; 95% CI = 1.74–226.9), or hypertension among family or friends (AOR = 2.14; 95% CI = 1.21–3.83), were more likely to have heard of AMD.

Those with a history of hypertension themselves (AOR = 0.44; 95% CI = 0.20–0.99) were less likely to have heard of glaucoma, but those with a history of DM among family or friends (AOR = 2.98; 95% CI = 1.22–8.45) were more likely to have heard of glaucoma. There was no factor significantly associated with having heard of cataract.

Table 2 (awareness of the disease) showed that subjects with a history of AMD (AOR = 11.73; 95% CI = 2.73–62.22) or DM (AOR = 2.66; 95% CI = 1.41–5.14), or AMD among family or friends (AOR = 11.27; 95% CI = 2.56–79.34), were more likely to be aware of AMD. For cataract, those with a history of cataract themselves (AOR = 5.41; 95% CI = 1.53–34.41), or of their family or friends (AOR = 2.54; 95% CI = 1.08–6.80), were more likely to have awareness of this disease. For glaucoma, those with a history of hypertension (AOR = 0.55; 95% CI = 0.31–0.98) were less likely to have awareness, but if their family or friends had a history of DM (AOR = 2.10; 95% CI = 1.19–3.77) or glaucoma (AOR = 7.31; 95% CI = 2.37–32.10), the subjects were more likely to have awareness.

Table 3 (knowledge of the disease) showed that regarding AMD, subjects who had attained a secondary level of education (AOR = 12.23; 95% CI = 1.05–324.8) were married (AOR = 12.78; 95% CI = 1.24–379.9), or had a history of AMD among family or friends (AOR = 11.29; 95% CI = 1.20–356) were more likely to have good knowledge, while those with a history of hypertension (AOR = 0.23; 95% CI = 0.05–0.82) were less likely to be knowledgeable. For cataract, those with older age (AOR = 0.93; 95% CI = 0.89–0.98) were less likely to be knowledgeable. For glaucoma, those who had attained secondary level of education (AOR = 5.06; 95% CI = 1.83–15.47) or non-degree level (AOR = 4.47; 95% CI = 1.28–17.02) were more likely to have good knowledge than those with primary level or below. Similarly, if family or friends had a history of glaucoma (AOR = 3.97; 95% CI = 1.27–14.47), the subject was more likely to be knowledgeable.

Effect modification and confounding

Stratification and effect modification between age and gender are shown in Table 4. For AMD, there was significant interaction between age and gender (OR = 1.25; 95% CI = 1.04–1.63), such that the association between age and knowledge level varied with gender. Combining age and gender was more accurate and had a joint effect greater than the product of their individual effects on knowledge level. Stratified by gender, age was significantly associated with the knowledge level of AMD only for males (OR = 0.79; 95% CI = 0.61–0.93), and cataract only for females (OR = 0.91; 95% CI = 0.86–0.96).

Table 5 showed the relative changes in OR after adjusting for age to measure the magnitude of confounding effects. There were significant associations between age and having heard or awareness of AMD, and between age and having a history of AMD. After adjusting for age, the association of having a history of AMD with having heard of AMD increased from 8.08 (1.45–151.1) to 11.52 (1.98–219.5), and with having awareness of AMD increased from 5.22 (1.33–25.37) to 8.36 (1.99–43.71), with the effect of age remaining significant. Since the corresponding relative changes in ORs were 42.57% and 60.15% (>10%), we believed that age was a confounder of having a history and having heard or awareness of AMD. No such relationship was found for cataract or glaucoma.

Discussion

Our findings showed that cataract had the highest proportion of subjects having heard and awareness of the disease, followed by glaucoma and AMD, in that order. This ranking was comparable to similar surveys conducted in Hong Kong, Australia, Beijing, and Canada.[26,39,44,45] Medical history (including among family or friends) of eye diseases and other systemic conditions significantly increased the awareness of the three eye diseases, similar to previous studies.[31,36,46,47] However, we did not find a significant association of behavioral factors with having heard, awareness,

Table 1. Multivariate logistic regression analysis for the respondents hearing about three common eye diseases from a southern suburb of Hong Kong.

Eye diseases	Variables	Model 1		Model 2	
		AOR (95% CI)	p-value	AOR (95% CI)	p-value
AMD	Age (years)	0.99 (0.95–1.03)	0.563		
	Gender				
	Male (ref.)	1.00	–	1.00	–
	Female	1.94 (1.01–3.77)	0.048**	2.15 (1.17–4.02)	0.015**
	Educational level				
	Primary level or below (ref.)	1.00	–	1.00	–
	Secondary level (including matriculation)	2.59 (1.19–5.81)	0.018**	2.93 (1.40–6.33)	0.005***
	Non-degree level	3.35 (1.19–9.83)	0.024**	3.88 (1.45–10.88)	0.008***
	Degree level	3.93 (1.27–12.82)	0.020**	4.84 (1.71–14.59)	0.004***
	Marital status				
	Single (ref.)	1.00	–		
	Married	0.51 (0.07–2.57)	0.440		
	Divorced/widowed	0.31 (0.04–1.92)	0.231		
	AMD (selves)				
	No (ref.)	1.00	–	1.00	–
	Yes	15.10 (2.08–331.8)	0.024**	11.24 (1.74–226.9)	0.033**
	Hypertension (family or friends)				
	No (ref.)	1.00	–	1.00	–
	Yes	2.05 (1.15–3.69)	0.016**	2.14 (1.21–3.83)	0.009***
	AMD (family or friends)				
	No (ref.)	1.00	–		
	Yes	1.99 (0.42–14.41)	0.421		
Cataract	Employment status				
	Employed (ref.)	1.00	–	1.00	–
	Unemployed	3.10 (0.76–10.96)	0.089*	3.39 (0.84–11.74)	0.063*
	Hypertension (selves)				
	No (ref.)	1.00	–	1.00	
	Yes	2.40 (0.71–10.94)	0.194	2.55 (0.77–11.54)	0.162
	Diabetes mellitus (family or friends)				
	No (ref.)	1.00	–	1.00	–
	Yes	2.66 (0.74–12.86)	0.166	3.15 (0.95–14.41)	0.087*
	Hypertension (family or friends)				
	No (ref.)	1.00	–		
	Yes	1.56 (0.49–5.51)	0.466		
Glaucoma	Age ⩾ 70 years				
	No (ref.)	1.00	–		
	Yes	0.58 (0.25–1.37)	0.210		
	Hypertension (selves)				
	No (ref.)	1.00	–	1.00	–
	Yes	0.52 (0.22–1.21)	0.128	0.44 (0.20–0.99)	0.048**
	Diabetes mellitus (family or friends)				
	No (ref.)	1.00	–	1.00	–
	Yes	2.83 (1.15–8.05)	0.033**	2.98 (1.22–8.45)	0.025**

AMD: age-related macular degeneration; AOR: adjusted odds ratio; CI: confidence interval.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

or knowledge level of the three eye diseases. Thapa et al.[32] had considered smoking as an explanatory variable in a similar study but could not find any significant association.

Compared to the previous Hong Kong survey by Lau et al.[39] from almost 15 years ago, there was a notable increase in the proportions of subjects having heard of AMD and glaucoma, but not much difference was noted for cataract, probably because the Hong Kong population already had a good awareness of cataract in 2002. Some factors may have contributed to the variation. A high self-reported prevalence of the

Table 2. Multivariate logistic regression analysis for the respondents with awareness of three common eye diseases from a southern suburb of Hong Kong.

Eye diseases	Variables	Model 1		Model 2	
		AOR (95% CI)	p-value	AOR (95% CI)	p-value
AMD	Age (years)	0.97 (0.92–1.01)	0.134	0.96 (0.92–1.00)	0.056*
	Educational level				
	Primary level or below (ref.)	1.00	–		
	Secondary level (including matriculation)	1.83 (0.75–4.82)	0.196		
	Non-degree level	1.90 (0.62–5.96)	0.261		
	Degree level	1.34 (0.39–4.48)	0.635		
	Marital status				
	Single (ref.)	1.00	–		
	Married	0.22 (0.04–1.06)	0.063*		
	Divorced/widowed	0.24 (0.03–1.48)	0.132		
	AMD (selves)				
	No (ref.)	1.00	–	1.00	–
	Yes	10.60 (2.28–60.44)	0.004***	11.73 (2.73–62.22)	0.001***
	Diabetes mellitus (family or friends)				
	No (ref.)	1.00	–	1.00	–
	Yes	2.51 (1.26–5.09)	0.010***	2.66 (1.41–5.14)	0.003***
	Hypertension (family or friends)				
	No (ref.)	1.00	–		
	Yes	1.28 (0.64–2.58)	0.482		
	AMD (family or friends)				
	No (ref.)	1.00		1.00	–
	Yes	8.33 (1.73–61.82)	0.015**	11.27 (2.56–79.34)	0.004***
Cataract	Gender				
	Male (ref.)	1.00	–		
	Female	1.63 (0.77–3.49)	0.201		
	Marital status				
	Single (ref.)	1.00	–	1.00	–
	Married	2.31 (0.43–10.34)	0.286	2.17 (0.42–9.21)	0.308
	Divorced/widowed	8.76 (0.85–207.8)	0.093*	8.26 (0.83–192.3)	0.098*
	Monthly household income				
	$0–$10,000 (ref.)	1.00	–		
	$10,001–$25,000	0.71 (0.29–1.77)	0.461		
	$25,001 or above	0.48 (0.20–1.17)	0.106		
	Cataract (selves)				
	No (ref.)	1.00	–	1.00	–
	Yes	4.87 (1.35–31.29)	0.038**	5.41 (1.53–34.41)	0.025**
	Diabetes mellitus (family or friends)				
	No (ref.)	1.00	–		
	Yes	1.92 (0.86–4.55)	0.121		
	Cataract (family or friends)				
	No (ref.)	1.00	–	1.00	–
	Yes	2.13 (0.88–5.85)	0.113	2.54 (1.08–6.80)	0.044**
Glaucoma	Age group (years)				
	50–59 (ref.)	1.00	–		
	60–69	0.78 (0.34–1.77)	0.557		
	70–79	1.05 (0.41–2.71)	0.913		
	⩾80	0.51 (0.14–1.80)	0.305		
	Marital status				
	Single (ref.)	1.00	–		
	Married	0.17 (0.01–1.09)	0.112		
	Divorced/widowed	0.15 (0.01–1.16)	0.110		

(Continued)

Table 2. (Continued)

Eye diseases	Variables	Model 1		Model 2	
		AOR (95% CI)	p-value	AOR (95% CI)	p-value
	Hypertension (selves)				
	No (ref.)	1.00	–	1.00	–
	Yes	0.57 (0.31–1.04)	0.071*	0.55 (0.31–0.98)	0.043**
	Diabetes mellitus (family or friends)				
	No (ref.)	1.00	–	1.00	–
	Yes	2.04 (1.13–3.73)	0.018**	2.10 (1.19–3.77)	0.011**
	Glaucoma (family or friends)				
	No (ref.)	1.00	–	1.00	–
	Yes	6.50 (1.98–29.94)	0.005***	7.31 (2.37–32.10)	0.002***

AMD: age-related macular degeneration; AOR: adjusted odds ratio; CI: confidence interval.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

Table 3. Multivariate logistic regression analysis for the respondents' knowledge level of three common eye diseases from a southern suburb of Hong Kong.

Eye diseases	Variables	Model 1		Model 2	
		AOR (95% CI)	p-value	AOR (95% CI)	p-value
AMD	Educational level				
	Primary level or below (ref.)	1.00	–	1.00	–
	Secondary level (including matriculation)	1.22 (0.20–7.26)	0.821	1.11 (0.18–6.47)	0.903
	Non-degree level	11.41 (0.98–302.3)	0.075*	12.23 (1.05–324.8)	0.067*
	Degree level	2.62 (0.26–31.72)	0.421	2.98 (0.30–36.16)	0.363
	Marital status				
	Single (ref.)	1.00	–	1.00	–
	Married	11.77 (1.12–346.6)	0.074*	12.78 (1.24–379.9)	0.065*
	Divorced/widowed	9.09 (0.41–428.2)	0.191	7.35 (0.35–332.6)	0.231
	Hypertension (selves)				
	No (ref.)	1.00	–	1.00	–
	Yes	0.25 (0.06–0.94)	0.048**	0.23 (0.05–0.82)	0.031**
	AMD (selves)				
	No (ref.)	1.00	–		
	Yes	0.27 (0.01–2.56)	0.296		
	AMD (family or friends)				
	No (ref.)	1.00	–	1.00	–
	Yes	10.13 (1.08–318.3)	0.085*	11.29 (1.20–356.0)	0.072*
Cataract	Age (years)	0.93 (0.89–0.98)	0.009***	0.93 (0.89–0.97)	<0.001***
	Educational level				
	Primary level or below (ref.)	1.00	–	1.00	–
	Secondary level (including matriculation)	0.83 (0.36–1.87)	0.647	0.86 (0.38–1.91)	0.711
	Non-degree level	1.97 (0.65–6.27)	0.238	2.00 (0.69–6.08)	0.206
	Degree level	0.94 (0.29–3.07)	0.922	0.92 (0.29–2.93)	0.883
	Marital status				
	Single (ref.)	1.00	–	1.00	–
	Married	0.21 (0.01–1.39)	0.168	0.19 (0.01–1.29)	0.146
	Divorced/widowed	0.16 (0.01–1.29)	0.131	0.15 (0.01–1.23)	0.120
	Monthly household income				
	$0–$10,000 (ref.)	1.00	–		
	$10,001–$25,000	1.39 (0.66–2.92)	0.384		
	$25,001 or above	1.36 (0.58–3.18)	0.476		

(Continued)

Table 3. (Continued)

Eye diseases	Variables	Model 1		Model 2	
		AOR (95% CI)	p-value	AOR (95% CI)	p-value
	Hypertension (selves)				
	No (ref.)	1.00	–		
	Yes	0.86 (0.43–1.70)	0.652		
	Cataract (selves)				
	No (ref.)	1.00	–		
	Yes	1.03 (0.45–2.39)	0.945		
Glaucoma	Educational level				
	Primary level or below (ref.)	1.00		1.00	–
	Secondary level (including matriculation)	5.88 (2.04–19.33)	0.002***	5.06 (1.83–15.47)	0.003***
	Non-degree level	5.48 (1.51–22.14)	0.012**	4.47 (1.28–17.02)	0.022**
	Degree level	2.37 (0.60–9.63)	0.217	2.19 (0.58–8.47)	0.247
	Glaucoma (selves)				
	No (ref.)	1.00	–		
	Yes	7.99 (0.94–177.3)	0.090*		
	Glaucoma (family or friends)				
	No (ref.)	1.00	–	1.00	–
	Yes	4.16 (1.27–15.91)	0.025**	3.97 (1.27–14.47)	0.024**

AMD: age-related macular degeneration; AOR: adjusted odds ratio; CI: confidence interval.
*p < 0.1; **p < 0.05; ***p < 0.01.

Table 4. Association of age (years), gender, and knowledge level of three common eye diseases among the respondents from a southern suburb of Hong Kong.

Variables		AMD		Cataract		Glaucoma	
		OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
	Multiplicative interaction model						
Exposure	Age (years)	0.79 (0.61–0.93)	0.021**	0.94 (0.88–1.00)	0.057*	1.04 (0.96–1.13)	0.402
Effect modifier	Gender	0.00 (0.00–0.03)	0.034**	4.56 (0.01–1424.5)	0.606	150.8 (0.17–175,268)	0.151
Interaction	Age:gender	1.25 (1.04–1.63)	0.042**	0.97 (0.89–1.06)	0.522	0.93 (0.84–1.03)	0.164
	Stratification (by gender)						
	Male	(n = 21)		(n = 66)		(n = 43)	
Exposure	Age (years)	0.79 (0.61–0.93)	0.021**	0.94 (0.88–1.00)	0.057*	1.04 (0.96–1.13)	0.402
	Female	(n = 44)		(n = 116)		(n = 74)	
Exposure	Age (years)	0.99 (0.91–1.07)	0.764	0.91 (0.86–0.96)	<0.001***	0.96 (0.91–1.02)	0.223
	Overall	(n = 65)		(n = 182)		(n = 117)	
Exposure	Age (years)	0.96 (0.89–1.02)	0.173	0.93 (0.89–0.96)	<0.001***	0.99 (0.94–1.03)	0.561

AMD: age-related macular degeneration; OR: odds ratio; CI: confidence interval.
*p < 0.1; **p < 0.05; ***p < 0.01.

three eye diseases among our subjects may have increased the proportion of having heard or awareness because they were positively correlated. On the other hand, our survey targeted only older subjects, which, in contrast, may have lowered the proportion of having heard or awareness of the three eye diseases as they were negatively correlated. Finally, the study locations (Shatin and Chi Fu areas), as well as the time frames (2002 and 2016), differed between the two surveys. Both spatial and temporal factors may have contributed to the variation. In the Indian state of Andhra Pradesh, the prevalence of glaucoma awareness was 0.33% in rural area and 2.4% in urban area.[28,34] In Singapore, there has been a fourfold increase in AMD awareness from 7.3% in 2006 to 28.1% in 2011.[48] For Hong Kong, the actual impact from spatial variation is likely minimal given the geographical compactness of this city (1106 km^2, the fourth most densely populated area in the world) and its efficient transport network. However, temporal variation is likely to be significant given the recent advances in communication technology and the high saturation of smartphone usage in Hong Kong.

Due to imposing a lower age limit, the effect of age on the proportions of having heard, awareness, and the knowledge

Table 5. Association of age (years), having a medical history, and having heard/awareness of three common eye diseases among the respondents from a southern suburb of Hong Kong.

Variables	AMD		Cataract		Glaucoma	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Having heard of eye diseases						
Association of age (years) with respondents having heard of eye disease	0.96 (0.93–0.99)	0.035**	1.03 (0.96–1.10)	0.450	0.97 (0.92–1.01)	0.160
Association of age (years) with respondents having history of eye disease	1.10 (1.02–1.20)	0.019**	1.18 (1.12–1.25)	<0.001***	1.06 (0.96–1.17)	0.208
Association of history (selves) of eye disease with having heard of it	8.08 (1.45–151.1)	0.051*	NA		NA	
Association of age and history of eye disease with having heard of it						
Age (years)	0.96 (0.92–0.99)	0.011**	NA		NA	
History (selves) of eye disease	11.52 (1.98–219.5)	0.025**	NA		NA	
Magnitude of confounding: relative change in OR of history of eye disease on having heard after adjusting for age (years)	42.57% (>10%)	NA		NA		
Having awareness of eye diseases						
Association of age (years) with respondents having awareness of eye disease	0.96 (0.92–0.99)	0.022**	1.03 (0.99–1.08)	0.200	0.98 (0.94–1.01)	0.145
Association of age (years) with respondents having history of eye disease	1.10 (1.02–1.20)	0.019**	1.18 (1.12–1.25)	<0.001***	1.06 (0.96–1.17)	0.208
Association of history (selves) of eye disease with having awareness of it	5.22 (1.33–25.37)	0.022**	7.00 (2.04–44.03)	0.009***	NA	
Association of age and history of eye disease with having awareness of it						
Age (years)	0.94 (0.90–0.98)	0.006***	1.00 (0.95–1.05)	0.854	NA	
History (selves) of eye disease	8.36 (1.99–43.71)	0.005***	7.31 (1.94–48.18)	0.011**	NA	
Magnitude of confounding: relative change in OR of history of eye disease on having awareness after adjusting for age (years)	60.15% (>10%)	4.43%	(<10%)	NA		

AMD: age-related macular degeneration; OR: odds ratio; CI: confidence interval; NA: not applicable as odds ratio could not be calculated.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

level of the three eye diseases was mitigated. If younger age groups were included, we believed that the effect of age would be more obvious based on the results from previous studies.[39,46] Also, as most of our subjects in this survey have retired, this may have biased the effect of household income level. Having a personal medical history of AMD and cataract was positively associated with the proportion of having heard or awareness of the diseases but negatively associated with the knowledge level, showing that a rise in the proportion of having heard or awareness did not necessarily correspond to a rise in knowledge level. The significant relationship between family or friends' medical history and proportions of having heard or awareness of the eye diseases supported the results of other studies investigating sources of medical knowledge. Most studies have noted that family and friends were an important source of medical information in the past. Haddad et al.[35] reported that the most common source of information on eye diseases was family, relatives, and friends rather than mass media. Shrestha et al.[49] found that family, relatives, and friends suffering from the condition and not suffering from the condition were the second and third most common sources of information. Maharana et al.[50] reported that close acquaintance was the most common source of information.

We did not find that current and past smokers were more aware or knowledgeable of the three eye diseases when compared to nonsmokers, which was comparable to the results of other similar studies in Nepal and Singapore.[32,51] One possible explanation is that the antismoking campaigns in Hong Kong mainly focused on the adverse effects of smoking on lung cancer, cardiac diseases, and other respiratory diseases rather than eye diseases.[52] Another explanation is that the risk perception of blindness from smoking may be low in the general population, as has been reported by studies in Singapore and the United Kingdom.[53–55] Epidemiological studies showed that smoking tobacco and drinking alcohol were risk factors for all three eye diseases.[56] Theoretically and ideally, the subjects with smoking or alcohol-drinking habit currently or in the past should be more aware and knowledgeable of these eye diseases for which they are at a higher risk of developing. Consequently, we recommend targeting these members of the community, rather than the entire general population, as focus groups for health education.[57]

For the overall knowledge level, the highest median score was for glaucoma and the lowest was for AMD. Most of the subjects who had awareness of the three eye diseases, only demonstrated a limited level of factual knowledge as the median knowledge score for all three eye diseases were less than 50% of the maximum possible score. It was difficult to do a direct comparison with other studies because different studies adopted various definitions and measurements of knowledge. For the individual knowledge items, less than 50% of the subjects with awareness were able to identify the correct symptoms and pathophysiology of the three eye diseases, based on the guidelines and recommendations from the American Academy of Ophthalmology, National Eye Institute, Mayo Clinic, and National Health Service in England.[58–70] If we included those subjects without awareness, the overall percentages of correct selection will be even lower. The implication from this gap in knowledge is that patients with early diseases may delay seeking ophthalmological assessment because of inadequate symptoms appreciation or incorrect information concerning pathogenesis. Regarding the knowledge of treatments, our survey showed an improvement when compared to the previous Hong Kong study by Lau et al. in 2002. Most subjects correctly identified surgery, followed by laser, as possible treatment options, but neglected other alternatives. Only a small proportion of subjects knew that intraocular injection, dietetic intervention, and photodynamic therapy can be used for treating AMD. Few knew that wearing spectacles and taking medicine are possible treatment options for cataract and glaucoma, respectively. Again, the limited knowledge of treatment options may deter patients from seeking help, especially if they are apprehensive about undergoing surgery for their eye condition.

Strengths and limitations

Our strengths were that we covered the sociodemographic, behavioral, and medical risk factors, and measured the effect modification and confounding effect in our survey. However, there were a few limitations. First, the sample size was relatively small, making subgroup analysis difficult. Second, since a free eye examination was provided with the questionnaire, there may have been selection bias because people suffering from or interested in eye diseases were more likely to participate. Third, medical histories were self-reported and subject to recall bias. Finally, the knowledge level could be overestimated as the subjects may have simply guessed the correct answers to the multiple "yes-no" type questions.

Conclusion

In this pilot survey of a middle-class population in Hong Kong, we have found a significant increase in the proportion of subjects having heard of AMD and glaucoma when compared to the previous Hong Kong eye disease survey in 2002. Subjects having awareness of an eye disease, as defined by knowledge of at least one fact concerning that disease, were significantly less than those having only heard about the disease without possessing any knowledge of it. Other than the treatment for cataract, the knowledge level of the three eye diseases in most areas was low. Sociodemographic factors and medical history, rather than behavioral factors, were more likely to be associated with having a higher knowledge level. Current and past smokers or alcohol drinkers did not appear to have sufficient awareness and knowledge of the eye diseases they are at higher risk of developing. Our result was consistent with the findings from other studies that family, relatives, or friends played an important role as sources of health information. In particular, for AMD, gender modified

the effect between age and knowledge level, while age was a confounder of having a history, and having heard or awareness, of the disease. It was difficult to do a direct comparison of knowledge among the different studies because of varying definitions and measurements that were used. In general, the knowledge level of our subjects remained surprisingly limited, despite the increasing ease of access to medical information from technological advancement of recent years. Despite improved proportions of having heard or awareness over the past 15 years, much effort remained for improving health knowledge of common eye diseases in Hong Kong. We recommend focusing efforts on current and past smokers or alcohol drinkers as a targeted audience for further health education, and better utilization of family, relatives, or friends as an alternative way of distributing health information.

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Author contributions

All authors have made a substantial contribution to the concept or design of the work; or acquisition, analysis, or interpretation of data; contributed to drafting the article or revised it critically for important intellectual content; approved the final version to be published; and have participated sufficiently in the work to take public responsibility for appropriate portions of the content.

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Ethical approval

Ethical approval for this study was obtained from the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster (HKU/HA HKW IRB; study reference no. UW 15-160).

Informed consent

Written informed consent was obtained from all subjects before their study enrollment and collection of data.

Trial registration

Trial registration is not applicable as this is an observational study (survey using questionnaire) and not a clinical trial (with evaluation of a medical, surgical, or behavioral intervention).

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Supplemental material

Supplemental material is available online for this article.

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